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Special Issue on Millets

Scheduled Castes & Scheduled Tribes Research and
Training Institute (SCSTRTI), CRPF Square
Bhubaneswar, Odisha, India



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Prof. (Dr.) A.B. Ota

Advisor-cum-Director and Special Secretary, Scheduled Castes & Scheduled Tribes Research and Training Institute (SCSTRTI), CRPF Square, Bhubaneswar, Odisha, India

Editor

Prof. (Dr.) A.B. Ota

Advisor-cum-Director and Special Secretary

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EDITORIAL

SCs and STs Research and Training Institute (SCSTRTI), which is the oldest Tribal Research Institute of the Country, has been uninterruptedly publishing this nationally reputed Research Journal *Adivasi* incorporating the original writings, mainly based on empirical research, of reputed anthropologists, experts and researchers engaged in the field of study of tribal society and culture. This is the 1st issue of its 62nd volume.

This issue contains a total number of 07 articles. All these articles reflect rich experience, analysis, field observations and efforts of the authors. This issue comes out as a special issue on Millets, considering importance of millets in tribal culture and because there has been a vibe for revamping the millets biodiversity through customized programs on mission mode.

The association of the millets in tribal socio-cultural and economic life sets the context for this special issue. Further, the Department of Agriculture and Farmers Welfare (DA&FW) is implementing a Sub-Mission on Nutri-Cereals (Millets) under National Food Security Mission (NFSM) to enhance area, production & productivity of millets including bajra. The Rashtriya Krishi Vikas Yojana – Remunerative Approaches for Agriculture & Allied Sector Rejuvenation (RKVY- RAFTAAR) has set a premise for cultivation, promotion and popularization of millets. Odisha Millets Mission, formed in 2017, is one of the flagship programs launched by the Department of Agriculture and Farmers Empowerment, Government of Odisha being implemented in 142 blocks of 19 tribal and mining affected districts of Odisha.

In view of the nutritional value of the millets, the Government has notified millets as nutri-cereals in April, 2018. The Millets are a rich source of Protein, Fibre, Minerals, Iron, Calcium and have a low glycemic index.

The National Year of Millets was celebrated in 2018. To create domestic and global demand and to provide nutritional food to the people, Government of India had proposed to United Nations for declaring 2023 as International Year of Millets (IYoM). The proposal of India was supported by 72 countries and United Nation's General Assembly (UNGA) declared 2023 as International Year of Millets in March, 2021.

The first article captioned *Tracing our millets: History, archaeology, cultures, and conservation* contributed by M. K. Jena, J. Mishra and A.B. Ota ventures into the importance of millets in cultures and communities across India and enlightens the distant history of millets as evidenced from neolithic cultures in parts of India and Odisha. The authors view that the tribal communities have centuries old association with millets as evidenced by their religion, festivals, cuisine, and food production pursuits. Considering the importance of

millets in terms of climate resilience, drought proofing, food and nutrition, endemism and their potential to contribute to the food, nutrition, livelihoods and income of communities around, policy level initiatives and programs have been expedited over the years. Many research and studies in this regard have been concentrating more on the agriculture and economics grossly ignoring the society and culture of the tribal communities who are the saviours of millets so far. The paper provides a comprehensive account of the history, archaeology, culture and conservation perspectives contextually and suggesting new areas of research studies that may be undertaken to provide inputs for policy level changes and reorientation of strategies.

The nutritional importance of millets is pertinently presented by D. Panda in his article *Sprouting of millet enhances nutrient bioavailability and better for human health* in the 2nd article of this issue. The paper provides comparative nutritional compositions of raw and sprouted millet flours of proso millet, finger millet, little millet, pearl millet, sorghum millet, fox tail millet and kodo millet that are commonly used as traditional food by the tribal/rural people of Koraput. The author observes that, traditional processing by sprouting of millets led to greater retention of nutrients and moderate loss minerals as well as enhances the bioavailability and can be beneficial for health.

The 3rd article explores into the agro-biodiversity of millets especially in the context of Odisha as presented by S.S. Chaudhury and A. Pradhan in their article *Varietal differences and geographical indication of Millet species: Exploration into tribal hinterland of Odisha*. The authors have presented that there is variation in millets varieties being cultivated in diverse ecosystems of Odisha, especially in tribal dominated districts of Odisha. The authors have observed that livelihood activities of the tribes are generally farming on undulating landscapes and hill slopes, with remarkable crop diversification factored by topographic variations. Considering the above factors millet is preferred as major crop in tribal farming ecosystems. The preference of tribes, as regards to field crops, varies from area to area depending on the soil, water, natural resources, and socio-culture. Due to this varietal difference is seen at various geographical location in millet crops. The paper discusses the existing millet varieties cultivated in tribal areas of Odisha and the geographical indication related to certain varieties of millets.

The 4th article in the issue prepared by B.K. Nayak and C.R. Das titled *Revalorizing millet-based production system and its agroecology in Koraput District: Issues, challenges and policy recommendations* critically analysed various key components of millet-based production system and its agroecology- conservation, cultivation, consumption and commercialization of millets along with policy recommendations based on the contextual impact assessments. The paper reveals about the various useful information from various programme and action research projects implemented at Koraput through using various statistical tools. Moreover, agricultural impact assessment methods are used for collecting and validating data from the primary and secondary sources, community-based

organizations, and agriculture departments. It also focuses on various tangible and intangible impact of interventions to safeguard millet-based production, consumption, processing and marketing for enhancing food, income and nutrition security. The study identifies various grassroots policy recommendations to strengthen interventions like Millet Mission through community-based organizations in the context of climate change and livelihood interventions. The study finds that the production of millets can be enhanced through enabling tribal communities to adopt sustainable agriculture practices, avail timely technical and inputs support from government and CSOs of the locality.

Empirical observations on millet cultivation and use in tribal villages provides new insights for strategizing promotional interventions in millets. In this context, the 5th paper of the issue contributed by P. Mohanty with the title *Empirical study on Status of Millets cultivation and use in a Kutia Kondh Village* analysed millet-based bio-diverse farming pattern, practices and knowledge associated including the food habits, customs and cultural beliefs. The paper presents the observations on the millets and the thematic dimensions associated with millets in Dupi village of Kondhmal district. With reference to Millet Network of India (MINI), the author holds that, 'millets are not mere crops; they are an entire concept'. Across the country, it is seen that millets have never grown alone, and always in combination with a host of other crops that include other millets, pulses, oilseeds, vegetables and a host of other crops - each with different cropping cycles and different uses. Based on the empirical observation, the author views that the current programs and paradigms in millets interventions should comprehensively address the biodiversity, the organic practice, the marginal- small farmers' survival, livelihoods, nutritional aspects and the agenda of indigenous peoples' knowledge systems and climate coping mechanisms for effective outcome.

In the 6th paper in this issue, T. Roy's article *Valuing traditional millet recipes* unfolds the importance of millets for the small and marginal tribal farmers in food, nutrition, fodder, especially in the context of climate change and crop resilience. The author has observed that the food system of the tribals has undergone many changes in the last two decades and still changing fast. In this transition, the millet food is slowly losing the links with the ecosystem and its biodiversity. Odisha tribals possess skill and knowledge of making different types of traditional millet recipes. The paper presents an account of finger millet recipes by tribal people in Koraput based on a primary study on 100 tribal households in Dasamantpur block of Koraput district in Odisha. Information related to the traditional millet recipe was collected, documented and analysed for frequency and time of millet recipe consumption, perceptions on millet recipes, and brings out set of peoples' suggestions towards promoting consumption of millets. The paper views that valuing traditional millet recipes will not only address the food security but also the nutritional security of the people.

The 7th and last article of the issue brings in an interesting account on interventions in mainstreaming millets by exploring vertical and horizontal linkage. The article by A. Likhar

titled *Mainstreaming millets in Southern Odisha's Malkangiri District* takes a look at the reasons of deterioration in millet production in Malkangiri and the efforts made towards promoting millet production there through comprehensive market led extension under Odisha Millets Mission. The concerted efforts of many actors and agencies have brought about inspiring results in extension of millet cropping, conservation of local varieties, value added marketing through Farmer Producer Organizations (FPOs) and above all in the food and nutritional security of tribal households.

I express my heart-felt gratitude to all the paper contributors for their sincere efforts in contributing the articles for this volume of Adivasi. My sincere thanks go to our Associate Editor Shri S.C. Mohanty Consultant (research) and our Lead Consultant Dr. Mihir Kumar Jena for taking all the pains to prepare this volume for publication. I take this opportunity to invite scholars and contributors to enrich all our future volumes with their valuable suggestions and contribution of empirical research papers.

30th September, 2022
Bhubaneswar

Prof. A. B. Ota
Editor

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Tracing our millets: History, archaeology, cultures, and conservation

Mihir Kumar Jena¹, Jitu Mishra², Akhila Bihari Ota³

Abstract

Millets are native species indigenous to a given region or ecosystem in many parts of the world including Asia and Africa. The most widely grown millets are finger millet, sorghum, foxtail millet, proso millet and pearl millets, which are important crops in India. There are archaeological evidences conforming endemism of millets in geographical regions of India.

The nutritious millets traditionally occupied substantial part of the diets and crop systems in tribal areas of Odisha especially in the rainfed regions. The tribal communities have centuries old association with millets as evidenced by their religion, festivals, cuisine, and food production pursuits. However, due to several reasons the millets cultivation in tribal areas came through a gradually decreasing trend. Considering the importance of millets in terms of climate resilience, drought proofing, food and nutrition, endemism and their potential to contribute to the food, nutrition, livelihoods and income of communities around, policy level initiatives and programs have been expedited over the years. Many research and studies in this regard have been concentrating more on the agriculture and economics grossly ignoring the society and culture of the tribal communities who are the saviours of millets so far. The paper takes a comprehensive view at the history, archaeology, culture and conservation perspectives contextually and suggesting new areas of research studies that may be undertaken to provide inputs for policy level changes and reorientation of strategies.

Introduction

Oxford dictionaries defines millets⁴ as a highly varied group of small-seeded grasses, widely grown around the world as cereal crops or grains for fodder and human food. According to McDonough, et.al. (2000) millets are important crops in the semiarid tropics of Asia and

¹Lead Consultant, SCSTRTI, Bhubaneswar drmihirkumar@gmail.com

² Archaeologist and Researcher, Sarna Educational and Cultural Services, Bhubaneswar

³ Advisor cum Director SCSTRTI & Special Secretary to Government of Odisha, SCSTRTI, Bhubaneswar

⁴ Definition of millet. Oxford Dictionaries. Oxford University.

Africa with 97% of millet production in developing countries. This crop is favoured due to its productivity and short growing season under dry, high-temperature conditions. Millets are native species indigenous to a given region or ecosystem in many parts of the world as they justify their presence in that region as the result of only local natural evolution. The most widely grown millets are finger millet, sorghum, foxtail millet, proso millet and pearl millets, which are important crops in India. Millets may have been consumed by humans for about 7,000 years and potentially had "a pivotal role in the rise of multi-crop agriculture and settled farming societies" (Cherfas, 2015).

Millets are one of the oldest foods, these are the small-seeded hardy crops which can grow well in dry zones or rain-fed areas under marginal conditions of soil fertility and moisture. Millets are cultivated in low-fertile land, tribal and rain-fed and mountainous areas. These areas include Haryana, Uttar Pradesh, Chhattisgarh, Gujarat, Rajasthan, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Telangana.

Due to their short growing season, millets can develop from seeds to ready to harvest crops in just about 65 days. This highly beneficial characteristic of the millets is of vital importance in thickly populated regions of the world. If stored properly, millets can keep well for two years or beyond. Millets can not only grow in poor climatic or soil conditions and provide nutritious grain as well as fodder, but these can also very well fit into multiple cropping systems under irrigation as well as dryland farming due to their short growing season. The prolonged and easy storability of millets under ordinary conditions has given them the status of Famine Reserves and this feature is of great importance for India, as the agriculture of our country suffers from unexpected changes in monsoon.

There is evidence of the cultivation of millet in the Korean Peninsula dating to the Middle Jeulmun Pottery Period (around 3,500–2,000BC). In India, millets have been mentioned in some of the oldest Yajurveda texts, identifying foxtail millet (*priyangava*), Barnyard millet (*aanava*) and black finger millet (*shyaamaka*), thus indicating that millet consumption was very common, pre-dating to the Indian Bronze Age (4,500BC).⁵ Even until 50 years ago millets was the major grain grown in India. From a staple food and integral part of local food cultures, just like many other things, millets have come to be looked down upon by modern urban consumers as "coarse grains".

The millets commonly grown in India include major millets like Jowar (sorghum), Bajra (pearl millet), ragi (finger millet), Kangu (foxtail/ Italian millet), and minor millets like barnyard millet, Proso or common millet, Kodo millet etc. Many of the minor millets have become threatened and endangered.

⁵<https://www.icrisat.org/a-short-history-of-millets-and-how-we-are-recognising-their-importance-in-the-modern-context>

Millets in India		
Millets⁶	Other names	Characteristics / nutritional facts
<i>Eleusine coracana</i>	Ragi, Finger millet	Finger Millet is a staple that is a very good substitute for oats and cereals. It is nutritionally superior to rice and wheat due to high amount of dietary fibers, iron, zinc, Ca, phosphorus, potassium, vitamin B, and essential amino acids (Parameswaran and Sadasivam, 1994).
<i>Panicum miliaceum</i>	Proso millet, broomcorn millet, hog millet, white millet	Proso millet is rich in minerals, dietary fiber, polyphenols, vitamins and proteins. High lecithin which supports the neural health system. It has a low glycemic index and reduces the risk of type-2 diabetes. (Das, et.al. 2019)
<i>Panicum sumatrense</i>	Little millet	Loaded with iron and fibre. Known for several health benefits due to the presence of bioactive nutraceuticals such as phenolic compounds, gamma-aminobutyric acid (GABA), carotenoids, and tocopherols (Guha, et.al. 2015).
<i>Pennisetum glaucum</i>	Pearl millet, Bajra	High source of proteins. Pearl millet has high nutritional value in terms of high levels of energy, dietary fibre, proteins with a balanced amino acid profile, many essential minerals, some vitamins, and antioxidants (Jukanti, et.al. 2016).
<i>Setaria italica</i>	Foxtail millet, Italian millet	Rich in minerals and vitamins. Its grains contain a comparatively higher amount of essential amino acids, proteins, important nutritional elements like potassium, calcium, zinc, iron, phosphorous, vitamin B, etc. (Bandyopadhyay et al., 2017b).
<i>Echinochloa frumentacea</i>	Indian barnyard millet	Nutritionally, it is a decent source of protein, which is profoundly absorbable and is an amazing source of dietary fibre. Can be suggested for the patients with cardiovascular sickness and diabetes mellitus. (Rao et al., 2017)
<i>Echinochloa crus-galli</i>	Common barnyard millet	
<i>Paspalum scrobiculatum</i>	Kodo millet	Has high protein content, low fat and very high fibre content. It is rich in B vitamins as well as the minerals such as calcium, iron, potassium, magnesium and zinc; and contains a high amount of lecithin and is an excellent for strengthening the nervous system.
<i>Brachiaria ramosa</i>	Browntop millet	

⁶ <https://en.wikipedia.org/wiki/Millet#Research>

<i>Sorghum bicolor</i>	Sorghum, great millet	Nutritionally, it is composed of carbohydrates, kafirin (protein), polyunsaturated fatty acids (PUFA), fibers and resistant starch. The functional composition of sorghum plays an essential role in human health by inhibiting the risk of chronic diseases (Khalid, et.al. 2022).
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Millet in Neolithic Cultures of India - An Archaeological Summary

Millet is a group of cereals grown in low fertile soil and areas receiving low rainfall. Millets contribute largely to the food security of marginalized communities. Most millet varieties are native to India. They provide most of the nutrients for the normal functioning of the human body. Millets were the oldest cultivated food human communities have been consuming in Asia and Africa. However, over time especially after the industrial revolution, the cultivation of millets declined due to the large-scale cultivation of rice and wheat.

Consumption of Millet in Indus Valley Civilisation

Indus Valley was a Bronze Age civilisation, which flourished in a large area of the north-western part of the Indian Subcontinent between 3000 and 1400 BCE. Archaeobotanical investigations have revealed a substantial quantity of both sorghum and little millet from various archaeological sites of the Indus Valley Civilisation.

Sorghum millet has been reported from the early Harappan level (3000 - 2500 BCE) at Kunal and Banawali, mature Harappan level (2500 - 2000 BCE) at Banawali and Rohira, and late Harappan level (2000 - 1400 BCE) at Mahorama, Hulas, Sanghol, and Pirak.

Little millet has been reported from all phases of Harappan culture in the core region of the civilisation. Likewise, other varieties of millet including pearl millet, finger millet, Italian millet, and foxtail millet have also been reported from various Indus Valley sites. Though millet was reported from the early phases of Indus Valley Civilisation, its consumption increased towards the later period thus confirming the shifting of food culture from rain-fed to drought resilience. It is established that the erratic behaviour of the Indian monsoon in the middle of the 2nd millennium BCE was one of the major factors for the decline of the Indus Valley Civilisation.

The Northern Vindhyan Plateau

The Northern Vindhyan Plateau is situated in the north-central part of the Subcontinent in the states of Madhya Pradesh and Uttar Pradesh. This hilly tract is characterized by rugged topography of hills and plateaus. The undulating plateau gradually merges at many places with the plains of the Gangetic Valley in the north. The plateau enjoys a transitional climate between the maritime climate of the east and the tropical continental dry climate of the west.

Neolithic sites excavated in the plateau are Koldihwa, Mahagara, and Pachoch in the Belan Valley, Indari in the Adwa Valley, and Kunjhum in the Son Valley.

Though rice was widely consumed in the region, the neolithic community also subsisted upon little millets. Evidence of little millet has been reported from Koldihwa.

South Indian Neolithic Culture

In and around the granite hills of South India, neolithic culture was well-evolved. In the southern neolithic sites, mostly in Karnataka and Telangana, groups of village-based farmers grew dry farmed millets, both introduced and locally domesticated. The later phase of the Neolithic Period saw a significant innovation in crop regimes. Both domesticated finger millet and imported sorghum and pearl millet from Africa were introduced. The evidence establishes that the neolithic farmers of South India were actively experimenting with plants and animals including millet.

Millets in Neolithic Odisha

In Odisha, little millet is widely grown in the hills of the Eastern Ghats and Chotanagpur Plateau. It is generally shorter having smaller panicles and seeds. It grows on a large scale with minimum care on hill slopes and foothills. It matures quickly and withstands both drought and waterlogging. Little millet is being cultivated in Odisha since Neolithic Period.

In the pre-history of Odisha, the neolithic was the most elaborate and widely spread both in the coastal plains and in the highland river valleys. According to radiocarbon dates, the time bracket of neolithic culture in Odisha is between the 3rd and 2nd millennium BCE. During the Neolithic Period, the early inhabitants of Odisha became food producers from food gatherers. Excavations carried out at different neolithic sites, such as Golabai, Gopalpur in coastal Odisha, and Khamberswarpalli, and Hikudi in Middle Mahanadi Valley have revealed evidence of food including millet. Impressions of rice and millet have been recorded on several burnt clay lamps both from coastal and middle Mahanadi basin sites.

Considering the archaeological evidence and the spread of Mundari (an Austro-Asiatic language group) in highland Odisha it is believed that several bands of Austro-Asiatic communities had arrived in Odisha from Mainland Southeast Asia through the corridors of Northeast India. They brought with them various species of domestic animals, such as water buffalo and pigs, and crops, such as small millets.

GolabaiSasan is one of the earliest well-excavated sites in coastal Odisha located on the left bank Malaguni River of the Mahanadi Delta system, close to Chilika Lake. Radiocarbon dates suggest that GolabaiSasan was inhabited between 2300 – 2100 BCE.

Gopalpur is yet another Neolithic site located close to GolabaiSasan. In the absence of radiocarbon dates, relative dating suggests that both Golabai and Gopalpur were contemporary. Floatation techniques at both sites have revealed evidence of rice and small millets (*panicum sumatrense*, *paspalum* sp, and *setariasp*). The early settlers in both the sites also cultivated horse gram, pigeon pea, mung, and urad.

Though rice constituted a large percentage of the staple diet at Golbai Sasan during the Neolithic Period, millet was grown as an insurance crop. Millet became staple food during the years of low rainfall. Possibly millet was also cultivated in order to provide fodder for cattle and other livestock.

The food evidence of neolithic coastal Odisha shows striking similarities with the archaeobotanical remains found in the Belan River Valley of the Vidhyan Mountains of Central India. Both the regions exploited small varieties of millet along with rice and native pulses.

Tribes of Odisha and their association with millets

The nutritious millets traditionally occupied substantial part of the diets and crop systems in tribal areas of Odisha. Millets are part of the traditional staple diet and crop systems in Odisha supplementing nutritional needs of the communities in the rainfed regions. Tribal people of Odisha well recognise and assert the value of millets, a cereal crop that was once central to their culture and is seen today as a perfect adaptation to ensure nutritional security in these times of climate distress. The tribal communities have centuries old association with millets as evidenced by their religion, festivals, cuisine, and food production pursuits.

There is a preference of different types of millets that these tribals grow. Odisha tribals possess knowledge of making different types of traditional millet recipes. Millets are consumed as a staple food and drink by the local tribal communities. The tribal communities predominantly cultivate local landraces of millets using traditional agronomic practices. Millets are mostly raised in kharif (June–September) on marginal lands in the upland and hilly regions with few or no external inputs, either as a pure crop or with a range of pulses, legumes and oilseeds under mixed cropping systems. Tribals practice shifting cultivation on medium and uplands along the hill slopes, where the crop is cultivated during June to September. Despite great value associated with this nutri-crop by the local communities, there has been decline both in area and in production of the crop. The tribal people are thus the custodians of millets agro-biodiversity in the region where traditionally they have been growing millets that are suited to local climate and terrain.

The potential of millets as a source of nutrition and a tool for hunger eradication is well established. Millets constitute one of the oldest forms of source of food, particularly in the tribal regions of Odisha and elsewhere. Millets have been the main source of nutrition to these tribal communities. The tribal food habit and religious culture are integrated with the millets. Different ethnic groups know their cuisines prepared out of millets describe it in their language and the millets are associated with rituals and festivals of many tribal communities. The table below presents some of the cuisines prepared out of millets and references to certain cuisines in their religious culture.

Tribal cuisines with millets in Odisha				
Tribe	Name of cuisine			Ritual significance
	Tribal	Odia	English	
Bonda	Sametura/ Intira Riktar Uidhar Barijana Pendama Kirimatar	Mandiapej Suanbhata Kangubhata Jana bhata Mandiamada Mandiapitha	Ragi porridge Little millet rice Minor millet rice Sorghum rice Ragi beverage Ragi cake	Kirimatar is a cake prepared out of ragi, little millet, cow pea and carpet legume, offered to gods and goddesses during Sumegelirak and Kurukgige festivals
Binjhia	Gangeiruti Mandiaruti Suanbhata Gundlibhata Mandiajau	Bajra roti Mandiaruti Suanbhata Gurjibhata Mandiajau	Bajra chapatti Ragi chapatti Little millet rice Minor millet rice Ragi porridge	
Bhatara	Mandiapej	Mandiajau	Ragi porridge	Bihan puja
Bhumia	Suanbhat Mandiapej	Suanbhata Mandiajau	Little millet rice Ragi porridge	
Dangaria Kondh	Mande kape Pagalahi Jana lahi Larkalahi Akapite	Mandiajau Kosala bhata Bajra bhata Kangu Khiri Mandia pitha	Ragi porridge Little millet rice Bajra rice Minor millet kheer Ragi cake	Millets and millet cakes are worshipped/ offered to spirits in festivals like Mandiarani or Pabda Parba, Bicha parba for better yield
Didayi	Mandiapej Suanbhat Pendama	Mandiajau Suanbhata Mandiamada	Ragi porridge Little millet rice Ragi beverage	Pendama is prepared for offering to spirits during Pusa Parab
Durua	Beu/ Beyu Rata bawa/pita Koelabawa/pita	Suanbhata Mandiajau/pitha Suanjau/pitha	Little millet rice Ragi porridge/cake Millet gruel/cake	In the Landakhia Parab, fermented beverage prepared out of little millet is offered to spirits.

Gadaba	Samelida/ pita Samelpendam	Mandiajau/pitha Mandia landa	Ragi porridge/cake Ragi beverage	Fermented beverage offered to spirits
Gond	Gora jawa Gora pitha	Mandiajau Mandia pitha	Ragi porridge/cake Ragi beverage	Offered to spirits in Dijputan ritual
Holva	Mandiajau	Mandiajau	Ragi porridge	
Juang	Kude tana/jau Kudealak Gangeialak	Mandiabhata/jau Mandia pitha Gangei pitha	Ragi porridge Ragi cake Millet cake	Cakes are prepared out of millets to offer to spirits in festivals and rituals
Koya	Padkedoda Garra	Suanbhata Mandiajau	Little millet rice Ragi porridge	Millets are worshipped during Kurumpandu festival
Kutia Kondh	Mandesia Kueri bidi Katul/ Kena	Mandiajau Kosala bhata Katulmada	Ragi porridge Little millet rice Little millet beverage	Millets worshipped in Burlangakalu, fermented beverage offered to spirits in Punikalu festivals
Lanja Saora	Burairungarakul Kambarungarakul Mandiatundakul	Kangubhata Bajra bhata Mandiajau	Little millet rice Sorghum rice Ragi porridge	
Paroja	Mandiapej/pitha Suananda/pitha Pendam/Landa	Mandiajau/pitha Suanbhata/ pitha Pendam	Ragi gruel/cake Millet rice/cake Fermented beverage	Millet cakes are offered to spirits in Puspuni. Cakes are ritually fed to a woman after conceiving.
Paudi Bhuyan	Gangeibhat Tisidiabhat Kangu/suanbhat Gangei mad/pita	Bajra bhata Mandiajau Kangu/suanbhata Bajra mada/pitha	Sorghum rice Ragi porridge Millet rice Beverage/ cake	The fermented beverage and cake prepared out of sorghum is offered to spirits in Puspunei.

The long association of the tribal communities with millets is justified from their selection of millets in consideration to the landscape and ecosystem, their preferred food habits, the importance of millets as offerings to gods and goddesses in various rituals and festivals, the special cuisines prepared out of millets in special social and religious occasions, the involvement of men and women in cultivation and utilization of millets, and above all in

considering millets as food they can fall back upon in times of crisis owing to the fact that millets can be stored for years together in ordinary conditions.

Rationality of development intervention in millets

According to the Ministry of Agriculture & Farmers Welfare, in 2016 – 2017, the area under the cultivation of millet declined with 60% less coverage area (to 14.72 million hectares) due to change in consumption pattern, conversion of irrigated area for wheat and rice cultivation, unavailability of millets, low yield, dietary habits, less demand and marauding market. This resulted in fall in the level of nutrients like vitamin-A, protein, iron and iodine in women and children leading to malnutrition.

With regard to the Global Hunger Index - GHI, India ranks 64 among the 81 nations. It occupies second place in child malnutrition highlighting the poor plight of our country. This scenario persists when the Public Distribution System and Targeted PDS are working for nearly six decades. The reason is that the focus has been only on wheat and rice distribution while the millets have long been disregarded.

Despite numerous qualities, utilization of millets as food is confined to the traditional consumers i.e. tribal populations. This is mainly because of the non-availability of consumer-friendly ready-to-eat millet-based products. However, recently, millets have gained attention and efforts are underway to obtain their convenient and value-added processed products. Since many households in dry land and hilly regions depend on millets to meet their food needs, it has now been proposed to enlarge the food basket and include millets like jowar, bajra, ragi etc in the Public Distribution System.

Government has recognized the role of millets in the food chain. Targets have been set under the National Food Security Mission (NFSM) towards more allocations for increasing the millet cropping area and enhancing the production potential to the extent of 8% of the enhanced food grain production. Towards that policymakers in India and Odisha refocused their attention towards millet farming systems and enacted policies to create an enabling environment for the farmers. With respect to millets production, some of the existing schemes by the Government of India include:

- Integrated Cereals Development Programmes in Coarse Cereals (ICDP-CC) based Cropping Systems Areas under Macro Management of Agriculture (MMA).
- Initiative for Nutritional Security through Intensive Millet Promotion (INSIMP), a part of Rashtriya Krishi Vikas Yojana (RKVY) which is the only comprehensive initiative to support millet production.
- Rainfed Area Development Programme (RADP), a component of the Rashtriya Krishi Vikas Yojana (RKVY).
- Instituting National Millet Mission under the National Food Security Mission
- Odisha Millet Mission for facilitating promotion in production, processing, marketing and consumption of all millets.

Through the various schemes, programs, missions and sub-missions towards promotion of millets for multi-dimensional implications larger efforts are being given towards increasing the area under millets production, improved package of practices for yield enhancement, technology transfer for processing and value addition of millets products, publicity and marketing seems to have been over emphasized. However, the objective achievement of these noble initiatives is also facing socio-cultural issues challenging the outcomes. It is therefore important that to understand the tribal socio-cultural way of life through research studies and documentations that would provide new insights towards strategizing millet promotion initiatives in tribal areas of Odisha and elsewhere.

New Frontiers in millets research

Millets are generally considered tribals' crops or crops grown in tribal areas. Despite its importance from point of view of food, nutrition and economy of the tribal communities, there is no comprehensive database on millet growing areas in Odisha. Therefore, it is important to develop a scientific database that will serve the baseline and can be used as a planning tool.

In addition, millets being a major crop grown in tribal areas deserves special attention in research and documentation especially given the millets' relationship with tribal culture, food habit, agro-ecosystems, agronomic practices, germplasms and genepools. In order to build a comprehensive literature on the relationship of millets with tribes of Odisha, it is essential to undertake certain research studies.

Over the years, shifting cultivation became confronted with policy restrictions as the practice used to clear forest patches at intervals to make space for cultivation. Gradually, the shifting cultivation system took the form of slope agriculture without leaving the land under fallow as it used to be in the case of shifting cultivation. Due to several ecological and anthropogenic factors, changing land use and crop diversification the millet production systems dwindled reasonably. However, there is no dependable or authentic information regarding the extent of millet land use that was in past and the extent of area where millets are still being grown. This information is very important as the government under its flagship program in the name of millet mission is looking forward to upscale millet cultivation in tribal areas. This may be seen in two priority considerations like saving and propagating the climate resilient crops in which millets stand by merit; and on the other hand, to harness the objectives of nutrition.

Millets are nutritionally superior to most other cereals, making them a favorable crop to address the prevalence of malnutrition in tribal areas. Traditionally, millet has been a major staple for tribals and significantly address food scarcity during lean season when there is no agricultural harvesting crop on farm. The method of traditional millet recipes is easy to cook, mainly in the form of gruels, and occasionally as a mixture with few other vegetables, pulses and spice ingredients. Some of these traditional recipes include mandiajau (finger millet with broken rice, maize and barnyard millet), mandia and a (ragi flour with broken rice), mandia

tampa (ragi flour with broken rice and warm water), etc. However, with the introduction of monocropping, easy availability of rice under PDS and influence of urban food culture, tribal youth have reduced their millet consumption. Over the years, there has been rapid decline of millet cultivation and production leading to reduced grain availability for household consumption. In this context it is important to investigate and document the changes that has happened in millets-based food habit of tribals in Odisha and look into their allied dimensions.

Throughout ages, the observations on human ecology of tribes have brought into view many different aspects of tribal livelihoods and their geographical and cultural basis. Many In the context of tribal communities in Odisha, it is needless to say that many rituals and festivals are associated with millet cultivation, consumption and conservation. Millets are not merely a grain to be consumed, rather it is the repository of generations of community's wisdom of collective sowing and harvest. It holds the tradition of all the festivals which celebrates the underlying values of caring and sharing of their agriculture. Despite being neglected crop as "poor-men-food" millets survived for its deep-rooted cultural associations and festivals, which played a vital role in preserving them. Agriculture in tribal areas is not just limited to tilling, sowing and harvesting. There are many sub-activities like the observance of different kinds of rituals associated with cultivation. The festival provides a platform, particularly for the tribal people to celebrate diversity and tradition. It is in this context that the dimensions of tribal peoples' relationship with millets that may be explored from the range of their association with the topography, economy, ecology, culture and religion.

The agricultural geography of Odisha is classified into 10 diversified agro-climatic zones. With the variation of climate, topography, water cycle, soil structure and texture, and other demographic and environmental factors influences the adaptability and adoptability of local varieties of millet crop. With change in adaptability, various character traits of millet varieties undergo or has undergone changes across regions paving way for evolution of natural hybrids, various locale varieties and also the improved varieties. Based on the varietal variations, the farmers' perceptions relating to cultivation, yield estimate, climate resilience, etc of different varieties of millets is also changing. Farmers prefer local varieties based on different parameters such as consumption habit and association with socio-cultural and religious activities. Several locale varieties are being cultivated in different tribal locations of Odisha which are having unique character traits. Traditional cultivation practices are employed in production of locale varieties of millets. Tribal farmers often prefer mixed farming with locale varieties of millets under intercropping and multiple cropping methods under rainfed conditions. In the cropping cycle, millets cultivation is generally adopted at the high land regions essentially to avoid water logging situations. Various unique indigenous systems are employed in farming, pre- and post-harvest management of millets. Traditional farm mechanization evolved by tribal communities is by and large used for activities like drying, grading and storage. Indigenous knowledge transferred from generation to generation and farmers' experience of production practices

and crop management plays a critical role for post-harvest management of millet crops. In this context studies on millet diversity and traditional agronomic practices in Tribal Odisha may help building a knowledge body for informed decision making.

Landraces are ecotypes cultivated for a long time in pristine habitats. Tribal landscapes are home to many such landraces. Over the years the tribal people have isolated characteristically typical varieties and continued to cultivate such varieties that suits their food habit and food culture. The selection of the landraces by the tribal communities, presumably, were guided by the topographic variations, climate adaptability and resilience, site specific cultivation technology, insect-pest infestations, processing requirements, and of course taste. Thus, it may be generalized that varieties of landraces have been domesticated by the tribal people and most of them are still being cultivated in diverse ecosystems. Selected forms of millets are highly adapted to their native growing areas, conditions, and their agronomic practices have been inherited by the tribals from their predecessors. The traits that characterize such landraces express only in their sites of adaptation and if grown in other areas may not express fully. In addition, given the diversity of micro-climates in Odisha, farmers may be willing to sacrifice one criterion, for example, yield or genetic purity for sake of diversity or resilience. Given that clients of landraces are often local tribal farmers themselves, a systemic and systematic approach is needed for identification of various millet landraces. There is every possibility that certain landraces may have clear geographical indication while many could be universal to any place. Hence, studying geographical indication of millet varieties will help securing and protecting the typical landraces. The unique character traits of landrace varieties need to be documented which will help in understanding what landraces exist as common types, what have become rare and what have become threatened. Geographical indication studies have the potential to contribute to biodiversity studies and also would provide ready reference for plant breeding initiatives. Geographical indication references also have the potential to increase the marketability of millet landraces that would be incidental to boast the climate resilient agriculture of tribal people, and by that promote the livelihood and security of tribal communities.

There are many endemic crop germplasms in tribal areas of Odisha. Seed is the fundamental input for agriculture. Over the years, modernization of agricultural practices and cropping patterns has led to changes in genetic diversity in seed. The genetic base of traditional seed varieties has reduced considerably. Several traditional seed varieties are now facing extinction. The main reason for this is the lack of seed banks and seed preservation behaviour at community level. Farmers, in the process of adopting improved crop cultivars, have been losing their inheritable and accumulated knowledge, traditional process of seed selection, treatment and storage. Considering these issues, promoting the local seed varieties through informal seed distribution systems such as community seed banks is imperative in tribal areas. Knowledge on seed banking is required to promote informal seed distribution

systems. In order to conserve the millets germplasm, it is important to explore the domain of knowledge embedded in their traditional technology.

Gender studies in the perspectives of millet cultivation, utilization, conservation and management would suffice to the initiatives under millets promotion. Millet farming directly results in preserving and conserving biodiversity. This is one reason why women farmers in tribal communities, with their ecological acumen and their close association with climate protection, are best suited to be ambassadors of millet cultivation. Women also play a crucial role in practicing seed sovereignty principles and water conservation. They are also the repositories of traditional knowledge regarding millets. They are sustaining biodiverse farming by combining traditional knowledge and innovation to protect local seed system. They are more prominent in conserving local landraces, which are often better adapted to local environments and provide crucial options for adaptation to future climatic and market changes. Preserving traditional seeds is intrinsically linked to the food security, livelihood and culture of farming communities. Women play a greater role in sustaining biodiverse subsistence farming linked with responsibility for ensuring food security for the family. In most tribal communities' women are the primary producers of millets and spend long hours in processing them as it requires arduous labour. Traditionally, women play crucial role in the off-farm production and processing of millets. Much of the work related to on-farm and post-harvest processing for use is laborious, time consuming and involves drudgery. According to the Agriculture Census 2015-16, 73 percent of women in India practice agriculture. Around 42 percent of farmers in the country produced millets and about 80 percent of them were women.

Conclusion

Odisha was one of the earliest regions where possibly little millet was introduced as an indigenous food. However, not much archaeobotanical work has been carried out to establish the origin and spread and early millet culture in Odisha compared to South Indian and Vidhnyan neolithic sites. Now the time has come to do more investigation on the early farming of millet in Odisha and carry out an ethnographic investigation to draw the analogy.

Tribal cultural traditions have contributed largely for survival of millets in Odisha despite the fact that Green Revolution favoured rice and wheat ignoring the nutri-cereals like millets. What is exciting about it is that it is the diverse and vibrant tribal culture that has secured the stock of genetic diversity in millets. The world is probably thinking to reenergize the tribal practice of multi-culture and intercropping that is well suited to the climate challenges and at the same time provides food insurance and sustainable livelihoods. However, irony is that India has witnessed a decrease in the area under millets in past six decades, the main reasons attributed towards that being low returns in terms of remuneration, lack of input subsidies and price incentives, subsidised supply of cereals through the PDS, and change in consumer preferences.

Millets are being promoted through technology dissemination, quality seeds through millet seed hubs, awareness generation, minimum support price and possibility of inclusion in PDS. However, it is seen that larger importance is being given to Ragi as a consequence of which the minor millets are threatened. The Millet Mission does not restrict itself to Ragi but Ragi is gaining popularity for its easy processing. There should be a parallel policy of promoting minor millets along with the major millets both in production and marketing. It's time to lay equal focus on other millets for their genetic conservation. On the other hand, there is a perceptible focus on productivity delinking the spiritual, cultural and ecological dimensions of millets and their association with tribal culture. Instead of the linear arrangement in promotional interventions, it is suggested to adopt multi-pronged strategies integrating productivity, culture, environment and indigenous knowledge of tribal people. The approach to millets should reflect on the importance of local landraces. Also, strategies should be adopted to integrate the sub-mission of nutri-cereals with the flagship Poshan Abhiyan of the Union government. The focus on revival of millets should be complemented by the revival of consumption by producers for long term impacts in reduction of malnutrition especially in tribal areas. The considerable traditional knowledge of the tribal communities on millets conservation and propagation should be given due importance.

India's proposal to Food and Agriculture Organization for observing the year 2023 as International Year of Millets that has been approved in the 160th session of the FAO Council in December 2018 which is seen with lot of aspirations towards promoting conservation of traditional landraces and their propagation at a scale.

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Sprouting of Millet Enhances Nutrient Bioavailability and Better for Human Health

Debabrata Panda¹

Abstract

Millets are nutrient-rich food sources after rice and wheat, traditionally grown and consumed by economically poorer section all over the world. Millets are characterized by their ability to adapt to adverse climate condition, least agro-input requirement and with the exceptional nutritional quality. There are varieties of major and minor millets that are consumed in different preparations by different cultures all over India and the world. Though millets are unique for their food and medicinal properties, but these are neglected and under-utilized for their scarce knowledge about processing, lower cooking quality and low bioavailability of nutrients. Improving its bioavailability of nutrients is one of the important approaches to promote its utilization. The paper provides comparative nutritional compositions of raw and sprouted millet flours of proso millet, finger millet, little millet, pearl millet, sorghum millet, fox tail millet and kodo millet that are commonly used as traditional food by the tribal/rural people of Koraput. The author observes that, traditional processing by sprouting of millets led to greater retention of nutrients and moderate loss minerals as well as enhances the bioavailability and can be beneficial for health.

Introduction

Millets are nutrient-rich food sources after rice and wheat, traditionally grown and consumed by economically poorer section of the world's population (Singh and Sharma 2018). Unique attributes of millet such as ability to adapt under severe and adverse climate condition, least agro-input requirement and with the exceptional nutritional quality makes them crucial plant genetic resources for agriculture (Gupta et al. 2017). The major millets are proso millet (Chinna), finger millet, (Mandia), little millet (Suan), pearl millet (Ganthia), sorghum millet (Khedjonha), fox tail millet (Kangu) and kodo millet (Kodo). Globally, small millet is consumed in different forms: unleavened bread (roti or chapatti), porridge, gruel, and dessert; and it also referred to as "poor man's bread" (Chandra et al. 2016). Grains and flour of small millets are important components of traditional diets and beverages of local and tribal communities for their nutritional and health benefits (Dass et al. 2013; Pradhan et al. 2019). The tribal/rural people developed a range of processing methods such as soaking, sprouting and cooking for their utilisation in accordance to their needs. Millets are good sources of crude energy, protein, fatty acids, vitamins, minerals, dietary fiber and polyphenols (Panda et al. 2020; Mukami et al. 2019). Though millets are unique for their food and medicinal properties, but these are neglected and under-utilized for their scarce

¹Department of Biodiversity and Conservation of Natural Resources, Central University of Orissa, Koraput-764 021, Odisha, India, E mail: dpanda80@gmail.com

knowledge about processing, lower cooking quality and low bioavailability of nutrients (Babu et al. 2017). The non-availability of refined and processed millets in ready-to-use form has limited their wider use and acceptability. Improving its bioavailability of nutrients is one of the important approaches to promote its utilization.

Effect of sprouting on nutritional compositions in Millets

The author compared the nutritional compositions of raw and sprouted millet flours of proso millet, finger millet, little millet, pearl millet, sorghum millet, fox tail millet and kodo millet that are commonly used as traditional food by the tribal/rural people of Koraput. The results were reported based on the synthesis of experiments carried out at laboratory of Central University of Odisha, Koraput.

The soluble sugar, starch and amylose content of raw millets ranged from 8.38 to 25.44 (mg/ g dry weight), 51.68 to 69.10 (mg/ g dry weight) and 5.26 to 12.54 (mg/ g dry weight), respectively (Table 1). The value of sugar, starch and amylose content was significantly higher in pearl millet in compared to the other millets. There was significant increase in sugar and amylase content was recorded after sprouting in all millets, whereas starch content was significantly decreased in all samples except finger millet. The protein content of different raw millets ranged from 9.3 to 14.3 mg per g dry weight with highest protein content was observed in pearl millet (Table 1). The range of ascorbic acid (vitamin C) and α tocopherol (vitamin E) content varied from 0.84 to 7.68 (mg 100 g⁻¹) and 3.07 to 4.25 (mg 100 g⁻¹), respectively among the studied millet sample. Sprouting led to the significant improvement of vitamin C and vitamin E in all the millets. The crude fiber, ash and fat content in different millets ranged from 2.03 to 11.01 %, 1.42 to 4.02 % and 1.06 to 3.68 % of dry weight, respectively. Sprouting significantly improved the fiber content and lowering the ash and fat content in all the studied millet grains.

Effect of sprouting on mineral compositions in Millets

The mineral compositions such as K and Na content in studied millets was varied from 227.4 to 441.2 mg and 10.30 to 11.05 mg per 100 g dry weight, respectively (Table 1). Sprouting led to significant increase of K and Na content. Based on these results, some millet, such as little millet and proso millet showed remarkably higher Na and K content compared to the other millets. The level of potassium was higher than the sodium content in all the millet flours, which have better health implication and considered as safe food for human consumption. The P content of the sprouted millets was significantly higher than the raw millets. Based on these results, some millet, such as little millet and proso millet showed remarkably higher mineral compositions and indicated their nutritional superiority compared to the other millets.

Conclusion

In conclusion, some millet flours recorded superior nutritional, mineral and vitamin compositions and indicated their nutritional superiority compared to the other millets. Interestingly, little millet and proso millet showed remarkably higher mineral compositions and indicated their nutritional superiority compared to the other millets. The presence of

low levels of sodium compared with potassium coupled with improved minerals makes these millets to be safe food source for human consumption. Traditional processing by sprouting of millets led to greater retention of nutrients and moderate loss minerals as well as enhances the bioavailability and can be beneficial for health. It also suggested that sprouted millet are the safe food sources for mass consumption and should be included in different Integrated Child Development Services scheme such as Anganabadi and mid-day mill for combating hunger and malnutrition of children.

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About Author

Dr. Debabrata Panda is working as Assistant Professor in Biodiversity and Conservation of Natural Resources at Central University of Orissa, Koraput from May, 2012. His main areas of research interest include Agro biodiversity, Underutilized plant species and Wild crops used by tribal people of Koraput. His contribution in collection, evaluation and characterization of indigenous millets from Koraput towards nutritional and climate resilience traits. He has taken initiative for popularisation and conservation of valuable traditional finger millet genotypes of Koraput.

Table 1. Sprouting associated changes of Nutritional and mineral compositions in different millets. (Source: Panda et al. 2020).

Millets	Sugar (g/100 g)		Starch (g/100 g)		Amylose (g/100 g)		Protein (g/100 g)		Ascorbic acid (mg/100 g)		Vitamin-E (mg/100 g)	
	Raw	Sprout	Raw	Sprout	Raw	Sprout	Raw	Sprout	Raw	Sprout	Raw	Sprout
Proso millet	11.62±0.41	12.64±0.55	64.78±1.80	64.05±2.97	10.62±0.88	13.88±0.31	13.50±0.71	8.38±0.88	7.68±0.04	9.45±0.16	3.57±0.09	4.08±0.12
Finger millet	15.42±1.31	16.00±0.88	66.53±3.43	68.48±1.45	11.16±1.53	15.84±2.55	13.75±0.35	10.13±1.59	4.98±1.38	8.60±0.35	3.52±0.27	4.19±0.13
Little millet	8.38±0.81	9.88±1.24	51.68±0.39	40.88±0.60	8.16 ± 1.36	10.76±0.74	9.38 ± 0.88	5.63 ± 0.53	1.33±0.18	1.73± 0.10	3.07±0.09	3.60±0.28
Pearl millet	25.44± 2.3	33.94±1.15	67.75±1.63	52.13±0.32	11.66±0.48	14.84±1.13	23.13±0.53	16.38±1.24	6.87±0.75	9.12±0.67	4.28±0.03	4.59±0.01
Sorghum	16.56±0.80	18.56±1.68	69.08±1.87	54.83±2.44	5.26±0.54	9.16 ± 0.34	14.38±0.53	8.13 ± 0.18	2.96±0.23	3.06±0.05	4.25±0.07	4.80±0.12
Foxtail millet	11.90±0.39	13.63±0.53	61.60±1.06	56.03±1.17	8.28 ± 1.13	11.44±1.58	13.38±0.53	8.38 ± 0.18	1.16±0.10	1.67± 0.07	4.09±0.14	4.46±0.04
Kodo millet	9.75±0.35	11.88±0.53	69.10±0.49	51.58±0.74	12.54±1.16	14.94±2.23	10.00±1.06	7.00 ±1.06	0.84±0.15	1.73± 0.10	4.22±0.01	4.71±0.21
Mean	14.17	16.64	64.36	55.43	9.67	12.98	13.93	9.15	3.69	5.05	3.85	4.35
<i>LSD*P<0.05</i>	2.05	3.58	1.96	1.84	0.95	0.25						
Millets	Crude fibre (g/100 g)		Ash content (g/100 g)		Crude fat (g/100 g)		Na (mg/100 g)		K (mg/100 g)		P (mg/100 g)	
	Raw	Sprout	Raw	Sprout	Raw	Sprout	Raw	Sprout	Raw	Sprout	Raw	Sprout
Proso millet	5.00 ± 1.26	7.09±0.13	4.02±0.11	3.60±0.14	3.68 ± 0.41	2.31 ± 0.31	10.70±0.01	10.72±0.04	339.5±0.14	240.1 ± 4.24	113.0±2.1	125.0±1.5
Finger millet	2.79± 0.27	3.42± 0.28	2.10± 0.14	2.02± 0.18	0.44 ± 0.05	0.31 ± 0.03	10.39±0.04	10.94±0.08	441.2±0.28	340.2 ± 2.76	11.0 ± 1.2	32.0 ± 1.3
Little millet	5.45± 0.00	6.08± 0.11	2.25± 0.21	1.90± 0.14	3.27 ± 0.25	1.00 ± 0.05	11.05±0.22	10.72±0.14	227.4±0.99	194.7 ± 0.57	131.0±.1	183.0±3.2
Pearl millet	9.67± 0.04	11.16±0.07	1.42± 0.18	1.09± 0.08	2.55 ± 0.07	2.30 ± 0.14	10.43±0.11	10.55±0.04	346.9±2.19	294.4 ± 6.79	49.0 ± 1.2	75.0 ± 1.1
Sorghum	2.03± 0.05	3.08± 0.12	1.95 ± 0.07	1.45 ± 0.21	1.06 ± 0.08	0.83 ± 0.08	10.35±0.01	10.66±0.06	240.0±0.57	150.9 ± 0.57	35.0 ± 2.1	61.0 ± 1.2
Foxtail millet	6.51± 0.66	10.12±0.17	2.15± 0.21	1.95± 0.21	2.24 ± 0.14	2.05 ± 0.07	10.30±0.09	10.83±0.05	350.2±1.91	258.8 ± 0.57	89.5 ± 2.4	159.0±.5
Kodo millet	11.01±0.47	12.02±0.18	3.70± 0.14	3.09± 0.08	2.34 ± 0.30	1.15 ± 0.21	10.55±0.11	11.02±0.07	297.6±0.00	204.8 ± 5.44	79.0 ± 2.1	102.0±.1
Mean	6.07	7.57	2.52	2.28	2.23	1.42	10.54	10.78	320.4	340.56	72.5	105.29
<i>LSD*P<0.05</i>	0.91	0.19	0.31	0.31	5.74	5.74	0.21					

Varietal differences and geographical indication of Millet species: Exploration into tribal hinterland of Odisha

Susanta Sekhar Chaudhury¹, Abhisekh Pradhan²

ABSTRACT

Odisha, situated on the eastern part of the country has diverse ecosystems comprising coastal plains, central plateau, central hilly regions, flood plains and uplands. Most tribal communities inhabit the high-altitude zone of eastern ghats, which cover around 18 Districts. The south portion of the ghat receives less rainfall compared to the north portion of the ghat. The climatic condition can be referred as tropical monsoon with average rainfall 800mm to 1200mm. The livelihood activities of the tribes are generally farming on undulating landscapes and hill slopes, with remarkable crop diversification factored by topographic variations. Considering the above factors millet is preferred as major crop in tribal farming ecosystems. The preference of tribes, as regards to field crops, varies from area to area depending on the soil, water, natural resources, and socio-culture. Due to this varietal difference is seen at various geographical location in millet crops. The paper discusses the existing millet varieties cultivated in tribal areas of Odisha and the geographical indication related to certain varieties of millets.

Keywords: Eastern ghats, Tribes, Tropical monsoon, Diversification, Topography, Eco-system, Social-culture, Varietal difference, and geographical location.

Introduction

The tribal dominated geography of Odisha falls under the tropical monsoon zone. The high occurrence of rainfall and varied topography in the tribal hinterlands hamper other field crops cultivation apart from millets. Millets as crop has a lesser nutrient requirement compared to other field crops and has a high adoptability in adverse situations; both natural and unnatural. The millets are rich in energy supplements, especially rich in calcium and fibre. The intake of millet as part of daily diet is considered inevitable by the tribals, for it provides instance energy to take up strenuous long duration works in field. Millets play a significant role in food security and maintaining the socio-cultural identity of tribal communities. Depending on availability of land and complementary natural resources at different tribal locations, many different varieties of millets are cultivated by tribal communities. Certain varieties of millets have also assumed geographical indication for their typical characteristics in particular socio-ecological set up. There are certain millets identified

¹Programme Manager, WASSAN, Bhubaneswar

² Project Coordinator – Seed system for landraces, Odisha Millet Mission, WASSAN

to have been the most favourite of the tribal communities leading to their adaptation in particular communities and cultures.

Millets is always referred to as ignored cereal for generation by majority population of the state. Mainstream communities know millets better as animal/bird feeds than palatable human diet. The implementation of programs under green revolution emphasized increase in cereals like paddy and significantly ignored the millets. Over the years, the indiscriminate application of synthetic fertiliser and inappropriate agronomic practices adopted by rural farmers have affected the soil condition badly and apparently rendered the soil unproductive. The structure and texture of the soil has been changed drastically which has been challenged to match the productivity of cereal crops. The change in micro-climatic conditions and its typical impacts on crop ecosystems warrants extensive cultivation of climate resilient crops among which the millets stand on merit.

Various factors, including demographic and climatic, are triggering the introduction, intensification and diversification of climatic resilient crops. Millets as a crop has shown potential as a climate resilient crop because of its lesser soil nutrient requirements and higher adaptability. Indian institute of millet research and various agricultural universities and research organisation have reaffirmed that millets have high nutritional value. They are not only rich sources of potassium, more than that they are palatable human diets contributing to improved digestive system with enzymatic functions in human system. In Odisha, millet has lost its importance as a staple food crop, even in the tribal areas where they used to be the exclusive staple crop. It is because of the preference of tribal people for millets in their subsistence economy, that a number of millet varieties are still preserved and being cultivated in their landscapes. The wisdom and knowledge related to millets, in the case of tribal communities, have passed down from generation to generation. Millets assume to be inseparable from the crop varieties cultivated in the tribal areas, although, the extent of millets cultivation has gone down through years of interventions in high yielding better performing crops in terms of productivity and utilization. Tribal people, elsewhere in Odisha, have adopted different methods of millets cultivation and their consumption in form of various preparations.

Ethnic diversity of tribal people in Odisha

Odisha has diverse ethnic groups and their populations are spread over in all the 30 districts of the state. Odisha accounts for 9.7 percent of total tribal population of India. The major tribal dominated districts in Odisha includes Mayurbhanj, Keonjhar, Nuapada, Bolangir, Sundergarh, Kandhamal, Gajapati, Koraput, Rayagada, Malkangiri and Nabarangpur. Kandhas are the numerically largest tribal group of Odisha. Based on traditional habitat and locality the tribe is divided into several sections. The major livelihood activities of Kandhas are agriculture, agroforestry, slope agriculture, wage labour, and gathering forest produce. After Kandhas, the other major tribes found in Odisha are Gonda, Santhal, Munda, Sabara, Sounti, Bhuiya, Bonda, Oraon, Paroja, Gadaba, Matya, Dharua, Kharia, Kolha, Didayi and

Juang. The tribes have a diversified socio-religious culture and speaking languages. Millets that once ruled the food habit of the tribal communities is still a major crop in tribal localities.

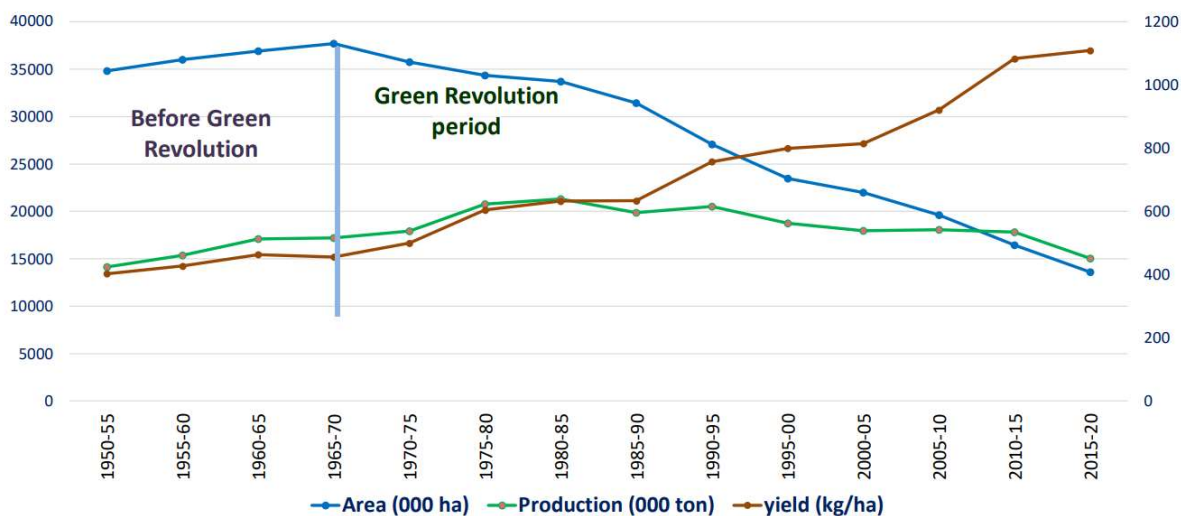
Millet preferences in tribal districts of Odisha

The food habit of the tribal communities has undergone drastic changes over the last 5 decades. One of the major reasons attributed to this is promotion of high yield varieties of paddy and other crops supported by various programs and schemes. Apart from that, various other reasons are there like inadequate support for millet cropping under government schemes and on-time seed availability for cultivation. Despite several issues and challenges, the tribal communities in Odisha have sustained the millet cultivation practices in their localities. The finger millet (Mandia) is the major millet that is grown in Odisha covering around 75-80 percentages of the total millet coverage area of the state followed by little millets. Apart from these, other millets like Foxtail millet (Kangu), Kodo millets, Sorghum (Gangaie), Pearl millet (Kathiya), Porso millet, Barnyard millet, Brown top millet and teff are cultivated in relatively smaller coverage in various pockets of tribal Odisha.

Geographical indication of millets

Millets are the collective group of small seeded annual grasses that are grown as a grain crop. Marginal lands of temperate, sub-tropical and tropical regions provide better environment for millet cultivation. Earliest evidence of millet cultivation was found in Indus valley civilization (3000BC) where millet was domesticated for food grains. It is estimated that, as on the decade 1960-70, millets contributed to about 20 per cent of total food grain of the country. In the current situation, the contribution of millets to the total food grains of the the country. In the current situation, the contribution of millets to the total food grains of the country has decreased to as less as 6 percent due to the domination of wheat and paddy. India produces more than 170 lakh tons of millets compared to worldwide production of 863 lakh tons. Thus, India contributes to 80 percent of Asia and 20 percent of global production. The average yield in India is 1239 kg/ha compared to world average of 1229 kg/ha which indicates the adaptability of millet crops and its better performance in Indian tropical and subtropical climatic regions. The millet varieties sustained in tribal hinterlands of Odisha is largely because of the preferential food habits and socio-cultural activities of tribals. Due to the influence of green revolution the millet crops took a back seat in Odisha especially due to multiple factors like unavailability of quality seeds, poor post-harvest management practices adopted by tribal farmers etc.

The tribal population of Odisha is majorly involved in millet production. As per the record of 2018, Odisha stands 9th position in the country in term of production. Gradually with time, the productivity decreased as tribal farmers partially shifted away from their traditional crops and crop production practices. This triggered situations for revamping traditional agriculture and towards that, currently, state agriculture department is collaborating with various research institutes to promote package of practices to boast the scenario of millet cultivation in the state.



The tribal people in remote locations take up millet cultivation under rainfed conditions as kharif crop. A wide range of millet varieties are cultivated in smaller patches especially on degraded lands. There are certain varieties widely cultivated only in certain pockets, thereby providing geographical indications on the landraces and varieties confined to particular locations.

The geographical indication related to millets cultivation in tribal hinterland of Odisha can be referred as the millets that has originated from that location and possess some quality that justify the socio- religious culture of the tribal communities. On the way of adoption of the millet varieties in a particular area or with reference to a particular tribe there is interplay of various factors like topography, climate, soil type, traditional cultivation practices and above all, the tribal farmers' preference. In this manner, the survey of millets in tribal Odisha provides to understand that certain varieties of ragi are geographically indicated crops in Odisha.

Landscape challenges in Odisha

The millets landscapes in Odisha have lots of variation due to their geographical locations. Southwest monsoon has a higher influence on crop cultivation in Odisha. The fluctuations in rainfall due to improper prevalence of southwest monsoon has a factor to play in adaptation of millet in tribal communities. Being diverse in nature, millets landscape in Odisha faces typical challenges like poor drainage system, varied soil types and sloping terrain. The tribal communities living in different landscapes of the state, through their decades' long association with the environment, have sort of domesticated different types of millets. The preference of tribes for particular type or variety of millets is based on the understanding of the landscape characteristics, climate conditions, indigenous knowledge and practice, and above all the yield level and preferential food habits. If livelihood is the considered the prime objective, millet selection is based on its yield performance at a particular landscape. If religious culture is taken into consideration, a particular millet that has ritual significance or

association with myth is given the preference in the agro- ecosystem of the tribal belt of Odisha.

Odisha hinterland: Varietal variation

The variety of millets show similar attributes having specific unique characteristics. The specific characteristics possessed by the millets does not relate only to high yield. The religious point of view plays an important role in varietal selection by tribal groups. The other factors that influence the millets adoption in tribal areas are organoleptic characters of millets. In tribal Odisha, generally 4 types of millets are cultivated over significantly large patches of land. They are, finger millets having more area coverage followed in sequence by little millet, foxtail millet, sorghum, and kodo millets. Other minor millets like proso millet, barnyard millet and brown top millets are scattered in marginal and small patches of land. The preference to pearl millet by the tribal communities of Odisha is gradually decreasing and getting extinct. It has been seen that the preferences of tribal farmers towards high value crop is increasing for enhancing their standard of livelihood. Gradually with time, farmers are losing the quality indigenous seeds in the competition for higher yield with high yielding varieties. As compared to lesser economic returns of pearl millets on the face of high value crops has decreased pearl millet preferences in the state. Some types of millets dominate in particular districts like sorghum in Keonjhar and Sundergarh districts, little millet in Nuapada district, foxtail millet in Gajapati district, Kodo millet in Bolangir district, and finger millet in Koraput and Malkangiri districts. Apart from these districts, millet is also a popular crop adopted in other tribal districts of Odisha like Rayagada and Kandhamal etc. Some particular tribes also contribute to the genetic conservation of some particular millets by way of cultivating regularly, irrespective of the yield analysis. Examples like, Bati mandia (Finger millet) dominates all other millets varieties in Koraput district; similarly Burka mandia, Budha mandia, Sika mandia in Kandhamal district; Karkati mandia in Rayagada district; Bhoda mandia in Bolangir district; Similipal mandia in Mayurbhanj district; Guruji (little millet) in Nuapada district; Bada Suan in Malkangiri district; Luit Sorghum in Keonjhar District; and Kodo millet in Bolangir district. The tribal communities involved in preserving the particular millet varieties and the unique characteristics of such varieties have been presented hereunder.

District	Tribes	Millet types	Varieties	Unique character
Koraput	Gadaba, Paroja, Sabara	Finger millet	Bati mandia	Highly compact panicle
Kandhamal	Kandha	Finger millet	Burka Mandia	Number of tiller is more
Kandhamal	Kandha	Finger millet	Budha Mandia	Long-open panicle
Kandhamal	Kandha	Finger millet	Sika Mandia	Medium size panicle
Rayagada	Bhuiyan, Gadaba, Munda	Finger millet	Karkati Mandia	Semi-compact panicle
Bolangir	Koda, Sabara, Kandha, Bhuiyan	Finger millet	Bhodo Mandia	Short duration life-cycle

Mayurbhanj	Kolha, Santal	Finger millet	Similipal Mandia	Shade loving
Nuapada	Munda, Koda, Kandha	Little millet	Guruji/Koshala	Easily threshable
Malkangiri	Bonda, Kandha, Koda	Little millet	Bada Suan	Long duration
Keonjhar	Gond, Bhuiyan, Juang, Santal	Indian millet	Luit Sorghum	Strong cooking smell
Bolangir	Kandha, Koda, Gadaba, Sabara	Kodo millet	Kodo	Large seed size

Conclusion

Millet as a cereal crop is gaining back its lost glory because of its nutritional importance and climate resilient characteristics. These typical characteristics of the millets have made them special and for that millets have got worldwide attention today. The Odisha government, intending to promote the cultivation and consumption of millets has taken on board various partners to revive and maintain sustainability of millet crops in the state. The program Odisha millet mission (OMM) is also implemented under Directorate of Agriculture and Food production involving various stakeholders. The program aims to increase the productivity and production of millet in the tribal zone of the state and increase the consumption of millets as well. Odisha Millets Mission is playing a vital role in identification of different varieties of millets at different geographical location and promoting the promising varieties of millet having economical and cultural importance. Local entrepreneurs in form of farmer producer company are stepping in large numbers to look out the opportunity related to business with millet crops. Different varieties of millets that are explored in tribal areas of Odisha plays important role in enhancing livelihood opportunities with indigenous varieties of millets.

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Revalorizing millet-based production system and its agroecology in Koraput District: Issues, challenges and policy recommendations

Bijaya Kumar Nayak¹ & Chita Ranjan Das²

Abstract

Millets are considered as climate-resilient and nutri-cereals for food, income and nutrition security in rainfed areas of India. The provision of supplying subsidized rice, wheat and coarse grains (millets) under National Food Security Act (NFSA) 2013 enforces central and state governments along with many civil society organizations to work for promotion of millets. This paper critically analyse various key components of millet-based production system and its agroecology- conservation, cultivation, consumption and commercialization of millets along with policy recommendations based on the contextual impact assessments. The paper reveals about the various useful information from various programme and action research projects implemented at Koraput through using various statistical tools. Moreover, agricultural impact assessment methods are used for collecting and validating data from the primary and secondary sources, community-based organizations, and agriculture departments. It also focuses on various tangible and intangible impact of interventions to safeguard millet-based production, consumption, processing and marketing for enhancing food, income and nutrition security. The study identifies various grassroots policy recommendations to strengthen interventions like Millet Mission through community-based organizations in the context of climate change and livelihood interventions. The study finds that the production of millets can be enhanced through enabling tribal communities to adopt sustainable agriculture practices, avail timely technical and inputs support from government and CSOs of the locality.

Key words: agroecology, millet mission, community-based organization, climate change, PVTGs,

Introduction

Agriculture and allied sectors are the main sources of livelihoods among more than 70 percent of Indian population. In rainfed areas, coarse grains like millets are mainly grown in India. The millets like finger millet (*Eleusine coracana*), foxtail millet (*Setaria italica*), barnyard

¹ Ph.D Scholar, Nabakrushna Choudhury Centre for Development Studies (NCDS), Bhubaneswar (bijaya.nayak@gmail.com)

² Ex. Sr. Research Officer, Nabakrushna Choudhury Centre for Development Studies (NCDS), Bhubaneswar

millet (*Echinochloa frumentacea*), little millet (*Panicum sumatrense*), pearl millet (*Pennisetum glaucum*) and proso millet (*Panicum miliaceum* L.) are found in most of the southern and central states in India especially wherever annual rainfall is below 350 mm, perhaps where no other cereal crop can grow under such moisture stress. However, in spite of a rich inter/intra-species diversity and wider climatic adaptability cultivation of diverse millet species/varieties is gradually narrowing in the recent past (Bhag et al., 2010). These crops are hardy and quite resilient to varied agro-climatic adversities. Farmers at Koraput district are cultivating mainly four types of millets such as *Mandia* (Finger millet), *Suan* (Little millet), *Kangu* (Foxtail millet) and *Ganthia* (Pearl millet). The area of cultivation of millets among the growers is decreasing due to competition of other cash crops. Moreover, growers have been facing problems related to cultivation, yield and post-harvest management, processing and value addition of millets etc. because of many local situations. The decline in millets in India can be attributed to many factors; agronomic, economic, and social. The Green Revolution of the 1970s witnessed government promotion of rice and wheat push millets into ever more marginal areas. Post Green Revolution hastens the loss of genetic diversity and traditional knowledge about the production, processing, and use of millets. Production is inefficient as a result of the lack of suitable higher-yielding varieties, poor quality seeds, and unimproved cultivation practices. In addition, there is a lack of attractive recipes for adding value, a lack of awareness of the nutritional value of millets, poorly organized integration with markets, and generally unfavorable environmental policy (Padulosi, 2015).

In the above context, the paper aims to examine agroecological practices that are being adopted by the millet growers of Koraput district for enhancing production, income, food and nutrition through sustainable agriculture practices and crop diversification. Moreover, the paper critically analyses various key components for policy recommendations for the safeguard of agroecology.

Objectives, materials and methods

Government of India celebrated National Year of Millets 2018. However, United Nations (UN) declares 2023 as International Year of Millets towards creating awareness on the health benefits of millets as well as towards enhancing its production under tough condition of wider variability of climate change. In this context, the study responded to the objectives of assessing current status and trends in millet cultivation; identify major constraints faced, and interventions availed for millet growers; and to critically analyse various varietal diversity as well as its production systems with a focus on scenario in tribal districts of Odisha.

According to Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA), being an agro-biodiversity hotspot, Koraput has highest number of millet cultivation i.e., four out of six types of small millets namely finger millet, little millet, pearl millet and foxtail millet with maximum number of varietal diversities. In order to gather adequate primary data to suffice to the above, agricultural impact assessment methods through observations, personal interview and focus group discussions (FGDs) were conducted among millet growers,

agriculture officials and CBO members. The data and information thus collected were triangulated and validated by cross examining the same with information from relevant primary and secondary sources. Primary data collection was done covering 100 household surveys, selected on purposive sampling method, on millet growers inhabiting Luhaba village of Subai Gram Panchayat of Semiliguda Block and Bandliguda village of Jujhari Gram Panchayat of Borigumma Block. Farmers having experience of at least one type of millet cultivation were considered for personal interview. Moreover, various action research data and its analysis report of government and non-government organizations (NGOs) were critically analysed further to understand the status of millet agroecology as well as suggest for policy level recommendations.

I. Status of millet cultivation

Ethnobotanical surveys indicate that hundreds of such species are still to be found in each country, representing an enormous wealth of agro-biodiversity with potential to contribute to improved incomes, food security and nutrition, combating hidden hunger caused by micronutrient (vitamin and mineral) deficiencies. Moreover, millets are best suited to rainfed/ dry land conditions. Less water consumption, low external inputs because of fewer incidences of pest and diseases are the additional benefits with millet production. The byproducts/ residues may also be used as fodder/ feed for livestock (Sankaran, 1994). Millets have a comparative advantage in marginal lands where they have been selected to withstand stress conditions and contribute to sustainable production with low inputs at low cost of production (DHAN Foundation & WASSAN, 2012; Padulosi, et al., 2015). They also contribute to the diversity-richness as well as to the stability of agro-ecosystems. There are hardly any alternatives to these species for their strategic role in fragile ecosystems, such as found in arid and semi-arid lands, in mountains, steppes and tropical forests. Farmers cultivating land in crop rotation method do harvest more production (Jodha& Singh, 2009).

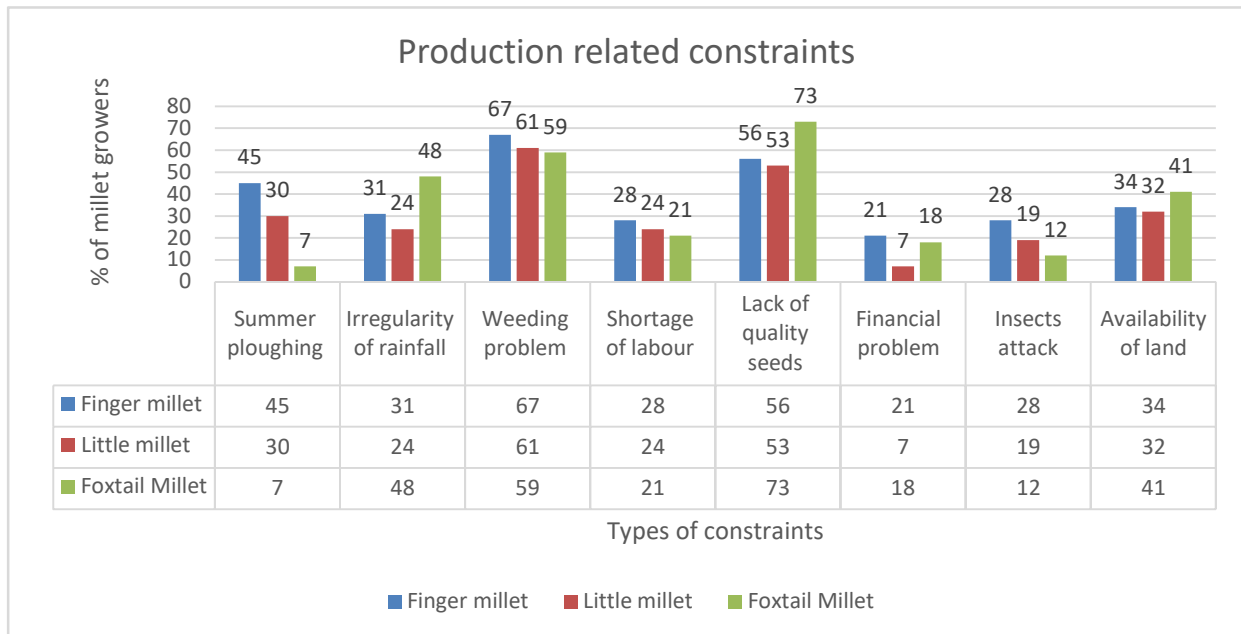
Out of the total 100 sample households, 72 households cultivated millet-based crop combinations. It was found that 68 % out of 70 finger millet growers cultivated it without any intercrop or mixed crop. Finger millet was cultivated with little millet as mixed crop by 8 growers. Other crops as mixed with finger millet were blackgram, horsegram, redgram, soybean and foxtail millet. This mix cropping system reduces the probability of crop losses and hence also make availability of food security. The overall productivity of finger millet in both villages was 2.85 qtl/acre. Overall, it was found that higher the landholding category, higher is the productivity. It is as high as 3.15 qtl/acre among medium landholding households followed by 3.10qtl/acre, 2.95 qtl/acre, 2.20 qtl/acre and 2.1 qtl/acre among semi-medium, small, marginal and landless households respectively. It is very low and can be increased up to 15qtl/acre with the adoption of improved package of practices.

II. Issues and challenges

After Green Revolution, there has been a systematic decline in the production of millets. Under traditional practice, seeds of some of these crops are mixed in variable proportions

and broadcasted. It also uses a heavy seed rate as a safeguard against poor seed quality and uncertain soil moisture. Such seed rate under favourable soil moisture results in a very dense crop, which is normally not thinned out and leads to crowded plant population and poor yield. Traditional practice of cultivation also does not apply manure or fertilizers or any other intensive management practices (Chang, 1977). The crop offers poor to modest yield depending on weather. Due to change in climate conditions, there is lots of probability of crop failure and also not even moderate yield. Cropping pattern studies therefore assume special importance in taking cognizance of soil-climate factors and the crops that could be grown within that environment (Venkataraman & Prahaladchar, 1978; Singh & Sidhu 2004). For increasing the productivity of millets, it is necessary for the use of quality seed produced in participation with growers, planting in rows instead of broadcast sowing, use of scientifically recommended seed rate, encouraging application of farm yard manure and/or fertilizers, thinning to regulate plant population etc. (Ninan & Chandrashekar, 1993).

The study has identified several important constraints that factors for reduction in the rate of production. The production constraints revolve around the last ten-years' experience of millet cultivation. Factors like summer ploughing, irregularity in rainfall, weeding constraints, shortage of labour force, non-availability of quality seeds, financial inputs, pest infestations and above all the availability and extent of land directly influence the millets production in the study pockets. Respondents' reactions in this regard are presented in the following chart to understand the production constraints.



Source: Household survey

One of the major production constraints is the weeding problem that accounts for about 67% in case of finger millets and 61% in case of little millets. Weeding is a labour-intensive work and the timing coincides with cash crops and paddy related agricultural operations.

However, about 73% respondents in case of fox-tail millets, 56% in case of finger millet, and 53% in case of little millet attributed lack of availability of quality seeds as one of the limiting factors. Inadequate availability of land for growing millets was raised by majority of farmers as factor limiting opportunities for crop diversification intended towards improving socio-economic status of families. Appropriate farming implements for summer ploughing and weeding operations may be supported for reducing drudgery of the farmers in the study pockets of Koraput district.

III. Agronomic practices

It is remarkable that, there are relatively lesser technological interventions in millets cultivation starting from varietal diversity to post-harvesting. Moreover, public distribution system which provides rice and wheat at subsidized rate to low-income households lowered the interest level of small and marginal farmers to go for cultivation of millets (Ninan & Chandrashekar, 1993; Mandal et al, 2016). Tree plantation and cash crop cultivation are also accounted for as major problems for millets cultivation. The study findings also coincide with other scholarly observations that, there is land encroachment for the cultivation of eucalyptus as well as other cash crops in the rainfed regions to meet the demands of the paper and pulp industry (Nadkarni, 1986). This declining diversity has serious concerns in terms of overuse of natural resources, ecological problems and growing income risk. As diversity in the production pattern declines, variability in the gross value of production also increases (Mruthyunjaya & Kumar, 1989). It is necessary to diversify varieties as well as improved package of practices to adopt to or as a coping mechanism against climate change, and by that harvest more yield from millet cultivation. It is observed that most of the growers (86%) in the sample pockets used own farm-saved seeds. While the government department is promoting varieties like *Champabati*, *Chilika* and *Bhairabi*, the non-government organizations are promoting GPU-28, GPU-48, GPU-66 and GPU-67 varieties. The yield comparison of various finger millet varieties conducted at field of Jagu Bhoi of Lunguri village by DHAN Foundation provided in table-1 indicates the difference. Indigenous varieties like *Dasarabodi*, *Kala Kerenga*, *Bodel*, *Dinda*, *Chilli*, *Sunamani* etc. give yield almost equal yield to some of released varieties. It is necessary to adopt improved package of practices to adopt climate change and harvest more yield. Organization has introduced various released varieties through on-farm trials.

It can be seen from the following table that released varieties like *Chilika*, *GPU-28*, *GPU-67*, *GPU-66* & *GPU-48* etc. gave substantially better yield. These varieties have been introduced through proper participatory varietal selection (PVS) approach with the involvement of farmers. The low yield of *Bhairabi* is due to water logging as well as grain stuttering during the rainfall in maturity stage. Moreover, it is a short duration variety. But it has better performance and farmers have adopted in a large proportion as it was introduced earlier by agriculture department. It has been found that there is potential of finger millet to increase yield at local context up to 15.92qtl/acre by adopting improved varieties in case of finger

millet cultivation. Providing quality seeds can be an effective strategy for extension agricultural intervention of millets in the tribal villages.

Table 1: Comparison of varieties

SL. No.	Name of the varieties	Types of varieties	Yield/ plot in kg (Plot size 3 mX3.5 m)					Mean yield	Yield /ha	Deviation from grand mean (2875.23)
			R1	R2	R3	Total= (R1+R2+R3)				
1	Mati	Local	2.55	2.9	3.45	8.9	2.97	2828.57	46.664	
2	Bati	Local	2.4	2.9	2.2	7.5	2.5	2142.85	-732.384	
3	Kala	Local	2.4	3.5	3.1	9	3	2857.14	-18.094	
4	Sunamani	Local	1.2	2.7	3.05	6.95	2.32	2209.52	-665.714	
5	Chilika	Released	2.75	2.5	5.3	10.55	3.52	3352.38	477.146	
6	GPU-28	Released	3.25	3.6	2.8	9.65	3.22	3066.66	191.426	
7	GPU-67	Released	2.55	3.2	4	9.75	3.25	3095.23	219.996	
8	GPU-66	Released	2.6	3.5	4.05	10.15	3.38	3219.04	343.806	
9	GPU-48	Released	3.05	4.05	5.45	12.55	4.18	3980.95	1105.716	
10	Bhairabi	Released	2	2	2	6	2	2000	-875.234	

*R1, R2 and R3 are the rows of randomized complete block design

Source: Randomized complete block designed trials

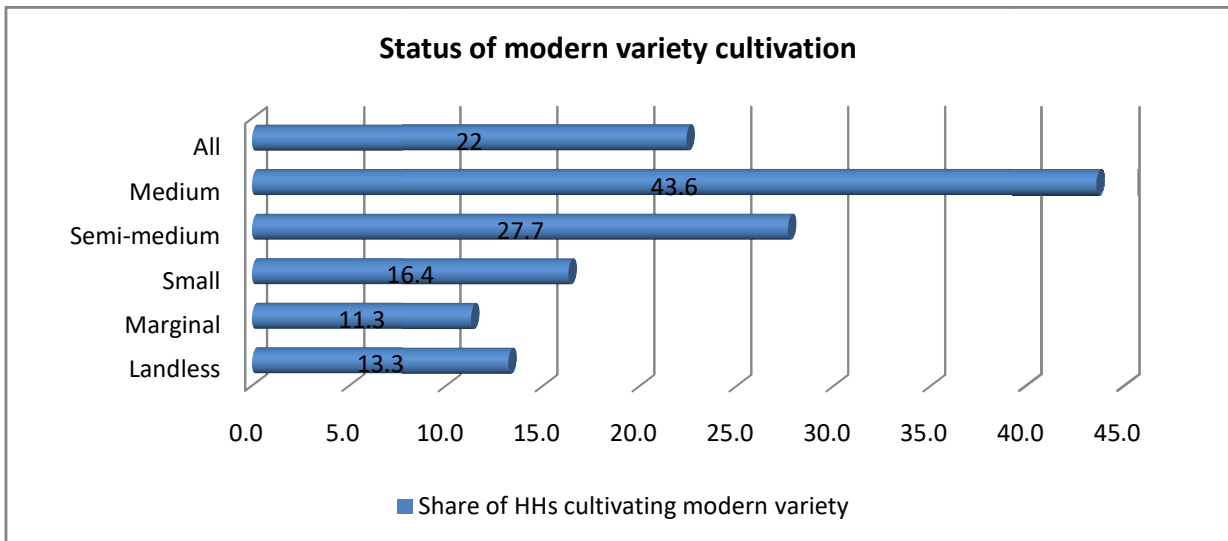
IV. Technological interventions

There are institutional constraints in improving productivity of dry farming and in promoting lightly irrigated cultivation as against intensive irrigation. In the meantime, there is lack of interventions from government for the promotion millets cultivation with the interventions of inputs support, farm mechanization support etc. There is a change in preference patterns for consumption of millets and people are moving away from them for various reasons, one important reason being the belief that it is poor man's food. This is mainly due to inclusion of only rice and wheat into the public distribution system (DHAN Foundation & WASSAN, 2012). According to the study, "the new technology also needs to be supplemented by measures for conservation of soil moisture and supply of proper equipment to farmers, which can enable them to quickly take advantage of the brief spell of rain during which they have to plough, sow and fertilize. Timeliness of operations is of crucial significance to farmers in drought-prone areas". Mechanization is also needed in the

first instance for soil and moisture conservation measures. “These institutional constraints seem to be more serious in the case of improving the productivity of rainfed crops and semi-arid regions than in irrigated agriculture (Nadkarni, 1986)”. Women play major role in the promotion of millets in the tribal areas. They select land, method of cultivation, package of practices needs to be followed for the crop cultivation etc. They are involved starting from seed selection, procurement, land preparation, transplantation, weeding, harvesting etc. agricultural operations. The technological interventions need to be based on their comfortability and handy to use it.

Adaptation of better context specific quality seeds plays major role in production enhancement in the context of climate change. The existing finger millet varieties may be broadly classified under two heads, viz. i) released varieties and ii) local varieties. There were only four released varieties cultivated by the sample households. These are GPU-28, GPU-48, GPU-66 and GPU-67. Similarly, there are nine local varieties namely *Dasarabodi mandia*, *Bada mandia*, *Sana mandia*, *Chilli mandia*, *Badu mandia*, *Modaimaskuli*, *Bodel mandia*, *Jana mandia* and *mati*. As perceived by the respondents, by adaptation of various improved package of practices like that of system of rice intensification (SMI), the yield of the especially finger millet has increased up to 10.8 qtl/acre among the tribal farmers.

Around 22 per cent of finger millet growers were using released varieties. The remaining growers were cultivating local varieties. The category of varieties grown by 5 per cent of the growers could not be identified. Among the released varieties, *Bhairabi* was found to be the dominant ones (10 per cent growers) followed by GPU-66 (7 per cent) and GPU-67 (5 per cent). The percentage of HHs cultivating improved varieties among millet growers is given below.



From interviews with tribal farmers, it is indicated that there is lack of little millet varietal diversity at the household farm level in both the Gram Panchayats. Only two households were found having two varieties of little millets each, though there were a total of three

known varieties cultivated among the sample households. There is no released variety of little millet cultivated among the sample households. The three known local varieties were called *Bada suan*, *Ganjei suan* and *Sana/mami suan*. *Bada suan* was found to be the dominant one.

V. Drudgery in post-harvest operations of millets

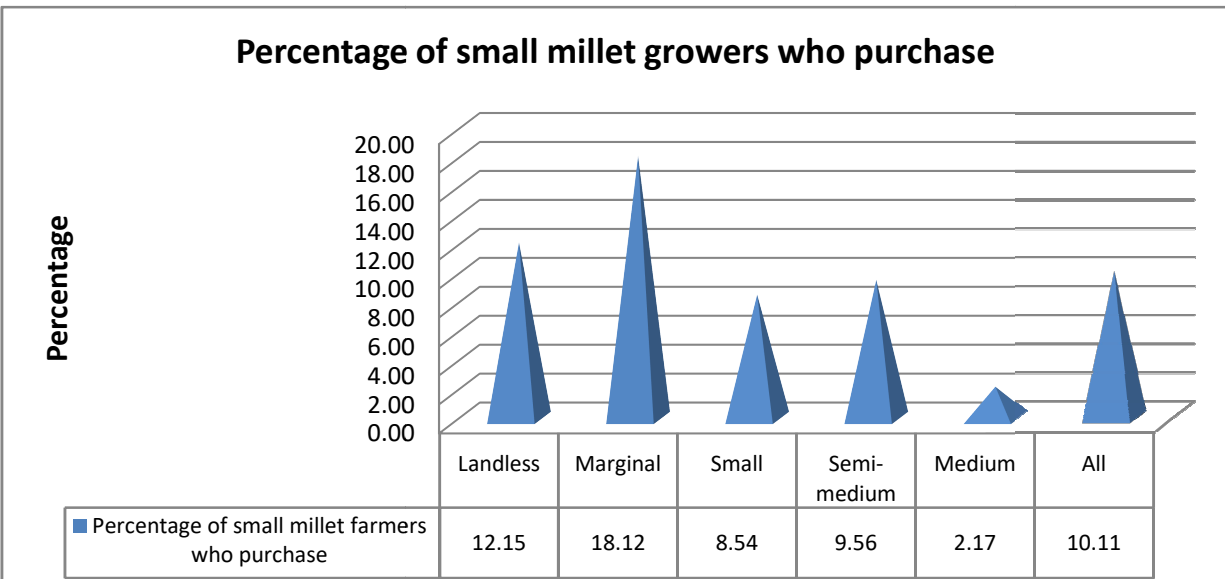
Nutritious millets are neglected in all respects of technology in developing new varieties of seeds, improved package of practices, harvesting, threshing, post-harvest as well as processing etc. It involves lots of drudgery and time consuming labourious work for threshing and processing into fine grain. All these tedious post-harvest operations are performed by the women. There is no efficient technology for processing these grains at village level, despite the fact that India is producing about 2 million tons of these grains. This has discouraged the use of these millets in household consumption, particularly when there is access to alternative grains like rice, wheat or sorghum (Bhag et al., 2010). Several research has been conducted by different government and non-government research institutions for understanding constraints faced by millets growers at the national level. This is another reason contributing to the decreasing popularity of these grains even among people who had been its traditional consumers (Ohiokipihai et al., 1998).

VI. Nutritional importance of millets

Millets are highly nutritious and contain high amounts of fiber, vitamins and minerals as compared to other crops. By any nutritional parameter, millets are miles ahead of rice and wheat in terms of their mineral content. Finger millet has thirty times more calcium than rice while every other millet has at least twice the amount of calcium compared to rice (ICAR-IIMR, 2016). In view of nation's food security and the declining ground water scenario, M.S. Swaminathan's report on 'National Commission on Growers' suggested for bringing in the millets under the purview of the public distribution system (PDS) in India. Once the millets are made available for consumption to the public, it was envisaged that it may trigger the production of the same. The study "Nutritional status of the Bonda high landers of Odisha" explains about the different dietary habits of tribal people in Koraput district. According to the study, tribal communities frequently consume millets recipes in the form of rice, gruel, snacks, etc. irrespective of seasonality; they consume finger millet in forms of preparations like Landa, Mandru, Anda etc., and preparations like upma, kheer and rice from little millet. They make local beverages from millets. The per capita consumption of cereals and millets food during harvesting is more (420gram) compared to lean season (326 grams) as there is more laborious work (Modak& Das, 2009) during the harvesting season. However, Odisha PVTGs Empowerment and Livelihoods Improvement Programme (OPELIP) also gives importance on consumption of millets through organizing training and capacity building programme as well as creating infrastructure for setting up millet processing units across 17 Micro Project Agencies (MPAs). Along with Mission Shakti, OPELIP has also set up restaurants and tiffin centres for consumption of millets in PVTGs areas with technical

support of Indian Grameen Services, a nationalized professional organization which provides technical support for income generating activities.

It is observed from the study that cent percent of the households consume finger millet in the study areas in the form of ragi gruel (*MandiaJau*), and other traditional recipes like *landa*, *pendum*, *mandru*, *mecha*, *anda*, etc. However, its consumption has reasonably declined among the youth and school going students. It is due to lack of knowledge on the health and nutrition benefits of the millets as well as unavailability of various attractive recipes. People in the study area believe that consumption of millets heals headache, body pain, and various intestine problems and strengthen their immunity system. According to them, after consuming one glass of millet porridge they can work for long time even under scorching sun. During the festivals, they usually prepare various traditional recipes. These recipes are served to *Nishanimunda* or any other village deities during *Push* or *Chita Paraba*. Millets are prioritized over rice in preparation of these recipes along with the locally cultivated pulses. As per the survey, 11 % and 14% of household consumed *Suan* and *Kangu* in their main meals over one year. Percentage of small millet growers who also purchase millets for their own consumption is given by landholding category as below.



VII. Marketing

Bringing back nutritious millets to the local food system needs lots of efforts from encouraging its production system to value added marketing i.e., across millet producing clusters to non-producing clusters of millets. However, marketing plays an important role for door step availability of inputs of millets for cultivation, processing, value addition and its consumption. The price of millets has been increased by three times of the minimum support price (MSP) during 2010-11. For example, MSP of ragi has been increased from Rs.965/- in 2010-11 to Rs.3377/- per quintal in 2021-22. This increase in MSP motivates

farmers to go for cultivation, although there are constraints met with while in selling the harvests on MSP across due the complex procedures in the procurement system. In Kharif Marketing Season (KMS) 2018-19, Odisha Millet Mission, Govt. of Odisha initiated ragi procurement through the Tribal Development Co-operative Corporation of Odisha Ltd. (TDCCOL) at Rs.2897 per quintal. But, farmers in the interior areas are seen to have relatively lesser accessibility to the ragi procurement centre (*Mandi*), and hence are compelled for distress selling at door step to the middleman. Moreover, farmers show hesitation to sell at fair average quality (FAQ) parameters as it involves lots of drudgery like drying in sun, removing foreign particles etc. Furthermore, there are payment related issues like late payment due to technical and operational processes on the part of procurement agency. However, this system of ragi procurement also helped producers to bargain price of ragi in local market.

VIII. Policy recommendations

COVID-19 pandemic situation provided opportunities for all migrants of the tribal villages to be engaged in agriculture related activities. However, there are impediments in achieving the desired targets. Millet growers need better access to inputs like seeds, fertilizers, and low-cost farming equipment for reducing drudgery in weeding and post-harvest operations in the village. Optimum training and capacity building programmes need to be conducted for adopting improved technologies among farmers for production enhancement. Moreover, farmer producer organizations (FPOs) should be promoted to enhance knowledge and skills of millet growers through training and capacity building programmes as well as through forward and backward marketing linkages in the villages to ensure income, food and nutrition security of the communities. There is need of policy level interventions for supply of quality seeds, including well performing successful local varieties, subsidy support for high cost inputs, support for low cost farming implements, support for farmers' producer organisations for collective marketing and value addition on millets, increase public funding for research on millets, support for establishment of millets processing units, support for small scale entrepreneur on highly specialised products (capital subsidy, credit and tax exemption) etc.

Conclusions

Millet-based agroecology plays an important role for ensuring food and nutrition security among the tribal communities. However, farmers faced various constraints related to its production, post-harvest operations, processing, and marketing opportunity. For enhancing production, farmers need to adopt for sustainable agriculture practices through proper training and capacity building programmes facilitated by the state training institutions with collaboration of civil society organization and agricultural institutions. Moreover, there is a need of support for supply of quality seeds, subsidy support for high-cost inputs in farming implements, establishment of millets processing units, small scale entrepreneurship on developing value added food products etc. Massive awareness programmes on health and

nutrition benefits of millets is required for increasing household level consumption with diversified and nutritious recipes. Farmer producer companies may be promoted for sustainable production enhancement as well as marketing linkages throughout the year.

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Empirical study on Status of Millets cultivation and use in a Kutia Kondh Village

Prasant Mohanty¹

Abstract

Debates have been continuing on inclusion of Millets in the National Food Security Bill specifying distribution of Millets (largely it means only Jowar, Bajraor Ragi) along with Rice and Wheat. In addition, efforts at the state level have resulted in formulation and implementation a Millet Mission to address the production of millets, enhancing millets' productivity and increasing the area under millet farming. The strategic approach is very likely to encourage the package driven Green Revolution technologies and there is every chance that, it will be all market-based and focused on the elitist health and nutrition agenda.

The Millet Network of India (MINI), puts it clearly that, 'millets are not mere crops; they are an entire concept'. Across the country, it is seen that millets have never grown alone, and always in combination with a host of other crops that include other millets, pulses, oilseeds, vegetables and a host of other crops - each with different cropping cycles and different uses. However, the biodiversity, the organic practice, the marginal- small farmers' survival, livelihoods, nutritional aspects and the agenda of indigenous peoples' knowledge systems, climate change effects have not been adequately addressed yet.

This paper is part of the outcome under MINI initiated processes to document millet-based bio-diverse farming pattern, practices and knowledge associated including the food habits, customs and cultural beliefs. The paper presents the observations on the millets and the thematic dimensions associated with millets in Dupi village of Kondhmal district.

Introduction

The Kutia Kondh is a well- known Particularly Vulnerable Tribal Group inhabiting parts of the Kondhmal and Kalahandi districts of Odisha. The Kutia Kondhs are numerous in the Baliguda subdivision of Phulbani district. The present study is carried out amongst the Kutia Kondhs of Belghar area.

¹Executive Director, Nirman (NGO), Bhubaneswar (prasant@nirmanodisha.org)

Their economic life hinges mostly on slash and burn type of cultivation which has become a way of life for them. They also undertake food gathering and occasional hunting. Apart from the daily routine of work, the seasonal drudgery is hard and labourious. Division of labour is based on sex. Women have to do all the vital tasks of housekeeping. In swidden plots, debushing, dibbling, hoeing, weeding, guarding the crops, harvesting, winnowing and finally storing are the women's job. Men undertake the tasks of cutting big trees, firing the felled trees, watch the crops, etc. In wet cultivation women undertake the important tasks of transplanting, weeding, reaping, harvesting and storing the produce.

Cereals, pulses, eggs, meat, tubers and other edibles available in the forest are the main sources of food items of Kutia Kondhs. The principal food is gruel with some vegetables. Gruel is also prepared out of Mande i.e., finger millets (*Eleusine coracana*), out of little millet (*Panicum miliare*), Jana (*Sorghum vulgare*) etc. Mande gruel is a favorite item for them. The increasing focus on rice and wheat under the Government aided Food Distribution System (FDS) has ablated the Kutia Kondhs away from millets; on the other hand, the relative lack of support of the State over the years for their millet cultivation has discouraged the community from cultivation. However, millets for the Kutia Kondh are very much ingrained in their system of living. Millets hold a very significant position in their life style. Their integrity and intimacy with millets is inherited.

The Study was conducted in Dupi, a revenue village of Gumma Gram Panchayat, 20 kms away from Tumudibandha community development block of Kondhmal district. The village is inhabited by 40 Schedule Tribe and 14 Schedule Caste households. The average operational land holding of the community is 1.78 acres, of which 56% accounts for upland, 19% for medium and 25% for low land. All the households are below poverty line. Most of the households face scarcity in food availability for about two to three months in a year.

Materials and methods

The study followed a diagnostic research design attempting to make use of rich primary resources available on the millets and millet farming by Kutia Kondh. Special emphasis has been put on millet farming on slope agriculture systems. The study followed a participatory approach and the qualitative information were gathered using group discussions, exercises and individual interactions. The discussions elicited relevant information to espouse the concept of millet based mixed farming as a means to achieve food and nutritional security.

For the study, 55 respondents including 23 middle aged women were divided in two groups for the purpose of conducting participatory exercises towards assessing their current farming practices, trends and shifts in practice and impact of such practices on food & nutrition status at family level. Various pre-assigned PRA tools were used during the entire exercise. Tools like diversity mapping, trend analysis etc. had been used in the study which reflects how diverse has been its presence and the process further reflected on the decrease in diversity from 66 to 15 varieties over three decades.

Findings from the study

A. Understanding the agricultural calendar and practice in relation to millets:

The Kutia Kondh has its own agricultural operational calendar. Moreover, most of their rituals are related to agricultural activities and influence the timing of these practices. They cultivate on the hill slopes, medium lands and low land areas beside the stream the *Patabidi*. The hill slopes are cultivated under slash and burn practice. The Kutia Kondh adopt a multiple cropping system in its cultivation practice on the hill slopes. They used to cultivate a number of crops together that includes cereals, pulses, spices, oil seeds and vegetables. The millets, legumes and oil seeds as companion crops dominate the other crops. However, they use the medium lands for maize and mustard cultivation and the low lands for paddy cultivation.

Their agricultural calendar is divided into three seasons: summer (from mid-February to mid- May), winter (from mid-October to mid-January) and rainy season (from mid-June to mid- September). For each of these seasons, they have specific agricultural operations and activities:

Summer season (February-May): At the onset of the season, the Kutia Kondh take up land development and preparatory activities for the up-coming cropping activities during the late summer. They follow '*poduchasa*', otherwise called swiddening or slash and burn agriculture, with fallowing of the land for a reasonable period between two cropping cycles. They usually cultivate a slope continuously for at least 3 years and then shift to another slope where they cultivate for three years. During that time the first slope is fallowed for restoring fertility. After completion of 3 years on the second slope, they shift to the third slope for another three years. In this process, they return to the first slope after about 6 to 9 years. However, this interval depends upon the number of slopes a family has under its possession.

During May-June, after two to three showers of rain, they observe the '*Bihan Puja*', a ritual of worshipping the seeds of various crops taken in a mixture. This ritual is observed both at household and village level. During the ritual, they select good seeds by examining their physical appearance. Besides, they also examine other aspects of the seeds like weight, density, smell, stickiness etc to be sure that the seeds they are going to worship are of good quality. Immediately after the festival, they set for broadcasting. Some seeds, like those of beans (cow pea etc) and legumes (pigeon pea etc) are dibbled while millet seeds are sown. After sowing, light hoeing is done to cover the soil. With the late summer rains, the seeds germinate. They inspect the fields to assess the germination rate. The patches where they see poor germination, there they sow seeds again for gap filling with millet seeds. Towards mid-June, they usually dibble castor seeds.

During summer, 40% of their food consists of uncultivated produces. They collect 14 varieties of wild tubers (yam species) and 6 varieties of green leaves from perennial plants

which are rich food sources. They also collect tamarind and mahua fruits during the summer.

Rainy season (June-September): The KutiaKondh undertake weeding during June to August. Weeding is usually done for non-millet crops. They construct small huts on their farmland to protect their crops from wild animals (like monkey, wild boar, birds etc). The hut is also used against rain, to rest, to keep food inside, to cook and to keep the harvest too.

During the rainy days, they collect 11 varieties of chhati or kutka (mushrooms) like Amba chati, Panasachati, Sargichati, Basa chati, Kupachati, Phulichati, Piyalchati, Dunguchati, Jambuchati, Medrengachati, Surubalichati etc. This is the peak season to collect the karadi (bamboo shoot).

Winter season (October -January): This is the harvest season. During these months, the Kutia Kondh harvests finger millet, pearl millet, foxtail millet, little millet, sorghum, pigeon pea, cow pea, rice bean etc.along with tubers like sweet potato, taro, yam, and other yam species.

Sl. No	Type	Kui name	Odia name	English name	No of varieties
1	Millet	Ma-sha	Kosala	Little millet	1
2	Millet	Arka	Kangu	Fox-tail millet	2
3	Millet	Mande	Mandia	Ragi/ Finger millet	1
4	Millet	Khed-jana	Jana	Sorghum	1
5	Millet	Dhulia	Dhulia		1
6	Millet	Kaate/ Ganthia	Bajra	Pearl millet	1
7	Millet	Sakara			1
8	Maize	Pokanga	Maka	Maize	2
9	Paddy	Kulinga	Dhana	Rice	
10	Legumes	Jhudunga	Jhudunga	Cow pea	2
11	Legumes	Katinga	Kating/ Baragudi	Rice bean	2
12	Legumes	Jhata	Simba/ Jhata	Country bean	3
13	Legumes	Biri	Biri	Black gram	1
14	Legumes	Bereng	Simba	Carpet legume	1
15	Legumes	Kandula	Kandula/ Harad	Pigeon pea	1
16	Legumes	Kulthi	Kolatha	Horse gram	1
17	Oil seeds	Kabanga	Jada	Castor	1
18	Oil seeds	Sorisha	Sorisha	Mustard	1
19	Oil seeds	Tila	Alasi	Niger	1

A detailed listing of various crops cultivated by the Kutia Kondh indicates that they are the custodians of 8 varieties of millets, 2 varieties of maize, 10 varieties of legumes and 3 cultivars of oil seeds. Besides, the community shared 3 varieties of yam species that they

cultivate. The total number of varieties regularly cultivated on hill slopes is about 26; however, the community shared a total of 62 varieties that they used to cultivate about 30-35 years ago.

B. Association of Millets with Rituals and Festivals

Millets such as finger millets and little millets finds importance in all rituals, festivals and even regular worships in the Kutia Kondh ritual calendar. Ragi gruel, rice made up of little millet or fox-tail millets are the best offering to the deities, as their deities are fond of their indigenous crops. The millets therefore are inevitable parts of the religious culture of the Kutia Kondhs. In the Kutia Kondh religious beliefs and practices, fermented or distilled alcoholic beverages also occupy a significant place. Offering of alcoholic beverages is must in any religious performance, rituals and festivals. However, the types of alcoholic beverages depend upon its availability. If financial status allows, the family purchases mahuli liquor made from fermented mahua flower, if not, one can prepare from little millet rice and celebrate the ritual. In the Puni Kalu festival, the little millets are processed in a specific manner to prepare an alcoholic beverage. For making the beverage, first little millet rice is cooked, then the rice is wrapped in siali leaves and kept in a dark corner in the house. After about three to four days, the rice catches a pink colour. Then the rice is opened from the leaf packets and mixed with water. The preparation is left as such for about three to four days for further fermentation and the beverage called Katul or Ke-ena becomes ready for consumption. The little millets are therefore a very important crop for the Kutia Kondh inhabiting the Belghar area.

Sl. No	Name of the festival	Odia month	English month	Duration of celebration	Associated grains
1	Bichasupinere (BihanaParba)	Jyestha	May- June	Four days	All varieties of field crops
2	Kamani Balujai	Jyestha	May- June	One day	Millets
3	Taka kalu	Shravana	July- August	Three days	Mango kernel, millets, rice
4	Nua Bhatakhia	Bhadraba	September- October	One day	Millets
5	Punikalu	Pausha	December - January	Three days	Millets and paddy
6	Bada Puja	Magha	January - February	One day	Millets

C. Millet food habit of Kutia Kondh

The food habit of the Kutia Kondh used to be by and large millets based. They used to grow varieties of millets and making different recipes out of it, be it rice or gruel or cakes or

beverages. According to them, millets are palatable and millets meal suits their work habits and health conditions. Various preparations that they were making with millets were free from oil, spices and condiments. With the easy availability of rice, their food habits reasonably changed. The situation also influenced the intensity of millets cultivation in their area. Rice eating symbolized an uplift in their status, as most of the Kutia Kondh perceived. However, they still consider millets as their all-time favourite. Millets like finger millet, little millet and fox-tail millet are still cultivated and consumed, although there is reduction in extent of millets cultivation and their use in food present day habit. They used to take millet meals along with the legumes. Gradually, their consumption of millets has decreased. Though they take food for three times a day i.e., morning, noon and evening but the content of millet in their meal is decreasing remarkably. Their present-day food habit has become rice centered because of the easy availability and affordability of subsidized rice. In the remote pockets, their prevalent food habit today is a combination of rice and millets.

About 30-40 years ago in order of preference subject to availability	Present (Over last 10 years) in order of preference subject to availability
Finger millet gruel with a mix of little millet (60-80% finger millet, 20-40% little millet or fox-tail millet)	Finger millet gruel (with or without little millets and fox-tail millets) are cooked and consumed mainly in summer season especially as morning meal
Rice made of little millets	Tuber crops (boiled and roasted)
Fox-tail millet rice	Rice
Boiled maize as 'pokanga bidi' (maize rice)	Boiled maize
Tuber crops (boiled and roasted)	Little millet rice/ fox-tail millet rice
Sorghum rice	Boiled pigeon pea tender seeds

Timeline	6 am - 8 am	12 md - 1 pm	7 pm - 8 pm
30 years ago	Only millets	Millets and tuber crops	Only millets
20 years ago	Ragi gruel (50%) and rice (50%)	Rice (50%), millets (30%) and tubers (20%)	Only millets
2019-20	Only rice (during agricultural activities, mainly in summer)	Only rice	Millets (70%) and rice (30%)

Millets are replaced by rice either from PDS or purchased from market, in case of shortage of subsidized rice. Consumption of tubers is also less either due to lesser availability or greater market demand for tubers. The same trend is also found with pulses in-take. Major share of harvest of pulses are sold for cash income from market.

D. History of farming system approach

Probing was made with elderly people in the village to understand the history of farming system approach, especially on millets, specific to the region. “We planted one mana of seeds and got 100 mana of grain”, the community revealed. The millets Mandia and Kosala were stress resistant crops. These required just one or two showers, needed very little care and grow in the most adverse conditions. Jhudunga, they said was a sensitive crop that required a cold climate.

Regarding cultivated crops, the elders could recall 28 varieties of millets of 8 types and 16 legumes of 3 types (the decrease trend in millet diversity with legumes has been outlined in table-7). They were Mandia, Maa-sha, Khed-Janna, Kaate/Ganthia, Arka (khagu), Maka, Kandula, Katinga, Jhudunga, Kolatha, Biri, Alsi etc. While the varieties of tubers and uncultivated leaves have not reduced, the variety of millets have reduced to 20 of 8 types and similar to the legumes which has reduced to 13 of 3 types.

Table-5: Community perception upon climatic factors influencing field crops		
Grains/Food/Resource	Temperature/ Heat	ErraticRainfall
Littlemillet	X	√
Fingermillet	X	√
Pigeonpea	X	√
Cowpea	X	√
Countrybean	X	√
Sorghum	√	√
Pearlmillet	X	√
Fox-tailmillet	√	√
Niger	X	X
Castor	X	X
Ricebean	X	√
Yam species	√	√

Reflecting on the staple food crops grown, especially the millets, there were only 10 varieties of millet falling under 8 types, and 5 varieties of legumes under 3 types. Regarding fall in productivity, the villagers revealed that earlier they used to sow three addas (3kg) of seeds and used to reap teen-shoou (300kg) of grain, which is a day-dream now. Beyond any scientific value analysis, millets for them are simultaneously food and medicine for them. There are instances of using ragi powder with turmeric pestled together and applied on children to cure skin diseases and infections. They also use the mixture as syrup for deworming for all age groups. Hence, millets are considered both food and medicine.

Trend	Reference Point	Time-line	Diversity Trend (no.of varieties)									
Before 35-40 Years	Villagewell	1981-85	5	5	5	2	4	3	2	2	8	3
Before 30 Years	School Building	1990-91	3	4	3	2	3	3	1	1	6	3
Before 25 Years	MangoTree	1995-96	3	3	2	2	3	2	1	1	6	1
20 Years before	Dharani Penu	2000-01	3	2	2	2	3	2	1	1	4	1
10 Years before	Community MarketHall	2010-11	2	1	1	2	2	2	1	1	3	1
Present day		2021-22	1	1	1	2	2	1	1	1	2	1
Crops(in English)			Sorghum	Finger millet	Little millet	Peal millet	Fox-tail millet	Maize	Dhulia	Sakara	Cowpea	Pigeon pea

Conclusion

Millet based farming system approach has a significant role to play in addressing two of the world's biggest and most urgent issues: climate change and food security. Further cultivation of such varieties demands least external resources. The millet crops have the ability to withstand drought and desiccation, humidity and frost, increasing temperature, intensity of day light, erratic rainfall and adverse climatic factors.

The Kutia Kondh community of Dupi village understands the agronomic practices related to cultivation of millets. Their experience of millet cultivation, pattern and practices developed over many generations has made them food sovereign. This diversified farming system with rich ecological knowledge of the smallholder farmers had been resulting in enhanced productivity, greater resilience and resource efficiency, and providing improved access to food and income and ultimately contributed to strengthening the Kutia Kondh food security over many years.

Millet based mixed farming system approach is quite encouraging in the Kutia community, especially for the use of local and indigenous knowledge, agronomy, techniques, and recognizes the critical role of women throughout the entire food chain as farmers, consumers and mothers. Being abysmally smallholder farmers, the community throughout the region has developed a multitude of practices and innovations.

Today, the Kutia community faces the alarming trend of losing custodianship over their food production system. Their control over affordable, sustainable and locally adapted farming system is gradually weakening both by natural factors and by the policy environment. Their small farms with diverse crops are the key to their as well as local food and nutritional security. Gradual loss of crop diversity, especially the millets has been a threat to the local food sovereign regime which needs to be addressed strategically in order to deal with the situation of hunger, nutritional insecurity and climate variability. According to the community members, reduced rainfall over last 10 years, large-scale deforestation, soil erosion and soil hardening and restrictions over over shifting cultivation are attributed to be major reasons for reduction in millet production in the area. Besides, the villagers also point out that aggressive mustard cultivation on the medium-uplands is one of the major reasons for reduction in extent of land under millets cultivation.

It is high time to counter these challenging changing trends and demand for bringing the grassroots production systems well attuned with not only institutional and government production support mechanisms that encouraged organic farming, but also supports local livelihoods and nutritional diversity, cultural heritage and dignity. Therefore, along with establishment of area specific appropriate farming system approach which sustains and improves agriculture and relative livelihoods, it should also be ensured that the millet grains are procured by the government and utilized locally in various food distribution schemes and programmes.

Valuing Traditional Millet Recipes

Tapas Chandra Roy¹

Abstract

Milletts are rainfed crops mostly grown in the tribal dominated areas of Odisha. They play an important role for the small and marginal tribal farmers as millets have the capability to address food, nutrition, fodder, and the most important the climate change. The food system of the tribals has undergone many changes in the last 2 decades and still changing fast. In this transition, the millet food is slowly losing the links with the ecosystem and its biodiversity. Odisha tribals possess skill and knowledge of making different types of traditional millet recipes. The paper presents an account of finger millet recipes by tribal people in Koraput based on a primary study on 100 tribal households in Dasamantpur block of Koraput district in Odisha. Information related to the traditional millet recipe was collected, documented and analysed for frequency and time of millet recipe consumption, perceptions on millet recipes, and brings out set of peoples' suggestions towards promoting consumption of millets. The paper views that valuing traditional millet recipes will not only address the food security but also the nutritional security of the people.

Keywords: Millets, Finger Millet, Food, Nutrition, Tribal

Introduction

Milletts are the traditional staple food of the tribals of Odisha. It plays an important role for the small and marginal tribal farmers as millets have the capability to address food, nutrition, fodder, and the most important the climate change. Millets are just not food but an integral part of the tribal communities. Millets are adapted to wide range of ecological conditions demanding less water and inputs and fits well even in the infertile soil.

Generally, these millets are rainfed crops mostly grown in the tribal dominated areas of Odisha. It has a greater importance for sustainable agriculture and food security. Millets are the creative interaction of the tribals with their surrounding environment and its biodiversity. Millets are the storehouse of nutrients as they contain protein, fiber as well as micro-nutrients such as calcium, iron, zinc, magnesium.

¹District Agriculture Officer (Scheme Officer), Koraput. E-mail: tapas3773@gmail.com

The food system of the tribals has undergone many changes in the last 2 decades and still changing fast. In this transition, the millet food is slowly losing the links with the ecosystem and its biodiversity and the new generations are not inheriting them. There are couples of reasons for it. But the most appealing reason preferring to single cereal-based diet.

In the last 5 years there is drastic change in the millet ecosystem in Odisha and the sole credit goes to the Special Programme for Promotion of Millets in Tribal Areas of Odisha (Odisha Millets Mission) that was launched by Govt of Odisha in 2017 to revive millets in farms and on plates.

Valuing the Tribals Traditional Millet Recipes

Odisha tribals possess skill and knowledge of making different types of traditional millet recipes. Millets are considered to be the part and parcel of their food culture. It is positioned as healthy energetic food in their mind. The millet recipes are unique in taste, appearance and the cooking style.

Although, tribals grow different types of millets like Finger Millet, Little Millet, Foxtail Millet, Sorghum and Pearl Millet. The acceptance of Finger Millet in their traditional diet is more as compared to other millets. This is due to ease in processing after harvesting and versatile in nature for making millet recipes.

Observations on Finger Millet Recipes of Tribals of Odisha

The study was conducted in the tribal area of Koraput in Dasamantpur block. In this study a door-to-door survey was undertaken from 100 sample households. Information related to the traditional millet recipe was collected and documented.

From the analysis of the data, it is found that *Mandia Jau* (Finger Millet Porridge/Gruel) is consumed by 38% people. For making *Mandia Jau*, it hardly takes 10-15 minutes. The flour is taken in a bowl and a small amount of water is added to it and a semi liquid mix is made by mixing it properly and ensuring no lumps are left. In the mean time, water is taken in a cooking pot and after the water boils, the semi liquid is put into it. With a ladle it is continuously stirred for about 2-3 minutes and finally the flame is off and it is allowed to cool down.

Apart from *Mandia Jau*, the next Finger Millet recipe that is made by tribals is the *Mandia Tampa* (1 part of rice is mixed with 2 part of flour). Generally, broken rice is preferred to make this recipe. When the tribal people go for work in their field, they carry *Mandia Tampa* in jar to have it during lunch time.

Pitha (home-made pan cakes/dumplings) are consumed occasionally. It is made during festival or when any guest comes to their home. *Pithas* are made by mixing Finger Millet flour with jaggery, chilli, little amount of water and salt as per taste. Basically, a dough is made. Then the dough is flattened and wrapped in the banana leaves, turmeric leaves or

jackfruit leaves and roasted on circular griddle made of iron or clay in low flame. When one side is cooked, the other side is flipped and the *pitha* is ready to consume.

The other interesting millet recipes are Mandia Anda (round ball made with Ragi flour and broken rice), Mandia Kandul Raav (Ragi flour with some soaked whole arhar dal with masala), Mandia Sukua Raav (Ragi flour with dry fishes with some masala).

Millet recipes are also made with Little Millet and Foxtail Millet. But it is slowly disappearing from their diet. It is due to lot of drudgery is involved in processing or removing the husk from it. The tribal women say, it takes about one hour to process one kilogram of millets. If they want to make any dish out of Little Millet and Foxtail Millet, they buy the processed millets from market and that too paying high cost, around Rs.80-120 per kilogram.

Frequency and time of Finger Millet Recipe Consumption:

In this study, information related to frequency and quantity of Finger Millet consumed was collected from 100 sample households. It was found that every household had consumed finger millet recipes in the last year. Around 90% of them consumed it on a daily basis and 10% consumed it occasionally. The consumption of finger millet reduces during rainy season and sometimes they are unable to consume when the stock is out in their home.

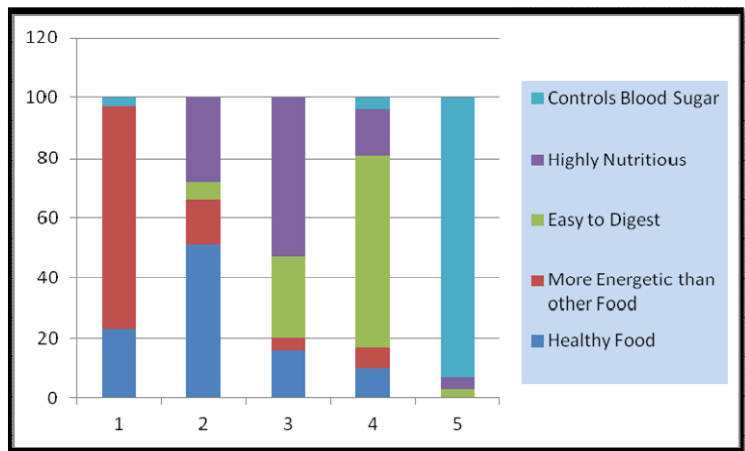
To understand the time and the quantity of consumption of the sample households, the quantity was taken in terms of number of glasses (250 ml) and the time was taken as morning, afternoon, evening and night. It was observed that 41% of the sample households had taken two glasses and 49% took 3 glasses in the morning. Most of them took during morning and afternoon but few during night. It was also observed that the quantity intake increases during summer season and negligible during rainy season.

Perception of Finger Millet Recipes Consumption:

To understand the perception of tribals of millet recipes consumption, a ranking system of the reasons were taken into consideration. The reasons were:

- More energetic than other food
- Healthy food
- Highly nutritious
- Easy to digest
- Controls blood sugar

It is understood from the analysis that people consumed Finger Millet recipes because it is more energetic than other food and least were



unaware of the control of blood sugar. But they were aware that millets are the healthy food and it is far ahead from rice and wheat. Tribal people say, they cannot work in the field without taking millets. Millets are the source of energy.

(Figure: Ranking of perception on the finger millet consumption)

Suggestions to increase the consumption of Finger Millet

From the study it was analyzed that to increase the consumption of Finger Millet, there is a need of holistic approach to increase production and productivity of millets, to address the consumption of millets and to address the primary and secondary processing of millets. Let us understand the outcome of the study.

(A) To increase the production and productivity of Finger Millet

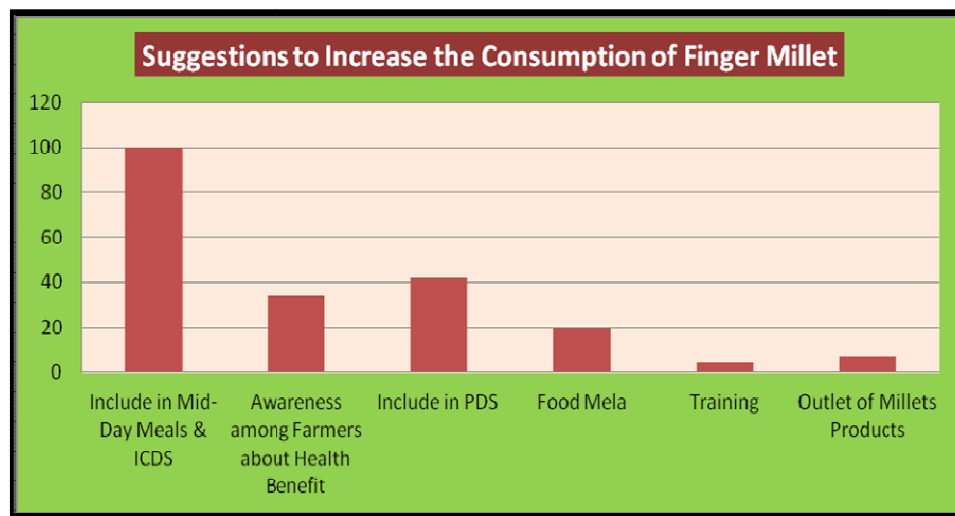
- Awareness creation on the system of millet intensification (SMI) of finger millet as this the method is giving more yields as compared to traditional methods.
- Conservation of local promising varieties which are giving more yields and sustaining from climate change.
- Giving more priority for weed control as it is the main constraints in Finger Millet production.
- Sowing/transplanting in time will enhance the production and productivity of finger millet.
- More production of finger millet will bring change in the livelihood of the tribal's by addressing the consumption part and also by selling in the market/mandi.
- Farmers must be encouraged to use the finger millet residue as fodder as it contains more nutrients and fiber.
- Development of context-specific improved varieties to improve productivity, increase shelf-life, improved nutritional content, and promote crop diversity.

(B) To address the consumption of finger millet

- Consumption of finger millet, every day is a tradition of tribal's as they keep 75% of their finger millet produces for consumption. It is seen that, the availability of finger millet in their house is almost for 12 months (65% households) but we have to address the rest (35% households) for round the year availability.
- The perception of most households is that they consumed finger millet as it gives more energy than other food and they can easily do the daily routine work and least were unaware of the control of blood sugar.
- Odisha tribals possess traditional knowledge of making different types of recipes from Finger Millet for ages. But we have to encourage them by organizing a food festival.

- As no modern recipe was available in the market neither they had any idea to make it. Only giving them training time to time will help to build their skill in cooking and simultaneously we can encourage the local entrepreneurs to come out with modern recipes at their local market. It is seen that most of them have the interest to have modern recipes like cakes, biscuits, and ladoos.
- All recommended to include ragi in mid-day meals and ICDS. The second suggestion (42 sample household) was to include ragi in PDS followed by awareness creation among farmers about health benefits, organizing food mela, an outlet of millet products in the local market, and finally training to farmers. They all had a concern that their children do not take ragi and including in mid-day meals and ICDS will surely address the nutritional security and malnutrition.

(Figure: Suggestions to increase the consumption of Finger Millet)



(C) To address the primary and secondary processing of Finger Millet:

- As good as 67% of households come under marginal and small farmers and 56% did not have any assets like farm implements, pump sets, motorcycles, and tractors. About 86% of households do their threshing of finger millet manually by using sticks. This can be addressed by establishing community hiring centers and also encouraging entrepreneurs to establish an agriculture service center in the locality.
- Most of the sample households (69%) does their milling by using traditional chhaki and rest (30%) by pulverizer. It was found that the sample households near to market availed the service of pulverizer. Community pulverizers can address this issue and can simultaneously reduce the drudgery of women.

Initiatives of Odisha Millet Mission

From the day of inception of Odisha Millet Mission, there is a remarkable increase in the yield of Finger Millet and consumption of millets in the tribal areas. This mission has revived

millet recipes on the plates of the tribals by organizing food festival and awareness campaign in these areas. Including millets in the mid-day meals and ICDS has boosted the consumption among the children and women.

Conclusion

It is the right time to promote millets as this will enhance the consumption of millets in the tribals areas and will help in reviving the millets on the plates and protect from disappearing from the ecosystem. Valuing traditional millet recipes will not only address the food security but also the nutritional security of the people.

Suggested reading

Best Traditional Millet Recipes of the Tribals of Koraput and their Perception

<https://tcrconnectingagriculture.com/2020/03/traditional-millet-recipes-of-the-tribals-of-koraput-and-their-perception/>

Mainstreaming millets in Southern Odisha's Malkangiri District

Aniket Likhar¹

Abstract

Predominantly, millets have been containing a substantial part of the food basket of the tribal communities. The majority of millet crops are generally recognized as Nutri-cereals as they provide the major share of the nutrients essential for normal human body functioning. Previously, these crops were known as orphan crops since they were the ultimate option for cultivation due to poor market demand and lower profitability than other crops. However, these neglected crops are important by virtue of their contribution to the means of livelihood, food and nutritional security of the tribal peoples and they diversify our food basket. Tribal dominated Malkangiri district of Odisha used to be one of the major millets producing areas but the scale of millet production substantially deteriorated over the recent decades due to demand and supply factors. The paper takes a look at the reasons of deterioration in millet production in Malkangiri and the efforts made towards promoting millet production there through comprehensive market led extension under Odisha Millets Mission. The concerted efforts of many actors and agencies have brought about inspiring results in extension of millet cropping, conservation of local varieties, value added marketing through Farmer Producer Organizations (FPOs) and above all in the food and nutritional security of tribal households.

Keywords: Millets, Ragi, OMM, FPO, Participatory Varietal Trial, Tribes

Introduction

Millets are one of the traditional rainfed crops of Malkangiri district of Odisha. Predominantly, millets have been containing a substantial part of the food basket of the tribal communities. The majority of millet crops are generally recognized as Nutri-cereals as they provide the major share of the nutrients essential for normal human body functioning. These crops largely contribute to food and nutritional security. They are called as the climate resilient crop which consumes comparatively less water and can withstand in dry spells and adverse weather conditions in comparison with other crops. Millets are grown in marginal/low fertile soils with minimal inputs like fertilizer and pesticides.

In terms of proteins, minerals, and vitamins, they outperform the commonly promoted rice and wheat. Being a natural source of micronutrients. Based on area grown and its grain size

¹ District Project Officer, Malkangiri, WASSAN E-mail: aniket@wassan.org

the millets are classified as major millet and minor millets. The major millets include sorghum and pearl millet while the minor millets include many such as finger millet, foxtail millet, little millet, kudo millet, barnyard millet, proso millet, brown top millet, fonio millet, teff millet, etc.

All these millets have a shorter growing duration complete their life cycle in 2-4 months, fit a wide range of cropping systems and also adapt themselves to the changing environmental conditions, especially during the vagaries of monsoon.

Previously, these crops were known as orphan crops since they were the ultimate option for cultivation due to poor market demand and lower profitability than other crops. However, these neglected crops are important by virtue of their contribution to the means of livelihood, food and nutritional security of the tribal peoples and they diversify our food basket. The area under millets cultivation and the scale of production has substantially deteriorated in the district in the recent decades both due to demand side and supply side factors. The area under Ragi had declined. The fundamental reasons for the decrease in millets cultivation and consumption were as follows:

- Promotion of rice through procurement and supply through PDS and State schemes.
- No incentive for production and availability of quality seeds.
- Lack of appropriate processing machinery to reduce drudgery.
- Competition from other crops such as Cotton, Maize, Cashew, Eucalyptus, etc.
- Cultural hegemony and looking down upon consumption of millets.
- No market development for millets.

Background of emergence of interventions in Malkangiri district

Increasing urban demand, improvements in processing machinery, availability of improved cultivars, better agronomic practices and possibility of accessing support irrigation have increased the potential of realizing higher productivity/profitability in millets thereby improving nutrition security, resilience and economic security of tribal households. The program impacts malnutrition in the tribal areas and also, makes their farming systems more sustainable.

The seeds for the "Special Programme for Promotion of Millets in Tribal Areas of Odisha" (or Odisha Millets Mission) were sown at a consultation meeting held on 27 January 2016 at Nabakrushna Choudhury Centre for Development Studies (NCDS). Based on the background survey done by the

Sr. No.	Blocks	Facilitating Agency
1	Mathili	Parivarttan
2	Khairput	Netaji Development Society
3	Kourkonda	Tagore Society for Rural Development
4	Chitrakonda	Sisu O Mahila Kalyana Samiti

NCDS and consultation with Civil Society Organizations, Malkangiri district has been chosen as one out of the 7 program districts where 4 blocks namely Mathili, Khairput, Kourkonda and Chitrakonda have been selected for intensive interventions. In Malkangiri district 4 civil society organization (NGOs) have been selected as Facilitating agency that supports the community-based organization (CBO) at the cluster level for the implementation of the programme.

In recent times, the government of India has also focused its efforts on promoting and strengthening of Farmer Producer Organisations (FPOs). The Special Programme for Promotion of Millets in Tribal Areas of Odisha (Odisha Millets Mission) envisages forming of Farmers' Producer Organizations in each block. These FPO's are farmer-led bodies that ensure improvement of production, productivity, direct linkages for higher value realization for the millet farmers, and take up some welfare activities directly.

Sr. No.	Blocks	Nodal CBO
1	Mathili	Saveri Setu FPC Ltd.
2	Khairput	Narishakti Panipariba Utpadanakari Mahila Samabaya Samiti Ltd.
3	Kourkonda	Chasi Bhai FPC Ltd.
4	Chitrakonda	Guru Priya FPC Ltd.

Promotion of improved agronomic practices

One of the primary goals of the Odisha Millets Mission programme is to increase millet productivity by implementing standard and improved agronomic practices such as System of Millets Intensification (SMI), Line transplanting, and Line Sowing, which will directly impact crop yield, crop coverage area, and farmer profitability. There are many advantages of improved agronomic practices. Proper usage of agronomic practices decreases input costs in producing farm products. Consequently, the quality and quantity of the yield will increase significantly. The exercises also help the farmers in taking good care of the environment by reducing pollution. Decreasing water usage and proper use of organic manures also contribute to maintaining the quality of the land.

Area Coverage under Odisha Millets Mission in Malkangiri District

Sr. No	Year	No. of GPs	No. of Farmers	Targeted Area (Ha)	Achievement (Ha)	Achievement in %
1	2017-2018	17	1561	800	679.8	85.0
2	2018-2019	22	2810	1600	1312	82.0
3	2019-2020	28	5096	2192	2402.1	109.6
4	2020-2021	38	7975	4542.8	4298.9	94.63
5	2021-2022	38	7801	4838.2	4411.2	91.17

Crop Cutting Experiments (CCE)

The CCE or the Crop Cutting Experiment is a process used to analyse the overall yield of the crop in a village. Crop Cutting Experiments (CCE) are more accurate, swift and scalable. CCEs are conducted using a Multi-Stage Stratified Random Sampling. It consists of various observations namely Location (Latitude, Longitude), Photographs, District, Block, Village, Name of Season, Date of Cutting, Name of Farmer, Field Size, Name of Crop, System of Cultivation, Variety, Source of Seed, Agronomic Practices, Date of Sowing and harvesting, Shape of CCE, Green weight, Moisture percentage, and Dry weight.

In Malkangiri district, all these experiments were conducted in all 4 OMM blocks for Kharif season in the presence of Block Agriculture Officer (BAO)/Assistant Agriculture Officer (AAO) and Village Agriculture Worker (VAW).

Participatory Varietal Trial

Participatory Varietal Trial (PVT) is a simple way for breeders and agronomists to learn which varieties perform well in on-farm and are preferred by farmers. The trial is to identify preferred cultivars in three phases: identifying farmers' needs; searching for suitable material to test with farmers; and experimentation on farmers' fields. Once identified, the seed of farmer-preferred cultivars needs to be rapidly and cost-effectively supplied to farmers for large scale production.

In Malkangiri district and with respect to overall scenario of Odisha, Marginal farmers continue to cultivate indigenous crop varieties that often give lower yields to farmers and which are less suited to current constraints. These farmers have had little exposure to new varieties, whilst those that have been released are often not suitable for conditions on marginal lands.

One means of addressing this problem is to place the seed of novel cultivars directly in the hands of the farmers. By facilitating collaboration between WASSAN research team and farmers, the farmers gained the opportunity to benefit from new varieties.

Sr. No	Block	Facilitating Agency	Best Performed Varieties
1	Mathili	Parivarttan	Bati mandia
2			Ladu mandia
3	Khairput	Madhyam Foundation	Sargi Mandia
4			Bada Mandia
5	Kourkonda	Tagore research for Social Development (TSRD)	Bada mandia
6			RisikaMandia
7	Chittrakonda	Sisu O Mahila Kalyana Samiti	Kalaghati Mandia
8			Mami Mandia

Following results suggests the final selection of varieties from PVT exercise 2019-2020 for quality seed production in kharif 2020-2021. The seed production plots were established in each block in Kharif 2020-21 and Seed Multiplication were done in Kharif 2021-2022 in all blocks.

Custom Hiring Centres

In order to bring farm machinery available at affordable hiring price, within the reach of small/marginal holdings, Custom Hiring Centres are being promoted under the Special Programme for Promotion of Millets in Tribal Areas of Odisha through the Nodal CBOsin order to

- reduce the drudgery of small and marginal farmers by mechanizing the farm activities
- make available various farm machinery /equipment to small and marginal farmers at an affordable hiring price.
- offset the adverse economies of scale due to high cost of individual ownership
- improve mechanization in places with low farm power availability
- provide hiring services for various agricultural machinery/implements applied for different operations.
- expand mechanized activities during cropping seasons in large areas especially in small and marginal holdings.
- provide hiring services for various high-value crop-specific machines uses for different operations.

A total of four numbers of Custom hiring centres are established in each OMM block and managed by existing community-based organization with support from facilitating agency. The following equipments are available in custom hiring centres in Malkangiri district in all four blocks under OMM.

Ragi Procurement at Minimum Support Price

Government of Odisha had approved the procurement of Ragi through Tribal Development Cooperative Corporation of Odisha Limited (TDCCOL). The TDCCOL procured ragi with the support of PACS/LAMPCS/FPO as per the FAQ specification laid down by Government of India and in accordance with the guidelines issued by the Agriculture and Farmers Empowerment department from time to time under the scheme. TDCCOL procured ragi from all the blocks of the under Odisha Millets Mission. The government of India

Sr. No.	Equipment	No. of Units
1	Cycle weeder	649
2	Sprayer	82
3	Pump sets	14
4	Sieving machines	54
5	Drums	17
6	Water delivery pipes	13
7	Winnowing fans	10
8	Markers	35

had announced the minimum support price for Ragi at Rs. 3377.00 only per quintal conforming to Fair average quality norms for KMS 2021-2022.

Farmer registration has been done under the M-PAS (Millets Procurement Automation System) portal by submitting personal, land and bank account details. Land Verification was done by AO/VAW whereas a bank accounts detail has been verified by respective nodal banks. After generation of token, farmers sold their ragi at respective mandi points. FAs and CBOs had supported in creating awareness and mobilizing farmers to sell at procurement centres.

FPOs as a block level procurement agencies

In order to increase the widening of the ragi procurement initiative of the Government of Odisha and as an attempt to promote farmers' organizations in agriculture value chain development, FPOs supported under the Odisha Millets Mission were impaneled as a procurement agency for Ragi Procurement in KMS 2021-22, in addition to or instead of LAMPCS and PACS in selected blocks of the Odisha Millets Mission.

The FPO provided a range of services to farmers. They have registered farmers on the MPAS online portal, conducted village level awareness campaigns to reach out to all millet growing farmers and hosted the Ragi Procurement Centres (mandis). The entire procurement operation was decentralized from one or two societies in a block earlier to multiple

points in a cluster of GPs or villages this year. Ragi Aggregation points were set up at the village / GP level where farmers bring their Ragi and get it tested for FAQ. The produce was also packed at the aggregation centre itself. The TDCCOL, which verifies quality, lifts produce, and initiates payment to farmers, was also able to do so directly from dispersed mandi points, reducing transportation and overall transaction costs for farmers and streamlined the process.

Ragi Distribution under PDS

The Government of Odisha initiated the procurement of millets from farmers and distribution through PDS in 2018-2019 which was one of the key commitments. Considering the nutrition benefits of millets, it has decided to integrate locally grown millets as part of public food systems such as PDS. Ragi based entitlements were included in PDS in the year 2020-2021 and 2021-22 also. A 2 kg ragi per ration card in Malkangiri was distributed as a substitute of rice to 1,57,638 to ration card holders. The programme follows farmers' welfare approach through food welfare so that by procuring these millets, substantial cash would

Procurement status of Malkangiri District under OMM 2021-22			
Sl. No	District	Block	Procurement in Qtl.
1	Malkangiri	Khairput	4221.09
2		Mathili	9323.47
3		Chitrakonda	6935.32
4		Korukonda	6265.19
5		Kudumulguma	2746.47
6		Malkangiri	2662
TOTAL			32153.54

flow to rural households and PDS cardholders would get access to nutritious food-grains at low prices.

Conclusion

The results obtained so far has brought about significant achievements in terms of increasing the crop area coverage under millets, transfer of technology and improved package of practices, streamlining the trade environment with millets, establishing ragi processing units at the block level, value addition to millets through procurement as per approved minimum support price and allied interventions. Although larger focus has been laid upon the extension agriculture of finger millets, it is expected that in the coming days, the conservation and propagation of the other local varieties will be expedited. In this context, the participatory varietal trials and other ways of conserving the traditional varieties should be expedited to bring back the ignored nutria-cereals back to the area and the communities.

OUR CONTRIBUTORS

Name	Address
Prof. A. B. Ota	Advisor-cum-Director, SCSTRTI and Special Secretary to Govt. Mob:9437492008 E-mail:(akhilabihariota@gmail.com)
Abhisekh Pradhan	Project Coordinator – Seed system for landraces, Odisha Millet Mission, WASSAN
Aniket Likhar	District Project Officer, Malkangiri, WASSAN E-mail: aniket@wassan.org
Bijaya Kumar Nayak	Ph.D Scholar, Nabakrushna Choudhury Centre for Development Studies (NCDS), Bhubaneswar (bijaya.nayak@gmail.com)
Debabrata Panda	Department of Biodiversity and Conservation of Natural Resources, Central University of Orissa, Koraput-764 021, Odisha, India, E mail: dpanda80@gmail.com
Dr. Chita Ranjan Das	Ex. Sr. Research Officer, Nabakrushna Choudhury Centre for Development Studies (NCDS), Bhubaneswar
Jitu Mishra	Archaeologist and Researcher, Sarna Educational and Cultural Services, Bhubaneswar
Prasant Mohanty	Executive Director, Nirman (NGO), Bhubaneswar (prasant@nirmanodisha.org)
Dr. Mihir Kumar Jena	Lead Consultant, SCSTRTI, Bhubaneswar, drmihirkumar@gmail.com
Susanta Sekhar Chaudhury	Programme Manager, WASSAN, Bhubaneswar
Tapas Chandra Roy	District Agriculture Officer (Scheme Officer), Koraput. E-mail: tapas3773@gmail.com

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