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LEIS INDIA



Millet farming systems



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Address : AME Foundation
No. 204, 100 Feet Ring Road, 3rd Phase,
Banashankari 2nd Block, 3rd Stage,
Bangalore - 560 085, India
Tel: +91-080- 2669 9512, +91-080- 2669 9522
Fax: +91-080- 2669 9410
E-mail: leisaindia@yahoo.co.in

LEISA India

Chief Editor : K.V.S. Prasad
Managing Editor : T.M. Radha

EDITORIAL TEAM

This issue has been compiled by T.M. Radha
and K.V.S. Prasad

ADMINISTRATION

G.G. Rukmini

SUBSCRIPTIONS

Contact: G.G. Rukmini

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S Jayaraj, Chennai

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Ramji Yellappa from Hanumanahalli village cultivates
brown top millet on his farm.
(Photo: Sahaja Samrudha)

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Dear Readers

Millet has been a part of daily diet in several regions in India. They were a part of biodiverse traditional cropping systems meeting the requirements of food, nutrition and fodder, contributing to sustainable food production till modernization and commercialization took over agriculture.

With food production dwindling with climate change effects, health issues arising out of lack of balanced diets, inappropriate food habits and lifestyles, wide prevalence of malnutrition, we are once again looking back at millets as 'climate resilient crops' and 'health foods' - the most viable and reliable solution for the problems being faced. On one hand, we see a lot of initiatives both at the individual as well as the community level, promoting millet production. On the other, there are fears that if millets are promoted on commercial lines, it could lead us nowhere. In this issue of LEISA India, we bring out some experiences, perspectives and challenges in promoting millet farming systems.

We thank all those readers who have been contributing voluntarily for the magazine. We request you to continue supporting us. To enable us to share a printed copy with you, kindly send your contributions along with the enclosed form. Wishing you a Happy New Year!

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.

AMEF is a member of AgriCultures Network, which is involved in co-creation and sharing of knowledge on family farming and agro ecology. The network is **locally rooted and globally connected**. Besides magazines, the network is involved in multi stake holders' engagement and policy advocacy for promotion of small holder family farming and agroecology. The network consists of members from Brazil, Ethiopia, India, Netherlands, Peru and Senegal. The secretariat of the network is located in IED Afrique, Dakar, Senegal.

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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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By reviving millet farming systems, the tribal households in Odisha have reduced their vulnerability to climate change. The millet based mixed farming has also helped in addressing the problem of malnutrition in the communities.



18 Millets and Markets *Need for networking and integration*

E D Israel Oliver King, Stefano Padulosi and Gennifer Meldrum

There is a growing interest in reviving millets in the country owing to their ability to survive in changing climatic conditions while providing high nutrition and better health. A number of initiatives are being promoted by various agencies towards enhancing millet cultivation and marketing. Integrated approaches and networking among key players are found to be crucial for wider impact.



22 Reviving millets, reconnecting to cultures

Aman Singh and Pratibha Sisodia

Farmers of Kerawal Panchayat in Rajasthan found that by reviving bajra based cropping systems, their farming got liberated from water hungry crops such as cotton, onion and wheat. Reviving millets not only brought in more food and fodder, but also reconnected farming households to their traditional cultures where bajra is central.

28 Return of the forgotten crop *Brown top millet*

Anitha Reddy and Krishna Prasad G

Millets, a staple food in Karnataka, is making a comeback. Farmers are reviving cultivation of brown top millet, a minor millet which can be grown on degraded soils with very little water. Besides being an answer to climate change crisis, brown top millet with its high nutrition content could also be an answer to deal with malnutrition among the rural poor and lifestyle diseases among the urban and semi-urban India.



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Millet farming systems

We do get disturbed with climate change, depleting resources, increasing hunger and malnutrition, eroding farm productivity and incomes, rural urban inequities. Climate change is not an absolutely new phenomenon. Malnutrition has been existing and is increasing owing to changing farming systems, food access and habits. Monocultures and commodity based 'business' farming approaches, focusing farming for income alone, is making farming a risky and uncertain proposition, especially for small farmers, under changing climate conditions.

We always get excited about complex, expensive solutions. We constantly try fitting solutions into the existing frameworks and templates. We refuse to dig deep into our own intrinsic human capacities, contextual opportunities in terms of biodiversity, which offer simple solutions. Often, these simple solutions are available, time tested and deeply entwined into our cultures. We brush them off. What we need to do is, revive them and support them.

This issue highlights one such 'solution' - millet based farming systems. By supporting them, we would indeed contribute to better living conditions for farming communities and promote healthy habits among people. We know that millet crops are resilient, demand less inputs, can survive in unfavourable weather conditions and are highly nutritious.

Traditionally, the communities were cultivating these crops for food and feed, till they were systematically marginalised by few high resource intensive crops – paddy and wheat. These irrigated crops were in response to a serious food crisis. They are nurtured by a robust supportive environment – research offering hybrid seeds, subsidised chemical inputs in the form of fertilisers and pesticides; the State led mechanisms like Minimum Support Price (MSP) and Public Distribution System (PDS). Though each of these measures were path breaking and need based, they further hastened the displacement and disappearance of traditional mixed farming systems which offered multiple benefits in terms of nutritious food, feed as well as steady income.

Shift towards millets

There is a welcome shift by State agencies towards encouraging millet based farming systems in rain fed areas – primarily for their ability to survive and offer nutritious foods. Their role in strengthening rural livelihoods, preservation of local cultures, however, is not yet fully recognised. The criticality of community led processes is grossly underestimated. While the revival is fundamentally the community's choice, it is being facilitated by a civil society or a local agency or organisation. Also, these approaches are based on meeting multiple requirements - improving farm productivity, resilient use of natural resources, diverse and better nutritional access, feed and fodder management, access to inputs and markets.

The communities having recognised the benefits, are reviving these farming systems. They adopt alternative farming methods, innovate, exchange their learnings and manage their input systems like, seeds, collectively. For instance, the tribal households in Odisha have reduced their vulnerability to climate change and addressed the problem of malnutrition by relying on millet based mixed farming systems. The traditional crop combinations were revived which offered a diverse diet which included proteins, carbohydrates, fibres, starch, vitamins and minerals. Women members preserved around thirty four traditional varieties of pulses, millets and vegetables. (Krushna Chandra Sahu, p.6).

These systems are embracing new innovations too. Agroecological innovations like System of Millet Intensification and System of Crop intensification are being promoted to deal with unfavourable and extreme situations threatening the survival of the cropping systems. With adoption of these approaches, the plant growth and yields improved substantially and crop losses minimised. (Nitin Kumbhar et al., p.14; Panda and Adhikari, p. 10).

There have been efforts to revive forgotten varieties too. For instance, bajra based cropping systems revived a whole gamut of local cultures and cuisine. Besides this, the mixed

cropping systems with bajra has ensured food security for 1300 buffaloes, 7000 goats, 50 cows, 300 sheep and 50 horses in Kerawal village. (Aman Singh and Pratibha Sisodia, p.22). Similarly, an interesting initiative has been successfully implemented to revive local brown millet which offers multiple benefits to the communities. (Anitha Reddy and Krishna Prasad, p.28).

Support for expansion

In spite of its inherent advantages and growing awareness in consumers and policy circles, much more needs to be done to popularise and promote millets on a wider scale. These include wider availability of processing equipment, investing in improving millet food quality standards, more proactive push into national and State managed public distribution systems and subsidised food schemes (Israel Oliver King et al., p.18). An individual's efforts in promoting millets, training and motivating youth, millet foods and cuisine in a big way, can serve as a model for inspiration and emulation (Amit Chakravarty, p.34).

In spite of the pioneering work being done by MINI (Millet Network of India) and its regional and state chapters, there

could be further impetus provided by the policy to recognise and support millet based farming systems. There are indications that the Government of India is planning to brand millets as *nutri cereals*, scale up production, support mechanical harvesters and distribute millets through PDS (p.31). Some State Governments like Karnataka are addressing the Minimum Support Price issue too. Government of India is asking UN to declare 2018 as International Year of Millets.

While the consumer demand and supportive policies may certainly give a new impetus and energy to this movement, one should be cautious about millet promotion becoming too commercial and consumeristic. Only a few varieties dominating the urban markets meeting urban demand is not a desirable development. (Debjcet Sarangi and Kavya Chowdhry, p. 26). Let us not forget that millets represent a repository of generations of community wisdom and any effort in promoting millets should be rooted in local tradition.



As health foods, millets are back on the farms





Sita Saunta harvesting millet

Millet based mixed farming

Coping with weather extremities

Krushna Chandra Sahu

By reviving millet farming systems, the tribal households in Odisha have reduced their vulnerability to climate change. The millet based mixed farming has also helped in addressing the problem of malnutrition in the communities.

Rayagada and Koraput districts come under the backward Kalhandi, Bolangir and Koraput (KBK) region of Odisha. With climate change fluctuations, the livelihoods of resource-poor farmers practicing subsistence agriculture have become highly vulnerable. The change in climate particularly in rainfall patterns and temperature has destabilized agricultural productivity, affecting the livelihoods, food security, income and health of the tribal families.

The slopy upland which is mainly rainfed is affected in many ways due to climate change in terms of delayed and untimely rains, long dry spells and deficit rainfall. Due to continuous

dry spell and delayed monsoon, land becomes dry and difficult to plough. Heavy downpour continuously for 2-3 days erodes the top soil, washing away the seeds, resulting in poor crop production. Also, early exit of rain and late arrival of winter also limits the scope of Rabi crops. The forest coverage and availability of seasonal fruits like mango, jackfruit, berries and edible tubers has been on the decline. The diet diversity has also reduced due to less availability of varieties of cereals and pulses. All factors combined together, are threatening the food and nutrition security, life and livelihood of the vulnerable tribal families.

Revival of millet based farming systems

Though millet was the staple food of the tribals in these districts the consumption of rice has increased since last 10 to 15 years. But, still the old generation is fond of certain traditional varieties of millet namely *Mandia, Sua, Knagu, Jana* and *Guduji*. From the consultations and studies

conducted by different CSOs, it was found that millets have potential to address issues relating to long dry spells, water scarcity situation and malnutrition. In this backdrop, Indo-Global Social Service Society (IGSSS) through local NGO partner EKTA and Integrated Development Society has taken up revival of millet based farming systems. The broad objective was to reduce the climate change vulnerability by promoting nutrition sensitive millet based mixed farming systems. The programme was implemented in 12 villages of Rayagada and Koraput districts of Odisha in 2013. Later in 2016, another 12 villages were further added in both these districts.

The initiative was promoted with 637 *Paraja* tribal families in Panchada gram panchayat of Laxmipur block, and with 846 *Kandha* tribal families in Kutuli and Kumbhikota gram panchayats of Rayagada districts. These tribal households largely depended on upland agriculture and local wage labor. The average landholding is 0.5 acres to 1.5 acres which is slopy and undulated. Dependency on rainfed farming has made these communities highly vulnerable and insecure.

The People Led Approach laying importance on experimentation, demonstration and replication was the key strategy. In the initial year, emphasis was on capacity building. Farmers were trained to identify opportunities in cultivating mixed crops like millets, pulses, oil seeds and tubers which have potential to cope with the climatic fluctuations and ensuring food and nutrition requirements.



Women are the primary caretakers of millet farming

At every village, Village Action Team (VAT) was formed. Participatory village resource appraisal process was conducted. Weather calendar was prepared in each village and specific crops for each season were identified. The potential farmers (men, women) for experimentation and adoption were identified by the Village Action Team (VAT). Eight Farmer Clubs and 6 Seed Committees were formed.

Cross learning sessions were organized for various groups - Village Action Team, Farmers Club and Seed Committees, for sharing their experiences and knowledge. As a result, the Seed Committees with the project support arranged 14

Women in Ledriguda have preserved 34 traditional seed varieties of millets, pulses and vegetables



types of millets, 3 types of pulses and 2 types of maize seeds. These seeds were distributed among the identified farmers for demonstration in 2014.

Regular exchange programmes were organized by the Village Action Teams on seed multiplication, compost preparation, bio pesticides preparation, seed collection to attract the young farmers towards agriculture. Farmers groups prepared organic pesticides and compost pits at homestead level with agricultural wastes.

During 2016, millet based mixed farming was expanded to 407 famers on 148 acres. The production of different crops was 718 quintals and resulted approximately in an additional 180 kilograms of food grains consisting of cereals, pulses, oilseeds and vegetables (Table 1). This was sufficient to meet the food needs for 3 to 4 months. The diverse diet included proteins, carbohydrates, fibers, starch, vitamins and minerals.

Most of the millets produced are being consumed at the household level. Millets are cooked as rice and cake for breakfast, lunch and dinner. Foxtail millet (Kangu) and Pearl millet (Bajra) are consumed as Upma. Ragi is consumed as soup, while sorghum is made into powder, along with ragi. Although millet is used for household consumption, it is also sold when they have cash needs. Due to lack of effective marketing facility, the needy families often sell it to the local buyers at a relatively lower price, as compared to the Minimum Support Price (MSP) declared by the Government.

Women and seed conservation

The women farmers played crucial role in seed collection, selection, preservation and storage of the local resilient varieties. Seed Committee members in Ledriguda, Temariguda, Nirariguda, Hodikendra, Temariguda, Bada Manadara Mandangi, DarnaMiniaka and Kurumunda have preserved 34 traditional seed varieties of millets, pulses and vegetables (See Table 2). The collected quality seeds are being kept in the earthen pots and plastic containers. The seeds are properly dried and kept with local preservatives

Women members preserved 34 traditional seed varieties of millets, pulses and vegetables.



Millet based foods make a comeback

mostly Bengunia (Sindhua/Nergundi) and Neem leaves. The physical location of seed bank varies from village to village as per the availability of dry and safe place. A document is being maintained by them. The document explains the contribution and variety of seeds they have collected and also about the distribution.

Upscaling and sustainability

The initiative was started in 2014 with 45 farmers on 11 acres of land and subsequently more farmers joined the process. During 2016, millet based mixed farming was expanded to 407 famers on 148 acres. This year (2017), 456 farmers have cultivated different kinds of millets with pulses and oilseeds in 156 acres in 18 villages. This is an indication for their collective efforts to bring back their age old agricultural and food practices and also meet the present

Table 1: Types of mixed millet farming as per the different slopes of the land

Crop	Acre	Farmers	Production in quintal
Jowar+Bajra+Maize	24	68	284
Little Millet+Red gram	18	64	178
Little Millet+oil seed	16	44	68
Finger millet/cowpea/Jowar	22	45	57
Little Millet+black& greengram+Vegetable	58	186	131
Total	138	407	718

Table 2: Types of seeds conserved

Name of the millet	Period of cultivation	Period of harvesting	Seeds available with the seed bank members (local names)
Little black/ Barnyard Millet (Suan)	Last week of May	November	HoruKohoda, JinjariKohoda, MunyaKohoda, KoturuKohoda, Jorutotili and TeyaKohoda
Foxtail/Italian Millet (Kangu)	June	November	TeyaArka (small size) and Kaja Arka (big size)
White/Great Millet Sorghum (Janha)	June	December	DasaraJanha, TeyaJanha, DeruJanha, DeplaJanha and PartiJanha (big size) SetraJanha, Katia Mata/KabaJanha and AndaJanha (small Size)
Ragi/Mandia	June	September, November	(3 months) Hikiritoya, KumdateyaDasaraMudu, Manji, PaluTeya, KorkatiTeya, Kodiagoti, Dipka (6 months) Janbu, Modoimuskori, Gangara, Sonadei, Kara, Koduru, Kerenga
Pearl/Spike Millet/ Bajra (Kuya, Ganthia)	June	November	Kuya/Ghantia
Guduji (local name) Millet	June	November	Guduji

food security demands. The village level institutions are also taking up initiatives on their own.(See Box 1).

The tribal families no more feel dependent on others for inputs and money. Sita Saunta and Sali Saunta of Ledriguda shared that “millet farming does not require money and they need not borrow for seeds and chemicals. Even the children have the knowledge and information associated with millets”. Similarly, Astajani, a women farmer from village

Niraniguda, says that “during the lean period when PDS rice is no more available at home, the millets, tubers, leafy vegetables and forest foods come to our rescue”.

The nutrition value and the climate resilience capacity of millets has provided food and nutrition security to the marginalized farmers. The future focus will be on conservation and propagation of traditional and local varieties of millets through seed banks.

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Krushna Chandra Sahu

Head, Livelihood-Programmes
Indo-Global Social Service Society
28 Institutional Area, Lodhi Road, New Delhi
E-mail: sahu@igsss.net

Box 1

Niraniguda VAT members identified a patch of 20 hectares of upland during vulnerability assessment. Around 11 landless poor tribal families were asked to initiate farming activities with the condition that all the members need to pay Rs 100 each per year to the village committee. Convergence with MGNREGA was also mobilized for land development activities. Nearly 4000 cashew seedlings were raised and planted in 5 hectare of upper ridge land. Inter cropping (millet farming) was also practiced with vegetable cultivation and on the bunds, tuber plantation was initiated. The members fetched water by diverting a perennial water stream through a channel which is located at 2km to their agricultural fields. Now they are able to cultivate paddy, millet, pulses, oilseeds, vegetables and tubers, with papaya and banana and tapioca.

Although a small initiative, it sets an example to others who want to address their livelihoods and food security issues in similar socio cultural and agro climatic conditions.

Intensification of finger millet production

An agro-ecological innovation

Luna Panda and Muralidhar Adhikari

Crop production is vulnerable to various abiotic and biotic stresses that are made more adverse by climate change factors. Improved agronomic practices and cultivation of stress tolerant varieties can sustain production in changing climatic condition. System of Millet Intensification is one such approach which resulted in higher production in finger millet, contributing to the food and nutritional security of the tribal households in Koraput, even under extreme weather conditions.

Finger millet is a major staple food crop, second only to paddy, among subsistence farming households in the rainfed uplands of Koraput district in South Odisha. While it is traditionally cultivated for food security, it also provides them with much needed nutritional security too. Finger millet is a sturdy crop, resilient to a variety of agro-climatic adversities, such as poor soil fertility and drought conditions, and it requires low inputs. Also, the crop provides a hardy ecosystem, with little or no need for external plant protection measures. Finger millet seeds can resist storage pests for as long as 10 years, ensuring year-round food supply, even during a crop failure. This has earned it the name of ‘famine crop’

The tribal farmers of Koraput cultivate finger millet in the uplands as a sole crop and also as a mixed crop with other minor millets, pulses, maize and oil seeds. Farmers generally follow seed broadcasting method. Broadcasting results in inefficient use of moisture and nutrients, resulting in low yield. Less attention is given to timely weeding, pest and nutrition management. The yield is generally 3-4 qts/ha in broad casting method and 8-9 qtls/ha in traditional transplanting method. Farmers maintain local cultivars by continuously selecting seeds suitable to local agro-

ecosystem. However, presently only three varieties of finger millets (*Bada Mandia*, *Kala Mandia*, and *Bhairabi*) are mostly cultivated. Among them, the *Bada Mandia* being most productive, dominates. Access to quality seeds and storage continue to be major constraints. All these factors have threatened not only the millet eco-system but also accelerated loss of their genetic diversity and the traditional food culture associated with them.

After years of declining interest and support, finger millet, of late, is finding demand in urban food markets. This article highlights the experience of Pragati-Koraput, an NGO, in reviving finger millet among small holder farmers under the rainfed farming systems in Koraput district in South Odisha. The programme objective is to enhance production from small farms through system of crop intensification.

System of Finger Millet Intensification (SMI) – An agro ecological innovation

Agro-ecological approaches like System of Rice Intensification aims to produce crops more efficiently and sustainably by depending more on endogenous processes than on external inputs. With the success of promotion of SRI from 2008, Pragati promoted the principles of crop intensification in ragi too.

In 2011, Pragati organised a demonstration of SMI in Raising village of Nandapur block. Initially farmers were skeptical in following the practice. After rounds of discussion, eleven farmers adopted SMI in 0.5 acres of land each, with the condition that, Pragati will provide compensation in case of yield loss. SMI practices included raising nursery, transplanting young seedlings, weeding by weeders and application of organic manures.

Seven varieties of indigenous seeds were promoted. Farmers were trained on seed selection, conservation and seed



Nursery bed is being prepared to raise SRI seedlings

multiplication. Quality seeds are now preserved by farmers both at individual level and also in community seed banks.

The result of the trial was striking to the farmers as there were 12- 18 tillers on an average and the best field of one farmer had 44-47 tillers per plant hill. The average yield was 18 quintal/ha, the highest being 26 quintal/ha. A field day was organised to disseminate the result to the farmers, in which the officials of agriculture department also participated.

Spread

The average yield in SMI was 12-14 quintals per hectare which was more than double than the average yields from traditional method. This was a substantial motivating factor for farmers to adopt SMI, though initially farmers were skeptical that SMI is labour intensive. Video disseminations, wall paintings, posters, field support by community resource persons, farmers' fairs, field days and felicitation of the farmers are some of the methods that Pragati used for upscaling SMI.

Instead of pushing a set package of practices, Pragati has been encouraging farmer innovations. Farmers are being

Table 1: Average yield of different varieties under SMI

Variety	Type	Duration	Av. Yield qtls/ha
Bada Mandia	Local	140 days	20-22
Kala Mandia	Local	120 days	18- 20
Bhairabi	High yielding	120 days	20 – 22
Karnataka	High Yielding	140 days	25- 28
R-900	High Yielding	100 days	17-19

Note: Yield rate of different varieties under SMI in Pragati Koraput Field areas

motivated to try new methods, make adaptations to local conditions and practice based on their own assessment. For example, when the soil gets hard and is difficult to use a weeder, farmers resort to manual hoeing and ploughing by tying the mouth of bullocks. Pulling a wooden leveller on the plants after weeding is a farmer's innovation that leads to profuse tillering and enhanced yield.

All these efforts resulted in farmers taking up SMI on a large scale. Till Kharif 2017, the practice of SMI has spread to 3518 farmers in 215 villages covering 927 hectares of land in Nandapur, Lamtaput and Kotpad blocks.

Seedlings ready to be transplanted





Use of wooden leveller after weeding leads to profuse tillering

Impact

It was observed that crops were more tolerant to erratic monsoon and drought like situations where SMI was adopted. Farmers could harvest on an average 12-14 qts / ha, in spite of irregular monsoon and drought like situations in 2012 and 2013. In 2014, SMI fields could survive the hazards of the cyclone Hudhud which occurred during the month of October, while the crop grown in traditional method lodged and got damaged by the wind. Dayanidhi Khara of Maliput village in Nandapur block says *“Most of the paddy and finger millet crops were lodged due to heavy winds, but my robust finger millet plants grown in SMI method could survive fury of the cyclone in 2014. My family had enough harvest for consumption.”*

As transplanting facilitates inter-row and interplant weed control, farmers used weeding tools like roller weeder to incorporate the weeds into the soil, boosting fertility. Aerating the soil stimulated the growth of plant roots, making them strong enough to resist heavy winds. Also with the use of roller weeders, men started sharing responsibilities in weeding. Dependence on hired labour got reduced.

Harvesting became much easier as plant growth is more uniform and the mature fingers do not get entangled. The women found it easier to harvest the fingers in SMI field. They could complete the task in half the time as compared to time required in a traditional broadcasted field. Thus, there was less drudgery for women.

Increase in production has significantly contributed to the nutritional food security of a very vulnerable community, with small land holdings. For the farmers adopting SMI, there is now enough millet available for household consumption for the whole year. The yield increase has also generated surplus for sale. As the potential of finger millet market is expanding, the price has increased from Rs 5-7/ per kg in 2009 to Rs 22-25/per kg in 2017, thus ensuring better incomes.

In 2014, SMI fields could survive the hazards of the cyclone Hudhud which occurred during the month of October, whereas the finger millet grown in traditional method lodged and got damaged by the wind.

Box 1: SMI Practices

Around 400- 500 gm. of seed is required per acre. Seed selection is done through brine water solution. Seed treatment is done by medicinal pot manure/Bijamrita. Micro-organisms and nutrients are added to make the seedlings more vigorous, resistant to pests and diseases.

Raised seed bed is prepared by mixing soil and compost in 2:1 ratio. The seeds are put into the nursery soil at a depth of 1/2 inch, with spacing about 3 to 4 inches between the seeds. 15 kg of vermi-compost/powdered FYM is spread over the bed in a thin layer and covered with straw. Then the seed bed is watered once in a day. 15 days seedlings become ready for transplantation.

The land is ploughed thoroughly 2 to 3 times within an interval of 8-10 days. Compost and Neem/Karanja cake are applied during land preparation. After ploughing, the field is leveled using a wooden leveler.

Seedlings are transplanted from the nursery into the main field when they are only 15-18 days old, with mass of soil attached to the root and there is moisture in the field. The spacing is maintained at 25 x 25 cm using a rope marker. Farmyard manure and vermi compost are applied in the pits at the time of planting.

First weeding is done within 15- 20 days after transplanting with a roller weeder or cycle hoe. Second and third weeding is done either by roller weeder or manually by hoeing as the soil is hard (due to the upland). Vermicompost, pot manure or Jibamruta solution is applied after each weeding.

In order to control pests, medicinal pot manure or neem oil solution is sprayed.

Since the lands are rain fed, there is no need for water management.

Way forward

SMI is emerging as a solution not only to reduce the hunger gap, but also as an agro-ecological approach to address climate change conditions. High productivity, tolerance to climate adversities and reduction in drudgery for women are some of the contributing factors for the upscaling of SMI. However, scaling up is not devoid of challenges. As

the production increases substantially in SMI, one of the major challenges is primary processing i.e. dehusking and cleaning, which is a time consuming and tedious task for women. There are no primary processing units for millets in the production clusters. The problem of storage is also felt as the farmers do not have adequate space to keep their produce. This may also lead to distress sale to the middlemen in the value chain. It is therefore important to address these challenges, some of which include - organizing farmers, building collaboration with Government and appropriate policy support.

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Luna Panda

Executive Director

Muralidhar Adhikari

Team Leader

Pragati Koraput, Pujariput, Koraput- 764020

Odisha

E-mail : pragatikoraput@gmail.com

www.pragatikoraput.org

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System of Crop Intensification

Promoting a profitable crop sequence of finger millet and chickpea

Nitin Kumbhar, Ananda Wani, Sameer Raskar and Prithviraj Gaikwad

In distressed situations of drought and floods, tribal farmers of western ghats in Maharashtra adopted system of crop intensification (SCI), an agro-ecological method to create enabling conditions for the plant to grow to its potential. The traditional knowledge and innovative capacities of farmers proved to be effective in building climate resilient cropping system of finger millet and chickpea.

The western region of central India has become synonymous with drought, distress and poverty. The region also witnessed erratic, high intensity rainfall. Even in a year of average rainfall, the region faces acute water shortage, for irrigation as well as domestic use. Lack of drought proofing measures, knowledge of appropriate

farming practices, highly variable rainfall patterns result in frequent crop losses. Crop losses also lead to increasing indebtedness of farmers. Thus, the region has witnessed large scale migration of landless and marginal farmers.

Akole block of Ahmednagar district in Maharashtra receives an annual rainfall of 700 to 1200 mm. This zone is predominantly a *kharif* tract suitable for single rainfed crop. Principal crops grown in *kharif* and *rabi* season are paddy, pearl millet, groundnut, finger millet, wheat and chickpea. While some farmers cultivate only finger millet crop in *kharif* season leaving land fallow during *rabi*, others, cultivate chickpea in *rabi*, making use of residual moisture. The finger millet-chickpea cropping sequence is scientifically a good cropping sequence of cereals followed by legumes, for improving soil health.

SCI method in ragi resulted in higher yield



Table 1: Effect of SCI on grain yield and monetary returns of finger millet

Sr. No.	Name of the village	No. of SCI plots	Grain yield in SCI plots (kg/ha)	Grain yield in farmer practice plots (kg/ha)	% Grain yield increase	Gross returns (Rs /ha)	Cost of cultivation (Rs/ha)	Net returns (Rs /ha)
1	Khadkibk	2	1592	1360	17.1	55720	33420	22300
2	Shiswad	1	1720	1485	15.8	60200	35921	24279
3	Wanjulshet	1	1467	1294	13.4	51345	34525	16820
4	Purushwadi	1	1470	1304	12.7	51450	35638	15812
Average			1562	1361	14.7	54679	34876	19803

The normal practice of growing ragi by the tribal farmers includes preparing seedlings in a nursery, transplanting seedlings in the main field after onset of monsoon, without application of fertilizers and organic manure. The plant spacing is not maintained, thus, leading to low yields and decline in soil fertility. Chickpea is cultivated after harvesting finger millet. Seeds are sown behind the *Baliram* plough without seed treatment. Fertilizers and organic manures are not applied. Also, farmers do not follow any preventive and curative measures for pest and disease management. Yield of chickpea has remained low, largely due to infestation of pod borer.

System of Crop Intensification

In 2011, Watershed Organisation Trust, (WOTR), Pune initiated Climate Change Adaptation programme in 12 villages of Akole block of Ahmednagar district with support

of SDC and NABARD. WOTR is an internationally recognised non-profit organisation dedicated to transforming lives of poor rural communities by building resilience to climate change. The programme included 1285 families

Box 1: Practices followed in System of Crop Intensification of finger millet

- One ploughing was followed by two harrowings. Before last harrowing, compost was incorporated @ 5 tonnes/ha.
- Seeds were treated with *Azospirillum* @ 25 gm/ kg of seed.
- Seeds were sown in nursery @ 5 kg/ha and 25 day old seedlings were transplanted at 25 x 25 cm spacing.
- 30 kg nitrogen and 30 kg phosphorus was applied at the time of transplanting. 30 kg nitrogen was top dressed at 30 days after transplanting.
- Two sprays of *amritpani* were given at 30 and 45 days after transplanting for better growth and pest control.

Farmers started cultivating chickpea in rabi



Table 2: Effect of SCI on grain yield and monetary returns in chickpea

Sr. No.	Name of the village	No. of SCI plots	Grain yield in SCI plots (kg/ha)	Grain yield in farmer practice plots (kg/ha)	% Grain yield increase	Gross returns (Rs /ha)	Cost of cultivation (Rs/ha)	Net returns (Rs /ha)
1	Khadkibk	2	1271	1018	24.9	50840	32940	17900
2	Shiswad	1	1223	994	23.0	48920	31754	17166
3	Wanjulshet	1	1702	1425	19.4	68080	41500	26580
4	Purushwadi	1	849	746	13.8	33960	24569	9391
Average			1261	1046	20.3	50450	32691	17759

having 1463 hectares of agriculture land. The goal was to demonstrate the innovative agronomic practices that would improve water, food, nutrition and livelihood security among the vulnerable sections of the society. The crop management strategy was developed based on WOTR's experience with system of crop intensification in the states of Maharashtra, Telangana, Rajasthan, Madhya Pradesh, Jharkhand and Orissa.

Crop demonstrations were initiated in *kharif* season of 2012. Five crop demonstrations were conducted in four villages of Akole cluster on finger millet crop on 0.20 ha area, each. Farmers were motivated to practise System of Crop intensification (SCI) methods. (Box 1) .

The results indicated that, average grain yield of finger millet (1562 kg/ha) was obtained in SCI plot as compared to farmer practices plot (1361 kg/ha) and there was an increase in 14.7% in grain yield in SCI plot over the farmer practices. The average net monetary return was Rs. 19,803 per hectare.

Five farmers took up chickpea cultivation on the same piece of land during winter season. SCI methods were adopted. Seeds were first treated with *Trichoderma*, *rhizobium* and PSB, before sowing. Sowing of chickpea was done by two bowl seed drill at the spacing of 30 x 10 cm. Around 25 kg nitrogen and 50 kg phosphorus was applied at the time of sowing. Two tonnes of compost was applied per hectare. To control pests and diseases, 5% Neem Seed Kernel Extract was sprayed twice, at 30 and 45 days after sowing. *Amritpani* was sprayed at 25 and 40 days after sowing and *Dashparni ark* was sprayed at 60 and 75 days after sowing, for the control of pod borer.

The results indicated that, average grain yield of chickpea was 1261 kg/ha in SCI demo plot as compared to farmer practices plot (1046 kg/ha). Thus, an increase of 20.3% in grain yield in SCI plot was realised. The average net monetary returns were Rs. 17759 per hectare.

Farmers realised a number of benefits with SCI intervention. Firstly, farmers started cultivating rabi crops - earlier practice was to leave the lands fallow. SCI methods helped in improving soil health with use of organic manures. Cost of cultivation was reduced by using bio-pesticides and with reduced use of chemical fertilizers and pesticides. Reduced cost of cultivation resulted in increased net returns. Also, by cultivating a second crop, the overall farm income improved.

Scaling up

Between 2012 and 2015, system of crop intensification (SCI) was promoted in various crops like paddy, finger millet, chickpea and groundnut. SCI was upscaled using various methods - demonstrations on farmers field, through Farmer Field Schools (FFS), training to local youth and through involving women groups.

Farmers learn to prepare bio-pesticides



Decentralised procurement and local level processing and supply to the block level PDS is needed to include diversified millets in Fair Price shops.

Farmer Field School was conducted in each village to facilitate adoption by a group of farmers. Twelve sessions were conducted on SCI demo plot during the crop sequence period, at fifteen days interval. During the FFS, farmers learnt the process of preparing bio-pesticide formulations like, 5% NSKE, *Amritpani*, *Jeevamrit* and *Dashparni* ark. In all, 48 FFS sessions were conducted in all four villages in which about 347 women and 453 men participated.

Scaling up of activities was done in 8 other villages through exposure visits to successful demonstrations, agri-exhibitions, agricultural universities and KVK. Crop demonstrations and FFS were organised. Farmers having undergone various learning processes, modified SCI methods based on farm conditions, rainfall pattern, labour availability and made appropriate changes.

In all, the number of farmers in all 12 villages who adopted SCI was approximately 750 women and 1100 men farmers.

Farmers from these villages organised themselves into a Farmer's Producer Organisation (FPO) at Kohane village which now facilitates marketing of produce. Social institutions like VDC (Village Development Committee) and SMS (Samyukta Mahila Samiti) were formed at the village



Women prepare jeevamrit during a FFS session

level as part of the larger rural intervention, which helped in implementing watershed activities in the village.

Nitin Kumbhar

Watershed Organisation Trust
2nd Floor, The Forum
Padmavathi Corner, Pune Satara Road
Pune- 411009, Maharashtra

Call for Articles

Agroecological Value Chains

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Most agricultural research and extension efforts are focused on increasing crop and livestock production, in order to improve farm incomes and food availability. Often, however, the initial gains from improved production are negated by losses that occur during or after harvest. A March 2015 report of the Indian Council of Agricultural Research (ICAR)—Central Institute of Post-Harvest Engineering and Technology (CIPHET)—in Ludhiana showed that the cumulative percentage of post-harvest losses of cereals was low in the range of 4.65–5.99 per cent while that of pulses was between 6.36–8.41 per cent and oil seeds 3.08–9.96 per cent, amounting to a whopping financial loss of Rs. 92,651 crore.

Small holder farmers, who form the majority of the farming population produce both for self- consumption and for the market. They are not only threatened by climate changes more than anybody else, but also have to deal with the other major challenge - access to reliable and remunerative markets. The many benefits that farmers accrue by practising agroecological methods, like safe produce, less cost intensive and climate resilience etc., gets offset by lack of adequate post harvest storage infrastructure, low cost processing and value addition options.

Food products are often processed on the farm in order to make them less susceptible to pests and unfavourable climatic conditions.

This prolongs a product's life and also adds value. Today, many efforts are being made to process products for local, national or international markets, in the hope that the processed product may fetch the farmer a better price.

In recent times, there has been a spurt in innovative value chains. New agricultural markets are emerging. There are several initiatives to connect the farmer with the consumer. There are different forms of farmer organisations and collectives to deal with the markets. This issue will look at the ways in which farmers can become more resilient in the face of price fluctuations, climate change, or hostile institutions. What strategies do farmers and their organisations employ to meet the challenges posed by the corporate domination of agricultural markets? This issue will examine the policies and institutional frameworks needed to make value systems work for poor farmers, and how the development of local markets and local value chains can improve rural livelihoods in a sustainable way. This also implies strengthening the autonomy of family farmers and enhancing multifunctionality on agro-ecological farms.

*Articles for the March 2018 issue of LEISA India should be sent to the editors before 1st February 2018.
Email: leisaindia@yahoo.co.in*



Millets have been supporting millions of poor farmers struggling with degraded soils

Millets and Markets

Need for networking and integration

E D Israel Oliver King, Stefano Padulosi and Gennifer Meldrum

There is a growing interest in reviving millets in the country owing to their ability to survive in changing climatic conditions while providing high nutrition and better health. A number of initiatives are being promoted by various agencies towards enhancing millet cultivation and marketing. Integrated approaches and networking among key players are found to be crucial for wider impact.

Minor millets, a group of small-grained grass cereals, are of importance as food and fodder in the semi-arid regions of the world. In India, minor millets have traditionally been cultivated in the drylands, predominantly by poor and marginal farmers and in many cases by tribal communities, but the area under their cultivation is decreasing. Growing interest to revive millet cultivation in this country is driven by nutrition, health and

resilience considerations. These cereals grow well in drylands and at high temperatures; they have been supporting millions of poor and marginal women and men farmers struggling with poor soil, low moisture and scarce external inputs. Thanks to their hardiness and good nutritional profile they are in fact, important assets for adapting to climate change.

In order to better understand trends and obstacles faced in the use enhancement of minor millets, the M.S. Swaminathan Research Foundation, Action for Social Advancement and Bioversity International carried out a study in 2016 and 2017, involving value chain actors in Tamil Nadu and Madhya Pradesh. Key stakeholders engaged in both research and development of these crops were interviewed through an iterative process, involving Internet searches and a snowball sampling approaches.

Why millet cultivation is not picking up?

Key factors behind the declining trend of millet production include low crop productivity, high labour intensity, difficult

post-harvest operations and lack of attractive farm gate prices. Easy availability of rice and wheat through the Public Distribution System (PDS) has contributed to a shift in food consumption patterns in millet producing regions. With the exception of finger millet—for which technology has made faster advances—drudgery related to hulling of small millets is still discouraging local producers. Other disabling factors include, inadequate investment in product development and commercialization, and the persisting perception of low social status associated with their consumption. Lack of knowledge on ways to use small millets in the daily diet is widespread, in spite of the great array of dishes that can be made with them. The poor availability of millet foodstuffs in local markets, coupled with high prices for their products are also limiting their popularization. Following is a summary of specific R&D interventions that our study has identified as most strategic, to further the use of these resilient and nutritious crops in India.

The big challenge of processing

Difficult processing is the key challenge that hinders consumer demand and upscaling potential for minor millets. Several interventions can be made to facilitate access by value chain actors to processing plants on the one end and by consumers to processed millet products on the other. The lack of suitable processing units close to millet fields, forces local producers to take their produce to distant places. For instance, raw grains of little millets and Kodo millets produced in Dharmapuri (Tamil Nadu), Koraput (Odisha) or Dindori and Mandla districts (Madhya Pradesh) need to be transported as far as Nasik (Maharashtra) for processing.

Minor millets like Kodomillet, lack proper processing facilities



This causes price increases across the value chain, including for consumers, who have to pay higher amounts for millet foods as compared with paddy and wheat products. In this regard, it is interesting to note that the establishment of large-scale regional processing units by the private sector in Southern India (e.g. Theni district in Tamil Nadu) and more recently in Raipur (Chhattisgarh) is having a very positive effect, by shortening the value chains and favouring local and regional consumption through cheaper products. Similar interventions in other millet growing regions of the country would bear beneficial effects.

A policy measure to allow sales of millet processing equipment across the country, accompanied by a possible exemption/reduced tax on their purchase, would encourage development of the millet value chain. Removing restrictions for transportation of processing equipment would also help spreading the technology across states. The Government's "Initiative for Nutritional Security through Intensive Millet Promotion" has supplied small-scale millet processing mills from Tamil Nadu (Salem, Erode, Coimbatore) to Northern states of India (viz. Madhya Pradesh, Uttarakhand, Odisha, Chhattisgarh), which has made a robust contribution in this direction. Optimal performance of supplied machines through this programme requires follow up attention, and to that regard, we believe that training youth in equipment maintenance could well generate new employment opportunities, besides enhancing the use of existing mills.

More specifically, there is a critical need to optimise technology for de-hulling of different small millet species, which have different seed sizes. More research is needed for improving the separation mechanism in hullers to reduce removal of grits and other usable materials along with the husk. Improving the sieving efficiency of graders is also needed. Large-scale equipment is available for this operation but equipment tailored for the community level and the small and medium enterprise level is needed and would be most relevant for supporting development of farmer enterprises.

Technologies and standards for quality products

Increasing access to processed products is key to stimulate consumer demand for minor millets. But, it is essential that the quality of these products is assured. There is a need for standards and food technology development of millets for a higher quality and consumer appeal. Appropriate technologies for increasing shelf life of millet rice, semolina and flour; and value added products, that do not compromise the quality and nutrition of the product, is an area calling for research focus and would strengthen the small millet market significantly in the short and long term. Additional research is needed to increase the bioavailability of



Women sell millet at a mandi in Dindori

micronutrients in small millet products. For example, soaking of grains helps reducing anti-nutritional compounds like phytic acid and phytase activity, which inhibit bioavailability of minerals. In Maharashtra, Madhya Pradesh and other neighboring states, polished small millet rice (labeled as ‘*Bhagar Food*’ and used as fast food) is being marketed in different brand names without considering the loss of nutrients due to cone polish processing and ‘Colour Sorting’ technology. On the other hand, unpolished and parboiled small millet rice products have started emerging in periurban and urban markets and more research is required to guide their production: while CODEX standards are available for rice and wheat, currently, there are no standards for millets that processors have to adhere to, in terms of level of bran retention and presence of broken or shattered rice kernels and rice from semi filled grains. It is common to get rice in the market with un-hulled grains, weed seeds, small stones, pest infestation, or fungal contamination. Product standards have to be urgently developed, with a focus on product identity and composition, nutritional facts and food safety for ensuring quality and good product differentiation.

Enhancing use through public welfare programmes

Public procurement programmes present a valuable opportunity for enhancing the use of millets and leveraging their nutrition and sustainability benefits. Following the Food Security Bill (2013), the procurement policy of the Public Distribution System (PDS) for each state needs to be revisited to include millets (defined as ‘coarse cereals’). Decentralised procurement and local level processing and

Decentralised procurement and local level processing are needed to include diversified millets in Fair Price shops.

supply to the block level PDS is needed to include diversified millets in Fair Price shops. Successful stories exist for the effective inclusion of sorghum and finger millet in the PDS by the Karnataka Government in northern and southern districts respectively. In these districts, both sorghum and finger millets are made available in the PDS as whole grain. Consumers can pulverise these grains in the local flour mill for direct consumption. Little millet, foxtail millet, barnyard millet, and proso millet are not yet included in the PDS. To facilitate their consumption, dehulling would need to be done before grains reach the PDS or access to small scale processing technology should ideally be provided, at least at the Block level. In addition to the PDS, millet-based ready-to-eat foods can be promoted through the Mid-Day Meal Schemes and Integrated Child Development Schemes to enhance zinc and iron intake among children. For example, the Watershed Support Services and Activities Network (WASSAN) has successfully piloted introduction of millets in the noon meals in Government Welfare schools in the three blocks of Malkengiri districts of Odisha, setting an example for many more similar interventions elsewhere.

Improving seed quality

While acknowledging the important contributions made by the Indian National Agricultural Research System in crop

improvement, there is a need to further evaluate millet germplasm focusing on both improved varieties and landraces. This research is warranted especially with regard to assessing their performance under climate change. Opportunities to deliver high quality seed through enhancing capacities of farmers and community-based institutions is also a very promising avenue as experienced through the Farmers Producer Organizations (FPOs) established by Action for Social Advancement (ASA) in Madhya Pradesh. Further attention is required to better link such community-based seed production to public seed market systems for improving availability of better quality millet seeds.

Integrating efforts across India for wider impact

Presently a number of non-profit organizations, community-based collectives and farmers' producer organisations are working towards achieving greater cultivation and marketing of minor millets in India. The Government of India is also engaged at different levels in the promotion of small millets. Some of the key governmental programs and projects for promotion of small millets include: Initiative for Nutritional Security through Intensive Millet Promotion (INSIMP) Project (recently merged with NFSM); National Food Security Mission (NFSM); National Mission on Sustainable Agriculture; Rainfed Area Development Project (RADP); National Food Security Act 2013 and the Rashtriya Krishi Vikas Yojana (RKVY) etc. Also, ICAR institutes and State Agricultural Universities have developed technologies for making several products from millets. It would be desirable to upscale these technologies and make these products more widely and readily available on a commercial scale.

These many efforts are albeit not being carried out in an integrated manner and this is limiting the ultimate overall impact. Building on the insights from this study, future actions should strengthen the networking among key players of minor millets value chains. Integrated approaches and interventions such as provision of high quality seeds, development of decentralised processing infrastructure in support of small-scale local entrepreneurs are key actions to promote consumption and cultivation of minor millets.

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Kodo millets travel long distances before reaching the market

References

- King EDIO., **Impact of Reduced drudgery of women in production and post-harvest processing of small millets**, MSSRF Working paper. No.9, 2017, Chennai.M.S.Swaminathan Research Foundation.
- Mondal A., I. O. King, S. Roy, S. Priyam, G. Meldrum, S. Padulosi, and S. Mishra, **Making millets matter in Madhya Pradesh, 2016**, *Farming Matters* 06; 32.2, 10-13 pp. <http://www.agriculturesnetwork.org/farmingmatters>
- Padulosi S., Bhag Mal, O. I. King and E. Gotor, **Minor Millets as a Central Element for Sustainably Enhanced Incomes, Empowerment, and Nutrition in Rural India, 2015**, *Sustainability* 7(7), 8904-8933; doi:10.3390/su7078904<http://www.mdpi.com/2071-1050/7/7/8904>
- Rajshekar S.C. and S. Raju, **Introduction of millets in PDS-Lessons from Karnataka, 2017**, *Internal Report of the M.S. Swaminathan Research Foundation. Chennai, India.*

E D Israel Oliver King

M S Swaminathan Research Foundation
Chennai, India
E-mail: edio151173@gmail.com

Stefano Padulosi and Gennifer Meldrum

Bioversity International, Rome, Italy



Kerwawal farmers depend on agriculture and animal husbandry for their livelihoods

Reviving millets, reconnecting to cultures

Aman Singh and Pratibha Sisodia

Farmers of Kerwawal Panchayat in Rajasthan found that by reviving bajra based cropping systems, their farming got liberated from water hungry crops such as cotton, onion and wheat. Reviving millets not only brought in more food and fodder, but also reconnected farming households to their traditional cultures where bajra is central.

Kerwawal Panchayat comprising three villages, Kerwawal, Kerwadi and Pila Dhaba is located in the north-east of Rajasthan. The Panchayat area is flanked on the east by a ring of hills and the west by a stream locally known 'Sukri River', running north-south, thus forming a natural boundary. Terrain is undulating with extensive gully formation, sloping from east to west. In between there are extensive patches of land that has been leveled for cultivation. Foot hills feature a modest forest cover under the Orans/Devbanis (community conserved

areas) over limited stretches. Agriculture and animal husbandry are the main livelihood activities in the Kerwawal Panchayat. As much as 30% of the income of the farmers is derived from their livestock - pastoralism activity.

In the Panchayat, mixed cropping has given way to large-scale agricultural systems. Cultivation is done in the valley areas and at the bottom of the hills and is below subsistence level. Only dry land agriculture is practiced. The average land holding, ranges from 0.4 ha to 2.5 ha per household. Crops grown during the Kharif include bajra, maize, cotton, jowar; teel; mung; chola; gwar. Among the crops grown in Rabi season are onion, wheat, mustard, gram and barley. Some vegetables are grown too, but these are mainly in the backyards. Most of the area is double cropped, with very limited area in the low lying region with tube wells, which raise the third crop in summer.

The shift from traditional to high yielding and hybrid varieties has been largely due to two factors: need for short maturing seeds owing to deficit rainfall and desire for higher yields. Cultivation is highly, if not fully, mechanized. There is heavy extraction of water to irrigate the fields using deep well pumps. Also, crops grown are water intensive,

especially during the Rabi season. Mixed cropping is being practised by some families having small pieces of land.

Millet revival

During 2011-12, KRAPAVIS (Krishi Avam Parithitiki Vikas Sansthan) conducted a study in the Kerwawal Panchayat, to understand the factors for declining area under millets. The study found that there has been a 25% decline in millet cultivation over last 10 years. The reasons cited by farmers included: introduction of cash crops like cotton and onion; lack of proper price for millets; inadequate warehousing facility at the government level; bajra not being distributed in ration shops or balwadies and *Bajra ki kutti/ kadbi* (dry fodder) not being part of the government fodder banks, and hesitation of insurance companies to extend their services to this crop.

KRAPAVIS study noted that the PDS (Public Distribution System) has been in existence for over 4 decades in the Panchayat. Only rice, wheat and sugar are supplied through PDS. All the three items are not locally grown and have to be procured from other places, while the locally produced bajra millet has no takers. This has resulted in change in food habits, which has led to more dependency on outside items. (See Table 1)

In order to address this challenge of declining millet farming, KRAPAVIS facilitated farmer led initiatives in the Kerwawal Panchayat, to revive millet cropping.

Many meetings were organised with farmers and importance of bajra cultivation discussed. For about two decades, farmers in Kerwawal have been cultivating cash crops like cotton and onion in low lying flat lands, on which earlier they used to grow bajra. During discussions, elderly farmers like Dhanuram Prajapat, Dasrath Singh, Dhankori Devi, Santo Devi, Nanayaram Jatav, Ganga Ram Jatav, Raghu Vir, and so on of Kerwawal village indicated the following advantages of bajra – bajra can be grown in foothills, desert, undulating terrain and poor soils with very less and erratic rainfall (like we have in Rajasthan), because it is a drought tolerant crop. It does not require many inputs (like chemical fertilizers, pesticides, hybrid seeds etc), and can be grown in mixed cropping systems, with legumes and oilseed crops. It is highly nutritional and tasty too. It provides warmth, fitness and strength during the winter. Owing to its low price, it is easily accessible to the poor in the villages. Bajra also serves as a very good fodder (green as well as dry *Kadbi*) to the livestock. Bajra is used in medicines for treating the animals. Bajra is a part of the local culture (See Box 1).

Farmers of Kerwawal village started recalling that in the past their parents followed mixed cropping systems - Bajra

Table 1: Changing food habits

Past (about 50-30 years back)		Present (over the last 5-8 years)	
Rank	Recipes	Rank	Crops / variety
1	Chhach & Rabari of bajra Dudh & Rabari of bajra	1	Tea
2	Roti - Bajra	2	Wheat Roti
3	Roti - Bejad (gram & barley)	3	Bajra Roti, only in winter
4	Roti - Tinaja (gram, barley and wheat)	4	Dal Chawal
5	Sabji of gram, mung, urad	5	Veg. like tinda, onion, gobi, loki
6	Kadi with besan of gram	6	
7	Dal - Batti - Churm	7	
8	Pitod (Chhach & besan)	8	
9	Channa Mangodi, Besan gatta	9	
10	Khichadi of Bajra	10	
11	Bajra Khichadi	11	

grown with legumes (e.g. *Urad and Mung*) and oilseeds (e.g. *Til- sesame*), Tinaja (three grains- jau, chana, gehu), Gauchani (jau & gehu), Bejad (jau & chana), 7 dhans (seven grains) - bajra, maize, mustard, wheat, jowar, pigeon pea and barley. Thus, farmers started realising that the traditional bajra and millet mix cropping systems was inherently bio-diverse.

Box 1: Bajra, its many uses in local cultures

"Annakut" on the eve of 'Govardhan' festival (the second day of Deepawali festival), is celebrated in Rajasthan. The entire community gets together and has bajra feast of a special recipe called "*Khadi-bajra*". There is also a custom of donating bajra on the eve of "*Makar Sankranti*". Making chapattis with, mixing of til (sesame), is considered auspicious on the day of "*Makar Sankranti*". *Chauly* (minor millet) *ke laddoo* is made on the eve of Mahasivratri. "*Badpuja*" - ten grains namely, bajra, jwar, corn, channa, til, rice, wheat, barley, moath, mung are mixed and filled in a mud pot and used in worship of Dashara festival. During "*Kalash puja*", *Bajra* seeds are spread underneath the Kalash (mud pot) for carrying out auspicious rituals.

One ritual, "*Knaga Khelna*", is performed on the next day of marriage during which bride & groom throw bajra seeds at each other. Another ritual called "*Dund*" is performed when a child is born in the family, then kheer of bajra is distributed to neighbors on the Holi festival of that year.

In order to maintain the best habitats for birds, there is a system of feeding birds everyday with "*Chuga dalna*", made with bajra, in the orans and temples compound. Similarly, "*Cheetawal*" is another ritual, meaning feeding ants with millet.



Interaction with women farmers to understand traditional cropping systems

Once the farmers realised the importance of this system, KRPAVIS facilitated the following: 1) identified traditional mixed cropping systems; 2) identified farmers who are willing to take up bajra mixed farming or who have been making efforts to practise some form of traditional farming like mixed millet-based cropping systems, vermi-composting and biofertilizers etc.

Farmer to farmer and community to community exchanges were facilitated by organizing exposure visits. An exposure visit was organized to Danta Ramgarh to visit Sunda Ram Verma, an educated farmer, who has been trying to find new options and new varieties of different crops with tolerance to drought, frost, pest and diseases.

Initially, KRPAVIS encouraged farmers to bring back the traditional seeds of bajra and bajra based cropping system. Villagers had almost lost their traditional seeds. KRPAVIS facilitated to collect, exchange and save indigenous bajra and jowar seeds.

With the procurement of traditional bajra seed, crop demonstration of mixed cropping with 7 dhans (seven grains-bajra, maize, mustard, wheat, jowar, tur, barley) was organised.

In the village, the women groups called Mahila Mandals (SHGs) were formed. The group meets every month and does saving as well. In this group, it was good to observe

that members maintain registers and also manage credit activities. Women members were taken to exposure visits to places where they saw many varieties of seeds. To improve access to traditional seeds, SHGs created seed banks. Mahila Mandals started storing the seeds and providing the same to both internal members as well as those outside the group. Each member in turn returns the amount of seeds borrowed by him/her along with a little bit extra to increase the seed bank size. A steel container was provided by KRPAVIS to the groups to enable easy storage of seeds as well as keeping the seeds safe from attacks by various insects. As a result of the seed bank, women were able to preserve the traditional seeds, reduce dependence on hybrid seeds, as well as cut down on expenses incurred on buying expensive hybrid seeds.

Some demonstrations on water conservation and renovation of traditional water bodies were carried out, through desilting and deepening of tanks, including catchment treatment, to facilitate ground water recharge, improve availability of water for livestock as well as water for

The mixed cropping systems with bajra has ensured fodder security for 1300 buffaloes, 7000 goats, 50 cows, 300 sheep and 50 horses in Kerawal village.

domestic use. Communities with help of KRAPAVIS, renovated two oldest Johads (water harvesting structures) in Kerwawal village located in the best millet agricultural lands. Also, built several *khels* (water troughs) to store water for watering plants, fodder crop, livestock and birds.

As a member of a larger network called MINI (Millet Network of India), lobbying and advocacy efforts were made for a favourable millet policy. We involved many scientists, doctors, farmer organisations, and consumer organisations in the Millet Campaign. With the support of many groups and with as many as 92 endorsement letters from Rajasthan (including MP, Sarpanch, Doctors, Scientists, Panch, and Academicians etc), we have sent the Millet Campaign letter to our Agriculture Minister and Chief Minister and also released it to the media.

Also established MINOR (Millet Network of Rajasthan) to promote sustainable livelihoods of rural pastoral communities through “forest (orans)-livestock-agriculture trinity”. KRAPAVIS has continued to campaign for sustainable agriculture; advocating for traditional mixed cropping systems, traditional seeds, particularly of mustard, gram, tur and bajra. Through network, we have been demanding the government to ensure supply of indigenous seeds of bajra and other traditional crops through its agriculture extension services; procure *Bajra ki kutti/kadbi* as part of government fodder banks and supply during the famine period, distribute bajra through ration shops (PDS), Anganbadi and midday meal schemes; and set up community managed warehousing at the village level.

Major outcomes

There is greater acceptance and adoption of traditional millet based mixed cropping systems, not only in Kerwawal Panchayat but in surrounding villages too. This is evident by the number of farmers in Kerwawal and 14 neighbouring villages growing mixed cropping of bajra with indigenous seeds and low input agriculture. Around 177 farmers are now practising sustainable agriculture with indigenous varieties. With increase in number of farmers accepting sustainable agricultural practices, there is improvement in productivity and sustainability of agriculture.

The mixed cropping systems with bajra has ensured fodder security for 1300 buffaloes, 7000 goats, 50 cows, 300 sheep and 50 horses in Kerwawal village.

There is increased awareness amongst villagers regarding local seed conservation. As many as 7 issues of the quarterly



Farmers trying out bajra based cropping systems in Kerwawal

newsletter “Devbani Re Baat” were brought exclusively on millet and mixed cropping systems as an effective resource cum communication material on local seed conservation. The concept of saving traditional seeds through SHGs managed ‘Seed Banks’ spread to other 4 Panchayats/villages – Kalikhol, Bandhe ka bas, Kagpur and Bakhtpura. Networking among farmers from over 20 villages has been developed and strengthened, further facilitating seed exchanges.

Millet Network of Rajasthan (MINOR), on its own and as a part of larger networks like MINI, has continuous dialogue with local government department, politicians, NGOs and policy makers. These efforts contributed towards the National Food Security Act getting passed. Due to advocacy efforts, state government has now taken steps to ensure minimum support price (MSP) for bajra farmers.

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Aman Singh and Pratibha Sisodia
Krishi Avam Paristhitiki Vikas Sansthan (KRAPAVIS)
KRAPAVIS Training Centre
Prachin Bhurasidh, P.O. Kala Kua
Alwar – 301001, Rajasthan, India
E-mail: krapavis_oran@rediffmail.com

From coarse grains to health foods

Time to introspect

Debjeet Sarangi and Kavya Chowdhry

Millets have always been part of an eco-cultural system for Kondh tribal communities in Odisha. Kondh communities nurture cultures of sharing and caring, celebrate a relationship with earth and all the life forms that sustain life. Any initiative promoted from outside need to be rooted in the traditional cultures to sustain and promote societal well-being.

In the middle of a region which is being rampaged by mono-cultural eucalyptus plantations, Bt Cotton and external input-intensive agriculture, is Kandhuguda, a village which is a repository of agro-ecological wisdom. Adi Kumruka, a Kondh farmer of Kandhuguda says “Whatever I obtain from my field is more than sufficient. It feeds my family, our community, the birds, the insects and the animals who visit my field. Everyone is full and happy!”

Kondh way of farming

In Kondh way of agriculture, access to land for everyone is ensured. Land is allotted according to the size of the family; if one has a bigger family to feed, they get a larger piece of land. All the households carefully collect seeds over the previous season. Seeds from all the households is collected and kept in the center of the village and equally distributed to all the families to sow. It does not matter if someone was not able to save seeds, because, among the Kondh adivasis, there is a seed for everyone. In this way of life, everyone has access to land and seeds. And, sowing and harvesting are done collectively.

The Kondh communities maintain a common village fund, which can be utilized by anyone in times of necessity. The village fund is generated from within the community in the form of food grains, or at times cash, and is used to aid the person in need. What can be seen here is that the Kondh society lives in a way that revolves around an ethos of sharing ones concerns with others and caring for others well-being.



Kondh system of farming is deeply rooted in tradition

Coarse grains to health-foods

Historically, millets have been grown in poly-cropping systems using agro-ecological methods. In communities like the Kondh adivasis, millets is not merely a grain. It reflects a repository of generations of collective community wisdom. They worship the mountains, the lands, the skies and the forests and their agricultural practices reflect the respect and gratitude they hold for the *Dharini Penu* – The Mother Earth. For them, millets stand for a diverse vibrant agriculture which sustains and keeps their internal solidarity.

In the 1960s, when the Green Revolution hit the Indian agricultural scene, the land under millets cultivation dropped drastically as all the policy favours went to rice and wheat cultivators. Hybrid seeds, chemical inputs in the form of pesticides and fertilisers were promoted. Millets, then, were called coarse grains only to be consumed by the “poor”.

Millets is not merely a grain. It reflects a repository of generations of collective community wisdom.

These same grains are now being touted as health food and are viewed as silver bullet to tackle the impact of climate change on food security.

In glaring contrast to the world view of this community holding immense ecological agriculture wisdom, is the current agricultural paradigm which has replaced the culture in the word “agriculture” with business - “agribusiness”. One of the ways in which the agri-business model is taking shape around millets is through interventions which are promoting millet supply from rural to urban areas. This supply is a result of a high demand from middle-class urban consumers who are plagued with non-communicable diseases like diabetes, cardiovascular diseases and obesity, seeking solace in consumption of millets as a “health food”. Also, only those millet varieties which have a high demand in urban markets are being promoted. This has an inherent risk of shrinking millet diversity and weakening farm resilience, contributing to the vulnerability of millet farmers, especially in the context of climate change.

Some serious concerns

There is a worry in the Kondh community that their way of life is now being severely threatened. Millet cultivation is a part of the identity of the Kondh society; around its cultivation are organized sowing, harvesting and seed sharing festivals which are occasions for the people to meet, sing, dance and celebrate their ecology and their oneness. This oneness has also been their strength in resisting existential threats to their way of life in the form of forest felling, forced displacement, migration of the youth and many other ways. If their agriculture withers away, it may result in distancing them from each other and their customary forms of support. Their children may not be able to learn their knowledge and skills on food production, collection and sharing with each other.

Making millets a focus by consumerist cultures with little or no respect for cultural integrity and its life sustaining features is not likely to contribute towards its revival. There are several pertinent questions - does this change from the consumption of polished rice, wheat and maize to millets hold the potential to address the consequences that have entailed the transition from agri-culture to agri-business? Does this address the farmers’ loss of control over knowledge, seeds and land?

P. Sainath in one of his recent write-ups asks if the people in villages are less thirsty. (India Water Portal, 2017). He tells us that in drought-struck farmer-suicide ridden Maharashtra, is a building being constructed with a swimming pool on each floor, on the lands abandoned by

farmers because of water scarcity. In any metropolitan area of India, the elite continue to lead water intensive lifestyles, generating huge amounts of waste and using industrial products that release effluents into the environment. For anyone to assume that the mere consumption of millets will ensure their well-being is highly flawed. Our high ecological footprint reflects highly unequal resource distribution. But more importantly, it shows how our lives are threatening our farmers’ survival. The need of the hour is to interrogate our choices and to revive the culture of an agriculture that is rooted in the societal well-being.

Way forward

Behind this culture of eating together and celebrating seed distribution together is a deep sense of equity. This ensures that no one goes hungry in the community- a rather radical idea in this age of widening inequality. The underlying belief is that the well-being of one is deeply linked with others, hence the concern for the birds, the insects, the ecology and every person in their society. A millet revival disconnected with the concern of societal well-being will not go too far. If this continues, we will be dismally failing to be honest to our farmers and our ecology- the spirit of whom we have already managed to damage.

When we asked the older women of Khalpadar if they would ever let anyone cultivate a whopping 20 acres of land, they laughed, dismissing our concerns, saying they had no reason to object to it if the person had the energy. And in any case, they said, “*we know that in the end we all will eat the foods together.*”

We express our deep gratitude to indigenous communities like the Kondhs who have refused to bow before the God of pseudo modernity. They have always celebrated the multifaceted bounty of the earth which respects the tiny ants that crisscross their fields, as much as they do to humans, who enjoy the bounty.



Debjeet Sarangi and Kavya Chowdhry

Living Farms

Plot No.1181 / 2146, Ratnakarbag-2,

Tankapani Road

Bhubaneswar - 751018

Odisha - India

E-mail: livingfarms@gmail.com



'Korale Raghu', as he is popularly known, with brown top millet

Return of the forgotten crop

Brown top millet

Anitha Reddy and Krishna Prasad G

Millets, a staple food in Karnataka, is making a comeback. Farmers are reviving cultivation of brown top millet, a minor millet which can be grown on degraded soils with very little water. Besides being an answer to climate change crisis, brown top millet with its high nutrition content could also be an answer to deal with malnutrition among the rural poor and lifestyle diseases among the urban and semi-urban India.

Browntop millet or *signalgrass* as it is commonly called, is one of the rarest among millets. Being native to India, it grows well in the dryland tracts of Karnataka-Andhra Pradesh border areas, covering regions of Tumkur, Chitradurga and Chikkaballapura districts in Karnataka and Ananthpur district in Andhra Pradesh.

Termed *Korale* in Kannada and *Andakorra* in Telugu, Brown top millet is also grown and consumed in limited quantities in north central India - the region commonly referred to as Bundelkhand.

Browntop millet is drought hardy and heat tolerant, but can also be planted in low areas that get flooded. The shadow tolerant nature of *Korale* makes it distinct from other crops. The shade loving crop grows well even under tamarind trees. Thus, the practice of farmers growing browntop millet under the tamarind tree shade is still prevalent in places like Pavagada, Madhugiri and Sira in Karnataka. In these regions, millets form the staple diet of the people. The crop survives under arid conditions and has the potential to spread widely because of its rich nutritional value as well as its ability to adapt to climate change.

It is planted in mid-April until mid-August in most locations, though later plantings will result in lower yields. It can be planted either as a sole crop or in combination with other

seasonal crops. It is also an excellent choice when combined with other millets. In fact, redgram is grown as a mixed crop - for every 12 rows of browntop millet.

Browntop millet is remarkable for its early maturing ability. The crop is harvested in 75 to 80 days. Some farmers grow it for fodder purpose only and harvest within 50 days. Because of its very short maturity, it can be planted as late as August and still offers ample supply of grains. It survives even if monsoon is delayed. It requires a little bit of moisture during sowing and one or two rains later, for the crop to grow and mature. Even with broadcasting method, the crop yields about 7 to 8 quintal grains per acre and four tractor loads of good quality fodder which cattle relish.

Browntop millet is not only nutritious but also very delicious. The millet is gluten free and rich in essential nutrients. It is a rich source of natural fibre, when compared to other grains. Korale contains about 12.5% fibre due to which it serves as medicine for dealing with life style diseases. Lower incidence of cardiovascular diseases, duodenal ulcer and hyperglycemia (diabetes) are reported among those who regularly consume millets.

The browntop millet is known for its rapid forage production. It is grown for several other purposes as well - as cover crop in coconut and arecanut groves, for soil erosion control and for high straw production. It suppresses root-knot nematode in the soil. The sharp leaf structure of the plant obstructs the intrusion of rats into the fields. Hence, farmers grow this crop also to control rodents in coconut and arecanut groves.

Millets make a comeback

Continuous drought in Mysore and Mandya district for three years brought back millet cultivation in these areas. Mandya farmers always enjoyed the water flow from Krishna Raja Sagar Dam for both kharif and rabi crops. But due to water shortage in the previous years, they were forced to look at alternatives to replace irrigated crops. The workshop and millet mela organised by Sahaja Samruddha, in 2015, made farmers to think beyond the irrigated crops like paddy and sugarcane. The farmers at the workshop were introduced to millets as alternative crops during rabi season. Since most of the millet varieties, particularly browntop millet, are

Korale is a rich source of natural fibre and serves as a healthy food



More than 2000 farmers across Karnataka are cultivating Korale, owing to its various merits.

drought resistant, farmers experimented with millets and were successful with record yield.

Puttaswamy, a farmer in Haleboodanuru, said “*Millets don't require much water and cultivation is easy when compared to paddy. I cultivated brown top millet and did not expect much yield owing to severe summer and depleting moisture. But to my surprise, the crops were robust and withstood the severity of drought and yielded a good harvest. Also none of these farms were affected by pests or diseases*”. He remembers millet being the staple food in Mandya region, but was replaced with rice and wheat in the last three to four decades. Farmers have found out that these crops can grow with the moisture available in the soil after paddy harvest.

Similar has been the experience of C.P.Krishna, farmer from Gulurudoddi in Mandya district, who reaped a rich harvest. He says “*Hardly any expenses were incurred, as only seeds were purchased and no fertilizers or pesticides were used. It grew well in the residual moisture on the field and gave a rich harvest. Now we are convinced that we will benefit if our farmers shift to these hardy dryland crops to tide over the water crisis*”.

Raghu of Hendore village, Sira taluk in Tumkur district has put in efforts to popularize the crop and now he is popularly known as ‘Korale Raghu’. In addition to cultivating Korale, Raghu is also engaged in supplying seeds, value addition and marketing. He says, “*Korale cultivation is cost effective. With minimum investment, farmers can register maximum returns.*”

Korale is gaining popularity in some parts of north Karnataka as well. Many farmers in Hanumanahalli and Mathighatta village in Kundgol taluk, Dharwad district have started cultivating *Korale*. Attracted by the shadow tolerant nature of *Korale*, some farmers in Koppal region have also shifted to this crop from last three years. Presently, more than 2000 farmers across Karnataka are cultivating *Korale*.

Challenges in upscaling

With changes in climate, browntop millet could be an alternative crop for the farmers. However, while the cultivation of *Korale* is simple, its processing is difficult due to the hard outer cover of the seed. As a result, farmers get only 40 to 50 kg of grain from one quintal of *Korale* seeds. Earlier, grinding stones were used to separate the grain



Korale is grown in arecanut plantations

from the seed. Today, grinding stones have almost disappeared and *Korale* seeds are processed in the flour mills that process finger millet. One should be careful while processing millets in the existing flour mills as the size of these grains is very small. Even after processing, there will be some bran on the rice. This is processed further through winnowing. The size of *Korale* rice is also very small and separation of stones is difficult. Hence, processing has become a bottleneck for *Korale* farmers, and efforts have to be made to design suitable processing machines. Thirty years ago when groundnut replaced browntop millet, it upscaled very fast owing to its ease in processing resulting in better income compared to *Korale*.

Despite all the benefits it offers and with the popularity it has gained, *Korale* cultivation is still confined to certain regions. It is a less cultivated crop and is almost on the verge of extinction. Conservation, popularisation and invention of appropriate and easy processing equipment for *Korale* could go a long way in addressing the issues of food security, malnutrition and climate change, while protecting the livelihoods of farmers.

Krishna Prasad G

Sahaja Samrudha

No 7, 2nd Cross, 7th Main, Sulthanpalya,
Bengaluru-560032

E-mail: sahajaindia@gmail.com

India asks UN to declare 2018 as International year of millets

India has asked the United Nations to declare 2018 as the 'International Year of Millets' and promote it as nutrition-rich smart food across the world. A letter in this regard has been written to UN Secretary General Antonio Guterres by Union Agriculture Minister Radha Mohan Singh.

In the letter, Singh said there is a need to promote millets as the "awareness is low" among consumers, policy makers, industry and R&D sector. Sorghum, Bajra and Ragi are some popular millets in India. "Promotion of production and consumption of millets through conscious efforts at global level is likely to contribute substantially in the fight against the targeted hunger and mitigate the effects of climate change in the long run," he said.

The yield of millets can be increased three times and they have multiple untapped uses such as food, feed, biofuels and brewing. Therefore, millets are smart food and good for consumers, farmers and the planet, he added. "Considering the importance of millets ...the Government of India along with other country governments urges the UN to declare 2018 as the 'International Year of Millets'," Singh said. This will go a long way in popularising millets which would benefit future generation of farmers as well as consumers, he added.

Read more at: <https://economictimes.indiatimes.com>

Karnataka announces 3-day Organics and Millets global fair

Karnataka on Monday announced a three-day international trade fair on organics and millets that will be held in January at Bengaluru, as part of the government's continued push for organic food production and consumption.

"While other states are also growing organic foods, Karnataka is the only one taking up the task of creating a market for these products. Our intention is to take organic and millet foods to the international market," Agriculture Minister Krishna Byre Gowda said at a curtain-raiser event here. Karnataka has been aggressively promoting organic foods for the last couple of years, the minister said. "Ragi, white corn (bili jola) and pearl millet (sajje) are being cultivated on 18 lakh hectares in the state. This will go up

by 10-15% this year. Also, the area under cultivation of minor millets such as saame, baragu, navane and udalu has doubled from 20,000 to 40,000 hectares. All this is because of the government encouraging organic foods," Gowda said.

The international trade fair will be held between January 19 and 21 at Bengaluru. The Minister also launched the official website for the Organics and Millets 2018 international trade fair - organics-millets.in

Read more at <http://www.deccanherald.com/content/641328/karnataka-announces-3-day-organics.html>

Centre working to include millets in school feeding programmes & public distribution system

With a view to ensure that millets become a part of average Indian's diet, the Union government is trying to include it in school feeding programs, Union Agriculture Secretary SK Patnaik said at an ASSOCHAM-Karnataka Government joint event held in New Delhi.

"The government is thinking to coin a new term called 'nutricereals' for millets, perhaps that will have a much better meaning and carry the message to every citizen of this country," he added.

According to the agriculture department, it is trying to resolve various issues related to millets as the Indian Council of Agriculture Research (ICAR) is working on producing high yielding varieties and enhancing the shelf-life. Besides, the government is also planning to give specific assistance to those willing to grow millets under the National Food Security Mission of the department of agriculture.

Read more at <https://timesofindia.indiatimes.com/india/centre-working-to-include-millets-in-school-feeding-programs-public-distribution-system/articleshow/61822595.cms>



Mainstreaming agrobiodiversity in sustainable food systems Scientific foundations for an agrobiodiversity index

Bioversity International, 2017, *Bioversity International Rome (Italy)*, 180 p. ISBN: 978-92-9255-070-7

www.bioversityinternational.org/mainstreaming-agrobiodiversity



The first comprehensive scientific analysis of how agrobiodiversity can make our vulnerable food system more resilient, sustainable and nutritious has been carried out by leading agrobiodiversity research centre Bioversity International. The 200-page guide provides solid evidence that investments in agrobiodiversity also play a critical yet overlooked role in tackling wider global targets such as reducing poverty and malnutrition, reversing environmental degradation and combating climate change. It demonstrates that agrobiodiversity can be a more mainstream approach to sustainable development.

This book summarizes the most recent evidence on how to use agrobiodiversity to provide nutritious foods through harnessing natural processes. The book focuses on the following thematic areas: - Agricultural biodiversity and food system sustainability - Food biodiversity for healthy, diverse diets - Using biodiversity to provide multiple services in sustainable food systems - Seed systems for crop and tree diversity in sustainable food systems - Conserving agricultural biodiversity for use in sustainable food systems - Towards an Agrobiodiversity Index for sustainable food systems

Eco Agri Revolution: Practical lessons and the way ahead

M. H. Mehta, 2018, *NIPA*, 296 p., *INR 2995.00*, ISBN: 9789386546197



The Sustainable Development Goals endorsed by the United Nations, put great emphasis on moving away from heavy input agricultural system to more eco-friendly and balanced farming. Eco Agriculture or Agro Ecology is the approach capable of producing enough food and accessible food without harming the environment.

This book is about moving from 'Know How' to 'Do How' and brings about rich experience in industrial research and farm scale demonstrations in different parts of the world to show the practical aspects of Eco Agriculture. Theory and practice and recent developments in the areas of Bio Fertilizers, Bio Pesticides, and Bio Composts and agrowaste management form important base for Eco Agriculture practices. The global scenario of industrial development and future trends are discussed.

Developments and field experiences in Bio shield, Water use efficiencies, ICT, Rehabilitation post disasters like Earth Quake and Tsunami, Saline Water Agriculture and River Revival Projects, Urban agriculture and their common link for Eco Agriculture Revolution makes the book especially significant. Finally, the Author describes the 'Way Ahead' for Eco Agri Revolution including aspects of Soil and Waters and COP 22. The conviction about the coming Eco Agri Revolution and planning and implementation for a sustainable future are the final thoughts that makes this book extremely valuable to the current and future generations.

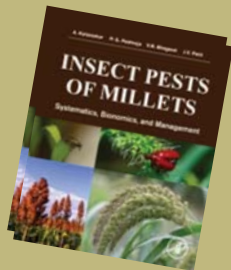
The State of Food and Agriculture - 2017

Leveraging Food Systems for Inclusive Rural Transformations

FAO, October 2017, 178 p., ISBN 978-92-5-109873-8



One of the greatest challenges today is to end hunger and poverty while making agriculture and food systems sustainable. The challenge is daunting because of continued population growth, profound changes in food demand, and the threat of mass migration of rural youth in search of a better life. This report presents strategies that can leverage the potential of food systems to become the engine of inclusive economic development and rural prosperity in low-income countries. It analyses the structural and rural transformations now under way, and examines the opportunities and challenges they present to millions of small-scale food producers. It shows how an "agroterritorial" planning approach, focused on connecting cities and towns and their surrounding rural areas, combined with agro-industrial and infrastructure development can generate income opportunities throughout the food sector and underpin sustainable and inclusive rural transformation.



Insect Pests of Millets Systematics, Bionomics, and Management

A. Kalaisekar, P. Padmaja, V. Bhagwat, J.V. Patil, 2017, *Academic Press*, 204 p., ISBN: 9780128042434

Insect Pests of Millets: Systematics, Bionomics, and Management focuses on protecting the cultivated cereals that many worldwide populations depend on for food across the semi-arid tropics of the world. Providing coverage of all the major cultivated millets, including sorghum, pearl millet, finger millet, barnyard millet, proso millet, little millet, kodomillet, and foxtail millet, this comprehensive book on insect pests is the first of its kind that explores systematics, bionomics, distribution, damage, host range, biology, monitoring techniques, and management options, all accompanied by useful illustrations and color plates.

By exploring the novel aspects of Insect-plant relationships, including host signaling orientation, host specialization, pest – host evolutionary relationship, and biogeography of insects and host plants, the book presents the latest ecologically sound and innovative techniques in insect pest management from a general overview of pest management to new biotechnological interventions.

The book includes the most comprehensive and relevant aspects of insect systematics, including synonyms, nomenclatural history, and identification characters to quickly guide readers to desired information; addresses aspects of insect-plant relationships, including host signaling and orientation, host specialization, pest – host evolutionary relationship, and biogeography of insects and host plant and presents the latest research findings related to the ecological, behavioral, and physiological aspects of millet pests.

Millets Nutritional Value and Processing Technology

Chavan, U. D., Patil, J.V., 2016, *Daya Publishing House*, 332 p., ISBN: 9789351247128, 9351247120



Millets: Nutritional Value and Processing Technology book contains 14 chapters, several food products photographs and health benefits. It also provides extensive information on the nutritional value, chemical composition, processing and health benefits of these foods. In addition, the anti-nutritional factors present in these foods and ways of reducing their health hazards are discussed. The author has described formulations of various popular foods prepared from sorghum and millets and their nutritional composition and quality. This book gives in-depth information about major/coarse millets and minor millets. Sorghum and millets in human nutrition is intended to provide up-to-date scientific and practical information to scientists, government officials, extension workers, university professors and others interested in these food crops.

Minor Millets in South Asia Learnings from IFAD-NUS Project in India and Nepal

Bhag Mal, S. Padulosi and S. Bala Ravi, (Eds.), 2010, *Bioversity International, Maccaresse, Rome, Italy and the M.S. Swaminathan Research Foundation, Chennai, India*. 185 p., ISBN: 978-92-9043-863-2



This publication contains valuable information on the outstanding contributions made under the IFAD supported project “Enhancing the Contribution of Nutritious but Neglected Crops to Food Security and to Incomes of the Rural Poor: Asia Component – Nutritious Millets”, both in India and Nepal to advance the sustainable conservation and use of minor millets, including the characterization of their genetic resources, their participatory variety selection, the development of improved agronomic practices, seed production, value addition and product development, capacity building of stakeholder groups and public awareness. This publication will be very useful to all stakeholders engaged in promoting these crops, such as researchers, farmers and community members, entrepreneurs, students, planners and policy makers.

Meet the Millet Man

Amit Chakravarty

Millets face low consumer awareness and demand, weak value chains and low interest from research organizations as well as commercial players. This lack of interest is surprising given that millets have high nutritional benefits, mitigate risk for farmers under adverse weather conditions induced by climate change. They are good for the environment as they require less water and need very little external inputs. Farmers are turning the tide by addressing the issues that plague millet promotion.

As we walk towards the fields we see a shed under construction and Mr Veer Shetty is telling us about his future plans - “I plan to provide employment to at least 100 youth in this cluster of villages through our traditional crops – millets and sorghum – and attract them back to agriculture.”

We are in Gangapur village, Sangareddy district in Telangana, with Mr Shetty. He has transitioned from a farmer to an entrepreneur setting up his own food processing plant, producing millet-based ready to eat food. This processing unit is expected to be ready over the next three to four months. He also has a shop-cum-restaurant, SS Bhawani Foods, in Hyderabad, selling millet based products like *bajra roti*, *jowari roti*, *multi-millet laddu*, *pooranpoli*, millet malt etc. With a daily customer base of 200-300, Shetty is encouraging urban consumers to eat healthy food, while inspiring farmers to grow millets.

Shetty is the eldest of three brothers. After having studied upto Class X, he had to start earning for the family. He began working as a driver. In 2005, he turned his attention to sorghum cultivation. In 2007, he opened a small shop in Hyderabad selling *jowari roti*. At that time there wasn't much awareness among the people on the benefits of sorghum and millets, so the venture failed. He decided to move his

Different types of millet products on display





Demonstrating millet rotis to farmers in Odisha

shop to another locality where he started getting more customers, especially diabetes patients. He then set up SS Bhawani Foods to operate on a larger scale, complete with an industrial scale kitchen and a small restaurant. Apart from serving millet-based meals, the restaurant aims to educate people on the nutritional benefits of millets through posters adorning the walls.

Shetty designed the roti making machine and got it manufactured in Bangalore which can make 500 rotis per hour. He sells 2,000 – 3,000 rotis per day through his outlet. From this outlet, items like dry rotis, which have a shelf life of 6 months, are exported to Australia and *pooranpoli* is exported to Dubai through a food export agency. Around 2,000 rotis and 300-400 *pooran polis* are exported every month.

In 2016, Shetty started the Swayam Shakthi Agri Foundation to work with millet farmers. Through the Foundation, he supplies inputs to farmers, trains them on cultivation practices for getting better yields, buys back the produce, offering premium price. The Foundation in collaboration with MS Swaminathan Research Foundation (MSSRF)

Apart from serving millet-based meals, the restaurant aims to educate people on the nutritional benefits of millets through posters adorning the walls.

reaches 500 tribal farmers in Koraput district, training them on how to make various millet products such as *laddu*, *sevaiyan*, *chiwda*, *roti*, etc. They have also been trained on various aspects of farming such as preventing diseases, techniques of rainwater conservation, preparing vermi compost, aerobic compost, improving soil organic matter, various sowing techniques, etc.

Collaborating on another project with the Indian Institute of Millets Research, Shetty is working with 1,000 farmers in 8 villages of Sangareddy district, Telangana. *“To buy a kilogram of seed, a farmer has to travel to the town. Even then, he has no idea of the quality of the seed he purchases. We supply quality seeds to farmers at their doorstep. We even advise them on what crop to plant every season taking into account the market prices, the glut and shortfalls in the market.”* After procuring from farmers, the produce is graded for food, feed and brewing purposes. The produce suitable for human consumption is retained for further use. The remaining produce is sold to seed companies, livestock feed companies, and distilleries for ethanol production.

Elaborating on the health benefits of millets Shetty says, *“Sixty percent of my customers are young professionals from the information technology (IT) industry who we see are more prone to health disorders such as obesity and diabetes. The remaining customers are middle-aged or elderly people with health disorders. A small fraction is the health conscious segment of consumers. Due to rising incidence of lifestyle*



Explaining about different products on display

diseases, doctors are advising patients to switch to millet based diets”, he adds.

Due to the low returns, farmers are reluctant to grow millets. “Promoting millet consumption among urban consumers will increase demand, thus encouraging more farmers to switch to cultivating millets”, feels Shetty.

The government also can do a lot - promote millet consumption in canteens situated in government office complexes like Secretariat; ashram schools run by the tribal welfare department; residential schools like Jawahar Navodaya schools and those run by the social welfare departments of different states; also, in mid-day meal scheme. It can promote entrepreneurship to set up processing and sales outlets in urban areas. *“Some state governments like in Tamil Nadu and Telangana provide subsidised meals to people which is usually rice and sambar. Millets can be substituted for rice,”* says Shetty. He feels that the government should encourage farmers to grow millets on at least 10 percent of their land along with other crops that they are growing. Food processors can be encouraged with

tax breaks and buy back support from the government, to supply to government canteens, hostels, etc.

“People would like to consume millets, but they are not easily available,” he adds. Back in Gangapur village, his food processing unit is the foundation of a larger dream. A warehouse, a farmer training centre, demo plots, organic farming and many other initiatives are waiting in the wings to give life to Shetty’s dreams. From this unit, he plans to supply millet based products to urban consumers, various urban outlets and to overseas markets. *“I want to reach consumers all over the world who are looking for a healthy lifestyle and thereby, benefit my farmer friends”,* says Shetty.

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Amit Chakravarty

Chief of Staff to the Director General
ICRISAT
Patancheru 502324 Telangana, India
E-mail: a.chakravarty@cgiar.org