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Calamansi

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Introduction

Calamansi (*kalamansi*) is a popular, evergreen citrus fruit tree that is native to China. It is grown throughout India, Southern Asia, and Malaysia and is an important food source on the island of Guam. In the United States it is mainly grown for its attractiveness and performance as a garden ornamental or hedge (Aggie Horticulture, n.d.). Originally identified as *Citrus mitis*, its scientific name has altered overtime because it is considered a natural intergeneric hybrid with kumquat, giving it the proper name *Citrofortunella microcarpa* (Mortin, 1987). In Guam, cultivation of calamansi started in 1970, and it has since become a staple in local dishes (Marutani, 2018).

Figure 1
A mature calamansi tree grown in the demonstration garden at House #2, Dean's Circle, University of Guam. *Photo courtesy of AJ Illai.*

Growing Calamansi

General Plant Characteristics

Calamansi is an evergreen tree that thrives in warm climates (65°F–77°F), or in places where it can tolerate drought as it is more tolerant than most citrus (The Leaf Network, 2016). Calamansi can also thrive in cool climates that are frost-free. It can tolerate a wide range of soils but prefers sandy or clay loam soil with a pH range of 5.5 to 7.0 (Fern, 2014). It is important to ensure that soils are rich in organic matter, slightly acidic, and well-draining (Philippine Council for Agriculture, 2018).

The tree is erect, cylindrical, and slightly thorny with a height range of 6 to 25 feet high. Calamansi leaves are single, alternate leaflets that are aromatic and dark green. Calamansi fruit are small and round and have a smooth, thin rind that changes from green to orange upon maturity. The pulp of the calamansi is highly acidic, juicy, and may or may not contain seeds (Morton, 1987).

Propagation and Planting

Calamansi can be propagated through various techniques. Propagation by seed is commonly done by extracting

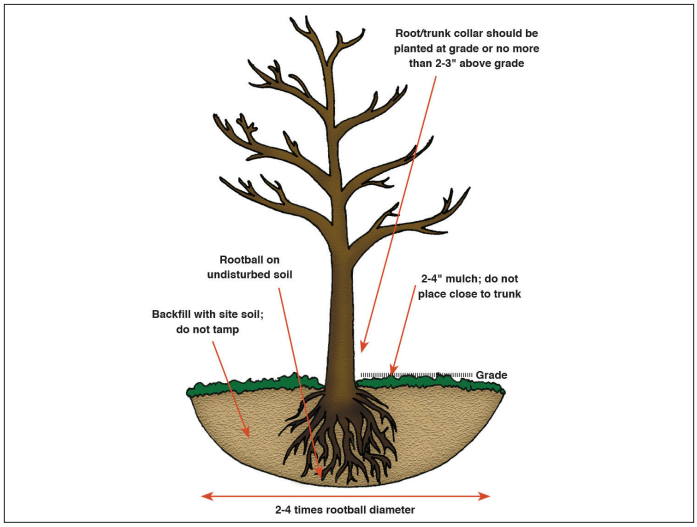

Figure 2
Proper guidance on how to plant a calamansi tree.
Source: Cooperative Extension & Outreach, University of Guam (www.uog.edu/extension)

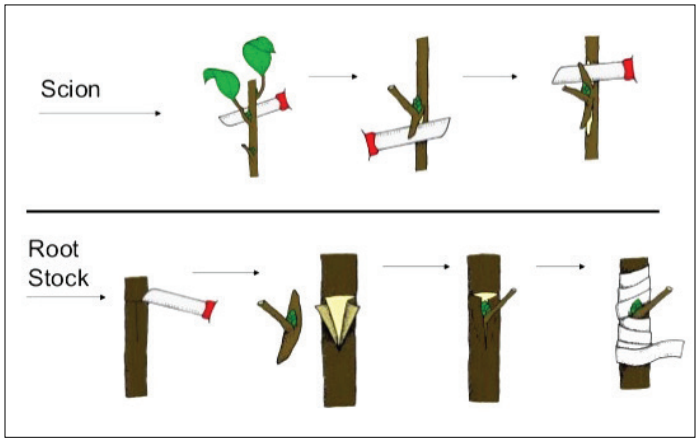

Figure 3
Example of grafting technique called T, or shield, budding.
Source: Aggie Horticulture (aggie-horticulture.tamu.edu)

Figure 4
Scion wood being grafted to the top of a seedling of citrus plant.
Source: Agroforestry.org

fresh seeds from the calamansi fruit. Seeds can be sown into containers or seedbed trays, where germination takes approximately 2-3 weeks before seedlings sprout (Fern, 2014). When seedlings are 4-6 inches tall, they can be transplanted into the ground or into bigger pots.

In an orchard setting, calamansi plant spacing is 10'-14' apart. When used as a windbreak, plants should be spaced 8'-10' apart (Acosta, Cruz, and Bamba, 2018).

Site selection plays a crucial role in transplanting seedlings. Because Guam soils tend to be shallower than most, it is important that the top of the root ball of the seedling is even with the existing soil surface. Holes where calamansi seedlings will be transplanted should be as deep as two times the diameter of the root ball width (Acosta, Tuquero, Bucayu-Laurent, Hollyer, Barber, Cruz, Santos, and Quitugua, 2017). Refer to Figure 2 for proper guidance on how to plant a tree.

Vegetative propagation through forms of stem cuttings, grafting, and air layering are the most commonly used methods for commercial production of calamansi. It takes approximately 5-6 years for trees to mature when grown from seedling and 3 years if grown through cuttings or grafting (Fern, 2014).

Stem cutting is a process used in propagation that requires a healthy stem from the mother plant that is rooted into a growth medium. It is important to take stem cuttings from the upper portion of the plant as these are younger stems and will produce higher percentages of roots. Healthy, disease-free, and nutrient-abundant stems are also recommended when preparing for stem cuttings. Cuttings should be made at a 45-degree angle and 4-6 inches long. The ends of the cuttings can be treated with root-promoting hormones to stimulate root growth and transplanted directly into containers or a bed tray (Evans and Blazich, 1999).

Grafting techniques commonly used are T, or shield, budding, which involves the union of a detached scion piece to the branch of a rootstock (after it has budded) or mature tree desired for fruit production (Aggie Horticulture, n.d.). When grafting takes place, you are replacing the upper portion of the rootstock that has been removed with the scion (Bamba and Wall, 2018). For proper grafting techniques it is important to select mature, vigorous, and round branches that are close to or smaller in diameter than the proposed rootstock that is preparing to be grafted. Vegetative propagation through grafting presents several advantages: thornless mature plants (Mark Acosta, personal communication), successful reproduction of characteristics from the parent tree, and being able to select a rootstock that is tolerant to diseases and produce calamansi in soils that are not well-suited for the particular scion (Elevitch, 2006).

Air-layering is another method of vegetative propagation used to produce calamansi. This technique is done by wrapping the desired branch in moist growing medium to promote root growth. Air-layering is often used to clone desired varieties (Joe Tuquero, personal communication).

Plant Care and Maintenance

Pruning

Proper pruning of the calamansi tree plays an important role in fruit production, easy maintenance, and attractiveness. Training the tree's branches will help keep the tree's shape suitable for an open center. Three primary objectives should be considered when pruning calamansi trees: increasing the total leaf area, improving airflow throughout the canopy, and increasing the amount of light to the branches. Interlacing dead branches should also be pruned (The Leaf Network, 2016).

Citrus trees are prone to pests and diseases, and infested branches should be removed to prevent possible deterioration of the tree. If you are unable to identify a pest or disease, contact the Cooperative Extension & Outreach Office at the University of Guam College of Natural & Applied Sciences.

Additional publications can be found at www.uog.edu/publications/ceo.

Irrigation

Keeping the soil moist is essential for calamansi development and can be done every other day through regular watering. A total of 4-6 inches of water is needed per month to keep calamansi moist enough for plant development (The Leaf Network, 2016). Though soil moisture is important, watering daily can prove harmful as it can cause soil to waterlog, which will eventually lead to root rot. As mentioned previously, calamansi is drought-tolerant; however, the soil should never completely dry out. For commercial production, installing a drip irrigation system is highly recommended.

Plant Nutrition

Fertilizer application should begin one month after seedlings have been transplanted into the field or pot (Cerastre, 2010). Approximately 50-100 grams of urea can be applied during the calamansi tree's first year and should increase to 200-300 grams within the second year (Philippine Council for Agriculture, 2018). As the tree gets older, the amount of fertilizer/urea should increase, as well. Fertilizer application should be distributed at the beginning and toward the end of rainy season, or every four months (Morton, 1987).

Flowering and Fruiting

Calamansi flowers are comprised of five oblong, pure-white petals that form in clusters. Flowers are small and produce a rich and sweet fragrance. Calamansi flowers and fruits produce throughout the year and have 4-5 periods of new growth each year; a single harvest could last for 3 months at

Figure 5
Flowers of calamansi during flush period preparing for fruit.
Source: Aggie Horticulture (aggie-horticulture.tamu.edu)

Figure 6
Calamansi fruit before maturing into its yellow/orange color.
Source: Pinoy Negosyo (https://pinoynegosyo.net)

Figure 7
Mature calamansi fruit ready for harvest in the demonstration garden at House #2, Dean's Circle, University of Guam. *Photo courtesy of AJ Illai.*

Figure 8
Citrus canker symptoms on leaves and fruit.
Source: Agroforestry.org

a time. Fruits begin to mature approximately 5 months after flowering (Fern, 2014).

Common Pests and Diseases

Common pests that have been reported to attack calamansi trees include numerous piercing and sucking insects, like scales, mealybugs, black and white flies, and several species of mites (Jesse Bamba, personal communication). *Phyllocoptruta oleivora*, is a citrus rust mite that causes extensive russeting damage to the fruit, which, in turn, makes it unmarketable (Elevitch, 2006). Management of pests require proper application of pesticides and insecticides to assist with eliminating pests.

Diseases known to infect calamansi are fruit splitting, root rot, nutrient deficiencies, scab, citrus canker, greening, greasy spot, and tristeza. Citrus canker, *Xanthomonas axonopodis* pv. *citri*, is a bacterium known to exhibit symptoms of lesions on young fruit and leaves from bacterial ooze due to humid conditions (Figure 7) (Elevitch, 2006).

For identification or proper management of citrus pests and diseases, contact the Cooperative Extension & Outreach office at the University of Guam College of Natural & Applied Sciences. Additional publications can be found at www.uog.edu/publications/ceo.

Harvest and Post-Harvest Storage

In Guam, peak harvesting season for calamansi is from March to July, though the fruit is in production year-round (Yang, 2016). Harvesting calamansi fruit should be done using clippers or scissors, rather than pulling them from the tree. Proper removal of fruit will keep the stem end from tearing and reduces increasing fruit deterioration (Aggie Horticulture, n.d.). Because it has a thin-skinned rind, it is crucial that calamansi fruit be used within a week of harvesting. Fruit can remain in good condition for 2-3 weeks if refrigerated after harvest (Philippine Council for Agriculture, 2018).

Uses and Nutrition

Its production allows calamansi to be consumed year-round and used to flavor and season a variety of dishes in Guam. Calamansi is commonly used in local dishes, the most popular being the "national dish" kelaguen. It is also used to zest up a local dressing called finadene and

as garnish for pancit, a noodle dish made with vegetables and meat. The juices are also used on sashimi (raw fish).

Commercially, the juice of the calamansi is primarily used as bottled concentrate, ready-to-drink beverages, marmalades, and as food/drink enhancers for teas, seafoods, meats, desserts, and other culinary dishes (Stuart Xchange, n.d.). Calamansi is a rich source of Vitamin C.

Calamansi is also used medicinally and cosmetically. The juice is used to help remedy itching and irritation from bug bites, coughing, and stomach aches. It can be used as a shampoo to promote hair growth, to bleach freckles, and to remove acne. The leaves of the calamansi tree are often used for essential oils (Morton, 1987).

References

Acosta, M., Tuquero, J., Bucayu-Laurent, C., Hollyer, J., Barber, R., Cruz, F., Santos, J., and Quitugua, I. (2017). *Windbreak benefits, design, and management.* Cooperative Extension & Outreach, University of Guam. https://www.uog.edu/publications/ceo/WindbreakBenefitsDesignandManagement20.

Acosta, M., Barber, B., Cruz, F., and Bamba, J. (2018). *Seven trees, seven practices: Starting your forest garden with seven fast to fruit trees.* Cooperative Extension & Outreach, University of Guam.

Bamba, J., and Wall, P. (2018). *Avocado tree care on Guam.* Cooperative Extension & Outreach, University of Guam. https://www.uog.edu/publications/ceo/AvocadoTreeCareonGuam17.

Aggie Horticulture. (n.d.). *Calamondin - The most versatile citrus.* Texas A&M University. https://aggie-horticulture.tamu.edu/patiocitrus/Calamondin.html.

Aggie Horticulture. (n.d.). *T or Shield Budding.* Texas A&M University. https://aggie-horticulture.tamu.edu/propagation/budding/budding.html.

Cresastre. (2010). *Calamansi cultural management.* Agriculture on the Move. https://letsplantsomething.wordpress.com/2010/10/22/calamansi-cultural-management/.

Elevitch, C.R., Manner, H.I., Buker, R.S., Easton Smith, V. (2006). Citrus species (citrus), ver. 2.1. In: Elevitch, C.R. (ed). *Traditional trees of Pacific Islands: Their culture, environment, and use*. Special Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources, Holualoa, Hawai'i. https://agroforestry.org/images/pdfs/Citrus-citrus.pdf.

Evans, E., & Blazich, F. (1999). *Plant propagation by STEM cuttings.* North Carolina State University Extension. https://content.ces.ncsu.edu/plant-propagation-by-stem-cuttings-instructions-for-the-home-gardener.

Fern, K. (2014). *Citrofortunella x microcarpa.* Useful Tropical Plants. http://tropical.theferns.info/viewtropical.php?id=Citrofortunella%2Bx%2Bmicrocarpa.

The Leaf Network. (2016). *Citrus-Calamondin.* http://leafnetworkaz.org:80/resources/PLANT%20PROFILES/Citrus_Calamondin_profile.pdf.

Morton, J.F. (1987). *Fruits of warm climates.* Julia F. Morton. 176-178. http://www.guamsustainableag.org/fruittrees/Calamondin%20(12).htm.

Stuart Xchange. (n.d.). *Kalamansi / Citrus microcarpa / Chinese orange / Gan: Philippine Medicinal Herbs / Alternative Medicine*. (n.d.). http://www.stuartxchange.org/Kalamansi.html.

Yang, J. (2016). *Preparing shelf-stable citrus juice and drinks at home.* Cooperative Extension & Outreach, University of Guam. https://www.uog.edu/publications/ceo/PreparingShelfStableCitrusJuiceandDrinksatHome176.

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