



Calla California Callas® Cultural Guidelines for Pot Use

Start with GSBG Grower “Clusters”

- Bulbs are pretreated with a blend of fungicides/bactericides intended to get you off to a good start.
- Follow up with preventative drenches as detailed later in the “Disease Prevention and Control”.

Media

Calla California Callas® prefer “even moisture” while avoiding dry/soggy conditions and/or “wet feet”:

- Use a deep, well-draining media with a pH of 5.5-6.5 that is high in organic matter.
 - o Suitable medias generally have 20-40% coarse peat plus other coarse components for drainage.
 - o Potted plant medias benefit from 10-20% coarse graded sand for ballast and additional drainage.

Disease suppression can be partially addressed with soil incorporation of the following materials:

- Gypsum/lime/dolomite/calcium carbonate can improve pH balance and offer calcium supply for plant strength and disease resistance.
- RootShield (Trichoderma) @ 1lb/yd³ (593gm/m³) aids to reduce disease pressure using beneficial organisms and is compatible with our recommended fungicides.
 - o See also Disease Prevention and Control section
 - o Follow disease drenching protocols using the calla cocktail mix.

Planting

- Selected containers should be deep/tall with elevated “feet” and several drain ports to optimize drainage physics.
- Plant bulbs rounded side down and eyes/sprouts up with 1-1.5” (2.5-3.8 cm) of media over the bulbs.
 - o Roots develop from the top of the bulb; planting too shallow may lead to stress and/or weak performance.
 - o For multiple bulbs per pot consider planting individual bulbs into 3-4 inch pots or in 6 packs to later transplant into larger pots. When all small pots are organized by plant size this conserves bench space and allows uniform multiple plantings of mixed colors or of the same variety. This also reduces uneven or missing plants in final pots. 70°F germ room can be used after fungicide drenches to enhance even emergence. Plant prior to bloom initiation but after last Bonzi application.

Growing Conditions

The crop withstands a wide range of light conditions from 4,000 to 8,000 foot-candles (43,000-86,000 lux).

- Higher light can be tolerated during cool and humid periods.
- Rapid PAR assimilation can prematurely trigger flowering; reduce light during brighter/warmer conditions.
- Plants can tolerate full sun to 40% shade. In high light situations, 30% shade is often optimum also helps control high temperatures.



Callaifornia Callas® Cultural Guidelines for Pot Use

- Callaifornia Callas® are not day-length sensitive nor do they require temperature treatments to induce bloom.
- Vigorous large-leaved varieties benefit from higher light and additional space, improving balance and floral productivity.
- Very low light levels and/or crowded conditions may inhibit optimal flowering, stretch/weaken stems and/or soften color.

Growing Stages

Callaifornia Callas® are relatively robust growers that tolerate various temperatures but truly prefer relatively moderate-to-cool “staged” conditions after germination. Optimum temperature for plant growth and flowering are as follows:

- Stage #1 – Germination: A constant 68-72°F (20-22°C)
 - Early and even heat improves uniformity, vigor and determinacy from aggressive rooting and eye activation.
- Stage #2 – Foliage Development: Days @ 65°-70°F (18°-21°C) / Nights @ 55 - 60°F (13°-16°C)
 - May initiate a “cold pulse” 2-5 days after 1st Bonzi PGR application. This combined with Bonzi PGR drench enhances height control.
 - Omit stage 2 when growing long stored tubers.
- Stage #3 – Bloom Push: Days @ 60-65°F (15-17°C) / Nights @ 50° - 55°F (10-13°C)
 - Hardens plants and richens colors while reducing Bonzi PGR requirements.
 - Under poor light conditions, it is advisable to cool nights an additional 2-5°F (1-2°C) in “Stages 2 and 3”.
 - Cool nights with clear days will tone plants - promoting stronger, shorter stems and more vibrant flower colors.

Other temperature considerations are as follows:

- Avoiding high temperature spikes will help minimize stress and associated disease pressure.
- Prolonged warmer greenhouse temperatures, especially at night, loosens plants and inhibits coloration.
- Callaifornia Callas® are rather sensitive to frost; foliage will not withstand freezing temperatures. Bulbs will take some frost but cannot withstand a soil freeze to bulb depth.
 - Speed growth through increasing temperatures but leads to softer growth, stretching and muted colors.
 - Slow or harden plants through reducing night/day temperatures in late “stages”; plant arrest begins @ ≤50°F (≤10°C).
 - Vigorous large-leaved varieties can benefit from cooler temperatures for more compact growth.
- Provide sufficient airflow i.e. HAF (horizontal air flow) and give adequate spacing to crop.
 - Low relative humidity will act to reduce leaf widths, lessen general vigor and fullness.

Disease Control and Prevention

Callaifornia Callas® are generally susceptible to three primary soil borne pathogens: Pythium and Phytophthora (“water molds”) plus Rhizoctonia and bacteria: Erwinia (Pectobacteria spp.). “Water molds” are often the first and most critical component in the disease complex. Every effort is critical to primarily PREVENT Pythium. Once root injury occurs, Erwinia and/or Rhizoctonia will often enter and cause soft rot as a secondary infection.



Calla California Callas® Cultural Guidelines for Pot Use

Our best tank mixed, four-part chemical drench targets the “3-pathogen complex” with the following preferred materials:

- 1) Water Mold Part 1
 - o Subdue Maxx (mefenoxam 25.1% ai) @ 0.5-1 oz/100 gal (4-8 ml/100 L)
- 2) Water Mold Part 2
 - o Aliette (fosetyl-aluminum 80% ai) @ 13 oz/100 gal (97 gm/100 L)
- 3) Water Mold + Rhizoctonia
 - o Heritage (azoxystrobin 50% ai) @ 4 oz/100 gal (30 gm/100 L)
- 4) Erwinia
 - o Agrimycin-17 (streptomycin sulfate 21.2% ai) @ 8-16 oz/100 gal (60-120gm/100 L)

Fungicide drench timing is critical.

- The 1st drench should occur together with the initial watering or within 3-5 days of sowing.
- A 2nd drench is important as leaves begin to unfurl. Generally this should occur in week 3 (early season) or week 2 (late season or sprouted bulbs plantings).
- It is important to scout root development for cleared or browning roots for disease incidence and progressions for subsequent drenches.
- A 3rd drench may be necessary as crop enters flower bud stage, ranging from week 12 to 7 (early vs. late season).
 - o Always drench in the mornings or early enough for all foliage/runoff to dry thoroughly.

Occasionally leaf spot can occur. If so, use the recommended dosage of fungicides like Champ II, Dithane, Daconil or Chipco. Contact your local chemical supplier for chemicals available and allowed. Trial chemicals on a small basis if new or unfamiliar.

To avoid leaf spot, airflow and an active growing climate are important.

Noninfectious or Abiotic Leaf Damage can be caused by a number of factors:

- Leaf spot phytotoxicity can occur when using overhead irrigation on bright, warm days and/or pesticide sprays remaining “active in solution” for an extended period.
- Leaf tip or edge Edema can occur during early developmental stages. Also called leaf-tip “clearing”, “glassiness” and “vidrio” it’s caused by warm soil paired with low evapotranspiration and very high turgor pressures leading to cell rupture.
- Guttation or leaf-tip water droplets can result in damage due to salt concentrations accumulating along leaf tips and/or margins. Prevent with leaching.
- Leaf sheath decline or “dirty socks” may sometimes occur (sheaths are stubby leaf-like or bract appendages found below 1st leaf). Sheaths become chlorotic and/or desiccate. Keep even moisture, E.C. salts, and environment extremes to reduce incidence.

Inspect Crop Weekly. Routinely scout for cleared or browning roots, leaf spots, etc.

- Always watch for Erwinia infected plants to carefully rogue and discard.
- Re-drench per recommendations if root problems are discovered, up to a total of three times over the life cycle.
- Sanitation is critical, especially in multiple cropping programs where rot can progress without an obvious cause.
 - o Sanitize benches, floors, conveyors, pots, soil mixers, etc. between crops.
 - o Soil incorporated biological such as Trichoderma spp. are often tolerant to calla fungicides and can lengthen periods of health while reducing fungicide use.



Callaifornia Callas® Cultural Guidelines for Pot Use

Insects

- Control Fungus Gnats and Shoreflies due to their ability to spread bacteria and other diseases.
- Control white flies, aphids and thrips on an as-needed basis. If aphid or thrips are present, use aggressive control measures since they are capable of inflicting flower/leaf damage and rapidly spreading various viruses.
- Watch for early leaf chewing evidence from larvae after sprouting.

Growers generally have preferred insecticides for the control of horticulturally important insect pests. Provided below is a quick reference sample listing for consideration: Abamectin (abamectin 2% ai); Conserve (spinosad 11.6% ai); Diazinon (diazinon 48% ai); Dursban (chlorpyrifos 50% ai); Endeavor (pymetrozine 50% ai); Evergreen (pyrethrins 6% ai); ImidiPro (imidacloprid 21.4% ai); Malathion (malathion 56.8% ai); Mavrik (tau-fluvalinate 22.3% ai); Mesuro 75-W (methiocarb 75% ai); Orthene (acephate 75% ai); Overture (pyridalyl 35% ai); Pylon (chlorfenapyr 21.4% ai); Tempo (cyfluthrin 20% ai).

- See labels for appropriate rates, pests control, approved locations and methods, rotational requirements, etc.
- Most materials can safely be applied at label rates; beware of chemical incompatibilities described on label(s).
- Availability by state, region or country may vary; inquire with local agricultural advisors if you are in doubt.

Water Management

- Irrigations should be full and thorough while also being appropriately timed based on conditions.
- Water in freshly planted bulbs with recommended "cocktail drench". Drenching must be done within 3-4 days of initial watering if not drenched in at planting.
- Maintain moderate soil moisture until substantial sprouts emerge.
- Between timing of sprouts emerging and unfolding of the leaves, be careful with watering. Never let the plants become dry, but use care to prevent prolonged overly wet root zone conditions until leaves unfold fully. In this stage it is better to be a bit on the dry end than on the moister end. Once when the leaves starts unfolding stay with uniform soil moisture.
- As canopy/evapotranspiration advances, maintain uniform soil moisture while avoiding soggy conditions.
 - o Excessively wet/dry/high salt media can result in stress leading to root injury and increased pathogen susceptibility or the development of dried early sheath bracts called "dirty socks".
 - o Dry stress can further impact flowering (i.e. shorter stems, abortion and/or blindness).
 - o Leaves remaining wet overnight from irrigations, sprays or rainfall may be subject to foliar pathogens.
 - o Pooling and splashing can easily spread diseases.

Fertility

Proper fertility is critical for full plant growth with well-colored leaves and optimal floral productivity in Callaifornia Callas®.

- Callaifornia Callas® appreciate a constant fertilization that will result in E.C. levels in the soil of around 1.0.
- It is possible to use a soil incorporated slow release fertilizer, but only where high pot temperatures will not prematurely release too much fertilizer and burn roots. Begin with 100



Callafornia Callas® Cultural Guidelines for Pot Use

ppm N weekly of a semi-balanced blend (+ minors) such as 20-10-20 and include routine applications of Calcium Nitrate. Some prefer to alternate between Calcium and Potassium forms of Nitrate.

- Modifications can then be made based on individual growth objectives and conditions.
 - o At leaf unfurling, reducing N to 50 ppm keeps plants from getting too leafy and improves floral productivity.
 - All varieties, especially the large-leaved varieties benefit from earlier reduction of N ppm for improved balance/flowering; reduce at sprouting.
 - Pale foliage color can be corrected with sequestered iron chelate at a rate of 6oz/100 gal (46.9 mls/100 L).
 - Alternately, consider the use of a low phosphorous fertilizer (i.e. 17-5-17 CalMag or 14-4-14 CalMag) has resulted in better plant balance under some growing conditions, media and water.
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Other fertility considerations are as follows:

- Maintain E.C. levels initially between 2.0-2.5 in water.
- Avoid E.C. levels above 3.0; notice that high salts with periods of dryness may lead to root damage.
- Avoid ammonia forms of nitrogen since it is linked to increased Erwinia pressure.
 - o Additional calcium assists in strengthening cell walls of leaves and flowers, plus improves disease resistance.
 - o Excessive nitrogen can lead “lush” growth, reduced floral productivity and increased Bonzi PGR requirements.
 - o Fertilizer applied to leaves in warm and bright conditions may cause leaf or flower spotting or sun lensing phytotoxicity spots.

Height Control

It is important to appropriately time crop spacing and optimize cultural inputs to minimize Bonzi PGR requirements. Numerous variables can separately or together affect growth habit; these include but are not limited to:

- light
- temperature
- fertility
- water management
- morning “cold pulsing”
- far red-light (twilight) exclusion

Generally it is best to make a Bonzi PGR drench application when plants are during “early” sprout development (i.e. 0.25- 0.5” (0.63-1.26 cm)). Note that the required rate will depend primarily on variety, pot size, bulb size, planting season, sprout length at time of receipt, light, temperature, fertility and market desirability of plant height.

- In general a range of 8-50 ppm paclobutrazol (i.e. Bonzi, Paczol, Piccolo, etc) @ 0.25-1.6 oz/gal (2-12.5 ml/L) is recommended.
- 1 – 3 applications of paclobutrazol are needed for the best result. Number of applications depending on crop inputs, environmental conditions and goals.
 - o 2nd and 3rd applications are best made 6-10 days after the previous (7 days is common practice).
 - o Use 8-15 ppm @ 0.25-0.48 oz/gal (2-3.75 ml/L) if lighter effects are desired.
- It is critical that a measured volume of bonze PGR solution is accurately applied to moist media.
 - o Paclobutrazol rates may arrest plant height completely, particularly with more compact varieties. Varieties can differ significantly in susceptibility to Bonzi; see masterplanner.



Calla California Callas® Cultural Guidelines for Pot Use

- Bonzi PGR volume is as critical as rate since paclobutrazol is “trapped” in the media as excess Bonzi PGR solution is applied.
- Earlier Bonzi PGR application = greater response; large-leaf varieties are best treated with little-to-no sprouts.

Bonzi PGR “overdose” causes leaf-wrinkling, rosetting, stunting, overly darkened leaf color, reduced flower counts and/or increased bench time. A “GA Rescue” spray can be helpful @ 25-50 ppm of GA3 (Falgro/ProGib) or GA4 + 7 and BA6 (Fascination/Fresco). Early recognition of overdose is important in that GA rescue takes a week or so to evidence.

- Bonzi PGR application to dry media will cause “shock” and results in stunted plants.
- Bonzi PGRs applied beyond 40 days post emergence can result in shorter/fewer flowers.

For Shelf Life Enhancement

2-3 days prior to shipping plants should be sprayed with GA to create a longer shelf life for the plants. Apply 20 – 30 ppm of GA3 (Falgro/ProGib) or GA4 + 7 and BA6 (Fascination/Fresco).

- An application early in the morning is recommended as the light conditions are not that bright by then and the foliage will be dry before it will be evening again.
- An application 3-4 weeks before shipping with GA @ 10-15 ppm GA3 (Falgro/ProGib) or GA4 + 7 and BA6 (Fascination/Fresco) is recommended to create a flush of flowers.

Disclaimer

These guidelines can help growing your Callas. Golden State Bulb Growers is not responsible for any damage as a result of following recommendations made in these guidelines, as every facility and environment is different. Every facility has its own requirements for a good Calla crop. The head grower should be able “to read” his own situation and use these guidelines to achieve an optimal crop.

For more extensive details regarding crop characteristics and optimal culture please contact Golden State Bulb Growers.

These instructions are not prescription guarantees, nor are they recommendations and/or endorsements of any of the chemicals mentioned herein.

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