



Gardenia Culture

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GARDENIA CULTURE

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The gardenia, also widely known as the Cape-jasmine, is a desirable evergreen garden shrub in the Southern States as far north as the Coastal Plain region of Virginia. Its fragrant flowers appear over a period of several months, most of them in May and June, but a succession of flowers may be borne during the summer.

Gardenia jasminoides is the most widely grown species, although several others are sometimes grown in gardens. *Gardenia veitchi*, classed by several authorities as a form of *G. jasminoides*, flowers more freely in the winter and its varieties, Hadley and Belmont, are most used in greenhouse culture.

In addition to its value as an ornamental shrub, the gardenia is one of the most important of the cut flowers grown in the open ground in the South. It is one of the best flowers for florists' use, supplying a most pleasing green foliage with the flower and lovely fragrance in addition to possessing the ability to keep well in storage. The industry of growing the gardenia or Cape-jasmine out of doors occupies a considerable acreage, the flowers being shipped to practically all northern florists. The largest volume is sent for Memorial Day, but shipments continue during the summer as long as the flowers are available. Although a large market is found for the flowers, the present supply appears ample for the demand, if not in excess, so that persons beginning gardenia culture for the market must meet keen competition with established growers.

Outdoor Culture

Southern growers propagate the plants by cuttings in the open nursery or in coldframes. The cuttings, 6 or 7 inches long, are made in late winter or early spring. They should be planted in sandy soil, which should cover two-thirds of their length. During the succeeding several months care is necessary to prevent a crust from forming around them or the soil becoming hard. It is important to avoid moving the cuttings while working around them. They are usually left in the nursery row for 2 years, after which they are ready for transplanting to the field where they are to be grown for cut flowers.

In transplanting them the roots should be "balled" and more than usual care exercised in handling so as to avoid disturbing the soil around the roots. Other cultural practices that will favor the development of the plants are pruning the branches to encourage the formation of flowering shoots and watering sufficiently to keep the soil moist at all times. Under favorable conditions a few flower buds may be

expected the second season. The plants are in their prime during their third, fourth, and fifth seasons. When they become older they tend to produce small buds with little foliage. Careful pruning to shorten the older wood and fertilizing to induce moderately robust growth make it possible to lengthen their productive life for several years.

The flowers can be kept for several weeks if they are packed well and stored near ice, or even in an ordinary cool cellar, although they do not last very long if exposed to air and sunlight. The buds are picked just as the petals begin to unroll or show white edges of petals. Inasmuch as they open rapidly, very close attention must be given them in order to cut the buds while they are in just the right stage. In the packing house, they are first sprinkled, then graded, made into bunches of 25 buds, and wrapped tightly in paper to prevent the flowers from opening.

Greenhouse Culture

The greenhouse culture of gardenias has been increasing in recent years, because the prices obtained in winter are high enough to be attractive, although even experienced growers consider the gardenia a most uncertain crop to handle. The best of judgment is required to solve successfully problems of nutrition during the winter, proper environment as to temperature and moisture, and the control of pests, among which nematodes are most troublesome.

Gardenias in the greenhouse need a free circulation of air, especially during the summer, and a maximum amount of light during midwinter. To provide for ample ventilation and light, a detached house is usually preferable to one in a connected range. Raised benches offer some advantages over solid beds, including ease of sterilizing the soil to destroy nematodes, supplying mild bottom heat in midwinter, and better control of moisture in the soil.

Greenhouse gardenias are propagated by means of cuttings made during December and January. Immature wood is taken at a stage of growth when the stems are just beginning to harden. For the rooting medium a mixture of sand and granulated peat is considered desirable, in the proportion of two-thirds sand to one-third peat by measure. Good rooting may be obtained, however, in clean sharp sand free from organic matter. During the 6 or 8 weeks while it is in process of rooting, the bed of cuttings is enclosed in a glass-covered case to maintain high humidity. A little ventilation should be given daily for about an hour. The temperature is maintained as near 70° F. as possible. When rooting starts, more fresh air is admitted, the amount being increased daily until the cuttings are fully exposed for several days before they are removed for potting. While the newly rooted plants are becoming established in the pots they are kept under conditions similar to those in the cutting bed, except that the air is not confined around them. Although the soil must be kept moist at all times, care is necessary to avoid overwatering. Growth without checks is encouraged by maintaining an even temperature and repotting before the plants become pot-bound.

A soil mixture suitable for potting and for the beds in the greenhouse may be prepared by adding upland peat to the ordinary greenhouse

¹ Compiled the information on diseases from the literature.

compost in the proportions of about one-fourth peat to three-fourths compost. Peat formed from decayed oak leaves is desirable for this mixture, but commercial granulated peat is often used. If the compost has a clay base, sufficient sand should be added to insure free drainage. As an additional aid to drainage the bottoms of the beds are provided with cracks or holes for the outlet of water. The soil should be mildly acid. The addition of peat as suggested will usually provide the needed acidity without further special treatment. The degree of acidity regarded as most suitable is about pH 6 as expressed in terms of soil analysis. A depth of 5 to 7 inches of soil in the beds is sufficient.

May is the usual time for transplanting the potted plants to the benches. The plants are spaced from 15 by 18 inches to 18 by 24 inches. If they are spaced too closely the inside plants will not set buds as freely as those at the edges. In greenhouse culture the plants are usually grown 2 years and then discarded.

During the summer, while growth is active, the humidity is kept high. Beginning late in August, the soil and air are kept a little drier, to harden the growth and favor the formation of buds for winter flowering, but care is needed to avoid checking the plants too much during the autumn. Late in September ventilation is reduced and humidity increased. Humidity is kept very high until buds can be seen. The buds must continue development without check until near the end of December.

The plants may be fertilized during the summer and early autumn by light applications of ammonium sulfate ($\frac{1}{2}$ pound per 100 square feet), tankage, cottonseed meal, or similar high nitrogen mixtures that tend to increase acidity.

Culture in the Home

The exacting requirements of the gardenia when grown indoors are indicated by this outline of greenhouse culture. It is an unpromising plant for the home window garden not only because of its need for carefully regulated temperature and humidity but for the additional reason that it is susceptible to several diseases and insect pests which are difficult to control in the home. Some of the more common of these troubles are discussed in the following section.

Diseases

Chlorosis

The loss of the normal rich green color may be due to any one of several causes such as insufficient light, overwatering or poor drainage, too low a soil temperature, iron deficiency, or disease in the roots or stems. According to several investigations, a soil temperature below 70° F. induces chlorosis. Iron may be lacking in the soil or unavailable because of an alkaline condition of the soil. Certain fertilizers (calcium and sodium compounds) tend to change the pH of the soil to the alkaline side, thus preventing the assimilation of iron. Under such conditions a small amount of sulfur (one-half pound to 100 square feet) or aluminum sulfate (1 pound to 20 square feet) added to the soil will prevent or correct the condition.

Nematodes and stem canker may cause or accentuate chlorosis symptoms.

Bud Drop (bloom failure)

One of the most difficult problems in gardenia culture is bud drop. This may be caused by poor illumination, by the soil becoming dry, by overwatering or poor drainage, by sudden changes in temperature, by dry atmosphere or high humidity combined with lack of light, or by high soil temperature.

A generous supply of light, favorable and uniform temperature and moisture, and disbudding, to allow only one bud to a shoot, are necessary to control bud drop.

Some recent experiments indicate that bud formation and complete development can be secured by maintaining a low soil temperature at night.

Stem Canker

Stem canker is caused by a fungus (*Phomopsis gardeniae*). Early symptoms are slightly sunken discolored areas on the lower stem; sometimes these occur below the soil level. The infected tissues gradually enlarge and the surface becomes rough and cracked. On these cankered areas the spores of the fungus are produced in great numbers and distributed by splashing water, by cultivation, or necessary handling of the plants. The disease spreads rapidly under the warm, humid conditions most suitable for the gardenia. The soil becomes infested and plants become infected from this source. Experiments have proved that the disease can enter the plant only through wounds, so all possible care should be taken to avoid even slight injuries. If the disease is found in a planting, the infected plants should be destroyed or isolated.

Bordeaux mixture, 4-4-50 (purchase from horticultural supply firm; use according to directions), as a spray, or 20-percent copper-lime dust or red copper oxide (cuprocide), 1 part in 100 parts fine sand, scattered around the crowns, are suggested as preventives. Precautions in all the handling of the plants will help to prevent the spread of the infection. When cuttings are made for propagation they should be placed in a solution of potassium permanganate (1 ounce to 5 gallons of water) for 5 to 10 minutes before they are planted.

The leaves of attacked plants become pale green, then yellow, and many may fall. Flower buds are more subject to shedding than those on normal plants. The plants may wilt or appear sickly, but the decline in health is rather slow. No cure is known at present. The best control measure is prevention of wounds and the use of clean soil.

Leaf Troubles

Tipburn.—In a plant affected with tipburn the leaf tissues, especially at vein terminals, become discolored and dead. This condition seems to be caused by a lack of balance in the moisture supply.

Leaf spots.—There are several fungi that attack gardenia leaves and produce spots of various types. Bordeaux-mixture spray is recommended to control these fungi.

Sooty mold.—The leaf surfaces and stems of plants attacked by sooty mold become more or less covered with a crusty black substance. This is a fungus growth, not strictly parasitic, but it injures the plant

by shading and smothering the leaves and is also very unsightly. It follows infestation by white fly, scale, or other insects. If the insects are eradicated, the sooty mold will disappear. To hasten the process a spray of burgundy mixture² can be used.

Brown leaf margins.—Brown margins, usually appearing on older leaves, seem to be brought about by a lack of potash. To combat it, potassium sulfate or potassium chloride at the rate of 3 pounds to 100 square feet of soil surface should be added to the soil. For a 6-inch pot, one-eighth of an ounce or less would be sufficient.

Small dark-green leaves and short internodes indicate a lack of phosphorus. This condition may be corrected by adding acid phosphate (superphosphate) to the soil at the rate of 5 to 25 pounds to 100 square feet of soil.

Sun scald.—Some leaf spots are caused by strong sunlight on wet leaves.

Nematodes

Nematodes are perhaps the most serious pests of gardenias. They are small parasitic worms that attack the roots, producing enlargements of various sizes and causing dwarfing and general unthrifty symptoms in the plants.

Hot water at 120° F. into which the roots are plunged for 30 minutes has been found to kill nematodes, but this treatment is so near the danger point for the plants that it is not recommended except where facilities are available for accurately controlling the water temperature during immersion of the plants. Complete sterilization of the soil before planting and avoiding the introduction of infested plants into the beds are the best means of preventing nematode troubles.

Insect Pests

White Flies

The immature stages of white flies occur as small, flat, pale-yellow scales on the under side of the leaf or as snow-white, wedge-shaped adults that fly about when disturbed. Injury to the gardenia plant by white flies is twofold in character. Besides producing an unhealthy condition of growth by feeding on the gardenia, these insects excrete a liquid that provides a medium for the growth of unsightly black sooty mold. The result is an unsatisfactory plant.

Mealybugs

Mealybugs during their feeding, devitalize the plant by sucking the juices. Sooty mold becomes conspicuous on leaves of badly infested plants. Mealybugs congregate in small groups and cover themselves with fluffy white, cottony wax. They are usually located in crevices near the bases of leaves on stems or around the base of the flower bud.

² A recommended formula is 1 pound copper sulfate, 1½ pounds sal soda to 50 gallons of water, but the concentration may be increased 2 to 4 times for use on hardy foliage. Sal soda should always be dissolved in water before it is mixed with copper sulfate. This spray produces a less-conspicuous coating on foliage than does bordeaux mixture; its general properties and uses are similar.

Scale Insects

Gardenias are frequently attacked by scale insects, particularly the soft brown scale. These small insects occur as oval, brown or greenish bodies on the twigs and give the branch a lumpy appearance. Not only do they weaken the plant growth by their feeding, but an unsightly black sooty mold develops on the excretions which they drop on the leaves below.

Fuller's Rose Beetle

The adults of Fuller's rose beetle are brown, oval insects about ½-inch long, with a diagonal buff stripe on each side. They are found during the day clinging to twigs or hiding in folded leaves. At night they eat rounded notches in the margins of the leaves. The young, or larvae—small, dirty-yellow grubs with brown heads—feed on young rootlets and the bark of older ones.

Leaf Rollers

Gardenias in greenhouses are sometimes attacked by leaf rollers, such as the Mexican leaf roller or related species. The damage is done by a small green caterpillar which ties two leaves together and feeds on the inner surfaces or bores into young buds. The larvae develop into small, triangular, brown moths that lay eggs for another generation of caterpillars.

Control of Insect Pests

Control of the various gardenia pests will vary somewhat, depending on where the plants are being grown.

White flies in the greenhouse may be readily controlled by fumigating two or three times at weekly intervals with calcium cyanide at the rate of one-eighth to one-fourth ounce per 1,000 cubic feet, depending on the tightness of the house. The granulated dust form of calcium cyanide prepared especially for greenhouse fumigation is scattered once a week along the center walk of an ordinary greenhouse at dusk after the ventilators have been closed. The temperature is kept uniform, and the foliage of the plants must be dry. The greenhouse is ventilated early the following morning.

Caution: Calcium cyanide is a dangerous poison and when exposed to the air yields the deadly gas known as hydrocyanic acid. This fumigant should be used only by those familiar with its poisonous qualities and with the precautions necessary to avoid accident. It should not be used in houses or in greenhouses connected with living quarters.

Out of doors white flies are most readily controlled by applying a spray containing the following ingredients.

	Large quantities	Small quantities
A special mineral oil containing derris extract...	1 gallon	3 tablespoons.
Liquid soap (containing 40 percent dry soap)...	2 quarts	1½ tablespoons.
Water to make.....	100 gallons	1 gallon.

A slightly less effective spray consists of a white oil emulsion that is generally available for greenhouse and nursery use. Mix 1 gallon of the emulsion in 24 gallons of water or, for small quantities, two-thirds of a cupful in 1 gallon of water. If an extract of derris containing 5 percent of rotenone is obtainable, add 2 teaspoonfuls to each gallon of the above spray or one-half pint to 25 gallons.

Mealybugs are difficult to control because of their protective covering of wax. In the greenhouse and in dwellings it is usually possible to syringe the plants with a forceful stream of water and thereby dislodge many of the insects or disrupt their waxy covering. The syringing should be followed with a spray application to destroy the exposed adhering mealybugs. Use the white oil emulsion at the rate of 1 gallon to 24 of water, as suggested for the control of white flies. Thiocyanate sprays, obtainable through most horticultural supply houses, are also very effective against mealybugs, and directions for their use are given on the package. In ornamental plantings where it is not possible to syringe the plants, good control may be obtained by applying the above sprays under high pressure several times at 10-day intervals.

In houses where it is not practicable to spray and syringe the plants as described above, the masses of mealybugs may be removed by means of a soft brush or a matchstick wrapped in cotton and dipped in a solution containing 4 tablespoonfuls of dissolved soap chips and $1\frac{1}{4}$ teaspoonfuls of 40 percent nicotine sulfate per gallon of water. The plant should then be dipped or sprayed with this solution, and the procedure repeated at 10-day intervals until all the mealybugs have been destroyed.

Scale insects are controlled by spraying two or three times at 10-day intervals with the white oil emulsion described for the control of white flies. The derris extract need not be added to increase the effectiveness of the spray against scale insects or mealybugs.

Fuller's rose beetle is readily controlled by dusting the plants with a pyrethrum powder which contains at least 0.4 percent of pyrethrins. In purchasing the material, specify that it contain at least this quantity of the effective ingredient. If the beetle larvae are found to be damaging the roots of potted plants, the plants should be freed of all soil and larvae and then repotted in fresh soil to prevent further damage.

Leaf rollers are combated by picking off the badly webbed leaves or squeezing them between the thumb and finger to crush the caterpillars within. Spraying will destroy the more fully exposed larvae and also the small brown moths. The spray for this purpose is prepared by mixing 4 teaspoonfuls of an alcoholic extract of pyrethrum in 1 gallon of water (1 quart per 50 gallons) and adding to each gallon of spray three-fourths of a teaspoonful of a spreader-sticker such as sodium oleyl sulfate plus a synthetic resinous base.

All sprays should be applied with considerable pressure and as a fine mist. Sprays should be directed to the under side of leaves and to the twigs in order to wet the body of the insect and give an effective control.

If local dealers are unable to supply the insecticides mentioned in these recommendations for control, information on concerns from which they may be procured may be obtained from your State entomologist, State experiment station, or the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, Washington, D. C.

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