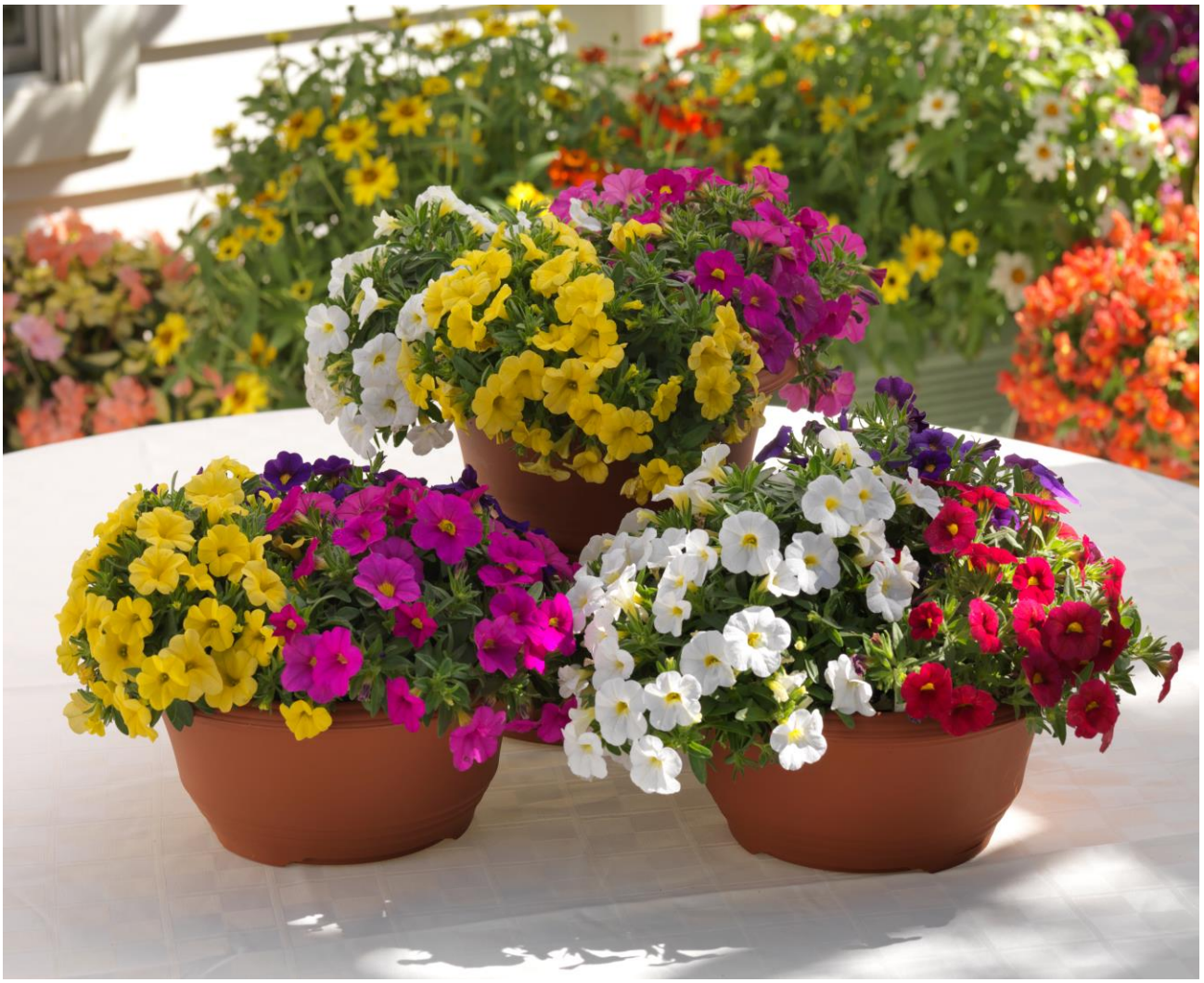
Calipetite®

Culture Guide



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Few plants in floricultural have enjoyed the success and sales growth that calibrachoa have experienced since the first commercial hybrids were introduced some twenty years ago. Given the many favorable attributes calibrachoa offer, their success in the marketplace has been well earned. With the introduction of the all new Calipetite® series, Sakata offers growers a uniquely compact calibrachoa that is ideal for small-pot and mini-color bowl production.

What really sets the Calipetite series apart from all the others is its naturally compact growth habit and day-length neutrality. There is no need to apply chemical growth regulars or provide supplemental lighting to produce beautiful, dense, well-mounded pots covered with flowers. Available in five bright colors, the Calipetites are well matched in habit and can be mixed to produce high-impulse color bowls or long lasting mini-planters. The series also features exceptional tolerance to extremely high pH levels (7.2+). Plants are able to maintain their healthy rich green foliage throughout the production and delivery process for greater retail shelf appeal.

Producing stunning pots of Calipetite Calibrachoa is quite easy if you follow the recommendations noted below. It is critical, however, that growers recognized Calipetite is not the same as traditional calibrachoa and should not be treated as such. **Applying chemical growth regulators to a naturally compact plant can severely stunt future growth.** Although Calipetite will spread to 10-12 inches across, they may not be the first choice for growers looking to finish large containers or hanging baskets quickly (especially in northern climates). Still, adding Calipetite to your color assortment is an excellent way to maximize your production density and provide for higher turnover, while delivering a quality product that is sure to peak your customer satisfaction.

Rooting Material

Select a sterile, porous and well-aerated material for optimum rooting. Good aeration is important for preventing soft rots such as Pythium and Rhizoctonia and allows for more controlled growth during the later stages of propagation. Foam, peat, rockwool and media blends with 30-40% aggregate are all good choices. Target the media pH between 5.5 and 6.0 and the EC at less than 0.75 mmhos (1:2 slurry).

Cuttings

It is important to purchase cuttings from a reputable source that uses certified virus free mother stock and best practices for sanitation, disease and insect control. When cuttings arrive, inspect them immediately by opening the box in a shaded sterile area to avoid exposing cuttings to insects. Cuttings can be held overnight in a cool, shady area or refrigerator at 45-50°F/7-10°C. If leaving overnight, open the box and allow the cuttings breathe and prevent moisture build up. Do not expose the cuttings to temperatures below 45°F/7°C, or higher than 60°F/16°C.

Calipetite cutting, ready for sticking

Stage One: sticking to callus (Days 1-6)

Cell Size – 1 inch / 25-28 mm

Stick cuttings into a pre-moistened rooting medium. For best results use a rooting hormone with up to 2,500 pm of IBA. Mixtures that also include up to 500 ppm of NAA work well too.

Submerging the cuttings into a 5 gallon/20 liter bucket filled with water and a capful of chlorine bleach prior to sticking is an option to sanitize. To reduce leaf surface tension and maximize water delivery to freshly stuck cuttings, apply a spreader sticker to the cuttings a day following sticking. CapSil 30 adjuvant works well at 3-4 ounces per 100 gallons/24-32 ml/100 liters, to reduce stress from transport and sticking. Follow all label directions.

Calipetite cutting with callus

Maintaining a slightly higher media temperature (+ 5ºF) than the ambient air will encourage callus and root development faster than shoot growth. Therefore, bottom heat is highly recommended for optimum results. Calibrachoa Calipetite roots best at a media temperature between 68-72°F/20-22°C. Optimum light level for propagating Calipetite is 1,500-2,000 foot candles/ 16,000-22,000 lux. Mist regularly the first week until callus formation and then apply mist only as needed to keep the cuttings turgid. Frequency of misting is highly dependent upon light and temperature and should be adjusted as conditions change. If using bottom heat, overnight misting is recommended to prevent excess drying. By day 7 the cuttings should have formed a callus.

Stage Two: root emergence (Days 7-13)

Once roots start to emerge, raise the light level to 3,000-3,500 foot candles/32,000-38,000 lux to speed development and prevent stretching. Reduce air humidity to 70-80% and target a day and night temperature of 68°F/20°C with a two hour morning temperature drop, (5-7°F/2-3°C) beginning at dawn. Maintaining as close to a 0° DIF (difference between the day and night temperature) as possible with morning temperature drop reduces stretching and promotes compact cuttings.

When roots form, apply 75 ppm nitrogen from a well-balanced calcium nitrate-based formulation to strengthen the plants and enable them to tolerate higher light levels.

Calipetite with root emergence

Stage Three: bulking (Days 14-20)

Once roots have formed, allow the plants to dry down somewhat between irrigations. Keeping the media too wet promotes a hydroponic root that is less able to supply the plant with water and nutrients once transplanted into containers.

Calibrachoa Calipetite is naturally compact and branching. Proper watering, optimum light and recommended temperatures are all that is necessary to produce dense, compact plants. Do Not Apply Plant Growth Regulators to Calipetites!

Calipetite showing strong root development

Stage Four: toning (Days 21-30)

Calipetite roots easily and should be ready for transplanting in 4 weeks (no pinch) or 5 weeks (pinched) from sticking. As the liners reach the transplant stage, allow them to dry down between watering to tone and prepare them for transplanting. Do not delay transplanting as Calipetite is a strong grower and undesirable stretching will occur. If the liners need to be held, lower the temperature to 60°F/16°C.

Calipetite finished liner

Pinching

Pinching is recommended to improve branching and enhance the development of dense, compact finished plants. With well-developed roots that are actively growing, apply a soft pinch to the tip prior to or at transplanting. Pinching prior to transplanting has the advantage of concentrating the labor in an easy to work area; especially if growing hanging baskets or using flood floors that are not easily accessible to workers. Another advantage of pinching in the propagation tray is more wet/dry cycles, allowing the grower to push growth with frequent fertilizer applications. When liners are pinched, (either in the propagation tray at transplanting) pinch back to 3-4 nodes.

Diseases (Propagation)

Rhizoctonia solani (fungal root rot) is a natural fungus that causes diseases such as damping-off, root rot, crown rot, stem cankers, and web blight. *Rhizoctonia* is a main concern for growers who direct stick Calipetite into larger containers or use poorly aerated media. The fungus characteristically grows across the top of the soil to attack the stem base. Keep hose-ends off floors as *Rhizoctonia* can persist in dirt and debris on concrete floors. Fungus gnats and shore flies may also introduce and spread this fungus within a crop. Biological and chemical methods are available for controlling these insects. Sanitation is always the first defense against *Rhizoctonia*. Use sterile, soil-less growing medium, clean pots and flats, and keep field soil away from propagation areas. If preventative drenches are necessary, select those labelled as safe for use on Calibrachoa. Fungicides with active ingredients such as thiophanate-methyl (3336, 6672 (Banrot), strobilurins (Heritage, Compass, Insignia), and PCNB (Terraclor) are effective in combatting *Rhizoctonia*. Biofungicides containing Trichoderma or Bacillus subtilis, are also helpful in fighting this pathogen.

Insects (Propagation)

Fungus Gnats (*Bradysia* spp.) and shore flies can be a problem if algae are present in the propagation area, on floors, walls and/or benches. Heavy infestations of fungus gnats and shore flies can negatively affect rooting and quality. Larvae cause direct plant injury to roots and create wounds that may allow secondary soil-borne pathogens to enter. Both the adult and larval stages are capable of disseminating and transmitting diseases.

Fungus gnat adults live for 7-10 days and females deposit 100 to 200 eggs into the cracks and crevices of the growing medium. A characteristic diagnostic feature of fungus gnat larvae is the presence of a black head capsule. Larvae are generally located within the top 2.5 to 5.0-cm of the growing medium. However, they can also be found in the bottom of containers near drainage holes. The life cycle, from egg to adult, can be completed in 20 to 28 days, depending on temperature.

Proper sanitation such as removing weeds, old plant material, and old growing medium can reduce fungus gnat populations. Weeds growing underneath benches create a moist environment that is conducive for fungus gnat development. Hand pulling or employing herbicides will kill existing weeds. Most importantly, eliminate the build-up of algae. Avoid excess watering and over fertilization of plants as this leads to conditions that promote algae growth. Keep floors, benches, and cooling pads free of algae by using a disinfectant containing quaternary ammonium salts.

Insecticides combined with algae control works best to control populations. Options include conventional insecticides (adults) insect growth regulators (larval stage) and microbially-based insecticides applied as drenches or “sprenches” to control larvae.

Biological control is another option to manage fungus gnats when growing Calipetite. Biological control agents or natural enemies that are effective in controlling fungus gnats are the beneficial nematode, *Steinernema feltiae*, the soil-predatory mite, *Hypoaspis miles*, and the rove beetle, *Atheta coriaria*. All three biological control agents attack fungus gnat larvae. They can be applied to the growing medium or soil in the floor. They need to be applied early before fungus gnat population’s build-up.

Transplanting

Media

Calipetite does best in a media that is well-aerated. High porosity mixes, such as those made from coarse/ long fiber peat moss or short fiber peat moss blended with 30-40% aggregate work very well. For containers that will not be re-transplanted, such as hanging baskets or large patio pots, a media with higher water holding capacity is desirable for consumers. Optimum pH for Calipetite is 5.5 to 6.0 with a starting EC of 0.75 mmhos (1:2 slurry). A major advantage of Calipetite is its high pH tolerance compared to traditional Calibrachoa varieties.

Calipetite Pink versus (R) Competitor Calibrachoa Pink (L) (media pH 7.2)

Containers

Calipetite work well in a wide range of containers. Use the chart below as a guide.

Container Size	Number of Liners
4 inch/10 cm.	1
5 inch/15 cm. (Quart)	1
6 inch/20 cm.	3
8 inch/20 cm.	3-4
10 inch/25 cm. Hanging Baskets	5-6

Temperature

Establish the crop at an average temperature of 65°F/18°C. Once established grow at 65-70°F/18-21°C during the day and at 63-65°F/17-18°C at night. For faster cropping, establish and grow at an average daily temperature of 68°F/20°C. Calibrachoas respond well to DIF regimes. Provide good air circulation at all times. Maintain relative humidity below 70% to prevent diseases like Botrytis gray mold.

Light Level

Bright light is ideal for this crop. Provide a minimum of 4,000 foot candles/43,000 lux. Calipetite is day length neutral, but flower quicker under high light and long day conditions. In high light areas, like California, Calipetite will flower in early March (Northern Hemisphere) or early September (Southern Hemisphere). The use of supplemental light (14-16 hours, beginning at midnight) may be beneficial for early spring flowering; especially in low light areas.

Growing Tip: Plants that are subject to excess shading (<3,500 foot candles/38,000 lux) from overhead basket lines will flower later, produce less flowers and develop unwanted stretch.

Watering

To establish a quality plant with a strong root system, be careful not to initially over-saturate the media. In addition, allow the media to dry down in between irrigations to promote root growth. Once established, do not allow excessive drying which results in damage to foliage and flowers. Watering early in the day is best; especially if watering overhead.

Fertilizer

Delay applying fertilizer until the roots are well established. Then, begin feeding with a complete, balanced fertilizer at 200-250 ppm N constant liquid feed (CLF). An EC level of 1.2 - 1.5 (1:2 slurry) is a good target range under most conditions. Provide a complete minor element program. Calipetite is more tolerant of a higher pH and less prone to iron deficiency. However, additional iron applications may be required to promote good leaf color; especially if the pH is above 7.0. The use of Osmocote®, such as 18-6-12, or other appropriate slow-release fertilizer products may be beneficial in supplementing a CLF program and may provide improved performance for the consumer. Provide periodic clear water applications if excess soluble salts accumulate.

Cal/Mag formulations such as 13-2-13, 15-5-15 and 17-5-15 work well to supply valuable calcium and magnesium. Do not apply fertilizer during the heat of the day or when plants are drought-stressed. Periodic fresh water, (no fertilizer), irrigations may be needed in areas where salinity is a concern. The growing media should be routinely tested every two weeks to monitor EC and pH levels.

Growing Tip: For outdoor production with cool soil temperatures avoid applying high amounts of ammonium to prevent toxicity.

pH – Calipetite is more tolerant of alkaline soils, tolerating a pH up to 7.2. As the pH rises, so does the risk of iron deficiency, characterized by interveinal chlorosis of the newly formed leaves. Iron is an immobile element and symptoms will spread to the lower foliage if the pH is not corrected. If needed, drench with iron sulfate, (avoiding contact with the foliage), at 1-2 lbs. per100 gallons / 120-240 grams per 100 liters, or treat with iron chelate either as a spray or drench according to label directions.

Calipetite showing iron chlorosis from highly elevated

Magnesium is a macro element and often undersupplied in commercial fertilizer mixes. Magnesium is a mobile element, so a deficiency shows as chlorosis of the lower leaves. If not corrected, chlorosis will lead to necrosis. Magnesium deficiency is easily corrected by adding MgSO4 (Epsom Salts) to the fertilizer.

	Amount of MgSO4	PPM Magnesium /Sulfur
Per 100 gallons (USA)	1 ounce (by weight)	7.5 ppm Mg / 10.5 ppm S
Per 100 liters	7.5 grams	7.5 ppm Mg / 10.5 ppm S

Growing Tip: Although visual symptoms are helpful, periodic testing of the substrate by a certified lab is the best way to manage pH and plant nutrition.

Potassium, Calcium and Magnesium Balance:

Supplying Potassium, Calcium and Magnesium at a 4:2:1, (4 K : 2 Ca : 1 Mg) promotes healthy root and flower development. Below is a chart outlining how to supply this ratio using single element fertilizers. Growers should target this balance based on an analysis of their irrigation water and substrate testing.

4 : 2 : 1	KNO3 Potassium Nitrate	CaNO3 Calcium Nitrate	MgSO4 Magnesium Sulfate	Total N-K-Ca-Mg
Per 100 gallons (U.S.A.)	5.9 ounces	6.2 ounces	5.3 ounces	130-160-80-40
Per 100 liters	44 grams	46 grams	40 grams	130-160-80-40

Phosphorus

Phosphorus is a mobile element and the general recommendation for Calibrachoa Calipetite is to supply 10-20 ppm at each fertilizer application. Higher phosphorus rates promote luxuriant growth. When phosphorus is deficient, the lower leaves take on a reddish-purple color. Growers who use mineral acid to neutralize alkalinity may need to use a combination of phosphoric and sulfuric acids to avoid oversupplying phosphorus. 20-10-20, popular with many North American growers, may be alternated with 15-5-15 to maintain optimum pH but note that it does not supply calcium and at 200 ppm N supplies 44 ppm (parts per million) of phosphorus.

Micro-elements are needed in smaller amounts but are important for optimum plant growth. Provide a standard amount of trace elements to Calipetite, similar to what you would supply to Petunias, Impatiens walleriana and Marigolds.

Spacing

Initially, keep plants pot tight and then space when leaves begin to touch neighboring plants. Failure to space on time could resulted in stretched plants with thin stems.

Pot Size	Space Recommendation
4 inch/10 cm.	6-8 in./15-20 cm. on center
5 inch/12 cm. (Quart)	7-9 in./18-23 cm. on center
6 inch/15 cm.	8-10 in./20-25 cm. on center
8 inch/20 cm.	10-12 in./25-30 cm. on center
10 inch/25 cm.	12-14 in./30-35 cm. on center

Plant Growth Regulation

Calipetite is naturally compact and **does not require chemical plant growth regulation**. Use of PGR's (especially during propagation) can result in severely stunted growth and care should be taken to avoid any exposure or overspray. Under rare conditions (low light, warm temperatures, positive DIF, etc.) growers may experience some unwanted stretching. Use high light, cool temperatures and a slight negative DIF for controlling or managing plant height.

Establish the plants warm (68ºF/20°C) and pinch to create a full plant body. When the plants are filled in, move them to a cool greenhouse or outdoor growing area at a temperature ranging between 50-60°F/10-14°C to enhance color.

The following cultural controls should also be implemented to promote optimum growth.

Cultural Control	Method
High Light	> 3,500 foot candles / 38,000 lux
Water Stress	Allow plants to wilt slightly prior to watering
Low temperature	55-60°F / 13-14°C (once established)
Spacing on time	See chart under spacing

Gibberellic Acid

In northern climates under cooler conditions or instances where Calipetite may have been exposed to PGR application, some growers have expressed concerns over Calipetite's ability to fill-in quart pots in a timely manner. The key is to establish the crop warm (68°F/20°C) and then move to cooler temperatures as plant growth dictates.

If needed, a single application of gibberellic acid (ProGibb® / Florgib®) can assist with stem elongation and faster production time. Calipetite's treated with gibberellic acid at 1-5 ppm, 14-21 days after transplanting, have shown an increase in overall growth. Care should be taken to establish the correct rate for each grower's specific conditions. ***See suggested rates at the top of the following page.***

Calipetite Variety	Recommended GA Rate
Mid Blue, White	1-2 ppm
Blue	2-3ppm
Pink, Red, Yellow	3-5 ppm

NOTE: Trials with Fascination® caused phytotoxicity to the leaves and eventual death due to containing both gibberellins and N-(phenylmethyl)-1H-purine 6 amine.

Diseases

In general, Calipetite is not prone to disease issues. However, preventative care should by maintaining good sanitation. Possible diseases include *Botrytis cinerea* (gray mold) and *Crown rot*.

Botrytis cinerea is mainly an issue when high humidity and decaying tissue are both present. Only five hours of a water film (such as that caused by condensation) are needed for infection to take place if temperatures are between 64-77°F/18 -25°C. *Botrytis* blight is likely to attack flower petals so plants in flower or those growing underneath lines of flowering hanging baskets are most at risk. The spots caused by *Botrytis* are large and irregular with tan to brown areas. *Botrytis* is also a concern when plants are not spaced properly to allow sufficient light penetration and air circulation. The lack of light causes lower leaves to senesce which then serve as hosts for inoculation.

Sanitation and environmental control are the best tools for keeping *Botrytis* in check. Remove all dead or dying plants or plant parts, and lower humidity levels. Water overhead early in the day to avoid prolonged periods of leaf wetness. It is important not to leave open containers of plant debris in the greenhouse. Heat and vent to reduce excess humidity and provide good air movement to prevent water condensation on leaves. Products containing the active ingredients fenhexamid (Decree), iprodione (Chipco 26019), chlorothalonil (Daconil), and copper (Phyton 27, Kocide) are good options in managing this disease. Please note that chlorothalonil and coppers may damage open flowers. Biological include *Streptomyces* (Actinovate), *Bacillus* (Cease), and *Trichoderma* (Plant Shield).

Crown rot

Crown rot is a disease that affects many different plant species and targets the area where the stem joins the root. Among the most prominent crown rots is caused by *Phytoptha sp.* Although Phytopthora is often referred to as a fungus, it is actually a member of the Protista Kingdom (neither animal, plant or fungus). Fusarium is a true fungus, and a common cause of crown rot along with other fungal species and sometimes the condition is linked to bacteria and nematodes. When a plant is attacked by crown rot, symptoms appear quite quickly with discoloration of leaves and wilting. The plant eventually dies as the disease effectively separates the plant from its roots.

Phytopthora can become a chronic problem when recirculating irrigation systems are used. Treating the water with copper ionization has been successful in some cases. However, please note that chelates in the fertilizer (typically iron chelates) inactivate the benefit of adding copper. Fungicides are effective if the causal agent is a fungus.

Prevention is the key to managing crown rot and starts with using a well-aerated, sterile media. In addition, good watering practices are important as over saturating the media and or keeping it too wet invites problems. A good practice is to let the media dry slightly in between watering as this breaks the disease cycle By maintaining an optimum EC and pH level promotes healthy, stress-free plants that are much less susceptible to crown rot.

Black Root Rot

Black root rot is caused by the fungus *Thielaviopsis basicola* with stunting and or wilting of infected plants. One of the earliest signs of infection is yellowing or purpling of lower leaves, often mistaken for nitrogen or phosphorus deficiency. Affected roots develop dark spots or bands that contrast sharply with the typical white healthy roots of Calibrachoa. Eventually, the entire root system becomes black and water-soaked. The fungal spores are easy to see with a 15-20x magnifying glass. Spores survive up to two months on greenhouse benches and plug trays and longer in plant debris and media.

Conditions that favor disease expression are high temperatures, ammonium nitrogen and a media pH greater than 5.8. Management strategies include using only new soilless, pathogen-free potting mix, new plug trays and pots and avoiding water and heat stress. Maintaining optimum media EC and targeting the pH at 5.5 inhibits the fungus's ability to reproduce and spread.

Discard infected plants immediately making sure to remove all plant debris and infested soil. If needed, fungicides with the active ingredients *thiophanate methyl* (Cleary's 3336, Fungo Flo), *triflumizole* (Contrast, Terraguard), or *fludioxonil* (Medallion) may be used as a preventative but do not cure an already infected plant. When stem rot is present, fungicide must contact the stems for effective control. It is important to rotate fungicides with the same active ingredient to prevent the development of resistance.

Insects

The major pests of concern are aphids, fungus gnats, leaf miners, spider mites, thrips and whiteflies. Some of the information below is gleaned from Raymond Cloyd's article on insects that appears in the Sakata Gerbera Manual.

Aphids

Aphids are soft bodied insects (2-3 mm) with antennae that use their sucking to feed on plant sap. The species most commonly found in greenhouse crops are the green peach aphid (Myzus persicae) the cotton or melon aphid (Aphis gossypii) the potato aphid (Macrosiphum euphorbiae) and the foxglove aphid (Aulacorthum solani). They usually are found in colonies on the undersides of tender terminal growth. Heavily-infested leaves can wilt or turn yellow because of excessive sap removal. Saliva injected into plants by these aphids may cause leaves to pucker or to become severely distorted, even if only a few aphids are present. Also, aphid feeding on flower buds and fruit can cause malformed flowers. In addition to aesthetic damage, Aphids are important vectors of plant viruses.

Infestations generally result from small numbers of winged aphids that fly in through open vents to suitable host plants. They deposit several wingless young on the most tender tissue before moving on to find a new plant. The immature aphids or nymphs that are left behind are all female and feed on plant sap and gradually increase in size. They in turn give birth to live young, which in turn can reproduce within 7-10 days. Individual aphids can give birth to 60-100 young (depending on host plants and nutritional status) over a 20-day period. Aphid numbers can rapidly build up to very large populations. The process is repeated several times, resulting in tremendous population explosions. Less than a dozen aphid "colonizers" can produce hundreds to thousands of aphids on a plant in a few weeks. Aphid numbers can build until conditions are so crowded, or the plant is so stressed, that winged forms are produced. These winged forms fly off in search of new hosts and the cycle is repeated.

Early detection is important as aphids multiply quickly. Scout for insects and the white flakes of skins that are cast off from molting insects. Control measures include both contact and systemic pesticides. Contact options include fatty acid salts and or insecticidal soaps, which disrupt the insect's cell membrane, and nervous system insecticides. Both of these require direct contact with the insects which can be challenging as aphids congregate on the lower leaf surface.

Systemic chemicals, such as Marathon, (Imidacloprid,1-) can be useful if there is sufficient time between the start of an infestation and the sell date of the crop. Since aphids are sucking insects, the systemic poison is easily taken in by the insects without having to be concerned about making direct contact.

Due to the ability of aphids to rapidly reproduce, the use of biological controls is not practical unless implemented as a long term strategy prior to filling the greenhouse with crops. However, good cultural practices, such as watering and fertilization, will help to reduce stress by these insects. Problems with honeydew and sooty mold may develop but tend to be temporary and disappear after the aphids are gone.

Leaf Miners

The serpentine leafminer (Liriomyza trifolii) causes visual plant damage primarily as larvae since the y feed between the leaf surfaces in the mesophyll layer of cells, creating serpentine mines or trails. Females may puncture both the upper and lower surface of leaves to lay eggs; which may reduce photosynthesis and kill young plants.

Leafminer adults are small, 2 to 3.5 mm long, shiny, black flies with yellow markings on the abdomen. Each female lives for 2 to 3 weeks laying an average **of** 60 eggs during her lifespan. Eggs hatch into bright yellow to white larvae (or maggots) that feed on the mesophyll layer of cells creating mines within the leaf. The last larval instar cuts a

semicircular slit in the leaf and normally drops to the soil to pupate. Pupae are oblong, and brown to gold in color. Leafminers require darkness in order to pupate so they are typically located deep within the growing medium. Adults emerge from the pupae stage in 9 to 10 days. A life cycle (egg to adult) may be completed in 16 to 24 days, depending on temperature.

Implementing cultural control strategies is important in avoiding or minimizing problems with leafminers. Avoid over fertilizing plants especially with nitrogen, as Calipetite plants receiving excessive nitrogen levels are more susceptible to leafminers. Weed removal inside greenhouses and outdoors will eliminate alternative hosts for leafminers and removing plant debris will reduce any sources of leafminers. Screening greenhouse openings, placing yellow sticky tape and removing highly infected plants will reduce leafminer numbers.

Insecticides that are primarily used for controlling leafminers are either insect growth regulators, which target the larval stage or insecticides with translaminar activity. Insecticides with translaminar properties are effective against the larvae because these materials enter the leaf and kill the larvae directly. Pyrethroid-based insecticides are effective against the adults; however, these materials are generally less effective on the larvae. The number of leafminers present and the occurrence of overlapping generations influence the frequency of insecticide applications needed. Sprays should be applied in the morning when females are laying eggs in order to disrupt this behavior. Several neonicotinoid-based insecticides have activity on certain leafminer species.

Biological control of leafminers involves the use of natural enemies, primarily parasitoids. Parasitoids in the genus Diglyphus spp., including D. isaea, D. intermedius, or D. begini may be useful for controlling certain leafminers. Diglyphus spp., are more effective at warmer temperatures that occur in spring and summer. The leafminer parasitoid, Dacnusa sibirica works best at cooler temperatures, which occur during winter and early spring. Parasitoids are attracted to yellow sticky cards, so they should be removed prior to release.

Twospotted Spider Mite

Twospotted spider mite is approximately 1.6-mm long, and oval shaped. They vary in color from greenish yellow to reddish orange. The adult females possess distinct black spots located on both sides of the body. Adult females live about 30 days and can lay up to 200 small, spherical, transparent eggs on leaf undersides. The life cycle from egg to adult takes 1 to 2 weeks, depending on temperature. For example, the life cycle from egg to adult takes 14 days at 70°F/21°C and seven days at 90°F/29°C.

Management generally involves combining cultural practices with the use of miticides. Cultural practices that may be helpful in controlling populations are listed below.

- Avoid over fertilizing Calipetite; especially with ammonium, as this results in the production of soft, succulent tissue that is easier for twospotted spider mite to penetrate with their mouthparts.
- Remove “old” plant material, which may serve as an inoculum source for mites for subsequent crops.
- Avoid over stressing the plants with water (too dry) because this increases susceptibility to attack.
- Remove weeds from within and around greenhouses because weeds (including the nightshades and creeping woodsorrel) are hosts for twospotted spider mite.

If insecticides are needed, thorough coverage of all plant parts, especially the underside of leaves, is essential. Products with translaminar activity, that enable the chemical (after foliar application) to move from the top of the leaf surface to the bottom, work well. Insecticidal soaps may be phytotoxic, so read the label to determine on which mite life stages each material works best.

It is extremely important to rotate miticides or insecticide/miticides with different modes of action in order to reduce the possibility of mite populations developing resistance. Greenhouse producers should only use a material once or twice during a generation (depending on the time of year) then switch to another material with a different mode of action.

Western Flower Thrips (WFT)

Western flower thrips (*Frankliniella occidentalis*) feeding on Calipetite leaves results in leaf scarring, necrotic spotting, distorted growth, and sunken tissues (primarily on leaf undersides). Damage to flowers or un-opened buds may result in flower bud abortion or deformation of flowers.

Western flower thrips are slender, small insects approximately 2.0 mm in length with fringed or hairy wings. They may vary in color from yellow-brown to dark brown. Adult females insert eggs into leaves. They can lay up to 250 eggs during their 45 day lifespan. Eggs hatch into nymphs that feed on leaves and flowers. Western flower thrips will pupate in flowers, leaf litter, or growing media. Adults that emerge from the pupae stage typically feed on flowers. The life cycle, from egg to adult, takes approximately three weeks to complete although this is dependent on temperature.

Sanitation practices such as removing weeds, old plant material debris, and growing medium debris will minimize problems with WFT. Remove plant material debris from the greenhouse or place into containers with tight-sealing lids. Screening greenhouse openings such as vents and sidewalls will prevent WFT from entering greenhouses from outside. The appropriate screen size or mesh for WFT is 192 microns (132-mesh).

The principal management strategy is to apply insecticides when populations are “low,” which avoids dealing with different age structures or life stages—eggs, nymphs, pupae, and adults—simultaneously over an extended time period. Contact insecticides or those with translaminar activity are generally used to control WFT, because systemic insecticides typically don’t move within flower parts (petals and sepals) where WFT adults normally feed. Treating early, prior to insects entering the terminal or flower buds, is critical as treating open flowers is risky and may lead to damage. High-volume sprays are typically used to kill WFT that are located in hidden areas of plants such as un-opened flower buds.

Three to five applications within a 7 to 10 day period may be needed when WFT populations are “high” and there are different life stages present or overlapping generations. Frequency of application depends on the time of year (season), as during cooler temperatures the life cycle is extended compared to warmer temperatures, which will influence the number of applications required.

The primary way to prevent or minimize the potential of WFT populations from developing resistance and prolong the effectiveness of currently-available insecticides is to rotate insecticides with different modes of action. In general, rotate different modes of action every two to three weeks or within a generation. However, this depends on the time of year since the development rate of the life cycle is temperature dependent.

Biological control of WFT relies on using natural enemies such as predatory mites (*Neoseiulus* or *Amblyseius* spp), minute pirate bugs (*Orius* spp.), and entomopathogenic fungi (*Beauveria bassiana*). However, the key to implementing a successful biological control program against WFT is to release natural enemies early enough in the cropping cycle. Releases must be initiated prior to WFT entering terminal or flower buds. Natural enemies will not control an already established or existing “high” WFT population, because it takes time from initial release before natural enemies will lower WFT numbers below damaging levels

Whiteflies

The major whitefly species include the greenhouse whitefly (Trialeurodes vaporariorum) and silverleaf whitefly (Bemisia argentifolii), which is synonymous with the sweet potato whitefly (Bemisia tabaci) B-biotype. Most whitefly life stages (eggs, nymphs, pupae, and adults) are located on the underside of leaves. The nymphs cause direct plant injury by feeding on plant fluids, which results in leaf yellowing, leaf distortion (curling), and plant stunting and wilting. The nymphs also produce a clear, sticky liquid material called honeydew that serves as a growing medium for black sooty mold fungi. The presence of large numbers of whitefly adults can be a visual nuisance, which may impact salability of a Calipetite crop.

Adult whiteflies are white, narrow-shaped, and about 2.0 to 3.0 mm in length. Adult females deposit eggs in a crescent-shaped pattern on leaf undersides. Eggs hatch into nymphs or crawlers that migrate short distances then settle down to feed within the vascular plant tissues. The life cycle, from egg to adult, takes approximately 35 days; however, this is dependent on ambient air temperatures. A single female whitefly can lay eggs 1 to 3 days after emerging as an adult. Each female may live for about 30 days and lay up to 200 eggs.

Whitefly control involves implementing cultural, insecticidal, and biological control strategies; preferably using all three. Whiteflies are attracted to plants receiving abundant levels of nitrogen-based fertilizers. Sanitation is always the most important means of avoiding and reducing problems with whiteflies. Weed removal (inside and out) eliminates potential sources of whiteflies since certain weeds such as sow thistle (Sonchus spp.) and creeping woodsorrel (Oxalis corniculata) may harbor whitefly populations.

Whiteflies are vulnerable to contact, translaminar, and systemic insecticides. Contact insecticides, including many insect growth regulators, insecticidal soaps, horticultural oils, pyrethroid-based insecticides, and other insecticides with contact activity are effective against whiteflies; however, more than one application may be needed because these insecticides are primarily active on two life stages: nymphs and adults. In fact, insect growth regulators only kill whitefly nymphs with no direct activity on the adults. In addition, contact insecticides are primarily effective early in the crop production cycle since the smaller plant size makes it easier for sprays to penetrate the crop canopy and ensure adequate coverage of leaf undersides. Systemics such as the neonicotinoid-based insecticides and feeding inhibitors are also effective against whiteflies, especially when applied early on in the crop cycle and before whiteflies build-up excessively. Systemic insecticides may be applied as a drench to the growing medium or to the foliage. There are a number of insecticides that have both translaminar and systemic properties.

Biological control is another strategy that may be successful in dealing with whiteflies on Calipetite. This involves using either parasitoids, predators, or beneficial (=entomopathogenic) fungi. Biological control agents (=natural enemies) commercially available include the parasitoids, Encarsia formosa, Eretmocerus eremicus, and Eretmocerus mundus; the predatory ladybird beetle, Delphastus catalinae; and the beneficial fungus, Beauveria bassiana (sold as BotaniGard and Naturalis-O).

Virus diseases

All Calipetite cuttings are produced from mother stock that has been established from elite cultures that have been repeatedly indexed for a wide range of possible virus diseases. Although Calipetite do not seem to be particularly sensitive or susceptible to plant virus diseases it is good to be familiar with symptoms of various Topsovirus and Calibrachoa Mottle Virus.

Tospovirus (INSV, TSWV)

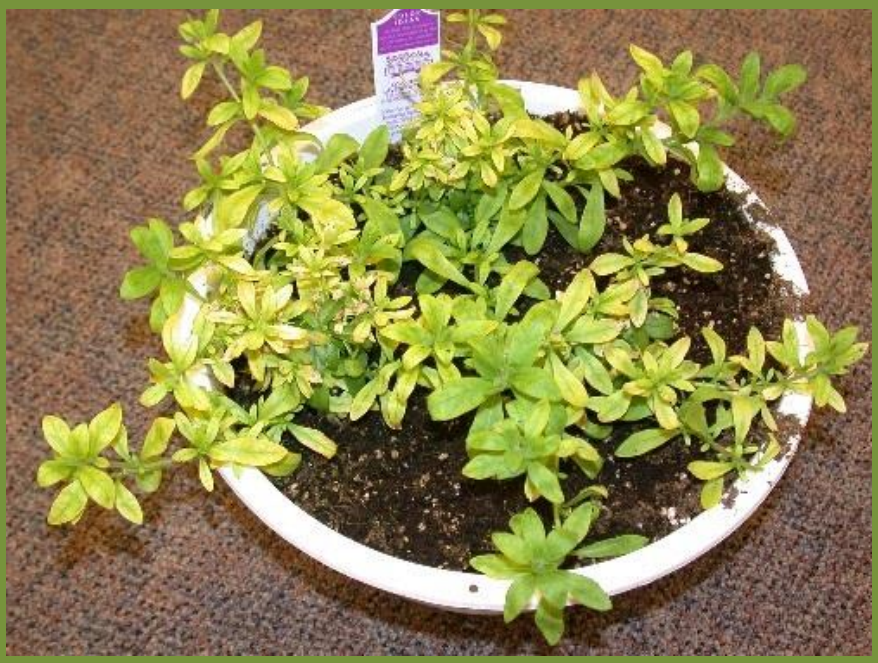
The tospovirus group of virus diseases includes Tomato Spotted Wilt Virus (TSWV) and Impatiens Necrotic Spot Virus (INSV), both of which can occur in commercial greenhouse operations, and both have a very broad host range. Typical symptoms include stunting, necrotic and yellow spotting, stem cankers, line patterns and ring spots. In severe cases, a tospovirus infection can lead to the demise of the plants; furthermore, infected plants can serve as inoculum for further spread of the disease to other crops

Tospovirus is spread through propagation or by Western Flower Thrips (see section on Insects); larvae that feed on infected tissue grow into adults that can infect other plants through their feeding activity. Hence, stringent thrips control is paramount in preventing these diseases.

Calibrachoa Mottle Virus (CbMV)

Calibrachoa Mottle Virus affects both calibrachoa and petunia and hybrids of the two. Major symptoms include leaf yellowing, dieback and spotting (easily confused with iron deficiency). CbMV is easily spread through propagation and sap. At the moment there is no known vector. A list of symptoms is outlined in the following chart.

Iron deficiency or CbMV?



Symptom	Iron Chlorosis	Calibrachoa Mottle Virus
Interveinal chlorosis	Yes	Yes
Necrotic Spots with severe yellowing	Yes	No
Chlorotic blotching	No	Yes
Flower streaking	No	Yes
Fairly uniform throughout the crop	Yes	No
Action	pH correction	ELISA bioassay test to confirm

If a virus is confirmed, immediately discard affected plants.

Attribute List

Cultivar	Earliness*	Bloom Size	Vigor	Habit
Blue	=	=	=	Mounding
Mid Blue	=	=	+	Mounding
Pink	=	=	=	Mounding
White	=	=	=	Mounding
Red	=	=	=	Mounding
Yellow	=	=	-	Mounding

*based on average flowering at 8 weeks in a 6 inch pot.

+	slightly earlier flowering	slightly larger flower size	larger plant habit
=	average flower timing	average flower size	average plant habit
-	slightly later flowering	slightly smaller flower size	more compact plant habit

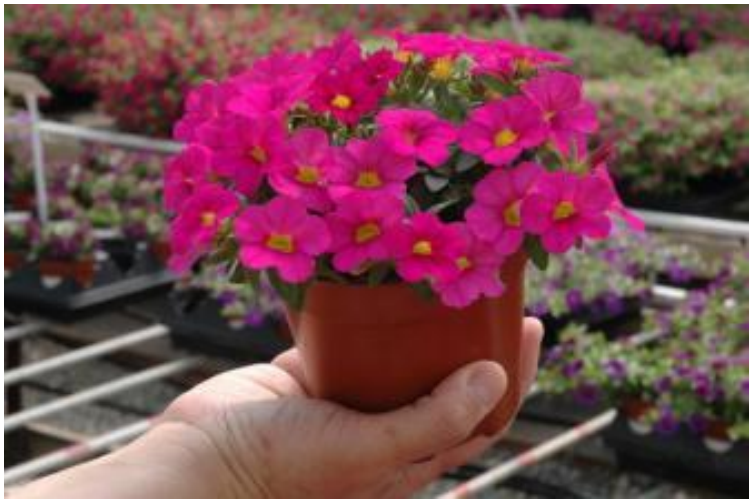
Crop Schedule

Calipetite is basically day neutral and will set buds when the day length is 10 + hours or greater. However, faster development and flowering occurs under long day conditions (>13 hours), higher temperatures and irradiance. Please see the chart below for more details.

CROP SCHEDULING (REGULAR) Average daily temperature of 65°F/16°C

Season	Container Size	Rooted liners per pot	Weeks to establish	Weeks of development	Total crop time weeks*
Spring	4 inch/10 cm.	1	1	5-6	10-11
Spring	5 inch/10 cm.	1	1	6-7	11-12
Spring	6 inch/15 cm.	2-3	1-2	8-9	12-13
Spring	8 inch/20 cm.	3	2-3	9-10	13-14
Spring	10 inch/25 cm.	4	3-4	10-11	14-15

* Assumes 4 weeks rooting time



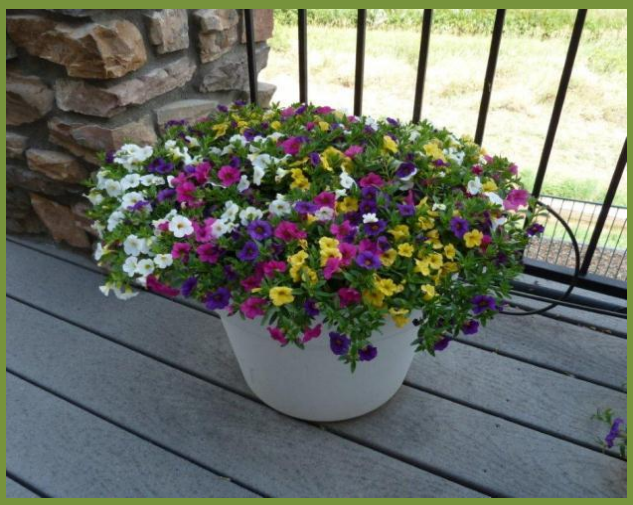
Factors that influence plant development and flowering

Factor	Effect
Day length < 12 hours	Increases crop time
Day length > 14 hours	Decreases crop time
Temperature < 60°F/21°C	Increases crop time
Temperature > 60°F/21°C	Decreases crop time
Light Level < 5,000 f.c./ 54,000 lux	Increases crop time
Light Level > 5,000 f.c./ 54,000 lux	Decreases crop time

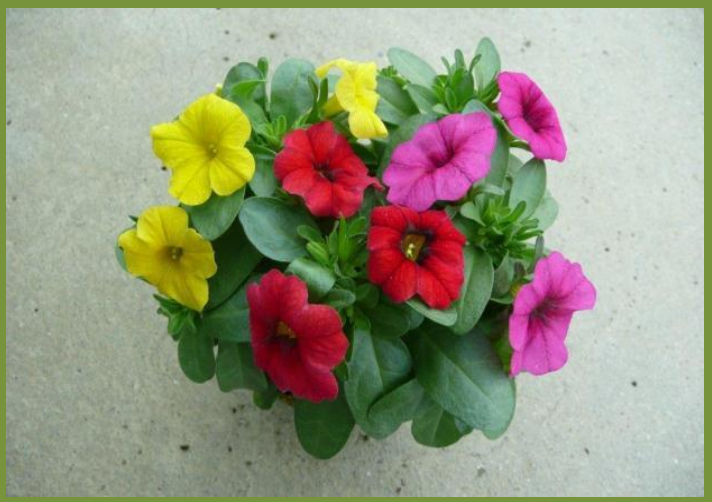
Consumer Care

Calipetite is a less aggressive Calibrachoa for use in pots and mixed containers. The plants are self-cleaning so not dead-heading is required. Allow plant to dry in between watering to avoid root diseases/rot. Calipetite tolerates light frosts allowing it to be displayed outdoors well before other annuals. Calipetite is also a season extender with flowering continuing after initial light frosts.

Top dressing with a slow release fertilizer works well to keep the plants healthy and full of flowers. Calipetite is less sensitive to iron deficiency from high pH than other commercial Calibrachoa lines. However, in areas with high alkaline water, periodic applications with an acid fertilizer, such as Miracle Gro, may be needed. In some locations Calipetite may be attacked by caterpillars and Tobacco Bud Worm (Heliothis virescens) which damage new growth and flower buds. A safe and natural (biological) remedy for controlling this pest is Dipel or Bt (Bacillus thuringiensis var. Kurstaki). The product is applied to the leaves either with a pump sprayer or as a dust (ferti-lome). Periodic applications are needed; especially after heavy rains.



Patio container filled with a multicolor of Calibrachoa



Combining 3 plants in a 4 inch/10 cm. pot is ideal for impulse