Section 1

African Violet

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History and Use

The African violet, *Saintpaulia ionantha*, is among the most popular houseplants with wholesale sales in 1995 exceeding $25 million. This popularity is due to its ability to thrive under common household conditions, and its usefulness as a specimen plant (Figure 1-1), centerpiece, or feature in dish gardens.

Since its introduction into the United States in 1894, hundreds of African violet cultivars have been developed, providing a wide range of flower colors, foliage types, and plant sizes. Although many Americans purchase African violets as an impulse item, there are dedicated enthusiasts who grow, breed, and show them.

Figure 1-1. African violets can make stunning specimen plants.

African violets were originally discovered in 1892 in two separate locations of northeast Tanga in eastern Africa by Baron Walter von Saint Paul, then governor of German East Africa. Saint Paul sent either plants or seed to his father in Germany, where they quickly became popular in European horticultural circles. Herman Wendlan, a prominent botanist at the Royal Botanical Gardens in Herrenhausen, Germany, gave the genus name *Saintpaulia* in honor of its discoverer, and the two species, *S. ionantha* and *S. confusa*, became parents to most of the cultivars available today.

Most commercial growers of African violets in this country do so on a modest scale. These growers usually obtain established transplants from a wholesale propagator for either year-round production or, more often, to meet seasonal demand. However, there are a number of large-scale operations that propagate and produce more than one million plants a year. The primary marketing holidays for African violets are Valentine's Day, Easter, and Mother's Day.

Figure 1-2. Maintaining a variety of colors helps sustain customer interest.

Cultivars

Cultivars available for greenhouse production have been selected for consistent production timing, vigorous performance in the different climatic regions of the country, trueness to type, uniform flowering, and market acceptance. An important sales consideration is to provide customers with a wide variety of flower colors (Figure 1-2) and cultivar selection to maintain interest. In general, cultivars are placed into flower color categories: red, blue, purple, lavender, pink, white, or bicolor. Two to 10 cultivars of each color may be on the production list, but only one or two will be finished each week and then rotated with the next set.

Growers must consider the adaptability of cultivars to their production conditions. At some time each year, new cultivars should be ordered and evaluated for possible production based on performance

under existing conditions. Recently, new introductions of different African violet forms including miniatures and trailers have interested producers and customers.

Growing Environment

African violets are usually incompatible with other greenhouse crops because of their environmental requirements. Therefore, the grower should consider using a separate greenhouse or controlled section for production. This facility should have excellent capacity for temperature, humidity, and light control.

Temperature

African violets have an above average night temperature requirement. Night temperature should be 68 to 70°F for the most rapid vegetative growth, with a 75 to 80°F day temperature. An average daily temperature of 77°F provides the highest rate of leaf unfolding. When the day temperature exceeds 85°F, plants often flower prematurely and grow poorly. For this reason, fan and pad cooling systems are almost mandatory in warmer areas of the country. Plant growth slows at a night temperature of 65°F, and almost stops at or below 60°F. Propagation areas are often maintained 2 to 4°F warmer at night than production areas.

Bench surface heating or under-bench heating pipes are effective for increasing the growth of African violets, particularly in the leaf flat and plug flat stages. Maintaining a medium temperature of 68°F can reduce production time by two weeks and improve plant quality and flowering.

Temperature is the main factor used by growers to speed up or slow down flower development as the crop approaches finish. African violet flower development can be divided into nine stages:

1. Bud visible in the leaf axil (≥1/16 inch long).
2. Flower stalk begins to elongate.
3. Flower stalk begins to bend.
4. Flower stalk curves over to protect primary bud.
5. Flower stalk completely curved.
6. Inflorescence pokes through leaf canopy, flower starts to straighten.
7. Flower stalk straightens out.
8. Primary flower opens.
9. Five flowers open per plant.

If the crop is not on schedule, temperatures may be raised to speed flowering or lowered to delay flowering by identifying the stage of flower development and using the temperatures listed in Table 1-1. The temperature can be reduced a few degrees in the last week of a crop to enhance flower color and size.

Light

One reason African violets do well in most homes is because they are basically shade-adapted plants. Light intensity is the primary factor regulating both the time to flower initiation and the number of flowers produced. The usual recommendation is for

Table 1-1. Days from visible bud to five open flowers on African violets.*

Temperature	Inflorescence Development Stage								
°F	1	2	3	4	5	6	7	8	9
64	50	45	40	34	29	23	18	13	0
66	48	43	38	33	27	22	17	12	0
68	46	41	36	31	26	21	16	12	0
70	44	39	34	30	25	20	15	11	0
72	42	37	33	28	24	19	14	10	0
74	39	35	30	26	22	18	13	9	0
76	37	33	28	24	20	16	12	8	0
78	34	30	27	22	19	15	11	8	0

* Adapted from Faust and Heins, 1994.

800 to 1,200 footcandles measured in the middle of a clear day. However, this depends on the temperature and season. During the winter, higher light intensities (1,200 footcandles) can be used when temperature is more controllable and the number of hours of natural light is short. In the summer, lower light intensities (800 footcandles) are best to help control heat.

Plants receiving too much light produce hard brittle growth and are generally stunted, with short petioles and bleached foliage. Excess light can actually burn both flowers and leaves. Without enough light, plants have long petioles, large thin leaves, and few, if any flowers. Shading can be applied to the greenhouse glazing in March, with a second application, if required, in May to reduce light intensity. This should be removed in October. The installation of an automated shadecloth system can provide a finer degree of control over light levels. Shade systems are often placed under computer control.

Amateurs and professionals have grown African violets under artificial light effectively for years. Commercial growers wanting to make more efficient use of greenhouse space have developed multi-layer bench systems, in which plants on top receive natural light and those on lower layers receive fluorescent lighting. Installations for this purpose should be designed to provide 600 to 900 footcandles with a photoperiod of 14 to 18 hours per day. This may be accomplished by mounting two, dual-bulb, 8-foot fixtures 10 to 12 inches above the plants. Lighting companies manufacture special fluorescent bulbs for growing plants, although several studies have been unable to show that these lamps improve plant growth compared to cool-white or warm-white bulbs. Flowering of African violets may also be improved by adding incandescent light at 10 percent of the total wattage. HID lighting from high-pressure sodium or metal halide lamps has also been used to grow African violets either as a sole light source or to supplement natural light.

Humidity

The desired greenhouse humidity depends on light and temperature. African violets usually grow well at 50 percent to 70 percent relative humidity. During the summer, every effort should be made to keep the humidity up when temperature and light are high. Low humidity at this time can desiccate flower petal margins, resulting in petal burn. Humidity may be raised by using evaporative cooling or by simply wetting walks with a hose several times a day. In the winter, high humidity, especially at night, can lead to disease problems. When the humidity approaches 100 percent at night, *Botrytis* can infect the flowers. One solution to this problem is to run a ventilating fan, controlled by a humidity sensor, at night.

Carbon Dioxide

Supplementing the greenhouse atmosphere with additional carbon dioxide to 800 to 1,000 ppm increases African violet growth and may allow plants to be grown at a lower light intensity without sacrificing quality. This technique is especially applicable during the winter months when light levels are lower and less frequent ventilation is required.

Growing Media

African violets have a very fine root system and therefore require a well-aerated, well-drained medium high in organic matter. Media may be commercially available mixes or those prepared on-site. In either case, the medium should have a low soluble salt and a high water- and nutrient-holding capacity. A recommended starting media for mixing on-site would be either the Cornell A mix or the Cornell Gesneriad mix, which consists of peat moss plus vermiculite and/or perlite. These media should be amended with dolomitic limestone to a pH ranging from 5.8 to 6.2. Some growers include low rates of micronutrients and superphosphate, while others supply major and minor elements exclusively through the liquid fertilization program. Soilborne fungal diseases can be a serious problem, so media pasteurization is often recommended.

Nutrition

African violets can be classified as light feeders, preferring a low steady supply of nutrients from a balanced fertilizer. Preferably, this should be a liquid fertilizer with low salts index, high nitrate, and low ammonia and urea, such as 15-16-17 peatlite special, 14-12-14, or 15-15-15. A constant fertilization rate of 100 to 125 ppm nitrogen is adequate, along with one clear watering per week. Soluble salts should be about 0.8 to 0.9 mmhos/cm (=ds/m) (2:1 extract) for young plants, 1.2 to 1.4 mmhos/cm for plants about six weeks after potting, and no higher than 1.7 mmhos/cm at the finish. In general, newly potted plants should not receive fertilizer until the second or third week or when roots reach the sides and bottom of the pot.

Watering

African violets thrive best when the soil is maintained uniformly moist, but not saturated for any length of time. When the media is allowed to dry to the wilting point, growth is stunted and the plants

never seem to fully recover. This is often because of root damage from concentrated soluble salts. On the other hand, saturated medium deprives the roots of oxygen (Figure 1-3). Root damage from either moisture extreme provides an opportunity for crown rot disease to develop.

In all seasons, it is a good practice to overhead water early in the morning so the foliage dries quickly. Overhead watering can be used on African violets up to flower opening. However, it is of utmost importance that the water be tempered close to the foliage temperature. If the water is too cold or too hot, chlorotic circles appear on the leaves, called "ring spot." Many greenhouses temper the water with large water heaters or heat exchangers associated with the boiler heating system. A 65 to 75°F water temperature range is generally safe. Once flowers begin to open, many growers use tube watering or some form of subirrigation such as capillary matting or ebb-and-flow systems, because the lifetime of the bloom is decreased by directly applying water overhead. The frequency of fertilization should be cut in half when supplied through subirrigation.

Figure 1-3. Roots "drown" and rot in overwatered media and cannot support healthy top growth.

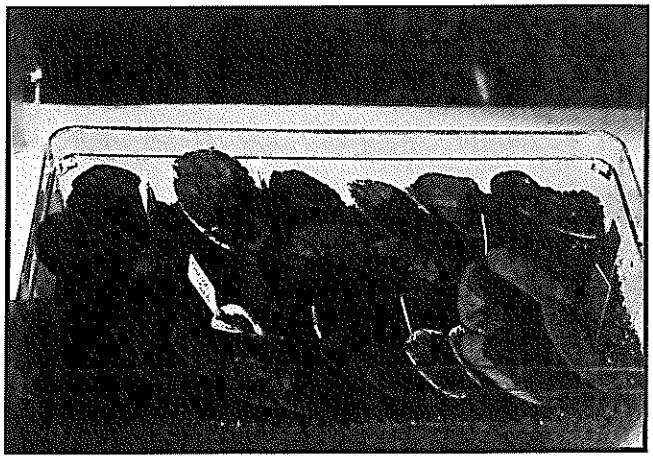


Figure 1-4. African violet propagation is done principally through leaf cutting.

Propagation

African violets can be propagated from seed, but only a few cultivars are currently available that will come true from seed. The major means of propagation is by leaf cuttings (Figure 1-4), although some progress is being made using tissue culture.

Growers who propagate using leaf cuttings maintain an extensive stock plant program and allocate a large area to leaf and plug flats. This requires investment in greenhouse space and labor, both to perform the propagation and to maintain the stock plants. Many of the cultivars better suited for commercial production are patented. Therefore, propagation should not be done without a propagator's license. The decision to propagate in-house or to order in transplants is largely an economic decision and should be made carefully.

Leaf Flats

Leaves for propagation should be selected from well-maintained stock plants that are recently mature and have good green color. A good rule of thumb is a size between 1.25 to 1.75 inches long. The petiole is trimmed to 0.5 inch long and inserted into the medium so the leaves do not touch each other. Leaves are generally arranged in rows in 14- by 24-inch nursery flats at 56 to 72 leaves per flat depending on the cultivar. Many different propagation media have been used by growers including peat, peat and sand, vermiculite, peat and vermiculite, or general potting media.

Rooting of the leaves occurs in about two weeks, and plantlets (offsets) emerge from the base of the petiole in about 6 to 8 weeks from sticking. At this time, the mother leaf is removed to prevent shading the newly emerged plantlets. Some growers will remove about half of the mother leaf and then remove the remainder several weeks later. This is based on the idea that the mother leaf continues to contribute to the growth of the plantlets. Light fertilization of the young plants can begin at about the time of mother leaf removal. The total propagation time for leaf flats is 14 to 16 weeks depending on the cultivar and time of the year.

Plug Flats

Plantlets are removed from leaf flats and separated into single crowns when they have about three to five mature leaves. They are then graded into small, medium, or large groupings. The process of

grading by size may be done by hand or mechanically based on weight. Plantlets can then be rooted in plug flats (72 or 84 cells/flat), 14- by 24-inch nursery flats, or directly in finished pots. The latter method is often used for 2.5- or 3-inch finish pots. Plug flats work best for transplanting to 4-inch pots. Once the plantlets are stuck in flats, about six weeks will be required to reach a transplantable size. This time can vary depending on growing condition and grade size. The small grade often requires about one week longer to mature in the plug flat, and the large grade takes about one week less than the medium grade.

Potting and Finishing

The majority of African violets are potted and finished in 4-inch pots, although 4.5- and 5-inch pots are not uncommon. During potting, care should be taken not to plant the plugs too deep and that patented cultivars are properly labeled. Once potted, the plants can be maintained on the bench, pot-to-pot, for five to six weeks. Optimum light, temperature, and other cultural practices are important at this stage for a vigorous uniform crop. When flower buds begin to poke up through the leaf canopy, plants can be placed at a final spacing of four pots per square foot on capillary or ebb-and-flow benches. African violets are usually shipped when five blooms are open, depending on the desire of the market. This will usually occur five to six weeks after spacing. The total production time from leaf cutting to a finished 4-inch pot is 32 to 36 weeks depending on the time of year and geographic location.

Scheduling

The production schedule in Table 1-2 is a generalization. Individual stages may require more or less time depending on the cultivar, time of the year, and geographic location.

Problems

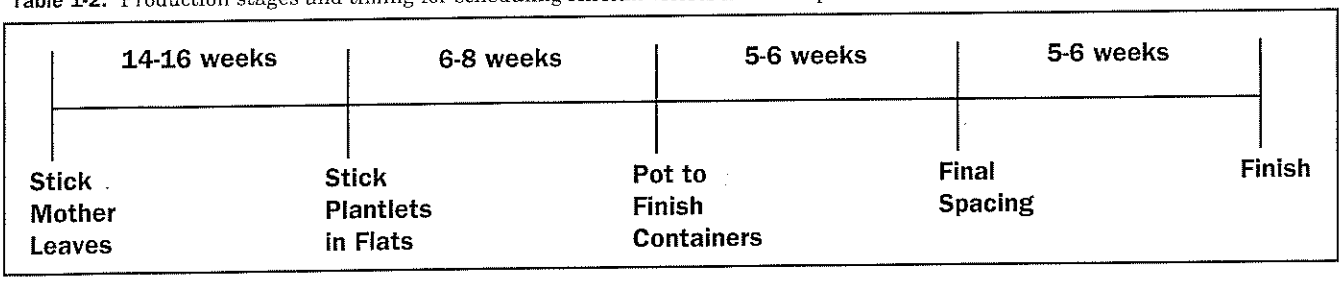
Diseases

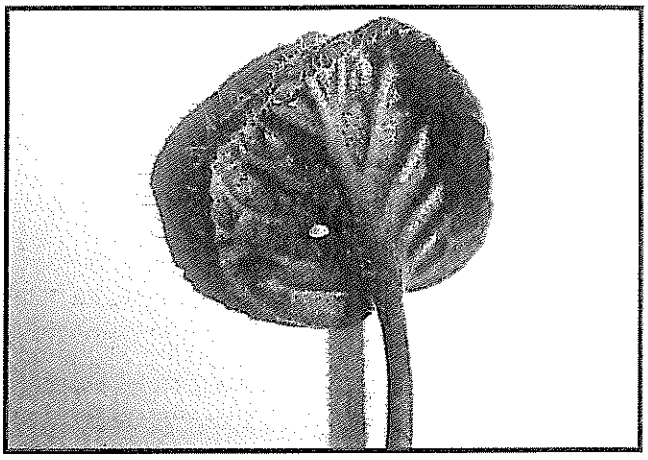
The most important consideration for a disease-free crop lies with sanitation of all pots, flats, benches, media, and other articles coming in contact with the plants. General greenhouse cleanliness is a must! This is especially true where "crown rot" (*Pythium/Phytophthora*) is concerned. Other factors in disease prevention are: obtaining healthy transplants, keeping plants growing vigorously, maintaining the correct environment, and carrying out production stages on time. Fungicide treatments come and go, but it is easier and less expensive to prevent disease problems than to cure them. Powdery mildew can be a problem during changeable weather. This can be controlled by burning sulfur and modifying the environment to keep the foliage dry. *Botrytis* is best controlled by reducing the humidity.

Insects

Greenhouse cleanliness and isolation of new incoming material can go a long way toward preventing insect problems. The major insect pests of African violets are foliar nematodes, thrips, mealy bugs, and cyclamen mites (Figures 1-5a and 1-5b on page 12).

Table 1-2. Production stages and timing for scheduling African violets in 4-inch pots.





Figures 1-5a & 1-5b. Insects and mites can cause significant problems. Although cyclamen mites are too small to see, the injury they cause (left) is not. Mealy bugs (right) are another common pest.