

RESEARCH ARTICLE

Indigenous Tuber Crops Production System Practiced by the Tribe of West Garo Hills District of Meghalaya

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Received: 20-08-2017; Revised: 20-09-2017; Accepted 01-10-2017

ABSTRACT

Tapioca, sweet potato, colocasia, yam, and elephant foot yam are the important traditional tuber crops of Garo Hills district of Meghalaya. These tuber crops are grown exclusively in five districts of Garo Hills, i.e., East Garo Hills, North Garo Hills, West Garo Hills, South West Garo Hills, and South Garo Hills. In Jhum or shifting cultivation fields, tapioca, colocasia, and *Dioscorea* are commonly grown, while sweet potato and colocasia are grown considerably not only in the hills but also in the plains. In sweet potato, mainly two types of species are available in the region, i.e., red and white, while in tapioca, both sweet and bitter types are available. Major species of *Dioscorea* found in the region are *D. alata*, *D. esculenta*, *D. bulbifera*, *D. pentaphylla*, *D. hamiltonii*, *D. cylindrical*, *D. sativa*, *D. oppositifolia*, *D. deltoidea*, and *D. floribunda*. Different types of local traditional varieties of tuber crops which are highly nutritious and good in taste are found in Garo Hill districts of Meghalaya. The farmers sow the planting material of tuber crops in their field in March–April using locally made farm tools. The farmers stored the tubers produced in shady place on the floor with 2–3 cm thick sand layer. After grading their produce into different sizes, they piled in heaps inside the indigenous structure for storage made of bamboos. From the study, it was found that the farmers faced transportation to the nearby and far markets as their main priority problem in the village. Among the various tuber crops grown, colocasia ranked the highest in terms of productivity, market demand, taste preference, contribution to food security, nutrition, and pest and disease resistance which is followed by tapioca, sweet potato, yam, and elephant foot yam. The farmers consumed the tender leaves of tuber crops, and tubers are cooked with fish and meat. They also used as snack purpose after boiling or baking in fire.

Key words: Colocasia, elephant foot yam, sweet potato, tapioca, tuber, yam

INTRODUCTION

The traditional agricultural production systems evolved from the traditional, knowledge systems are performing very well even today in conserving bioresources/natural resources and in sustaining hill ecosystem of North East Garo Hills (NEH) districts of Meghalaya. It is one of the most promising areas within NEH region as far as the potentiality and variability of tuber crops are concerned. This district offers scope for the cultivation of a wide variety of tuber crops because of highly diversified

topography, altitude, and climatic conditions. Tuber crop plays a crucial role in the food and nutritional security of many tribal farmers of the region. The local farmers of Garo Hills districts are already in the habit of growing tuber crops. Major tuber crops grown in Garo Hills are sweet potato, cassava, taro, yam, and elephant foot yam. In Jhum or shifting cultivation fields, tapioca, colocasia, and *Dioscorea* are commonly grown, while sweet potato and colocasia are grown considerably not only in the hills but also in the plains (Roy *et al.*, 2014). West Garo Hills district has 390 ha area with a total production of 1280 MT under sweet potato and 1094 ha area under tapioca, and its production is 6208 MT. In sweet potato, mainly two types are available in the region, i.e., red and white. In

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tapioca, both sweet and bitter types are available. In *Dioscorea*, about 28 species and 25 varieties have been reported from NE region mainly in the Garo Hills.^[2] Major species found in the region are *D. alata*, *D. esculenta*, *D. bulbifera*, *D. pentaphylla*, *D. hamiltonii*, *D. cylindrical*, *D. sativa*, *D. oppositifolia*, *D. deltoidea*, and *D. floribunda*. (Hore and Sharma, 1995). Elephant foot yam (*Amorphophallus campanulatus*) is widely grown in Meghalaya. Root and tuber crops are also receiving attention because they can be grown on marginal or difficult land. Due to growing population, pressure on land has increased and farmers have to move onto marginal lands with difficult soil, weather, or other environmental conditions. Cassava can tolerate drought and high level of aluminum in soils. Taro has always received interest because it can be grown in hydromorphic soils or under flooded conditions. In view of the importance of tuber crops in agriculture farming system for the livelihood security of a large number of tribal farmers, an attempt has been made to study the traditional production system of tuber crops in West Garo Hills of Meghalaya.

METHODOLOGY

The study was conducted in two tribal dominated villages, namely, Rongdenggre and Kamagre of West Garo Hills district of Meghalaya state. The data were collected through a structured questionnaire-based survey. Several Focus Group Discussions and participatory tools were also used for collection of information. A total of 60 randomly selected farmers of different age group constituted the sample size for the study, of which 63% were male and 37% were female farmers. Data collection exercise was done by a team of scientific staffs of KVK, ICAR, West Garo Hills in the year 2015. The data were collected concerning the production system, consumption pattern, storing, and marketing of tuber crops in West Garo Hills.

Study area

The Rongdenggre and Kamagre village is mostly covered with upland and midland area, and average annual rainfall of the village is 2560.9 mm with 93 numbers of rainy days. The climate of the area is sub-tropical and moist sub-humid. Soil texture is loamy silt with low-to-medium in organic carbon and low in phosphorus and potassium.

The total population of the study area is 442, and its literacy rate found to be 40%. The average family size is 5. The village has a total of 105.33 ha of cultivable land, of which 62.01% is upland, 29.14% is medium land, and 8.85% is lowland. The forest and wasteland area of the village covers around 80.0 ha and 40.0 ha. The villagers assessed their food and needs from the nearest local market which is 4–6 km away from village and sometimes from jhum area for vegetables and other food crops which is 3–6 km away from the village. They rarely used any improved variety of seeds because of unavailability of input outlets nearby. The traditional activities of the villagers were mostly agriculture and forest dependent.

RESULTS AND DISCUSSION

Cropping pattern

The farmers cultivate paddy as monocrop in Kharif season in low- and mid-land areas. In pre Kharif season, farmers grow tuber crops like tapioca and colocasia as mixed crop with other local varieties of chilli, maize, ginger, turmeric etc. mostly in Jhum whereas sweet potato, taro, yam, elephant foot yam are mostly grown as pure crop both in Jhum and lowland areas. Over the past 5–6 years, the area of tuber crop in the village has been grown widely. Around 90% of the farmers practice shifting/jhum cultivation, and their cultivation totally depends on the rainfall. They practiced mixed cropping system which includes jhum rice, maize, ginger, pumpkin, chillies, millets, potato, brinjal, sesame, colocasia, tapioca, sweet potato, and yam. The major crops grown in the village, and its area and productivity are shown in Table 1.

Varieties of tuber crops grown

Traditional varieties are highly nutritious and tasty compared with improved varieties as per

Table 1: Area, production, and productivity of major crops in the villages

Crops	Area (in ha)	Productivity (q/ha)
Ginger	24.2	30.3
Chilly	17.4	7.50
Pumpkin	12.9	900 nos.
Tapioca	14.6	31.0
Sweet Potato	13.4	35.11
Colocasia	13.5	4.10
Rice	9.30	15.2

the feedback of the respondents. Each variety has different special characteristics. It is said that some varieties are tolerate pest and diseases. Some produce high yields, while others can survive even in years when there is very little rain. The existing varieties have different lengths of maturity. Some varieties and characteristics of local tuber crops which are commonly grown in the study area are as shown in Table 2.

Agricultural implements used

The tribal farmers of the villages use simple tools and implements for various farm operations as shown in Table 3 for the cultivation of tuber crops. The local implements are either bought

from the market or made by themselves with the help of local specialists such as carpenters and blacksmiths. Almost every family has its own collection of agricultural implements and does not depend very much upon others. The number of each type of implements however, varies from family to family according to the landholding size (Anilkumar K., 2010). The farmers used to grow yam near the areca nut or any tree as a reason of staking of the crop.

Sowing

The farmers sow the planting material of tuber crops in their field in March–April using local dibbler called as *matha* which is made of bamboo

Table 2: Characteristics of the local tuber crop varieties available in the village

Name	Variety	Special characters	Yield (kg/plant)	Problems	Reasons for preference
Tapioca	<i>Kanem</i>	Tuber are long in shape and red in color	7–10	Stem borer	Very good in taste
	<i>Simol</i>	Tuber are long in shape and white in color	7–9	Stem borer	Very good in taste
	<i>Gippok</i>	Tuber are white in color, leave are used for curry purpose and making chips, etc.	8–10	Stem borer and leaf curl	Very good in taste
	<i>Meghalaya</i>	Tuber red in color and early variety	7–9	Stem borer	Early variety
	<i>Naga</i>	Tuber yellow in color and early variety	6–8	Stem borer	Medium in taste
	<i>Cake</i>	Tuber are white in color and small in size	7–8	Stem borer	Good in taste
Colocasia	<i>Thama chongkam</i>	Tuber have more number of eye/ fingers and size also big	4–6	Leaf spot, leaf curl and tuber rotting	Very good taste
	<i>Tha kolthom</i>	Early variety	3–5	Leaf spot and leaf curl	Early variety
	<i>Thamangsong</i>	Tubers cover red in color and inner corm white in color	4–6	Leaf spot and leaf curl	Very good taste
	<i>Maraka Japhang</i>	Tuber mainly used for boiled curry purpose	4–6	Leaf spot and leaf curl	Medium in taste
	<i>Tha mittim</i>	Tuber mainly used for boiled curry purpose	3–5	Leaf spot and leaf curl	Very good in taste
	<i>Thama rongbol</i>	Tubers are football/round in shape and big in size	4–7	Leaf spot and leaf curl	Good in taste
Yam	<i>Thajong Japha</i>	Tuber inside the soil	10–15	Rotting	Good in taste
	<i>Thajong thamachi</i>	Tuber white small and sticky and thorny in nature	15–20	Rotting and die back	Very good in taste
	<i>Thajong gippok</i>	Tuber completely white in color	15–18	Rotting	Good in taste
	<i>Thajong gichak</i>	Tuber completely red in color	15–20	Rotting	Very good in taste
	<i>Thajong dalgipa</i>	Tuber very big in size	20–40	Rotting	Medium in taste
	<i>Thajong kanem</i>	Tubers cover in red and corm white in color	10–15	Rotting	Very good in taste
	<i>Thajong remmol</i>	Tuber long and white in nature	10–15	Rotting	Very good in taste
	<i>Tha thalok</i>	Tuber look like potato	8–12	Rotting and die back	Medium in taste
Elephant Foot Yam	<i>A'mikam</i>	Tuber are round in shape	1–8	Rotting and die back	Good in taste
Sweet potato	<i>Tamlang gichak</i>	Tuber are red in color	0.1–0.5	Rotting	Good in taste
	<i>Tamlang gipok</i>	Tuber are white in color	0.05–0.35	Small tuber size	Excellent in taste

with a pointed metal attached at the tip. The planting materials used are from the rhizomes kept in previous years and maintaining a spacing of 20 cm × 30 cm row-to-row and plant-to-plant distance. The farmers retained the rhizomes for next season keeping criteria of choosing healthy plants randomly after the harvest of the crop.

Intercultural operations

In the early morning, the farmers used to have their meal and go to field for weeding. Usually weeding is done manually 45 days after sowing and 3–4 times during the crop period. Garos do weeding mainly by hand hoeing. It was found that the second weeding is usually carried out after rainy season thus the weeds act as mulch during rainy season and control soil erosion (Deb et al., 2013). The local farmers also practiced earthing up of tuber crops after three months of sowing of the crop. As a moisture conservation measure, 1–2 cm thick layer of paddy straw or locally available plant leaves are used as mulching of tuber crops.

Pest and disease

The study reveals that most commonly occurred pest and disease in tuber crops is stem borer, fruit rotting, and leaf curl, and there are no management measures till date. The yield of tuber crops gets loss by 20% due to damage by rodents and wild animals. Conventionally, the farmers used to apply wood ash on the leaves of tuber crop plants so as to prevent from pest and disease infestation to the crops.

Harvesting

Nearly all farmers harvest tuber crops manually using small spade called as *Gitchi* in morning hours so as to sell their produce fresh in daytime. The harvesting of yam, colocasia, elephant foot yam, and sweet potato is done when the vegetative portion of the plant and soil of the field dries up. Due to high rainfall during monsoon months in Garo Hills, most of the lowland area remains wet at the time of harvest of tuber crops. Therefore, the farmers usually delay the harvest so as to avoid from rotting of tubers due to high moisture content during their storage.

Storage

After harvest, the farmers used to keep their produce in shady place on the floor with 2–3 cm thick sand layer. Other indigenous methods/structures for storage are made of local bamboos. After grading into different sizes, they piled in heaps inside the bamboo structure. The produce was kept inside jute bags and placed inside the bamboo structures and stored till time of selling or next season of planting. Some few farmers practiced the techniques of reburying the tubers in trenches and covered with plant material and soil. About 50% of the produce quantity was used for selling in market, 30% used for consumption purpose and 20% kept as seed purpose for the next season.

Marketing

Maximum farmers of the village are small and marginal. The farmers used to bring their harvested produce to the nearby small markets by carrying manually in locally made bamboo baskets. They sold the harvested tuber crops in the market immediately after harvest. Due to lack of transportation facilities and improper market information in the village,

Table 3: Local agricultural implements used by farmers in tuber crops cultivation

Local name	English name	Uses
Cheni	Small sickle	Weeding
Gitchi	Small Spade	Weeding and to dig up the soil, Harvesting
Ate Ganga	Dao (Sword)	Clearing the jungle
Ate Mande	Dao (Sword)	Cutting of stems and clearing of jungle for Jhum cultivation
Kudal	Spade	Harvesting and Earthing up
Matha	Dibbler	Digging stick seeding
Katchi	Sickle	Weeding and cutting of leaves for animal consumption purpose

Table 4: Problems faced by the farmers in marketing

Rank	Problems
1	Transportation
2	Market information
3	Storage
4	Higher marketing margin
5	Storage problem
6	Price instability
7	Pest and disease incidence

Source: Computed by author using survey data

Table 5: Scoring of preference of commonly cultivated tuber crop by villagers

Parameter	Crops				
	Colocasia	Tapioca	Sweet potato	Yam	Elephant foot yam
Productivity	7	7	6	6	2
Market demand	6	4	5	3	2
Taste preference	6	5	4	4	2
Food security	5	5	4	4	1
Nutrition	5	4	4	4	1
Pest and disease resistance	6	4	3	2	7
Total score	35	29	26	23	15

the farmers faced a big problem which affects the actual price received by them. The tuber crops are semi perishable to highly perishable commodities, and due to unavailability of small-/large-scale processing units in the village, the farmers could not perform any postharvest management or value addition to the crop. From this study, it was found that the transportation problem in the village ranked first and pest and disease incidence the last among all the problems as shown in Table 4.

Preference of tuber crop by the villagers

The preference of tuber crop by the villagers was analyzed using matrix ranking as shown in Table 5. Different parameter related to tuber crops was selected and scored 1–10. Among the various tuber crops grown, colocasia ranked the highest in terms of productivity, market demand, taste preference, contribution to food security, nutrition, and pest and disease resistance which is followed by tapioca, sweet potato, yam, and elephant foot yam.

Uses

The farmers used the tender leaves of tuber crops as vegetable purpose, and tubers are cooked with fish and meat. They also used as snack purpose after boiling or baking in fire. Other than human consumption, the unmarketable and poorly developed tubers are utilized in animal feed. The sweet potato vines and cassava leaves are used as a nutritive and palatable feed for cattle. The sweet potato and cassava tubers, colocasia corms, and young petioles are chopped boiled and fed to the pig.

CONCLUSION

Agriculture has been the main source of livelihood of the tribal community in the village.

The study concludes that no farmers in the village used any inorganic fertilizers and pesticides in growing tuber crops. The soil and climatic condition of the village are highly favorable for production due to rainfed and wider adaptability of the crop. Most of the farmers utilized the tuber crops for human as well as animal consumption purpose. During the survey and group discussion with farmers of the villages, several constraints such as non availability of improved varieties, no knowledge about nutrient and disease management, price instability, no proper marketing and transport facilities, unavailability of suitable tools and machineries, no post harvest management facilities were recorded. Therefore, the Government or some other agencies should developed a network of purchase points in major tuber crops growing areas and also should established agro-service center in the villages for enabling the farmers to sold their produce at reasonable and proper time.

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