Calamansi Production Guide

**Description**
The calamansi tree is evergreen and small, attaining a height of 2-7.5 m at maturity. Its broadly egg-shaped leaves are dark green above and pale green below. The small, white fragrant flowers are grouped in clusters. The calamansi fruit is round, with greenish yellow to orange skin which can be easily peeled. There are six to ten segments in a fruit with an orange colored, very acidic juice and each fruit has 4-11 seeds.

**Variety**
The calamansi seed produces plants which originate mainly from the mother tissues giving rise to seedlings which have the same characteristics as the mother tree. For this reason, the calamansi trees in the country are believed to belong to only one variety.

**Uses**
Due to its varied uses, the calamansi is grown on a large-scale in the country. The fruit is commercially processed into bottled concentrate, as a ready-to-drink juice in tetra packs, and as a marmalade. The juice is also very popular as a flavor enhancer for native dishes. As a cleanser and hygienic substance, it can be a stain remover, body deodorant, skin bleach, and hair shampoo. Calamansi can be used for medicinal purposes. Rubbing the juice on insect bites eliminates itching and irritation. It is taken orally as cough remedy, as a laxative to loosen the bowels, and is combined with pepper to expel phlegm. The roots are used for treatment at childbirth and leaves to cure gas pains. Calamansi is also popular as a potted ornamental plant.

**Soil and Climatic Requirements**
The calamansi thrives in warm to cool climates with an evenly distributed rainfall of 1,500-2,000 mm/year. It is generally grown in the lowlands. Calamansi can grow over a wide range of soil types from clay loam to limestone to sand. However, it grows best in a slightly acidic, well-drained sandy or clay loam soil rich in organic matter.

**Cultural Management**

**Propagation.** The calamansi may be propagated by seed. However, for large scale multiplication of superior trees, propagation by shield budding using calamandrin as rootstock is practiced. Other methods of propagating calamansi are by stem cuttings, marcotting, and grafting.

**Planting/Transplanting.** Sow seeds in a seedbed, 1-2 cm apart at a depth of 1cm. transplant to individual containers after four to five months when seedlings are 10-15 cm tall. Field planting should be done during the rainy season. Set the plants at a spacing of 4-6 m apart.

**Irrigation.** Irrigate during the first dry season after which the trees may depend entirely on rain for their water requirement. If early of-season flowering is desired, heavily water the trees one to two months before normal flowering time. Commercial orchards may employ a drip irrigation system.

**Fertilization.** During the first year, apply urea at 50-100 g/tree and 200-300 g/tree during the second year. In the third year when the tree starts bearing fruit commercially, apply 350-400 g complete fertilizer/tree. Correspondingly increase the amount as the tree gets older. Evenly
distribute the **fertilizer** in two applications, one at the onset of the rainy season and another towards the end of the rainy season.

**Pruning.** Remove diseased, dead interlacing branches.

**Pest and diseases.** The common pest of calamansi is the fruit fly. The most serious disease is leaf mottling which is transmitted by the insect carrier, Diaphorina citri better known as citrus psylla or jumping plant lice. As a preventive measure, use certified disease-free planting materials and spray trees regularly with an insecticide. Totally remove and burn infected trees.

**Harvesting and Post harvest Handling**
A three-year-old tree produces 75 kg fruit; at six years, 10 kg; and at ten years, 50 kg. on the average, calamansi produces 20 t of fruit/ha per year. Though **fruits** are available throughout the year, the peak season is from August – October. Harvest **fruits** by hand or by clipping with shears.

Pack calamansi fruit in kaings or bamboo baskets lined with **banana** leaf sheaths or newspaper. The fruit will keep in good condition for two to three weeks at 8?-10?C and 90% relative humidity.

**Lanzones** is a tree which grows up to a height of about 30 meters with trunk 75 cm in diameter. However, cultivated trees are only 5-10 m in height. Inflorescences bearing **perfect flowers** emerge from the trunk and largest branches. The fruit is a **berry** with 1-3 seeds, enveloped by a fleshy aril. Some cells may consist of aril tissue without developed seeds.

The tree is mainly grown as an **intercrop** under coconut or mixed with **durian** and other trees which serve as companion trees that provide shade. It thrives only in sheltered and humid environments with elevation up to 800 m, but prefers near sea level. It does not tolerate water stress and high **light intensity**. It prefers soils with good drainage and water retention, rich in organic matter and slightly acidic. Lanzones dislikes sandy coastal soils and alkaline soils.

Lanzones trees grow slowly. They are shallow-rooted and depend on a layer of litter to protect the numerous surface-feeding roots. Trees start fruiting normally 10-15 years from seed. However, with proper care seedlings may bear within 7-8 years. Grafted longkong trees in Thailand bear within 5-6 years. The use of advanced or large planting materials (LPM) which are more mature may also result to earlier fruiting.

The inflorescences usually emerge in the dry season and may fully bloom in about 7 weeks. The fruit ripens 14-17 weeks later or about 98 to 119 days after full bloom.
The harvesting season is short, with the langsat types usually ripening ahead of the others. In Thailand and in the Philippines, the fruit is available in 4 months from July to October but 8 months in Peninsular Malaysia from June to February.

Planting. Recommended plant-to-plant distance vary, from 8 m x 8 m in the Philippines to 12 m x 12 m for the longkong types in southern Thailand. There is a report, however, that longkong trees can be grown 6 meters apart in the Philippines (Sarian, 2010). Outplanting is preferably done at the onset and just before the end of the rainy season. But in places with well distributed rainfall or where irrigation is available, planting can be done any time.

Planting holes may be 50 cm wide and deep. 5 kg of farm manure and 100 gm of complete fertilizer are deposited at the bottom and covered with a layer of soil before planting. When the seedling is set in, the hole is refilled with topsoil and watered immediately.

Care of Trees. Young trees are provided with shade and watered regularly during the first few years. The main stem of the upright langsat types may be cut back 80-100 cm from the ground and the emerging branches trained horizontally. In older trees, only watersprouts and diseased branches may be pruned. Weeding and mulching should be practiced regularly.

Irrigation can advance the flowering of lanzones by one or two months if the floral initials have emerged during the preceding dry months. Regular supply of water to fruiting trees is especially important during drought. A dry period during fruit development stage may cause crop losses due to fruit cracking when water becomes suddenly available.

The use of both organic and inorganic fertilizers is recommended. The recommended rates are 5 kg of farm manure (preferably compost) and 500 gm of complete fertilizer per year for the one-year old trees, split into 2 to 4 applications. For old trees, the rates can be as high as 50 kg of manure and 2.5 kg of inorganic fertilizer. The addition of potassium fertilizer is generally recommended for adult fruit crops.
Flower and fruit thinning is practiced to promote better yield and fruit quality. Flowers that arise from small twigs and those in tight bunches should be removed, as well as fruit clusters below 8 cm. Rotten fruits are likewise removed regularly.

Insect Pest and Diseases Control. The bark borers are the most common insect pests of lanzones. The caterpillars of the carpenter moth (Cossus sp.) and the green moth (Prasinoxema sp.) cause the scraggy appearance of the dead branches. Control of these pests include the scraping of the affected branches and painting with insecticides. Other borers affect the trunk, fruit and twigs. Other insect pests are scales, mites, leaf miners, leaf rollers, beetles and bugs.

Bats, birds and rodents may also cause reduction in fruit yield. Control practices include covering of the fruit bunches with nylon bags and using torches at night.

The serious diseases of lanzones are the root rot and anthracnose. It is not clear what pathogen causes root rot. Anthracnose (Colletotrichum gloeosporioides) appear as brownish spots on the fruit bunch. It can cause premature fruit drop and lead to post-harvest losses.

Harvesting. Fruit bunches with 90% or more ripe fruits are harvested by cutting the fruit stalk with a sharp knife or with a pruning shear. This is preferably done in the afternoon where flow of latex is slow. The point of attachment of the bunch with the tree should not be injured because this is where the next inflorescences may arise. Fruit is ripe when its color changes from brown to yellow.

Complete harvesting of a lanzones tree may take 4 to 5 repetitions. Generally the fruits in a bunch ripen at the same time but there are some cases of uneven ripening which poses a problem. The fruits should be harvested dry.

**Tamarind** (*Tamarindus indica Linn.*) is one of the minor fruit crops in the **Philippines** with a great potential for commercialization. In certain parts of the country, it is an important crop because its fruits and other parts have varied food and medicinal uses.
Tamarind has great export potential because its fruit may be processed into a number of acceptable products. But the mature and ripened tamarind fruit of the sweet type is said to be more important and expensive than when it is processed. However, the supply still does not meet the demand.

**Sweet Tamarind Propagation**

Tamarind may be propagated by seeds and asexual propagation (i.e. grafting). Propagation by seeds is not recommended because the resulting plants do not grow true-to-type.

Seeds obtained from healthy and mature fruits should be cleaned. Individual seeds are planted about two centimeters deep in potted soil rich in organic matter. A soil media with one part soil, one part sawdust, and one part compost is suggested.

For **sweet tamarind**, cleft grafting is recommended especially for large-scale propagation because it gives a higher percentage of success.

Rootstocks which are six months or older (about 0.8 to 1 cm in diameter) are used for grafting. Mature scions (budsticks) measuring 8-15 cm long and with the same diameter as rootstocks, and with well-developed buds are collected from full-bearing trees of outstanding characteristics. Defoliate the scion after collection and graft immediately. After grafting, cover the scion with plastic ice bag (4×12 in) and place the newly grafted plants under the shade. Transfer them in the open (full sunlight) when the new shoots develop.

Water the plants regularly. In 3-4 weeks, the scion will start to form shoots. It's best to graft starting November up to May.

**Transplanting**

Before the onset of the rainy season, the land must be plowed once and harrowed several times until the soil is in its fine tilth. Stakes are set following the desired distance of **planting** (8 x 10 m). The dug holes must be large enough to accommodate the root system of the plants. The soil around the base of the plant should be packed firmly.

For lahar-laden areas, mix 5 kg compost with the soil. Put about six inches of the mixture before planting. Cover the base of the plant with the remaining mixture. Planting is best done during the rainy season.

**Intercropping**

For large-scale planting, intercrop the tamarind with short-season cash crops. This way, some income could be derived while the trees are not yet bearing fruits. When the trees
have grown and their branches begin to touch each other, intercropping should be stopped.

**Irrigation**

Water the plants right after planting. This must be done as the needs arises. Sufficient water should be provided during the early years. In later years, watering becomes less critical. Irrigation is beneficial, especially for the development of flowers and fruits.

**Fertilization**

Tamarind trees bear fruit well even without fertilization. However, fertilizer application is recommended to keep the trees in healthy condition. As a general recommendation: apply 50 g of 16-20-0 and 100 g of 14-14-14 per tree one month after planting. The same amount is added at the end of the rainy season. The amount of fertilizer is gradually increased as the trees grow.

For early bearing fruits, apply 500 g of 14-14-14 per tree twice a year. A full bearing tree may need at least 3 kg of 14-14-14 per year.

**Trimming and Pruning**

Young trees require little trimming during the first few years. Remove the very low branches and cut long upright shoots during the early years. For bearing trees, remove dead, weak, diseased branches and water sprouts.

**Control of Insect Pest and Diseases**

There are no major diseases of sweet tamarind observed. However, insect pests such as bagworms, mealybugs, scale insects, leaf feeding caterpillars, shorthole borers and green locust were recorded. These pests may be controlled by spraying the trees with common insecticides at the recommended dosage.

**Harvesting**

Grafted sweet tamarind may start fruiting in about a year after planting. The fruit may be harvested half-ripe (malasebo) stage and full ripe stage.

To determine the half-ripe stage, scratch the fruit surface with the fingernail at the side not exposed to the sun to remove the brownish powdery material. Mature fruits have brown shells.

Fully ripened fruits are determined by just tapping with the finger which produces a hollow, loose sound. This is because the pulp shrinks at maturity and the skin becomes brittle. Since the fruits mature at different times, harvesting must be done by priming.
Fruits are usually harvested from January to February as the trees bear flowers in May or June.

**Guapple** is non-seasonal or ever bearing variety with an extra large size fruit which attracts some people from Negros province. It weighs an average of 400 to 1,000 grams per fruit. It produces thick and white-fleshed fruit but with bland taste. However, this variety is crispy in flesh texture.

The guapple tree excels most other fruit trees in productivity, hardness and adaptability. Its tree type is relatively spreading in growth habit with four-angled branches, leaves are opposite, oblong to elliptical in shape with pointed apex and base which are usually rounded and light green in color.

**Economic Importance:**

* Fresh fruit is eaten raw, a good source of Vitamin C.
* Fruits can be processed into jelly, wine, guava jam preserves.
* Decoction of 25 leaves in 2 glasses of water is a good cure for diarrhea, as astringent, mouthwash for swollen gums, antipyretics, reduce fever and anti-spasmodic.
* Bark and leaves are used in childbirth to expel the placenta. The bark is recommended in making complex cosmetics for what seems to be hysteroepilepsy.
* Young tender leaves chewed or crushed applied to tooth cavity acts as eugenol for toothaches.

**Soil and Climatic Requirement:**

Guava can be grown best in a well-drained clay loam to sandy loam rich in organic matter with pH ranging from 6.0 to 6.5 and display some tolerance to salinity. Prefers dry climate with well-distributed rainfall throughout the year. Moreover, they are more drought resistant than most tropical fruit trees. Elevation ranging from sea level to 500 feet above sea level.

**Recommended Cultural Requirement:**

The soil for the seedbox should be sterilized first by using heat or pouring boiled water. Soil mixture should be 1/3 sand, 1/3 garden soil, 1/3 sawdust humus. Purpose of sterilization is to eliminate organisms found in the soil. Place in desired sizes of seedboxes or in individual small plastic bags.
**Planting Materials:**

Fresh seeds should be sun-dried first for a day to break the dormancy period and hasten germination within 15 days. In asexual propagation, marcotting is done using branches or stem of 1/2 inch in diameter. When roots appear, cut marcots and plant in plastic bags.

For bud/cleft grafting, when the scion has successfully germinated cut stock and put under the surface. Tend these planting materials under the shades for at least 2 weeks to enhance easy adaption to environment before planting them in the open field or orchard. Seedlings are ready for transplanting after 6 months when they are 30 cm high.

Guava are open-pollinated and they produce seedlings which are available in fruit and tree characteristics. Use asexual propagation by marcotting and bud/cleft grafting as planting materials to produce high yield of desirable fruits. Variability in seedlings can be minimized by hand self-pollination of individual flowers designated for seed production.

**Land Preparation:**

The land should be plowed once followed by two harrowings until excellent condition for planting is attained. For newly opened land, underbrushed branches and twigs should be burned before the holes are dug.

**Planting and Spacing:**

Holes, 2 x 2 x 2 feet are dug and refilled with manure or compost. Plant three (3) months old seedling at the onset of the rainy season. The distance of planting is 3m x 3m. A hectare will require 1,111 planting materials.

**Irrigation:**

The plants do not need intensive irrigation, but in areas with a longer dry season, the orchard should be irrigated every 5-7 days. This way, trees can be fruitful throughout the year.

**Cultivation and Weeding:**

Young trees do not require much cultivation. Weeding and loosening of the soil periphery of its foliage to a depth about 2-3 cm should be done before the time of fertilizer application. Maintain sanitation or clean culture.
**Pruning:**

The pinching or terminal buds is necessary as new young leaves start to come out after planting. The purpose is to initiate more new productive branches.

**Flowering and Thinning:**

The plants will start flowering as early as eight (8) months from planting. Some of the young fruits should be removed and thinned retaining only at least five (5) fruits for a year old tree. The purpose is to produce big fruits weighing one kilo per fruit.

**Fertilization:**

The trees should be fertilized with both composed organic manure and inorganic fertilizer manure. It is placed at the bottom of the hole and on the periphery of the roots.

Age of Plants Rate Method of Application Planting 100-150 grams of complete fertilizer (14-14-14) Apply 2 in the roots and to sides Young trees 200-300 grams Apply by digging shallow furrow along the periphery of the canopy Bearing trees 300 grams to 1 kg of complete fertilizer plus 300 grams of 0-0-60 and 16-20-0 - same - Intercropping

To minimize use of the land, intercropping is highly recommended. Raising annual crops such as vegetables, legumes, ginger, gabi for the first year after planting, give the farmers an additional income from the orchard as well as suppresses the growth of weeds.

**Control of Pest and Diseases:**

**Pest and their control:**

1. Oriental fruitfly – The larvae of the fruitflies burrow through ripe fruits making them unfit for human consumption.
   Control: Spray with Malathion on a monthly intervals or with Sevin 85, as directed.
2. Aphids – These feed on young growth causing curling of leaves. Control: Spray with Malathion or Sevin
3. White flies – These feed on either surface or mature leaves. Control: spray with phosphatic insecticide.

**Disease and their control:**

Anthracnose and fruit canker – spotting of fruits ad leaves. Control: Spray with
fungicides (copper zinc or Bordeaux mixture, benlate) Remove all affected fruits and bum.

**Harvesting:**

Harvest when the preferable market weight is about 300-500 grams per fruit. It is done by pulling the fruits from the twig. A matured fruit of this variety weigh 1,000 grams.

**Production:**

The tree on its first year fruiting can yield about 15 kilos weight which cost 15.00 per kilo (2001 market price). On the second year 45 kilos and succeeding year about 60 kilos and more.

For 200 trees, it can gross around P140,000 per year and the cost of production for P35,000 per hectare covering the expenses on the cost of seedlings, water system, labor, fertilizer, insecticide, fungicide, weeding and others.

---

**Growing Citrus Fruit in the Tropics**

*Posted in* Agri *By* Mixph *On January 10, 2013*

Citrus thrives well in tropical and subtropical climates. Some of the best quality oranges are grown in the non-humid, irrigated, subtropical areas such as the Mountain Province. It can be grown in our four types of climate but areas with well-distributed rainfall throughout the year are best. Those with distinct and long dry periods should bank heavily on irrigation to raise high quality citrus fruits. Fields of citrus in the country are generally low. Citrus plantations are run on modern and intensive technology to allow their produce to compare favorably with those of developed countries.

**Value**

Citrus fruits are rich in vitamins, especially vitamin C. Its mild acid and bitter taste favorable to digestion and blood circulation. Citrus peels are rich in pectin, valuable in making jellies, marmalades, candies, jams and pharmaceutical preparations.

**Varieties**
Several species are highly adapted to the country. The most important include calamondin, mandarin, pummelo, lemon and lime.

- **Calamondin** Locally known as “kalamansi” or “kalamundin”, this is a small tree with upright branches. Its leaves are broadly oval, dark green above and pale green below. Its fruits are small subglobos, ranging from 0.3 to 3.5 cm long and 3.8 to 4.5 cm in diameter. Each fruit has 7 – 10 segments with a very thin rind. The juice is acidic and usually used for flavoring.

- **Mandarin** Actually it is native to China. Its local names are “sintones” or “dalanghita”. This tree has a dense crown with slender branches, with a few rows to ovate and pointed. The fruit is flattened and turns yellow or reddish orange when mature. It consists of 10 – 14 segments easily separated from one another to form an open core. The rind is loose and can be easily removed. Its popular varieties include Szinkom, Ladu, Batangas, and King.

- **Pummelo** It originated from the Malayan and East Indian archipelago. Locally, it is known as “lukban” or “suha”. Its tree which is medium to large and spreading, bears fruit that is large, round to pear-shaped and with a thick and spongy rind. The segments usually open at the sutures. The flesh is commonly firm with large vesicles and with low to high juice content. It usually matures from October to March. Its outstanding varieties include Amoy, Siamese, Pink, and Suiwui Luk.

- **Sweet Orange** Locally called “dalandan” or “kahel”, it originated from China. Its varieties cultivated in the country are Hamlin, Pineapple, and Valencia. Its typical tree is moderately vigorous, medium-large and productive. The fruit is usually medium-sized and spherical to slightly obovate. Valencia type which is of excellent quality may be seedless or may have five to six large seeds.

- **Lemon** It is grown primarily for its acidic juice. The tree is medium-sized, elliptical to oblong, sometimes obovate with a short neck or low collar at the base. It usually has 10 segments and the rind turns yellow when it ripens. Its flesh is greenish yellow, tender and juicy. Best commercial varieties grown here are Eureka and Lisbon.

- **Lime** Locally known as “dayap”, this common tree is small and bears seedy small fruits with a very thin, aromatic rind. Its flesh is juicy and very acidic.

**Propagation**

Citrus can be propagated by seed budding, grafting and marcotting. Commercially, seed budding, which is universally applicable to all citrus species, is the preferred method. Although grafting and marcotting produce satisfactory materials, and therefore may be recommended only for small-scale propagation. Shield budding unites a desired scion variety with a suitable rootstock. Success depends on the skill of the propagation and the conditions of the scion and the rootstock.
I. Rootstock
- Must be compatible with the scion variety allowing good growth, long life, good yield and good fruit qualities;
- Seeds must be readily available, preferably high poly-embryonic to get uniform seedlings and with high percentage and germination;
- Must be adaptable to a wide range of soil depth, texture, structure, pH, salinity, moisture, and nutrient supply; and
- Must be resistant to soil-borne diseases, such as Phytophthora grimmosis.

Budwood should be taken from parent trees which:
- Hold a record satisfactory production over a period of at least 5 years;
- Are free from systematic diseases; and
- Have true-type fruit characters.

Budwood should be plucked from green, vigorous, second-flush growth. Its leaves should be clipped and the budwood is collected. It should be immediately labeled, indicating the name of the variety, source of budwood, and date of collection. Only freshly cut budwood should be used. If it needs storage, it should be kept by wrapping it in moist sphagnum moss or similar materials, put in polyethylene bag and kept in a cool place. This will last for 10 days.

2. Care
By means of shallow cultivation, the nursery is always kept free. Weekly, seedlings are sprayed with the appropriate insecticides to control pests and leaf cutting insects. Every 2 weeks, copper fungicide is mixed with the insecticide to control diseases. Once a month, at time of weeding, one (1) level tbsp 5 g urea is applied around each seedling. From a budded plant, tape is removed 2 – 3 weeks after budding. If the bud looks fresh and green, the lower half of the tape is left intact until the bud begins to grow. When the budding reaches about 10 cm, lopping can be done to hasten growth. Only one vigorous scion should be allowed. Cultural practices such as weeding, cultivation, watering and fertilization should be continued to promote the development of the plant. To avoid infestation, spraying of appropriate insecticide should be done every 2 weeks.

3. Orchard Establishment
Planting can be done anytime of the year if irrigation is available. Balled or bare-rooted budlings are planted in holes big enough and always enriched with a handful of complete fertilizer, high in phosphorous. Topsoil is used to fill the holes and this is pressed down firmly to avoid large air spaces. Newly planted budlings should be watered immediately.

Planting of citrus follows a certain arrangement in which trees are set out in the orchard. Systems used include square, rectangular, triangular, and quincunx. Rectangular and
square systems are to be used where intercropping is to be done. In rectangular and square systems, the rows of trees are set at right angles to each other. In a triangular system, trees are set at the corners of equilateral triangle. In the quincunx system, four trees are set in a square and a tree is planted in the center.

4. Care for the Bearing Groves
Care for the bearing groves is observed through the following:

a. Irrigation. This is important to avoid water stress. Trees are watered until the rainy season begins. Irrigation can be through furrow, hose, or sprinkle.

b. Fertilization. Plants need 2 – 3 fertilizer applications each year.
   - First, when the rainy season begins;
   - Second, during the middle of the rainy season; and
   - Third, when the rainy season is about to end. Fertilizer can be applied or sprayed. Fertilizer can be applied directly or sprayed.

Common Role of Fertilization in Orchard for Each Application

c. Pruning. Pruning means removing diseased and dead twigs, branches, and leaves which are unproductive and are less exposed to sunlight. Best time for pruning is during the dry season or after harvest.

d. Spraying. A certain spray program should be strictly observed. Two or three types of chemicals against a particular pest should be alternated to avoid developing resistance of the chemicals.

e. Propping and Setting of the Windbreaks. To prevent the crop from touching the ground and the branches heavily laden with fruits. Ipil-ipil windbreaks on the windward sides of the orchard can be set up.

5. Pests and Diseases
Many important pests limit citrus growth. A systematic virus-like disease called leaf molting with its insect nectar was responsible for the decline of more than half a million citrus trees. Efficient pest management simply requires an understanding of the nature and cause of diseases, conditions that favor the spread of the diseases and the most
effective control measures. Knowledge of the most common and destructive insect pests therefore becomes vital.

To prevent unnecessary injury to plants when using pesticides, make sure that instructions and recommendations in pesticide packages and containers are followed.

6. Harvesting
Periodically, sampling has to be done to check whether fruits are ready for harvesting. Generally, citrus trees start bearing fruits 3 – 5 years from planting and can be harvested 5 – 6 months from flowering depending on the species and the environment. Unlike other fruits, citrus does not ripen further after it has been harvested, so it is important that it is picked at the right stage of maturity. Maturity indices include color, juice content, level of soluble solid (sugar), titratable acidity, and solids to acid ratio.

Table of Minimum Maturity Requirements for Local Citrus

Best time to harvest citrus is from 8 a.m. to 3 p.m., when the dew has dried up and fruits have lost their turgor. Fruits, which are frigid, are easily bruised resulting in brown patches on the rind, which indicate direct injury to the oil cells in the rind. This lowers fruit quality.

The proper way to harvest citrus is by pulling or clipping from the stem. “Twist, jerk and pull”, experts say, is the general rule. Use of hand gloves reduces to a great extent injuries on the peel of citrus. Canvas bags of suitable sizes with hooks at the bottom are best for transporting fruits to large, padded, field containers.

Rambutan (*Nephelium lappaceum*) is a medium-sized tropical tree growing to a height of 12-20 m. The leaves are alternate, 10–30 cm long, pinnate, with 3-11 leaflets, each leaflet 5–15 cm wide and 3-10 cm broad, with an entire margin. The flowers are small, 2.5–5 mm, apetalous, discoidal, and borne in erect terminal panicles 15–30 cm wide.

The fruit is a round to oval drupe 3–6 cm (rarely to 8 cm) tall and 3-4 cm broad, borne in a loose pendant cluster of 10-20 together. The leathery skin is reddish (rarely orange or yellow), and covered with fleshy pliable spines, hence the name rambutan, derived
from the Malay word rambut which means hairs. The fruit flesh is translucent, whitish or very pale pink, with a sweet, mildly acidic flavour. **Rambutan** is a popular garden fruit tree and propagated commercially in small orchards. It is one of the best known fruits of Southeast Asia and is also widely cultivated elsewhere in the tropics. The fruit are usually sold fresh, used in making jams and jellies, or canned. Evergreen rambutan trees with their abundant coloured fruit make beautiful landscape specimens.

**Preparation of Planting Materials**
1. Select well-developed seeds from mature/ripe fruits of the recommended varieties/selection.
2. Remove mucilage from the seeds by rubbing them with fine sawdust, ash or old newspaper.
3. Germinate the seeds immediately after extraction in light loamy soils or in germination beds made up of sawdust.
4. Germinated seedlings should be ready for potting in 24 days after sowing or 10 days after germination in 15 cm x 20 cm perforated plastic bags containing garden soil and place them in nursery shed.
5. Water them immediately after planting in polyethylene bags. Then water every 2 to 3 days or as the need arises.
6. The rootstocks would be ready for asexual propagation in 8-12 months; then 6 months from grafting, it would be ready for field planting.

**Rambutan Varieties**
Plant only grafted rambutan from a superior variety. Among the superior varieties are from Thailand (Rongrein and gulahbato), Malaysia (R162 and R5), Singapore (Jitlee), Super Red, Malaysian Jade, Sakay Selection and some others. R5 is particularly superior in a number of ways. It was the first prize winner in the 1996 Fruit Search competition. It produces big fruits that are intense red, hence attractive to customers. The white flesh is thick, sweet, smooth in texture and separates readily from its seed.

**Land Preparation**
1. Clear/Underbrush and remove all stumps.
2. Plow and harrow thoroughly to loosen the soil.
3. Stake at a distance of 8-10 meters between hills and 8-10 meters between rows. Prepare holes 30 centimeters in diameter at a depth of 30 centimeters.

**Planting**

1. Remove the plastic bag and plant the seedling into the prepared hole without breaking the ball of soil.
2. Cover the hole with top soil and press gently.

**Maintenance**

1. Provide shade to the newly planted rambutan seedlings for a period of two weeks to a few months depending on weather condition to enable the plant to recover from transplanting shock and to shade it from strong sunlight.
2. Apply basally, 60 grams (6 tbsp) of complete fertilizer (14-14-14) or based on soil analysis and cover with thin layer of soil. The rate of application increases as the tree grows bigger.
3. Ring weed quarterly or as the need arise.

**Fertilization Schedule**

Fertilizer- Complete (14-14-14) 2nd Year- 200 gm/tree, 3rd Year- 300 gm/tree, 4th Year- 400 gm/tree

**Harvesting**

Harvest rambutan fruits when skin is pinkish red. Rambutan fruits do not ripen at the same time even within a bunch and this necessitates harvesting by priming. Harvesting is done using secateurs or a long pole with a hook on one end. Avoid making damage to the branches while harvesting as these are the sources of next crop. Harvesting schedules in a moderately-sized orchard (200-300 trees) are three times a week during the height of the season.

**Storage and Packing**

The fruits should be kept under shade. Fruits are graded based on size and degree of ripeness. Then they are washed and dried before packing. Fruits of good quality are selected and packed by placing them in a ventilated box or case of 60 cm x 28 cm x 28 cm.

**Products**

Aside from eating its fresh fruit, Rambutan fruits can also be processed to products like jam, jellies, rambutan cocktail, rambutan sweets and canned rambutan. Rambutan
sweets are used for pie (as raisin), ice cream and fruit ice. Sometimes arils are canned by stuffing with pineapple in heavy syrup.

**Insect Pest, Diseases and their Control**

- **Fruit Borer (Cacao Pod Borer)** – Spray Decis, Gusacarb, Gusathion or Kafil
- **Mealy Bugs** – Spray with Malathion, Roxion
- **Twig Borer** – Prune infested twig and burn
- **Powdery Mildew** – Spray with Fungitox, Benlate, Bayleton
- **Damping-off** – Spray with Benlate
- **Leaf Spot** – Spray with common fungicides

**JUST A MINOR FRUIT.** Unfortunately, balimbing is considered as just a minor fruit in the Philippines which is not usually found in the backyard. It is not being grown in a plantation like other crops that are planted for commercial purposes.

So the potential market is there. With an attractive package, it could become a bestseller in upscale supermarkets.

**CHOOSING THE GROWING AREA.** Choose the right place to grow your balimbing. If we are to suggest, grow your trees not far from Metro Manila. This could be in eastern Rizal that includes Antipolo and the other towns up to Tanay. You can also grow the same in Cavite, Laguna, Bulacan, and even Batangas.

Why are we suggesting these places? Because they are near the market. Of course, other growers can grow balimbing around areas of big cities like Cebu, Davao, Bacolod, and others where there could be enough prospective customers with purchasing power.


**FOR WEEKEND MARKETS.** Aside from supermarkets, we could just imagine how many weekend market goers would be continually returning for their weekly supply of freshly-harvested balimbing.

Make sure you get the sweet varieties. We particularly like two that we have tasted. One is the sweet balimbing with big fruits and seeds and the other one which is also big and seedless.

If there are not enough available grafted planting materials, you can buy a few mother plants and propagate them yourself by grafting. Balimbing is quite easy to graft.

**EARLY BEARER.** The good thing is that grafted planting materials usually start bearing flowers in just a year after grafting. Balimbing seeds are easy to germinate. You can produce your own rootstocks for grafting. You might also experiment and find out how long it will take for seedling trees to produce fruits.
The thing you have to pay special attention to is how to produce quality fruits. Your trees should be well nourished. They should be planted in the open sun, well fertilized, watered when necessary, and protected from pests and diseases.

Fruitfly is a major pest of balimbing. You can of course prevent fruitfly infestation by wrapping the fruits with paper bags or cloth fruit bags if you wish.

TAIWAN PLANTATION. We remember a balimbing plantation we visited many years back in Taiwan. The trees were topcut about six meters high, and they allowed only the side branches to develop up to six feet. That way, the workers can wrap the developing fruits conveniently. Wrapped fruits are very clean and without insect damage. Health-conscious customers will surely love such undamaged fruits that are not sprayed with insecticide.

The beauty about balimbing is that fruiting could be more than once a year, especially if the trees are taken care of very well. Spraying the Power Grower Combo and the Heavy Weight Tandem of Alfonso G. Puyat will surely boost fruiting as has been our experience in our own little farm.

CARE IN HARVESTING. Special care should be observed during harvesting. Rough handling could easily bruise the delicate fruits. Special care should also be observed during packing and delivery to the market. Such fruits should be able to command a good price in the market.

Sugar Apple Production Guide (Atis)

The Sugar Apple (Annona squamosa L.) or atis in Filipino is a small deciduous tree that reaches a height of about 15 to 20 ft (4.6-6.1 m) and spread. Sugar apples are a common fruit tree in the home landscape throughout the tropics. Its leaves are dull, pale green, hairy when young but smooth
at maturity, thin, lanceolate to oblong lanceolate, and 2.5 to 4 inches long (6.4-10.2 cm).

Sugar apple trees produce flowers on -1 to 2-year-old wood and in new vegetative growth. Flowers are small, about 1 inch long (2.54 cm), produced singly or in clusters of 2 to 4 from the leaf axils on year-old shoots or new growth. The flowers are composed of 3 green, fleshy petals, 3 small, inconspicuous sepals, and numerous pistils on a common receptacle.

The aggregate fruit is heart-shaped, round, ovate, or conical, from 2 to 5 inches (5.1-12.7 cm) in diameter and weighs from 4 to 24 oz (113-682 g). The fruit is composed of loosely cohering segments, which project as rounded protuberances and are easily separated when the fruit is ripe. The pulp of green and purplish-red sugar apples is white or creamy white, with a custard-like consistency and sweet, pleasant flavor. There are numerous, small, shiny, dark brown seeds embedded in the pulp.

**Sugar Apple / Atis Varieties**

Most sugar apple trees are grown from seed and within a particular selection (e.g., ‘Thai Lessard’, ‘Kampong Mauve’), there appears to be little variability among seedlings. Several selections have been introduced including 'Thai Lessard' (a green type), 'Purple' or 'Red', 'Kampong Mauve' (purplish-red types), and a seedless type known under various names, 'Cuban Seedless' and 'Brazilian Seedless'. However, the seedless fruit split when nearing maturity, and the fruit quality and yield is reported to be inferior to seedy types. Green or red type sugar apples are recommended for the home landscape.

**Propagation**

Sugar apples are generally propagated by seed since there is little variability among seedlings. However, improved selections may be veneer- and cleft-grafted or shield-budded onto suitable rootstocks (e.g., sugar apple, atemoya, custard apple).

**Production (Crop Yields)**

Sugar apple trees may bloom from March through May, and fruit are harvested from mid-summer through fall. Fruit may be available through midwinter if no frost occurs and leaves remain on the trees. The crop yield of sugar apple varies from year to year and is influenced by climate, presence or absence of natural pollinators, disease and insect pressures, and cultural practices. Sugar apple yields may range from 20 to 50 fruit (10 to 50 lbs; 4.5 to 23 kg) per tree.

**Spacing**

Sugar apple trees make an attractive tree in the home landscape. Sugar apple trees should be planted in full sun and at least 15 to 20 ft (4.6-6.1 m) from adjacent trees and structures. Trees
planted too close to other trees or structures may not grow normally or produce much fruit due to shading.

**Soils**
Sugar apple trees are well-adapted to most well-drained soil types, including the sands and limestone based soils. Trees in muck soils may tend to grow more vigorously but produce less fruit due to the high native nitrogen content. Sugar apple trees are intolerant of continuously wet or flooded soils.

**Planting a Sugar Apple Tree**
Proper planting is one of the most important steps in successfully establishing and growing a strong, productive tree. The first step is to choose a healthy nursery tree. Commonly, nursery sugar apple trees are grown in 3-gallon containers, and trees stand 2 to 4 ft from the soil media. Large trees in smaller containers should be avoided because the root system may be “root bound.” This means all the available space in the container has been filled with roots to the point that the tap root is growing along the edge of the container in a circular fashion. Root bound root systems may not grow properly once planted in the ground.

Inspect the tree for insect pests and diseases, and inspect the trunk of the tree for wounds and constrictions. Select a healthy tree and water it regularly in preparation for planting in the ground.

**Site Selection**
In general, sugar apple trees should be planted in full sun for best growth and fruit production. Select a part of the landscape away from other trees, buildings and structures, and power lines. Remember, sugar apple trees can grow to about 20 ft (6.1 m) high if not pruned to contain their size. Select the warmest area of the landscape that does not flood (or remain wet) after typical summer rains.

**Care of Sugar Apple Trees**
Maintain a grass-free area 2 to 5 or more feet away from the trunk of the tree.

**Fertilizer Practices**
During the first 2 to 3 years after planting, growing a strong, vigorous tree is the goal. It is recommended that any fruit that sets during the first year or so be removed so that the tree will grow vigorously. After the third year, the emphasis changes to cultural practices that enhance flowering, fruit set, and fruit development. These include reduced frequency of N-P2O5-K2O applications and close attention to irrigation from flowering to harvest during prolonged dry periods.

Fertilizer recommendations are based on experience and observation. Frequent applications of small amounts of nitrogen-containing fertilizer and watering during the growing season when there are prolonged dry periods is recommended (Table 2). After the third year, trees will begin to bear fruit and the strategy is to reduce the number of applications of nitrogen-containing fertilizer. Minor
element sprays to the foliage should contain magnesium, zinc, and manganese (some also contain boron, molybdenum and iron). Foliar sprays are most efficient from April to September.

Young trees should be fertilized with a complete fertilizer every six to eight weeks during the growing season. A complete fertilizer is a fertilizer containing a source of nitrogen (N), phosphate (P), and potassium (K) (many also contain a source of magnesium, Mg). By-convention fertilizer formulas are written as the percentage of nitrogen (N), phosphate (P2O5), and potassium oxide (K2O) (e.g., 6-8-9, 6% nitrogen, 8% phosphate and 9% potassium oxide). Acceptable mixtures include 6-6-6 or 8-3-9 or some similar material. Suitable fertilizer formulations for sugar apple include 2-8-8, 4-8-8, 6-6-6-3 or 8-3-9-5 or similar materials. Frequent applications at low rates will provide a more constant nutrient supply and reduce the potential for leaching of nutrients beyond the roots due to heavy rainfall.

Apply about 1/4 lb (100 g) per tree per application (Table 1). The rate may gradually be increased as trees grow. For mature trees, increase the NPK rates from 1.5 to 4 lbs per tree per application as trees become older. Make 2 to 4 applications per year.

Applications of magnesium and micronutrients such as zinc and manganese may be made in ground applications to trees growing in sandy soil with a low-pH (4-7). However, foliar applications of zinc, manganese, and magnesium are more efficacious for trees growing in highly calcareous with a high-pH (7-8.5). Micronutrient applications should be made 2 to 4 times per year, generally during the growing season. Iron should be applied in a chelated formulation. For the calcareous, rocky soils, and for sandy soils with a high-pH, use a chelated iron specifically formulated for high-pH soils. For sandy soils with a low-pH, use either a chelated iron specifically formulated for low-pH soils or iron sulfate, or similar materials. Iron should be mixed with water and applied as a soil drench under the tree canopy.

Guyabano (Soursop) Production Guide

Guyabano or soursop is one of the minor crops that is gaining popularity because of its economic uses. It is a nutritious fruit, rich in ascorbic acid, potash, phosphorous and calcium. The edible portion is 70% with food energy of 63 calories and the sugar content ranges from 4 to 14%. Because of its many economic uses and great demand in processing industry especially in producing guyabano drinks, expansion and more production should encourage to meet its demand. Consequently, the crop is now gaining its prospect in the world market.

Based on BAS crop statistics of 2003; a total land area of 3,016 has. were planted to guyabano with the following as the five leading producing regions: Western Visayas (705 has.); Region IV-A (643 has.); Cagayan Valley (400 has.); Central Visayas (169 has.); and Central Luzon (165 has.).

Economic Importance
Guyabano is a potential crop with varied economic uses. The nature green fruits are used as a vegetable and for making sweet meats, while the ripe one is eaten off hand or as dessert. Its juice is used for flavoring ice cream, sherbets, canning and for preparation of refreshing drinks. It may also be processed into preserve, candies, jam and jelly. Guyabano also possesses some medicinal properties. The trees maybe used for landscaping and for shade.

Varieties

There are two strains presently grown.

Aguinaldo – Fruit, 1kg; peel, yellow green; flesh, juicy, sub-acid, 78% of fruit weight; seeds, 70 per fruit

Davao – Fruit, 1.7 kg; peel, light green; flesh, moderately juicy, pleasantly sub-acid, 82% of fruit weight; seeds, 82 per fruit.

Nursery Practices

Seed Preparation and Germination

The seeds to be used as source of seedlings for planting should be obtained from outstanding mother trees. The mother plant should be hardy, prolific and regular bearer and its fruits be medium-sized to large, well formed, few seeded and excellent quality. Seed extracted from the fruit should be cleaned thoroughly in tap water and allowed to air dry. They may be stored for quite sometime but it is best to plant them without delay. They are sown in seed boxes or flats containing fine and/or sandy soil of about 2.5 cm distance and 1 cm deep. The seedbed is provided with shade and watered regularly to keep the medium moist at all times. Fresh seeds germinate from 20 to 30 days with 85 to 90 percent germination.

Care and Transplanting of Seedlings

The seedlings are watered regularly and sprayed with insecticide and fungicide if insect pests and diseases become a problem. When the young plants are 3-4 inches high or when the first set of leaves has matured, they may be transferred in individual container like plastic bags. The soil medium should be clay loam preferably mixed with sand or compost. The newly transplanted seedlings are placed under partial shade and, when well established, they may be exposed to the sun for hardening. They are regularly watered to ensure continuous growth and to protect against pests and diseases. Seedlings are ready for field transplanting when they are 6 to 8 months old or about 15 cm tall.

Propagation
The guyabano is usually propagated by seeds. However, selected trees of inherent characters may also be propagated asexually by marcotting, inarching, grafting and budding.

Soil and Climate Requirements

Soil – the plant thrives in any kind of soil but it grows well in loose, fairly rich, deep loam and well drained soil.

Climate – guyabano culture require a warm, dry climate during the blooming period to get a good fruit set. After this, almost a continuous light rainfall is necessary.

Elevation – it thrives well from sea level up to 300 meters above sea level.

pH – it grows better on soil with pH ranges 6.1 to 6.5.

Cultural Management

Land Preparation

In preparing the land be sure to have a ready supply of compost or organic manures for basal application in order to improve the soil texture. The land should be plowed two or three times followed by harrowing with the incorporation of organic manure until the excellent condition for planting is attained. For newly opened land, under brushed branches and twigs should be burned before the holes are dug. For backyard planting, a hole wide and deep enough to accommodate the ball of the root system of the seedlings is dug just before planting. The field is laid out by putting stakes following the desired distance of planting which ranged from 4 to 7 meters each way. Holes are dug at the positions occupied by the stakes. A hectare at this planting distance would require 204 – 625 planting materials.

Planting – may be done in any month of the year provided the soil is not so dry and there is good supply of water for the newly planted seedlings. Holes, 2 x 2 x 2 ft. are dug and refilled with top soil and compost. Water the young plants soon after setting them in the field. The newly planted seedlings should be protected from strong wind and bright sunshine. Mulch each young tree before the dry season begins and irrigate whenever necessary during the dry months.

Cultivation – the area around the base of the tree should be kept free of weeds by regular shallow cultivation. Brush weeding and shallow cultivation of the soil below the periphery, of its foliage to a depth of about 3 cm at the time of fertilizer application are sufficient.

Fertilization – generally, fertilizer application is beneficial in promoting plant growth and makes the young tree grows strong and sturdy. It also help increase fruit production. The application of 100 – 150 grams Ammonium Sulfate a month after planting and an equal amount six (6) months after or at the end of the rainy season is recommended. The quantity is increased every year until the tree
start to bear fruit at which time, 250 – 300 grams of complete fertilizer is applied. This amount also increased in each succeeding year of fruiting from 1.5 to 3.0 kg. of complete fertilizer (14-14-14) plus 200 – 300 grams of Muriate of Potash (0-0-60).

**Pruning**

When branching is excessive and other branches are defective growing downward or interlacing with others, pruning is necessary. Such branches together with water sprouts should be pruned. Dried twigs and disease branches should likewise be pruned to avoid further infestation and disease infection. This practice improves aeration on the interior of the tree, permits sunlight to fall on the whole tree thus stimulate better fruit yield.

**Intercropping**

While the trees are still young, weeds could grow in the spaces between plants and compete with food nutrients. Hence, to give full utilization of the land, intercropping the orchard is usually accorded. The perennials that may be intercropped with guayabano are banana, coffee, cacao, blackpepper, mulberry and/or citrus. It may also be planted as an intercrop to bigger fruit trees such as avocado, starapple, durian, mango, jackfruit, rambutan, santol and under coconut.

Intercropping with such annual crop as vegetable, legumes, cassava, ginger and gabi for the first 3 years after planting would be profitable and will help put down growth of weeds aside from the added income.

When intercrops are no longer grown, the orchard should be planted to perennial legumenous cover crops such as centrocema and calopogonium.

**Irrigation**

Guyabano can tolerate dry soil condition better than other fruit trees. However, during the dry season with prolonged drought, plants may shed too much leaves and needs water application. For the rapid growth of the trees irrigation is needed due to their relatively shallow root system.

**Crop Protection**

**Pests**

Guyabano is attacked by a number of pests, such as:

**Root grubs** – they attacks the roots and during the advance stages causes the wilting of the whole plants. Grubs can be controlled by drenching with chlordane at the base of the tree.
**Mealy bugs** – they suck the sap of young leaves and fruits. Attacked leaves turn yellow and the plant become stunted in growth. These insect pests can be controlled by spraying Malathion, Methyl Parathion or Azodrin at manufacturer's recommended dosage.

**Carpenter Moth Larvae** – they bore into the inner part of the wood where they feed and grow. Damage may be reduced by collecting and burning of infested twigs.

**Scale Insects** – they are commonly found feeding on the under surface of the leaves, and suck the sap causing the leaves to dry up. These pests can be controlled by spraying the tree with Malathion at recommended dosages.

**Oriental fruit fly** – the maggot eat up the tissue of the fruit leading to decay. Bagging the fruits may help reduce fruit fly damage. Kalingag powder may be used to attract fruit flies mixed with insecticide and kill the insects.

**Nest Building Ants** – the ants do not damage the tree but they protect the scales and mealy bugs and get nourishment from the secretion of this insects. Ants may be controlled with the same insecticide sprayed for the above pests.

**Diseases**

The following are the major diseases:

**Root Rots** – it infects and causes the decay of the roots eventually leading to the collapse and death of the tree. The diseases trees should be cut down and burned.

**Pink Disease** – causes twigs and branches to collapse and die. The presence of the disease is manifested by a fungal growth on infected areas. The disease may be controlled by collecting and burning infected twigs, branches, and leaves, and spraying the tree with copper fungicide.

**Anthracnose** – flowers and fruit may be affected by the anthracnose fungus and fall. This disease may be controlled by spraying the tree with fungicide such as Maneb, Captan, or Vitigran Blue. The same fungus can also cause damage to seedlings and shoot of bearing trees.

**Harvesting and Storage**

**Harvesting**

The guyabano trees bear fruits in 3 – 5 years after planting. They flower most months of the year but the peak of flowering is May and June, and the fruit ripens in November and December.

The guyabano fruits should be harvested when they are fully matured. They are considered mature when they turn shiny green or yellowish green and their spines are set far apart. If the fruits are
picked prematurely, they will ripen but their quality is poor. On the otherhand, fruits left to ripen on the tree are often attacked by birds and bats if they do not first fall to the ground.

The fruits on a tree do not mature at the same time which therefore requires selective harvesting. Fruits for vegetable purposes are usually harvested when they are only about 4 months old.

Fruits are harvested by bending the branch or climbing the tree and twisting each fruit off its peduncle with or without use of knife. The harvested fruits are then placed in a bamboo baskets lines with soft materials, such as newsprints or rice straw. Fully mature fruits ripens in 3 to 5 days after harvest. Ripe fruits are easily injured because of their soft and tender skin, and should be handled with great care. The fruits are transported to nearby markets soon after harvest.

**Storage**

Fruits for the factory are placed in a bodega under ordinary room temperature and allowed to ripen with firmness until they are ready for processing/preservation.

On the otherhand, ripe fruits may be held 2 or 3 days longer in refrigerator, but the skin blacken and become unsightly. However, the flesh and flavor are not affected.

**Processing and Utilization**

Preservation/utilization of fruits has been getting widespread attention not only on its increasing acceptability in the food market but also because of its potential as a means of generating an export. The various preservation of guyabano was briefly described in the following procedures.

**Guyabano Juice** – after washing sound ripe fruits, they are blanched for 3-4 minutes in boiling water. They are cooled in water, peeled and their inner core removed. They are cut into 5 cm square pieces. One cup water is added to 1 cup fruit heated at 800C for 3 minutes or until the fruit is soft enough to squeeze of the juice. The juice is pressed through a muslin bag while hot. The juice from the residue is extracted for the second time with the same amount of water. The two extracts are mixed and sugar is added to taste. The juice is poured into jars and exhausted before sealing to 820C (approximately 15 minutes from boiling time). The jar is sealed immediately, sterilized in boiling water for 10 minutes, cooled and stored.

**Guyabano Preserve** – mature but firm fruit is peeled sliced about 1 cm thick using stainless steel knife, and soaked in water. It is blanched in boiling water for 5 minutes cooked in syrup (2 parts sugar and 1 part water), and soaked in syrup overnight. It is again boiled for 30 minutes until thick, drained and packed in preserving jar. The jar is filled up with syrup, half-sealed, sterilized for 25 minutes in boiling water and sealed completely.

**Guyabano Candy** – mature but firm fruits peeled sliced to about 1 cm thick with a stainless steel knife, and soaked at once in water to avoid discoloration. It is cooked in syrup (2 parts sugar to 1
part water) for 10 minutes and soaked in syrup for 1 week, boiling it daily for 5 minutes. It is cooked over a slow fire until syrup becomes sugary. It is removed from fire, separated from sugar, cooled and wrapped individually in cellophane.

**Guyabano Jam** – the fully ripe, sound fruit is peeled and its seeds are removed. To every cup of fruit, an equal amount of sugar is added and the mixture is cooked to jam consistency. It is poured while hot in a preserving jar. After removing the bubbles, the jar is half-sealed, sterilized for 25 minutes in boiling water and sealed completely.

**Frozen Guyabano Pulp** – the sound ripe fruit is peeled and its seeds are removed. To every cup of fruits are added ¼ cup refined sugar and 2 tbsp. calamansi juice. The mixture is packed in a plastic bag container and stored in a freezer (240F). To serve as juice, enough cold water and sugar are added to taste.

**Guyabano Jelly** – thoroughly ripe fruit is rinsed and sliced, retaining the skin and seeds. It is put in a pan with enough water to cover, and boiled until soft, with constant stirring. It is removed from the fire and passed through a double cheesecloth. The extract is returned to the fire, boiled until all the scrum has risen, and strained again. To each cup, 1 tbsp. calamansi juice is added and the mixture is boiled again. To the boiling juice is added 1 cup hot dissolved sugar and the mixture is boiled until it hardens on spoon removing all rising scrum in the process.

**Guyabano Juice Concentrate** – fully ripe, sound fruits are thoroughly washed with detergent and carefully rinsed in water. They are cut into halves and the skin and seeds are removed. Two cups of water are added to 1 pulp, the mixture is blended to facilitate juice extraction, and strained through a muslin cloth bag. The clear juice is concentrated juice is “cut back” to 160C Brix by adding freshly prepared juice. Ascorbic acid equivalent to 50 mg/cc is added during pasteurization to retard normal oxidation browning in storage. Fortified concentrate is pasteurized at 850C for 5 minutes, hot filled into previously sterilized cans, sealed completely and processed into boiling water for 10 minutes. Cans are immediately cooled in running water and wiped dry.

Red Lady Papaya Nursery Business

**Papaya** (*Carica papaya* Linn.), originated from tropical America and is considered as one of most important fruit crops in the Philippines because of its great economic potential. The fruit is cylindrically long, pear shaped or round, it is orange to orange-red, sweet and juicy when ripe. Unripe papaya makes for a good concoction of vegetable stew, salad or pickle. The fruit is rich in Vitamins A and C, iron, calcium, protein, carbohydrates and phosphorous. Papaya produces latex which contains papain, an enzyme that breaks protein. Papain has been commonly of use to the food,
pharmaceutical and cosmetic industries. Papain is used for cleansing lotions, facial creams and toothpastes.

A study conducted by the University of Indonesia discovered that glycoside, an organic compound that can be extracted from ripe papaya seeds, reduces fertility among men. This breakthrough is being pursued to provide an alternative contraceptive method for men. Further, a new scientific finding reveals that papaya could be an effective remedy for cancer.

**Papaya Varieties**

**Solo** – Solo is an improved, high quality selection with reddish-orange flesh. Its fruit weighs about half a kilogram.

The most popular strains of Solo papaya commercially propagated in the Philippines are the Kapoho and Sunrise which are high-yielding and pear shaped. They are smoother and sweeter but smaller and lighter compared to other Solo strains.

**Cavite Special** – Cavite special is a popular semi-dwarf type that blooms 6-8 months after planting. The fruit is large, oblong and weighs from 3 to 5 kilograms. It has a star-shaped cavity. The flesh is yellow orange and sweet when ripe.

**Sinta** – Sinta is the first Philippine bred hybrid papaya. It is a cross between Line no. 5 and Line no. 3. It is moderately tolerant to papaya ringspot virus (PRSV) and produces more quality fruits than the ordinary papaya strains. It is semi-dwarf and therefore, easier to harvest.

Sinta is early maturing and prolific, which bears 17-50 fruits per tree. Its fruit weighs 1.2 – 2.0 kg, is sweet and has firmer flesh.

**Red Lady Papaya** (F1 Hybrid) – Early, vigorous productive and tolerant to papaya ring spot virus. Plants begin to bear fruits at 80cm. height and normally have over 30 fruits per plant in each fruit setting season. Fruits are short-oblung on female plants and rather long shaped on bisexual plants, weighing about 1.5 – 2 kg.
**Known - You No.1** – Tolerant to papaya ring spot virus. Plants are thick, sturdy early and heavy yielding. Yellow – fleshed fruit is large, weighing about 1.6 – 3 kg.

* Tainung No. 1 – Plants are vigorous and prolific. Fruits weigh about 1.1 kg with red flesh and good aroma.
* Tainung No. 2 – Fruits with pointed blossom end weigh about 1.1 kg. Flesh is orange red, tender with good taste and quality. Suitable for local market.
* Tainung No. 3 – Plants are dwarf but with good growth. Fruits are larger than Tainung No. 1 and weigh about 1.3 kg. Flesh is yellow – orange, sweet and good quality.

**Adaptation**

Papaya thrives best in areas with dry climate (25-30°C) with annual rainfall of 1,200 mm to 1,500 mm distributed throughout the year. Normally, it is a crop for low to medium elevations (from sea level to 900 meters above sea level) with humid to fairly humid conditions. It requires ample sunshine and protection from strong winds.

**Papaya** is adapted to a wide range of soils but its grows best in well-drained light textured soils with pH range from 5-6.5. Good drainage is important as water logging kills plants. Sticky and calcareous soil are not good as rain water, may accumulate in the soil even only for a few hours. In this case, raised beds and drainage ditch are recommended.

**Cultural Requirements**

**Land Preparation**

Clear the area of all shrubs and trees preferably during dry season and alternately plow and harrow to obtain fine tilth.

**Planting**

Seeds are recommended to be sown in polyethylene bags. Sow at least 3 to 4 seeds and cover with fine soil. Germination takes 15 to 20 days. Thin out to two seedlings per polybag. A booster dose of 2 grams urea after emergence and 2 weeks interval in subsequent application may be given for rapid growth and development of seedlings.
Regular daily watering is necessary. The seedlings are ready for transplanting when they are about 6 inches high or 2 months old.

Prior to planting, stake at a distance of 2.5 X 2.5 and dig 45 cm X 45 cm holes. Two seedlings should be planted per hole and later thinned out to only one after assurance of most vigorous tree.

**Water Management**

Water is required for papaya during the early stages of growth and periods of prolonged drought. Lack of moisture over prolonged periods causes growth retardation, flower abortion and dropping of young fruits.

Water newly transplanted seedlings daily until they become fully established. Young papaya seedlings should be irrigated once a week and bearing trees every week during dry periods. During rainy season, hill up to improve drainage.

**Weed Control**

Remove the weeds by proper cultivation of the soil around the plants. It is done by hand pulling, hoeing or by shallow cultivation. Extreme care should be exercised in manual weeding around the trees since papaya is shallow-rooted and surface feeder roots injured. Mulch during the dry season to control growth of weeds and to conserve moisture.

**Fertilization**

The following is the general fertilizer recommendation for papaya:

**Common Pests and Diseases and their Control**

**Pests**

1. **Mites** – Under local conditions, the red spider mites (Tetranychus kanzawai Kishida) is most common attacking and severely damaging the older leaves of papaya
and sometimes attacking its seedlings. Its serious damage causes the leaves to dry up, thus, reducing the photosynthetic activity of the plant.

Control Measures

* To prevent the sources and build up of mite population, leaf pruning and burning of damaged and attacked leaves are done weekly.
* For chemical control, use selective miticides sprayed at 7 to 10 days interval.

2. Scale insects – The most common scale insects species colonizing and feeding on papaya fruit is the Aspidiotus destructor Sig. Their feeding caused the fruit to ripen prematurely and destroy the external appearance of the fruits.

Control Measures

* Spray recommended insecticide to control incidence of scale insects in the fruits. Spraying should be done directly to the fruits 15 days before harvest. Adjust spray nozzle so as not to hit harvestable fruit in case there are available harvestable fruits. Re-spray 7 days after if presence of such pest is still visible.

3. Fruit Fly – Dacus dorsalis and Dacus cucurbitae Coq. are species of fruit fly attacking papaya. When an outbreak in population occurs, the eggs are deposited in the ripening fruits while they are still attached to the tree. Harvested fruits eventually rot as the newly hatched larvae start to feed inside the fruit.

Control Measures

* Sanitation inside the population is essential by gathering all ripened, damaged and fallen fruits. Gathered fruits should be dumped in pit and burned.
* Use Methyl Eugenol to attract male files and kill them.
* Do not allow ripe fruits to remain in the tree for sometime.

Diseases

1. Damping - off
Symptoms

* Tissues of the papaya seedling stems at the solid line become water-soaked and rotten due to infection by one or more species of fungi-like Pithium debayranum, Pytophthora palmivora and Rhizoctonia sp. It is common in the nursery or in the field where seedlings are too crowded. It is favored by high temperature and wet weather.

Control Measures

* Avoid overcrowding of seedlings.
* Provide good drainage and adequate soil erosion. Practice proper plant spacing and depth of planting.

2. **Papaya mosaic**

Symptoms

* Leaves of infected plants develop a wrinkled and rough appearance. Younger leaves are generally stunted and chlorotic and are accompanied by vein-banding or transparent oil that are scattered over the leaf veins.
* Older and mature leaves show more pronounced chlorotic areas and are stunted.
* Severe attack results in stunting of petioles.
* Infected young fruit shows small, dark green spots, which appear either on the stem or blossom end. They enlarge as the fruit develops. Mottling of green and brownish rings appear.

Control Measures

* Cut down infected plant and burn.

3. **Bacterial Crown Rot**

Diseased papaya are really distinguished in the field by the dropping leaves which results from infection of the petiole or stem with the bacterium Erwina cariceae.

Symptoms
Initial symptoms found on the petiole and stem are water-soaked spots. The spots rapidly enlarged causing rotting of the petiole or stem. Then the crown droops and wilts showing leaf yellowing it may topple-over.

Young, soft plant parts are susceptible to infection with the bacterium gaining entry through natural openings and wounds. In susceptible cultivars, infection becomes systematic causing vascular discoloration of the stem, fruits and roots. The disease is common during periods of prolonged wetness or continuous rainfall. Infected plants may recover and produce productive branches during dry season.

Control measures

* Eradicate severely infested plants and disinfect tools with 10% formalin solution. In cases when the stem is not infected, remove only the infected petioles and leaves.
* Provide protection to the papaya plants during rainy periods by spraying crown (petioles, leaves, fruit and young stem) with copper fungicide at 3 g/li. of water once every 14 days.

4. **Anthracnose**

The disease is caused by Collectrichum gleosporiodes and effects not only the fruits but also petioles of older leaves.

Symptoms

* Small, round, water-soaked areas appear on infected ripened portion of the fruits.
* Fungus produces pink spore masses, which appear in concentric rings in the lesions. Fungus also penetrates into the tissues of the fruit, causing it to become darker and softer than the surrounding tissues.
* Infected portion have unpleasant flavor.
* On green parts, it appears as small, water-soaked lesions oozing out from the infected areas.

Control Measures
* Spray with recommended fungicide plus a spreader sticker to ensure good spray coverage at 7-10 days interval.
* Post harvest storage decay can be reduced by treating fruits in hot water at temperature of 110-120°F for 20 minutes.

5. **Pythoptora rot**

Symptoms

* Seedling damps-off, root rots, trunk cankers and fruit rots.
* Immature fruits are attacked through wounds while mature fruits at any location.

Control Measures

* Remove infected fruit and dispose properly.
* Spray copper fungicide at recommended rate. (For fruits in storage, control by hot water dips at 46.7°F for 20 minutes then cool with running tap water.)

6. **Papaya Ringspot Virus**

The Papaya Ringspot Virus (PRSV) is readily transmitted mechanically by sap. It is also stylet born and insect transmitted by aphids. It is not readily transmitted through seeds.

Symptoms:

* Vein clearing, mottling and the presence of yellow spots are the initial symptoms of the leaf.
* Later, the leaves are reduced in size and margins tend to curl upward and downward. Dark green concentric rings or green spots appear on fruits and the disease progresses, fruit set is sharply deformed and smaller.

Control Measures:

* Eradication of infested plants and spraying the infected and the apparently healthy tree surrounding it with appropriate insecticide before uprooting and chopping the
infected trees to small pieces. Place the chopped plant debris in a sack or plastic bag and burn it in a suitable place.

* Never intercrop papaya trees with possible alternate host such as watermelon, cucumber, squash, etc.
* Enforce quarantine measures prohibiting the transfer and introduction of papaya and alternate hosts from affected orchards to new growing areas.
* Use resistant papaya cultivars.

**Harvesting and Post Harvest Management**

Papaya generally starts to flower after 5 months from seedling and the first harvest is obtained 4 to 5 months later. When intended for vegetable, papaya can be harvested when fruit is at color break to ripe. For shipping to distant market the fruits should be harvested when the apical end starts turning yellow and the latex is no longer milky. Do not allow fruits to ripen on the plant and they should not be dropped to the ground to avoid possible injuries. Use step ladder or plumber helper with long bamboo pole to pick the fruits if the tree grows taller.

To harvest, to twist the fruit until its stalk snaps off the plant or cut the stalk with sharp knife.

The productive lifespan of papaya gradually ends on the 3rd or 4th year. As the tree matures, production also slackens. The yield of well-managed papaya plantation is 35 to 40 tons per hectare.

**Packing**

A good method of packing is to place the fruits in single layer in a rectangular wood container lined with dried banana leaves or shredded newsprint to protect the fruit against the normal hazards of transport and handling.

**Storing**
Ripe papayas may be stored at 8.3°C and partially ripe ones at 11.9°C. At these temperatures, the fruit can be kept for 3 weeks. To avoid chilling injury which is manifested by impaired ripening, do not store less mature fruit below 7.1°C.

Coconut Production Guide

Coconut Plantation Establishment

Site Selection

1. Land must not be waterlogged. Coconuts do not grow well on flooded land.
2. Soil depth must not be less than 1 meter. Root canopy is more than 1 meter.
3. Rain water is available most of the year. Areas that have distinct dry season is not preferred.

Clearing and Levelling

First activity in Field planting is clearing of weeds, debris and other unwanted crops. Most unwanted crops are old coconut trees that have pest and diseases. It is very important to properly dispose infested / diseased coconut trees. If possible burn or bury into deep pits to avoid contaminating newly planted coconut trees.

Lay-outing and Planting

Triangular system of planting coconut is recommended with rows laid out in a north-south direction. The distance between palms in a row should be 9 m x 9 m to 10 m x 10 m for tall varieties and 8 m x 8 m to 8.5 m x 8.5 m for dwarf hybrid coconuts. Staking is done to ease in locating where the tree will be planted.

After staking, dig a hole with the dimension of 50 cm diameter and 50 cm depth. Seedlings are ready to for planting when they reach 7 months in seedbeds or pots. Best time to plant is during the onset of the rainy season. This is to avoid drying up of newly planted coconut trees. And to ensure greater survival since the trees roots have established itself and ready to absorb moisture left in the soil during the summer months.
Before the seedlings are placed on the hole, fertilizers are applied inside the hole as basal application (refer to table on fertilization below). Prompt replanting of dead trees must be done to avoid uneven growth of coconut trees.

**Plantation Management**

1. **Cultivation** – to remove weeds and improve soil moisture absorption and aeration.
2. **Irrigation and drainage** – water logging and drought damages significantly coconut trees.

<table>
<thead>
<tr>
<th>Component</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Planting</td>
<td>30 g</td>
</tr>
<tr>
<td>6 months from Field Planting</td>
<td>40 g</td>
</tr>
<tr>
<td>1 year</td>
<td>0.10 kg</td>
</tr>
<tr>
<td>2 years</td>
<td>0.15 kg</td>
</tr>
<tr>
<td>3 years</td>
<td>0.20 kg</td>
</tr>
<tr>
<td>4 years</td>
<td>0.30 kg</td>
</tr>
<tr>
<td>5 years and above</td>
<td>0.40 kg</td>
</tr>
</tbody>
</table>

**Table 2.0: Corrective fertilization of N, K, CL and S depending on the age of coconut (wt per palm per year)**

3. **Cover crops and control of weeds** – Cover crops are beneficial to coconut because it prevents erosion during rainy season, excessive water lost during summer months. Some leguminous cover crops like Centrosema and Stylosanthes fixes nitrogen in the soil. Competition for sunlight, water and nutrients with coconut however must be avoided. Two serious weed problems for coconut are cogon and lantana. These two weeds can completely take over the small coconut tree.

4. **Intercrops** – these are extra sources of income for the farmer. This is explained further on Chapter VI below. Considerations in selection of crops are market for the intercrop, competition it may offer to coconut as regards to water and nutrient
requirement, tolerance or need for shade and dangers it may offer as alternate host for pest and diseases.

5. Animals under the coconut – same as intercrops these are extra income for the farmer. However, caution must be considered in over crowding in one area. Soil tends to be compacted in overgrazed areas especially for cattle.

**Nutrient Management**

**Pest and Disease Management**

Two main methods in controlling pest and diseases are a) chemical and b) biological. Chemical makes use of insecticides, herbicides, fungicides, etc as a means of control. While biological means utilizes parasites and predators.

**Harvest Management**

For the purpose of obtaining high oil content in copra, the nuts should be harvested not earlier than twelve months after pollination. Harvesting using a “Halabas” (a sickle mounted on a bamboo pole) is much faster than climbing each tree. A picker can harvest 100 trees a day using the “Halabas” while only 25 trees a day for climbing each tree.

**Intercropping**

The active root system of a coconut palm is concentrated only within 2 meters from its base. Therefore, for a coconut plantation with a spacing of 8m x 8m leaves about 8,000 sq. meters space is left unproductive. To maximize the use of land and other resource such as manpower, machinery, fertilizer, pesticide, etc, intercropping is then adopted. Another reason why intercropping is practiced is the unusual fluctuations of the price of copra. Inclusion of other crops lessens the burden of the coconut farmer by giving alternative sources of income.

Two types of cropping pattern:

1. Sequential crop – producing two or more crop in single stand one after the other on the same plot during the same year.
2. Intercropping – growing two or more crop species at the same time in the same field.

Five ways of Intercropping:

1. Mixed intercropping – simultaneous growing of two or more crop species in an irregular arrangement, i.e. without a well-defined planting pattern
2. Row intercropping – simultaneous growing of two or more crop species in a well-defined row arrangement
3. Strip intercropping – simultaneous growing of two or more crop species in a strip wide enough to allow independent cultivation, but at the same time, sufficiently narrow to induce crop interactions
4. Relay intercropping – planting one or two crops within an established cropping pattern wherein the final stage of the first crop coincides with the initial development of the other crops
5. Multi-storey cropping – coconut + black pepper + cacao + pineapple are planted so that each crop produces canopies at different heights.

One general rule in intercropping is to arrange rows of intercrop in a way that these receive maximum sunlight throughout the day. With regards to selection of crops, the following factors must be considered:

1. Market for the intercrop – coconut farmers must ensure they know where to sell the products of the intercrop. Alternate market outlets must also be determined in case pole vaulting happens.
2. Competition it may offer to coconut as regards to sunlight, water and nutrient requirement. - Intercrops must be selected so as not to compete with sunlight, water and nutrient. Tree, root canopy must carefully be calculated so as not to cover other intercrop. In very tall coconut, sunlight increases as the height of coconut trees becomes taller.
3. Ecological factors
   a. Microbial activity – Interplanting cacao between coconut palms showed success in many trials. Coconut-cacao intercrop improved the microbial activity of the rhizosphere. There was an increase in organic matter component of the soil caused by the periodic shredding of cacao leaves. Nitrogen fixing and phosphate solubilizing bacterial activity also increased. As a result, coconut yields were retained and cacao yields increased. Presently, PCA with funding from DA BAR will be spearheading an agri-business development project on Coconut-Cacao Intercropping project.
Increase of pest and disease – some intercrop favor the build up of unfavorable pest and disease population. Observations on different trials are being documented for reference purposes. In other instances, however, build up of parasites and predators occur. This favors slow down of pest and disease population. In fact, some institutions like PCA and BPI are into direct research on rearing parasites and predators.

Another option in Coconut-based Farming System is Animals under coconut – the main benefit of grazing animals under coconut is for the removal of weeds. Manual and chemical process of weeding is done away with. Manure from the animals also helps in increasing the organic matter and nutrient of the soil. A disadvantage however especially for large animals is the over grazing which leads to compacted soil. Coconut roots are sensitive to aeration. To avoid this, cattle grazing must be supervised carefully.

**Products and By-Products**

1. **Copa** – is the dried coconut meat. It is the source where coconut oil is extracted for many uses.
   a. **Oil** – extracted processed/filtered oil obtained from copra. It is mainly used for cooking but also used for many other purposes; moisturizer, liniment for muscles and joints, cosmetics, medicines, soaps and detergents, paints, biofuels, etc.
   b. **Coconut milk** – the liquid obtained by pressing grated coconut meat. This is used for cooking. And making home-made coconut oil.
   c. **Latik** – heat coagulated content of coconut milk. This is also used for food purposes.
   d. **Dessicated coconut** – dried coconut grated meat mainly prepared for food uses.
   e. **Coconut Flour** – this is the de-oiled dessicated coconut that is finely grounded. This is used in baking.

   - **Coconut Shell** – This is the protective covering of the coconut meat and water. This makes a very good source of charcoal. This is a very good fuel for domestic cooking.
     a. **Activated charcoal** – found to possess the ability to adsorb gases and vapors hence finds uses in gas mask, cigarette filters, removal of bad odors from air-conditioning, freezers and refrigerators, and many other adsorption capabilities. Continuing research on this is making advances lately. Activated charcoal are used in filtering water and air.
     b. **Charcoal briquettes** – coconut shell charcoal are processed into briquettes so that it is easier to transport. Specifically used in grills.
c. **Novelty items** – local craftsmen make indigenous novelties from shells such as lamps, figurines, picture frames, musical instruments, souvenirs and many more.

- **Coconut Husk** – the fibrous outer covering of the nut. This part extends from the nut skin to the shell and varying thickness up to 5 cm.

a. **Coco-coir** – The hair-like thread extracted from the coconut husk by mechanical method or by the decorticating machine. The resulting products are coco dust and coco coir. Coco coir is used for upholstery, mattress fibers, filter pads, carpets, erosion nets, insulation material, biodegradable pots, orchid and ornamental planting medium, etc.

b. **Coco dust** – Are the medium collected after separating the coir from the husk. It has very good water retention capabilities thus used mainly as potting medium.

- **Coconut Water** – the liquid found inside the coconut. It is an excellent and readily available drinking water. The quality of water varies according to the age of the nut. Younger nut water is largely consumed locally as beverage. Water from mature nuts is used as raw material for making nata de coco, vinegar, intravenous fluid, electrolyte, wine and alcohol. Large uses however have not prospered

- **Coconut Sap** – a very sweet juice obtained from a young inflourescence. Locally known as Tuba. Toddy in India.

a. **Liquor** – Coco-sap are left to ferment and made into alcoholic beverages called “Tuba”. In Samar and Leyte province, they add bark from a local tree and ferment to produce “Bahalina”. In Southern Tagalog and Bicol area, coco-sap are distilled and made into a strong alcohol called “Lambanog”.

b. **Vinegar** – Coco sap are also made into vinegar.

c. **Coco sugar** – Coco sap are sometimes cooked to produce sugar. This has been a long practice in some places but not in very large quantities.

https://www.olx.ph/item/fruit-bearing-trees-nursery-ID3zTnG.html?p=1&h=e2ed2b6cb2#e2ed2b6cb2