

Indigenous Knowledge-based Technologies Practiced in Hill Farming Systems in Bandarban Hill District in Bangladesh

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Abstract

This paper presents some indigenous or traditional technical knowledge on *jhum* (shifting cultivation) cultivation and management in Bandarban hill district in Bangladesh. These include indicators for *jhum* land selection, fire management in *jhum* field, three- phase seed sowing technique in *jhum*, use of colored flower plants to keep away insects from *jhum*, slope differentiation of hills in crop selection, use of local climate for crop selection, altitude and wind velocity in crop selection, indigenous seed collection and germplasms management, indigenous seed storage method, seed distribution, indigenous nursery method for raisings citrus seedlings, and indigenous ginger storage method by the Bwam community in Bandarban hill district of Bangladesh. Three-phase seed sowing technique in *jhum* is the new documentation of indigenous knowledge. An integration of indigenous and scientific knowledge will help to develop sustainable management of indigenous farming practices.

সারসংক্ষেপ

বাংলাদেশের বান্দরবান পার্বত্য জেলার জুম চাষ এবং ব্যবস্থাপনার প্রথাগত জ্ঞান নিয়ে এ প্রবন্ধে আলোচনা করা হয়েছে। জুম চাষের জন্য ভূমি নির্বাচন, জুম চাষে আগুনের ব্যবহার পদ্ধতি, তিন স্তরে বীজ বপন, পৌকা রোধে শোভাবর্ধক উদ্ভিদের ব্যবহার, ঢালু উপযোগিতার ভিত্তিতে শস্য নির্বাচন, স্থানীয় আবহাওয়া ও অবস্থানের ভিত্তিতে চাষাবাদের জন্য প্রজাতি নির্বাচন, বীজ সংরক্ষণ ও বিতরণ পদ্ধতি, কমলা জাতীয় উদ্ভিদের চারা উত্তোলন এবং আদা সংরক্ষণে দেশীয় জ্ঞানের ব্যবহার নিয়ে আলোচনা করা হয়েছে। এগুলির মধ্যে তিনস্তর বিশিষ্ট বীজ বপন নতুনভাবে লিপিবদ্ধ করা হয়েছে। দেশীয় জ্ঞান ও বৈজ্ঞানিক জ্ঞানের সমন্বয় সাধনের মাধ্যমে উক্ত এলাকার ফার্মিং পদ্ধতিকে আরো টেকসই করা যাবে।

Key words: Farming system, indigenous knowledge, *jhum* cultivation, sustainable management

Introduction

Jhum, the shifting cultivation is the indigenous and major farming system practiced by hill communities in Bandarban hill district of Bangladesh. The tribal farmers have their own indigenous or traditional knowledge system for *jhum* cultivation and management. Over the last few decades, they have been transforming from subsistence shifting *jhum* cultivation to cash oriented farming practices. Development programs and interventions are trying to develop ecologically and socio-economically sustainable appropriate farming practices for this area. Indigenous knowledge is location and community specific and transmitted by the communities over time. It is suitable for specific agro-ecological and socio-economic environments. It is generated and transferred through a systematic process of observations, experimenting with solutions, and readapting to modified environment, socioeconomic and technological situations (Fernandez 1994). It is also vital for its ecological rationality, inspiration and sustainable use of ecosystem (Agarwal and Narain 1992). indigenous knowledge helps in development planning and adopting appropriate farming technology and also can cut research and development cost significantly (Posy 1996). Combining indigenous knowledge, research and development may produce a sustainable appropriate technology for a particular area.

Studies on indigenous or traditional knowledge and efforts towards development in Bangladesh are very recent (Alam and Khisa 1998, 2000; Bose *et al.* 1998, Hassan 1999). Alam (2000) discussed the role of indigenous knowledge at local level environment management. Alam and Khisa (2000) reported the perceptions about plants for different uses and their linkages with biodiversity conservation in Bandarban hill district. Alam (2002) stated the importance of ethnobotany in the development of upland

farming system. Hill people in Bandarban hill district follow an indigenous land use system. This paper discusses some indigenous knowledge practiced by tribal people in Bandarban hill district in *jhum* cultivation.

Methodology

Findings presented in the paper are mainly based on authors' observations and discussions with local people. Once a practice was observed, it was documented and verified in the field. Discussions were made with farmers to get feed backs on the practiced methods. In some cases, group meetings and participatory rural appraisals (PRA) were conducted to collect information on indigenous knowledge. Such efforts provided effective information for new tropics like cultural knowledge. The observations were mainly confined to the Bwam, the Marma, the Murang and the Tanchangya tribal communities of Bandarban hill district in Bangladesh.

Results and Discussion

Indicators for *jhum* land selection

Tribal people in Bandarban practice *jhum* in hill slopes (Fig. 1). They select *jhum* sites based on certain criteria as perpetuating among them for generations. In selecting *jhum* land, farmers traditionally give emphasis on the following characteristics:

- **slope:** gentle slopes are preferred to the steep slopes; generally the middle portion of the hills is considered for good production;
- **soil texture:** loose and black soil is preferred (admixture of gravel is avoided);
- **vegetation cover:** lands covered with dense bamboo jungle; luxuriant growth of vegetation, *kurjuk lota* (*Mucuna sp.*) is

mostly preferred; area covered with *rankola* (wild *Musa* sp.) is supposed to be suitable for chili cultivation. Farmers also think that the banana ash enhance chili production.

- **earthworm burrows:** lands with earth worm burrows are preferred.

Little admixture of gravel in soil is considered better for fruit orchard establishment as reported by farmers of Empu Para. Hills consisting of sandy loamy soils are considered as good site for village establishment. It is reported that soil fertility for *jhum* site is determined on the basis of dense bamboo jungle (Bessaigier 1958, Ishaq 1971), soil colour (Goswami 1980), and secondary vegetation (Conkin 1957, Dove 1983).

Fire management in *jhum* field preparation

The tribal farmers make fire to dry organic materials in preparing *jhum* fields, that sometimes causes damage to natural forests and also to villages. So, they practice some indigenous fire management methods by making a fire protection line (a wide strip of vegetation free zone) surrounding the selected plot during jungle cutting. Generally they lit fire from the top of the hill in the mid of the day time or evening based on the size of the area and try to complete the burning by 10 PM. The fire moving from top of the hill to down ward direction is easy to control as the fire velocity is generally reduced. The farmers consider that the wind velocity is generally less in the afternoon than in the morning. If the *jhum* is very near to a village, the male folks of the village take shelter on the roof of their house with water to save the houses from the fire, but most of the time it is very difficult to save the village.

Three-phase seed sowing technique in *jhum*

The tribal people of Bandarban have their own technique for seed sowing in *jhum*

field. Generally they use three-phase sowing system in *jhum* cultivation. After field preparation, the farmers first broadcast the small sized seeds (e.g. *Ocimum* sp., *Capsicum* sp., *Seseli daucifolium*, etc.) all over the field. After about a week they sow the seeds of rice, cotton, maize and other vegetable crops by dibbling methods (Fig. 2). When the rice seedlings become about 10 cm in height, the farmers broadcast sesame (*Sesamum indicum*) seeds spreading over the field. Farmers reported that if sesame seeds are sown with rice it hinders the growth of the rice tillers. This indigenous practice reduces the crop competition at germination stage and ensures higher production. This was not reported earlier in the literature. It has been regarded as a new documentation of indigenous knowledge in this report.

Evil spirit and insect repellency by planting colorful flower plants in *jhum*

Cultivation of some red or yellow flowered ornamental plants along the borderlines of the *jhum* field for beautification of *jhum* is a custom of *jhum* cultivation. In Bandarban, farmers plant merry gold (*Tagetes patula*), coxcomb (*Celosia cristata*) and cosmos (*Cosmos bipinnatus*) flower plants along farm borders. The farmers believe that evil spirits fear those kinds of flowers. Farmers reported that pungent smell of ginger (*Zingiber officinale*), onion (*Allium cepa*), mint (*Mentha spicata*) and pepper (*Piper nigrum*) and bright colour of flowers reduce insect attack. It could be a good biological pest control approach (Fig. 3). This practice will help to reduce insect attack at field with any use of insecticides.

Slope differentiation of hills for crop selection

Moisture content and nutrients of the hill soils vary with slope gradients. It is generally higher in foothill than hilltop.

Tribal farmers differentiate slopes for different crop cultivation. They plant crops of different kinds in different slopes, such as annual crops (like aroids, ginger) towards the lower slopes and foothills. In the mid-slopes they plant fruit trees. Toward the hilltop they prefer to plant timber trees. It is reported that flat to moderately steep sloping land (0-35% slopes) could be utilized for annual crops and that would reduce the soil loss (ADB 1984).

Local climate as an indicator for crop selection

Climate of an area is an important parameter for selecting crops for that particular area. The Murang community of Empu Para has their own climatic knowledge for selecting crops for the area. Farmers select crops considering the climatic-conditions such as *thanda* (coldness) and *gorom* (warmness) of a locality depending on altitudinal variation. They consider hills of higher altitudes with much variation in day and night temperature as "*thanda*" and hills of lower altitudes with little variation in day and night temperature as *gorom*. The farmers of Empu Para at a higher altitude in Chimbuk hill range (about 875 meter) grow citrus fruits like orange (*Citrus reticulata*), malta (*Citrus sinensis*), jambura (*Citrus maxima*), and *satkora* (*Citrus hystrix*), etc., in addition to *jhum* farming (Fig. 4). They consider that Empu Para is "*thanda*" (cool) and suitable for citrus cultivation. Farmers of Empu Para do not go for pineapple cultivation though the farmers near Bandarban and Ruma grow pineapple. Empu Para is situated at higher elevation than Bandarban and Ruma. The climate is comparatively cooler in Empu Para, and this condition is locally called as *thanda* and considered as suitable sites for citrus cultivation and not suitable for ginger cultivation. Foggy weather during flowering

time is considered to be suitable for good citrus fruit setting. On the other hand, Sharon Para is comparatively warmer (*gorom*) than Empu Para, and, considered suitable for ginger cultivation. Climate is considered comparatively warmer (*gorom*) in Ruma and Bandarban than Empu Para, where the farmers grow pineapple. Use of this knowledge helps to select species for a particular site.

Altitude and wind velocity in crop selection

Altitude and wind velocity of an area are also considered as important criteria in selecting crops of an area. The tribal people of Empu Para and Rowangchari have their indigenous knowledge for crop selection based on the altitude and local wind velocity of the locality. The farmers of the Empu Para do not cultivate sesame (*Sesamum indicum*) in *jhum* at high altitude, because when the sesame ripens, the pods split up and disperse for high wind velocity. Cashew nut (*Anacardium occidentale*) is an important cash crop of the Bwam community of Rowangchari Upazilla. Farmers of a higher elevation at Sharon Para do not cultivate cashew nut. They reported that high wind velocity during flowering season in the area causes less fruit setting than Rowangchari. It is considered that in low wind velocity fruit setting is good. This practice provides site-specific crop selection information and thus ensures higher productivity.

Seed collection and germplasms management

Indigenous knowledge of seed sorting and seed storage is very simple. The tribal people select healthy and disease-free plant as seed plants. They also select mature and bigger sized fruits for seeds. In case of upland paddy, desired seed crops are

harvested in a sunny day and threshed immediately after the harvest to avoid getting wet. In case of fleshy cucurbit fruits, farmers put some rice straw beneath the fruit so that the fruits do not touch soil. After collecting seeds farmers dry them in sun for 7-10 days and store them in bamboo or hallow gourd pots. To protect from insect attack and keep moisture at optimum levels, seed jars are stored near fire place or hung under roof over stoves. Thus they maintain local crop germplasms.

Indigenous seed storage method

Existing indigenous seed storage method are almost the same among the tribes in Bandarban hill district. After collection, the seeds are stored using indigenous seed storage technique (Table 1). It is an economic

and sustainable seed management system for the tribal areas (Fig. 5).

Agro-biodiversity conservation through community based seed distribution

Community based seed sharing system still exists among the Marma peasants for conserving and maintaining the indigenous rice varieties. There are more than ten varieties of rice cultivated in the hilly areas of Chittagong Hill Tracts as reported by the Marma farmers. One family generally maintains 3-4 varieties. They share among themselves different varieties of rice according to their choice of cultivation. This community based sharing of seeds has been maintaining agro-biodiversity over time and localities. This also reduces the storage risk.

Table 1. Indigenous crops storage process practiced by the tribal people of Bandarban.

Seeds types	Indigenous storage process
Paddy	Stored in bamboo made baskets locally called <i>turong</i> . Seeds are covered with dried leaves of banana (<i>Musa sp.</i>), teak (<i>Tectona grandis</i>), moos (<i>Pterospermum acerifolium</i>) or palm (<i>Caryota sp.</i>) to maintain moisture.
Cucurbit seeds	Washed thoroughly with water and sun dried for seven to ten days and stored in locally made small bamboo baskets (<i>Turong</i>).
Other vegetable seeds	Stored in earthen pots or in <i>toyea</i> (hard shell of gourd) and kept them in a warm dry place usually attached with the kitchen wall.
Maize seeds	5-10 bunches are tide together and kept hanging from kitchen roof to keep seeds viable and free from insect and fungal attack.
Lady's fingers, Borboti (long bean)	Tide up together and kept hanging from kitchen roof to avoid insect and fungal attack.
Tulsi (<i>Ocimum sp.</i>)	The whole plant is dried and kept beneath the house roof.
Root crops	Tubers or roots are stored in dry places covering with soils near their house. Aroids stored in field or in bamboo basket (<i>Turong</i>) covered with grass and placed in shade near their house.



Figure 1. A growing jhum in hill slopes



Figure 2. Three phase seed sowing technique in jhum field



Figure 3. Colourful flower plants in jhum border



Figure 4. Citrus cultivation in Empu para, Bandarban



Figure 5. Indigenous seed storage method



Figure 6. Indigenous nursery technique for citrus

Indigenous nursery technique for citrus

Citrus has become an important cash crop for income generation to the Murang community in Empu Para. The tribal farmers have developed indigenous nursery method for rising of citrus seedlings. They raise citrus seedlings in bamboo baskets. An abandoned bamboo basket is filled with soil, or a bamboo platform layered with soil is made at about one meter above the ground (Fig. 6). Seeds are sown in the baskets or into soil layers on platforms. The seeds germinate in the baskets and soil beds in bamboo platform. After one year the seedlings are pricked out and transplanted in the seedbeds in the field. The perception behind this practice is to keep the seedbed away from the disturbances of poultry birds, pigs and to enhance easy nursing of the seedlings. When the seedlings attain about one meter height, bare-rooted seedlings are planted in the field during the monsoon. In this practice local resource based biodegradable containers are used and thus it is environmental friendly and economic.

Indigenous ginger storage method by the Bwam community

Ginger is a root crop and cannot be stored in open condition for longer period after harvesting. Storing of ginger for longer period can bring better price to the farmers. But there are no modern storage facilities for ginger storing in the tribal areas of the Hill Tracts. So, the Bwam farmers of Sharon Para have developed indigenous ginger storing

method, which help them to enhance their income. To store ginger the farmers dig large rectangular pits near their houses. They spread a layer of sand on the pit floor and put fresh gingers on the sand layer. A layer of hay or rice straw or other dry grasses is spread over the ginger and then covered with soil. A shed of thatched roof is made over the pit and a drain is made around the pit, so that rain water does not get into the pit.

Linking indigenous knowledge with modern knowledge

All the local practices are not always sustainable. Indigenous knowledge need to rigorous scientific testing to render their value globally (Gurung 1994). The knowledge is dynamic, evolving to suit changing circumstances and remaining relevant to the group's socio-cultural make-up. Therefore, an integrated approach may be taken to encoding the indigenous knowledge with scientific knowledge for developing a sustainable appropriate technology for that area.

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