UF IFAS Extension UNIVERSITY of FLORIDA

UF/IFAS PEER REVIEWED

HS1348

https://doi.org/10.32473/edis-hs1348-2024

Vanilla Growing in South Florida[1]

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Scientific name: *Vanilla planifolia* Jacks. ex Andrews

Common names: Vanilla orchid

Family: Orchidaceae

Origin: Mesoamerica

Distribution: Globally from latitudes 27°N to 27°S.

Abstract

Vanilla extract is popular around the world as an ingredient in food, cosmetics, and pharmaceutical applications. The botanical source of vanilla extract is primarily the cured beans of *Vanilla planifolia*. The United States is the world's largest importer of vanilla beans. Southern Florida has a favorable growing environment for vanilla cultivation. Though currently there is no commercial production of vanilla in southern Florida, it has the potential to be a highly profitable crop in the future. This publication aims to provide basic information to growers interested in establishing a vanillery.

History

Processed vanilla seed capsules (commonly called beans) have long been appreciated for their distinct aroma and flavor. The major commercial species is *V. planifolia*, with *V.* × *tahitensis* cultivated to a lesser extent. *V. pompona* is also grown for local use in Central and South America. Madagascar leads in vanilla production worldwide, with Indonesia, Uganda, India, Comoros, and Mexico significantly contributing to global production. Vanilla extract is widely used in ice cream, baked goods, chocolate, cosmetics, and many other products.

V. planifolia spread from its native range in Mesoamerica across the Caribbean islands, into Europe, and then globally starting in the late 1500s. Colder climates relied on greenhouses to maintain this tropical species. The vines were not productive outside their native range in the absence of natural pollinators. The development of manual pollination methods in 1837 and 1841 by Charles Morren and Edmund Albius, respectively, unlocked the potential of this species for commercial production outside Mesoamerica. This timely development supported expanded vanilla production in the 1850s and 1860s in response to supply constraints from Mexico. Today, clonal descendants of the original plants are grown commercially in several countries.

Vanilla has been cultivated domestically in Puerto Rico, Hawaii, and Florida since the early 1900s. Records indicate that *V. planifolia* was imported into Florida from Mexico starting in 1899 (Cook 1899). *V. planifolia* was introduced from Florida into Puerto Rico before 1909. The USDA research station in Puerto Rico conducted horticultural, breeding, and bean-curing research in support of the vanilla industry. The industry in Puerto Rico grew until the

1. This document is HS1348, one of a series of the Department of Environmental Horticulture and the Horticultural Sciences Department, UF/IFAS Extension. Original publication date November 2019. Revised January 2023 and February 2024. Visit the EDIS website at https://edis.ifas.ufl.edu for the currently supported version of this publication.

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1950s, when it declined after World War II as industrialization superseded agriculture. Hawaii received vanilla as part of trade routes before 1900. Hawaii still has vanilla production but mostly favors agritourism-focused ventures.

Florida has four native vanilla species: *V. barbellata, V. dilloniana, V. phaeantha,* and *V. mexicana*. The species *V. planifolia* is naturalized (Figure 1), and *V. pompona* is also common among gardens in southern Florida. The native Florida vanilla species are endangered and should not be collected from natural areas without proper authorization and permitting by regulatory authorities. Puerto Rico has six species growing wild: *V. barbellata*, *V. dilloniana, V. poitaei, V. pompona, V. claviculata*, and *V. planifolia*.

Figure 1. Flowers of *V. planifolia* (top left), *V. pompona* (top center), *V. phaeantha* (top right), *V. mexicana* (bottom left), *V. dilloniana* (bottom center), and *V. barbellata* (bottom right) growing in southern Florida. Credits: Alan Chambers, UF/IFAS

Importance

Vanilla extract is the second most valuable spice (after saffron) and is the world's most popular flavor (Jareld et al. 2023). The United States is the world's largest importer of vanilla beans (Volza Grow Global 2023; Tridge 2023). Natural vanilla extract comes predominantly from the cured beans of *V. planifolia,* which is the major commercial species, and to a lesser extent from *V.* × *tahitensis* and *V. pompona*. The aroma and flavor profiles vary for each species and from each growing environment. These differences could be useful for a variety of applications, including as food ingredients, in cosmetics, and others.

Description

Plant

V. planifolia is a fleshy, perennial vine with green stems. The vines live for many years, and some species reach 60 m (200 ft) in length. The stem diameter increases as the plant matures. Vanilla is hemi-epiphytic, meaning it is capable of rooting in the ground and of growing on other plants without direct soil contact.

Leaves

V. planifolia has succulent, bright green leaves. Mature leaves can vary in size, ranging from 8–25 cm (3–14 in) long and 2–8 cm (0.75–3 in) wide. They are lanceolate to oval-shaped with pointed tips and can survive about three to four years. Some types of *V. planifolia* have variegated leaves.

Flowers and Fruit

Vanilla flowers once per year, usually between February and April in southern Florida depending on the species. *V. planifolia* flowers are large and fragrant, with waxy cream-green sepals and cream-to-yellow petals. *V. pompona* flowers are characteristically more yellow in color than those of *V. planifolia*. Flowers range from about 6–8 cm (2.5–3 in) in length and about 5–10 cm (2–4 in) in diameter. Two of the petals are similar in appearance to the sepals. The third petal is modified into a lip shape. This lip-shaped petal contains two pollinia (pollen masses) and the stigmata, mounted on a column. A structure situated between the stigma and pollinia, called the rostellum, effectively prevents auto-pollination.

The flowers are formed in axillary bunches, with a few to many flowers per cluster, called racemes. They first appear two to three years after planting a new cutting. Vanilla tends to flower on larger vines when the diameter reaches 6–13 mm (0.25–0.5 in). Usually only one flower, but sometimes up to three, in a cluster can open at a time, usually early in the morning. Flowering usually occurs over a period of two months, but each individual *V. planifolia* flower lasts for only one day. Flowers of some other vanilla species can remain open longer than those of *V. planifolia*.

Following pollination, the ovary swells to produce a long seed capsule (bean) that can reach about 20 cm (8 in) in length and takes between eight and nine months to ripen. Vanilla beans contain thousands of tiny black, round seeds. At maturity, the bean will split open along two longitudinal seams, exposing the seeds and ruining the bean for commercial purposes.

Roots

Vanilla produces two types of roots, aerial roots and terrestrial (ground) roots. Aerial roots are generally non-branching and are formed on the stem opposite the leaves. Their primary function is to support the vine's climbing

habit and are therefore very effective at adhering to supporting plants or structures. Terrestrial roots are usually found at the base of the vine or where the vine is in contact with the substrate. They are branched and possess root hairs that are often associated with mycorrhizae. As with other terrestrial roots, the primary role of these roots is the uptake of nutrients and water from the soil.

Pollination

Auto-pollination of *V. planifolia* flowers is rare to nonexistent in regions where native pollinators (bees and perhaps hummingbirds) do not occur. Though not native, the orchid bee *Euglossa dilemma* (Figure 2) has become established in southern Florida and could potentially be a pollinator of vanilla orchids. In parts of Mexico and Florida, pollination has been observed in natural areas without human intervention (Figure 3). One hypothesis is that *Euglossa dilemma*, or an unidentified native orchid pollinator in southern Florida, could be pollinating the *Vanilla* flowers, reducing the need for manual pollination.

Figure 2. *Euglossa dilemma* lured and captured at the UF/IFAS Tropical Research and Education Center. This bee could be a pollinator of vanilla orchids.
Credits: Daniel Carrillo, UF/IFAS

Figure 3. Bean development in the absence of manual pollination for *V. phaeantha* (left) and *V. mexicana* (right) in natural areas.
Credits: Alan Chambers, UF/IFAS

V. planifolia is generally self-compatible, meaning that pollen from one flower can be used to fertilize the same flower or other flowers on the same vine and lead to bean development. Pollination efficiency is reportedly low (under ~10%) in the native Mexican range even when pollinators are present. Thus, commercial vanilla production is heavily reliant on manual pollination.

To pollinate a vanilla flower, the rostellum that separates the pollinia and the stigma needs to be bypassed. Manual pollination can be accomplished using a toothpick or other narrow implement. Pollinations should be attempted in the morning, usually between 6 a.m. and noon. The general structure of vanilla flower is shown in Figure 4 using planifolia and V. pompona as example. The lower petal can be torn to expose the anthers with pollen (pollinia), rostellum, and stigmata (multiple stigma). The rostellum is gently pushed up and away from the stigmata to enable contact between pollinia and stigmata. A pollination demonstration of vanilla flower is available online at this link: https://www.youtube.com/watch?v=AB61HX0QO6s. If the pollination is successful, the flower will be retained on the plant; otherwise, it usually drops off in two to three days. Beans will rapidly begin to swell and elongate over a few weeks if successfully pollinated.

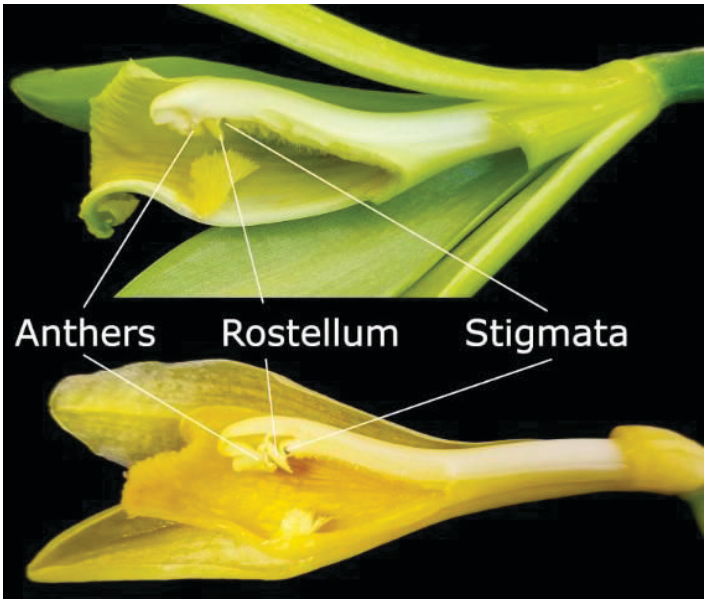

Figure 4. *V. planifolia* (top) and *V. pompona* (bottom) flowers with anthers (pollinia), rostellum, and stigmata. The stigmata are shielded directly behind the rostellum.
Credits: Alan Chambers, UF/IFAS

As a general commercial practice, flowers on the lower side of the cluster are used to produce the beans for a higher quality crop without over burdening the vine, leading to poor vine health the following year. Usually no more than 10 beans should be allowed to develop per raceme.

A general estimate is that one skilled person can pollinate 200 flowers per day. This includes monitoring the plants every day during the flowering season and pollinating the freshly opened flowers.

Varieties

V. planifolia has not generally benefited from modern plant breeding, so few named cultivars exist. Only a single cultivar, 'Handa', has been patented (Grisoni and Dijoux 2017). This variety was developed by researchers from Réunion, and the future availability of this material is unknown. Otherwise, a few distinguishable types of *V. planifolia* have been characterized. These include 'Mansa' types originating from Mexico, which are commonly cultivated for commercial production. There are also two types of variegated *V. planifolia* generally available online and grown only for ornamental purposes.

V. × *tahitensis* is the second vanilla type grown on a commercial scale. *V.* × *tahitensis* is an interspecific hybrid between *V. planifolia* and *V. odorata*. The "×" denotes that this is a hybrid and not a separate species. The genetic contribution of *V. odorata* to *V.* × *tahitensis* has major impacts on bean splitting and aroma. The increased anise flavor notes of this type are popular in French desserts. Online sources of *V.* × *tahitensis* cuttings are often found to be *V. planifolia* clones. Molecular markers have been developed to verify the identity of *V.* × *tahitensis*.

Tissue-culture companies in both Florida and outside the United States (e.g., Costa Rica) that produce *Vanilla* plants can be identified online. Caution should be taken to ensure that these companies are selling *V. planifolia* or *V.* × *tahitensis* if you plan to sell "vanilla extract."

Environmental Conditions

Southern Florida's hot, humid climate is suitable for vanilla cultivation. Vanilla is sensitive to chilling and can be killed by freezing temperatures. Therefore, a location with reduced risk of freeze events should be selected for vanilla cultivation. Optimal rainfall for vanilla has been reported to be around 170–280 cm per year (67–110 in/year). Vanilla requires a dry season of about two months to initiate flowering. Excessively wet conditions during capsule ripening can lead to bean rot. The rainy season and high summer temperatures stimulate rapid growth. Figure 5 shows average monthly rainfall and temperatures in Homestead, Florida, as recorded by the FAWN weather station at the UF/IFAS Tropical Research and Education Center.

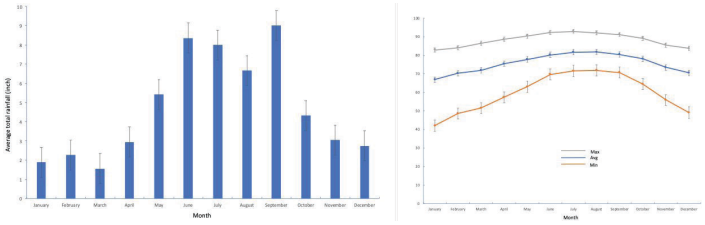

Figure 5. Average monthly rainfall and maximum, average, and minimum temperatures for Homestead, Florida. Data are averages from 10 years spanning 2013 to 2023.

Propagation

Vanilla is primarily propagated by cuttings. It is important to let cut sites heal prior to planting by leaving fresh cuttings at room temperature under low light for one to two days. All other factors being equal, the longer the cutting, the more quickly the vine will establish and begin to flower. Cuttings that are 30 cm (12 in) long will generally require three to four years to flower, while meter-long cuttings should flower in two to three years. Cuttings should include a minimum of two nodes per cutting.

Cuttings can be planted directly into the growth substrate by planting the cutting upright with one node being covered with the substrate as soon as the cut sites have healed. Misting will help vines retain leaves and support the rapid development of new roots and shoots. The apical end of longer cuttings can be tied to a support post with one of the distal nodes completely covered by the substrate. Leaves should be removed from nodes that are in contact with the growing substrate.

V. planifolia plants are available from a few companies. Tissue-culture plants are attractive as a clean source of starting material but will take minimum three to four years to mature and flower. Tissue-culture plants received in enclosed containers will need to be hardened in soilless mix under humidity domes and bright indirect light for a few weeks to months before they can survive in an environment with lower humidity and free-flowing air. Regular light misting will increase the survival of young tissue-culture plants.

Vanilla is not commonly propagated by seed due to germination challenges. The thick, highly lignified seed coat prevents timely germination, and seeds take significantly longer to grow into mature plants than cuttings. In addition, seed germination is likely associated with fungi or other microorganisms. Such constraints have supported the use of cuttings as the primary propagation method.

Production Methods

Vanilla vines require trellising to maximize production. Two major production methods are used. One uses "tutor" trees to provide both shade and a suitable structure on which the vines can climb. Tutor trees can be selected based on hardiness in a given location, availability, and co-cultivation considerations. This type of cultivation can be less expensive in some areas and naturally reduces the risk of vine death by *Fusarium* by increasing the distance between plants. Growers in southern Florida could consider vanilla as a secondary crop on existing fruit trees. Figure 6 shows *V. pompona* growing on an avocado tree. Any agricultural inputs will have to be compatible with both species under the intercropping model.

Figure 6. *V. pompona* growing on an avocado tree. Vines were received as 1-meter-long cuttings. Growth is after one year without supplemental irrigation.
Credits: Alan Chambers, UF/IFAS

More intensive cultivation under shade structures can increase yields. This system requires more initial investment for infrastructure but allows for increased planting density and yield potential. Trellis support systems vary greatly but are generally made of vertical wood or concrete supports with wire running between them. Supports vary in height but are usually no more than 2 m (6 ft) tall to facilitate pollination once vines mature. The post and wire system allows for greater control over vine spacing compared to tutor trees. Vines will need to be maintained on 15–20 cm (6–8 in) of a mulch substrate.

As an estimate for establishing a commercial vanillery, 1,000 plants per acre is often used as a target value. Spacing recommendations are to plant vines 1–3 m (3–10 ft) apart with 2.5–3 m (8–10 ft) between rows. A healthy vine will stay productive for three to five years. Regular cycling with new, disease-free plants will ensure sustainable bean production.

Soils

Vanilla can be grown in a wide range of soil types but thrives in light soils with plenty of organic material. Under co-cultivation circumstances, a slight slope may be beneficial to reduce the incidence of standing water and disease. Dry soils will require additional irrigation to maintain adequate soil moisture. Under more intensive cultivation systems, soil moisture can be regulated by managing the height of raised mulch beds.

Mulch is a popular substrate for vanilla cultivation. The specific composition of the mulch is not as important as its ability to provide a slow release of nutrients and retain an optimal level of moisture for roots. Some areas rely on aged coconut husks to mulch vines. Mulch will need to be reapplied every six to 12 months to replenish nutrients and to suppress weeds. Mulch can be applied directly on top of the resident soil without the need for incorporation.

Irrigation and Fertilization

The natural rain cycles of Florida are favorable for vanilla production. Supplemental irrigation can be useful for establishing new cuttings and potentially for frost protection. The drier season induces a rest period needed prior to flowering. As a result, established vanilla plants sometimes may not require supplemental irrigation except during extremely dry periods. Vanilla plants are tolerant of short periods of desiccation. Irrigation is more critical for commercial production than in the home landscape.

Vanilla cultivation relies on the slow release of nutrients from decomposing organic material. Supplemental foliar nutrition can be applied, but scientifically validated tests to justify this additional input are still lacking.

Pruning and Training

Vines are trained to facilitate manual pollination and harvesting in a process called looping. Vines should be looped around supporting trellises or branches as they grow. Looping vines to the ground will stimulate terrestrial roots to form, especially if they are covered in mulch, leading to stronger vines.

Looped, healthy vines from mature plants can be tipped (apex removed) to induce flowering. Vine tips are cut about 15 cm (6 in) from the end (above the soil line) right before the dry season; they will be primed to flower in the coming months.

Pests and Diseases

Insect pests do not typically cause serious damage. Snails and slugs, however, can be problematic if not controlled. Insect larvae feeding on young plants can usually be manually removed.

A major limitation to vanilla production in many regions is root and stem rot disease caused by *Fusarium oxysporum*. *Fusarium* is a ubiquitous soilborne fungus that causes rot in many species. One specialized type (*Fusarium oxysporum* f. sp. *radices-vanillae*) causes rot in vanilla in all major producing areas by penetrating roots and spreading throughout the plant. Typical symptoms include browning and wilting, eventually leading to death of vines. The disease can be partially controlled by good horticultural practices including the avoidance of excessive waterlogging. Fungicides and biocontrol agents can have some benefit under certain conditions. Other potential fungal diseases include anthracnose, viruses, and mildew.

Acknowledgement

This study was supported by the Southern Sustainable Agriculture Research and Education (S-SARE) Projects GS21-238 and LS23-481.

Additional Resources

Bianchessi, P. 2012. *Vanilla Handbook*. Technical Centre for Agricultural and Rural Cooperation.

Cameron, K. 2012. *Vanilla Orchids: Natural History and Cultivation*. Timber Press.

Childers, N. F. 1948. *Vanilla Culture in Puerto Rico*. US Department of Agriculture, Washington, D.C. https://doi.org/10.5962/bhl.title.95624

Cook, O. F. 1899. *Plant Inventory No. 5 of Foreign Seeds and Plants: Numbers 1901–2700*. United States Department of Agriculture, Division of Botany. https://naldc.nal.usda.gov/catalog/37066

Fouche, J. G., and L. Jouve. 1999. "*Vanilla planifolia*: History, Botany and Culture in Reunion Island." *Agronomie* 19 (8): 689–703. https://doi.org/10.1051/agro:19990804

Grisoni, M., and J. -B. Dijoux. 2017. Vanilla variety named 'Handa'. US Patent 20170013762-P1, filed July 6, 2016, and issued January 12, 2017. https://image-ppubs.uspto.gov/dirsearch-public/print/downloadPdf/20170013762

Havkin-Frenkel, D., and F. C. Belanger. 2018. *Handbook of Vanilla Science and Technology*. 2nd ed. Wiley-Blackwell. https://doi.org/10.1002/9781119377320

Jerald, S., A. Gangaprasad, and S. P. Mathew. 2023. "Double phase culture system mediated enhanced protocol for shoot proliferation of *Vanilla andamanica* Rolfe. — An endemic wild relative of commercial Vanilla from the Andaman and Nicobar Islands." *Plant Science Today* 10 (4): 186–191. https://doi.org/10.14719/pst.2475

Odoux, E., and M. Grisoni (eds.). 2010. *Vanilla*. CRC Press. https://doi.org/10.1201/EBK1420083378

Tridge. 2023. "Import of Vanilla." Vanilla HS Code: 090510. Accessed November 1, 2023. https://www.tridge.com/intelligences/vanilla/import

Volza Grow Global. 2023. "United States Vanilla Bean Imports." Accessed November 1, 2023. https://www.volza.com/p/vanilla-beans/import/import-in-united-states