



TRADITIONAL PADDY VARIETIES OF JHARKHAND AND CONSERVATION PRIORITY

Himadri Sinha

Professor and Head, Department of Research and Planning
Xavier Institute of Social Service (XISS, Ranchi)
email: himadrisinha19@gmail.com

Mukul Xaxa

Junior Research Scientist (XISS, Ranchi)
email: mukulxaxa01@gmail.com

Introduction of Hybrid rice has obviously broken the vicious cycle low production, forced seasonal migration and poverty in rural Jharkhand. However, no hybrid can continue unless traditional pure lines are preserved. In Jharkhand, traditional varieties are fast declining and more and more farmers are stop growing traditional paddy varieties. This is causing erosion of rich genetic diversity. This calls for preservation of traditional varieties both at research stations and farmer's level. This article tries to rediscover traditional paddy varieties that existed in Jharkhand and institutional intervention for storing the genetic diversity. The article also attempts to explore ways to boost conservation effort for future research and development.

Two Fold Challenges

Eastern India Green Revolution is one of the flagship programmes of government of India. Under this programme, achieving food security at household level through promotion of hybrid rice cultivation is one of the key strategies. During 2009-2014, cultivation of hybrid rice has spread like blazing flame in all eastern Indian states including Jharkhand (Sinha & Sanga, 2013). Attaining food security at household level is a key indicator of Millennium Development Goals hence cannot be negotiated. Absence of food security leads to seasonal labour migration from poverty stricken villages Jharkhand and Western Odisha (Sinha & Sanga, 2013). Such migration often turned to be detrimental for in social, health and educational wellbeing of migrant families. However, spread of hybrid rice has caused growing desertion of cultivation of traditional paddy varieties (Dang et al., 2013). This is a catch twenty two situation. Farmers are opting for hybrid rice because that offers both food security and cash flow from more marketable surplus. Nevertheless erosion of traditional varieties poses two vital challenges (a) how to conserve these varietal lines which are the basic requirement of future hybrid programme and (b) absence of these varieties at farm level would create seed slavery by the seed producing multinationals. This chapter has focused on the first challenge. Our effort was to compile the rich genetic diversity of paddy in Jharkhand and current process of preserving this rich genetic diversity for future researches.

Paddy Cultivation in Jharkhand: Current Scenario

During 2013-14, in Jharkhand rice was cultivated in 1767 thousand acres land. Out of which hybrid rice occupied almost thirty percent area, HYV rice occupied almost forty nine percent area and traditional varieties occupied remaining twenty one percent area.

Total rice production in Jharkhand during the same year was 7136.5 thousand metric ton. Out of which highbred rice contributed 44.5%, HYV contributed 42.5% and traditional varieties contributed only thirteen percent. Jharkhand is currently consists of twenty four districts. Out of these fifteen districts are tribal district officially recognised as scheduled five area. These districts together contributed 76.4% area of rice cultivation and 73.8% of rice production of Jharkhand during 2013-14. In the tribal districts, highbred rice was grown in 34.4% area, HYV in 47.8% area and traditional varieties in only 17.8% area (Table 1). However production wise, highbred contributed 45.7% of production followed by HYV rice 42.9% and traditional varieties 11.4%.

Table 1: Coverage and Production Different Rice Varieties in Tribal Districts and in Jharkhand During 2013-14 (Area in '000'ha & Production in '000' Mton)

State/ Districts	Hybred		HYV		Traditional		Total	
	Area	Production	Area	Production	Area	Production	Area	Production
Jharkhand	529.5 (29.98)	3177 (44.5)	865.7 (48.99)	3030 (42.5)	371.8 (21.0)	929.5 (13.0)	1767 (100)	7136.5 (100)
Tribal districts (15 nos.)	464.5 (34.4)	2409 (45.7)	645.7 (47.8)	2262 (42.9)	239.8 (17.8)	599 (11.4)	1350 (100)	5270 (100)

Figures within parenthesis are in percentage of row total

Source: State Agriculture Department, Jharkhand

Genetic Diversity of Paddy in Jharkhand

Traditional varieties refer to those varieties which are adapted to local climatic and ecological situation and are cultivated and multiplied by farmers for at least past half a century. Traditional varieties are by and large ecologically adapted stable genetic strains. These varieties are the basis of any genetic improvement programme including hybrid varieties. If these varieties become extinct, human civilization will lose precious genetic inheritance. Rice belongs to the genus *Oryza* of the sub tribe *Oryzineae* in the family of *Gramineae*. The genus includes twenty four accepted species of which twenty two are wild and two *Oryza sativa* and *Oryza glaberrima* are cultivated. In India and Asia, *Oryza sativa* is cultivated. In India alone, around 4,000 varieties are reported to have been recorded (Burkill 1910; Ramaih 1953).

Central Rainfed Upland Rice Research Station (CRURRS), Hazaribagh have identified around 600 rice varieties from Chotanagpur plateau and Santhal Pargana region of Jharkhand. Few are also trying preserving these varietal strains. However, due to their internal policy, they did not share its information with the authors. College of Biotechnology, Birsa Agriculture University has developed one gene bank for all traditional varieties of Jharkhand. National Bureau of Plant Genetic Resources (NBPGR) as on 31.01.2014 has preserved 97,279 gene strains of paddy in their National Gene bank at -180 C (Dang et al., 2013).

Paddy Culture among Oraon and Sadan of Jharkhand

Jharkhand is primarily an agricultural state. It is a homeland of thirty two tribes including eight primitive tribes. The economy of tribes in the state is primarily rural and predominantly agricultural. Tribes have rich knowledge about the indigenous practices especially in soil

management, seed protection and post-harvest management on paddy. This traditional knowledge has been derived from the tribe's farming experience through trial and error method and handed down from previous generation to present generations. These indigenous methods and practices are very human in nature. This indigenous knowledge can be blended with existing scientific technologies to explore more sustainable and human friendly methods of agricultural practices (Lakra et al., 2010).

Table 2 : Cultivation and Production of Different Rice Varieties in Different Tribal Districts of Jharkhand vis a vis Jharkhand Total During 2013-14 (Area in '000'ha & Production in '000' Mton)

Districts	Hybred		HYV		Traditional	
	A	P	A	P	A	P
Ranchi	84(15.9)	504(15.86)	67.2 (7.7)	235.2(7.76)	16.8 (4.5)	42(4.52)
Gumla	52 (9.8)	312(9.82)	110 (12.7)	385(12.71)	26 (6.9)	65(6.99)
Khunti	21(4.0)	126(3.97)	35 (4.0)	122.5(4.04)	20 (5.3)	50(5.38)
Simdega	22.5(4.2)	135(4.25)	53.5 (6.1)	187.3(6.18)	9 (2.4)	2.5(2.42)
Lohardaga	23 (4.3)	138(4.34)	15 (1.7)	52.5(1.73)	9 (2.4)	2.5(2.42)
Latehar	7 (1.3)	42(1.32)	14 (1.6)	49(1.62)	5 (1.3)	12(1.29)
E Singbhum	30 (5.7)	180(5.67)	68 (7.8)	238(7.85)	12 (3.2)	30(3.23)
W. Singbhum	52 (9.8)	312(9.82)	94 (10.8)	329(10.86)	40 (10.7)	00(10.76)
Dumka	29 (5.5)	174(5.48)	48 (5.5)	168(5.54)	32 (8.6)	80(8.61)
Pakur	13 (2.5)	78(2.46)	25 (2.9)	88(2.90)	11 (2.9)	7.5(2.96)
Sahebganj	8 (1.5)	48(1.51)	19 (2.2)	67(2.21)	17 (4.5)	2.5(4.57)
Devghar	14 (2.6)	84(2.64)	25 (2.9)	88(2.90)	13 (3.5)	2.5(3.50)
Godda	13 (2.5)	78(2.46)	20 (2.3)	70(2.31)	13 (3.5)	2.5(3.50)
Palamau	18 (3.4)	108(3.40)	21 (2.4)	73.5(2.43)	8 (2.1)	20(2.15)
Garhwa	15 (2.8)	90(2.83)	31 (3.5)	109(3.60)	8 (2.1)	20(2.15)
Total (Tribal districts)	464.5 (87.7)	2409 (75.83)	645.7 (74.5)	2262 (74.65)	239.8 (64.4)	599 (64.44)
Jharkhand	529.5 (100)	3177 (100)	865.7 (100)	3030 (100)	371.8 (100)	929.5 (100)

Figures within parenthesis are in percentage

Source: Department of Agriculture & Sugarcane Development, Govt. of Jharkhand

A= Area, P= Production

Among the tribes, Oraon is most progressive farming community. Their skill and involvement in agriculture keep them ahead of other tribe. Sadans are non-tribal original settlers of Jharkhand. Their settlement in Jharkhand is as old as tribal. Sadans are found both among Hindu and Muslim. Both of them are agriculturist by and large. Other tribes and communities usually adapt farming practices from them. Our study was confined only among Oraon and Sadans of Jharkhand.

Rice Geography of Jharkhand

Jharkhand consist of two major plateaus namely Chotanagpur plateau and Santhal Pargana plateau which includes Rajmahal hill. Two kinds of land are used for paddy cultivation namely upland commonly called Tanr and low land locally known as Doin. Both upland and low land according to the fertility and slopes are sub divided into three sub groups each.

Upland or Tanr is sub divided as Tanr I, II, III. Tanr I land is the lowest portion of upland and most fertile among the upland. Tanr II is situated just above Tanr I. This is comparatively less fertile than Tanr I. Tanr III is highest steep of upland mostly used for human habitation and not so suitable for cultivation. Tanr I lands are mostly used for rice cultivation (i.e sown by broadcasting or directly).

Low land or Doin is also subdivided into three categories – I, II, III. Doin I is the lowest most land segment/strip of plateau land scape and most fertile land. Above this lies Doin II. This is also very fertile. Between doin II and tanr I lies doin III. Doin lands are mostly used for paddy (transplanted) cultivation. A list of traditional varieties still cultivated by Oraon and Sadan are given in Table 3.

Traditional Varieties of Rice/Paddy of Jharkhand

There are numerous traditional (indigenous) varieties of rice/paddy which are currently cultivated by the Oraon and Sadans of Jharkhand. With the introduction of hybrid rice, most Oraon and Sadans are fast switching over to hybrid varieties. However, our study could identify twenty six upland rice varieties (see Table 3) which are still being cultivated. Commonly they are called Gora Dhan but each variety has distinct characters. Likewise, we have found twenty three varieties cultivated in Doin III, forty five varieties cultivated in Doin II and seventy four varieties cultivated in Doin I land (Table 3).

However, there are several varieties which are grown in more than one kind of land. For instance, varieties like Bacha Kalamdani and Lal Dhan are grown both in Doin II and Doin I. Eliminating the duplicity our research team could collect 146 varieties from the field which are still cultivated by the Oraon and Sadan in Jharkhand. As mentioned earlier that Central Rainfed Upland Rice Research Station (CRURRS), Hazaribagh have identified around 290 varietal strains of rice from Chotanagpur plateau and Santhal Pargana region of Jharkhand. But many of these strains are given code name by CRURRS. Only 194 varietal strains are identified by local name and the same are recognised by CRURRS

a. Upland Rice Varieties

During our study only twenty six upland varieties could be found from Oraon and Sadan farmers in Chotanagpur region. These varieties were then matched with the CRURRS's gene bank for confirmation. Uplands are yet to be invaded by hybrid rice varieties. In all districts of Chotanagpur, mostly traditional rice varieties are grown in upland. Some farmers also grow improved upland rice varieties like Birsa Goda, Sita etc. Upland rice is grown as purely rainfed crop. Agronomical practices are designed to take the benefit

Table 3: Traditional Varieties of Rice/Paddy Currently Cultivated by Oraon and Sadan of Jharkhand

Type of Land									
Tanr I		Doin III		Doin II			Doin I		
Agni Sal	Prasad Bhog	Alsanga	Rai Sari	Asamiya	Raisisi	Kera Ras	Agin Sar	Khanika Sar	Kapoor Bhog
Arsanga	Rai Chuni:	Asanloya	Rangi	Bacha Kalamdani	Rangi	Ketki	Bacha Kalamdani	Kharika Khonchi	Ketki
Arsunga Gora	Rani Kajal	Barijhinga	Rata	Barha Sar	Rani Kajar	Lal Dhan	Badshah Bhog	Kharkoili	Jhili
Bhainsa Chandi	Sathi	Bhora Rasi		Bakiras	Ras	Neta	Band Phul	Khira Bicha	Jo Phul
Chali	Sudina	Dahia Ras		Bans Phul	Santia	Newair	Barah Sar	Kishun Bhog	Jolea
Chandra Gahi	Syam Jira	Deo		Bhagwan Sar	Saraikela	Rai Chuni	Basdari	Kobi Phool	Kabri
Chandra Galir	Tainr-Ramsal	Don Karanga		Bhata Phul	Sikhar Bhunja	Rai Sari	Bhara Phul	Lacchmi Vilas	Kairabera
Harakhunta		Gora Dhan		Bhosa	Sikhar Sar	Jhalgenda	Bhojni	Lal Dhan	Kala Jeera
Hidbaha		Guli		Chaina Bhog	Subarna (Bauna Dhan)	Jhallar	Bhorang Sar	Madhumal	Kalamdani
Jaunga		Jhengne		Chhorki Kalamdani	Tanr Jhili	Kairabera	Dadkhani	Nanhia	Kalamkati
Kala Gora		Kanaubar		Chingmohri	Tila Sar		Dahia	Numbri	Sonbudi
Kanchi		Kanou		Dahia	Kala Parvat		Damodar	Pandubi	Sonka Rka
Karanga Gora		Karhani		Damodar	Kalamdani		Dhusri	Prasad Bhog	Sonpiya
Karhani		Kolamani		Dudhras	Kanakchampa		Dhusri Kalamdani	Ram Sar	Sonpiya (Red)
Karyagara		Kore		Hesel Sar	Kanau		Dourka Sal	Randu	Sursuria
Khating		Kusma		Jaya	Karanga Gora		Dudh Kobi	Rani Bhog	Tengnusra
Lal Gora		Lapra		Jengne	Karhani		Dudhkattar	Rani Kajar	Tewa
Mehra		Neta			Katika		Gondli Phul	Rani Sar	Tharh Musra
Onukrakha		Rae Sari					Gopal Bhog	Ratgauni	Tila Sar
		Rai Dhuni					Gundri Bhog	Rout Goli	Tusi manjar
							Hardi Gunda	Safri	Jeera Phul
							Hardi Sar	Sambalpuria	Jhalak Genda
							Hathi Panjar	Samilai	Jhiga Sar
							Jabakusum	Sarai Nakhi	Sargi
								Sarai Phul	Sikki

of early summer rain during end of May and early June. Upland varieties are commonly

short duration, fast growing and low water requiring crops. The height of upland rice varieties varies from 2.5 to 3 feet. Grain to straw ratio varies from 40:60 to 35:65. These varieties mature by September and meet the early season cereal needs of tribal and non-tribal families. The upland harvest also helps farming families to clear the debts they incur for monsoon cultivation. Besides rice these varieties also provide good amount of straw for livestock.

Upland varieties are sown by broadcasting method (Buna). This helps in utilising soil moisture. Normally sowing is completed by June and if the rain is delayed it is continued till early July. Farmers usually rotate upland rice with mandua (ragi) or maize in two to three year rotation plan period. Upland rice are coarse grain but rich in nutrient. Apart from using it as staple food during three to four months, Oraon and Sadans also use it for making rice beer or handia. Gora dhans are used for the Nayakhani (means eating the new rice after harvesting). Some of these varieties are used for making rice beer.

The agronomical culture and social and economical importance upland rice varieties are given in Annexure-1. Upland rice is helpful in reducing the food shortages during September to November. Many farmers borrow money for growing low land paddy and other cash crop. Upland rice harvest helps them to repay the loan early and maintain household economy.

b. Low Land Paddy Varieties

Low land varieties are adapted to transplanted condition. Transplanted rice is agronomically called paddy. These varieties have higher yield than upland rice varieties. In Jharkhand low land varieties take 120-140 days to mature. If upland rice ensures household food security for three to four months, low land paddy ensures the food security for remaining year (i.e. eight to nine months). Additionally, farmers also produce marketable surplus which ensures cash flow at household level to meet various household consumption. For this reason, farmers showed much inclination to HYV (High yielding varieties) and hybrid varieties for low land cultivation than traditional varieties.

Currently cultivation various hybrid paddy varieties are spreading like blazing fire across the districts among all farmers irrespective of caste, creed and religion. However, during study during July to September 2013, we have found twenty three traditional varieties are still cultivated in Doin III, forty five varieties cultivated in Doin II and seventy four varieties cultivated in Doin I land among Oraon and Sadan (Table 3). However, there are several varieties which are grown in more than one kind of land. For instance, varieties like Bacha Kalamdani and Lal Dhan are grown both in Doin II and Doin I. Eliminating the duplicity our research team could collect 120 varieties from the field which are still cultivated by the Oraon and Sadan in Jharkhand in low land.

Conservation Initiatives

Conservation of these rich genetic diversities to large extent will ensure the survival of paddy cultivation during any epidemic attack, failure of improved strains (as happened in Bt Cotton). Conservation of genetic can be done in two ways. First, by growing the variety

every year either in research station or in farmer's field and preserve the freshly harvested seed for multiplication in the following year and second preserving seeds below -100 C in any suitable container free from any kind of damage. In this way seed can be multiplied once in eight or ten years.

NGOs like Gene Campaign have been trying hard to conserve the traditional paddy varieties at farmer's field. Such initiative has added benefit of maintaining variety specific paddy culture alive at farmer's level. This is important as ethnic group's several songs and dances have direct link with the varieties and their cultivation. These cultural dialect and heritage may be lost if farmers stop growing the variety.

Conservation of paddy variety at research station may be safer because these are handled by scientist with improved technologies. But scientists may not have the cultural bondage with the variety like any ethnic farmer or farming community. Lack of cultural touch and emotional bondage may develop a casual and routine attitude to the entire preservation aspects. This was evident when we observed that good number of varietal strains is kept with code number without having any name or description of varietal characters in several research stations.

The above mentioned research stations and plant genetic bureau have all latest technology to conserve the traditional paddy varieties for next few centuries at least. Preservation of gene bank is expensive. In the event of any severe varietal crisis will these centres be able to revive the se varieties through rapid multiplication within a short period or only multinational seed farms will reap the full benefit of these gene bank— is a matter of concern.

Conserving Biodiversity at Farm Level

Farm level conservation of biodiversity has multiple benefits. There is an old adage 'out of sight, out of mind'. This is quite applicable in biodiversity conservation. Existence of any species/plant varieties also helps in practice of conservation alive. The knowledge that evolves out of practice remains alive and may get refined as long as that particular species/plant variety is in vogue. Cultivation of traditional paddy varieties generated vast pool of agronomical knowledge among various tribe/caste. This knowledge will likely to be eroded once people stop cultivating the same.

Furthermore, farm level biodiversity conservation is also responsible for evolution of cultural heritage. These are expressed in the form folklore, songs, dance, drama and arts. Many of these cultures do no longer exist once the tribe/people' group became disassociated with the plant/animal conservation (Singh, 1986; Singh & Singh, 2003; Xalxo, 2008). Oraon and Sadan of Jharkhand share a rich paddy culture in the form folklore, seasonal songs/ragas, dances and arts. Rapid urbanisation has already caused much erosion of the cultural heritage (Bahadur, 1997; Kaur, 2004; Keshari, 2003; Lakra, 1999; Mishra, 1978; Roy, 2004); Sachidananda & Prasad, 1996). Discontinuation of traditional varieties may hasten the further erosion of paddy culture heritage from the minds of the above tribes in particular and all paddy based communities in general.

Conclusion

If not for other reasons, but for economic and food security spread of hybrid paddy cultivation deserves to continue. This is complementary to GDP growth of any state on one hand and overall economic empowerment of farming community on the other. Therefore, no rational economic agenda can ignore the contribution of hybrid paddy culture. However, after almost half a century of gross rejection in human dietary requirement, Oats has staged a major come back. Growing of Oats is getting popular. This may be the silver lining for the entire conservation efforts of traditional paddy variety. We need to explore a viable economic use of traditional varieties which will prevent these from being extinct as well as help in maintaining cultural heritage.

Notes: Bt Cotton was developed to combat against pink boll worm. After high success in initial years, this strain has reported to be attacked and damaged by pink boll worm.

References

- Bahadur, K. P. (1977). Caste, tribes & culture of India: Bengal, Bihar & Orissa, Vol.3, pp. 27-35. New Delhi: Ess Ess Publication.
- Burkill, I. H. (1910). The agriculture ledger, No. I, Reprinted in Races of rice in India, 1996 Edition. New Delhi: M. D. Publication.
- Dang, F., Xaxa, M., & Sinha, H. (2013). Historical review of paddy growing culture: Global diffusion and Jharkhand adaptations. *Jharkhand Journal of Development and Management Studies*, 11, (3), 5511-5531.
- Kaur, S. B. (2004). The peasant culture of Chotanagpur, p. 242. Varanasi: Kishor Vidya Niketan.
- Keshari, B. P. (2003). Cultural Jharkhand: Problems and prospects, pp. 46-53. Ranchi: Nagpuri Sanstan.
- Lakra, C. (1999). The new home of tribals, pp. 43-58. Faridabad: Om Publication.
- Lakra, V., Singh, M. K. Singh, Sinha, R. & Kudada, N. (2010). Indigenous technology of tribal farmers in Jharkhand. *Indian Journal of Traditional Knowledge*, 9(2), 261-263.
- Mishra, N. (1978). Cultural persistence and caste: A rural profile of Anjan, pp. 33-187. New Delhi: Classical Publication.
- Ramaiah, K. (1953). Rice breeding and genetics. Indian Council of Agriculture Research Testing Monograph, No.19.
- Roy, S. C. (2004). The Oraons of Chotanagpur, pp. 75-95. Ranchi: Crown Publications.
- Sachchidananda & Prasad, R. R. (1996). Encyclopaedic profile of Indian tribes. New Delhi: Discovery Publishing House.
- Singh, R. S. (1986). Changing occupational structure of schedule tribes, Inter India Publications, New Delhi.
- Singh, V. N. P. & Singh, L. K. P. (2003), Jharkhand: Land and people, p. 54, Rajesh Publications, New Delhi.
- Sinha, H. & Sanga, P. (2013), Food security in India: A critical review. *Jharkhand Journal of Development and Management Studies*, 11(4), 5559-5578.
- Xalxo, P. (2008). Current ecological crises and its moral dimension: A tribal perspective, Ranchi: Xavier Publication, Ranchi.

Annexure

Annexure-1 : Varietal Characteristic, Agronomical Practices, economic and nutritional importance of upland rice varieties

Variety	Characteristics	Economic importance	Nutritional importance	
	Seed (grain)	Agronomical		
Arsanga Arsunga Gora	1. Light red colour 2. Size:6.1mm 3. Coarse rice	1. Short duration semi dwarf 2. Sown by broadcasting in June in the early rain after first shower, reaped in September end or early October	1. Low investment 2. Minimum use of fertilizers 3. Early maturity 4. Drought tolerant	1. Medicinal value 2. Preparation of rice beer 3. Grain is hard, non-glutinous and non-scented 4. Nutritious and hard grain; if villagers consume one time they can work in their field for whole day without feeling hungry
Khating	1. Light red colour 2. Size:6.1-6.3mm 3. Coarse rice	1. Sown by Broadcasting in June and reaped in September 2. Medium height	1. Low investment 2. Minimum use of fertilizers 3. Early maturity 4. Drought tolerant	1. Nutritious and hard grain; if villagers consume one time they can work in their field for whole day without feeling hungry 2. Hydrated starch (Mar) is thick
Dani Gora Lal Gora Kala Gora	1. Red colour 2. Size: 6.3mm 3. Coarse rice	1. Sown by broadcasting in June at the beginning of rain 2. Early crop for farmers	1. Low investment 2. Minimum use of fertilizers 3. Early maturity 4. Drought tolerant	1. Nutritious and hard grain; if villagers consume one time they can work in their field for whole day without feeling hungry 2. Effective in gastric problem 3. Rich in carbohydrate, protein & minerals, 4. Hydrated starch (Mar) is drunk as food supplement
Bala Gora	1. Light red in colour 2. Size: 6.3mm 3. Coarse rice	1. Sown by broadcasting in June at the beginning of rain 2. Early crop for farmers	1. Medium investment, 2. Low grain yield, 3. Medium straw yield 4. Medium Drought tolerant	1. Good source of B1, B3 and carbohydrates , 2. Medium quality of rice beer is made 3. Hard grain and takes time to digest 4. Good for hardworking people
Jaunga	1. Red colour 2. Size:5.8 mm 3. Coarse rice	1. Sown by broadcasting in June at the beginning of rain and harvest in September 2. Blackish at Maturity crop 3. Early harvesting crop	1. Low investment 2. Minimum use of fertilizers 3. Early maturity 4. Drought tolerant	1. Good for lactating mother. It is believed that the Laddoo made from roasted rice mixed with sugar, eaten by lactating mother is helpful to produce milk and provide more nutrition to the breast-feeding child

Rai Chuni Asanloya Tanr Jhili	1. White colour 2. Size: 6.3 mm 3. Fine rice	1. Sown by broadcasting in the end of June and harvested in December	1. Low investment 2. Minimum use of fertilizers 3. Early maturity 4. Drought tolerant	1. Parboiled rice is white fine and stick less 2. Grain is white hard, sub transparent, non-glutinous and non scented
Rani Kajal	1. White colour 2. Size: 6.3 mm 3. Medium scented rice	1. sown by broadcasting in June at the beginning of rain	1. Low investment 2. Minimum use of fertilizers 3. Early maturity 4. Drought tolerant	1. Parboiled rice is white fine and stick less 2. Grain is white hard, sub transparent, non-glutinous and non scented
Sathi	1. Deep red colour 2. Size: 7.5 mm 3. coarse rice	1. The variety escape drought to some extent 2. Grown as summer paddy 3. Spikelet – awn less, dark purple when young and light black at maturity	1. Insurance against malnutrition 2. Early maturity period 3. Need less water availability	1. Parboiled rice is sweet in taste 2. Hydrated starch is drunk as food supplement 3. Stale rice is also eat for 1-2 days after
Kannu	1. Light red colour 2. Size: 6.2 mm 3. Coarse rice	1. Sown by broadcasting in May and reaped in August 2. Thick stem so weeding is not done ,it might be broken	1. Low investment 2. Minimum use of fertilizers 3. Early maturity 4. Drought tolerant	1. Rich in carbohydrate, protein & minerals, 2. Parboiled rice is eaten, 3. Hydrated starch (Marh) is taken as food 4. Marh (starch water) boiled with green/ dry leaves is taken as vegetable dish

Annexure-2 : Characteristics, agronomical practices, economic and nutritional importance of lowland rice varieties

Variety	Characteristics		Economic importance	Nutritional Importance
	Seed	Agronomical		
Agin Sar Khanika Sar Bhorang Sar	1. Light red colour 2. Size: 6.2 mm 3. Medium coarse rice	1. Sown by broadcasting April-May and transplant in July-August and reaped in November –December	1. Good yield even rain fails 2. High paddy straw produce 3. flood-tolerant varieties 4. Good for poor and Marginalize farmers.	1. Parboiled rice is good in taste 2. Good for hard working people in village 3. Rich in minerals and vitamins 4. Cooked stale rice can be eaten for next day 5. Starchy water is very helpful to keep fresh and energetic
Badshah Bhog Chaina Bhog	1. White colour 2. Size: 5.5 mm 3. Short and fine light scented rice	1. Late winter paddy ,sown usually by transplanted in July-August and Harvested by 2nd week of Dec	1. Higher market prices than the HYVs. 2. Drought tolerance, good yield even crop damage 3. High paddy straw produced	1. Parboiled rice is fine white and stick less 2. Different cooking items is made 3. Unpolished rice is rich in B1 and B3 4. Less time to cook
Agni Sal Tila Sar (sair)	1. Light Red colour; 2. Size: 6.8 mm 3. Coarse (medium) rice	1. Medium duration crop, 2. Sown by broadcasting in June/ mid July (Lewa)	1. Low investment, 2. Medium grain yield, 3. Tall plant, high straw yield, 4. Helpful for livestock	1. Rich in carbohydrate, protein & minerals, 2. Parboiled rice is eaten, 3. Hydrated starch (Marh) is taken as food supplement

Barah Sar Ram Sar Bhagwan Sar	1. Red Colour 2. Size: 6.9 mm 3. Fine rice	1. Sown by broadcasting and transplanted 2. Broadcast in April – May , Transplanted in July- August and Harvested in Nov-Dec	1. Long and High straw yielding 2. Stand upright even after the maturity of grains in the panicles	1. Hydrated starchy water (Mar) is very helpful to keep villagers fresh and energetic 2.Amount of rice rise while cooking
Bhojni Saraikela	1. Red Colour 2. Size: 6.6 mm 3. Coarse rice	1. Sown by transplanted in July-August and reaped in November - December	1. Low yield but high straw strength	1.The red or brown unpolished rice is a healthy food because it provides with rice bran
Dahia	1. Light red colour 2. Size: 6.8 mm 3. Fine and long rice	1. Sown by transplanted in the month of July – August and harvesting in the month of Nov- Dec	1. Disease-resistant varieties 2. Thickness of the grain is large 3. Good yield potential even drought	1. Parboiled rice is good in taste 2. Good for hard working people in village 3. Rich in minerals and vitamins
Dhusri Rani Kajar	1. Light reddish brown colour 2. Size: 6.6 mm 3. Fine rice	1. Sown by broadcasting and transplanted 2. Broadcast in April – May , Transplanted in July- August and harvested in Nov-Dec	1. Low Investment 2. Previous year stocked seed is used for cultivation 3. Less use of commercial fertilizers	1. Parboiled rice is good in taste 2. Good for hard working people in village 3. Rich in minerals and vitamins
Lal Dhan Don Karanga	1.Light red 2. Size: 6.4 mm 3. Coarse rice	1. Sown by broadcasting and transplanted 2. Broadcast in end of April to early May , Transplanted in July and Harvested in Nov-Dec	1. Stand upright even after the maturity of grains in the panicles 2.Drought tolerant 3. Less investment 4. Non shattering quality	1. Rich in vitamins and minarels 2. Good for hard working villagers 3. Sweet in taste 4. Less requirement of rice supplements 5. Lal dhan is good for puffed rice/ pressed rice
Prasad Bhog	1. White Kernel 2. Size: 6.3 mm 3. Aromatic Fine rice	1. Generally transplanted in the month of July-August and reaped in November-December	1. Good market value 2. Medium straw yield 3. Straw liked by Livestock	1. Different food items is made 2. Less time to cook 3. Used during special occasions / festivals 4. Parboiled rice is white fine is less sticky
Jhaliar Geanda Chhorki Kalamdani Sambalpuria	1.White colour 2 Size: 6.5 mm 3.Fine rice	1. Sown by broadcasting and transplanted 2. Broadcast in April – May , Transplanted in July- August and Harvested in Nov-Dec	1. Long panicle 2. High straw yield 3. Non-lodging, saline-tolerant, drought-tolerant and flood-tolerant varietie	1. Arwa rice used to make different cooking items 2. Parboiled rice is good in taste 3. Use in making local rice drink

Ketki Khira Bicha Rangi Chingmohri	1.White colour 2. Size: 5.8 mm 3. Medium rice	1. Sown by broadcasting and transplanted 2. Broadcast in April – May , Transplanted in July- August and Harvested in Nov- Dec	1. Hard and solid grain 2. Drought tolerant in nature 3. Tolerant to pests and diseases	1. Good cooking quality/taste 2. Hydrated starch (Mar) is drunk as food supplement 3. Good for Hardworking village people
Sursuria Dudhras Newair Jaya	1.White color 2. Size: 6.3 mm 3. Medium rice	1. Broadcast in April – May , Transplanted in Harvested in Nov- Dec 2. Weeding is done	1. Less investment 2. Minimum water consumption 3. Less requirement of commercial fertilizers	1. Rich in carbohydrate, protein & minerals, 2. Parboiled rice is good in taste
Sonachur Kishun Bhog Kapoor Bhog	1.White colour 2. Size: 4.8mm 3. Super fine scented rice	1. Sown by transplanting in the month of July- August and reaped in November- December	1. Tall and long panicle plan 2. High straw yield 3. Higher market prices than the HYVs.	1. Used during special religious or social ceremonies. 2. Suitable for making different cooking items 3. Very less time to cook
Motichur Nanhia Basmari	1.White colour 2. Size: 5mm 3. Super fine rice	1. Generally transplanted in the month of July- August and reaped in November- December	1. Good market value 2. long straw yield 3. Good for Livestocks	1. Different food items is made with Arwa rice 2. Less time to cook 3. Used during special religious or social ceremonies.
Megh Jawain	1.White Kernel colour 2.Size:5mm 3.Super fine scented rice	1. Sown by transplanting in the month of July- August and reaped in November- December	1. Tall and long panicle plan 2. High straw yield 3. Higher market prices than the HYVs.	1. Used during special religious or social ceremonies. 2. Suitable for making different cooking items 3.Very less time to cook
Jeera Jawain	1.White Kernel colour 2. Size: 5 mm 3. Super fine scented rice	1. Sown by transplanting in the month of July- August and reaped in November- December	1. Tall and long panicle plan 2. High straw yield 3. Higher market prices than the HYVs.	1. Used during special religious or social ceremonies. 2. Suitable for making different cooking items 3.Very less time to cook
Karmusal Sikki	1. White colour 2. Size: 6.3mm 3. Medium rice	1. Sown by broadcasting and transplanted 2. Broadcast in April – May , Transplanted in July- August and Harvested in Nov- Dec	1. High straw yield 2. Cost effective 3. Less water requirement 4. Pests and disease tolerant	1. Thickness of grain is heavy so good for hard working villagers 2. Stale rice can be eaten for 1-2 days after 3. Starchy water is very helpful to keep fresh and energetic
Tulsi manjar Baans Phul	1. White colour 2. Size: 5.3mm 3. Super fine scented rice	1. Sown by transplanting in the month of July-August and reaped in end of November and early December	1. Tall plant with high straw yield 2. Minimum Investment 3. Higher market prices than the HYVs	1. Early cooking quality 2. Arwa rice is used in various religious or social ceremonies 3. Starchy water emits good fragrance 3. Arwa rice used to make pitha/ idli /dosa(Chilka roti)

Shaha Jeera Syam Jira	1. White colour 2. Size: 5 mm 3. Super fine scented rice	1. Sown by transplanting in the month of July- August and reaped in November- December 2. Thin plant with long panicle 3. Proper Irrigation is required	1. Higher market prices than the HYVs 2. Stand upright even after the maturity of grains in the panicles 3. Good market value	1. Used during special religious or social ceremonies. 2. Suitable for making different cooking items 3. Very less time to cook 4. Easily digestible good for sick persons
Rais dhan Jabakusum	1. White 2. Size: 5,3mm 3. Medium fine	Sown by transplanting and broadcasting in the month of end June, reaped in early December	1. Good market price 2. High straw	1. Good in taste 2. Rais dhan is known as 2nd Kalamdani 3. It is good for pressed rice
Hathi Panjar (Hathi Panja)	1. Reddish Brown 2. Size: 5,8 mm 3. Medium coarse rice	1. Sown by only transplanting in Doin I 2. Base of stem is little blackish 3. Easy for weeding	1. Very high yield in normal conditions (no commercial fertilizer is used) 2. High straw yield, non shattering 3. strong straw so plant do not fall easily	1. Medium taste 2. Market value medium 3. Usna rice is preferred 4. Good for Hardworking village people