Sustaining Rice Landraces In-situ and on Farm through Biocultural Diversity in Koraput, Odisha, India

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Abstract

The paper is an effort to highlight the inter linkage between human culture, on-farm diversity, and traditional practices of tribal farming communities in sustaining landraces and ancestral rice varieties. Koraput (Odisha) is known to be a center of origin and diversity of Asian cultivated rice (Oryza sativa). *A large number of rice varieties having diverse morphological and agronomic characters are cultivated by different tribal groups in this region. Agriculture is the primary occupation of most of these tribal communities, and rice is the chief crop used for consumption, local trade, sociocultural rituals, and magico-religious celebrations. Three tribal groups cultivate thirty-seven varieties of rice under diverse agro-ecologies, of which eleven varieties have strong cultural associations. Tribal communities celebrate agricultural rituals throughout the year and use specific rices for each and every rite. Coarse, oval, long, and slender rices having white, light red, and red kernels, with diverse maturity dates, have been preserved by them through in-situ and on-farm practices. Sustaining these tribal practices will help not only in the conservation and evolution of rice varieties in their natural habitats, but also in coping with changing temperature and rainfall patterns, and benefit generations in the future.*

The predominance of *Oryza sativa* (Asian cultivated rice) in Southeast Asian countries has led to rice-centered agricultural, economic, and social systems throughout the Pacific Rim (van der Kroef, 1952; Piper, 1993; Walker, 1994; Sponsel, 2000). Over hundreds of years, the widespread cultivation and use of diverse rice landraces has helped conserve an impressive genetic diversity interwoven with a rich human cultural diversity and rice-based traditions (Terwiel, 1994; Hardjana, 2001; Hamilton, 2003). In spite of these efforts, there is a lacuna in the understanding of the broad socio-cultural context which is also responsible for selecting and conserving rice varieties on the farm. Thus there is a requirement to include biocultural approaches for effective short- and long-term conservation of our living heritage involving farm families in research programs (Pfeiffer, 2004).

'Biocultural diversity' is a blending of biological and cultural diversity, the value of which has been addressed extensively in the biological and social sciences for stabile natural and anthropogenic ecosystems (Tilman and Downing, 1994; Posey, 1999; Maffi, 2001; Stepp *et al.,* 2002). Indigenous tribal groups have been responsible for domestication of a wide range of food crops to sustain food security at household and community level. It is believed that on-farm conservation of wide ranges of traditional food crops is a product of interdependence of both the diversities.

Over a period of time, micro-agro-ecological zones have been developed by indigenous communities for on-farm conservation and cultivation of food crops. Simultaneously, changes in their cultures have taken place to obtain maximum benefits from their surrounding environments. The process paved the way for the evolution of specific biocultural diversity which has been maintained for generations resulting in on-farm conservation of crop genetic diversity.

The Convention on Biological Diversity (CBD) embraces the importance of cultural diversity and traditional knowledge. CBD's Article 8(j) on Traditional Knowledge, Innovations and Practices calls on Parties to:

"*respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge innovations and practices*."

Study area

In this context, the tribal villages of Koraput district in the state of Odisha (India) offer unique opportunities to showcase existing tribal cultures and their impact on in-situ and on-farm conservation of rice landraces (Fig. 1). Koraput is renowned for its heterogeneous tribal population and enormous genetic diversity of rice. The human cultural diversity and traditional rituals have promoted widespread cultivation and use of numerous (red, black, purple, brown, straw and many pigmented) rice landraces over thousands of years, and have helped in conserving specific rice landraces required for social ceremonies, cultural merriment and religious functions. Regrettably, modern varieties introduced during the Green Revolution started replacing landraces and traditional varieties of rice gradually and steadily resulting in widespread genetic erosion.

Landraces and traditional rice varieties

To stem the incidence of rapid genetic erosion the MS Swaminathan Research Foundation (MSSRF), Chennai (India) during 1995–96 had chronicled 131 rice landraces from thirteen tribal communities residing in twenty-nine villages. From the study it was apparent that small and marginal tribal farmers generally cultivate traditional rice varieties for their wide adaptability, varied duration, low cost of cultivation,

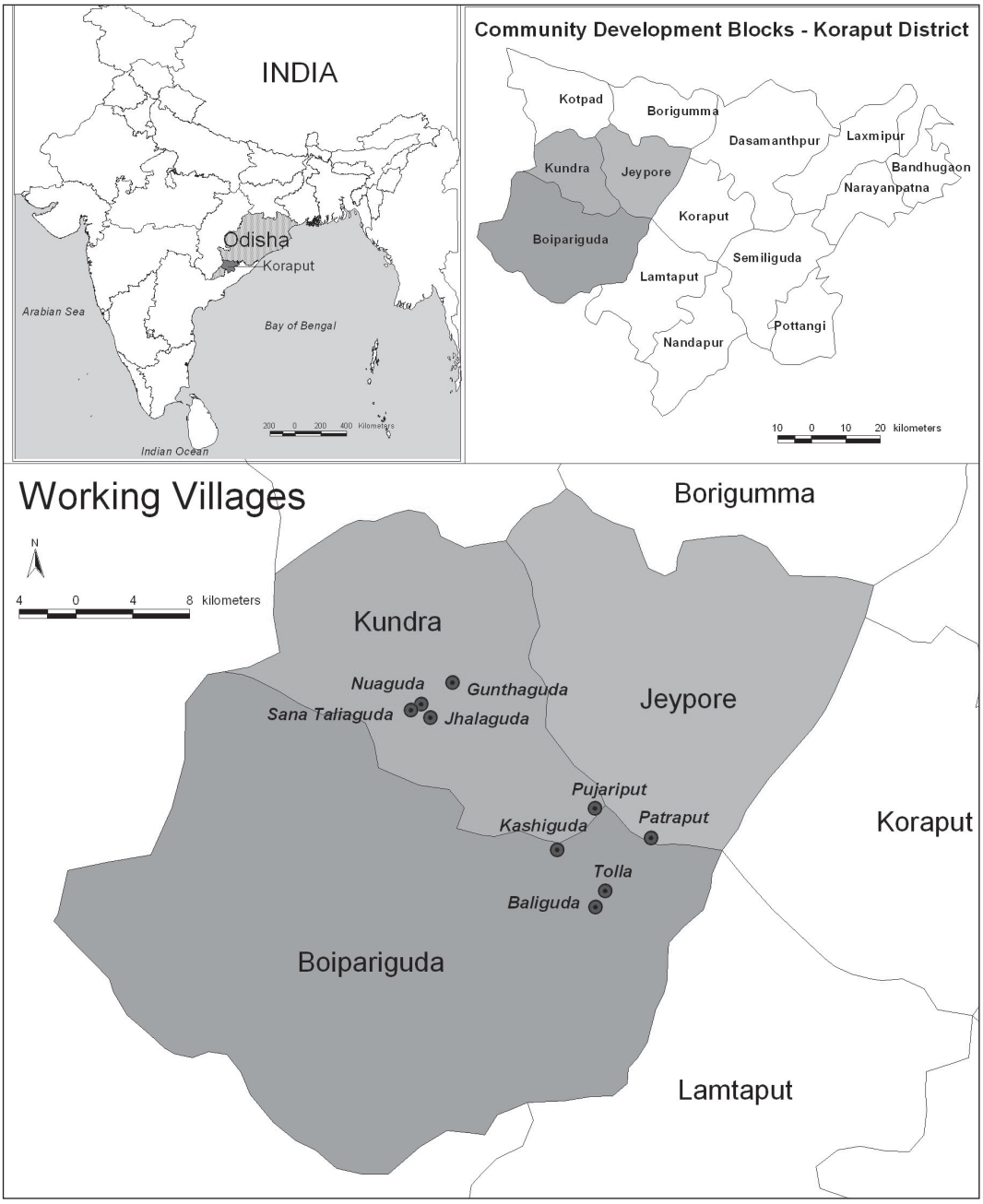

Figure 1. Map showing the study area.

cooking quality, taste and for utilization in socio-cultural rites. The majority of tribal households acknowledged that they have been cultivating – since ancestral times – a few short-duration rices to celebrate *Nuakhia* (the first ceremonial eating of the

new harvest) in September/October as per their traditional calendar, and tall varieties of long-duration rice for thatching their houses (Sharma *et al*., 1996; Tripathy *et al*., 2005).

Since 1998, MSSRF has implemented several projects in Koraput among marginal and small rice farmers and developed mechanisms for making conservation and commercialization mutually reinforcing. The efforts have helped tribal farmers revitalize and conserve desirable rice landraces and create an economic stake in conservation through development of market-oriented value chains of aromatic rice landraces *Kalajeera*, *Haldichudi,* and *Machakanta* (Arunachalam *et al.,* 2006, 2007).

Apart from these initiatives, systematic works on linkage of tribal cultural diversity and rice genetic diversity are few and spaced sparsely across decades. Elwin (1950) detailed the agriculture and general ceremonies of the Bondo tribe. Elwin (1955) conducted a detailed and exhaustive study about the religious aspects of the Sabara tribe of Koraput, covering even their magico-religious beliefs about agriculture and food collection. A detailed festivals and ceremonies calendar related to livestock and poultry offers, has been reported for ten tribes of Koraput district (Das, 1999a). Also, Das (1999b) has reported the conservation of paddy varieties through a traditional ceremony among the Gutab Gadaba families.

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Over a period of time, micro-agro-ecological zones have been developed by indigenous communities for on-farm conservation and cultivation of food crops.

Target 9.1 of the 2010 Biodiversity Target (CBD), "*Protection of traditional knowledge, innovations and practices by maintaining socio-cultural diversity of indigenous and local communities*", opened an avenue for MSSRF scientists to explore various aspects of conservation and intense cultivation of selected landraces in terms of number of farm families and villages.

Objectives

- Document evidence that supports linkages between tribal cultural diversity and rice genetic diversity.
- Record the contribution of socio-cultural practices in preserving and maintaining specific landraces on the farm.
- Witness gender participation and equity in tribal societies and conservation of ethno-botanical flora and fauna used by communities.

Methodology

Three dominant tribes – Paroja, Bhumia, and Gadaba – from nine villages were selected for data collection. Focused Group Discussions (FGDs) were held in each village during 2008 and gendered participation was ensured through

MSSRF volunteers. A structured questionnaire was prepared to collect data systematically on the purpose and mode of celebration, rice varieties used, and participation of villagers at individual and community level. An annual *Odiya* agricultural calendar was developed, and the cultural practices of each month related to rice cultivation were incorporated. Seed sources of individual landraces cultivated were collected to establish the relationship between tribal culture and conservation of ancestral rice varieties.

Results and discussion

The three communities observe a number of socio-cultural functions aiming at ensuring family well being and happiness as well as community welfare and harmony (Fig. 2). Cultural rituals and festivals centering on human, livestock and crop welfare, agricultural operations, first fruit eating, are descended from ancient times and are preserved and celebrated till date. The analysis of data clearly indicated that communities have socio-cultural similarities signifying their cultural homogenity but at the same time, each community has developed its own rituals and celebrations with little modifications signifying the level of development.

Cultural rituals of the communities can be classified into two broad groups – those celebrated within the family, and those observed at the community level. The individual functions and rites relating to the

Figure 2. Rice in tribal cultural celebrations.

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birth of a child, to marriage, death, sowing and harvesting of rice are observed family-wise, whereas, the rites and rituals relating to eating of new fruits and harvests, hunting, are observed by the village community. The village priest *Disari* or *Pujari* fixes the date and time for all rituals to be observed for both levels. People belonging to different classes of the society participate and celebrate with joy and happiness.

Traditional rice occupies an important place in the three studied villages. To assure its availability for a longer time, tribal farmers cultivate rice with varying maturity dates from 60 to 180 days in three seasons: autumn (July–September), winter (June–December) together known as *kharif*, and summer (January–March) known as *rabi*. A few rice landraces having short maturity dates have been prioritized and preserved for household consumption and celebration of *Nuakhia* (ceremonial eating of the first harvested rice). In addition, coarse and fine rices with white or red kernels, bold as well as white superfine medium- and long-duration rices have been preserved for tribal socio-cultural systems.

Progressive farmers with irrigation facilities prefer to go for summer rices, which are mostly modern high-yielding varieties. Table 1 explains in detail the characteristics of three different categories of rice complementing each other for a sustained tribal livelihood.

Rice cultivation cycle and tribal rites

Traditional rituals relating to rice cultivation start in the month of April prior to the beginning of field operations, and continue until January when postharvest activities come to an end. Specific rituals have been fixed for seeds (before sowing), rice fields (standing crop), and threshing yards (postharvest) distributed at regular intervals

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Table 1. Characteristics of three different categories of rice complementing each other for a sustained tribal livelihood.

Characters	Short-duration rice	Medium-duration rice	Long-duration rice
Duration (days)	70–100	100–130	More than 130
Land type	Upland	Medium land	Lowland
Photoperiod sensitivity	Insensitive	Sensitive	Highly sensitive
Plant height	Short	Medium to tall	Tall
Leaf length (cm)	35.5–46.6	36–47.3	33–58.5
Leaf width (cm)	1.2–0.84	1.2–0.78	1.3–0.72
Productive tillering/hill	Low	Medium	Profuse
Panicle length	Short	Medium to long	Medium to long
Grains/panicle	Less	More	Most
Chaffs/panicle	More	Medium	Less
Panicle shattering	Low	Easy	Easy
Awning	Mostly present	Absent to long	Mostly absent
Lemma and palea color	Black, brown, straw	Brown, straw, red	Black, brown, red, striped, straw
Grain length (cm)	0.9–1.0	0.7–1.0	0.7–1.0
Grain width (cm)	0.3–0.4	0.3–0.4	0.2–0.4
Seed coat color	Red to light red and white	Light red to white	Mostly white
1000-seed weight (g)	20–32	16–23	14–28
Grain yield (q ha^{-1})	10–15	27–30	35–40
Straw yield (q ha^{-1})	6	10–15	20
Utilization	Household consumption and barter for other necessary things, utilization in cultural events.	Consumption and local sale. Utilization in socio-cultural and religious ceremonies.	Consumption and commercialization. Maximum utilization in socio-cultural and religious ceremonies.

throughout the cultivation cycle. Table 2 explains the existing cultural observance and its importance from tribal perspective. *Chaita Parab* is the first ritual observed to ceremonially worship seeds of various crops (*Bihana Puja*). The first mango eating and community hunting are the two other activities following *Chaita Parab*, and are performed by all the three tribes. *Bihanabuna* (sowing of seeds) for long-duration rice starts in May, marking the begining of rice cultivation in the lowlands, and ends before the full-moon day of *Baisakha* (May). Prior to bulk sowing tribal farmers ceremonially

Table 2. Existing cultural observance related to rice cultivation and its importance from the tribal perspective.

Month	Name of ritual	Bhumia tribe	Gadaba tribe	Paroja tribe	Purpose
April	*Chaita Parab*	√	√	√	Ceremonial worshiping of seeds, start of community hunting for a week. First mango eating ceremony.
May	*Bihanabuna*	√	–	–	Check seed quality and germination percentage through seed sowing ceremony.
July	*Asadhia Jatra Uanshi Parab*	√	√	√	Make *beushening* (traditional weeding) successful.
	Chitalagi Amamashya				Safeguard the crop field from leaf blight and livestock from evil eye.
August	*Bandapana (Puni Parab)*	√	√	√	Celebrate Lakshmi *puja* for good tillering vigor and a bumper harvest. Ceremonial selection of healthy plants for seeds.
September	*Nuakhia*	√	√	√	Worship individual house deity with new harvest and ceremonial consumption.
October	*Osa Puja/ Dussera*	√	√	–	Worshiping of Goddess Durga with new vegetables and rice, and worshiping of bows, arrows, axes, and spades used during community hunting.
	Langaladhua	–	√	√	Washing and cleaning of traditional agricultural implements used in cultivation.
November	Diwali	√	√	√	Worshiping cattle, offerings to forefathers, annual bonus to caretakers of cattle.
December	*Pusa Parab*	√	√	√	Worshiping *Hundi Thakurani,* postharvest celebration.
January	*Magha Jatara/ Upuria Jatara*	√	–	–	Protect children from eye infection.
March	*Kandula Puja*	√	–	√	*Hundi puja* and worshiping forefathers.

Three dominant tribes – Paroja, Bhumia, and Gadaba – from nine villages were selected for data collection.

check the germination percentage of seeds in one corner of the field.

In July, *Asadhia Jatra* is celebrated to make *beushening* (traditional method of weeding the direct-seeded lowlands) successful. To safeguard/protect rice fields from the evil eye as well as from insect and pest infestations, tribal communities celebrate *Uanshi Parab* or *Chitalagi Amamashya*. Tribal women celebrate *Bandapana* or *Puni Parab* in August to obtain good tillering vigor and healthy crop as well as to select and mark healthy plants for future seed selection. September is the time when the whole family celebrates *Nuakhia* using short-duration rice. Newly harvested vegetables are also cooked and offered to individual house deities along with rice. The time to rejoice commences from *Nuakhia*. *Langaladhua* is celebrated in the month of October. Tribal farmers clean and wash all their traditional agricultural implements and give them rest till the next season. During *Osa/Dussera*, freshly harvested rice along with newly harvested vegetables are offered to Goddess Durga. To express their gratitude to cattle, tribal farmers worship them on Diwali and feed them *khichadi*, i.e., yellow rice mixed with vegetables. New storage structures made of bamboo are purchased on that day.

Rice hangers are made from long slender white grains and hanged at the entrances to houses to welcome Goddess Laxmi who symbolizes wealth and peace; they are also hung around the necks of cattle to show their deep connection with rice. People offer cooked rice to their forefathers in the form of *Khichadi* (yellow rice made out of rice and green gram with turmeric powder). Men and women celebrate *Pusa Parab* in groups for merrymaking by visiting friends and relatives and dancing and singing. They eat a particular rice, *Umuriachudi*, to keep them energetic and smart. In March, *Kandula Puja* is observed to worship their forefathers and offer *kandula* (*Cajanus cajan*).

Of the ten agricultural ceremonies, six are common for all the three tribes which highlights the importance of quality seeds, weeding, crop protection, tillering vigor, selection of seeds, and importance of cattle in rice cultivation. Celebrations with the new harvest and postharvest operations at family and community level indicate their sharing of happiness and satisfaction for their produce.

In addition, women worship on the days of sowing and uprooting seedlings from nursery beds. They offer either white or maroon hens to the gods. Well-to-do families sacrifice a pig, along with white rice, popped rice, coconuts, incense sticks, and flowers to make the seedlings healthy.

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Prior to harvesting and subsequent to threshing, men worship the Goddess and sacrifice either a black hen or a goat, with eggs, white rice, flowers, incense sticks, coconuts, and bananas; they invite 10–15 guests, offer *pendam* (rice beer) with other cooked items.

System of celebration

The mode of celebration has been standardized and fixed by the *Disaris* (priests). *Disaris* take the responsibility of fixing the time and date for carrying out particular rituals for the community as well as for individuals by refering to palm leaf books and looking at studying the birth stars of individuals. Normally they give enough time to families to enable them to arrange the necessary offerings like coconuts, bananas, seasonal flowers, incense sticks, earthen lights, black paste (*kajal*), and vermillion besides handfuls of specific raw and white rices for each ritual. Bells and conches are also used to make the environment lively.

Routine animal sacrifices, mostly goats and occasionally buffaloes are made during community-level ceremonies, while hens are preferred by individual households. People with minimum resources place eggs as offerings. *Kandula kukuda* (special colored hens) are reared by each and every household. Such cultural rites have been providing highly nutritious food to communities during peak agricultural seasons and spread across the annual cycle.

Preservation and use of ethno-botanical species

Further analysis revealed that tribal culture has served to identify and preserve a number of wild, semi-wild, and cultivated plant species associated with rituals celebrated during rice cultivation. To celebrate *Uanshi Parab,* twigs of nine different species of plants are collected from the forest and planted in rice fields to protect from insect and pest infestations. The plant species are: *bana bhalia* (*Semicarpus anacardium*), *kendu* (*Diospyros melanoxylon*), *deobadini* (*Asparagus racemosus*), *phulabadhuni* (*Thysanolaena maxima*), *bana-dhungia* (*Elephantopus scaber*), *bagha-nakhi* (*Gloriosa superba*), *keo-kanda* (*Costus speciosus*), *khatua-koli* (*Benkara malabarica*), and *budhi-mahula* (*Hymenodictyon orixense*). Many species used for rituals have been reported to have medicinal properties and are being used in the traditional health care systems (Sharma *et al*., 1999). During the celebration of *Nuakhia*, tribal women cook leaves of pumpkin and colocasia together with newly harvested rice. They offer blackgram, horsegram, hillgram, sweet potato, radish, and *jhudunga* (cowpea) to Goddess Durga during *Osha Parab.* Green gram, *jhudunga*

In July,* Asadhia Jatra *is celebrated to make* beushening *(traditional method of weeding the direct-seeded lowlands) successful.

(cowpea), greens of amaranthus, pumpkin, colocasia, sweet potato, cowpea, elephant's tuber, cucumber, broad beans, and bottle gourd are cooked along with rice to feed cattle in Diwali. Storage units made from several bamboo species are used to store seeds and grains. Bitter gourd and beans are used as a special offering to the goddess on a particular day; split bittergourd is used as serving spoons among the Bhumia tribe.

Gender equity

Participation of men and women in all agricultural celebrations shows inclusion and importance of gender in the community. Tribal women get involved in all socio-cultural celebrations and play key roles for their family and village. Women have greatly been involved in arranging offerings and cooking specific dishes for particular worship. Barring *Asadhia Jatra,* women participate in all ceremonies, and men are not permitted to participate in *Bandapana*.

Rice genetic diversity vis-à-vis tribal cultural rituals

The overall study documented a total of thirty-eight rice landraces growing in fragmented holdings sustaining the on-farm genetic resources. Twelve each from short- and medium-duration, and fourteen of long-duration were cultivated in different frequencies still fulfilling the integrated social, economic, and cultural needs. Table 3 highlights landraces preserved and maintained for cultural celebrations.

Wide-ranging duration and diverse traits of rice help tribal communities in performing the rites. Rice in small quantities is used for worshiping the village gods and goddesses, and for rituals related to rice fields, whereas larger quantities are needed for social ceremonies. Raw uncooked and white rice, irrespective of the duration, is essential for *pujas* performed for deities. Early-maturing red coarse rice is used for *Nuakhia* (ceremonial consumption of new harvest) while early-maturing fine rice, *Osagathiali* is offered in *Sakti puja* (*Dussera*). Medium-duration rices – *Bodikaveri, Ladiari, Gathia* – are cooked with turmeric and vegetables in a customary manner and offerings are made to one's forefathers; cattle are also fed with special yellow rice (*khichdi*). Late-maturing white rice having straw colored husks is used to celebrate *Push parab* to mark the end of the rice cultivation cycle. *Umuriachudi* and *Machhakanta* are the two foremost rices preserved for the purpose. During *Chaita parab*, tribal people visit their friends and relatives and depend more on late-maturing rice varieties such as *Umuriachudi, Machhakanta* and recently

Of the ten agricultural ceremonies, six are common for all the three tribes which highlights the importance of quality seeds, weeding, crop protection, tillering vigor, selection of seeds, and importance of cattle in rice cultivation.

Table 3. Landraces preserved and maintained for cultural celebrations.

Cultural rites	Landraces
Chaita Parab	*Umuriachudi, Machhakanta, Kalajeera*
Bihanabuna	*Umuriachudi*
Asadhia Jatra	*Umuriachudi, Sapuri*
Uanshi Parab/ Chitalagi Amamashya	*Matidhan, Kalajeera, Machhakanta*
Bandapana (Puni Parab)	*Umuriachudi*
Nuakhia	*Para Dhan*
Diwali	*Bodikaveri, Ladiari, Umuriachudi, Assamchudi, Sapuri, Sunaseri*
Pusa Parab	*Machhakanta, Umuriachudi*
Magha Jatara/Upuria Jatara	*Sapuri, Machhakanta*
Kandula Puja	*Umuriachudi*

Kalajeera, which provides them strength to walk long distances.

Rice with white kernel is soaked in water and ground into a white paste in a stone grinder and used for making traditional drawings at the place of worship, walls of houses, place of cooking, and on the exterior walls of houses. Various rice cake recipes are prepared using grated coconut and jaggery and offered to deities on celebration days.

Making of rice garlands immediately after harvesting is an age-old tradition. Tribals decorate house entrances and place garlands around the necks of cattle on Diwali before worshiping. Artisans make handicraft products out of rice panicles and grains for sale in local markets. Long and dense panicles of long-duration rice having slender grains like *Machhakanta* and *Haldichudi* are used for such purposes.

From Table 4 it is evident that various landraces with significant variations in characters have been preserved for the observance of rituals. Five short-duration rices were used in four events matching their harvesting and later period, and possess multiple traits useful for food, nutrition, soil, and water, and insect and pest resistance in random combinations. Tribal communities used four medium-duration white rices for traditional rituals. *Bodikaveri* and *Sapuri* significantly contributed to tribal socioeconomic conditions other than cultural celebrations. Of the fourteen rices cultivated in lowlands, four are used in traditional celebrations. *Umuriachudi* is the most popular rice among all for its taste, cooking quality and value-added characters besides lodging resistance. *Machhakanta, Sunaseri,* and *Kalajeera* were also used for worshiping deities. *Machhakanta* has the advantages of flood resistance and

Table 4. Significant characters of landraces used in cultural rites.

Landrace	Specific characters as perceived by tribal households
Short-duration rice	
Donger Basumati	Profuse tillering, heavy panicles, aromatic white soft rice suitable for preparing special dishes. Insect and pest resistant having high yield potential.
Donger Gathia	Grows well in any type of land, lodging-resistant, disease- and pest-resistant; red hard rice weighs more, has good milling quality, and gives quality rice flakes, and thick rice gruel.
Mati Dhan	Grows well in different types of soil. Nutritious rice suitable for making rice flakes.
Osagathiali	Drought- and lodging-resistant; fine, white, and soft rice, stays overnight without spoilage.
Para Dhan	Weed suppressor, nutritious red rice, disease and pest resistant, produces quality rice flakes.
Medium-duration rice	
Assamchudi	Lodging-resistant, tolerant to diseases and pests; superfine white rice, densely packed grains, higher yield, suitable for all parched rice, preferably popped rice.
Bodikaveri	Drought-resistant, weed suppressor, white, long rice with excellent taste, shorter cooking time, suitable for parched rice, especially puffed rice.
Ladiari	Long grains with awns, sweet taste, swells more on cooking, non-sticky, thin husk helps in pounding and milling.
Sapuri	Lodging-resistant; non-Basmati mildly aromatic rice with multiple desired characters. Long, super-white rice. Often given as bride price. Highly preferred for making popped rice during marriage ceremonies. Heavy rice with a good market price.
Long-duration rice	
Kalajeera	Non-Basmati aromatic rice with aroma often lasting 8 months. Short and oval grain suitable for making special dishes.
Machhakanta	Flood-resistant; dwarf, long, and slender grains, higher yield and market price.
Sunaseri	Medium-sized white rice; golden grains; swells more on cooking, shorter cooking time, sweet taste, non-sticky, stays longer in the stomach, good milling quality.
Umuriachudi	Lodging-resistant; stays longer in the stomach; tasty, suitable for making parched rice.

dwarfness with a potential of higher yield and good market demand.

On-farm conservation

This section deals with linkages between tribal culture, on-farm conservation of rice landraces and sustainability at community level. Frequency of cultivation at the village level highlighted seven landraces of the thirty-eight growing intensively in the three land categories. Two short-duration landraces *Para* and *Mati* were rigorously cultivated in seven of the nine villages surveyed, showing up their importance across the communities. Other short-duration landraces were growing in 1–4 villages, the maximum falling between 1 or 2. Medium-duration landraces *Bodikaveri* and *Muktabali* were reported in five villages, and *Sapuri* in nine villages. The remaining nine landraces were cultivated either in 1 or 2 villages. The long-duration popular landraces *Kalajeera* and *Umuriachudi* were documented growing in seven villages, contrast to the other twelve landraces cultivated only in 1–3 villages. The study revealed that significant and popular landraces were being maintained from ancestral times by farm families in a majority of the villages. Some of them have temporarily discontinued cultivation and restarted by exchange or through Community Seed Banks facilitated by MSSRF, Chennai.

Close to 420 households (more than 80%) still cultivate short-duration traditional rices to celebrate *Nuakhia* (ceremony of new crop harvest) as well as to get immediate food for the family. Even after forty years of the Green Revolution, stray cases of use of a short-duration modern variety *Khandagiri,* has been observed (personal observation) in case of non-availability of traditional rice.

A more precise four-cell analysis (De Boef and Thijssen, 2008) at the household level revealed that *Para* and *Mati*, short-duration landraces, have been maintained by many households in smaller areas for their high cultural value. It is assumed that these two would be continued on-farm in the future as well. *Bayalshi, Chipti, Dongerbasumati, Lalubaya,* and *Mora* are being cultivated by few households (less than 10) in small areas, hence are under threat and may be replaced with commercial crops or modern varieties of rice. There is a need to generate awareness among farmers for on-farm as well as ex-situ conservation. More than 10 households are cultivating *Dongerchudi, Donger Gathia, Lalu, Osagathiali,* and *Pandkaguda* in comparatively larger areas and thereby ruling out their disappearance from the villages in the near future. The specific traits of these landraces have to be identified for future agronomic research and participatory plant breeding.

Nearly a hundred households with repetitions were cultivating medium-duration rices in the reported villages. *Bodikaveri* and *Sapuri* were cultivated by 30 and 31 households respectively in larger areas, which assured their cultivation and conservation on farm. Those two were popular varieties and highly preferred for their multiple use value in socio-cultural rites. *Bodikaveri* was used in celebrating two traditional rituals, whereas *Sapuri* was used in three cultural celebrations. These

two landraces contributed to household food security besides local trading. Participatory Plant Breeding coupled with a market-oriented value chain approach is likely to be beneficial for farmers to continue it at the household level. Sixteen households cultivated *Beda Gathia* in larger areas, as they are adapted to specific niches. Research should be conducted to understand their physiological, ecological, and genetic characters to utilize in conventional breeding and biotechnology. Other medium-duration landraces apparently do not have any cultural value attached with them and were cultivated by very few households. These landraces need to be conserved scientifically and for their on-farm cultivation by raising awareness on their importance.

One hundred and five households cultivated fourteen landraces that take more than 130 days to mature. *Umuriachudi* and *Kalajeera* having socio-cultural values were being cultivated by twenty-seven and fifty-four households respectively in larger areas. Farmers used *Umuriachudi* on six occasions and *Kalajeera* in two incidents. Besides, they fulfilled their food, economic, social, and cultural needs using these two landraces. All other long-duration landraces were cultivated by very few households (1–5) in larger areas for their useful characters and special adaptation traits. These threatened landraces should be scientifically studied to highlight their specific traits if any, which could be utilized in variety improvement programs.

Some families of the three reported tribes have started using modern long-duration varieties such as *Lalata, Parijata, 1001,* and *1010* while celebrating their traditional rituals, either due to non-availability of traditional varieties or greater familiarity with the modern varieties. Attention should be given to conserve those both in-situ and ex-situ to prevent their depletion.

Social ceremonies

Social functions include life cycle rituals that are celebrated by every household with the support of close relatives. Childbirth and naming ceremonies, marriage and death ceremonies are the commonest functions that prevail among tribal households. Individual households as well as communities observed social functions paying lot of time and attention.

A range of rice landraces are used for every function. As established by their forefathers, raw rice is mandatory for all celebrations. After childbirth, a *Disari* uses white rice while worshiping and the midwife is remunerated with either red, light red, or white rice depending on the availability. Goats, sheep, and hens are offered by people to the concerned goddesses, and are distributed as food. Popular rice varieties such as *Pandakaguda, Sapuri,* and *Umuriachudi* are extensively used across the tribes for celebrations.

Bodikaveri and *Sapuri* are highly preferred by these communities for marriage feasts, and are particularly reserved for relatives. *Sapuri*, being long, slender, and white with a mild scent, is often selected to be provided as bride price. During a visit to close and important relatives, people prefer to give quality rice as gift, which stands for goodwill and strong relationship. Raw

Close to 420 households (more than 80%) still cultivate short-duration traditional rices to celebrate* Nuakhia *(ceremony of new crop harvest) as well as to get immediate food for the family.

coarse rice either white or red is used for death rituals depending on the availability. Again, white and raw rice is mandatory for magico-religious practices.

Conclusion

From the study it is clear that a number of rice landraces have been preserved by the three tribes to perform traditional rites. Conservation of mixed-duration rice varieties mutually serves as a food basket, besides other utilities. As a result, continuous cultivation enables them to co-evolve and adjust to changing rainfall patterns, temperature variations, insect pests and other ecological challenges.

The genetic diversity of short-duration landraces was impressive compared to that of the cultivated areas. It was felt that quality analysis would help in identifying useful genes that would fit aberrant weather patterns. Trust and observations of rice-based rituals had an impact on the physical and biological quality of rice fields.

It was concluded that landraces have a strong interrelation with tribal culture, aiding in the maintenance of rice genetic resources on farm and their sustainable utilization even in the era of modern agriculture. Sustenance of these practices could help to manage genetic resources for economic and ecological benefits on a sustainable basis, thereby leading to food security and sustainable agriculture.

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