Indian Journal of Traditional Knowledge
Vol 21(1), January 2022, pp 191-197

Barom nu: The traditional practice of rice-breeding in shifting agriculture by the *Inpui* tribe of Manipur, North-East India

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Received 31 August 2020; revised 09 November 2020

Paddy is one of the most important crops in shifting agriculture in North-East India where rice is the staple food. The rich collection of traditional paddy seeds enables farmers to cultivate paddy across a range of soil and climatic conditions as fields shift from one place to another. In the present study, as many as 40 different varieties of paddy were found to be in use in two villages belonging to the *Inpui* tribe. This paper details the process by which farmers have come to develop such a highly diverse collection of seeds. It focusses on a traditional process, locally known as '*barom nu'* by which new breeds of paddy are identified, bred and propagated. As paddy is a self-pollinating plant there is little scope for hybrid varieties to emerge from cross pollination. New variants arise due to genetic mutation in the plant triggered by the environment. Farmers are able to identify new variants due to their in-depth knowledge of paddy. The new variant is harvested and sown separately for a few years to ensure purity of seed after which it is introduced to the village. The study is based on an intensive fieldwork carried out in two *Inpui* villages of Tamenglong district, Manipur in 2014-15.

Keywords: Crop diversity, *Jhuming*, North East India, Paddy seed-bank, Rice-breeding, Shifting agriculture

IPC Code: Int. Cl.[22]: A01G 22/22, A23B 9/00

Paddy occupies a primary position in North-East India where rice is the staple food[1]. According to Kumar[2], the region is reported to have '9650 cultivars of rice'. Paddy is also the most important cereal crop cultivated by traditional shifting agriculture communities[3]. It usually takes up the maximum area in a typical *jhum* field as it is the primary source of food security. All other crops occupy a secondary position as far as proportion to cropped area in a field is concerned. The importance of paddy in *jhuming* is also reflected in the way farmers measure the quantity of paddy harvested as an indicator of success or failure for the year.

However, shifting agriculture, as the name implies, involves periodic or annual shifting of fields. Farmers need to produce a minimum quantity of paddy consistently to meet the food security needs. This is challenging because farmers rotate their fields over a wide range of soil and climatic conditions. One of the mechanisms by which farmers have adapted to this unique challenge is through the seed bank – a rich collection of paddy varieties that thrive in different climatic and soil conditions. The paddy seed bank is, therefore, an essential element in the practice of shifting agriculture even though this is hardly acknowledged.

Rice (*Oryza sativa* L.) is a self-pollinating plant[4,5]. It does not require bees, insects or other pollinators for pollination. Thus, new varieties of paddy do not emerge as a result of cross-pollination. Instead, it is due to genetic changes caused by mutation, triggered by external factors like soil, climate, duration of day or sunshine etc[6]. These changes allow paddy to adapt to unique agro-ecological conditions. Over a period of time, farmers have learnt to identify new varieties that emerge naturally, nurture them and grow them in conditions that suit them well. This traditional practice of 'breeding rice' is central to the rich paddy seed banks in many shifting agriculture societies. The study delves into this lesser-known practice of rice-breeding, known as '*barom nu*' in the study villages. It also documents and categorises the *jhum* paddy varieties according to their characteristics. But the study seeks not only to highlight the traditional system of breeding rice in the uplands of North-East India. It also seeks to show how it is crucial to the dynamic and sustainability of shifting agriculture.

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Materials and Methods

Study area

Data for the study was collected from intensive primary field surveys conducted in Hachong and Puichi villages of Tamenglong District, Manipur in 2014 and 2015. The study area is shown in Fig. 1. These two villages were selected for a number of reasons. Both the villages practice shifting agriculture extensively over large tracts of land (Fig. 2-4). They are old villages and have a sizeable number of older people with experiential knowledge of the system. Logistics and familiarity with the area and language which is crucial to gain trust were some of the other considerations in choosing the study area.

The two villages of Haochong and Puichi belong to the *Inpui Naga* tribe which was recognized recently in 2011[7]. This community has a total population of around 11,000 people concentrated in 15 villages in Manipur and Nagaland[8]. They speak a distinct language, a "Tibeto-Burman language of the Naga-Bodo subgroup of Naga group"[9]. Haochong village is an important center of the Inpui tribe and was recently made the headquarters of a newly formed Sub-Division of Noney district.

The altitude of the two villages ranges from a low of 500 masl to a high of 1400 m. The villages have sub-tropical monsoon climate with temperatures ranging from 4ºC – 31ºC and an average rainfall of 3135 mm[10]. They also receive pre-monsoon showers or 'norwesters' in April-May that help in the early sowing of paddy in the *jhum* fields. There are two typical seasonal winds that blow in the region. In the early part of spring, there is an easterly wind locally known as '*Tangmei*' that begins to blow in the later half of the day. It affects tree-cutting in *jhuming* negatively, forcing farmers to cut them before noon.

Fig. 1 — Map of the study area

Fig. 2 — *Jhum* fields are cultivated in a contiguous area. Puichi village, July 2014.

Fig. 3 — Partially harvested *jhum* fields of Puichi village. Oct. 2014

Fig. 4 — A family thresh paddy with the help of exchange labour. Puichi village, Oct. 2014

Another seasonal wind known as '*Taru*' begins to blow from west to east in the months of August and September. This wind often has harmful effects on the *jhum* fields when they are nearly ripe.

Fieldwork and data collection

Intensive fieldwork was carried out with multiple visits to the field in keeping with the agricultural cycle. Mixed methods that employed both quantitative and qualitative methods were used to collect data. A two-staged household survey was complemented by multiple interviews with different categories of people. Prior consent of the respondents was obtained before interviews where the implications of sharing information with the researcher were explained in detail. The bulk of the fieldwork was done in October 2014 even though there were other visits before and after it.

The quantitative part of the fieldwork involved detailed household surveys which were carried out in two stages. First, house-listing of the entire village was carried out. A total of 98 households of Haochong village and 89 households of Puichi village were house-listed. Second, households were selected for detailed interviews by employing stratified random sampling. Different strata were identified: the clan, whether the family was actively *jhuming* and the practice of horticulture and/or wet-rice. 38 households from Haochong village and 51 households from Puichi villages were selected for detailed interview. More households from Puichi village were selected compared to Haochong as the number of families dependent on *jhuming* was also more.

The qualitative aspect of the fieldwork involved key-informant and in-depth interviews with different categories of people, visits to the *jhum* field, participatory observation and the use of photographs. The people who were interviewed included the Chairman and Secretaries of the village authorities, members of the traditional village council known as *Thampei*, farmers both men and women and local traders, mostly women who act as agents between the farmers in the village and the wholesale and retail vendors in the market. These interviews were very dynamic and were often backed up by traditional songs and stories. Field visits to the *jhum* fields at different stages of the agricultural cycle gave much insight about the system. It also provided ample opportunities to capture agricultural work through photographs. The present paper draws mainly from the qualitative component of the work.

Findings and Discussion

Varieties of paddy

Shifting agriculture is known for the diversity of crops grown in the field[11]. However, few studies have alluded to the variety within paddy itself. Thus, one of the most significant findings of the study was the number of paddy varieties in the two villages. Table 1 captures over 40 different types of paddy along with their unique characteristics. This paddy seed bank is fundamental to the success and continuity of shifting agriculture over a wide range of temperature, rainfall, soil and other environmental factors. In other words, the resilience of the system is intricately linked to the crops that are cultivated in the field. And over the centuries, farmers have identified, nurtured and propagated the varieties that are best suited to the conditions.

Paddy can be categorised in any number of ways. In Table 1, they have been categorised broadly on the basis of the climate in which they grow well, that is, either warm (1-24) or cold (24-34). Paddy that grows well in lower altitudes and warmer areas do not grow as well in higher altitudes and colder areas and vice-versa. As pointed out earlier, the altitude of the two villages ranges from areas that are as low as 500 m to areas as high as 1400 m. Thus, paddy in the two villages can be broadly divided in terms of the climate in which they grow well.

Within the table, the more prominent categories are: sticky rice; early ripening varieties; paddy varieties based on the soil – those which grow well even in rocky, hard soil or black compact soil; those which flourish in plots carved out of bamboo forest or wooded forest, and in fresh plots or plots that have seen a long fallow of 25-30 years or more. Other categories include fragrant varieties, the colour of the paddy and/or the colour of the rice and the length of the stem. It has to be pointed out that almost every prominent characteristic in any given variety of paddy plays a significant role in the agricultural system.

The importance of paddy that grows well in hot or warm temperature regions have been pointed out earlier. Early ripening varieties that can be harvested in mid or late August are crucial to maintaining food security (*Saang karang kadumnu, Changat* (Fig. 5 and Fig. 6), *Napdum, Kalorei* in warm climate and *Loupui Karang* in colder climate). They allow farmers to get two harvests of paddy in a single agricultural season. In the study area, there were many instances where farmers were cultivating two fields – one smaller field

with the early variety closer to home and a bigger field with the normal/late variety farther away. This ensures a steady supply of rice throughout the year, even during the months of hard work especially if the previous year's harvest was poor.

Paddy varieties that grow well in different types of soil allow farmers to shift their fields without overexploiting a single area with favourable soil. There are at least 3 varieties that do well even in rocky and hard soil (*Banglai*, *Ditiang saang*, & *Takhi Ketngan*). While most paddy prefer soil from wooded forests, 6 or more varieties of paddy flourish in soil from bamboo forest (*Tariang tapnaang*, *Takhangba Tapnaang* (Fig. 7), *Katang rangaak tapnaang*,

Table 1 — Paddy Varieties and their characteristics in Haochong and Puichi villages, Manipur

Name of paddy	Sub-types	Climate type (Cold/warm)	Specificities (White rice color, unless specified)
Tariang tapnaang		Warm	Sticky rice. Good in bamboo soil.
Tapnaang	2 – Red & white paddy	Warm	Sticky rice. Red and white rice
Changmeison tapnaang		Warm	Sticky rice. Grows well in bamboo soil
Takhangba		Warm	Sticky rice. Good in bamboo groove soil, black compact soil.
Katang rangaak tapnaang		Warm	Sticky rice. Can grow either in bamboo or wooded forest soil.
Saang karang kadumnu		Warm	Early ripening variety – can be harvested by 15th August. Does well in good sunshine.
Changat	2 – Early & late variety	Warm	Early variety is harvested in August.
Napdum		Warm	Early variety. Small seed; fragrant;
Kalorei		Warm	Early harvest variety
Banglaai		Warm	Red rice. Good in bamboo forest. Suitable for rocky, hard soil.
Ditiang saang		Warm	Suitable for bamboo forest; rocky, hard soil.
Chingkao kompi		Warm	A newer variety, strong stem; good in bamboo forest.
Takhi Ketngan		Warm	Soft stem, grows well even in rocky soil.
Saang Kasennu	4 – Dwarf & long stem; Big & small grain size	Warm	All have red paddy. The short stem variety is good in fresh plots or plots fallowed for a long time (25-30 years).
Saang Katoilu		Warm	Red rice. Shortest plant height; suitable for plots which have been fallowed for a long time (25-30 years).
Kwangring saang		Warm	The stem is very green.
Chang san		Warm	Fragrant; Flat red paddy, white rice.
Napdai/Poland rwan saang		Warm	Long plant, large paddy size.
Bazinlu lwak		Warm	Wooded forest soil
Kongchaang		Warm	Very Fragrant.
Kachaknu		Warm	Red rice. Round, sparkling paddy.
Tompok saang		Warm	Used to prepare rice-beer (white).
Mogulwang/Pokchulu saang		Warm	Wooded forest soil
Marwangpa rwan saang		Warm/Cold	Can grow in both cold and warm conditions.
Loupui	2 – Early & late variety	Cold	Very fragrant; early variety is harvested in August.
Napchwang		Cold	Most fragrant variety.
Mang saang		Cold	One of the older varieties, wooded forest soil
Mupo		Cold	Wooded forest soil
Tangkhul rwan saang		Cold	The name implies that it came from the 'Tangkhul' people.
Takham saang		Cold	Wooded forest soil
Tin taza saang		Cold	Good in red, porous soil, less sunny areas. It has deep roots, long stalk. Last to be harvested – October last week.
Palem saang		Cold	Suitable for plots fallowed for a long time (25-30 years).
Tarikphik	2 – Big & small grain size	Cold	The paddy has a slightly glittering look. Does well in fresh plots or plots fallowed for a long time (25-30 years).
Yet to be named		Warm	The rice is fragrant, resembles '*Tin taza saang'*, but ripens much earlier, October 1st week.

Note: The Table is prepared with information gathered from household schedules, as well as in-depth interviews with the following respondents:
1. Ms. Bt. Bajalwanlu, 50 years; Haochong Village on 17th October, 2014.
2. Mr. Kh. Meinganlakba, 78 years; Puichi village on 28th October, 2014.
3. Ms. Bt. Thiunilu, 82 years and Ms. Bt. Nambuanlu, 36 years; Puichi Village on 31st October 2014

Fig. 5 — *Changat* variety of paddy. It grows well in warm areas and is usually harvested by the end of September. Oct. 2014

Fig. 6 — *Changat Karang* or the early variety of *Changat* paddy. It is harvested in August. Oct. 2014

Fig. 7 — *Takhangba Tapnang*, a variety of sticky rice. It grows well in bamboo soil. Oct. 2014

Banglai, *Ditiang saang* & *Chingkao kompi*). Bamboo forests cover the lower altitude areas of the villages, not to mention isolated bamboo groves that can be found within wooded forests as well. Thus, depending on the location of the field, the forest and soil type, farmers can use different combination of seeds to get a good harvest.

Farmers also pointed out that not every type of paddy grows successfully in a plot prepared from a primary forest or a long-fallow of 25-30 years. It may be kept in mind that the average fallow length is around 10 years. In cases of long fallow period, the soil is so rich that it usually results in an overgrown stem that breaks under its own weight or under rain and wind leading to very poor harvests. Dwarf varieties (*Saang Kasennu* & *Saang katoilu* for warm areas and *Palem saang* & *Tarikphik* for cold areas), on the other hand, are able to take advantage of the richness of the soil to produce bountiful harvests.

The paddy seed bank, with its rich variety of seeds that thrive in a broad range of climate, soil and forests allow the *jhuming* farmer the flexibility of shifting her fields year after year. In other words, shifting agriculture is built on an intricate knowledge of crops, especially paddy and the environmental conditions in which they thrive. This knowledge is not limited to the preservation of existing varieties but also includes the identification of new varieties as and when they appear in the field.

Traditional system of rice breeding

As mentioned earlier, rice (*Oryza sativa*) is an almost completely self-pollinating plant. Paddy varieties are largely due to mutation and are the subject of extensive research. A combination of various factors like soil properties and availability of water and rainfall lead to the expression of certain physical qualities, like fragrance, grain size, colour or adaptability to certain conditions in some varieties[12-14]. It is likely that these mutations are also adaptations to the particular environment that gives it an advantage over the parent variety. This explains how certain varieties thrive in certain conditions while many others do not.

Genetic mutations, however, are not common occurrences. Nor do they occur on a large scale. Unless they are identified, separated and consciously nurtured, they will disappear. Farmers, especially women, have played an important role in identifying new breeds of rice as and when they appear in the field. The technique of 'breeding' rice is known in the local *Inpui* language as '*barom nu*'. This is not a practice that has been lost to the current generation of farmers. In fact, there are two instances of new rice varieties that were 'bred' in the recent past in the two villages.

In Haochong village, there is a variety of sticky rice known as '*Changmeison tapnaang*' (Fig. 8). The

Fig. 8 — *Changmeison tapnaang*, a relatively new variety of paddy 'bred' by Mr. Changmeizinang and his wife Ms. Asonpi of Haochong village. Oct. 2014

name of the rice was coined by combining the names of the couple who 'bred' it – Mr. Changmeizinang Khumba and Ms. Asonpi Khumba. At the time of fieldwork, the old couple was still alive. It is widely used in both the villages and the story of its origin is well known. Like other sticky rice, it is fragrant and grows well in bamboo soil.

The more recent instance is from Puichi village where a new variety was discovered by Ms. Namdinreilu and her husband in their jhum field. At the time of fieldwork in 2014, this variant had been in existence for only the 4th year and had not been named as yet. It resembles the parent variety from which it emerged, known as '*Tin taza saang'*, but ripens earlier in the first week of October. It also has a fragrant aroma which is well appreciated. At the time of the fieldwork, this new variety of paddy was gradually becoming popular in the entire village.

'*Barom nu'* assumes an intimate knowledge about paddy and its cultivation. To the untrained eye, it is very difficult to differentiate one variety from another except when the differences are obvious like colour, size and texture. However, farmers who are well acquainted and trained by years of experience have a sharp eye that can spot even minor differences. This knowledge is perhaps the most important component of the process of '*barom nu*' as it requires the farmer to recognize even minute differences in the field.

The intricate process of '*barom nu'* is best illustrated with the story of Ms. Namdinreilu and her husband. In the autumn of 2010, the keen farmers noticed two stalks of paddy which were different from the rest. It may be pointed out here that the process of '*barom nu*' and its importance is well-known to farmers. Hence, they are alive to the possibility of new varieties emerging in their field. The two stalks were harvested differently and sown in a separate part of the field the following year. They harvested 2 kilos of paddy which was again grown separately the next year. From this, they harvested a *khawlwang* of paddy, a traditional basket which holds approx. 20 kg. By this time, the farmers were able to find out some of its unique characteristics including its harvest time, taste, fragrance etc.

By the third year, a few neighbours also began to sow little quantities of the newly 'bred' paddy separately in their fields. There was not enough seed yet to be circulated widely. In addition, despite the fragrant aroma which appealed to the farmers and the earlier ripening time, many things were not yet known: resistance to weeds and pests, resilience to climate variability during cultivation, resistance to moths and other insects which is fundamental to whether it can be stored for a long time in the granary etc. These properties will determine if the new variety will be adopted vigorously and grown on a large scale, or discarded. In the fourth year, which was when the fieldwork was conducted, it was being talked about quite excitedly.

This traditional ecological knowledge[15] of 'breeding' new varieties of paddy is an integral part of the highly intricate practice of shifting agriculture. To paraphrase an oft-repeated phrase by the farmers, '*new varieties of rice are discovered and replace older varieties which become less popular, unused and lost over a period of time'*. The 'breeding' and adoption of new paddy varieties, however, disrupts existing rhythms of work and re-orders the working cycle. For instance, if this new variety of were to be grown on a large scale replacing the popular *Tin taza saang*, harvest would be earlier by a few weeks, which in turn would affect other work in the field. Thus, '*barom nu*' not only introduces new varieties into the agricultural system but in doing so also ushers in internal changes while also ensuring continuity in terms of food production and food security.

Conclusion

Shifting agriculture is often perceived as a dated practice that has no place in the modern world. Such views tend to present *jhuming* in a one-dimensional manner that glosses over significant differences across space (topography, climate, soil) and culture (agrarian practices, property rights systems, beliefs, interaction with market). The traditional practice of

rice 'breeding' in shifting agriculture is one of those practices that is rarely highlighted in literature. However, it is a powerful lens through which the researcher can learn to appreciate the delicate balance required for the smooth functioning of a complex, interdependent system. For instance, shifting of field plots does not necessarily lead to food security if the right seeds are not planted, even if fields were prepared by cutting down a primary forest.

The variety of paddy available, adapted to a broad range of ecological conditions point to a rich heritage of traditional ecological knowledge. While this may be largely unrecognized, it continues to operate in the fields through the dynamic process of '*barom nu*'. New varieties of paddy continue to be added to the system that enhances genetic diversity within the species. This lends resilience to the system, not only over different ecological conditions but also in the face of climate change and climate variability.

Acknowledgements

I am grateful to Prof. Sucharita Sen who advised me at different stages of the work. I am also deeply thankful to the farmers of Haochong and Puichi villages. They generously allowed me to interview them and provided me with valuable information. They also did not hesitate to grant me use of photographs for my work. UGC funded this work with a Junior Research Fellowship.

Conflict of Interest

The author declares that there are no conflicts of interest.

Author Contribution

The author confirms sole responsibility of the following: study conception and design, data collection, analysis and interpretation of results and manuscript preparation. The findings in the present article are a part of a larger body of research conducted for an M. Phil dissertation titled 'Revisiting transitions in shifting agriculture in North-East India: A case study of two villages in Manipur' submitted to Jawaharlal Nehru University, 2015.

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