Package of Organic Practices from Assam, Manipur, Meghalaya and Nagaland for Ginger

Ginger (Zingiber officinale Rosc.) is an important member of the Zingiberaceae family.

Climate

Ginger is a tropical crop and is cultivated from sea level to altitudes of about 1500 m ASL. However, the optimum elevation for its successful cultivation is in the range of 300–900 m ASL. Moderate rainfall at sowing time till the rhizomes sprout, followed by fairly heavy and well-distributed showers during the growing period and dry weather about one month before harvesting are optimum requirements for its successful cultivation. Farmers of the northeastern region generally prefer to grow the ginger crop in moderate to high altitudes, where shifting cultivation or jhum has been carried out.

Growing season

The planting season for ginger is from March–April, with the onset of the monsoon.

Soil

A rich soil with good drainage and aeration is ideal for ginger cultivation. Ginger grows well in sandy or clayey loam, red loam and lateritic loam soils. Effective drainage is absolutely necessary for the prevention of disease. Ginger should not be grown on the same site, year after year.

Crop duration

The crop duration is generally around 9-10 months (March/April to December/January/February). Ginger starts flowering during the month of June–July along with the showers or rains.

Cropping system and pat tern

Different types of cropping systems are followed for ginger cultivation in the region. Generally farmers prefer mono cropping of ginger. However, they also practise mixed cropping with maize, chili, brinjal, papaya, cucumber, pumpkin, yam, tree tomato, tapioca and different types of leguminous crops in jhum. Sometimes they intercrop ginger with maize and pineapple.

Biodiversity management

Cultivation of different types of vegetable crops, besides supporting a wide range of beneficial insects and soil micro-organisms, also helps in soil and water conservation, improves soil fertility and generates better income for farmers. Rather than monocropping, intercropping or mixed cropping of ginger in the hill areas of northeast India facilitates conservation and management of crop biodiversity.

The most common types of crops grown along with ginger in NER are both annuals and perennials, which include chili (Capsicum annum), brinjal (Solanum melongena), pumpkin (Citrullus lanatus), cucumber (Cucumis sativus), papaya (Carica papaya), maize (Zea mays), pineapple (Ananas cosmosus), banana (Musa spp), winter squash (Cucurbita

maxima), pigeon pea (Cajanus cajan), castor (Ricinus commusis), tapioca (Manihot esculenta), kidney bean (Phaseolus aconitifolius), cluster bean (Cyamopsis psoraloides), french bean (Phaseolus vulgaris), etc.

Maintenance of buffer zone for organic cultivation

In order to cultivate ginger organically, a buffer zone of 5–10 m should be left all around to separate the plot from conventional farms. The produce from this buffer zone should not be treated as organic. Being an annual crop, the conversion period required will be two years. Ginger can be cultivated organically as an inter crop or mixed crop provided all the other crops are grown following organic methods. It is desirable to include a leguminous crop in rotation with ginger. Ginger-banana-legume or ginger-vegetable legume combinations are recommended as good cropping patterns.

Traditional varieties and their importance

Traditional varieties are more pungent and hence have a better market than other varieties. Since the majority of the population in the hilly areas of the northeastern region is non-vegetarian, ginger finds itself used in different culinary preparations. The farmers mostly prefer local varieties as these have less chance of being infected by pests and disease, and can be stored for a longer period (maximum for one week) as compared to high yielding varieties (maximum for 2–3 days). However, higher pungency status of the local varieties indicates higher oleoresin (gingerol) content, which is suitable for industrial extraction.

Varieties called Rio-de Janeiro and Nadia are popular among growers. Besides these, most of the states have their own local or traditional varieties. In the NER, different types of local and hybrid varieties are available, viz., Nadia, Moran, Thingpui, Thinglaidum, Karkai, Tura, Jate, Nadia, Rio-de-Janeiro, Suprabha, Poona, Varada, China, etc.

Seed Selection

Carefully preserved seed rhizomes, free from pests and disease, collected from organically cultivated farms should be used for planting. However, to begin with, seed material from high yielding local varieties may be used in the absence of organically produced material. Seed rhizomes should not be treated with any chemicals. The seed quantity required varies from region to region and with the method of cultivation adopted. However, the average is 1500– 2500 kg per ha. The weight of the seed rhizomes is approx. 25–30 gm and 4–5 cm length in size.

Treatment

Generally, no treatment of the seed is done. However, the farmers of Nagaland keep the seed rhizomes in the sun for a period of 20–30 days before planting, while in Meghalaya, they are kept in the sun for only a day. Rhizome sets should be treated with cow dung and urine preparation such as amrut pani / jeevamrut /panchagavya / cow pat pit, etc.

Cultivation

While preparing the land, minimum tillage operations may be adopted. Beds of 15 cm height, 1 m width and of convenient length may be prepared, giving 50 cm spacing

between beds. Solarisation of beds is beneficial for checking the multiplication of pests and disease-causing organisms. Solarisation is a technique by which polythene sheets are spread over moist field beds, covering all sides and being thus exposed to the sun for a period of 20–30 days. The polythene sheets used for soil solarisation should be stored safely once the work is completed.

Sowing methods (if directly sown)

At the time of planting, apply 25 gm powdered neem cake and mix well with the soil in each pit at a spacing of 20–25 cm within and between rows. Seed rhizomes may be put in shallow pits and mixed well with decomposed cattle manure or compost mixed with Trichoderma (10 gm compost inoculated with Trichoderma). However, in the northeastern region, ginger is planted directly in the main field. Seed rhizomes are planted randomly in shallow pits of 5 cm depth and at a plant-to-plant spacing of 15 cm (approximately) in the hill districts of Assam. In Meghalaya and Nagaland, about 45 cm distance is maintained between the rhizomes that are covered with soil (1–1. inches) and smoothed over by hand.

In mixed cropping, seeds of chili, brinjal, papaya, pumpkin, etc., are mixed and broadcast in the ginger planted field in Assam and Meghalaya; whereas in Nagaland, a nursery is prepared for chili, brinjal, tomato, papaya, etc., and these crops are transplanted in between the furrows of the ginger crop. The crops most commonly rotated with ginger in Kerala are tapioca, chili, rice, ragi, groundnut and maize. Ginger is also grown as a mixed crop and as an intercrop in coconut and arecanut gardens.

After site selection, the jungle is cut and burnt during the months of November to January, followed by burning of the felled trees one month later (February–March). Then the unburned debris is removed from the field. The rhizomes are then planted after a few days. The planting techniques vary from state to state in the NER. In some districts of Meghalaya, terraces are constructed. In Assam, khurpi is used for digging shallow pits of 5 cm depth with approximately 15 cm plant-to-plant spacing. In Meghalaya, bunds are constructed and the bund is broken into blocks in a zigzag manner in order to prevent soil erosion. In Nagaland, a naga kur (spade) is used for making furrows at a distance of 1–2 ft in monocropping and 2–3 ft for mixed cropping. The distance between the rhizomes is 20–25 cm and rhizomes are planted at a depth of 7–10 cm.

Managing soil fertility

Mulching the ginger beds with green leaves is an essential operation to enhance germination of seed rhizomes and prevent the soil from washing off due to heavy rains. It also helps to add organic mater to the soil and conserve moisture during the later part of the cropping season.

The first mulching with green leaves @ 10–12 t/ha is at the time of planting. It is repeated @ 5 t/ha 40 and 90 days after planting. Use of Lantana camara and Vitex negundo as mulch may reduce the infection of shoot borer. Cow dung slurry or liquid manure may be poured on the bed after each mulching to enhance microbial activity and nutrient availability.

For the management of soil fertility, the farmers mostly incorporate leguminous crops like pigeon pea, black gram, cowpea, cluster bean and french bean as green manure crops. Besides improving soil fertility, these are income-generating crops and have a good market demand. Some farmers use wood ash in the field as this increases the potash content of the soil. In Meghalaya, compost or cattle manure is used to enrich soil fertility.

Nutrients

Ginger is a nutrient-exhausting crop but in general, inorganic fertilisers are not used. Therefore, intercropping of ginger with leguminous crops, crop rotation and use of cattle manure are practised in order to replace the nutrients exhausted by the previous crop. Application of well-decomposed cow dung or compost @ 5–6 t/ha may be applied as a basal dose while planting the rhizomes in the pits. An additional application of neem cake @ 2 t/ ha is desirable.

Generally in the northern region ginger cultivation is mostly on freshly prepared land, where adequate nutrients are already available. Addition of cattle manure before plantation is not very popular, though it is advisable in order to enhance the yield.

Water requirements

Generally in the northeastern region the source of water is from seasonal rainfall, rivers and natural perennial streams. Since the source of water is from seasonal rainfall and perennial streams, the assessment of water quality may be carried out as per the norms and guidelines of permitted organic package of practices.

Requirement

Moderate rainfall is required at the time of sowing till the rhizomes sprout; fairly heavy and well-distributed showers during the growing period; and dry weather for about a month before harvesting. A proper drainage channel in between the bunds to drain off stagnant water is advisable to ensure optimum drainage for better plant stand. Mulching of ginger beds helps in soil and water conservation. The first mulching is done at the time of planting with 12.5 tonnes of green leaves/ha and the second is done after 40 days with five tonnes of green leaves/ha.

Conservation techniques

Mulching conserves soil moisture by checking evaporation loss. Bunds are constructed to prevent soil erosion and to retain the topsoil and proper drainage channels are provided to drain off stagnant water. Seasonal legumes are also grown along with ginger to suppress weed growth, minimize soil erosion and enhance soil fertility.

Problem – Insects and diseases

Shoot borer, leaf roller and rhizome scales are the major pests that infest ginger. Soft rot, bacterial wilt and leaf spot are the major diseases affecting ginger. Regular field surveillance and adaptation of phyto-sanitary measures are necessary for pest management. Major pests and diseases found in ginger crop are:

Shoot borer (Conogethes punctiferalis /Dicrhosis punctiferalis

Life cycle description

Shoot borer (Conogethes punctiferalis) in ginger plant

The moths lay eggs on leaves and other soft parts of the plant. The eggs hatch in about a week. The larvae pass through 4–5 instars and are full fledged in 2–3 weeks. Pupation takes place inside the seed or sometimes in the grass that collects after feeding. The pupal stage lasts about one week. The life cycle is completed in 4–5 weeks and three generations are completed in a year. The pest is most active from July to October.

Marks of identification

The full-grown caterpillar measures 25–30 mm in length and is reddish brown with black blotches all over the body and a pale stripe on the lateral side. The moths are orange yellow, with black markings on both wings.

The damage is caused by the caterpillar – which bores into the main stem of the young plants causing their death.

Economic threshold level

Management methods should be adopted at a stage when there is 1 egg mass per square meter.

Management

The shoots infested by the borer are cut open and the caterpillars are handpicked and destroyed. Some farmers grow neem trees along with ginger crops to repel the pest.

Do's and Don'ts in ginger IPM

Do's	Don'ts
Grow only recommended / tested varieties.	Don't grow varieties unsuitable for the season or region.
Seed rhizomes should be free from any infection or infestation. Biocides like Trichoderma may be used while planting seed rhizome.	Don't treat the seed rhizomes with any chemicals.
Remove weeds by hand weeding before each mulch and biofertiliser application.	Don't forget weeding before mulching and biofertiliser application.
Use biofertiliser as per soil test recommendation.	Don't mix micronutrients with biofertilisers and incorporate in the soil.
Proper drainage facilities must be provided to drain off stagnant water. Best choice of land should be with a gentle slope. Gently sloping land is best.	Don't allow water to be stagnant. Don't select flat land for cultivation of ginger to avoid water stagnation.
Visit the field periodically to check for pests or disease.	Don't use chemical pesticides.
Install light traps for collecting and monitoring shoot borer adult moths, if such infestation is observed.	Don't use insecticides.

Other insect pests

These include the rhizome fly (Mimegralla coeruliforns), white grub (Holotrichia setticolis), skipper (Udaspis folus) and scale (Aspidiotus garlic). Tilling of the soil during land preparation and solarisation are good practices that can reduce the chances of insect pests, particularly in controlling white grubs which get exposed at the time of tilling and are foraged by the birds. Light traps are helpful to control the adult population of insects. Mechanical collection of infected leaves and white grub adults is also practised. However, there is no intensity of insect pest attacks in the hill regions of NER. Suggested biological controls include application of Trichodema sp. At the time of planting, application of Lantana camara as mulch reduces infestation by shoot borer. Conservation of hedgerows around the ginger plantation also helps to maintain a population of ladybirds, spiders, etc., which are good natural bioagents for control of many of the insect pests.

Soft rot or rhizome rot

Soft rot is caused by Pythium aphanidermatum and Pythium myriotylum.

Ginger plant infected by Pythium spp

Life cycle

Two species of Pythium, viz., P. aphanidermatum and P. myriotylum are chiefly responsible for rhizome rot in ginger. The fungus Pythium can survive in two ways: (a) in diseased rhizomes kept for seed, and (b) through resting structures like chlamydospores and oospores that reach the soil from infected rhizomes. Soft rot fungi are soil dwellers and can live with soilsaprophytic allies in the absence of their host. A high temperature above 30°C and high soil moisture are the important predisposing factors favouring the disease. Hence, waterlogging in the field due to poor drainage increases the intensity of the disease. This disease mostly occurs during the months of June and July.

Symptoms and damage pattern

In the beginning, the leaves of the infected plants turn pale green. The top leaves become yellow. Gradually, yellowing of the leaf blade and leaf sheaths progresses downwards along the margin. Hence the leaf margins turn yellow while the centre remains green for a few days. After the leaves are completely yellowed, withered and dry, the dead area extends towards the leaf sheath. The dead leaves droop and hang down on the stem till the whole shoot dries. The junction of the plant and rhizomes on the soil surface turns pale translucent brown. Later, this junction becomes watery and soft. Such infected plants do not fall to the ground, but the shoot can be easily pulled out. Soft rot extends to the rhizomes from the collar region. Gradually the rhizomes decompose and form a decaying mass enclosed by the tough rind. Soft and rotten roots are found on the decayed rhizomes. The decayed rhizomes exhibit a very unpleasant odour.

Management

- Planting of disease-free seed rhizomes.
- Providing adequate drainage.
- Burning of diseased plants.
- Removing the affected clumps along with the soil.

Ginger growers in the hill districts of Assam believe that ginger is less prone to infection in bamboo growing areas and also give higher yields when grown in such areas.

Bacterial wilt

Bacterial wilt is caused by Ralstonia solanacearum/Pseudomonas solanacearum.

Bacterial wilt by Ralstonia

Life cycle

The bacteria are spread through soil, water, infected or contaminated rhizomes. The bacteria enter the plant through wounds made in the roots during transplanting, through cultivating equipment, nematodes and insects. They can also enter through the natural cracks from where secondary roots develop. The bacteria reach the xylem vessels and through them spread throughout the plant. Along the vessels they escape into the intercellular spaces of the parenchyma cells in the cortex and pith, damage the cell walls, and create cavities filled with slimy masses of bacteria.

Symptoms

Infected young plants die rapidly. In older plants there is leaf drooping and then discolouration. The plants exhibit one-sided wilting and stunting before they wilt permanently and die. Sometimes, development of adventitious roots increases. Vascular tissues of the stems and roots turn brown.

Damage pattern

The pathogen is soil-borne and it invades the root system and colonises most of the vascular elements, dramatically limiting the water uptake thereby resulting in rapid wilting and death of the plant.

Management

• Crop rotation with maize, cotton, soybean.
• Planting of disease-free seed rhizome.

Other diseases

Other diseases include leaf spot (Phullosticta zingiberi), sheath blight/leaf blight (Rhizoctonia solani), dry rot (Fusarium oxysporium), etc. A good drainage arrangements effectively reduces the occurrence of these diseases. Affected plants are generally removed mechanically by farmers and burned. However, in the case study areas, these diseases were reported to be uncommon.

Animal and rodent pests

In some areas, rodents damage the ginger crop by making holes in the ginger fields. Sometimes, monkeys, buffaloes, wild boar and other grazing animals also destroy the ginger cultivation by grazing or trampling over it.

Management

• Traps are used to catch and kill rodents.
• In the hill districts of Assam, ginger growers prefer to cultivate ginger in sloping and steep areas, as the crop will be protected from grazing animals and rodent pests.
• In the hills of Northeast India, the experience is that intercropping ginger with paddy or other crops reduces or lessens pest attacks.

Beneficial insects

Planting a variety of vegetable crops supports a wider range of beneficial insects, soil microorganisms and other factors that add to the overall healthy growth of the crop and result in higher yield. Natural predator insects and animals feed on the shoot borer, thus reducing the pest population. Birds are particularly beneficial as they feed on insect pests and grubs.

Post Harvest Management

The crop is ready to harvest in about eight to ten months depending upon the maturity of the variety. When fully mature, the leaves turn yellow and start drying up gradually. Clumps are lifted carefully with a spade or digging fork and rhizomes are separated from dried leaves, roots and adhering soil. The harvested mother rhizomes are separated from the remaining clumps. In the hill districts of Assam, particularly in the North Cachar hill district, farmers keep ginger un-harvested for 2–3 years and the weight of ginger also increases (one bunch of ginger may weigh 300–400 gm after three years). During the dry season the weight of ginger is slightly less, but when harvested during off-season (April–May) with a small shower of rain, the weight increases. The average yield of fresh ginger varies from 20–30 t/ha depending upon the variety.

Cleaning

Cleaning of harvested ginger is usually done by hand. After the soil particles are removed and the mother rhizomes separated, the harvested ginger is kept in the sun for drying from a few hours to a day. The duration of drying varies from area to area depending upon the availability of sunlight.

Drying

Generally the farmers of the northeastern region keep the harvested rhizomes in the sun for 2–3 hours (hill districts of Assam) or for a day (Meghalaya) on an average. The harvested ginger is kept on raised wooden/bamboo platforms inside the shed, either for seed or for sale.

Packaging

Cleaned or dried ginger is kept in gunny bags. In hill areas, many of the farmers also carry the ginger in baskets or store the ginger in bamboo baskets lined with dried banana leaves for transportation.

Storage

No storage godown treatment is followed as the ginger is sold within a short span of time (one week). In Meghalaya and the hill district of Assam, the harvested ginger is kept in pits with layers of sand in between. Dry leaves or green leaves are used to protect the ginger from sunlight or rain. Thatched huts are also constructed to protect ginger from rain and sunlight.

The rhizomes to be used as seed material should be preserved carefully. The indigenous practice is to spread layers of leaves of Glycosmis pentaphylla with the seed material. In order to get good germination, the seed rhizomes are stored properly in pits in the shade.

Healthy and disease-free clumps are marked in the field when the crop is 6–8 months old and still green. Seed rhizomes are stored in pits of convenient size made inside the shed and protected from the sun and rain. The walls of the pits may be coated with cow dung paste. Seed rhizomes are stored in layers along with well dried sand/saw dust. Sufficient gap is to be left at the top of the pits for adequate aeration. The pits need inspection once in twenty days to remove shrivelled and disease affected rhizomes. In some areas, the rhizomes are loosely heaped over a layer of sand or paddy husk placed in a thatched shed and covered with dry leaves.

Traditional storage stacking method of ginger in Meghalaya

Storage pests

Generally no pest management practices are adopted during the storage of ginger as storage periods are generally short. The only care taken is that the storage area should not be damp or wet.

Source: Prepared by North Eastern Region Community Resource Management Project (NERCORMP) for Upland Areas (IFAD & GOI/DoNER/NEC), Shillong