Table 2. Growth response of NonStop tuberous begonias 'Double Red' and 'Double Orange' to different temperatures.

Cultivar	Temp (Day/Night) (°C)	No. of leaves	Top fresh weight (g)	Tuber fresh wt (g)	Tuber size (cc)
Double Red	22/18	20.9	194.4	8.1	14.1
	26/18	16.2*	134.9*	5.5*	8.9*
Double Orange	22/18	16.0	147.6	7.2	11.6
	26/18	15.1	105.9*	6.4	10.6

*Paired means significantly different at 5% level, F test.

toperiod. Longer photoperiods promoted larger plants which, in turn, seemed to enhance flowering of both cultivars. However, plants under short days, while exhibiting less vegetative growth, did produce flowers. Number of flowers was related to size of plants, since plants produce axillary flowers while terminal growing points remain vegetative.

There were no differences between cultivars or the 2 long-day treatments with respect to tuber formation or top fresh weight. Leaf number was similar under the 2 long-day treatments with 'Double Red'. However, a higher leaf count was recorded for the extended-day treatment than for the night-interruption treatment in 'Double Orange'. Short-day treatments produced similar leaf numbers with both cvs.

Temperature. Lower day temperatures had greater effects on 'Double Red' in both vegetative growth and tuber formation than on 'Double Orange' (Table 2). Leaf number, top fresh weight, tuber fresh weight, and tuber size increased at 22°C in 'Double Red', while only plant fresh weight of 'Double Orange' increased compared with plants at 26°. Flowering was unaffected directly by temperatures; more flowers were present on the larger plants. The lower temperature seemed to produce more flowers as a result of producing larger plants. Tuber formation was enhanced at the lower day temperature.

Best flowering and best vegetative growth were at 22°C for both cultivars under either the extended-day or the night-interruption photoperiods. Short days (9 hr) and 22° day temperature produced the largest tubers.

These data on 'Double Red' and 'Double Orange' are in strong agreement with those of Oloomi and Payne (8) for 'Non-stop Yellow'. Tuber fresh weight (Table 1) for both cultivars ranged from 18.0 to 19.0 g under short days and 0.7 to 1.3 g under long days, whereas the tuber fresh weights in the Oloomi and Payne study under similar photoperiods were 19.2 g and 1.4 g, respectively. These data also indicate that short photoperiods and high day temperatures may have caused the forcing problems reported for the 1981 season.

Production of NonStop tuberous begonias as commercial pot plants would be enhanced by growing plants under long days and cool day (22 vs. 26°C) temperatures. For commercial production in the winter months, long-day treatments can be easily provided with night-interrupted incandescent lighting, such as is standard with short-day crops such as chrysanthemum and poinsettia.

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Postharvest Performance of Poinsettia as Affected by Micronutrient Source, Storage, and Cultivar[1]

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Abstract. **After 4 weeks indoors, 'Annette Hegg Dark Red' ('AHDR') and 'Gutbier V-14 Glory' ('GV14') had higher leaf abscission than 'Mikkel Improved Rochford' ('MIR'). 'AHDR' abscised more bracts than 'MIR' or 'GV14'. Plant grade was highest for 'GV14'. Fritted Trace Elements-treated (FTE) and Micromax-treated (MICROMAX) plants lost fewer leaves and bracts and had a higher plant grade than Perk-treated (PERK) or Soluble Trace Element Mix-treated (STEM) plants. Plants held in dark storage for 3 or 6 days had greater leaf abscission than plants not subjected to storage. Bract drop was highest for 6 days storage. Dark storage of 0 or 3 days had higher plant grade than 6 days dark storage.**

Changes in poinsettia marketing in recent years have affected postharvest keeping quality. Extended holiday sales and longer distance shipping prolong dark storage. Marketing through chain stores staffed with inexperienced personnel has increased. Although new cultivars have been introduced with longer postharvest life, problems associated with postharvest handling have not been alleviated. Decreased postharvest quality in poinsettias was related to a decline in the endogenous level of auxin, associated with increased senescence and bract abscission (1, 2), high light and high temperatures (5), and high N, P, and K levels (3) during production.

'Annette Hegg Supreme' and 'AHDR' retained better quality when held in dark storage for a minimal time in paper sleeves at 10°C (6). Dark storage may cause leaf and bract abscission, with the rate of abscission being dependent on duration of storage and subsequent interior lighting (4). However, leaf and bract abscission of poinsettias have

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not been related to micronutrient fertilization and postharvest dark storage. The objectives of this research were to evaluate the effects of micronutrient fertilizers on postharvest performance in dark storage of 3 poinsettia cultivars.

A 3 × 4 × 3 factorial experiment in a completely randomized design was established on Aug. 28, 1980, with 3 poinsettia cultivars, 4 micronutrient fertilizer sources, and 3 durations of dark storage. Treatment combinations were replicated 5 times with 1 plant/15-cm pot as an experimental unit. Uniform rooted cuttings of 'MIR', 'AHDR', and 'GV14' were potted in a growing medium of 3 sphagnum peat:1 sand:1 perlite (v/v/v) amended with dolomitic limestone at 10.7 kg/m^3. Plants were grown in a greenhouse with temperatures of 17°C minimum and 23° maximum and watered 3 times per week. All plants were pinched 2 weeks after potting, leaving an average of 5 to 8 leaves per plant. A standard fertilizer was applied weekly with 600 ppm N and 240 ppm K of a 25N–4.4P–8.3K soluble fertilizer until Nov. 1, when fertilizer was applied on alternate weeks. Soluble fertilizer was terminated 2 weeks prior to initiation of dark storage treatments, and all pots were thoroughly watered prior to posthandling.

Micronutrient treatments were applied at recommended rates of 74 g/m^3 of FTE, 1 kg/m^3 of MICROMAX fine granular slow release micronutrients, 1.7 kg/m^3 of PERK, soluble metal sulfate fertilizer grade micronutrients, and 60 g/100 liters of water STEM. FTE, MICROMAX, and PERK were incorporated into the growing medium after pasteurization. STEM was applied in solution with 200 ml/pot immediately after potting. On Dec. 12, plants were subjected to dark storage treatments of 0, 3, or 6 days in a temperature-controlled room designed to allow zero net photosynthesis. Temperature and relative humidity were maintained at 18 ± 1°C and 60 ± 10%, respectively. After dark storage, plants were moved into a simulated interior environment for a 4-week postharvest holding phase. Plants were held under 15μE $m^{-2}s^{-1}$, measured at the top of the bract canopy, from Cool White fluorescent lamps for 12 hours daily. Temperature was maintained at 18 + 1° and relative humidity was 60 ± 10%. Plants were watered once per week with 200 ml/pot.

Data collected at the end of the postharvest phase were leaf drop and bract drop determined every 4 days during the postharvest holding phase, and plant grade (1 = poor, not satisfactory; 3 = good, satisfactory; 5 = excellent quality) at the end of the experiment.

After plants were held 4 weeks indoors, postharvest leaf drop for 'AHDR' and 'GV14' was greater than for 'MIR' (Table 1). Bract drop for 'AHDR' was greatest followed by 'MIR' and 'GV14', respectively. The variable abscission rates among cultivars have been attributed to different rates of decline of endogenous auxin levels. The longer-lasting cultivars, having higher levels of endogenous auxin, would have slower rates of auxin decline from harvest as compared with other cultivars (1, 2). Abscission differences of leaves or bracts in cultivars have also been reported (4). Plant grade for 'GV14' was higher than for 'AHDR' due to the lower leaf and bract abscission. Plants treated with FTE or MICROMAX had less leaf and bract abscission and higher plant grade than PERK or STEM treatments. The lower abscission of leaves and bracts for plants treated with FTE or MICROMAX probably could be attributed to the release rates of the micronutrient sources over time. FTE and MICROMAX, both slow-release sources, are available over a period of several months and would be more resistant to leaching and thus are well-suited for the soilless medium used in this study. STEM, however, being of soluble formulation, could have been leached from the growing medium too rapidly for adequate uptake by the plants. PERK probably responded in the same manner as STEM. Leaf drop was greater when plants were subjected to 3 or 6 days of dark storage as compared to 0 days. Bract drop was greatest for 6 days storage and lowest for 0 or 3 days storage. Plant grade was higher for those plants held for 0 or 3 days in contrast to plants held for 6 days. These results are supported by previous research, which recommended minimal days storage for the best postharvest quality of poinsettias (4, 6).

These results indicated that the micronutrient source had an effect on the keeping life of poinsettias. FTE or MICROMAX would be a better selection as shown by the least amount of abscission. 'GV14' was a more tolerant cultivar to stress conditions than 'AHDR' or 'MIR'. Minimal storage would be recommended, since 6 days dark storage reduced the keeping quality. Further investigation on independent rates of these micronutrient sources, along with elemental tissue analysis, may clarify the different responses.

Table 1. Influence of micronutrient sources, dark storage, and poinsettia cultivars on abscission and quality after 4 weeks indoors.[z]

Treatment	Leaf drop (no/plant)	Bract drop (no/plant)	Plant grade[y]
Cultivar (C)[x]			
MIR	3.9b[w]	8.4b	3.4ab
AHDR	7.7a	12.8a	3.1b
GV14	8.4a	3.2c	3.6a
Micronutrient source (MS)			
FTE	4.9b[w]	5.2b	3.9a
MICROMAX	5.2b	5.2b	3.8a
PERK	8.6a	11.3a	2.8b
STEM	7.9a	10.8a	2.9b
Dark storage days (DS)			
0	4.1b[w]	5.0b	3.8a
3	6.8a	7.6b	3.4a
6	9.0a	11.8a	2.8b

[z]Interactions of C × MS, C × DS, and DS × MS were not significant.
[y]1 = poor, not satisfactory; 3 = good, satisfactory; and 5 = excellent quality.
[x]MIR = Mikkel Improved Rochford, AHDR = Annette Hegg Dark Red, GV14 = Gutbier V-14 Glory.
[w]Mean separation within columns and treatment groups by Duncan's multiple range test, 5% level.

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