

## Traditional practices of ginger cultivation in Northeast India

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Ginger is an important cash crop in Northeast region. About 3 lakhs tonnes of ginger are being produced annually from 47,641 ha land and the Northeast region is emerging as India's organic ginger hub. A large number of tribal farmers still practice the traditional methods of cultivation. Ginger is cultivated in *jhum* lands, *buns*, *Zabo* lands, terraced lands and in plains. In the traditional methods of cultivation, farmers rely on organic inputs, local resources and practices. The Northeast region is rich in ginger diversity. A large number of local cultivars like *Bola ada*, *Moran ada*, *Jatia ada*, *Keki*, *Bazar local*, *Naga shing*, *Thingpuri*, *Shing Bhoi*, *Shing Bhukir*, *Khasi local*, *Tura*, *Thinglaidum*, *Thingpuidum*, *Thingria*, *Jugijan*, *Vichii*, *Nagaland local*, *Bhaise*, *Gorubathane*, *Jorethane*, *Nangrey*, *Majhauley*, etc. are still grown. Ginger is raised as sole crop as well as intercrop. About 1.5-2.0 t seed rhizome are planted during March-April and about 6-8 t of green ginger are harvested per hectare. Removal of mother rhizome is a common practice in Sikkim. Marginal and tribal farmers mostly rely on ITKs for pest and disease management.

**Keywords:** Ginger, Indigenous cultivation, Northeast India

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Agriculture in Northeast Region (NER) of India, which comprises states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim, is predominantly traditional, rainfed, rice-based with exception of Sikkim where maize is a dominant crop. Ginger is a main cash crop, accounting 49% of India's ginger area and 72% of India's ginger production. This region is one among the highest ginger productivity area in the world (5.8 t/ha as against national average of 3.7 t/ha) and is emerging as India's organic ginger hub. Most of the tribal farmers living in remote places are following traditional methods for ginger cultivation, which are generally eco-friendly, less expensive, and utilize local resources, knowledge and labour. The paper describes indigenous methods of ginger cultivation prevailed among tribal of NER.

### Methodology

While making germplasm exploration and collection trips in NER under a DBT project on *DNA Fingerprinting and chemoprofiling of traditional ginger cultivars of Northeastern India*, information on indigenous methods of ginger cultivation prevailed in NER were collected. In addition, various literatures were surveyed to know the ITKs in ginger cultivation.

### Results and discussion

#### Area and production

Ginger produced in NER was reported to have higher oil (1.6-2.5% *versus* 1.5-2.0%) and oleoresin content (5.9-8.56% *versus* 5-8%) than ginger from other parts of India<sup>1</sup>. In NER, Assam ranks first in ginger acreage as well as production (Fig. 1) but productivity was the highest in Mizoram (8.40 t/ha) followed by Arunachal Pradesh (7.39 t/ha), Assam and Nagaland (6.99 t/ha). Meghalaya is the second largest ginger producing state (47,137 t from 9,230 ha). In Arunachal Pradesh and Mizoram, about 4,500 ha are always under ginger cultivation with an annual production of 33,000 t. However, ginger production is the lowest in Manipur (2,100 t from 1,270 ha) and Tripura (5,450 t from 1,360 ha). Of the 143 tribal communities reported in NER, most if not all, grow ginger either in homestead or as intercrop or sole crop. In Sikkim, the *Rai* community was the major grower of ginger, although the *Lepchas* also cultivate ginger for use in religious ceremonies<sup>2</sup>. However, as the crop became more important commercially, other communities also took up its production and more non-traditional areas is being brought under ginger, new techniques are introduced and practiced.

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### Land use system

The traditional systems of ginger cultivation found in NER are *jhum* system or shifting cultivation (except Sikkim), *bun* system (in Meghalaya), *zabo* system (in Nagaland), *tila* (in Tripura and Assam) and terrace cultivation (in Sikkim). Before planting ginger, weeds and bush re-growth are slashed manually and left on the soil as mulch or burnt *in situ* (in Sikkim, Manipur, Mizoram and Tripura). The land is then hand hoed often superficially. Farmers also make mounds with manually operated hoes. In the low hills of Manipur, Tripura and in Assam, farmers make drainage channels around the field. A slightly modified system of raised bed, called *bun system*, was reported from Meghalaya<sup>3</sup>. It is a slash and burn type and involves putting of dried or fresh weeds, bushes and crop residues in the form of raised bed (1 m width, 4 m length and 20-25 cm thick) along the slope, covering the *bun* with 3-5 cm soil. The space between one *bun* to another is generally kept at 1 m (Fig 2). After covering with soil the plant materials are burnt. Though it is not burn totally it helps in soil sterilization. Sowing and transplanting is done during April when first shower starts. Ginger, turmeric, capsicum, colocasia, tomato, cabbage, pea, French beans are planted on the *bun* in first year, mostly as mixed crops. Rice, maize, finger millet, etc. are sown from second year onwards. The system is prevalent since ancient time and it is said to overcome the problems of heavy rain, high humidity and low temperature. *Jhum* system is prevalent in all Northeastern states except Sikkim. About 4,92,000 tribal families are engaged in *jhum* cultivation<sup>5</sup>. The system involves clearing a patch of forest land, but retaining useful trees and plant varieties, cultivating it for two to three years and then abandoning it for 10-20 yrs to allow the natural forest to grow back and the soil to regain its fertility (Fig. 3). The cycle of cultivation, leaving it fallow and coming back to it for

cultivation, is called *jhum cycle*. In NER with exception of Sikkim, land is owned/controlled by community (not individual). The village headman leases a particular hill to a family for *jhum*. However, with increase in the population, pressure on land has increased and *jhum* cycle has reduced to 3-5 yrs, which is against the principles of ancient *jhum* system or conservation agriculture. In *jhum*, land crops like maize, paddy, finger millet, green gram, black gram, rice bean, rajma, tomato, cucurbits, colocasia, sweet potato, and turmeric are raised besides ginger, often in mixed stand. The *Mizos* of Mizoram celebrate a ritual called *chapchar ku* before sowing ginger in *jhum* field. The *jhumias* are using traditional implement like *chimkoi* for planting ginger.

### Land preparation

Ginger is cultivated in slopes, up to an altitude of 2,000 m amsl, with or without terracing, as well as in plains, in open as well as under the shades of bamboo and other forest trees. The plot size varies from 100 sq m small plots in the backyard up to 1 ha. Farmers believe that planting the same land every year does not produce a good crop of ginger hence, water stagnated fields are not selected, if not, a raised bed of about 30 cm height, 1-2 m width are formed with drains between them. In the low hills of Assam, Manipur and Sikkim the land is ploughed but in other places (mid hills /sloppy area) it is dug and hoed after incorporating FYM. In the *jhum* area, ginger is cultivated without much land preparation i.e. they just scratch the soil to make a hole and plant the rhizome in it. Farm yard manure is applied before ploughing or digging.

### Selection of seed rhizome

Before planting, stored seed rhizomes are sorted, rhizome that is large, shiny, free from spots or marks, bud or eye injury are selected for planting. In Sikkim,

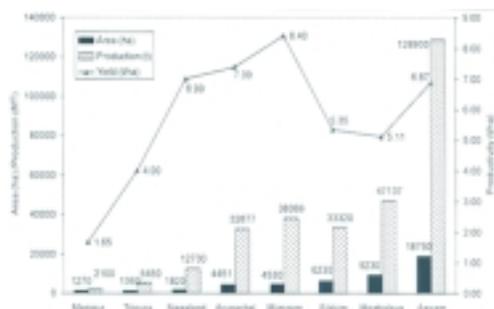


Fig. 1 — Area, production & productivity of ginger Fig. 2 — Bun system prior to planting ginger Fig. 3 — Forest burnt for Jhum

farmers dip seed rhizome in hot water (approx. 50°C for 10 min) to eradicate rhizome borne nematodes and the fungus<sup>4</sup>.

### Cultivars

Due to wide variations in climate, topography, soil characteristics and selection by various ethnic groups, in accordance with their production system and quality preference, have resulted in the evolution of multitude of local cultivars (Table 1). Therefore, the NER as a whole can be considered as treasure house of ginger diversity. The local cultivars are generally named after the locality, where it is popular or based on tuber morphology. For example, *Moran Ada* is a local cultivar from Moranhat of Assam, *Jorethangey* is from Jorthang of Sikkim. In Khasi language, *Shing Bhoi* refers to big ginger rhizome. *Sano Adwa* in Nepali refers to small ginger. Beside the named landraces, a large number of non-descript cultivars are also found in NER. These local cultivars are preferred by the tribal as well as in trade.

Mizoram is known for its fibre-less (4%) ginger (*Thingpuidum*, *Thingria*) with high pungency. The *Naga Shing* of Manipur contains high fibre besides aroma. It is suitable for processing dry ginger and oleoresin. The *Shing Bhukir* of Meghalaya with smallest rhizome is the best medicinal ginger hence sold at premium price. Its tuber morphology is almost similar to that of *Moran ada* of Assam and Nagaland local. These cultivars are given for flatulence and colic. The *Bhaise* of Sikkim is known for its high yield (a plant can give 1.8 kg rhizome from 50 gm

seed rhizome) hence not only popular in Sikkim but the entire NER. The improved variety *Nadia* is also popular in this region due to its low fibre content. There is another type of ginger called black ginger (*karkashur* or *yaimu* in Meiti) with deep bluish tinge inside the rhizome. Its leaf look like a turmeric leaf but it is a wild ginger belongs to *Zingiber zerumbet*. It is not popular because of bitter taste but used in folk medicine by *Nagas*, *Meities*, *Kuku-Chin-Mizo* and *Bodo* tribal. The rhizome contains a ketone called xeruminoe, which act against the bacteria and viruses.

### Planting

Depending on altitude and rainfall, planting is done from February and goes up to April. In Sikkim, early planted ginger results in high yield since they escapes from hailstorm. The rhizomes are planted in 2-3 rows in the beds and covered with soil. The spacing between rhizomes is kept at 15 cm. Farmers in Arunachal and Sikkim believed that high density planting would increase the rhizome yield hence go for 3-4 rows in a bed of 60 cm. During planting seed rhizomes are broken into pieces to ensure each piece has 2-4 sprouts. However, in Sikkim whole rhizome is planted without breaking it which increases the recovery of mother rhizome yield called *mau* extraction. Intercropping of maize, French bean, chillies and tapioca with ginger is common in NER. Generally, intercrops like maize are planted in channels in between raised beds. When ginger is intercropped with other crops inter-row distance is generally kept at wide (60-90 cm). In Meghalaya, ginger is intercropped in thinned pine plantation. In Sikkim, ginger is intercropped in Mandarin as well and under the shades of bamboo. High rainfall from June to September favours heavy weed growth. After a month, the beds are weeded and disposed off.

### Mulching

Immediately after planting, beds are covered with mulches consisting of forest litters, straw, grasses and other plant residues up to 8-10 cm thickness. Mulching protect seedlings from rain, prevents weed growth, keeps soil soft and moist, and accelerates growth. In some places, mulches are prepared by putting grasses in cattle shed for few days so that it mixes with cattle urine and dung. The leaves of *chilaune* (*Schima wallichii*), *banmara* (*Eupatorium*) and *utis* (*Alnus nepalensis*) are preferred in Sikkim for

Table 1 — Indigenous ginger cultivars cultivated in NER

States	Indigenous ginger cultivars
Assam	<i>Bola ada</i> , <i>Moran ada</i> and <i>Jatia ada</i> ( <i>ada</i> = ginger)
Arunachal Pradesh	<i>Keki</i> and <i>Bazar</i> local
Manipur	<i>Naga shing</i> or <i>Banada</i> and <i>Thingpuri</i> ( <i>shing</i> = ginger)
Meghalaya	<i>Shing Bhoi</i> , <i>Shing Bhukir</i> , <i>Khasi</i> local and <i>Tura</i>
Mizoram	<i>Thinglaidum</i> , <i>Thingpuidum</i> , <i>Thingria</i> and <i>Jugijan</i> ( <i>thing</i> = ginger)
Nagaland	<i>Vichii</i> , <i>Nadia</i> and <i>Nagaland</i> local
Sikkim	<i>Bhaise</i> , <i>Gorubathane</i> , <i>Jorethange</i> , <i>Nangrey</i> and <i>Majhauley</i>
Tripura	Non-descript local

mulching while the pine and *Parkia* leaves are preferred in Meghalaya. Farmers believed that mulching would increase germination; reduce weed growth and soft rot<sup>5</sup>. In few places, the residues of cruciferous crops like mustard, cabbage and cauliflower are incorporated in soil before planting to provide disease suppressive effects.

### Removal of mother rhizome

Mother rhizome removal, called *mau* extraction is an age old practice in Sikkim and Darjeeling<sup>6</sup>. Almost all the farmers in Sikkim and Darjeeling adopt higher seed rate, i.e. 2-2.5 t of rhizome as against the normal rate of 1.5 t/ha. By the end of May or June, i.e. when ginger crop attains 60 days age or 3-4 leaves, farmers remove mother rhizome, leaving the sprouted piece of rhizome in the soil. The removed *mau* is sold in local market. Almost 10 q of *mau* are removed per hectare. This is a reason behind for planting large sized mother rhizome or high seed rate. This practice is believed to give proper space to the developing rhizome and although the quality of rhizome is inferior farmers get income due to off-season price advantage (this income is important, as it solves financial problems during the rainy season). Fifteen days after *mau* extraction, FYM is applied once again and earthed up.

### Indigenous plant protection practices

The root and rhizome diseases, particularly the bacterial wilt (*Ralstonia solanacearum*), soft rot (*Phythium aphanidermatum*) and yellow (Fungus *Fusarium-Pratylenchus* nematode complex) are the major diseases besides insect pests like white grub (*Holotrichia*) and shoot borer (*Dichocrocis punctiferalis*). The farmers in this region have been following various indigenous pest and disease management practices. In Mizoram, the *jhumias* plant rhizome next day after burning the field so as to avoid soil born insect damage. The adult beetles of white grub (*Kumlay kheera* in Nepali) after emergence settle on trees like *Ficus hookerii*. Farmers collect and destroy them. The use unrotton cow dung is avoided in white grub prone areas as it carries the eggs. Some *Lepcha* farmers of Sikkim removed the mud from bottom of diseased plants to expose the roots to the sun. This practice was found to reduce disease (soft rot and wilt) spread<sup>7</sup>. In West Sikkim and Manipur, rotten plant roots are scratched and ash is applied to ginger field for vigorous growth. Ginger planted in red soil of Assam was found to have less incidence of

soft rot and storage rot. In Sikkim, planting *bikphul* (*Gloriosa suberba*) in ginger field could result in a disease free ginger crop, although it was not validated in the subsequent year<sup>7</sup>. Some farmers in Nagaland and Sikkim planted ginger on rocky soil or under the shade to reduce rhizome diseases. The *Galo-Adi* tribe of Arunachal Pradesh performs a ritual called *Ampu-Yolu* to protect the crops from pests and diseases. In Sikkim, some farmers who use the farm saved seeds for planting change seed source every 2-3 yrs to reduce the carry over of seed borne inoculum. Farmers of Sikkim also believe that intercropping maize with ginger would increase the incidence of ginger yellow but the pathogenecity and cross infection studies from maize to ginger and *vice versa* revealed that maize could not be a major source of infection<sup>4</sup>.

### Harvest

Ginger attains harvest maturity in 8-9 months hence, peak harvest starts from November and extent till January. Harvest is done as per market demand but some farmers do not harvest the entire crop but leave a portion *in situ* for seed purpose till February-March. The tender rhizome, called green ginger, is harvested in six month, i.e. before the rhizome attains fiber maturity and it is used in pickles, candy preparation or household uses. On an average 5-8 t of rhizome is harvested from a hectare, i.e. 4-5 fold increase of seed rate (1 : 4 or 1 : 5 ratio). Rhizome yield up to 13.5 t/ha was reported from Nagaland and 27 t/ha from Mizoram, Arunachal Pradesh and Sikkim. A progressive farmer is getting a gross return somewhere between Rs 25,000 to 30,000/ha. In *jhum* land, the proportion of ginger to other crops is generally 1/10<sup>th</sup> of a hectare and the reported yield was 1 ton<sup>3</sup>. Small and marginal farmers sell ginger without any processing.

### Crop rotation

Most of the farmers practice crop rotation. The cycle of rotation is varied from 2-4 yrs but it is highly influenced by size of land holding and market price of ginger. Paddy, potato and mustard are grown in rotation. However, few farmers grow ginger in the same area continuously because of land paucity.

### Storage

There are three traditional methods of seed rhizome storage found in NER. They are storage in soil pits, storage in a dry and shaded place, and *in situ* storage.

By *in situ* storage (delayed harvest), farmers harvest the rhizome according to market demand and allow the rest of rhizomes remain unearthed in the field. This method is prone for rhizome rot, rhizomes start sprouting in course of time and harbour insect pests<sup>8</sup>. In pit storage, either a circular or rectangular pit (1-2 m depth) is dug. A thin layer of straw is spread over the bottom of pit and rhizomes are placed into this in layers just below ground level. Again a thin layer of straw covers the rhizomes. The final covering is done with the soil little above the ground level (as roof). In Mizoram, instead of straw banana leaves are used. The pits are opened at the time of next year sowing. In this method, the rhizomes get spoiled in two ways, i.e., around 25-30% rhizomes rot in the pit itself and about 10-15% rhizomes sprout in the pit and are rendered useless for sowing<sup>9</sup>. Some farmers in Meghalaya opined that ginger stored in pits along with sand protect the ginger from rotting. In Central Pandam of Sikkim, some farmers select disease free and vigorous plants for next year seed and harvest them 10-15 days before harvesting bulk rhizome, store them in dry and shady places. Pit storage method is the best for small farmers, but expensive and laborious for large scale growers. Storage in dry, shaded places is economic for the larger growers but there is a problem of rhizome drying<sup>10</sup>. In Mizoram, the seed rhizomes are stored along with the leaves of local neem.

#### **Prospects for organic ginger in traditional farming system of NER**

The consumption of inorganic fertilizers (31.54 kg/ha) and pesticides (62 MT) is very low in NER except in Manipur where fertilizer consumption (135.18 kg/ha) is above the national average (84.82 kg/ha). In *jhum* and *bun* systems, no inorganic fertilizers and pesticides are used. Fertilizer consumption is insignificant in Nagaland (1.86 kg/ha), Arunachal Pradesh (2.84 kg/ha) and Sikkim (10.33 kg/ha). The consumption of pesticides is very low in Sikkim, Meghalaya, Nagaland and Arunachal Pradesh (20-40 gm/ha). Therefore, the traditional agricultural system of NER is by and large, organic by default. Farmers are increasingly taking up organic ginger cultivation on commercial scale. In 2003, Sikkim was declared as organic State. Organic ginger is now grown in Assam, Sikkim, Meghalaya, Manipur, Mizoram and Nagaland. In Karbi Anglong district of Assam, nearly 5,000 farmers cultivate

ginger. The ginger grower's cooperative marketing federation limited (GINFED) was established at Karbi Anglong to promote cultivation and export of organic ginger. The Government of Sikkim is promoting organic ginger cultivation. In 2007, about 115 registered farmers have raised organic ginger. Manipur produce large quantities of ginger suitable for processing into dry ginger, oil and oleoresin. A ready to serve drinks, known as ginger lime (ginger and lime mixed in 1 : 3) has a good potential and demand in Manipur and outside. The Destitute Women's Upliftment Society (DWUS) and the Agency for Integral Development Action (AIDA) are promoting organic ginger cultivation in Manipur and Nagaland, respectively.

#### **Gender roles in ginger cultivation**

Men and women do almost all works from land preparation to seed storage. However, their role depend more on the family situation than on gender or ethnicity. In a family with more male members, male works in the fields, whereas in families with fewer men, women work equally with men. Purchasing of seed is generally done by men. Men do the ploughing while men and women do the hoeing and digging. Sowing, planting, manure application, harvesting is done by both men and women. Mulching is done mostly by men, although women help as when required. Weeding is done by women. In Sikkim, mother rhizome extraction is done by women but its sale is looked after by men. In Meghalaya, Mizoram and Nagaland, women play a significant role in retail selling of ginger.

#### **Conclusion**

Sustainability in agricultural production largely depends on proper development, conservation and use of natural resources at the micro level. Over the last few years, rhizome diseases have affected the crop in many States of NER resulting in a decline of rhizome yield from 1 : 8 ratio (seed rhizome to harvested rhizomes) to 1:4. According to a survey report, more than 60% farmers in Sikkim feel that wilt and soft rot were the major limiting factors in ginger cultivation<sup>4</sup>. In Assam, 30% yield loss was reported due to rhizome rot. Wilt and soft rot are the threatening diseases in other states. In the traditional agricultural system as well as in organic farming, managing rhizome diseases is a greater challenge to marginal and tribal farmers. Many farmers have given up

ginger cultivation and others are still struggling to survive because of rhizome diseases and absence of alternative income generating crops. These issues have to be addressed so that the productivity in the age-old traditional farming system could be sustained at optimum level.

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