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TOWARDS BETTER TRADE OPPORTUNITIES FOR FEMALE FARMERS IN MYANMAR:

A GUIDEBOOK TO IMPROVE AGRICULTURAL PRACTICES, FOOD SAFETY, AND ACCESS TO CREDIT

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INTRODUCTION

This guidebook aims to provide women farmers in Myanmar with practical information and good practices in the agricultural value chains of tea, ginger, and avocado. It also aims to provide specific tips and practical guidelines for farmers on food safety, access to finance, and business management. It follows upon UNCTAD's study "A gender assessment of Myanmar and of the Inle Lake area with a focus on the agriculture and tourism sectors", analysing the three selected agricultural value chains – tea, ginger, and avocado – in Southern Shan (UNCTAD 2020).

Myanmar's population lives primarily in rural areas (70 percent of total population), and relies on crop, husbandry, and livestock to make a living. Farmers view agriculture as a traditional activity rather than a business in Myanmar. Coupled with the many supply-side obstacles, this perception is a major obstacle in front of developing a modern agricultural sector. Low productivity, inequality, and high price volatility are the main characteristics of the agricultural sector in Myanmar. Agriculture plays a key role in Shan State and agricultural activities revolve around the family unit, in which gender roles are embedded.

A gendered division of labour is common to all three agricultural value chains. Men are mainly involved in tasks related to preparation of soil and ploughing. Women are mostly involved in tasks such as planting, weeding, transplanting, harvesting, threshing, postharvest work, and marketing (SDC, 2018). Most women farmers in the Inle Lake area sell their products to traders or processors, and rarely to enterprises. Ginger and avocado are rather new commercial crops in the Inle Lake area while tea has been produced and marketed there for a very long time. Women in the Inle Lake area are involved in producing one or more the three selected products, and often grow them along with other fruits and vegetables.

Tea has been used in Burmese Cultural Events for many years. It is a cherished food that is indispensable in daily meals. In Myanmar, tea leaves are drunk as dry tea (sweet and bitter), and wet tea leaves are fermented and eaten as tea salad. The origin of tea tree is China, and it is an evergreen tree throughout the year. There are generally two types: the Chinese variety (Camellia sinensis) and the Assam variety (Camellia assamica). Myanmar tea varieties were first found in Northern Myanmar, and it is believed that Camellia sinensis (the Chinese variety) originated from Myanmar and Yunnan and the Sichuan Province of China. However, most Assam tea varieties are found in Myanmar. Shan State is the most tea-growing region, accounting for about 80 percent of the country's total acres.

Ginger can be grown throughout Myanmar; however, it is mostly cultivated in the Southern Shan State. Pinlaung and Kalaw townships have most of the ginger growing areas in the Southern Shan State regions. Ginger produced from these two townships is traded to Aungban, and then to the Yangon, Sittwe, Mandalay and other markets. The

quality is slightly different depending on whether it is grown in hilly areas or plain areas. The ginger from the Kalaw area is regarded as tough, tight and has a stronger pungency. The ginger from the plains is large, fleshy and has less pungency. Myanmar's ginger cultivation area is about 17,800 acres, and the production is 71100 tons (43500000 visses) annually. Farmers use the pieces or portions of rhizome from the previous crop as seeds of ginger for next season's cultivation purposes.

Dr. William Hacket from the American Baptist Missionary Society came after 1950 and started planting warm temperate avocado varieties brought from America in Shan State, and then it was spread in the mountainous regions of Myanmar. Currently, avocados are cultivated in tropical and sub-tropical hilly regions such as Shan, Kachin, Chin and Kayah. Avocados are cross-pollinated plants; hence, thousands of different cultivars can be found in the country. However, it is worth noting that the Mexican and Guatemalan varieties and their hybrids grow well only in cool and hilly regions. There are many different varieties of avocados in Myanmar such as Kyaut Tan, Kalaw, Mae Ne Taung, Hti Wah, and Pone Swe.

Avocado trees are grouped into type A and Type B depending on their flower types and ripening times. Understanding these two groups remain crucial in avocado farming both for the quality and quantity of output. Generally, planting a mixture of type A and B avocados results in higher yields and better-quality fruits than when each type is exclusively cultivated. Examples of type A type avocado varieties include Hass, Mexicola, and Stewart while type B varieties include Bacon, Zutano, and Buccanaer. There was less commercial cultivation of avocados in Myanmar. However, after 2015, the avocados are cultivated commercially following increased demand in the neighbouring countries, particularly China and Thailand. Until 2017, avocado trees were grown only from seeds in Myanmar.

Table 1 presents the characteristics of different varieties of tea, ginger, and avocado planted in Myanmar.

Table 1.
Product varieties for tea, ginger, and avocado

TEA	GINGER	AVOCADO
Chinese Variety:	Burmese ginger (Blue ring)	Fuerte variety
• The leaves are small and erect. • The vertical angle of the leaf is narrower than 50 degrees. • Bush-like stems are cold resistant and can survive for at least 100 years.	• It is medium in size and has well spread fingers. • It has low fibre and water content. • It has medium pungency and is preferred by processors for making dried ginger because it gives a higher percentage of dried ginger yield.  Blue ring ginger	• It is a hybrid of American and Guatemalan varieties and is very cold tolerant. • It has strong and broad leaves, and if the leaves are crushed and smelled, they smell like bay leaves. • They are a member of the “Type B” avocado group. • The neck of the fruit is medium-sized, the weight is 170-500 grammes, and the fruit peel is green. • The seeds are medium to large and have a pointed tip. • The pulp content of the fruit is 75-77 percent. • The skin colour is pale yellow. • The avocado fruit can be kept on the plant for a long time without ripening, but it ripens fast after harvest.

Assam Variety:

- The leaves are flat and broad.
- The young plants are assumed to have originally grown in forests.
- The vertical angle of the leaf is wider than 70 degrees.
- It has a single stem and grows at a height of 6-18 meters.
- It has many varieties and can survive up to 40 years with regular pruning and plucking.

Chinese (yellow ring) ginger

- It is preferred by fresh ginger traders as it is less pungent and has a high-water content.
- The rhizome is large and has a pale-yellow colour.

Yellow ring ginger

Shan (pink) ginger

- It is a small and wild type of ginger.
- It is used for making traditional medicine and beverages.

Pink ring ginger

Haas (California) variety

- It is the world's most famous avocado variety, and the quality is better than "Fuerte".
- It constitutes 90 percent of the avocado exports in Myanmar and are naturally grown from seeds.
- The plant size is medium to large.
- It is a "Type A" plant, and the shape of the fruit is oval, however, the fruit shape can change depending on the cultivation method.
- It tends to become pear-shaped.
- Fruit size is small to medium, 140 - 400 grammes, with an average of 250 - 350 grammes.
- The peel is thick and tough.
- The fruit colour is dark green on the plant and dark purple when ripe.
- The bulb is yellow and comprises 66-70 percent of the total fruit.
- The oil content contains 18-20 percent and can be kept on the plant for a long time.

SUPPLY-SIDE CONSTRAINTS FACED BY WOMEN FARMERS IN THE THREE VALUE CHAINS

UNCTAD carried out a survey with women farmers and producer associations in the Inle Lake region covering the three selected agricultural value chains. Associations cited inadequate skills (including entrepreneurial ones), time poverty, low level of literacy, lack of self-confidence, and gender stereotypes as the most serious problems impeding women's efforts to make their activities more sustainable. Table 2 gives an overview of the major supply-side constraints faced by women farmers in tea, ginger, and avocado value chains in the Inle Lake region as identified by UNCTAD (2020).

Table 2.
Key supply-side constraints faced by women farmers in the tea, avocado and gender value chains

Constraint	Characteristics
Access to extension services	• Most extension services (particularly involving the provision of inputs) are reserved for those who have their names on land titles (Land Use Certificates), therefore excluding most producers, and particularly women. • The extension services provided by the government largely fall short of demand. • Farmers' associations are still relatively new bodies with limited experience and presence. • Extension services tend to primarily reach men (Akter et al, 2017), and they generally do not take targeted approaches to include women, for example by considering time and mobility issues, even when the aim of the training is to integrate women. • Access to training is a bigger challenge for women farmers also because of the gender bias in the composition of field officers (i.e., few extension service jobs are available to women). • Training focused on gender sensitization and women's empowerment are largely absent in the delivery of extension services.

Access to inputs, technology, and information	• Issues with the cost and quality of seeds and other inputs and the high reliance on imports from China and Thailand are among the main barriers to improving farming techniques in the Inle Lake area (SDC, 2018; Burgess, 2017; ILO, 2019). • The lack of machinery and tools to increase production and process raw materials is one of the major difficulties identified by farmers of Southern Shan (SDC, 2018; ILO, 2019; Burgess, 2017). • Accessing information about technology remains challenging for women, as does identifying and getting in touch with technology providers as well as having the financial means to buy or rent new machines. • Access to information on production practices and on markets, as well as the identification of those who can provide reliable information, remain challenging for women. When seeking information on supplies and markets, women farmers tend to rely on traditional channels, mainly word of mouth.
Access to finance	• Accessing low interest- rate loans is critical for investment and business development as well as for reaching markets outside farmers' townships. Women are more likely than men to report borrowing money from family and friends, women self-help groups and NGOs, instead of from government agencies or village funds (SDC, 2018). • Microcredits made available by NGOs and the private sector are by far the most common form of financing for women farmers. • While micro-credit organizations provide loans at reasonable interest rates, the repayment periods are short. The loan's ceiling is too small to make serious investments – for instance, to purchase inputs such as high-quality seeds, fertilizers, and pesticides. • A proper land title is necessary to have access to credit through commercial banks and credit and rural cooperatives, resulting in non-farm rural households and female-headed household being de facto excluded.

GOOD PRACTICES IN MYANMAR'S AGRICULTURAL SECTOR AND THE THREE VALUE CHAINS

This section presents examples of good practices in different stages of agricultural production, from plant propagation to cultivation, harvesting and post-harvest handling in the tea, ginger, and avocado value chains. It also introduces practical guidelines and information on different issues concerning farmers including food safety, access to finance, and business management.

Climatic conditions and geography play an important role in the cultivation of tea, ginger, and avocado, and affect both the quality and yield of the produce. Table 3 below presents an overview of the required conditions of land and climate for tea, ginger, and avocado.

Table 3.
Land and climatic conditions for tea, ginger, and avocado

	TEA	GINGER	AVOCADO
Temperature	• Optimum temperature for growing tea plants is between 18°C and 35°C. • Plant growth is affected if the temperature is higher than 35°C and lower than 18°C.	• The basic temperature required for ginger growth is 13•C, and the optimum is 19 to 28 degrees Celsius. If the temperature is too high, it can cause the plant to get sunburned, and if the temperature is too low, the plant's ability to germinate can be stunted. • Ginger requires dry weather with a temperature of 28 to 35°C about a month before harvesting.	• It grows well in an average temperature of 18 to 26°C.
Humidity	• The optimum humidity for growing tea is 80 percent. • If the humidity is more than 80 percent, it will cause fungal diseases, and if it is less than 40 percent, it will not grow well. • The tea plant needs 120 to 280 cm of rainfall throughout the year.	• A humidity of 70 to 90 percent is required to grow ginger.	• The avocado tree likes high humidity. • It requires at least 750 millilitres of annual rainfall. • Moisture is mandatory in the soil at fruit formation time.

Shade	• Tea plants prefer shade and grow faster if they get shade.	• Ginger needs partial shade for better yield. • Ginger needs 30 percent shade, so it can be planted together with forest trees.	
Altitude	• The best quality tea can be obtained if it is cultivated at an altitude of 1,500 to 2,250 meters above sea level.	• In tropical regions, ginger can be grown up to 1,500 meters above sea level although the optimum is between 300 and 900 meters.	• The wild avocado tree grows at latitudes 8 to 24 N and at an altitude of 2,500 meters above sea level.
Soil	• The tea plants grow well in loamy soil with good drainage • They do not grow well in waterlogged areas as well as clay soil. • A soil pH of 4 - 5.5 is required for tea cultivation. • Alkaline soil is not recommended for tea cultivation as it can slow down plant growth and causes irregular flowering and fruiting time.	• Ginger should not be cultivated on the same lot as a continuous crop. • Before planting ginger, the land should be fallowed for at least 3 years. • The land should have no history of root rot disease infection and continuous ginger growing. • The same bacterial infection affecting ginger also affects potatoes, tomato, chili, eggplant, and cabbage. Therefore, avoid cultivating ginger on a field that was previously used for those crops unless the land must be burned for a long time under the sun.	• Avocado trees can be cultivated on a variety of soils except in very sticky soil, very sandy soils, and waterlogged soils. • The best soil for planting is loamy soil which is rich in natural compost. • The roots grow only in the topsoil and do not grow beyond the canopy, and thus they prefer having a lot of natural compost. • Heavy rain and waterlogged land can be difficult for commercial avocado farming in the long term. • Nutrient-rich and well-drained soil are the most suitable for planting avocado.

		• The avocado can grow in a pH range of 4.5 to 8.3. The optimum pH is 5 to 6.5.
Resistance	• Ginger is resistant to wind and drought but not resistant to water stagnation, snowing and salty conditions. • Ginger fields should therefore be well managed to prevent waterlogging during the rainy season. If it is waterlogged land, the ridges should be raised.	• As the avocado tree is not resistant to wind, the wind-break plants must be grown around the orchard. If there are large trees next to the avocado orchard, they should not be cut down.

A

PLANT PROPAGATION AND CARE

A. PLANT PROPAGATION AND CARE

TEA: How to propagate

The tea plant can be propagated from seeds as well as by vegetative propagation.

1. Seed Propagation

If the tea plant is propagated from seed, it can be genetically different from the mother plant. It can stimulate the growth of taproots, resulting in a stronger root system. As a perennial plant, good quality tea leaves can be plucked from 5 years old.

To propagate tea seeds, select a nursery site with a flat surface. The nursery should be as near as possible to the planting site for easy transportation. In addition, it must be close to a permanent source of water suitable for irrigation throughout the year. It should not be snowy and windy areas.

To obtain good quality seeds, the healthy mother plant with the desired qualities must be kept by applying nutrients and water. In addition, the mother plant must not be pruned. Young tea leaf plucking should be done only once in April (Shwephi). The flowers that bloomed in June and July transform into fruits. Tea fruits become mature about 100 days after pollination of the flowers. Although tea fruits reach the ripening stage from mid-October to early December, they should be harvested only when the seed coat colour changes from dark green to brown. The seeds' coat must be black when peeled.
To select good quality seeds, soak 1kg of seeds in 5liters of water for 24 hours. Only seeds that are submerged in water should be germinated because floating seeds are of poor quality. Better quality tea fruits are generally single-seeded and have a shiny dark coat colour. The dormancy period of tea fruit is 1 and a half months and should be germinated within 3 weeks after picking. If the seed is germinated later than that, the shoots will not emerge.

- **Step 1: Preparation of Germinating (Cracking) Beds**

  The size of the cracking bed should be 3 feet wide; 7 inches in height and the length depending on the land condition/availability and the intended production quantity of seedlings. Add 4 inches of soil to the 7 inches height of the germinating bed and enough water thoroughly, spread 3 inches of sand evenly on top of the soil, and then slowly add water again. The preparation of the cracking bed must be completed in November.

- **Step 2: Germination**

  Dip the selected tea seeds upside down into the prepared germinating bed, and buried three-quarters in the sand, with 0.5-inch plant spacing and 1-inch row spacing. After planting, it is important to moisten the germination bed slowly and thoroughly. Maintaining the temperature range of 21-24°C and moisture (20-30 percent) will

speed up seed cracking. Therefore, the cracking bed should be covered with a 400-gauge plastic sheet at a height of 1 and a half feet, and the bottom of the plastic sheet should be covered in airtight condition. If plastic is not available, a straw can be thinly covered over the seed. It protects from direct sunlight and retains moisture for a long time. Then, 6 feet-height filtered shade shed can be built using 70 percent of black sunshade nets or bamboo slats to get partial sunlight. If the seeds get 25°C temperature and enough moisture, they will crack in 4 to 6 weeks.

Because it is important to keep moisture on germinating beds, they must be watered every 10 or 15 days. After watering, the bottom of the plastic is tightly covered with soil. Cracked seeds can be transplanted into seedling bags from 20 days after germination.

Step 3: Transferring Seedling to Bags

For transplanting the cracked and germinated seeds, a mixture of sand and compost (1:3 ratio) should be filled to 9-inch thick in plastic bags which are 4 inches wide and 12 inches in height. The 9inches thick compost is for root growth and the remaining 3 inches must be filled with sand for rooting media. The seed bags are watered and placed upright in the form of germinating bed under the shade. After placing the germinated seeds in the germinating bag, water fully and cover with a plastic sheet to obtain a high temperature to stimulate faster the growth of the plant. Watering must be done in the morning or evening every 15 days.

Step 4: Hardening

Seedlings must be exposed to harsher conditions before transplanting to the field for strengthening. After covering with the plastic sheet for 3 months, when the seedlings have 6-8 leaves, the plastic sheet is removed within a month by opening the bottom of the plastic sheet a little to resist the harsher condition. The ungerminated and stunted seedlings should be replaced with healthy seedlings. At the age of 4-5 months, the plastic sheet should be removed. Natural organic foliar fertilizer can be used to strengthen the seedlings. Seedlings are ready to plant when they are 6 months old. The seedlings are usually transplanted in June and July.

2. Vegetative Propagation

Vegetative propagation is the process of taking cuttings from the mother plant and growing a new tea plant (clone) from it. With vegetative propagation, it is possible to obtain the identical genetic characteristics of the mother plant. Only the fibrous roots develop. The tea leaves can be plucked after 3 years and get a high yield.

For vegetative propagation, a mother plant that is healthy and has ideal characteristics should be selected. In choosing the mother plant, the strength of the plant, production capacity, branching pattern and rooting system must be considered. As the mother tea plant is the source of the cuttings, more nutrients are often required than plucked plants. Therefore, for the mother tea plant to get enough nutrients, the nutrient must be applied

twice that of other plucked plants. The selected mother plant must undergo heavy pruning (pruning 20-year-old plants) approximately six months before the cuttings are taken to produce more branches. However, as heavy pruning can be extremely harmful to tea bushes, medium pruning or light pruning is preferred. Weak and crossed branches should be removed once a year during one of the prunes. Pruning can be done from November to the first week of December, and the cuttings can be obtained from mid-May to the end of June. In addition, pruning can be done in the first week of June, and the cuttings can be cut from September to October. About 250 cuttings can be obtained from a mother plant per season. If the cutting cannot be planted immediately, it should be placed in a wet bag and placed under the shade.

Select cuttings with stem nodes, 7-8 green leaves and undamaged and healthy branches. newly axillary buds and sterile buds should also be selected. Collecting cuttings can be done early in the morning and in the evening. The cuttings should be cut again into small cuttings that have a single leaf and single bud. Cut the cuttings leaving 1-1.5 inches in length under the leaves with a sharp knife parallel to the leaf. The axillary bud must be included. Too young and too mature parts must not be used.

Step 1: Growing Cuttings

The preparation of seedling bags and construction of filtered shades are the same as from seed propagation. In vegetative propagation, small cuttings must be inserted into the centre of the seedling bag. The leaves and the buds beneath them should not touch the soil at all. The inserted cuttings in the seedling bag should be placed by pressing both hands around the cuttings. As the sweat from the fingers can affect their capacity to survive, one must ensure that the top or bottom cut of the stem is not touched by fingers during planting. In positioning the seedling bags, the leaves must be kept on one side. The seedling bags must be fully watered and covered with plastic in a dome shape over the seedling bags. Moisture can be maintained by watering often the small cuttings.

Step 2: Root Formation and Hardening

The root formation depends on the genes of the mother plant, life span, soil, soil pH, temperature and humidity. The hardening process happens in 4-6 weeks after inserting the cuttings and the roots will emerge within 10-12 weeks. If the soil pH is more than 5.5, the hardening process will happen and the root will not emerge.

Four months after growing cuttings, the ends of the plastic cover must be loosened and just touched the ground to get the air. One week later, the plastic cover is rolled up at both ends to get good aeration. The plastic cover is removed 8 months later, and should be hardened and can be planted at 1 year age on the farm.

TEA: How to prune

The tea plant requires pruning to produce tea shoots. Pruning supports the tea plant in maintaining the tea frame for the best plucking surface with a suitable height and increases the yield. Therefore, pruning must be done at pre-determined heights and specific intervals. Although yield is usually low in the first or second year, the yield will increase later if the pruning is done.

Before pruning, fertilizer should be added if severe malnutrition has occurred. Fertilizer application should not be done less than 6 months before pruning for impact.

Be careful not to harm oneself and tea plants in pruning. Gardening scissors are preferred, and the tools must be clean. It must be cut at 45 degrees slant to reduce fungi multiplying, splits and bark injuries when it rains.

Fungicide, painting paste, or tar may be applied at the cut ends after pruning to prevent fungal disease infection. Lime solution can be sprayed to grow buds early, to kill the moss and parasite and reduce the exposure of sunlight to framed branches. The moss and parasite on the stem can also be removed manually or with a wet sack bag.

1. Time of Pruning

Pruning can be done from November to January and skiffing pruning is done in June, July and August in Shat State, Myanmar. The roots must have sufficient nutrients at the time of pruning. Tea plants can be pruned when the soil has adequate moisture content and during the resting period. Tea plants must be pruned by remaining lung branches, branches above the pruning cut, in May, August, and September, which are the dry seasons.

2. Pruning Methods

Pruning methods vary depending on the tea variety, area and weather conditions. The pruning cycle depends on plucking systems and other conditions such as altitude. The pruning cycle can take five years in regions located above 4000 feet of sea level and three to four years in regions located below 4000 feet.

Medium Pruning – the pruning of all tea branches which are above 26 inches from the ground. Yields will decrease from 60 to 70 percent in the first year after pruning and will return to normal in the second and third years.

Figure 1: Medium pruning

Light Pruning – pruning the branches which are above 2 inches from the cutting end after three to four years from medium pruning to promote the formation of new shoots, maintain the yield and shape the plucking surface. This pruning method should be done after the Shwephi season in May.

Skiffing - cutting the branches above 4 inches from the last cutting of light pruning to below the plucking surface of branches which are complicated and shaped liked chicken legs and to facilitate early sprouting of new shoots.

Lung Pruning – cutting branches to recover tea bushes and allow new shoots to emerge. Lung branches protect the plant from sunburn and allow photosynthesis. In this pruning, the same methods mentioned above are adopted and some branches are not cut purposely. 1-2 branches with 35 to 40 leaves are left during strenuous pruning and the remaining lung branches are cut when new branches develop from the cutting end have 2-3 leaves. In modernized tea-growing countries, this pruning method is used and normally performed in May and September.

3. Pruning of Tea Plants above 20 years

The 20 years old tea plants must be pruned by applying a heavy pruning method as they gradually decrease the yield. In this method, all of the branches above half of the tea bush height are cut first followed by all branches above 6 to 10 inches. It is also important not to leave leaves on the remaining branches.

In the next season, when the leaves come out of 9-10 leaves in a branch (first branch), the top leaves should be plucked leaving 6-8 leaves. The leaves of the second branches which developed from that must be plucked by leaving 5-6 leaves in the second season. The third branch which developed from the second branch must be plucked by leaving 3-4 leaves. Skiffing should be done to maintain the plucking level when the tea plant reaches 3 feet.

This method must be done only if plants have enough carbohydrates and are healthy enough to grow. However, it is important to know that yields drop to 80 percent following heavy pruning.

TEA: Soil health and organic matter

Soil health is very important for tea plants. The topsoil contains a large amount of nutrition for plants which is essential for the concentration of roots and growth, so degradation of topsoil must be prevented. Soil erosion can be reduced by mulching and proper drainage systems. The soil pH must be adjusted to reach the required condition for the tea plantation. Organic materials and organic fertilizers must be added to the soil to contain nutrients. Fertilizer application must be only done only in the needed time.

Organic matters improve soil quality and are important for maintaining soil structure. Organic matters are naturally present in the soil; however, it is generally insufficient and decreases over time following planting. Therefore, a good amount of organic content in the soil should be maintained.

Adding organic materials such as manure and plant litter benefits the formation of microbes, water retention and nutrients. Crops such as leguminous species can be cultivated in the area designated for tea before 2 years of planting to improve soil condition. Cover crops and materials must be placed as possible since they reduce soil erosion and loss of organic matter.

1. Compost

Compost can be used during the time of land preparation and in all the growth stages of the tea plants. It can improve the soil structure in both muddy soil and more aerated in compact soil. It also improves water absorption. Adding compost to the hardened soil makes it easier to plow in the dry season. Compost releases nutrients slowly and it can reduce the frequency of fertilizer application. It can support the beneficial organisms in the soil and improve soil structure.

Since compost reduces the usage of other chemical fertilizers, not only does it preserve the environment and human health, but it is also cheap because of the reusing of other wastes.

2. Compost materials and process

Agricultural waste such as dry leaves, dry grasses, straws, farmyard manure (chicken and cow manure), and kitchen waste can be used to make compost. However, bones, meats and oils should not be used as they attract rodents and other pests.

- Bacteria, fungi, and Actinomycetes which are microbes are capable of digesting food as compost.
- The amount of carbon and nitrogen in compost is needed to be fair and the optimum ratio is 19: 1 to 30:
- The proportion of brown-coloured agriculture waste, green-coloured agricultural waste and farmyard manure must be careful to get the optimum ratio.

- The compost must be regularly overturned to improve aeration and multiplying microbes.
- Moisture content supports the metabolic process of the microbes and optimum moisture content is between 60-65 percent.
- The optimum compost pile size is 5 feet in length with a width of 3 feet to maintain the temperature and moisture and to get the best compost.

3. Compost Process

- Agricultural wastes such as dry leaves, corn stems, straws, and husks should be spread 6 inches high as the first layer.
- Then, green agricultural wastes such as weeds, and green leaves are also spread 6 inches high as the second layer.
- Farmyard layer, third layer, spread on the top of two layers, again 6 inches thick and pour the water on the compost pile which has three layers.
- Repeat the stacking of the three different layers in the same order until the compost pile reaches 3 feet high.
- Cover the compost pile with banana leaves or coconut leaves or a wet sack bag to maintain moisture and not exceed humidity in the rainy season if the compost is made in summer.
- On the fourth day, open the compost heap and mix it thoroughly using appropriate tools such as a rake or hoe. Check the moisture content by taking compost from the middle of the pile by hand and making a ball. If the moisture content is too high, water flows out of the ball when it is squeezed, and the compost pile must be spread out and left to dry for a few hours or should be added highly absorbent compost materials.
- If the ball cannot be made and broken down, the moisture content is low, and water should be added.
- If the ball remains in the hand without flowing out of the water and without breaking down, the moisture content is optimal. Then, the compost heap must be reshaped after overturning.
- After the two weeks, the compost pile must be overturned and overturned again once after five days and once during the next two weeks. The temperature will rise to 60-65° C.
- About a month later, the temperature slowly declined, and the compost pile will turn into brown and dark. The ingredients have already been composed and it looks like soil.

AVOCADO: Botanical features

Avocado trees grow very fast. Young plants can grow up to one meter in height and quickly grow sideways within a year. However, care must be taken not to exceed 4-5 meters in height to prevent disease and to pick the fruit easily. The branches are fragile and tend to hang down during the fruit formation time.

For flower bud formation, it is more important to have a temperature around 20°C than a day length. In particular, the short-day length can affect the acceleration of flowering, and not necessarily flower bud formation.

The avocado flower blooms in a unique and very rare nature. The pistils and stamens of the flower do not mature at the same time when flowering. Generally, a flower will bloom twice within 48 hours in good condition.

On the first day of flowering, the female flower opens in the morning and closes in the afternoon. The next day's afternoon, when it bloomed for the second time, it opens as a male flower. This type of flowering occurs with type A avocado varieties. The opposite holds for Type B avocados. The flower blooms in the afternoon on the first day as a male flower and closes within hours. The flower re-opens as a female flower the next morning. Avocado trees with this pattern of flowering cannot be self-pollinated. Only the Type A and Type B plants can be cross-pollinated, fertilized, and set fruits. It is difficult to self-pollinate because the male and female flowers mature at different times. Because of this, avocado growers intercrop Type A and Type B varieties, resulting in enhanced pollination and fruit set.

In good environmental conditions, this system provides the best conditions for cross-pollination. An avocado tree has more than a million flowers, however, most of them are abnormal or infertile (sterile). A lot of small fruits can be produced; however, the small fruits usually fall off. A densely planted avocado field produces a maximum of 200 fruits per avocado tree. However, about 500 fruits can be obtained from one avocado plant cultivated with regular spacing.

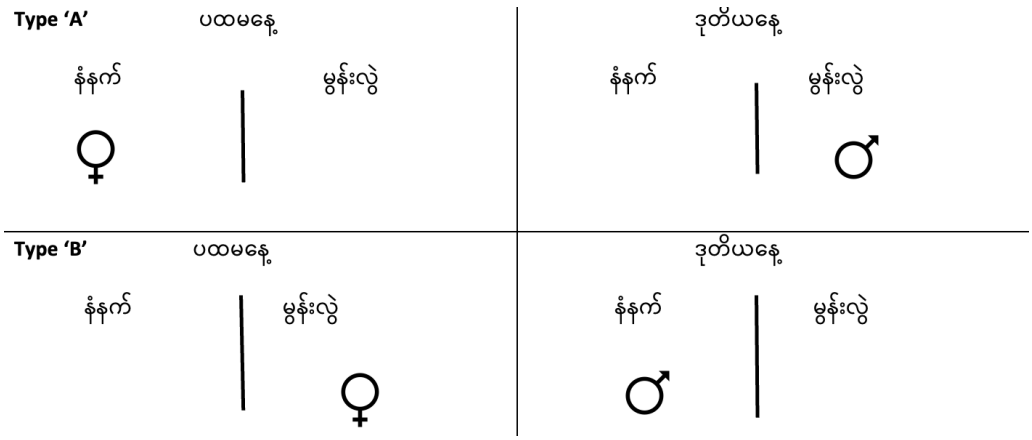

Figure 2. Flowering Time and nature of Type A and Type B Avocado Plants

The flowering period of the avocado trees differs across species, but it is generally longer in cool weather conditions. Specifically, the cooler the weather, the longer the flowering period. The Guatemala variety blooms later than the Mexican and West Indian varieties. However, on average, plants bloom for up to two months. Breeders can create their favourite two varieties by matching flowering times. For example, a late-blooming plant can be pruned to make it bloom early.

Good quality avocados do not ripen on the tree. A well-matured fruit can be stored on the plant in cold weather conditions. Depending on the variety, the picked avocados will ripen in about 10 to 15 days at room temperature.

AVOCADO: How to propagate

Avocado trees can be propagated both by seed and vegetative propagation. Methods of vegetative propagation are:

1. Layering 2. Cutting 3. Grafting

The avocado tree is less successful in layering due to the slow rooting rate and less amount of roots. Also, when planting the branches to grow roots in the sand pit, low rooting can be found, and the success rate is not good. Therefore, they are commercially propagated only by grafting on the rootstock.

1. Seed propagation

The most important part of avocado reproduction is the flower. Avocado flowers are unisexual, but because the male and female parts of the flower mature at different times, they are usually fertilized and produce fruits by cross-pollination.

Growing avocados from seed often come with several difficulties. Avocado seed has a thick, nutrient-rich pulp between two bracts tightly packed in an embryo. The seed coat is like thin paper. While the thin seed coat is in place, it protects the embryo and provides easy access to nutrients until the seed matures and the membrane dries out. If the thin seed coat dries before maturity, the fruit and seed will be smaller.

The seeds must be taken out and used when the fruits are ripe. If seeds are taken from fallen fruits, soak them in hot water at 90° C for 30 minutes to prevent Phytophthora fungal disease. Make sure the temperature is accurate. At 52°C, the seed germination rate will decrease. After soaking the seed in hot water, immediately cool it in cold water and plant the seed. If you remove the thin seed coat and plant it, you will get fast-grown and uniform plants. In a warm region (23-25°C), the seeds germinate within a month. Avocado seeds can be stored as seeds for up to 12 months if stored without moisture loss. It can be stored for 5 months at the specified temperature of 4.5°C.

Avocado seeds can be grown on a moisture-retaining seedling raised bed or in plastic bags.

2. Grafting

For commercial cultivation, the avocado tree is propagated in various ways, either in the nursery or in the garden. It can be propagated by grafting on the rootstock. The most important thing for avocado breeders is to choose good cultivars.

Grafting Tips
- *A suitable bud is at the tip of a resting branch.*
- *You must choose the tip of the branch that is dark green and has developed buds.*

Buds that swell during autumn to spring are flower buds, not leaf buds, and cannot reproduce vegetatively. You can get a strong new branch with the best buds by pre-cutting the branches of a large or small plant. However, the core of the very strong branch is hollow, and it dries up quickly. The scion must be firm. It must not be flexible. If the flexible branch tip is cut about a week in advance, the buds in the lower part of it will mature earlier. The bark and inner flesh of the scion are brown. Do not use branches with fallen buds.

In warm weather, the grafted scion may dry out. Some nurseries provide plastic cover for 1 - 2 weeks to keep the grafted plants moist. Some cover each tree with a white paper bag and tie the bottom.

Tips for successful transplanting
- *Keep the soil moist at all times and keep it in the shade when the shoots come out.*
- *Ensure hardening of grafted plants few weeks before planting on the plot (or) selling to the customers.*

There are only Mexican and Guatemalan varieties currently cultivated as rootstocks in Myanmar. Hence, only the seeds obtained from those varieties are to be used as rootstock plants and vegetative propagation could be carried out by grafting the good branches from the plants. In other avocado-growing countries, the rootstocks are mainly chosen from hardy, large-seeded West Indian varieties. This variety can give big seeds and strong seedlings. It is also resistant to drought, salinity and root rot caused by Phytophthora.

AVOCADO: How to graft

The various grafting methods commonly used in avocado cultivation are as follows:

1. Tips Grafting Method

- The best propagation method for avocados is tip grafting.
- Cut the buds early in the morning. A young branch for grafting must have a good bud at the tip and no other buds in the lower part.
- For the tip grafting method, the scion should be 50 - 75 mm long and 5 - 6 mm in diameter.

- Remove the leaves from the bud around a distance of 6 mm and pack the scion with a damp cloth or wet gauze and put it in a plastic bag not to lose moisture.
- For grafting in the field, the scion with usually 150-200 mm long and 9-18 mm in diameter and 3-4 buds should be selected.
- For the tip grafting, a small scion should be used for grafting immediately after picking.
- If they will be stored, do not store them for more than a few weeks. The large scion mentioned above can be stored for 2 - 3 months at 5.5°C after packing carefully.
- If they were treated with fungicides and stored, they can last longer than that.
- The scion should be allowed to dry the upper layer out before storage. Only about 50 branches should be prepared and stored at a time.

2. T-Budding Method

The T-budding or shield budding method was the earliest method of commercial vegetative propagation of avocados in the nursery. Even now, when the price of the scion or stock is high and when it is scarce, the T-budding method is still used. The budding propagation method is limited in time as it can only be done when the bark of the base tree is easy to peel off and when the brunch is succulent. This grafting method is not as successful as a tip or wedge grafting method with a small bud branch. These are the steps to be followed:

- Make a 1 to 1.5 inches vertical split in the stem of the rootstock with a knife.
- Then cut the upper part of the splits to make a cross (T) shape.On the scion, cut about 0.5 inches from both the bottom and top of the bud.
- Insert the small shield-shaped bud from top to bottom in the small shield-shaped (T) cut. Push the small shield-shaped bud into the bark of the stock.
- Wrap the bud tightly with tape. The image is shown below.

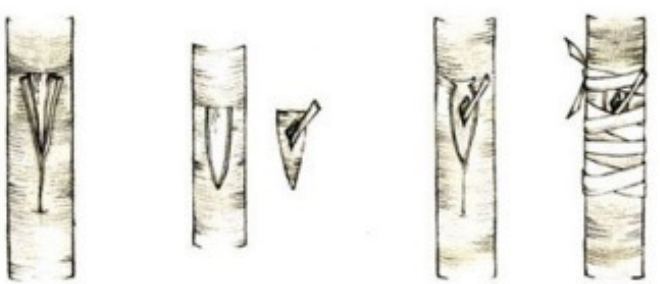

Figure 3. T-Budding Method

3. Wedge Grafting Method

This is the fastest and most successful method. Stock and scion have better cambium tissue layer contact due to the same size of branches.

- In the wedge grafting method, it is most suitable if the diameter of the scion is 6 mm.
- Cut off the bark and flesh of the scion about 25 to 50 mm long to form a wedge on each side of the base of it.
- Choose a stock that has the same size trunk as a scion and has 100 mm height above the ground. And then, cut it in that place.
- Split the stock straight down the middle to slightly longer than the scion's wedge length.
- Then put the scion in the split area and let both sides of the cambium layer touch.
- If the scion is young, stick it to one side of the stock so that it touches the cambium layer. If the scion is big, cut one side of it with a knife evenly.
- Securely tie the attached area with tape.

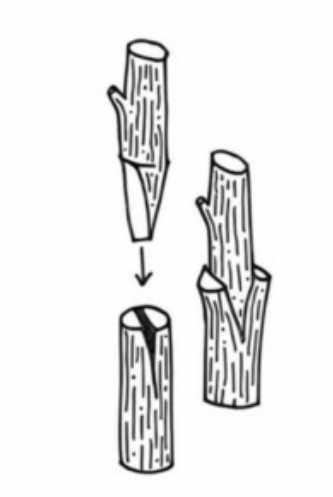

Figure 3. T-Budding Method

4. Splice Grafting Method

The splice grafting method is the most used grafting method after the wedge grafting method. However, since it is necessary to cut long enough to touch the cambium layer of the scion and stock, the size of the scion and the stock must be the same.

- Cut the upper part of the stock at a 60 mm slant to make splice grafting.
- Cut it completely off the top of the stock at a height of about 400 mm from the ground.
- The lower part of the scion should be cut in the same way, and it should be tied firmly with tape.

Whip and tongue grafting is practiced by modifying the splice grafting.

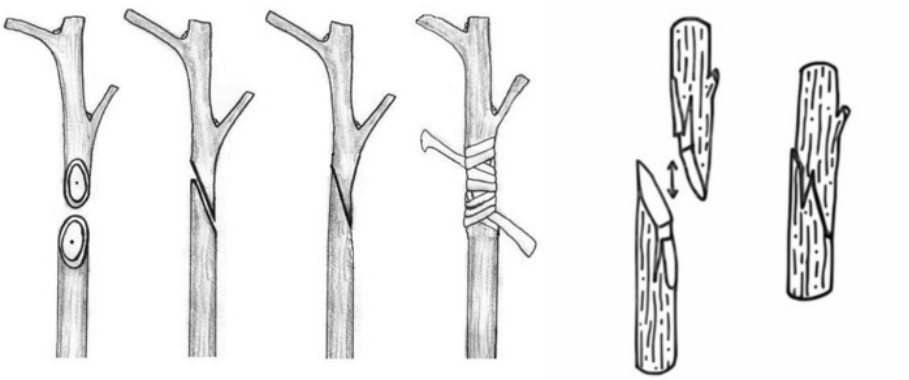

Figure 5. Splice Grafting and Whip & Tongue Grafting

5. Top Working

This is usually done when a new variety of an avocado plant is needed to meet market demand and to change to another variety for pollination. Healthy plants are easier to change, and it is faster than planting new plants. Even in 2 to 3 years, the grafted plant can bear fruit again. A common method of transforming into a new plant is to cut the stem above the previous grafted point and insert the scions under the bark. This method can be very successful if it is done with experts. If top working is done in late winter or spring, the scion can grow well before winter.

5.1. Bark grafting method

- Cut the trunk of the stock at 600mm from the ground with a chain saw.
- Wipe the surface of the cut stump and trunk with whitewash or lime mixed with water to prevent sunburn. Do not use oil paint.
- In the method of bark grafting, cut the lower part of the stock in a wedge shape, remove the bark from the base, and insert the scion at the back of the bark.
- It's a very easy method and both the scion and stock must be put tightly to contact the cambium layers.
- The bark on the stump separating from the flesh of the trunk easily is indicating that the cambium layer is growing well.

5.2. Bark refining

- If the bark is very thick and hard, then it will be difficult to graft. The bark area where the bud will be inserted should be cut and thinned to become 6 mm wide with a knife or double-handled grafting knife.
- Cut the bark vertically with a sharp knife as long as the length of the cut scion.
- Make 2 to 4 vertical slices that are evenly spaced depending on the stem circumference.
- Peel off the bark with a knife when the scions are about to be inserted. If the bark cannot be easily removed, a specially made three-pronged knife must be used to pierce between the flesh and the bark.

5.3. Selecting and inserting the scion

- The ideal scion should be 10-18mm in diameter and about 150-200mm long.
- The scion should have 2-3 buds and be 75mm above the surface of the stump.
- When preparing the scion for grafting, it should be cut forwardly to a length of 60 - 75 mm on the side that will touch the cambium of the stock.
- Cut about 12 mm on the side that will touch the bark.
- A longer wedge-shaped cut (75-125 mm) at both bases of the scion will be more successful with more cambium tissue layer contact. However, it is more difficult to cut an evenly long wedge at the base of the scion.

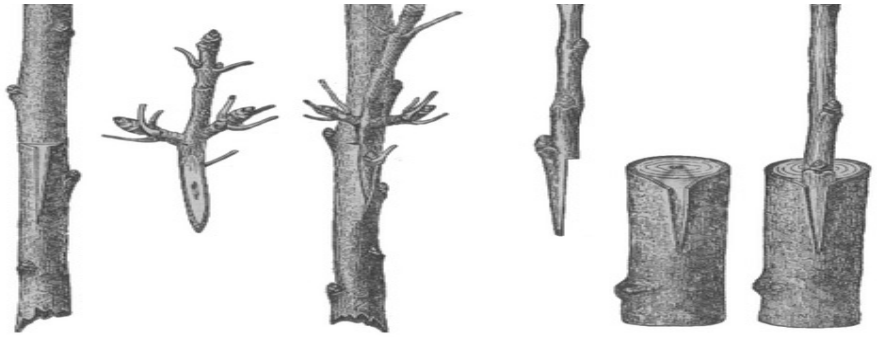

Figure 6. Top Working and Bark Grafting

- After inserting the scions, firmly wrap them from top to bottom with 25 mm flat tape.
- The areas where the scion has been cut must be wiped with grafting wax.
- Apply tar on the cut stump lightly. Do not allow the tar to flow into the split area.
- To prevent the scions from drying out, it is sometimes necessary to tie them to the trunk with bamboo sticks and cover the top with brown manufacturing paper.
- If the scions survive and come out, open the paper to get sunlight.
- If the scions are emerging highly, to protect them from the wind and other animals, 1.2 to 1.8 meters long bamboo slides should be hit with an iron to the tree stump in a place which is around the scions, and the scions should be tied to the bamboo slide.
- After selecting the strongest scion and leaving only one plant, continue taking care of it just as ordinary plants. Remove the shoots emerging from the stock often.

B

PLANTATION ESTABLISHMENT AND CULTIVATION

B. PLANTATION ESTABLISHMENT AND CULTIVATION

TEA: How to establish a plantation

1. Land Selection and Clearing

Land selection – Good-quality soil is necessary for planting tea. The selected land must have loamy soil with good drainage and adequate depth, and have a pH range of 4.0 to 5.5.

Clearing the land – If there are stones, other plants, and roots of felled trees in the selected area, remove them as much as possible. Removing them can avoid the spread of root diseases and the roots can grow without a barrier. Trichoderma can also be used to prevent the spread of root diseases.

As tea plants favour acidic soil, the remains of the plants that were previously cultivated and the parts which are dug should not be burned. The ashes from the burning fire may increase the amount of alkali. Windbreak trees at the edge of the field should keep originally until the large shade is untouched on the tea plants.

2. Water Management

If the land is on a steep slope, water management can be done by digging water drains to retain water and minimize surface runoff. The boundary or contour drains must be dug 1.5-2 feet wide, 1.5-2 feet deep and desired length on the slopes to prevent water from entering from above eroding the soil. The contour drains should be dug at an interval of 4 rows and 6 rows.

The natural rainy drain should be built as a lead drain with stairs 3 feet long, 2 feet wide and 1.5 feet deep. To ensure good drainage and sustainability, stone revetment can be used as drainage barriers and suitable grass can be planted along the drains.

On the steep slopes, water catchments should be dug 6-10 feet in length, 1 foot wide and 1 foot deep and located 6 feet from one between rows of tea bushes in a Zig Zag position to decrease surface runoff and conserve water.

3. Plant Population

Less amount of plant population with irregular spacing is one of the factors of decreasing yield. Contour double hedge planting, plating two rows of tea plants vertically with a spacing of 2 ft x 2 ft in zig zag position, can grow an average of 7400 plants per acre and reduce weed growth. Each double row should be 4-6 feet away.

4. Intercropping

Intercropping with other crops in tea plantations can reduce pest and disease infection and increase the yield of each plant. Intercropping with ginger, soybean or other crops should be done in areas where pest and disease infection occurs severely. Intercropping can improve the soil, absorption of water and green manure plants such as sunn hemp, sesbaina tree, and pulses can also be grown as a source of nitrogen.

5. Shade Trees

As tea plants grow well if they get the needed amount of shade, planting shade trees on tea plantations can increase yield. In Myanmar, the practice of planting shade trees is not common. Planting perennial trees and temporary shade trees can create natural land like forests, can prevent the tea plants from sunburn and give quality tea. Shade trees prevent decreasing yield, weakness of tea bushes, and dryness of branches due to direct exposure of the pruned branches to sunlight. However, shade trees should be planted in an already planted field after pruning has been done to get sunlight well.

The types of shade trees depend on the land and weather conditions, must be tolerant to wind and forest and should have low pest and disease incidence. It must be an evergreen tree with fringed leaves and provide filtered shade. Grevillea Robusta (silver oak) should be planted in Shan State. Cassia fistula, Cassia renigera and Delonix regia should be cultivated as permanent shade trees. Permanent shade trees must be planted on four contour lines of tea bushes apart with a spacing of 40 ft x 40 ft.

Even web plants can be cultivated 40 feet in the middle of the hearing, with 10 years after 10 years later. Be careful not to overlook the trees of the shadow plants in the tea plantation.

Permanent shade trees must be carefully chosen to avoid overshading the plantation. For example, orange, jackfruit, avocado and mango as shade trees can potentially cause excessive shade, which is not suitable for tea plantations, particularly if they are not pruned to get the fruits. Permanent shade trees should have value to enhance the income of tea growers. Therefore, the chosen shade trees should be easily propagated, resistant to pruning, and quick to rejuvenate.

Temporary shade trees should be planted after two contour lines of tea bushes. Spacing should be 8 ft x 10 ft and add 3-6 seeds in a pit. When the plants grow, remove the other plants by leaving the healthiest ones. Temporary shade trees such as pigeon peas which can increase nitrogen and enhance the incomes of tea farmers are recommended.

The shade tree should be pruned to lessen the excessive shade. When cutting down or reducing the shade trees, their rootstocks must also be removed. If it is not possible, the plants should be ring barked about two years before it is removed. The shade trees can be cut down below the soil level once the leaves become yellow and fall. The stumps of the trees that have been cut down must be covered with soil. If shade trees will be replaced, new plants must be cultivated before removing the old plants to ensure the field gets shade.

TEA: How to cultivate

1. Direct Seedling

A direct seedling method is used both when a nursery was not established and while establishing a nursery. However, direct seedling fails if done during seed ripening time in November and October. The seeds must pass a drying period. As such, the seeds are stored and planted only in June and July. At least 3-4 seeds must be planted in a planting hole that must be covered with compost about 1 inch. When the plants emerge, thinning and refilling must be done to get the required spacing.

2. Transplanting

Weeds near the planting holes must be killed before tea plants are transplanted. 2 feet deep and 1-foot-wide planting holes are dug and must be filled with compost which contains nutrients needed for plants. The soil inside the seedling bag must be wet at the time of the transplanting. If there is not enough moisture, water must be added before planting. One should be careful not to crack the cylinder of soil and disturb the root in handling and removing the seedling bag. The pit must be refilled with soil that was previously removed while digging and the soil should be pressed. Be careful when doing so because raised soil around the trunk can cause canker disease.

If the soil around the seedling is lower than the rest of the field, it can cause water logging and barrier to normal functions of the roots. If it is higher than the rest of the field, it will be difficult for the roots to get needed water. Therefore, the planting hole should be at the same level as the rest of the field. Tea plants are usually transplanted in June and July.

3. Post-planting Care

Methods of planting care are important for the good establishment of the roots and to reduce the death of the seedlings after transplanting. It is also important to access an appropriate amount of water for the development of the roots and the whole plant. Relative to sprinkler irrigation and drip irrigation systems, sub-surface irrigation is the most efficient to access water for roots and promote the development of a deep root system. Moreover, it can minimize the infection of pests and diseases caused by arising surface moisture and less weed growth than other irrigation techniques. After transplanting, tea seedlings should be maintained by using bamboo poles or small logs to be free from the destruction of humans, and animals and to be resistant to wind. The soil surface should be covered with leaves, straw, and dry weeds to maintain the soil moisture, reduce growing weeds, increase organic materials, and adjust the soil temperature.

In the first year of planting, apply fertilizers for the plants to get the required nutrients for good growth. Fertilizer application should be done when the field is

free of weeds and has sufficient soil moisture. When nutrients are applied, adequate care is required to ensure good absorption by the plants. Remove the soil covering materials for a while to reach directly into the soil and recover it. Fertilizers must not touch the plant. Apply the fertilizer around the plant at least 10 cm away. Reduce organic fertilizer application if harvesting time is closer. To avoid water contamination, animal waste and compost should be placed away from rivers, creeks, and water storage tanks.

4. Refilling

Tea plants are needed to refill if the spacing is wide and there are large spaces and many deaths. Refilling is done when the soil has enough moisture in June and July and be careful not to cause waterlogging. Refilling should be done in the year of pruning for better exposure of the tea bushes to sunlight. The side branches of adjacent mature tea plants should be clipped if refilling is done during a non-pruning year so that the young plants can receive adequate sunlight.

5. Tea Plant Training

Tea plant training, also known as pruning, refers to the shaping of young tea plants to pluck the shoots early and increase the yield. Although this may require more capital, it can result in a quick profit. The tea plant training is the pruning to develop the shape that has low and wide branches at specific intervals to get a large plucking area. Tea plant training may result in the growth of the desired shape. Decentring and tipping are common training methods. Tea plant training should be done when the soil has enough moisture, and the plant has stored carbohydrates to recover.

5.1. Decentring

When the tea plant is done one year after transplanting, the leader stem above 10 leaves should be cut for the growth of lateral branches which have wider surfaces. Any kind of pruning should not be done if the plant doesn't grow straight up. If the plants are branching, cut the stem above 6 inches from the ground, leaving 2-3 branches at the bottom.

5.2. Tipping

After decentring is done, the remaining axillary buds along the stem will develop as branches that have many leaves. The first tipping should be performed when two secondary branches at the bottom have about 10 leaves. The main trunk should also be cut back 4 inches above those two side branches.

5.3. Second tipping

After the tea plant has been grown to a height of 20 inches, when all the branches which are higher than 20 inches have more than 4 leaves, second tipping should be performed. If the branches have not developed four leaves yet, this performance should wait until they develop. This will stimulate the development of lateral branches. Then, the plucking surface must be levelled and if a new shoot emerges above 20 inches, the branches can be plucked.

Skiffing should be done to get better quality and yield when the tea plant height reaches over 28 inches.

GINGER: How to select a site

Ginger grows better in a warm, humid tropical or temperate climate and does not tolerate very low temperatures. Ginger can grow well in many types of soil such as loamy soil, clay soil, sandy soil, and red loamy soil. However, it grows best in sandy loam soil and well-drained and moisture-retaining soils. Fields selected for planting ginger should be free from contamination such as industry effluents, animal raising, hospital wastes, heavy metals, and pesticide accumulation. Figure 7 presents tips for site selection.

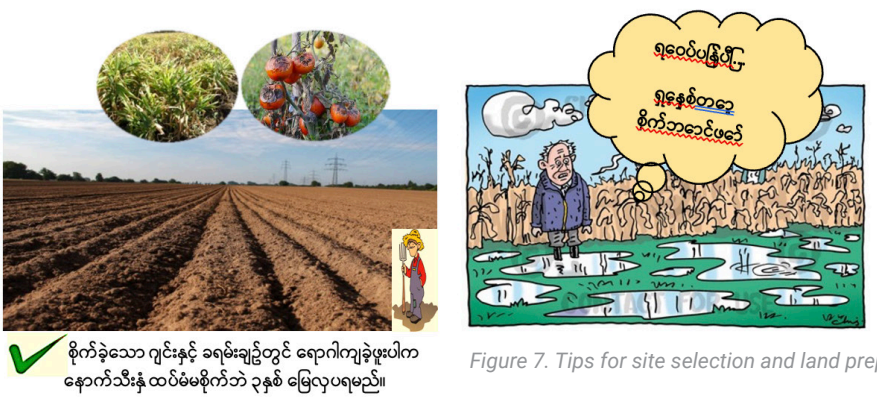

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Figure 7. Tips for site selection and land preparation

GINGER: How to cultivate

1. Land Preparation

The main factors to consider for planting ginger are weather conditions, planting time, spacing, and depth of seed placement. Depending on the availability of rain, land preparation should be done in March and April and planting should be begun in May and June. To get adequate soil texture that makes furrows easily, plowing and harrowing should be done twice each year. The plowing should be done 8-10 inches deep to grow the seedlings well. Avoid over-tillage to reduce soil erosion. The tractors and other machinery used in land preparation should be free and cleaned from soil particles, dirt, pest and diseases from other fields. In hilly regions, the field should be laid out along the contour line to prevent soil erosion. Drainage should be constructed where necessary to prevent water run-off. Small ponds can also be dug near the ginger plots to store rainwater for irrigation.

Figure 8. Tips for soil preparations

2. Ginger Seed selection

To obtain healthy ginger seed, healthy and vigorous ginger rhizomes must be selected at the time of harvesting. Only disease and pest free, clean and well matured ginger rhizomes must be used as seeds. When choosing the ginger seed, the pure variety should be selected.

- Selected seed rhizomes intended for the next growing season should be stored in a clean and dry place.
- Using a healthy seed and proper seed preparation methods reduces 80 percent of disease infestation. Therefore, it is important to use sterilized knives for cutting the seed rhizomes. To sterilize the knives and seed rhizomes, mix chlorine solution and water 1:10 times. (You can also use bleach that contains chlorine.)
- Cut the selected ginger seed rhizome into 0.04 – 0.07 viss size that has 2-4 well-developed buds (eyes).
- Soak the cut area of seed rhizomes in a mixed chlorine solution for a while to disinfect them. Dry the cut wounds of soaked ginger seed in a cool, dry and clean place for at least 3 to 5 days before planting.
- Soaking seed rhizomes in EM solution can improve germination and plant growth rate and prevent disease.

Figure 9. Treatment of ginger rhizomes before planting

2.1. Preparing the EM Solution

Ingredients

1. EM -5 times
2. Molasses- 5 times
3. Water -90 times

The procedure of EM solution

Mix the ingredients well and put the mixture in a sealed container

Open and close the lid of the container to release air during the fermentation process

It can be used after 7-10 days

Sown the seed rhizomes after soaking them in EM solution for about 30 minutes

Figure 10. Preparation of EM solution

3. Spacing, Population and Seed Rate

The planting depth is important for early germination and emergence. For bolder rhizomes, the planting must be done deeper and for the smaller rhizomes should place shallower. For better germination, light irrigation should be done after planting. It takes 10-15 days to sprout under favourable conditions. The raised bed or ridges or furrows should be prepared depending on the cultivated land. If it is a waterlogged place, the raised bed should be prepared. If the water can flow easily, the ridges should be used. The plant should be sown with a row spacing of 3 ft and the plant spacing of 1.5 ft. This can reduce the seed rate to around 500 visses on one acre and produces 80 percent of ginger rhizomes of 0.15 viss each. Normally, about 9000-9600 plants are needed for 1 acre (9680 seeds/acre).

4. Water Requirement and Management

- Annual rainfall of 1,500-3,000 mm is required during the 5 to 7 months period of ginger cultivation.
- In the absence of rain, watering should be done at intervals of 15 days. Depending on the moisture of the soil, watering should be done 2-4 times per week if required.
- Water is essential during the Germination and emergence times.
- The critical stages for irrigation are the germination stage, rhizomes formation stage (90 days after planting) and rhizome development stage (135 days after planting).
- Irrigated cultivation during dry periods produces better yields than rainfed farming.

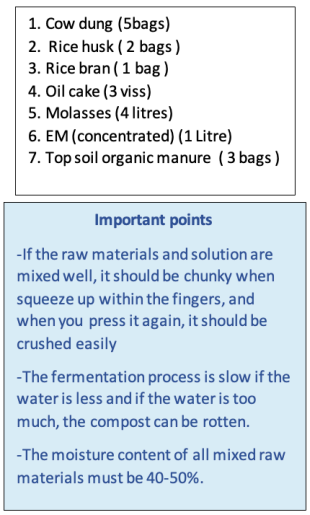
5. Soil and Nutrient Management

Ginger is a heavy feeder crop and requires intensive application of nutrients at the right time.

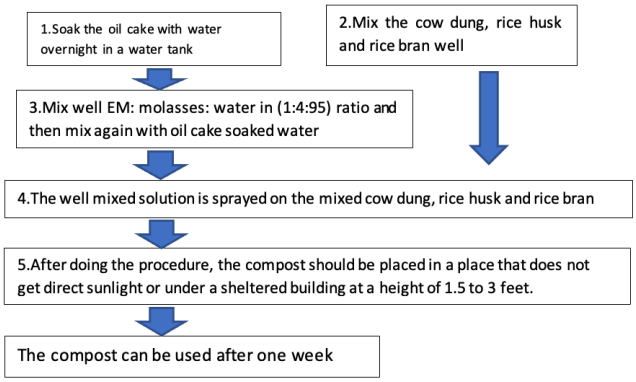
- Nitrogen-based fertilization is required during active vegetative growth (60-90 days after planting) to promote tillering.
- Potassium-based fertilization is required during rhizome development (130-190 days after planting).
- For better growth and development of the rhizome, calcium-based fertilizer is required. Nitrogen, potassium and calcium should be used at the rate of 60:20:20 kg per acre.
- A full dose of 20 kg of potassium per acre can be used as a basal application.

- Apply 20 kg per acre of Nitrogen at the time of planting. This must be repeated 45 days after planting, and again for the third time 90 days after planting.
- Apply 10kgs/acre of Calcium at planting and repeat the same 10kgs/acre 90 days after planting.
- Foliar spray can be applied 30 and 60 days after planting. Organic fertilizers and green manure can also be used. The rate of chemical fertilizer could be reduced proportionately if organic and green manure is used.
- Bokashi can be used as basal fertilizer when planting and should also be applied at earthing up. Bokashi 250 viss is required for one acre of ginger. After using EM-bokashi, T-Super and compound fertilizers can be added as needed.

Ingredients for Making Bokashi



Ingredients for Making Bokashi



Procedure

Figure 11. EM Bokashi compost making process

6. Hilling (Earthing Up)

Earthing up of soil is essential to break the soil hardpan formed by rain or irrigation. It helps in controlling weed growth, conserving soil moisture, mixing applied manure thoroughly with the soil, enlargement of rhizomes, and provides adequate aeration for root expansion and protecting the rhizomes from the damage of scale insects. Earthing up can be combined with weeding and mulching.

After each fertilizer application, hilling should be carried out about three times. First hilling at 45 to 90 days and second hilling after 135 days after planting. The height of the hill at the last time of hilling is 1.5 feet. The height of the hill at the last time of hilling is 1.5 feet. Hilling and making of rows must be carefully done to avoid damaging the rhizomes.

Figure 12. Optimum hill height for earthing up

7. Mulching

Mulching reduces weeds, maintains soil moisture, and provides organic matter to the soil. Mulching should be done at 4 and 6 weeks after planting. In commercial ginger production, mulching should be done with farm waste materials such as rice straw, rice husk, corn husk and other green manure at the rate of 5 tons per acre. After that, mulching should be carried out repeatedly at the rate of 2 tons per acre after every fertilizer application. The amount of mulching varies with the availability of the material used for mulching. The mulching materials must be free from pests and diseases, chemicals, and weeds. Water logging soil and the soil including high clay content should avoid mulching.

Avoid mulching in water logged and clay soil

Mulching materials must be free from pests and diseases, chemicals, and weeds

Figure 13. Tips for mulching gingers

8. Weed Management

The slow growth rate of the ginger plant at the initial stage promotes rapid weed growth. Weeds compete for moisture, nutrition, space, and sunlight. Weeding should be done manually or with machinery:

- 2-3 times weeding should be done depending on weed growth during the plant cycle.
- Mulching also suppresses weed growth and increases crop emergence, growth, and yield.
- Black polythene mulch is also effective for weed suppression.
- The first weeding is done 45 days after planting and the second weeding is done 120-135 days after planting.
- Chemical herbicides should be carefully applied because they can harm people and the environment of land and water.
- Atrazine and Glyphosate are the most used chemical pesticides.
- After herbicide application, the soil should cover with green manure or paddy straw.

9. Intercropping and Planting Shade Trees

By intercropping ginger with forest trees, the ginger quality and yield can be increased, farmers can get additional income from the shade crop and the seed rate can also be reduced. Intercropping with pigeon peas not only provides shade for the ginger plant but also provides the necessary nitrogen as it is peas and beans family. To get 30 percent partial shade, ginger can be intercropped with 1 row of pigeon peas and 4 rows of ginger. Other perennials such as mango, avocado, banana, papaya, coconut, and coffee can also be intercropped with ginger as shade trees.

In hilly regions, forest trees and mixed farming systems are particularly suitable for ginger, providing partial shade and support for sustainable production. Since ginger is a heavy-feeding crop, cultivating ginger continuously on the same land should be avoided. Continuous planting of ginger on the same land drains up essential nutrients from the soil and leaves the crop highly vulnerable to yearly disease infections. Potatoes, tomatoes, pepper, eggplants and cabbage are highly susceptible to bacterial disease and as such, ginger should not be intercropped with these crops.

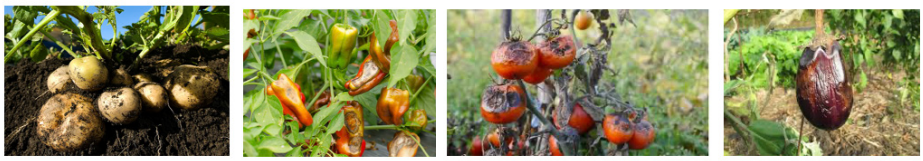


Figure 14. Tips for intercropping with gingers

AVOCADO: How to select a site

In Myanmar, the areas currently growing avocados are Chin State, Pyin Oo Lwin, Shan State and Kachin State. For flowering, cold temperature is more important than day length. While the cold temperature is key for flower bud initiation, day length only determines early and late flowering. If avocados are to be grown in Myanmar:

- It should be mountainous areas with a height of more than 1000 to 2000 meters above sea level.
- The average temperature should be between 10°C and 36°C, and the annual rainfall should be 1,200 to 1,500 mm on average during the five months of May to September.
- Latitude should be between 20°N and 24°N.
- The most suitable type of soil for avocado trees is clay loam soil which contains 30 percent clay, 30 percent loam and humus and natural compost.
- Avocado tree roots are only in the surface soil and grow towards the side until the plant canopy. Especially if the land is mountainous and has a slope, it should be planted around the contour to reduce soil erosion and drainage channels should be made at appropriate distances.
- If planting in tropical rainfed areas, it is important to take care of water erosion and moisture retention during dry periods.
- Avocado trees grow well in acidic soils. In nature, it grows at a pH of 3.5 to 5.5. Also in Myanmar, the Shan State where there is a lot of rain has a pH of about 5.5.
- Acidification in rainfed areas is mainly due to Aluminum (Al) and Manganese (Mn) and it is difficult to adjust the pH with lime. It is necessary to apply green manure in advance to obtain a lot of natural compost. It is most suitable if the soil depth is about 3 feet.
- Because the roots are only in the topsoil layer, it is important to grow windbreak plants before planting avocados to protect them from the wind.
- It is also important to prevent the phytophthora fungal disease that enters the roots through the soil.
- It flowers in December in early flowering areas and flowers in March in late blooming areas.
- Avocado plants usually bloom for 2 to 3 months. Depending on the variety, the fruit ripens only after a maximum of 6 months from the time of flowering. Depending on the weather, the fruits can be ripe and remain on the plant for 15 days to more than 2 months.
- Avocados ripen only after 5 to 15 days after picking at room temperature. Some varieties turn green to reddish brown when ripe. In some varieties, the peel is only green, and when ripe, it becomes smooth and slightly soft. If it is overripe, the fresh pulp adjacent to the seed will turn brown.

AVOCADO: How to cultivate

If the avocado is grown for commercial purposes, well-propagated plants should be used. It must be planted with suitable cross-pollinating species.

1. Planting

- 6 months to 1-year-old grafted plants from the nursery should be planted at a spacing of 4-5 meters. Currently, in Myanmar, only about 200 trees are planted per acre, with only 9 and 15 ft of spacing.
- The planting pits should be 3 ft wide and 2 ft deep and add compost and fertilizers one month before planting.
- In Myanmar, the best time to plant avocados is at the end of May, which is the beginning of the rainy season. However, where irrigation farming is feasible, avocados can be planted between the end of the rainy season and the beginning of the winter season. This allows for the plants to be irrigated in summer while they are getting good sunlight to enhance rapid and vigor growth in the rainy season.
- It is important to tie the plants to stakes immediately after planting so that they don't break when the wind blows.
- When planting, intercrop two rows of the main variety and one row of another variety that has the same flowering time for cross-pollination. For example, intercrop Haas (type A) and Fuerte (type B) to cross-pollinate for both higher yields and better-quality avocados.
- However, the fruits need to be picked separately.

2. Caring for Plants

- In commercial cultivation, regular pruning is required to keep the height up to 12-15 ft. That makes spraying fertilizer and picking easier. Otherwise, avocado trees grown from seed can grow up to 30 to 45 ft in height if it is left to grow freely without pruning (grown naturally).
- If the avocado trees grow more than three feet during the first year after planting, cut the stem to a height of only three ft. Leave only 3-4 side branches, and cut the small branches and the branches that turn inwards.
- The avocado tree grows very fast and can grow up to three ft in a year. Some growers cut all the upward branches, inward-turning branches and outward branches about 2 months before flowering. By cutting like that, the plant gets more direct sunlight and produces more fruits. Fully grown avocado trees only give 150 to 200 fruits per tree, therefore this type of pruning results in high yields of good quality fruits.

Irrigation is essential during fruit initiation and fruit development stages. As the fruit initiation period is the dry season, irrigation must be done once (1) a week if possible. However, the fruit development period is the rainy season which does not require irrigation. To keep the soil moisture beneath the plants, mulching with straw and dried grasses is necessary.

3. Applying Organic and Chemical Fertilizers

- If the avocado trees are grown naturally, animal manure, compost, and vermicompost should be applied three times a year. 1 to 2 baskets of manure can be applied at a time for one plant.
- As the plant grows, more compost needs to be applied. Micronutrients such as manganese, zinc, copper magnesium, and Sulfer should be applied as foliar fertilizer and bone powder should be added to the soil for phosphorus and nitrogen.
- If chemical fertilizer is used, it can be mixed with natural compost.
- At the time of planting, add 10-15 kg of compost and 100 grams of 16:16:16 compound fertilizer to the planting hole.
- Then about 100 grams of this compound fertilizer is added by digging a hole 1 foot away from the plant base once every 4 months.
- When the plants grow, increase the fertilizer application to 200 grams at a distance between 2 to 4 ft from the plant canopy.
- When it sets good fruit, 2 kg of fertilizer with 2:1:4
  (Nitrogen: Phosphorus: Potassium) is applied 3 times a year.

C

PEST AND DISEASE MANAGEMENT

C. PEST AND DISEASE MANAGEMENT

TEA: How to manage pests

1. Land Selection and Clearing

Pest management is important in tea production. However, pest management must be done when pest infestation is over the economic threshold level to cover the costs, time and labour. Table 4 presents the various pests seen in tea plants and the measures to control them.

Table 4: Types of tea pests and their control measures

	Characteristics	Control Measures
White Grubs	• White grubs which are the larvae of scarvab beetles are in the soil and destroy the plant by eating mainly the root of the tea plant. • The adult beetles lay eggs in the soil in June and the eggs grow as larvae between June and August. • They can infect not only tea farms but also the nursery by moving one plant to another. • As a result, leaves and branches which are the upper portion of the tea plant will be dry.  White grubs	• Use biological controls such as Beauveria Bassiana. • Use the compost which is sufficiently composted as white grubs reproduce in undecomposed farmyard manure. • Use neem extract or pyrethrum-based insecticide.

Thirps and Spider Mites

- Thirps and mites damage the tea plant by feeding on the tea plant sap.
- They reproduce under warm and humid conditions and mostly spread in the air because they are weak in flying.
- As a result, leaf margins will become yellow and also the leaf surface become uneven, curled and mitte.

Thirps

Mites

- Prune the infested leaves from the tea plant with a stem cutter individually and dispose of them thoroughly by sealing them in plastic bags.
- Cut the thrip-infected whole branch at the branch junctions with pruning shears or a saw.
- Spray water the infested plants with high pressure to the thrips are down. Spray mainly the underside of the leaves in spider mites-infested leaves. Spray for three consecutive days to eliminate them.
- Spray 2% percent insecticidal soap until it drips from the infested plants. Spraying three days for two weeks is the most effective.
- Spray spinosad insecticide which is microbe-based in the early morning or after dark until the larvae hatched from eggs deposited in leaf tissue. Spinosad kills the thrips when the thrips contact or ingest it.

Rodents

- Rodents dig holes near the tea bushes and also eat the roots, thus, the roots can't develop properly.
- Free from glass as much as possible since rodents proliferate in fields full of glass.
- Control with traps and poisonous baits
- Plant Cliricidea, a tropical tree, which is poison for rodents in the field.

TEA: How to manage diseases

Disease-infected plants can die due to the disruption of their normal functions. Plant disease spread from one plant to another in the field, affecting the quantity and quality of tea. Table 5 presents the list of diseases commonly seen in tea plants and the measures to control them.

Table 5:
Types of tea diseases and their control measures

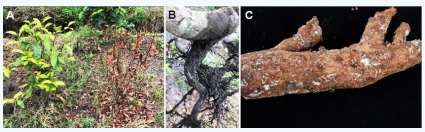
Blister blight

Characteristics	Control Measures
• Blister blight is caused by a pathogen called Exobasidium vexans. • The symptoms are the formation of small and needle-like spots on the leaves. Those spots gradually develop into blister-like white and velvety bulbs. • Then, they gradually turn brown, and the stems will become bent, distorted, broken and finally die. • Tea blister blight mainly occurs in high humidity, low temperature and sunlight level conditions and is a problem at higher altitudes in the rainy season.	• Limit giving shade since the causal organism is very sensitive to direct sunlight and it will destroy after 4 hours exposing sunlight. • Remove the infected stems.

Symptoms of tea blister blight

Root Diseases

- Root diseases cause the upper portions of the infected plants to wilt and dry from the rotting roots.
- The symptoms of root diseases become obvious after the pathogen has already attacked 50% of the plant.
- Remove the infected plants including the roots, transport them with hermetic bags and burn them away from the field.
- Use Trichoderma and neem cake.
- Plant the healthy seedlings only from the nursery and ensure proper drainage.



Symptoms of red root diseases

Root Knot Nematodes

- Root-knot nematodes are parasitic worms, and they infect both the plantation and the nursery.
- As a symptom, the knots will form on the root and plant growth will stunt without developing literal roots.
- In addition, the tea bush will become yellow since the upper portions of the plant are less growth and can't produce chlorophyll.
- Add organic matter which encourages the growth of beneficial organisms in the soil.
- Add the neem cake

Roots affected by root-knot nematodes

TEA: How to manage weeds

Weeds are competitive with tea plants in absorbing nutrients, sun and water. Weeds can increase the incidence of pests, diseases and rodents. Therefore, weeds must be controlled.

- Mulching, raising cover corps, and narrow spacing in the plantation.
- Create a wide plucking surface area because it provides more shade.
- Remove weeds manually or with tools.
- Use homemade herbicide mixed with a little liquid dish detergent and one cup of salt for effective weed control.
- Use white vinegar containing 5% acetic acid. When the stronger version is used, great care with protective measures should be followed not to be harmful to humans. It must be careful to minimize any overspray on the tea bushes and nearby soil. Repeated application may be necessary.
- Although weeds can be controlled with chemical herbicides, the usage of chemical herbicides must be reduced since they can damage water and soil resources and can be harmful to humans.
- Chemical herbicides and pesticides must only be used in the last condition by applying integrated pest management.
- It is necessary to use full protective equipment (mask, gloves, glasses, etc.) in the application of chemical pesticides.

TEA: How to use organic pesticides

If it is necessary to use pesticides, organic pesticides should be given priority over the use of chemical pesticides.

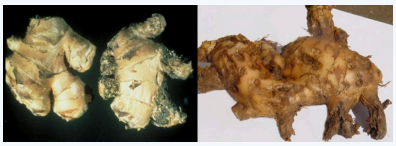
- Use Spinosad for pests that infect the garden including borers, beetles, bagworms, and tent caterpillars.
- Use Retenone for leaf-feeding caterpillars, beetles, aphids, and thrips. This pesticide takes a few days to be effective, so be patient.
- Use Pyrethrin which is extracted from the chrysanthemum plant.
- Use Bacillus Thuringiensis occurred naturally in the soil to control the leaf cutters.
- Use neem oil that inhibits the growth of the insect cycle and reduce the number of pests.

Care must be taken not to be harmful natural enemies when using pesticides.

1. Diseases

In ginger production, diseases caused by bacteria, fungus and nematodes are more common than a pest infestation. These diseases are Nematode root nod disease, Bacterial wilt/root rot disease and Fusarium wilt/root rot disease. Too much rain during the development of ginger; Ginger root rot can also occur due to waterlogging. Heavy rainfall and water stagnation during the rhizome development stage are indications of possible disease occurrence. Table 6 presents an overview of major diseases in ginger cultivation.

Table 6. Diseases in ginger

Disease	Illustration
Nematode Root Nod Disease • If the rhizomes are infested by nematodes, it is easier for bacteria, fungi and other decay-eating parasites to enter the rhizomes and the germination rate become significantly slow.	**Illustration**  Nematode-infested ginger rhizomes
Bacterial wilt/ Root Rot Disease • If the disease occurs, the plant will suddenly wither and begin to wilt and dry from the bottom of the plant. • Then the roots and mother rhizomes turn brown and rot and watery sores form around the diseased area, pungent smelling and the plant can be easily pulled out. • The plants dry out quickly and the leaves turn yellow to brown within 3 to 4 days.	 Symptom of bacterial wilt/ Root rot disease infection

Fusarium wilt/root rot disease

- When the disease occurs, the tips of the leaves will dry up and the lower leaves will turn yellow even though the plant has green leaves.

Symptom of Fusarium wilt/root rot disease infection

Root rot diseases cannot be controlled with fungicides but can be prevented:

- Planting only disease-free and healthy ginger seed rhizomes is the best way to prevent ginger root rot disease.
- The ginger sowing land should not be the same land where ginger has been planted repeatedly and affected by the disease.
- The crops which are very susceptible to bacterial diseases; tomatoes, potatoes, pepper, eggplants, and cabbages should not be intercropped with ginger.
- Weeding and setting up drainage channels to prevent waterlogging should be carried out. Excessive use of fungicides during disease outbreaks and for prevention is not recommended as it is not effective for preventing diseases.
- Trichoderma and neem pesticides that cannot harm the environment, land and people can be used to reduce the incidence of disease.

2. Prevention of Root Rot Diseases by Using Trichoderma

- Trichoderma and rice bran must be mixed in a ratio of (1:4).
- To prevent root rot disease, about 5 visses of Trichoderma and 20 visses of rice bran per acre can be applied as basal application either 3 weeks before planting or can be added to the planting ditches.

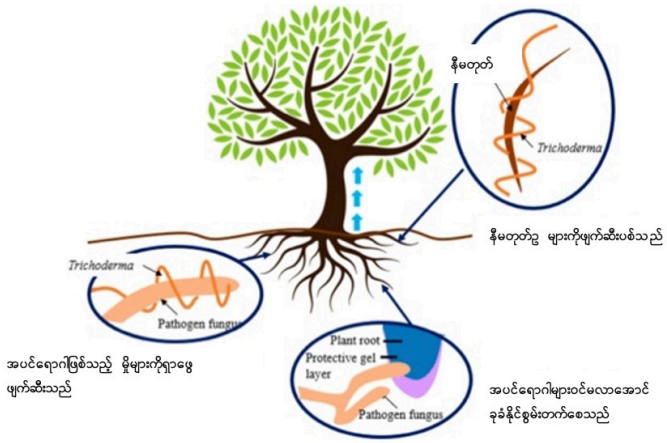


Figure 15. Functions of Trichoderma for disease prevention

3. Preventing and controlling Pests with Neem Oil

- Only spray the low-concentration neem oils early in the morning or in the evening.
- Mainly spray the lower part of the leaf surface where the eggs of insects are mostly found
- If the weather is hot, the frequency of spraying should be increased. It should be sprayed daily during the rainy season and once every 10 days during the winter. If a sprayer is used, only half the amount of water should be used.
- Spray up to (60) litres of neem oil diluted with water per acre. The amount to be used can be changed depending on the pest infestation.

Mainly spray the lower part of the leaf surface

Only spray early in the morning or in the evening

Figure 16. Tips for using neem oil spraying

4. Prevention and control of pests and plant diseases using EM-5 solution

- EM-5 solution should be sprayed every 7 to 10 days throughout the life cycle to prevent pests and plant diseases.

5.1. Making EM-5

Ingredients

1. Concentrated EM (1)
2. Molasses (1 time)
3. Vinegar (1 time)
4. Distilled Alcohol (1 time)
5. Water (6 times)

Procedure

- Mix the ingredients well and put the mixture in an airtight container or water bottle covered with a tight lid which should be kept in a cool location away from the direct sunlight
- It can be used after 10-14 days
- The shelf life of EM-5 is within 90 days after mixing

Application of EM-5

- Mix EM-5 solution with water 1:500-1000 ratio to improve plant resistance to pests and diseases
- To control pests and diseases, mix the solution with water 1-100 ratio at the early stage.
- EM-5 can be mixed with hot pepper, neem, etc to get the stronger effect

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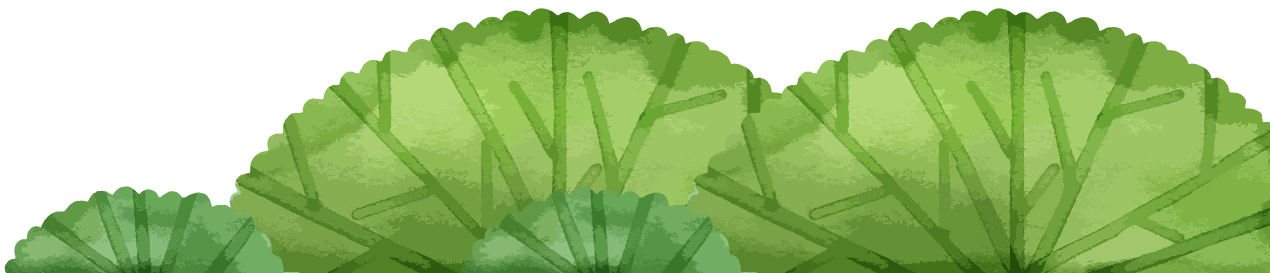
Figure 17. Items that can mix with EM-5 for stronger effects

AVOCADO: How to prevent pests and diseases

- Termites, red spider mites and white flies are the most common and worst pests in the avocado tree. Aphids and mealybug infections are not bad due to natural enemies.
- Red spider mites can be prevented with sulfer-based pesticides such as endosulfan. When it is rainy a lot, these red spider mites can be washed away with the water.
- To prevent termites, dilute 200 grams of Confidor in one liter of water and spray the plant base and soil. Dilute 600 grams of claudin with 100 litres of water and spray one litre per plant.
- White flies can be prevented by spraying under the leaves with contact and systemic insecticides.
- The worst disease is root rot caused by a phytophthora fungus. As this disease is mainly due to waterlogging, the flow and infiltration of water must be improved. If the West Indian varieties are used as stock, the root rot disease is resistant.



D

HARVESTING AND POST-HARVEST HANDLING

D. HARVESTING AND POST-HARVEST HANDLING

TEA: How to pluck

Tea plucking is the removal of top buds and young tender shoots of tea. Most tea-growing areas in Myanmar harvest tea between March and October. Tea is plucked in March, April and May (3 times in total). Tea which is plucked before the first rain is called Shwe Phi Moe Loot. Shwe Phi Moe Loot has a strong taste and good quality. After a resting period of two weeks, tea plucking is done twice a month from June to October (10 times in total). Thus, tea can be plucked 19 times a year.

1. Type of plucking

- The type of plucking affects the survival of the tea plant, quality and yield of the tea.
- Plucking only two leaves and one bud - produces the highest quality and highest price.
- Plucking three leaves and one bud - produces high quality.
- Although plucking many leaves can seem to increase yield, it might lower the surface area that can be plucked, hinder the tea plants' capacity to grow and decrease the number the new leaves that develop. Therefore, the yield will gradually decline.
- Plucking more than five leaves can weaken the tea plant and form the crow's feet branch.

2. Factors for successful plucking

- Should pluck the tea leaves after the young tea bush has been trained.
- The plucking surface must be leveled for easy plucking.
- Must pluck in the dry season.
- The plucking interval should be regular. If the plucking interval is longer than normal, young shoots will become rough and the formation of sterile buds which will decrease the yield and quality of tea will ensue. Moreover, the plucking surface will also be high.
- Plucking material should be cleaned and maintained well. They should be kept in a place that is free from insects and animals.
- Separate the building for tea storage and that building must be away from fuel, pesticides and fertilizers, agricultural tools and other materials and prevent pests and animals.

GINGER: How to harvest and post-harvest handle

The mother rhizomes can be harvested four months after planting for the first time. The price of ginger is usually high during that time. The mother rhizomes must be carefully taken not to damage the new rhizomes. After the mother rhizomes are harvested, earthing up should be carried out to encourage the development of new rhizomes. Weeding and fertilizer application should be done also. The second harvest can be done 8 to 10 months after planting. Harvesting time varies depending on market demand and its usage.

- For fresh use purposes, ginger should be harvested at the stage of low pungency and fiber content in rhizomes, which is before the fully mature stage, 180 days after planting.
- For dried and oil products, it is harvested at the fully mature stage, 210-240 days after planting when the leaves turn yellow. Delaying in harvesting can reduce the ginger quality and increase the fibre content, limiting the storage life as well.
- Ginger is usually harvested when the leaves turn yellow and have dried down completely. Depending on the market price, the ginger rhizomes can be kept in the field for 3-4 months without digging them.
- Irrigation should be stopped one month before harvest. During manual harvest, the soil around the rhizomes should be loosened first and then lift them carefully by using digging forks and hoes. A harvesting machine can also be used.
- The harvested ginger should be free from soil, dirt and other foreign matters.
- When harvesting is done in wet conditions, the rhizomes must be immediately transported and kept under a drying shed.
- Harvesters and other machinery used must be cleaned to reduce contamination from soil and other materials.
- The rhizome should be cut out using a sharp knife about a half inch above the stem and the rhizome meets.
- The long stem must be left to dry the rhizomes faster. Cutting the stem from rhizomes should be carefully done to avoid damaging the rhizome fingers.
- The rhizomes should be washed with clean water. A power nozzle can be used to wash soil particles from the rhizomes. After washing the rhizomes, dry them fully for an hour or more.
- Washed and dried gingers must be stored in a clean and dry place to prevent external contaminations.
- The gingers should be stored after drying for 14 days at 70-75 percent humidity and 22-26•C temperature.

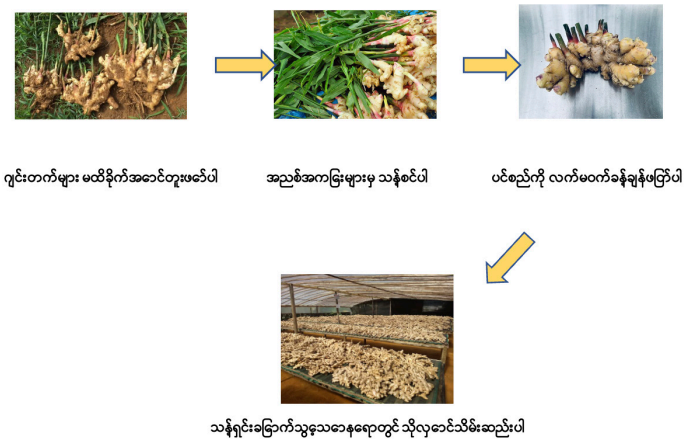


Figure 18. Harvest and Post-harvest good practices of ginger

AVOCADO: How it ripens and how to pick

- Avocados ripen differently than other fruits. Avocados are still hard while they are on the plant. After picking, it becomes soft and edible.
- Avocados do not ripe on the plant although they are fully mature. It will ripen only after picking.
- The well-matured fruit is evenly ripened. The edible bulb is smooth and elegant and can give a buttery soft touch.
- Depending on the cultivation area and the weather condition, the ripening time of the fruit is different.
- The shape of the fruit, fruiting style, fruit quality, flavours and ripening time vary depending on the variety.
- The same variety usually ripens at the same time. When the fruit is ripe, the seedcoat inside the fruit has changed from ivory to dark brown colour.
- If the unmatured fruit is picked early, the fruit will not ripen properly. Eventually, the peel of the fruit will shrivel.
- Avocados don't have to be picked immediately when the fruits are matured. The picking time can be adjusted since the mature fruits can be kept on the plant for 2 to 8 months depending on the variety.
- The maturity related to the water content in the fruit. Normally, the fruit can be picked if its moisture content is below 80 percent.

Avocado fruits need to be picked at the right ripeness. Careful handling is needed at picking and packing time. If the fruits are not handled properly, they can be crushed and bruised easily. Table 7 presents the procedures to follow while determining ripeness and picking avocados.

Table 7.
Procedures for determining ripeness and picking avocados

How to determine ripeness	How to pick avocados
✓ Pick an average-sized fruit at ripening time according to the variety as a sample. ✓ Store the picked fruit at room temperature until ripe. The avocado is ripe if it sags slightly when its entire surface is pressed down with light pressure. ✓ For example, if the tested fruit ripens within 8 to 10 days without shrivelling, the fruit can be picked. It can be defined as mature. And picking fruits similar to that fruit can start. ✓ If the fruit takes more than 10 to 12 days to ripen, the same function should be repeated after a week. ✓ This function is very important in determining maturity for picking. Not all the fruits on the tree reach the maturity stage for picking at the same time. ✓ If there is doubt, it is better to wait than pick before they're ripe.	✓ Workers should wear cotton gloves to avoid scratching the avocado fruit with their fingers while picking. ✓ When picking the fruit, the stalk must be cut with a knife or scissors. Hand-picking must be avoided. ✓ The fruit should be picked, leaving 10 to 15 mm of the fruit stalk. ✓ Vigorous fresh fruits should be transported in a bag made of cotton or cloth. More than 10 to 15 fruits should not be carried in the bag at a time. ✓ Fruits that are in a high place of the plant can be picked with a three-pronged ladder. ✓ Fruits that cannot be reached by hand can be picked with fruit picking tools. ✓ Using the right tools can prevent unwanted damage to the fruit. In addition, the cost of labour will be lower, and the risk to workers will be reduced.

AVOCADO: How to post-harvest handle

1. Handling after picking

- Take out the fruits one by one from the bag and place them in the tray.
- The fruit must be carefully transported to the building or place where it will be packed.
- Trays with fruit must be placed in the shade if they have to wait for transport. If there is no shading place, they should be covered evenly with these trays.
- Covering with awnings should not be done because it will block the aeration and the temperatures will rise under the awning.
- Picked fruit should be moved from the farm as quickly as possible.
- The picked fruit should be packed and transported to market or cold storage during the picked day.

2. Grading and Packing

- It is important to be aware of fruit crushing and bruising.
- The handling workers must wear gloves.
- The table where the fruit will be placed must be clean and smooth.
- The fruit stalks should be cut with a sharp knife to a length of about 6 to 12 mm.
- For export, the fruit must be graded according to its condition. Fruits that are visually flawless and have a good appearance are suitable for export. Avocados suitable for export must be moved to another table or place.
- After that, using a suitable post-harvest fungicide and waxing, if necessary, is done and they must be packed in suitable boxes.

3. Cold Storage

- Fruits must be stored quickly at cold temperatures to avoid rapid ripening. The lower the temperature, the longer it takes for the fruit to ripen. However, very low cold temperatures will potentially damage the fruit.
    - Cold storage of avocados at 5.5°C is generally best.
    - Early ripening fruits can be stored at a slightly higher temperature, and late-ripening fruits can be stored at a slightly lower temperature.

E

FARM MANAGEMENT

E. FARM MANAGEMENT

TEA: How to keep farm records

Farm record keeping is an important task for farmers.

- Farmers can review the performance of previous years and make a better plan for the coming year by keeping farm records. And farmers can also know the cost and revenue.
- In the farm record, each activity must be recorded accurately.
- Inputs, labour, yield, cost, and revenue must be recorded annually.

TEA: How to boost product value

- A strong relationship can be built between the customers and the business by increasing the value of tea.
- The wiliness to pay for the tea depends on the smell, taste, and quality.
- Thus, farmers need to analyse the market and produce the required quantity with high quality.
- There are many ways to improve the value of tea:
  - ✓ Selling high-quality tea, Shwe Phi separately
  - ✓ Getting the certificates by practicing a sustainable agricultural system that doesn't damage the environment
  - ✓ Value adding
  - ✓ Tea should be produced by following the food safety standard.
  - ✓ Tea farmers should produce by practicing Good Agricultural Practices since tea can be produced in various diversities of products and can be exported.

TEA: How to link with markets

Tea producers along the tea value chain need to be involved in the basic production stage and have good quality tea to access better markets.

- Tea can be sold individually or by a group.
- Farmers must know the market conditions and price to sell the place where the higher price by comparing the market price. Payment terms must be defined once.
- Tea production farmers are involved in the production stage along the value chain and must produce high-quality tea to access a better market.
- If farmers can link with a market that has a sustainable market system, production methods will be developed and they can get more income.

GINGER: How to keep farm records

- Farmers should keep the farm records (production plan) systematically for at least 3 years.
- Farm records must include all the steps from the preparations to marketing (seed, fertilizer, pesticide application and irrigation history, input cost, labor cost, post-harvest cost, etc.).
- The income statement, profit and loss must also be recorded. Farm records help farmers to analyse their past performance and future requirements.
- They are also useful for knowing and calculating the farm's income and expenditure but also to understand the strengths and weaknesses of the farm business.
- Overall, farm records are key for the systematic management of the farming business.

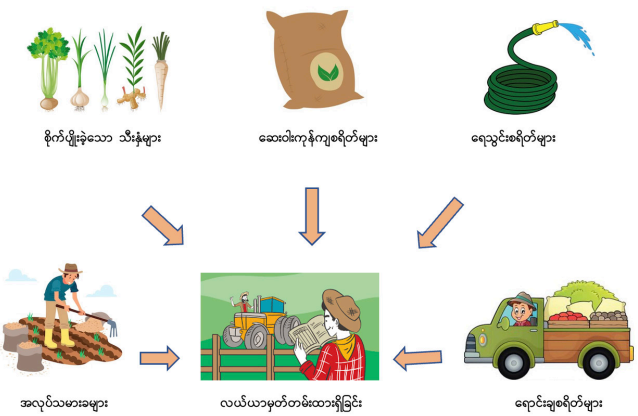


Figure 19. Items to keep in farm record

GINGER: How to boost product value

- To determine the value of the product, it is necessary to know the cost of production. Calculating the cost of production supports determining the selling price of the products.
- The price of the product can vary depending on the target market and selling form.
- The price of ginger can also vary depending on the product type and the time of selling.
- Usually, the mother ginger price is high due to a supply shortage in the market at mother ginger harvesting time.

GINGER: How to link with markets

- The product quality and the selling type can also vary depending on the target market. It is important to know the quality requirements of the target market.
- Depending on the market price, farmers can sell their ginger individually or collectively with other farmers.
- When selling ginger as a group of farmers, the buyers can reduce the transaction cost compared to buying small quantities from many farmers. As a result, the farmers can sell their products at high prices. Collective selling increases the bargaining power of ginger farmers for their produce.
- Ginger farmers can sell their products to the markets either through brokers or directly to the ginger-based food industries. In addition, the farmers can directly sell to the exporters.
- To fetch high prices for their products, meeting the quality requirements and the needs of the market is key.
- Farmers need to know and be updated on retail and wholesale market information.
- Farmers should sell their products after cleaning, grading, and packaging them. By doing this, the product value will increase and the product price will be higher.

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Figure 20. Types of selling your farm produces

AVOCADO: How to keep farm records

- Because the avocado tree is a perennial plant, costs and returns are not easily predictable. Therefore, it is necessary to keep records of expenses from the time you prepare to start planting.
- By keeping farm records, growers can not only review previous years' performance, but also plan and make selection decisions for the next season.
- In addition, the farmers can calculate the income and expenses, advantages, disadvantages, and the money drains of their farm. Through this, the farmers will improve their management skills by managing their farms very well.
- The farming records should include expenses such as Input costs, labour costs and post-harvest costs.
- The annual profit and loss must be calculated and recorded based on returns from crop sales and expenses.
- In the early years before fruiting, the cost of an avocado farm will be added each year. The returns obtained from the first year of fruiting shall be recorded annually.
- The returns of earlier years may not yet cover the total cost incurred. Only after a few years, the profits will come out. Therefore, a farm record should be kept by every avocado grower. Only then, profit, the returns and the capital invested will be clearly stated.

AVOCADO: How to boost product value

- Product prices can be set depending on the targeted market. The value of the product may vary depending on the way you want to sell it.
- If you expect a high-value product market, you may need to meet the minimum requirements of that market. The minimum requirements include product variety, quality, quantity and certification.
- To determine the value of your product, you need to know the cost of production. Calculating the cost of production can be an aid in determining the selling price of one's product.
- You can know whether the available market price exceeds the cost of capital or not. Therefore, you should also pay attention to the market price.

AVOCADO: How to link with markets

- The price may still vary depending on the type of sale and the time of sale.
- Availability of market information plays an important role in obtaining high prices and market access. Therefore, to obtain continuous market information, avocado farmers need to connect and cooperate with buyers, brokers, service providers and organizations.
- When it comes to selling, it is much more profitable to sell in a group or an association than to sell individually through brokers.
- Collective selling increases the pricing or bargaining power of one's products. It can get closer to getting the appropriate price that the farmers want than the price offered by the broker. Moreover, new market opportunities can be created by collective selling and action of the farmers.
- The nutritional value and medicinal value of avocados have become well known and their consumption has increased.
- The farmers have been planting the grafted avocado varieties which are the top variety and are widely accepted on the global market.
- The abundance season of avocados in Myanmar is at a time when other countries' avocados are off-season and, hence there is less competition in the market, thus presenting an increased market opportunity for avocado farmers in Myanmar.

F

FOOD SAFETY FROM THE PERSPECTIVE OF FARMERS

F. FOOD SAFETY FROM THE PERSPECTIVE OF FARMERS

Why is food safety important for farmers?

Food is one of the necessities for the survival of human beings. The nutrients that we got from consuming food give us energy and nutrients for performing sustainable daily activities. Indeed, food plays a huge role in our society. Consuming safe and nutritious food brings happy and healthy life. Everyone has the right to expect the food that they eat to be safe and suitable for consumption. Taken together, they also need to enquire themselves "Why is food safety important?"

Foodborne diseases are significant public health concerns throughout the world and every year, millions of people around the world (one in ten) suffer from them. Unsafe food is not only a threat to health, trade, and tourism sectors but also a burden on social-economic development. Together with global population growth, food safety and security are becoming the main important concerns compared to the past.

Food safety is the assurance that food will not cause adverse health effects to the consumer when it is prepared and/or eaten according to its intended use. Food safety is about preparing, producing, storing, and handling, food in a manner that prevents infection or diseases and retain nutrients for a healthy diet throughout the food supply chain (from farm to fork). Everyone, including primary producers, importers, manufacturers and processors, food warehouse/logistics operators, food handlers, retailers, and consumers, has a responsibility to ensure that food is safe and suitable for consumption. Therefore, as "Food safety is everyone's business", everyone has responsibility for participating.

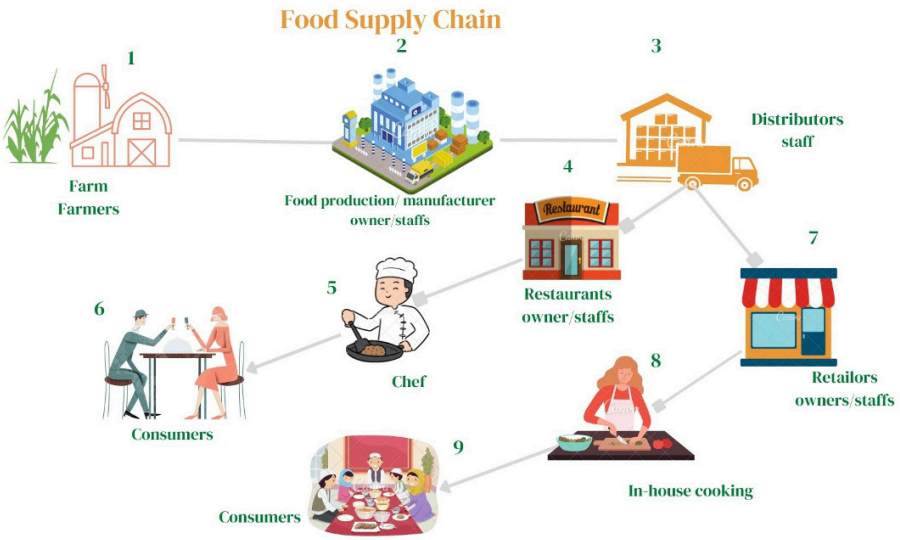


Figure 21. Food Supply Chain (Farm – to Fork, Farm to Consumers)

Why are food safety regulations important?

Food safety regulations are essential for consumers and food businesses as they protect consumers from potential food-related problems. Food safety regulations apply to consumers, food producers and the suppliers as well. These are guidelines to avoid occurrance of life-threatening food problems. These regulations help food businesses to trade domestically and internationally through production of safe foods. Food safety laws and regulations protect consumers from deceptive and dangerous practices on food.

All countries have national food control programs to help reduce and prevent illness and disease from unsafe food for all citizens. The main objectives of the National Food Stewardship Programme in Myanmar are:

- To protect public health by reducing the risk of foodborne illness
- To prevent consumers buying and consuming unclean, mislabelled foods which is not beneficial for health
- To provide a strong legal basis for domestic and international food trade, and to benefit economic development by providing consumers with confidence in the food production system.

Myanmar is a member of the Codex Commission. The Codex Alimentarius Commission is responsible for the implementation of all food standards programs jointly established by the Food and Agriculture Organization and the World Health Organization. The provisions of the Codex Commission are not mandatory laws. If you want to follow it voluntarily, you can follow it. However, when member states enact laws, the Codex Commission's standards and references are often made to the guidelines (for example, referring to maximum residue limits for toxic metals, pesticide residues.)

Which organizations are responsible for food safety controls in Myanmar?

Food safety is important to cover the entire food supply chain. Government departments and organizations that are mainly responsible for Myanmar's food supply chain; their main responsibilities and activities are shown in table 8 below.

Table 8.
Myanmar's food safety control organizations

Food Supply Chain step	Name of Organizations/ Departments	Key functions
Input supply	MOALI (DoA, PPD, DAR, LBVD, DoF), MITS, Customs Dept, MoHS(FDA), MoC, MoPFI	Quality inspection and quality control
Crop Production	MOALI, MOGPA, MFVP	Technical assistance in applying GAP, organic standards
Aggregation/ Trading	MoC, MoALI, MoHS and Associations of UMFCCI	Ensuring compliance with international trade agreements
Preliminary processing / Final Food processing	MoI, MoHS(FDA), MoPFI, MoE (DRI), Associations of UMFCCI	Support for accessing GMP, GHP, HACCP certificates
Packaged food import	MoC, MoHS (FDA), Township Municipal committees	Checking and control of food safety standards that can affect public health
Domestic Retail / Wholesale distribution	MoHS(FDA, Public Health), YCDC	Controlling compliance of food safety standards in markets; controlling issuance of certifications

What are the benefits of implementing food safety systems?

There are steps to apply (figure 22) for food safety and benefits to producers, workers, and consumers of a produce from implementing food safety systems as outlined in table 9.

Figure 22. Steps to follow for food safety

Table 9.
Benefits of food safety systems

Producers/ manufactures	Staff throughout the food supply chain	Consumers
• Full confidence in his product • Gaining consumer trust • Can be used as a marketing tool • Being able to go to the market with good prices • Reduction of wastage • Reducing customer complaints; and easy to solve	• Reliability throughout the food chain • Following good hygiene practices • Working in a safe workplace • Reduce wastage during production • Working in a workplace with a clear division of responsibilities	• Being able to consume the product with confidence • Avoiding food-borne illnesses and cost savings concerning with health problems • Living a healthy and long life by consuming safe foods

What causes foodborne illness? What are the preventive measures?

- Foodborne illness continues to play an important role in public health concerns worldwide.
- Unsafe food not only threatens health but also plays a major role in the country's socio-economic development.
- Biological hazard is the main food safety concern for consumers which can cause adverse health effects to consumers.
- Food-borne illness or food poisoning means that the consumer suffers from illness because of consuming food that contains harmful microorganisms during the production of food or consuming contaminated food with toxins that are produced from pathogens or due to the poison produced in the consumer's body by harmful microorganisms.

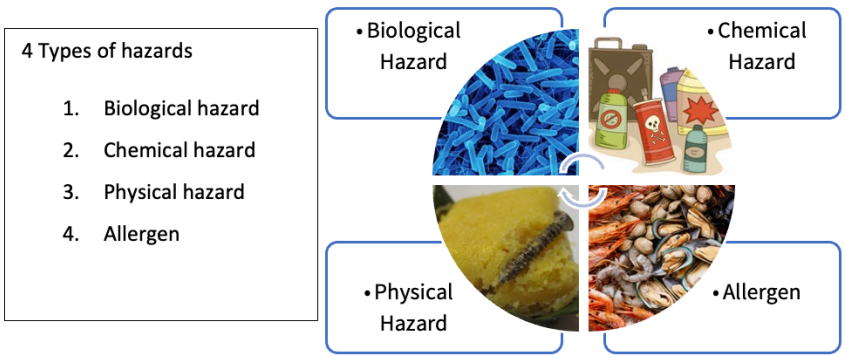
Table 10 gives an overview of symptoms of foodborne illnesses and measures to take for prevention.

Table 10. Possible symptoms of and preventive measures for foodborne illness

Symptoms	Preventive measures
Diarrhea	Using Good Agricultural Practices
Food poisoning	Following Good Hygiene Practices
Dizziness	Purchasing from a trusted partner
Vomiting	Keep Clean
Fever	Separate cook and raw food
Loss of appetite	Cook thoroughly
Muscle pain	Keep food at a safe temperature
Dehydration	Use safe water and raw materials
	Record everything

What are the sources of hazard? What are the preventive measures?

Unsafe food can make people sick with foodborne diseases and is caused by microorganisms and/or toxic chemicals. Therefore, it is essential to distinguish harmful substances in food that can cause adverse health effects, and these can be controlled systematically with preventive measures. There are four types of hazards as illustrated in figure 23.



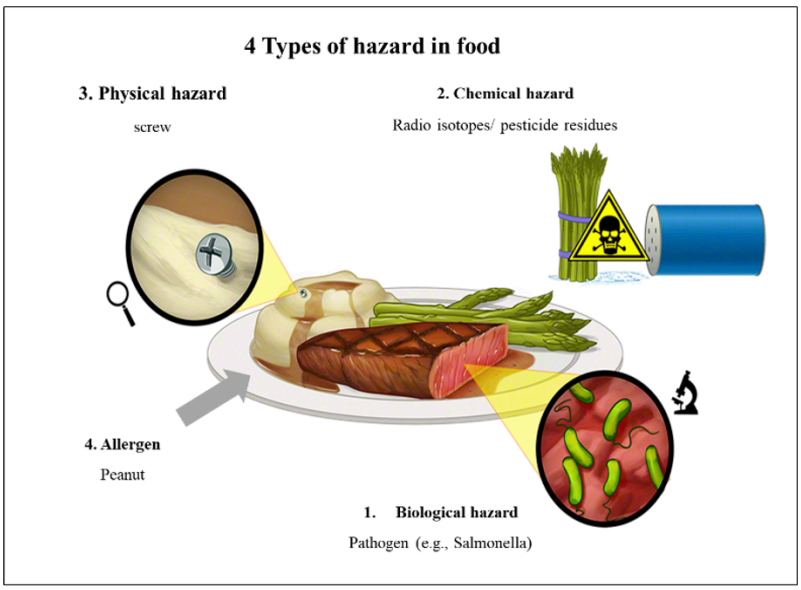


Figure 23. Four Types of Hazards

1. Biological hazard

Microbiological hazards are the greatest threats to human health. Biological hazard occurs when pathogenic organisms are introduced into the food and cause food safety issues for consumers. They can be encountered from environmental (e.g., soil bacteria, agricultural products) or contamination during food preparation or storage (e.g., poor personal hygiene practices).

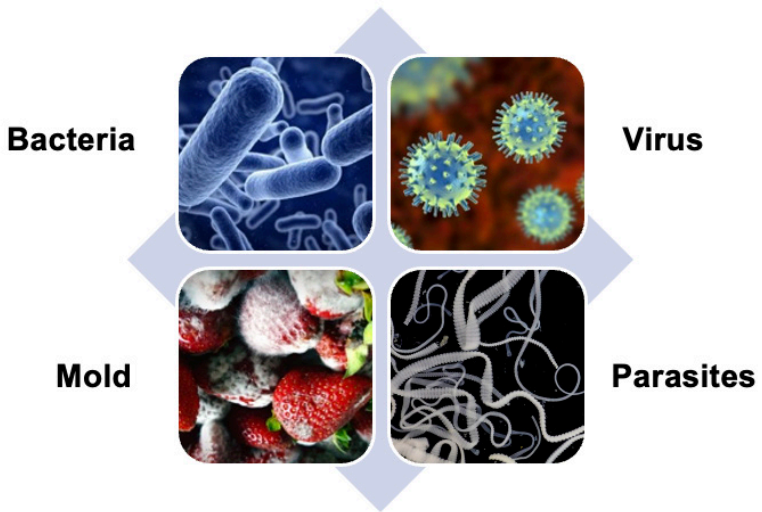


Figure 24. Biological Hazards that occur in Food

Microorganisms in food may include:

- Beneficial microorganisms that can be used in food (e.g., yeast for producing beer)
- Spoilage microorganisms that can cause food spoilage (e.g., Streptococcus spp. in spoilage of milk)
- Pathogens that can cause adverse health effects to consumers (e.g., Salmonella in eggs)

Table 11.
Specific products that contain microorganisms and preventive measures to take

	Food that contains….	Preventive Measures
Bacteria	• **Salmonella** – egg, impurified water, well-uncooked meat • **Staphylococcus aureus** – meat, poor personal hygiene practices, pudding, food with cream • **E. coli** - impurified water, food handlers, raw materials from contaminated soil, milk • **Listeria** – milk and milk products, well-uncooked meat, and fish • **Clostridium botulinum** – canned food, pickled vegetables	• Well documented the list of harmful microorganisms • Good Hygiene Practices (Personal hygiene, clean utensils, clean environment) • Following correct process steps (cooking at intended temperature and time) • Systematic classification (separation of raw materials and finished goods, separation of equipment used, separation of production zones) • Proper control of waste and germs that can enter with air from the outside • Preparation (having a proper systematic process in place for product recall)
Virus	• **Hepatitis A and E** - contaminated food with the saliva of that person	
Parasites	• **Taenia solium** – well-uncooked pork • **Taenia saginata** – well-uncooked beef	
Mold	• **Aflatoxin** – moist environment, unhygienic environmental conditions	

2. Chemical hazard

Chemical hazards occur when food contains more than acceptable levels of chemicals that can be harmful to humans.

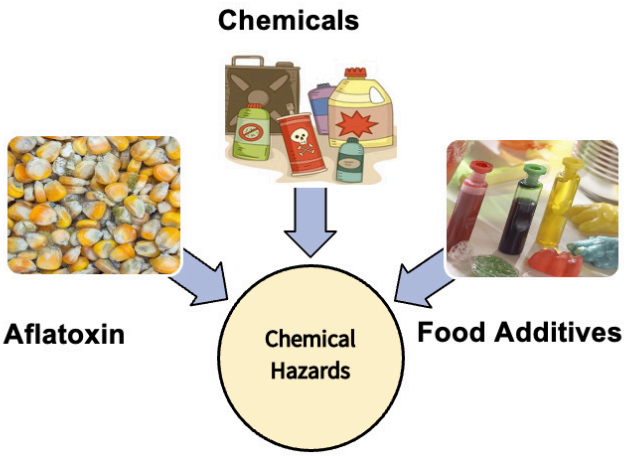


Figure 25. Chemical Hazards in Food

Table 12.
Types of chemical hazards and preventive measures

Type	Examples	Preventive Measures
Hazards found naturally in the environment	• Toxin in foods (e.g., aflatoxin, mycotoxin)	• Implementing good agricultural practices among farmers • Selecting a trusted supplier. • Screening and receiving of raw materials. • Segregation and storage of raw materials and finished products. • Knowing the environmental conditions that can lead to mold growth. • Knowing the use of chemicals intended for food • Knowing the acceptable limit of food additives in specific food • Proper separation of chemicals • Documenting
Man-made chemical hazards	• Agricultural fungicides; Herbicide residues • Industrial grade chemicals • Cleaning soaps (if not food-grade) • Printing inks; Lubricants • Surrounding water; Harmful substances introduced through air pollution (e.g., lead, mercury)	
Man-made chemical hazards from intentional use	• Dyes that are not allowed to be used in foods (e.g., Sudan III, Oramin O) • Preservatives that are not allowed to be used in food (e.g., formalin, borax) • Uses more than the acceptable limit in food (for example: using > 0.1% of sodium benzoate in sauces)	

3. Physical hazard

Physical hazard means the hazardous things that may occur during food receiving, preparation, storage, or adding intentionally from outside. For example, in the case of boneless meat, a bone can be a physical hazard for consumers, or a pin or glass piece in bread is also a physical hazard for consumers. They can cause adverse effects to consumers such as choking, cuts and bruises in the mouth and gastrointestinal system.

Figure 25. Chemical Hazards in Food

Table 13.
Examples of physical hazards and preventive measures

Examples	Preventive Measures
• Piece of glass – Cracks of glass, lamps and ceiling • Piece of metal – Fallen from machine or leftover within cleaning of equipment • Hair, artificial eyelashes, rings – Lack of personal hygiene or not following personal hygiene practices • Dust, stone, pieces of clothes – Poor cleaning and sanitation • Piece of wood, stone, sand – Raw material sources, wooden pallets • Piece of plastic – packaging materials and containers	• Visual inspection and checking (removing plastic or pieces) • Systematic inspection and recording (inspection of the number of thermometers, inspection and recording of lamps, an inspection of machines) • Adequate personal hygiene practices (wearing protective cloth properly, wearing a mask) • Keeping the environment clean (no dust or litter) • Covering (lamps) • Use of filters (sieve, etc.) • Examination using objects such as magnets (Metal detector, X ray)

4. Allergen

Food allergy is an immune system reaction that occurs soon after eating a certain food. Food allergies happen when the immune system of the body's defence against infection and mistakenly treats proteins found in food as a threat. Even though allergies occur in a small number of people, if they do occur, they range from mild illness to life-threatening and require serious medical treatment. Consequently, it is estimated that food allergens occur in 1-3 percent of the adult population and up to 4-6 percent of the children population. Therefore, Food and Drug Administration, Myanmar declared 8 allergen food groups for consumers to prevent the risk of allergen issues.

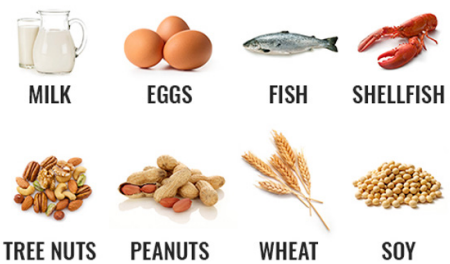


Figure 27. Common 8 Allergen Food Groups

Table 14.
Examples of allergens and preventive measures

Examples	Preventive Measures
• Cereals containing gluten i.e., wheat, barley, oats • Crustaceans and products of these • Egg and egg products • Fish and fish products • Peanuts, soybeans, and products of these • Milk and milk products (lactose included), • Tree nuts and nut products • Sulphite in concentrations of 10mg/kg or more	• Labelling (awareness of allergen consumption) • Clean production (Using clean utensils and cleaning workspace) • Separate (separate room, utensils, production line, equipment from others) • Systematic transportation (precise labelling of allergenic food, well packaging and separate from others during transportation) • Record for everything (document for every risk) • Prepare for recall (preparation of product mock-recall procedure in systemic ways)

What are the national and international Food Safety Certificates?

Food safety certificates are issued by an independent organization or third-party certification body verifying that a food system meets food safety, security, and quality specification throughout the supply chain. If the food industry has obtained a food safety certificate, it gives the consumer an assurance that the supplier has met the best hygiene practices recognized locally or internationally. As such, food safety certificates have a key bearing on the suppliers' market power.

In Myanmar, the DoA under MoALI extend its services across the whole country to ensure that all farmers follow Myanmar GAP standard as mendatory requirements. ASEAN GAP and Global GAP are applied by some group of farmers working in contract farming with certain exporting companies. Organic certificate is issued by Myanmar Organic Growers & Producers Association (MOGPA) and also by Control Union (Netherland) as globally recognized certificate.

In addition other supply chain actors such as food processors and manufacturers can be obtained SSID (Small Scale Industrial Department) certificte, FDA Licenses from Department of Food and Drugs Administration under MoH, HACCP (Control Union), etc.

Figure 28. National and International Food Safety Certificates along the food supply chain

1. Myanmar GAP Certificate

Myanmar's Good Agricultural Practices (GAP) initiative, led by the Department of Agriculture, shares the knowledge of GAP among farmers in Myanmar and helps farmers become GAP-certified. The Myanmar GAP Chatbot Platform provides a wide range of agricultural practices to farmers conveniently through a Facebook Messenger Chatbot. Farmers can apply for GAP certification, keep daily records required by the GAP certification process by just having a smartphone and internet. Detailed farmer's information is viewed, and GAP certificates issued. Myanmar GAP Platform links farmers and the Department of Agriculture in real-time, supporting the faster and more effective implementation of Myanmar GAP.

2. Global Good Agricultural Practices Certificate

The Food and Agriculture Organization of the United States defines GAP as "the rules established for agricultural production and post-agricultural processes to obtain safe and healthy food, taking into account economic, social and environmental sustainability". MoALI, MFVP are supporting farmers to get GLOBAL GAP certificate in Myanmar and Control Union is the only certification body.

3. Organic Certificate

Organic farming focuses on sustainable agriculture by ensuring healthy soils, better biodiversity and safe use of natural and organic pesticides and organic fertilizers. Organic always means naturally produced and not genetically modified. Designated organic guidelines; It is a production system that follows the standards. In Myanmar, Control Union certifies globally recognized organic certificate, while MOGPA also provide Myanmar Organic certificate for farmers.

4. Small Scale Industrial Department License

This is the first regional certificate issued for small or family businesses including food businesses with less than 9 staff. If the producers meet the specific criteria such as producing food with basic food hygiene practices and following national labelling guidelines, they can apply for the license at Small Scale Industrial Department (SSID). Consequently, if the food is tested in the laboratory and meets the specification, it can get the certificate issued by SSID.

5. FDA license

FDA certificates for importer, exporters and food business operators are issued by the Department of Food and Drugs Administration. FDA approval number can be obtained if the food business meets all criteria of national food safety standards in compliance with good hygiene practices throughout the food supply, quality, and safety specification of the product. Detailed information on the application can be freely downloaded at
www.fda.gov.mm.

6. Hazard Analysis and Critical Control Point (HACCP)

HACCP is a systematic approach to the identification, evaluation, and control of food safety hazards based on seven principles and 5 prerequisite programs to reduce the risk. According to Codex Alimentarius Commission, a new standard for the basic principle of food hygiene (CXC 1-1969,2020) includes good hygiene practices together with Hazard Analysis and Critical Control Point (HACCP). Therefore, if food producers in Myanmar would like to export to neighbouring countries such as Thailand, and China, HACCP certification is mandatory, and it can be obtained from Control Unicon in Myanmar. MoI, MoHS (FDA), MoPFI, MOE (DRI) and UMFCCI support respective food businesses to get GMP/GHP and HACCP certifications.

7. ISO 22000

GMP+ HACCP + ISO 9001 = ISO 22000
ISO 22000 is a food safety management system used by international food organizations. ISO food safety system management helps organizations identify and control hazards. The system can be utilized by all types and sizes of organization participating in the different levels of the food supply chain. It is a voluntary standard depending on customer requests or the international market that the producer would like to export. The third-party certification body can be contacted for certification of ISO 22000. In Myanmar TopCertifier, Control Union and SGS provide ISO 22000 certificate for food businesses.

8. FFSC 22000

ISO 22000 + additional requirements = FSSC 22000
FSSC 22000 is a globally recognized food safety certificate developed by the Global Food Safety Initiative (GFSI). FSSC 22000 has been developed for the certification of food safety systems, which guarantee the safety of products during primary production of animal products, manufacture of perishable animal and/or vegetable products, products with a long shelf life and (other) food ingredients like additives, vitamins and bio-cultures, animal food and feed production and food packaging manufacturing, and recently included catering, retail/wholesale and transport and storage services. Food producers can contact a third-party certification body highlighted aboved for implementation and application of FSSC 22000 certificate.

What are the food safety tips for producers?

1. Raw material selection and preparation

- Cultivation or breeding of raw materials must be done away from contaminated land, factories that emit waste
- Environmental control
- Hygiene production
- Monitor good transportation practices during transportation
- Select reliable and suitable raw material suppliers for the safe and suitable final product for consumers

2. Premises

- Food production factories must be located away from environmentally polluted areas and industrial activities which are reasonably likely to contaminate food
- It must be located away from insects and bad smells.
- Design and materials for building should be easy to clean and maintain.
- Design/layout must be one direction and do segregation to prevent cross-contamination
- The layout of premises and the flow of operations, including the movements of personnel and material within the buildings, should be such that cross-contamination is minimized or prevented
- The layout must be such that the production steps can be carried out in sequence. Different stages of production must be done separately.
- Must have a good ventilation system and maintain the required temperature.
- Must have adequate personal hygiene facilities.

3. Cleaning and sanitation

- Cleaning must be done properly so that germs do not breed in the factory.
- Garbage must be separated and disposed of properly.

- Systematic cleaning procedures must be followed in the cleaning of residual particles in production areas, such as removing debris, washing with water, washing with soap, rewashing with water etc.; if needed, followed by sanitization using hot water or spirit or chlorine (acceptable limit).
- Not only the processing area but also the floor and ceiling must be cleaned and sanitized.
- Equipment must be cleaned and sanitized according to the manufacturer's instructions.

4. Pest control management

To prevent contamination from pests:

- The factory area must be prepared to be safe and germ-proof.
- Must control occurrance of breeding areas for the pest and diseases within the factory.
- Drains, water pipes, and door bottoms must be properly controlled and insulated.
- Wastes must be disposed of individually.
- Rat traps or mouse glue traps can be used outside of the factory.
- An insect trap/light trap must be placed within the factory.
- If necessary, the factory can also subcontract with a certified third-party pest control agent to manage pest control in the factory.

5. Personal hygiene for employees

Staff working in the food production process:

- Must be in good health and not suffer from communicable diseases.
- Must be aware of personal hygiene.
- Be sure to wear the prescribed personal hygiene equipment before entering the workplace. (Apron, hood, mask, shoes)
- Do not apply artificial nails, eyelashes and jewellery which may be a threat to the safety and suitability of food
- Wash hands systematically according to proper hand washing instructions

- Refrain the following behaviour which could result in contamination of food, for example:
  - Smoking or vaping
  - Spitting
  - Chewing, eating, or drinking
  - Touching the mouth, nose, or other places of possible contamination
  - Sneezing or coughing over unprotected food.

6. Food labelling

When labelling food products, the basic principles must be followed according to Myanmar standards or international standards. Pre-packaged food shall not be described or presented on any label in a manner that is false, misleading, or deceptive, or is likely to create an erroneous impression regarding its character in any respect.

According to Codex Standard for food labelling and FDA Myanmar guideline of pre-packaged food, the information that shall appear on the label of pre-packaged foods appears as presented in figure 28 and explained in table 15.

Figure 29. Illustration of food labelling

Table 15.
Food labelling requirements

1. Name of food	The name of the food must indicate the true nature of the food and normally be specific.
2. List of ingredients	All ingredients shall be listed in descending order of ingoing weight (m/m) at the time of manufacture of the food. The food or ingredients which can cause hypersensitivity, allergen and must always be declared: • Cereals containing gluten i.e., wheat, barley, oats • Crustacean and products of these • Egg and egg products • Fish and fish products • Peanuts, soybeans, and products of these • Milk and milk products (lactose included), • Tree nuts and nut products • Sulphite in concentrations of 10mg/kg or more
3. Net contents and drained weight	The net content shall be declared in the following ways: • For liquid foods, by volume • For solid foods, by weight • For semi-solid or viscous food, either by weight or by volume
4. Name and address	The name and address of the manufacturer, packer, distributor, importer, exporter, or vendor of the food shall be declared.
5. Country of origin	The country of origin of the food should be declared. When the food undergoes processing in a second country which changes its nature, the country in which the processing takes place should be considered to be the country of origin for labelling.
6. Lot identification	Each container shall be embossed or otherwise permanently marked in code or in clear to identify the factory and the lot.

7. Date marking and storage instruction	When food must be consumed before a certain date to ensure its safety and quality the “Use–by Date” or “Expiration Date” shall be declared Where a “Use-by Date” or “Expiration Date” is not required, the “Best-Before Date” or “Best Quality Before Date” shall be declared Date marking can be expressed in these manners. (e.g. DD/MM/YYYY or YYYY/DD/MM)
8. Instruction for use	Instruction for use including reconstitution, where applicable, shall be included on the label, as necessary, to ensure correct utilization of the food.

7. Food traceability system

Traceability is the ability to access any or all information such as the supplier, raw material preparation, storage, distribution, etc. Therefore, a traceability system is beneficial for both producers and consumers.

“Food traceability system” records every step along the food supply chain from farm to fork as illustrated in figure 30, and provides various benefits to producers and consumers as summarized in table 16.

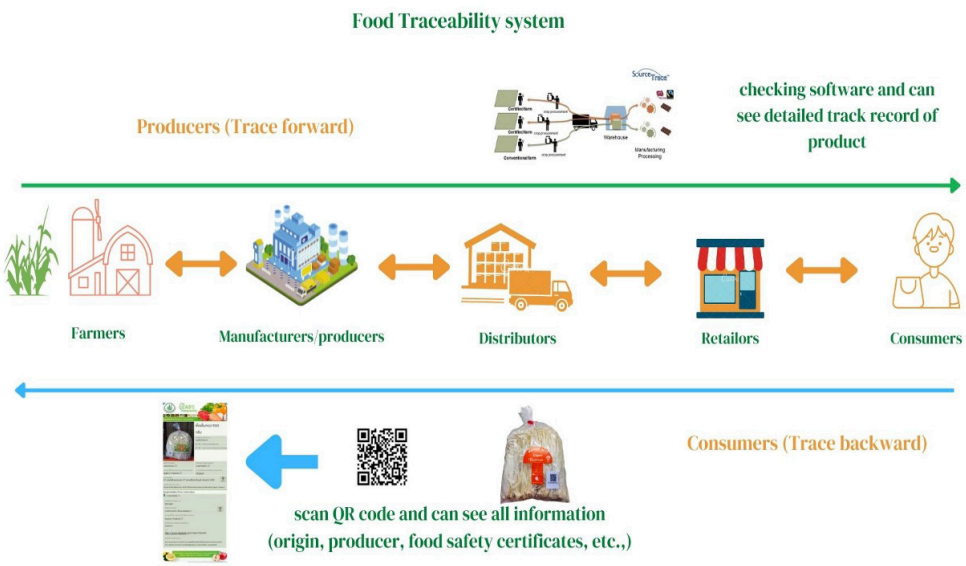


Figure 30. Overview of Food Traceability System

Table 16.
Benefits of food traceability system

For producers	For consumers
✓ Good product image Trade advantage Build up the confidence of consumers	✓ Provide trust in the product
✓ Reduce trade barriers between countries	✓ By scanning QR and tracing all information concerning products such as country of origin, food safety certificate, etc.,
✓ Reduce numbers and cost of a product recall, only for the problem lot and save time and money	✓ Reduce health risk
✓ Better control of product quality	
✓ Increase sale number and profit	

8. Training and Awareness

Delivering training is one of the most issues for ensuring the successful implementation of food safety culture and practices within the workspace. To ensure it, it is essential to

- Deliver awareness training for new employees
- Delivering refresher training annually
- Delivering pamphlet
- Arrange knowledge-sharing sessions monthly

What are the food safety tips for consumers?

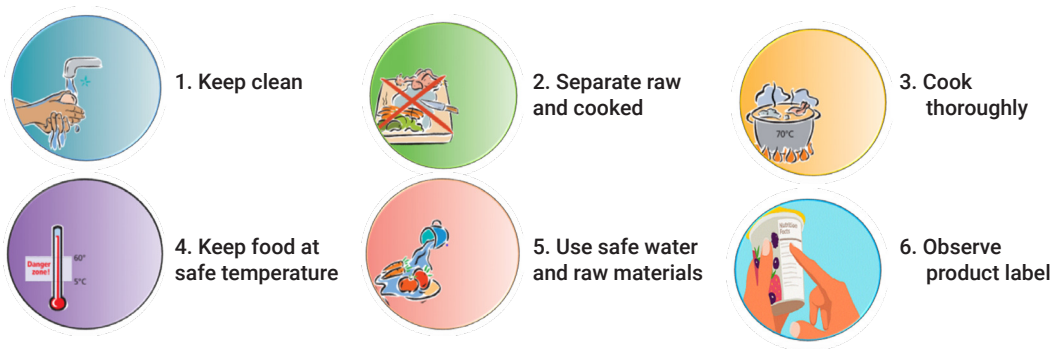


Figure 31. Tips for safe food and smart consumers

1. Keep clean

Even though all microorganisms do not cause disease, dangerous microorganisms can be found everywhere including in soil, water, animal, and human being. Since these microorganisms are carried on hands, wiping cloths and utensils, especially cutting boards, and the slightest contact can transfer them to food and cause foodborne diseases, “cleaning” is the priority for safe food. Therefore:

- Wash your hands before handling food and often during food preparation
- Wash your hands after going to the toilet
- Clean and sanitize all food contact surfaces and utensils
- Clean your kitchen to protect it from insects, pests and other animals

2. Separate raw and cooked food

Raw food, especially meat, poultry, and seafood, may contain dangerous microorganisms which can be transferred to other food during food preparation and storage. Therefore, to prevent cross-contamination:

- Separate raw meat, poultry, and seafood from other food
- Use separate utensils and equipment for each (for example, use a separate green colour cutting board for raw vegetables and another red colour cutting board for meat and fish, etc.,)
- Store food in containers in different spaces to avoid contact between raw and prepared food

3. Cook Thoroughly

Proper cooking can kill almost all dangerous microorganisms and according to the scientific literature review, cooking food at 70°C can help to ensure safe food. These are some tips for cooking to ensure for consumption of safe food.

- Cook food thoroughly, especially, meat, poultry, and seafood
- Reheat cooked food thoroughly

4. Keep food at a safe temperature

If the food is stored at room temperature, microorganisms can multiply quickly to an unacceptable level which may not be suitable for consumption. Microorganisms can multiply very quickly within a temperature range of 5ºC - 60ºC, which is known as the "Temperature Danger Zone". Temperatures below 5ºC or above 60ºC slow down or stops the growth of microorganism. However, some dangerous microorganisms can still grow below 5ºC. As such, to ensure safe food:

- Do not leave cooked food at room temperature not more than 2 hours
- Refrigerate cooked and perishable food (< 5ºC)
- Reheat cooked food thoroughly (> 60ºC)

5. Use safe water and raw materials

Raw materials, including water, ice, and expired raw materials, may be contaminated with a dangerous microorganism which may have adverse health effects on human health. Care selection of raw materials and water, simple tips including washing and peeling may reduce risk and it is one of the essential basic things for safe food. Therefore:

- Use safe water or treat it to make it safe
- Careful selection of raw materials
- Do not use or eat food beyond its expired date
- Wash fresh fruits and vegetables carefully

6. Observe product label carefully

A product label is the main communication tool between producers and consumers to provide all information concerning a product. Through product labels, consumers can get all information such as ingredients, nutritional information, allergen, storage instruction, and cooking instruction. It is therefore important to:

- Check the expiry date, first
- Observe the list of ingredients, especially allergen information
- Follow the storage instruction (for example, in the case of milk, instruction will be to keep at the refrigerator, if not followed, it may lead to spoilage and not suitable for consumption)
- Read the instruction for use
- In case, food safety hazards or foodborne illness occurs, send complaints to producers.

G

ACCESS TO FINANCE FOR FARMERS

G. ACCESS TO FINANCE FOR FARMERS

Why do you need a loan?

In Myanmar, 70 percent of the labour force is employed in agriculture, but only 3 percent of the loans have made it to the agriculture sector. As such, most farmers have financial difficulties buying agricultural inputs. If farmers had more access to financing for their farming business, they could expand their business and produce more. Moreover, their livelihoods will be improved by increased income and the country's food production will increase.

Traders, collectors, processors and small enterprises also need loans as most of them do not equally have enough capital to invest in the processing of their products, the purchase of raw materials, the storage of their products, or the marketing of their products. Hence, all actors along the agricultural value chains require financing to both start and operate successful businesses. Loans must not be misused and must only be utilized for the intended business purposes to avoid accruing debt.

Agricultural Financing Options

Many farmers in various regions of Myanmar normally have access to one or more than one type of loans from different financing institutions. However, in Southern Shan State villages, there are still many women farmers who do not have access to the available financing opportunities mainly due to low level of education, lacking exposure, lacking financial literacy, and lacking self-confidence.

Farmers can typically obtain agricultural loans from MADB for a variety of crops. Additionally, they have access to small loans from Micro Finance Institutes (MFI) and legitimate money-lending enterprises in the villages. Agribusinesses such as machine rental service providers, input dealers and other small agricultural enterprises normally access loans from government banks, private commercial banks and private money lenders for their required investments and operations.

Agricultural financing covers all activities from buying inputs before planting to selling products to the market. The process and required documents in getting a loan are different based on the respective financial institution.

1. Myanmar Agricultural Development Bank (MADB)

MADB covers about 1.3 percent of the total assets of the banking sector in Myanmar. However, in terms of outreach and the number of branches, MADB is the second-largest state-owned institution in the banking sector, after the Myanmar Economic Bank (MEB). The MADB dominates the agricultural financing market in Myanmar, while its loan market share is estimated to be approximately 74 percent of the total market.

Basically, there are two types of loans at MADB namely, Seasonal Crop Production Loan (SCPL) which is a less than one-year loan period, and term loan (TLs) which has a life of more than one year. Term loans are classified into three subgroups: (1) Short term loans (1-3 years), (2) Farm machinery loans (more than 3 years) and (3) Special project loans (more than 3 years) (MADB – Initial assessments and Restructuring Options: World Bank and LIFT. 2014)

The eligibility for applying for MADB loans is as follows:

- Farmers who have a land use/ cultivation right certificate (see figure 32) issued by the Land Record Department (LRD-MOALI) can apply for a loan at their respective township bank branch. Farmers who cultivate on the "forest land area" do not obtain Form-7 and are not eligible to apply for a loan from MADB.
- Farmers growing rice, maize, beans & pulses, oilseed crops, cotton, jute, mustard, sugarcane, etc are eligible to apply but farmers growing vegetables, fruits and spices are not eligible.
- In the case of a "term loan", a farmer who has agricultural land of more than 5 acres is eligible to apply.
- At the beginning of the crop season, bank agents reach each village and announce for application through the village administration committee.
- The loan repayment period differs upon crops but is normally about 6 months.

Figure 32. Copy of a Land use certificate (Form – 7)

2. Micro Finance Institutes (MFI):

These are registered micro-finance institutes, opening township-level offices that rural communities can access. International best practices for microfinance control are similar to banks but not the same. Microfinance institutions focus on clients with high risks than commercial banks and they can accept movable collateral to secure a loan. They offer different types of loans that are tailored to the nature of businesses and incomes from rural livelihoods, such as agricultural loans, MSME loans and loans for farm machinery in microfinance institutes.

Loans can be obtained individually with a self-guarantee of own property or in a group guarantee system comprising 3 to 5 members per group. Some microfinance institutes require a person who recommends the borrower. The amount of loan, interest rate, payment terms and type of enterprises are different. MFIs also provide non-financial services such as training and social development activities.

3. Contract farming (CF):

Contract farming is a kind of financial support in agriculture. CF is the practice of producing agricultural products following an agreement between a farmer and a buyer that specifies the terms under which a farm product or products will be produced and marketed. The buyer normally provides inputs such as seeds, fertilizers and in many cases land preparation machinery service and post-harvest machinery services and secure product market for the farmers. It frequently introduces new technology, and farmers can gain knowledge on the value of quality as well as the characteristics and demand of export markets through contract farming. These skills include record keeping, the effective use of farm resources, improved methods of applying chemicals and fertilizers, and a knowledge of the importance of quality. On the other hand, businesses can get better quality products with consistent supply than they could if they buy from the open market. Contracts between farmers and businesses that sell agricultural products usually contain provisions for both. Companies provide for inputs and other costs associated with production, and farmers are required by contract to sell their produce to the company.

Contractual agreements and processes vary from one to another. In Myanmar, Standard Operating Procedure (SOP) for Contract Farming was released by the government in 2019. The contract farming law for the implementation of the SOP is currently being developed at the State and Regional levels. According to the SOP, any contract farming agreement that applies to five acres or more must be registered by the respective government entity and follow the SOP.

4. Cash credits / In-kind credits:

Farmers can get a loan from traders and pay it back by selling the farm products to them after harvesting. However, this type of cash -credits are available between traders and farmers with long-term relationships and strong trust. However, in-kind credits such as fertilizers and other agrochemicals are often accessible from the input suppliers. It is not a regulated practice but a widely used practice between farmers and input suppliers across the country. Bad debt or loss of credits due to a farmer's failure to repay a loan could happen, but such cases occur only when farmers encounter crop loss mainly due to bad weather conditions, pest & disease destruction, or market price distortion. Normally farmers repay their loans when they have income, to maintain a healthy relationship with their creditors. These loans are normally accompanied by credit agreements normally drafted and kept by the traders/ suppliers. This could be either in a form of a credit book or a piece of paper with all the necessary information about the loan and the farmer's signature. Although this type of agreement is not legal, it is widely used in Myanmar.

Saving and Loan Groups

Although a business must be operated with its investment, it is important to know the available financing options and their requirements and terms including information on interest rates and collateral. This remains critical for prudent financing decisions depending on the needs of the household. For instance, loans with very low-interest rates and without collateral might be handy for the non-business needs of a household such as health, education, and other social matters.

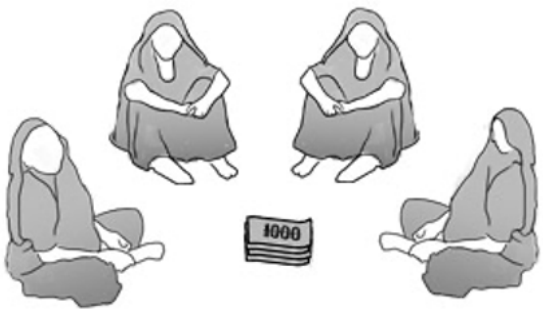
In most of Myanmar's rural villages, self-help Saving and Loan groups are formed and rural communities are trained on saving and loan practices with basic bookkeeping and financial literacy, particularly found in UNDP & NGO intervention areas and government-led development program areas in recent years. In particular, there are women-focused self-help saving and loan groups organized and well-operated in many villages. Village revolving funds initiated by different rural development programmes are set up and are functioning in many townships.

1. Self-help Saving and Loan Groups:

In villages, small loans can be obtained by establishing self-help groups, in which all the members contribute monthly savings and collectively agree on the amount of loan, rules and regulations, payback period and interest rate. Any member who needs a loan can borrow at a fixed interest rate. By doing so, all members will have their savings and those who need a loan can borrow with low interest rates and increase their savings. Although activities related to savings and loans can not solve all financial problems, there are many benefits from these activities.

2. Benefits of Comunity-based Saving and Loan Activities

- Through collective management, the needs and development of individuals and groups can be fulfilled.
- Rural people can solve their financial needs and other needs with their resources and capacities.
- Improve understanding within the community on financing, financial issues and how collective management works, which is also key in resolving financial problems
- The capacity and confidence of members are increased through understanding self-improvement.
- Group members can solve various needs and financial issues by learning from each other and through collective actions.
- The networking of the groups is improved, and they can find support from external organizations to raise funds.
- Ability to reduce high-interest rates when taking loans.
- Savings and financial management practices can be enhanced.



3. Requirements for community-based savings and loan activities

Every member:

- must have an organizational spirit.
- Must be able to handle financial statements accurately.
- Must follow the rules and regulations of the group such as payback amount and payback period, etc.
- Must have a good financial management plan.

The group must have a good organizational management plan.

Microfinance Services

It is important to know whether there are organizations that provide microfinance services in the community area. Microfinance loans can help many rural households have the ease of operating daily livelihoods and income-generating small businesses. Basic financial literacy knowledge and skills can also be gained from the training and coaching provided by the organizations.

Most microfinance loans require settlement in installments. The number of installments is based on the loan amount and period. For example, if a person takes a 100,000 MMK loan with a one-year payback period, she/he can devise a payment installment plan where fixed amounts will be repaid either twice a month or monthly. This type repayment is for non-farm livelihoods loans. For the agricultural loans, repayment schedule is fixed on the nature of crop cycle and income flow. Normally client farmers have to repay the principle of their loan over installments scheduled during the harvest season. Advantage and weaknesses of MFSs are summarized in table 17.

Table 17.
Overview of Micro Finance Services in S Shan State

The most dominant MFIs in S Shan villages	Advantages of MFSs	Weaknesses of MFSs
1. PGMF (Pact Global Micro Finance Institute) 2. Alliance for microfinance in Myanmar 3. HANA microfinance Ltd 4. Sathapana Limited 5. MIFIDA microfinance 6. Delta International Co., Ltd 7. TUTU Finance 8. WCI Myanmar and MAHA AWBA Finance Co., Ltd	Interest rates are lower than informal money lenders. Less collateral is required to get a loan. Can repay in monthly installments. By using a microfinance loan, one can generate regular income by doing small business	The payback period is inconvenient for regular small businesses and smallholder farmers. Although interest rates are lower than informal money lenders, it is still high for most farmers.

Village Revolving Funds

A revolving fund is a fund established specifically to give loans to members or to be expended or invested for a specific purpose, with the condition that repayments or benefits, or income from the fund may be used again for these purposes only. It can provide loans for willing borrowers for their businesses or other use, as per agreed interest rates and terms.

Village revolving fund systems were set up and are functioning in many villages across the country through the government-funded "Mya Sein Yaung Rural Development Project". They started with 3 pilot townships in 2014-15. Some development agency projects have also been initiating and setting up village revolving funds in their target areas for the past 10 years. Most of the village's revolving funds are properly functioning with community leadership and participation.

In operating a village revolving fund system, an external source allocates some funds for

the specific village community. These funds are managed by the selected community fund management committee to sustainably maintain and grow the seed funds. The funds can be borrowed by individual household businesses at a low-interest rate with an agreement on a payback period. The eligibility criteria for borrowing these funds depends on individual village committees. Normally, funds raised from this system are utilized for village development priorities.

1. Requirements for Establishing Revolving Fund

An organization (government agency or an NGO) that establishes funds or an organization that initiates a business to get funds in the village.

Village community's interest and involvement to increase funds and effective utilization.

Inventory Credit System

Some traders (individually or groups of traders or farmers' cooperative groups) provide warehouse space for farmers, who wish to wait for a product price increase, due to price falls during the peak of the harvest period, with minimum fees for storage space. Under this arrangement, farmers pay for the storage space for their produce and in return, they can take the agreed loan from the warehouse owner, with their farm products in the warehouse as collateral. The warehouse owners do not normally charge interest on credit since the farmers pay for the storage space.

This system is not regulated but is popular in major onion production areas in the Central Dry Zone of Myanmar. A similar practice is observed in areas where individual farmers have limited space for their product storage, especially during peak harvest season. However, only a few traders or farmers' cooperatives that can handle enough space, technology and resources in specific locations practice this system to help long-term customers or member farmers solving short-term financial problems. Table 18 lists some of the advantages and weakness of inventory credit systems.

Table 18.
Advantages and weaknesses of inventory credit system

Advantages of Inventory Credit System	Weakness of Inventory Credit System
• Collective selling practice promoted among farmers	• Group member farmers' profit increment goes into the group's accounts often, rather than practically having cash in their hands immediately.
• Solve short-term financial problems during rush harvest season for small-scale farmers	• If the financial statements are not handled properly, trust and unity among the members may be lost.

Value Chain Financing

For the development of a viable value chain, there is a need for improvements in production practices, post-harvest technologies and infrastructure support in processing upgrading that will support improving (adding value to) the products to facilitate its entry into high-value markets. However, the lack of access to finance with appropriate interest rates is a big barrier for farmers and MSMEs to effectively participate in these value chains.

Value chain financing is related to co-financing among actors within the chain and enhancing access to finance for all actors along the chain.

The following are the key ways that can solve financial needs along the value chain:

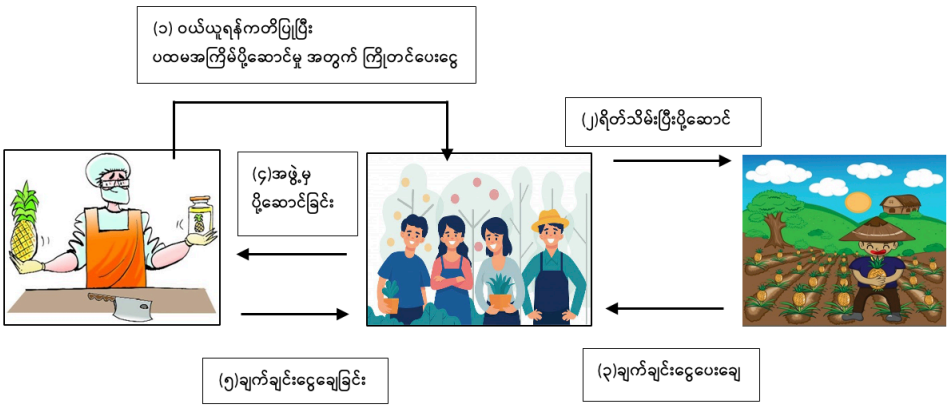
- Direct selling of the products from business to business can improve production potential and financial requirements from the main actors in the value chain. In addition, it will help to better understand the market opportunities. The person who has collateral or guaranteed bank loan, a loan based on cash flow and long-term private capital may also be involved along the value chain and linkage between lenders and borrowers can be strongly built by getting a loan from them. Thus, linkages among actors along the value chain are important at each level of the chain. For direct selling between business to business, field visits, demonstration plots, discussions, or meetings upon post-harvest technologies can be made.

- The financial problems of farmers can be solved by providing inputs as low cost credit for farmers by the input suppliers.

- Small farmers and MSMEs along the value chain can get loans from banks in groups with collective insurance.

- Well-organized groups which focus on quality can also solve the financial problem by taking loans from private banks with proof of land ownership.

- Financial needs can be solved with contract farming.
- Large companies and organizations support small enterprises with the infrastructure, and machinery to produce value added products depending on the cash flow and cost. This support can reduce financial needs and increase demand for the production of farmers and also improve marketing and standards.



H

BUSINESS MANAGEMENT FOR FARMERS

H. BUSINESS MANAGEMENT FOR FARMERS

Account Keeping

By establishing a specific and transparent accounting system for your business, the financial situation of the business can be easily understood in detail, and it can be presented to the shareholders related to it.

Having a transparent accounting system plays an important role in making investment decisions. By establishing a specific and transparent accounting system, the financial status of the business can be clearly explained to the shareholders and the financial statements can be handled systematically. Good decisions can be made when making investments. Initiating a transparent accounting system may be difficult at first, however, if it is properly done, financial flows can be easily handled later. If the required daily or monthly documents and records for the accounting system are not done systematically, the financial cash flow of the business becomes complicated. Then the trust of the stakeholders can also be lost. Table 19 lists the documents and records that need to be kept in the accounting system.

Table 19.
Records to be kept in the accounting system

Document/record name	Explanation
1. Cash Book	It includes a ledger book that contains daily expenses and a daily transaction list including receipts, refunds, and bank deposits.
2. Cash Balance Statement	In the opening balance, the cash flow statement of the business must be described from the month the statement was made.
3. Bank Receipts Book	It is a book with attached cash receipts received from sales representatives as a cash receipt book.
4. Sales records; Receipts; Cash and other sales documents	
5. Bank Payments Book	The bank payment book contains monthly cash statements, cheques, and documents used when repaying.

6. Monthly Cash Flow Statements	It is the essential monthly financial statement and is often used by the chief finance officer and audits to review the cash flow of the business.
7. Monthly Bank Reconciliation Statement (Balance Sheet)	It is used to identify the unusual transactions that can be caused by fraud and listing errors due to using more than one bank account of a business. It includes making the bank reconciliation statement, bank statement, and Internal bank statements.
8. Products in credit payments, interests, and debt records	It is adding and subtraction of cost and interest. It can identify the debt and interest due to a double-entry accounting system. A deposit can also be collateral that is repaid when taking out a loan.
9. Petty Cash Book	In most cases, the petty cash book is a daily record and is a real ledger book rather than a computerized record and is part of cash keeping.

Business Plan

Business planning is systematic planning based on the objective and goal of the business with available resources to achieve the objectives effectively. It is key for ensuring control of the future and success of the business. Its design accounts for the salient factors of each target market, region, and the preference of the consumers and users of products based on the objective of the organization.

A good business plan must account for the future. Thus, business planning is balanced planning to ensure business sustainability and achieve its goals.

In developing a business plan,

- ✓ Actions must be taken to achieve the goal and objective.
- ✓ Show the result in quantitative.
- ✓ allocation of inputs
- ✓ monthly activities plan
- ✓ Operating budget
- ✓ cash flow
- ✓ profit and loss statement
- ✓ a financial statement must be included.

In business planning, strength, weakness, opportunities, and Threats are also reviewed and plans which improve performance are set up based on the results. It is impossible to define other similar businesses in the market as competitors by studying them. Your business may have the same services and target groups as other similar businesses. Your business may have the same target group with different services and may also have the same services with different target groups with other similar businesses. Thus, strengths and weaknesses can be found by inquiring about their services and can be considered in business planning.

1. Benefits of business planning

The amount of investment, time to be invested and expenditure intended to be used can be estimated through business planning and long-term operational and financial sustainability of the business will be achieved.

Business operations and performance can be evaluated and reported upon completion to shareholders. Similarly, the success of the business can also be shared with stakeholders.

The future business and financial plans can be revised based on the reviews.

In designing a business plan, one needs to be aware of changing consumer preferences and consumption patterns. Factors that can cause these changes include consumption patterns, weather, health, and income status. In addition, the availability of raw materials and changes in the prices of the raw materials can affect the quantity and price of products, these factors must be accounted for in the business plan.

The activities of other similar businesses should always be observed and monitored. Business planning is for sustaining the business and achieving its goals. The strength, weaknesses, opportunities, and threats of the business can be reviewed, and performance enhancement programs can be designed based on these reviews.

Investment Proposal

Although business proposals for investors can certainly get complicated, they tend to have quite a straightforward concept at their core. An investment proposal is a tool meant to attract potential investors to finance your business. As such, it should succinctly provide all relevant information on key aspects of the business including the nature and type of the business (goals, objectives and products offered), marketing (including information on the target market such as potential competition and how you intend to thrive in that market), financial plan (encompassing capital expenditure, budgets and the financing gap, past revenue and profits (if available).

1. How to write an investment proposal

Fundamentally, you simply need to make sure that you include a few key components, be prepared to respond to any questions, and be aware of the kind of assistance your business needs.

The following four steps are key in developing a business investment proposal:

- Gather all your business's existing information, including data on your business's revenue, operating budget, expansion plan, etc.
- Integrate your goals, data on target revenue and operating budget, and financial needs
- Research thoroughly any investor you plan on presenting your investment proposal.
- Should you be required to make an oral presentation to the potential investor, summarize your investment plan into a concise, clean presentation. Practice your investment proposal presentation and be ready for every potential question.

Credit Guarantee Insurance

CGI loan scheme is a special SME financing scheme orchestrated by the government for the development of Myanmar SMEs. Under this Scheme, the Myanmar Insurance company has a special agreement with the government to guarantee up to 200 Million MMK loans to SMEs in respective private banks. As such, a collateral only becomes necessary for SMEs to access loans that are beyond this threshold. The loan amount is approved by the bank based on the business plan and other relevant requirements."

Registered SMEs in Myanmar are entitled to apply for SME loans under the Credit Guarantee Insurance system. The respective SME needs to obtain a recommendation

letter from the SME department under the Ministry of Industry. For that, SME's application can be put up to the relevant district office which will conduct a field inspection of the SME and submit a recommendation to the division level. The division manager will then, give a recommendation letter to SME if the verification process has strong results. The SME can apply for a loan from the designated bank with this recommendation letter.

1. Basic requirements for CGI application

- Business concreteness based on assured collateral or number of workers, annual income, market coverage, etc.
- Renewed business registration at the respective department
- Minimum 2 years of business operating experience (flexibility upon business running condition and locations)
- Businesses must be operational at the time of the application
- Already a member of SME Association
- Paid tax for 2 years (flexible)

- CGI can also be applied online at Myanmar National Portal:

  https://myanmar.gov.mm/smes1/-/asset_publisher/3jn7104EC6vW/content/credit-guarantee-insurance-cgi

Challenges and Lessons Learnt from Financial Practices

Increasing access to credit is an important component in improving the productivity of agricultural small and medium enterprises. Therefore, the types of loans, the requirements, and processes to take a loan, keeping a transparent accounting system, and business planning have been discussed in detail above.

It is worth noting that loans come with challenges for both borrowers and lenders mainly from the processes and terms/conditions for the loans. On the one hand, borrowers who are farming households and rural MSMEs are being challenged by the inadequate amounts of credits or small sizes of loans that are mostly offered and hence, they are forced to get loans from different sources to significantly cover their financing deficit. High interest rates on loans are another daunting challenge for them as this has a significant impact on the affordability of the loans. In this regard, most agribusinesses and farmers with high financing deficits in operational costs find it difficult to rely on micro-financing institutions due to the high cost of the loans and the small amounts offered relative to their financing needs. These challenges are further compounded by the short repayment period which is largely unfeasible for most farmers. Moreover, most agribusinesses and MSMEs have limited access to commercial bank loans which have better terms in terms of repayment period as most of them do not have the required to serve as collateral for the bank loans.

On the other hand, informal lenders and financial institutions are largely faced with bad-debt issues that are often caused by the misuse of loans by money borrowers. In some cases, borrowers take more amount than they can manage and face difficulties with interest and loan repayment. Although the interest rates of microfinance services are lower than informal money lenders, it is still high for farmers and agribusiness MSMEs. The payback period of some loans is inconvenient for most farmers, with a shorter cycle. It is more convenient for farmers to pay back the loan after selling their crops. However, the increment of the accumulated loan due to interest may lead to loan defaults.

Nevertheless, the above challenges are not common with self-help savings and loan groups which generally offer members soft loans at low interest rates. However, the sustainability of these groups requires a strong management committee and tight controls on the group's financial flows.

A contract farming system offers another financing opportunity to farmers with reasonable terms as there is no need for interest rates and repayment is generally at the end of the harvesting period, and in most cases, farmers are guaranteed a market for their produce. However, the system requires high levels of mutual trust and respect to systematically honour the agreements set in the contract. Lastly, an Inventory credit system comes in handy for farmers in terms of storage space at the peak of the harvest period. However, this works well for farmers with good experience and knowledge of the seasonal product market.

CONCLUSION

This guidebook presented a comprehensive review of good agricultural practices in different stages of the tea, ginger, and avocado agricultural value chains from harvesting to post-harvest handling and marketing as well as in the areas of food safety, access to finance, and business management for all farmers in Myanmar. Even though the good practices that are presented in this guidebook apply to men and women farmers equally, they are of particular importance for women farmers given the gendered supply-side obstacles that they face, as outlined in the introduction of this guidebook.

These good practices, when disseminated and adapted largely among farmers, and especially women farmers, can support farmers and their producer organizations in participating in the economy successfully, and may open new prospects for trading across state lines, and internationally in the future. As discussed in the introduction, the main obstacle to developing a modern agricultural sector that can be competitive nationally and internationally is the lack of an understanding of agricultural production as business. The procedures and practical guidelines in this guidebook would help fill this gap and help farmers carry out agricultural activity in a more professional way. This would in turn help increase agricultural productivity and boost production and exports in the future. Farmers and producer associations are expected to benefit from more trade opportunities once they have improved their agricultural practices and food handling practices, and learnt more about access to finance options, food safety requirements, and business management procedures, as outlined in this guidebook.

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