How to Grow Guavas

The guava is a shrub or small tree which grows 2 to 8 m tall. When cultivated it is usually pruned back to about 2 to 3 m. Trees that are not pruned, usually flower during October. When they are pruned, the period of full bloom is 10 to 12 weeks after pruning. Bees are the main pollinators, but self-pollination also occurs.

Fruit
• The fruit is a berry.
• Guavas vary in shape, from spherical to pyriform, and the size of the fruit varies from 25 to 100 mm in diameter.
• The flesh of the cultivar Fan Retief is orangepink with a granular structure as a result of the many stone cells. There are numerous hard seeds embedded in the pulp.
• The period from flowering to ripening of the fruit is 20 to 28 weeks, depending on pruning time.

Climatic requirements
• Guavas are adapted to areas with hot summers and cool winters. In some areas an average monthly maximum temperature higher than 32 °C and a minimum temperature below 3 °C are regarded as restrictive for the cultivation of guavas.
• Temperatures of up to 45 °C can be tolerated, although the highest yields are usually recorded at mean temperatures of 23 to 28 °C.
• Optimum vegetative growth occurs between 15 and 28 °C.
• Approximately 3,5 to 6 months, depending on the cultivar, of mean summer temperatures higher than 16 °C are needed for the trees to flower and bear fruit successfully. The quality of the fruit becomes inferior when mean temperatures fall below 15 °C during the maturing stage.
• Guavas can be grown successfully from sea level up to an altitude of 1 500 m.
• The trees are also well adapted to both summer and winter rainfall conditions.

Soil requirements
• Guavas grow well in any type of soil. Because of its distribution on a wide variety of soil types, the guava tree is often regarded as a weed. The trees are frequently found along streams, brooks and rivers where they apparently thrive, despite periodic waterlogging and poor physical and soil chemical conditions.
• For sustained successful commercial cultivation of the crop, it is, however, better to plant the trees on fairly well-drained soils. Shallow soils or those containing compacted layers can, in the long term, have an adverse effect on growth and production.
• Guavas can be grown in soil that is not suitable for the production of most other subtropical fruit trees.

Cultivars
• Guava cultivars include Fan Retief, Frank Malherbe, Van Zyl, Rousseau, Du Preez, Fredene, Dimple, Jonelle, Welheim, Frederika and TSG 2. The latter is preferred because it is not susceptible to guava wilt disease.
• At present only Fan Retief is planted on a large scale. It is, however, very susceptible to guava wilt disease (Acromonium sp.) which is prevalent in guava plantings in Mpumalanga and the Northern Province. Frank Malherbe, which is used for canning, is the only other cultivar planted commercially, mainly in the Western Cape Province.

**Soil preparation**
• A guava planting is a long-term investment. It is therefore important to plan a new planting thoroughly and well in advance.
• The first and most important step is to examine soil suitability with respect to depth, drainage and compacted layers. The soil should be at least 800 mm deep. The physical suitability of a soil can only be evaluated by digging holes in the ground and examining the soil profile.
• If the soil, regarding physical properties, is suitable for growing guavas it is of vital importance to prepare it carefully and well in advance of planting.
• A representative sample of the proposed orchard must be taken for soil analysis. It is desirable to take the soil sample 9 months, but preferably 12 to 24 months, before planting. There will then be enough time to prepare the soil thoroughly, especially if large quantities of lime are required.

**Soil sampling**
• It is important that a sample should represent a soil of homogeneous characteristics, i.e. where no visible differences occur. If there are differences regarding soil colour and texture in such a land, the land must be subdivided accordingly and separate samples taken of the different areas.
• If a soil auger is not available, a spade can be used for taking samples.
  – Depth of sampling: 0 to 300 mm for topsoil and 300 to 500 mm for subsoil samples.
  – Number of samples: a sample should be made up of at least 10 subsamples (preferably more). The area represented by the sample should not exceed 3 ha.
  – Distribution of sampling points: the samples must be taken evenly over the entire area.
  – Mixing and packaging: the subsamples from a particular land must be pooled in a clean container (not a fertiliser bag) and mixed thoroughly. A 2-kg sample is taken from this, placed in a clean bag or other suitable container and submitted for analysis.
  – Every sample must be marked clearly. The name of the sender, the number of the land and depth at which the sample was taken, must appear on the label. Attach the label to the outside of the container because it could become illegible on the inside.
• The analysis results will supply valuable information regarding the required types and quantities of fertiliser to be applied before planting. It is important that any lime or phosphate that is needed, be thoroughly worked into the soil before planting.
• The results will also facilitate the making of a preliminary fertilisation recommendation up to the stage when the trees are old enough for leaf analysis.
• The soil must be loosened as deep as possible before planting. In this case it will not be necessary to make large planting holes.

**Method of soil preparation**
• If the soil is very acid, heavy lime application may be necessary. In such a case two thirds of the recommended agricultural lime must be distributed over the entire area 12 months before planting, mixed into the topsoil by discing and then ploughed in as deep as possible. Because calcium (lime) moves slowly in the soil, it is essential to work it into the future root zone of the trees.
• A cover crop can then be planted and ploughed in 6 months later. This will help to increase the organic matter content of the soil. The remaining lime and all the required phosphate must be applied and lightly worked in simultaneously. The trees are planted 3 months later.
• If soil samples have not been taken early enough to proceed as described above, two thirds of the lime must be mixed with the soil and ploughed in deep; the phosphate and the rest of the lime are then distributed and worked in lightly. If large quantities of lime are required, these must be applied at least 3 months before planting (as described), thoroughly mixed with the soil and then worked in deep.
• Do not fertilise recently planted trees too soon. The trees must first become well established and grow vigorously before any fertiliser applications are made. In most cases it is advisable to wait a year. Such an application must be very light and the fertiliser must be applied evenly without coming into contact with the stem of the tree. Irrigation must be applied immediately.

**Planting distance**
• Planting patterns and distances are determined to ensure optimal fruit production at the earliest stage.
• The trees must remain healthy and productive and should therefore not be planted too close together or pruned too heavily.
• Planting distances must be wide enough for tractors, spraying machines and labourers to move easily between the trees.
• The recommended planting distance is 5 m between the rows and 2 m between the trees in the row. With this planting distance of 2 x 5 m a total of 1 000 trees can be planted per hectare.
Fertilisation

- Young trees should be well established and growing vigorously, preferably after about one year, before any applications are made.
- Never apply fertilisers against the trunks of young trees.
- Fertilisers must be spread evenly about 200 mm from the stem to about 500 mm from the drip area of the tree. Applications should be followed by a light, controlled irrigation or alternatively applications should be made during the rainy season.
- Fertilisers should not be worked into the soil. As soon as the trees are established and start to grow, fertiliser should be applied frequently.

Nitrogen

- For the first 4 years the nitrogen should be divided into 4 equal applications viz. 2 weeks before pruning and then at two-monthly intervals.
- Thereafter apply nitrogen as follows:
  - one third 2 weeks before pruning
  - one third 4 weeks after pruning
  - one third 10 weeks after pruning.

Potassium and phosphate

Half the quantity of potassium and all the phosphate must be applied together with the first nitrogen application. The rest of the potassium must be applied 4 months later.

Zinc (Zn) and boron (B) sprays

Because most soils are either naturally low in zinc or the zinc is not available, this element must be applied every year. The following substances and concentrations are recommended per 100 l water:
- Zinc oxide at 200 g or
- NZN at 150 ml

Many guava orchards are also low in boron and it is desirable to spray the tree every 2 years with 100 g borax or 75 g Solubor/100 l water.

Leaf analyses

The following instructions regarding leaf sampling for guava trees are important and should be strictly adhered to. Young, fully developed leaves are sampled 5 months after pruning directly behind the largest fruit as indicated in the figure.
- The time of sampling will normally be between January and March, depending on the time of pruning.
- The correct leaves must be sampled.
- When a leaf sample from a particular orchard is submitted for the first time, it must be accompanied by a soil sample. Thereafter, it would also be advisable to submit soil samples annually. When making fertilisation adjustments, it is essential to take into consideration the analysis results of the soil as well as the leaf samples.
- Only leaves taken from healthy trees must be sampled. The leaves must therefore show no signs of sunburn, deficiency, insect damage or disease.
- A leaf and soil sample should represent an area of not more than 3 ha.
- The recommended method is to select approximately 20 healthy trees that are well distributed throughout the orchard, homogeneous in appearance and representative of the entire orchard. Exceptionally good or poor trees must not be sampled. The 20 selected trees must be marked clearly, for example with paint, so that the soil and leaf samples can be taken from the same marked trees every year.

Pruning

Tree pruning is an annual practice on guava farms in South Africa and is carried out for a number of reasons, namely to:
- direct or control growth, to obtain the desired tree shape and size
- encourage flower and fruit production to maximise production of high-quality fruit per unit area
- facilitate harvesting and to utilise the bearing area of the tree optimally
- obtain the desired leaf to fruit ratio
- optimise sunlight utilisation and air movement in the tree. Efficient sunlight utilisation is essential for obtaining optimal yield and high fruit quality. Insufficient sunlight will cause dieback of the fruiting branches. Inadequate air movement promotes fungal and insect pests within the tree
- effect rejuvenation by removing dead or excessive wood or shoots
- allow spraying and cultural practices to be applied more effectively
- extend the production period. The production season of guavas can be controlled by the time of pruning. If pruning is done later in the season, fruit will also be harvested later. Pruning usually involves three basic techniques: thinning, heading back and pinching or tipping. Thinning involves the removal of entire branches at the point of origin. By thinning, the bulk of the plant is reduced without obviously altering its size or form. Heading back is the process of pruning to shorten branches. Heading back is usually used to induce production of flowers and fruit and to limit tree size. Pinching
usually used to induce production of flowers and fruit and to limit tree size. Pinching involves the removal of the growth tip of the stem. This action will stimulate the growth of side branches. These different techniques are usually combined to obtain the desired tree form. Structuring of the tree during the first 2 years is essential for maximum sunlight utilisation. Limited sunlight penetration will adversely affect yield and fruit quality once the tree starts bearing.

Pruning is usually applied during September or October.

**Diseases**

**Guava wilt disease**

Guava wilt disease (GWD), caused by an Acromonium sp. and reported for the first time in 1981 in South Africa is present in most of the guava-producing areas of Mpumalanga and the Limpopo Province. As a result of this disease the total hectarage of guavas in the southern Lowveld of Mpumalanga has decreased by 80 % in the period 1982 to 1994. Restrictions have been placed on the transport of guava planting material in terms of existing plant quarantine legislation, and plant material may not be taken out of the affected areas.

**Symptoms**

- The first symptoms of the disease include wilting and yellowing or bronzing of the leaves.
- The tree can decline rapidly or relatively slowly. Where tree decline is rapid, the leaves tend to remain on the tree, but shrivel and become necrotic, so that the tree has a scorched appearance. Where tree decline is slow, the leaves drop naturally, eventually resulting in the complete defoliation of the tree. The development of fruit on such trees ceases and the fruit eventually becomes mummified.
- GWD is spread mainly through root infection and the movement of infected plant material. The disease is also spread by contaminated soil clinging to farm implements and lugboxes.
- The disease tends to spread more rapidly during summer than winter.

**Control**

No chemical control measures have been registered against GWD. Eradication is at present the only control measure. Eradication involves the removal of the diseased tree, the 2 adjacent trees within the row, and the trees in the adjacent rows on either side of the diseased tree. Management practices in orchards should be kept to a minimum from December to February to prevent damage to the trees and spreading of the disease.

**Pestalotia branch dieback**

- This disease is caused by Pestalotia psidicola, and differs from GWD in that individual branches die back from the tips. The shoots usually die rapidly and the leaves remain attached to the shoots, giving the diseased shoots a scorched appearance.
- The only effective control measure is to remove the diseased branches and coat the pruning wounds with a fungicidal sealant.

**Blossom-end rot**

- Blossom-end rot is a major problem in the guava-producing areas of the Western Cape Province as well as in the cooler production areas of Mpumalanga and the Limpopo Province, mainly Brondal and White River.
- Copper oxychloride, captab and mancozeb are registered for control. Spraying programmes do not reduce the disease to a great extent and are therefore not cost effective.

**Fruitflies**

Fruitflies are a major pest in guavas in most production areas. Three types attack guavas in South Africa, namely the Natal fruitfly, Mediterranean fruitfly and the marula fruitfly. In the Lowveld, the Natal fruitfly is the most important of the three. They all cause the same type of damage and can be controlled in the same way.

**Damage and symptoms**

Female flies lay white, oblong eggs in groups just under the skin of mature, ripening fruit. A few days later the maggots hatch and feed on the fruit flesh. The maggots are creamy white, reach a length of about 6 mm and have no legs. Pierced fruit is characterised by small holes in the skin surrounded by a bruise. Such fruit soon becomes soft, and can decay and drop early.

**Control**

Fruitflies can be controlled successfully by means of a combination of chemical control, pruning, the eradication of useless host plants and regular orchard sanitation. A full cover spray with fenthion 500 g/l EC at 100 ml/100 l water 3 to 4 weeks before harvesting, followed by a second spray 10 days before harvesting gives good control. Three sprays are recommended for homegardens, namely 7 weeks, 4 weeks and 10 days before harvesting.
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Pruning
By pruning guava trees, harvesting time can be shifted to a period when fruitfly populations are lower. In Levubu, where the normal harvesting time of unpruned trees is March/April, the main harvest time could be shifted to June/July by pruning in October. By pruning in November, harvesting time is moved to July/August. However, pruning does not replace chemical control because it only helps to shift the main harvesting time to a period when there are fewer flies.

Eradication of host plants
The fruit of some useless host plants serves as an ideal breeding place for fruitflies, and should be eradicated. They include:

- Bug tree (Solanum mauritianum) which occurs in large numbers in plantations and along streams or rivers. The Natal fruitfly feeds on this plant during winter and large numbers of flies hatch from the fruitlets in summer.
- Wild-growing guavas which are good hosts for the Natal and Mediterranean fruitfly. The trees usually grow in the vicinity of roads and footpaths because guava seeds are spread mainly by human activities.
- Bramble fruit shelter the larvae of the Natal fruitfly and these plants should be eradicated where they occur in the vicinity of guava orchards.

Orchard sanitation
Guavas and other fruit, including wild fruit that has dropped, should be collected weekly and destroyed because fruitfly maggots emerge from the fruit, pupate in the ground and reappear as adult flies. Such fruit can be chopped up with a hammermill or buried at least 450 mm deep.

Post-harvest handling
- The guava is a climacteric fruit. It can therefore be picked green and will ripen during as well as after storage or shipment.
- Although the ideal ripening and harvesting norms have not been determined conclusively, it appears that the fruit should be picked when a colour change occurs. This stage is referred to as the “adult green” stage.
- The fruit has a delicate skin which can be damaged easily. Mechanical damage increases the extent to which the fruit can be infected by fungi. Harvesting practices must, therefore, be directed to keep mechanical damage to an absolute minimum.
- Because of the high respiration rate of guava fruit, refrigeration is a very important aspect. The period between harvesting and refrigeration must, however, be kept as short as possible. Attempts should be made to shift harvesting to the cooler part of the day and not to leave the fruit in the orchard unnecessarily. Picked fruit must not be exposed to the sun. The fruit is sensitive to low temperatures. The suitable storage temperature for guavas is approximately 5 °C.
- The standard export carton of which the dimensions have been adapted for pallet stacking and which are of variable height to allow for different fruit size, is also suitable for guavas.
- The fruit must be packed in a single layer to limit damage during transportation to a minimum. For the same reason, fruit should be packed firmly without bruising. It should be kept in mind that the aim of packaging is to protect the fruit as well as to create an attractive presentation of fruit on the market.
- If too many problems are experienced with the marketing of the fresh fruit, guavas can be processed in various ways. The fruit is especially suited to canning or processing into jams or dried guava rolls. Factories also purchase the fruit on a large scale for the manufacturing of guava juice and nectar.

Guava pulp
Use any ripe guavas (even the dropped ones underneath the tree which are in a good condition). Put the guavas in a pot and cover them with water. Boil the guavas until they are blanched (the skins crack and loosen). Prevent overcooking as it will result in a dark brown pulp instead of the desired pink-coloured pulp.
Remove the cooked guavas from the boiling water, place in a clean container and mash with a potato masher. The mashed guavas are then pressed through a strainer to separate the seeds from the pulp.
Throw away the pips and keep the pulp for guava rolls and guava juice. The pulp is highly perishable and should be used immediately or kept in a fridge for use at a later stage.

Making juice
Mix one cup of guava pulp, prepared in the first stage, with three cups of water and add sugar according to taste. The juice contains no preservatives and should be consumed immediately or kept in a fridge. This is a healthy drink with a high vitamin C content.
Making rolls
Open a piece of plastic. Cover the plastic with a thin layer of cooking oil, followed by a thin layer of guava pulp. The layer of cooking oil is to prevent the pulp from sticking to the plastic when it dries. Allow the pulp to dry in the sun for about one day. The dried guava rolls can be cut into pieces and covered in plastic for use at a later stage.

Bottling
Peel firm and ripe guavas and cut them in half. Remove all the bruised and damaged parts of the fruit.
Prepare the syrup by dissolving one cup of sugar in two cups of water and bring to boiling point. Place the peeled guavas in the boiled syrup and cook until froth starts to appear on top of the syrup or the pips start to loosen. Be careful not to overcook guavas. Overcooked guavas lose their pips.
Remove the labels from the glass bottles for the cooked guavas by soaking them in water. Sterilise the bottles by boiling in water for 30 minutes. All the bottles used must have metal caps and should not be cracked or chipped.
Remove the bottles from the boiling water and fill up to the rim with cooked guavas and syrup.
Remove all the air bubbles by inserting a knife against the inside of the bottles. Close the cap tightly and place the bottle upside down while it cools. This will ensure that the bottles seal properly. The bottles must be sealed tightly.