



CROP REGULATION IN KALANCHOE

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ABSTRACT

Kalanchoe (Kalanchoe blossfeldiana), a popular ornamental plant native to Madagascar, is valued for its year-round flowering, compact growth, and low maintenance requirements. Effective crop regulation is essential to optimize its commercial production, ensuring uniform growth, controlled flowering, and enhanced aesthetic quality. Key strategies include photoperiod management (short-day or long-short-day treatments), temperature control (60–85°F day/45–65°F night), light intensity adjustments (3500–4500 foot-candles), and the use of growth regulators (e.g., paclobutrazol, gibberellic acid) to manage elongation and flowering. Cultivar selection also plays a critical role, with early-flowering, compact, and uniform varieties like Calandiva® and Queen® series improving production efficiency. Additionally, pruning, balanced fertilization, and environmental stress responses (e.g., CAM induction under drought) further refine crop quality. By integrating these practices, growers can achieve high-quality, market-ready Kalanchoe plants with prolonged blooms and desirable morphology.

Keywords: Ornamental, Production, Elongation, Market and Morphology

INTRODUCTION

Kalanchoe (*Kalanchoe blossfeldiana*), a member of the Crassulaceae family and native to Madagascar, is a widely cultivated ornamental plant with approximately 139 species in the genus. Its commercial value lies in its ability to flower year-round, low input requirements, and compact growth habit. It is widely cultivated as a potted plant due to its low fertilizer and water requirements, as well as its ability to flower year-round with proper management.

However, unchecked stem elongation can reduce market quality, making crop regulation essential for commercial production. They may be marketed as a centre piece, in dish gardens, as patio plants, or as novelty gifts. The most commonly used species in traditional medicine is *Kalanchoe pinnata*, often referred to as the “cathedral bells” or “life plant”.





CROP REGULATION IN KALANCHOE

Crop regulation in *Kalanchoe* is used to control and optimize its growth, flowering and overall quality in greenhouse or garden settings. Below are the key aspects of crop regulation for *Kalanchoe*:

- **Photoperiod management:** *Kalanchoe* spp. have been categorized into two different photoperiodic response groups with respect to flowering:
Short day plant: *K. blossfeldiana* and *K. porphyrocalyx* were classified as SDP (Schwabe, 1985; Zimmer, 1985). Long short day plant: Zeevaart (1985) classified four *Kalanchoe* spp. such as *K. daigrimontiana*, *K. laxiflora*, *K. pinnata* and *K. prolifera* as LSDPs.
- **Light intensity:** A daily light integral (DLI) improves shoot weight, flower count and overall plant height. Supplemental lighting may be used during winters to achieve a DLI.
- **Temperature regulation:** Ideal temperature for *Kalanchoe* range between 60°F and 85°F. Cooler night temperatures (45 °F-65 °F) can prolong flower life, while high temperatures during the dark period can inhibit flowering through “heat delay”.
- **Growth control using PGRs:** To manage plant size and prevent excessive elongation, growth regulators like paclobutrazol and uniconazole are applied as foliar spray. These chemicals reduce stem elongation, while others like benzyl adenine and ethephon promote branching.

- **Pruning and Pinching:** Regular pruning or pinching is done to encourage bushier growth and more flower heads. Removing faded flowers also helps redirect energy toward new blooms.
- **Fertilization:** During active growth (spring and summer), *Kalanchoe* benefits from monthly feeding with a balanced fertilizer. Switching to a phosphorus-rich fertilizer can enhance flowering.

By combining these practices, growers can regulate *Kalanchoe* crops effectively, ensuring high-quality plants with vibrant flowers for ornamental purposes.

PHOTOPERIOD

K. blossfeldiana, is classified as a qualitative Short-Day plant with a critical day length of 12 hours (Currey and Erwin, 2010). For commercial flower production, photoperiods are artificially extended through night interruption (minimum 10 foot-candles from 10:00 PM to 2:00 AM from incandescent lamps) and shortened (through black cover) to maintain vegetative growth and induce flowering, depending upon the requirement. Sepal primordial stage is the most sensitive stage to the short-day condition during flower development of *Kalanchoe* spp. (Huang and chu, 2012). If the plant was transferred to the long-day condition before sepal primordia were initiated completely, floral development will be stopped. For commercial production, however, at least 42 short days (6 weeks) are recommended for complete induction of the wide variety of cultivars available. *Kalanchoe* cultivars fall into response groups that range from 9 to 13 weeks from the beginning of short days to flower.

Cultivar	Flower Color	Response Group
Bingo	Dark Pink	9-12
Eternity	Salmon	10-13
Fascination	Lavender	9-12
Garnet	Bright Red	10-13
Goldstrike	Golden Yellow	9-12
Royalty	Rost Red	10-13
Sensation	Dark Pink	10-13
Tropicana	Deep Orange	10-13



FLOWER REGULATION THROUGH CULTIVAR

Several Kalanchoe cultivars have been developed for optimized flower regulation, ensuring better control over flowering time, uniformity and plant quality. These cultivars vary in response to photoperiod, temperature and growth regulators, making some more suitable for specific production goals.

Kalanchoe Cultivars for Flower Regulation

1. Early-Flowering Cultivars (Shorter Induction Period)

These cultivars initiate flowering faster in 6-8 weeks under short-day conditions, making them ideal for quicker production cycles.

- ‘Blossfeldiana Compact Series’ – Early-flowering, compact growth with various colors.
- ‘Queen® Compact Series’ – Uniform flowering, ideal for controlled production.
- ‘Mandarin®’ – Fast-flowering orange variety, suitable for year-round production.

2. Long-Flowering and Uniform Cultivars

These cultivars are bred for extended bloom periods and uniform flowering across the crop.

- ‘Calandiva® Series’ – Double-flowered *Kalanchoe* with extended bloom time.
- ‘Forever® Series’ – Highly uniform flowering, making it suitable for mass production.
- ‘Flaming Katy’ (Classic Blossfeldiana type) – Well-known for long-lasting blooms.

3. Cultivars with Controlled Growth (Less Need for PGRs)

These varieties naturally have compact growth, reducing the need for growth regulators.

- ‘Queen® Compact Varieties’ – Naturally compact with less stretching.
- ‘Paris®’ – A compact-growing cultivar requiring minimal PGRs.
- ‘Mona Lisa®’ – Compact habit with vibrant pink blooms.



TEMPERATURE AND LIGHT

Optimum temperatures for growth of Kalanchoes during the vegetative stage are 65-68 °F at night and 75-80 °F during the day. Within a given response group, flowering is often longer in the winter than in the summer. This is believed to be the combined effect of differences in temperature and light intensity on flower development. Temperature directly affects vegetative growth and flowering response.

Cold night temperatures can positively affect flowering in some Kalanchoë species.

Optimal temperature range:

- **Night:** 15°C (60°F)
- **Day:** 20-21°C (68-70°F)

Temperatures exceeding 24°C (75°F) may suppress flowering. Kalanchoes generally require high light intensity (3500 to 4500 foot-candles) to grow compact and control height.

PLANT GROWTH REGULATOR

Optimum temperatures for growth of Kalanchoes during the vegetative stage are 65-68 °F at night and 75-80 °F during the day. Within a given response group, flowering is often longer in the winter than in the summer. This is believed to be the combined effect of differences in temperature and light intensity on flower development. Kalanchoes generally require high light intensity (3500 to 4500 foot-candles) to grow compact and control height.

The study on exogenous application of gibberellic acid (GA₃) on the flowering of two Kalanchoë species, *Kalanchoë*

longiflora and *Kalanchoë pinnata*. The experiment proved that exogenous gibberellin application shortened the juvenile phase in kalanchoe and induced earlier flowering (11-13days) along with positive impact on flower longevity, flower induction and plant growth. (Cohelo *et al.*, 2018)

The effects of two plant growth retardants, cycocel (CCC) and paclobutrazol (PBZ), on the vegetative and flowering characteristics of *Kalanchoe biosfeldiana* showed that both cycocel (CCC) and paclobutrazol (PBZ) have positive effect on kalanchoe but application of paclobutrazol (PBZ) at 150 ppm (applied twice) was the most effective treatment for producing compact, well-branched *Kalanchoe biosfeldiana* plants with early flowering (20-22 days), increased inflorescences, and enhanced chlorophyll and carbohydrate content. (Hamza *et al.*, 2019)

Research showed that the GA₃ promotes floral induction in the examined species (*Kalanchoe sexangularis*, *K. nyikae*, *K. marnieriana*, *K. longiflora*, and *K. × richaudii*) in a broad range of concentrations. The percentage of flowering in *K. marnieriana* and *K. nyikae* increased with increasing concentrations of applied GA₃ and number of days to flowering decreased. (Chang *et al.*, 2018)

ENVIRONMENTAL FACTOR

Kalanchoe blossfeldiana is a facultative Crassulacean acid metabolism (CAM) plant. The species employs C3 photosynthesis, and switches to CAM photosynthesis upon aging, flower induction, or the perception of certain environmental stimuli. CAM-inducing stimuli include water and heat stresses, photoperiodicity (SDs which also induce flowering), and the exogenous application of abscisic acid. CAM plants open their stomata at night to permit the passage of atmospheric



CO₂ and close them during the day to retain water. Phytochromes are the main photoreceptors that regulate different developmental processes in plants.

CONCLUSION

Crop regulation in *Kalanchoe* is a multifaceted process that combines environmental control, chemical interventions, and genetic selection to enhance ornamental value and production efficiency. Photoperiod manipulation remains central to flowering induction, while temperature and light management ensure compact growth and extended bloom longevity. Growth regulators like paclobutrazol and gibberellic acid offer precise control over plant architecture and flowering timing, reducing reliance on labor-intensive practices. The development of optimized cultivars, such as those with early flowering or natural compactness, further streamlines production. By adopting these integrated strategies, growers can overcome challenges like stem elongation and inconsistent flowering, delivering uniform, vibrant *Kalanchoe* plants that meet market demands. Future research could explore advanced breeding techniques and sustainable PGR alternatives to refine crop regulation further.

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