How To Schedule Thanksgiving Cactus

. . . and optimize flower number

by NATHAN LANGE and ROYAL HEINS

FLOWER induction in *Schlumbergera truncata* — also known as Thanksgiving cactus, Christmas cactus, or Zygocactus — is controlled by photoperiod and temperature. Plants induce flowers between 60°F and 70°F under short photoperiods. As the temperature rises above 70°F, the daily photoperiod required for flower induction shortens. At 86°F, it is only 8-9 hours, but flower bud abortion is common.

Growth will be entirely vegetative if plants are continuously exposed to photoperiods longer than 12 hours or are exposed to night interruption lighting at 5 footcandles for 2 hours. As little as one long day per week can delay flowering and decrease flower numbers (see Figure 1).

The Technique Called Leveling

S. truncata grows by forming consecutive stem segments. Many growers remove the terminal segments — a procedure called leveling — near flower induction to stimulate uniform flowering for late-fall (November/December) sales.

Leveling improves the plants' shape by making them less pendulous and therefore easier to sleeve and ship, rids them of immature segments that do not produce flowers, and encourages terminal segments to form multiple flowers. However, it sometimes results in undesirable vegetative rather than floral growth.

We hypothesized that temperature and the timing of leveling with respect to the start of short days (flower induction) controlled vegetative versus floral growth on leveled plants. We tested our hypothesis with the following experiment.

Plants of *Schlumbergera truncata* 'Madisto' were obtained from a commercial grower and held in a glass greenhouse under long days at 68°F. On November 19, 10 days prior to the start of the experiment, the plants were divided by a night interruption consisting of 5 footcandles of incandescent light from midnight to 2 a.m.

Beginning November 29, six plants from each temperature group were leveled every 2 days (from 2 to 10 days prior to the start of short days and up to 10 days after they began). Black plastic was pulled over all the plants from 5 p.m. to 8 a.m. starting December 9. The last group of plants was leveled on December 19. For experimental purposes, we leveled by removing all vegetative growth

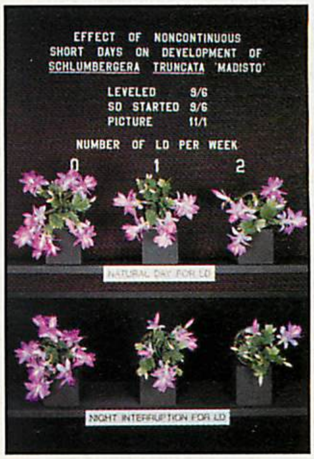

Figure 1: Influence of noncontinuous short days on *Schlumbergera truncata* 'Madisto' flowering. Long days were delivered by exposing plants to the natural long days of early September (top row) or by giving a night interruption of incandescent light for 4 hours per night.

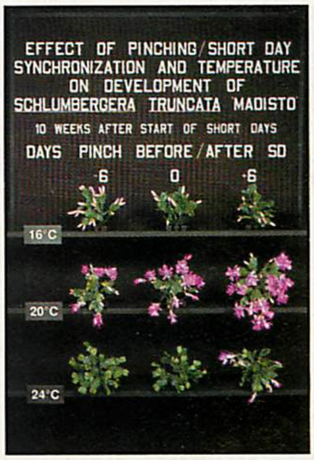

Figure 5: Influence of temperature and leveling 0 or 6 days before or after the start of short days on flowering of *Schlumbergera truncata* 'Madisto.' Plants were maintained at either 60°, 68°, or 75°F (16°, 20°, or 24°C).

Figures 2-4: The number of flowers and vegetative segments produced by each terminal segment was influenced by leveling 0, 2, 4, 6, 8, or 10 days before or after the start (on December 6) of short days at:

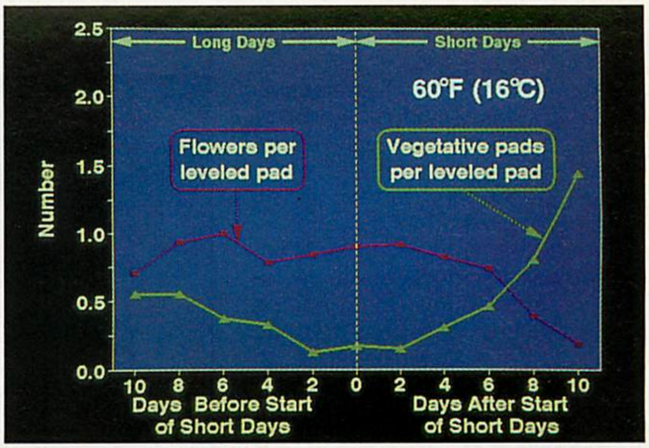

Figure 2 — 60°F (16°C)

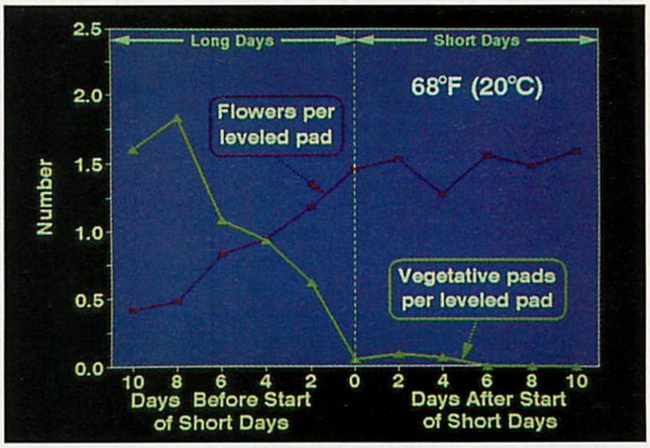

Figure 3 — 68°F (20°C)

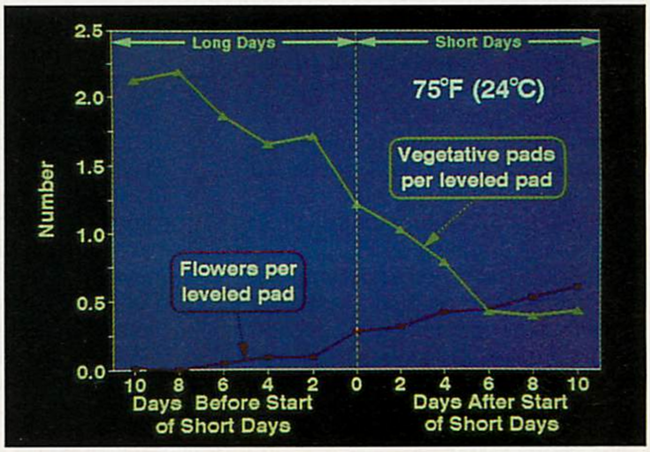

Figure 4 — 75°F (24°C)

above the fourth segment. The number of vegetative and reproductive buds at the end of each leveled terminal segment was recorded at the time of flower.

Because the number of terminal segments varied among plants after leveling, all the data presented are based on the average number of flowers and/or segments that developed from each terminal segment.

Both temperature and the timing of leveling influenced the number of flowers and segments produced by each terminal segment (Figures 2-5). As temperature increased from 60° to 75°F, the number of vegetative segments produced by each terminal segment increased across all leveling times, except on plants that were leveled after the start of short days at 60°F.

Leveling should maximize flower number and minimize vegetative growth. At 68° and 75°F, plants that were leveled on or after the start of short days produced the most flowers and the least vegetative growth (Figures 3 and 4), while those leveled before had decreased flowering and increased vegetative growth.

Leveling before starting short days gives the plants time to produce undesirable vegetative growth prior to flower induction. Plants leveled several days after the start of short days receive a sufficient number of short days to induce flowers. Buds that begin growing on these plants produce flowers, not vegetative growth.

Two Recommendations

We can make two suggestions based on the results of these experiments. First, maintain temperatures around 68°F during flower induction and until flower buds are clearly visible. Second, delay leveling until plants have received a sufficient number of short days to fully induce flowers.

At 60°F, plants may be leveled at the start of short days. At 68°F, delay leveling until 4-6 days after the start of short days. If temperature exceeds 68°F, delay it an additional 2-4 days. Even then, there might be a significant number of vegetative segments (Figure 4).

If you rely on natural short days for flower induction, plants should not be leveled before September 21-23. Natural flower initiation will occur near September 15 when daily temperatures average 68°F. If temperatures have been significantly warmer than 68°F from September 15 to 23, delay leveling a minimum of 3-5 additional days.

On Pulling Black Cloth . . .

How long should black cloth be pulled for early-flowering crops? Based on other trials we have conducted, short days started in late August or early September should be continued until at least September 20. By then, the natural days are short enough for continued flower development, assuming temperatures are kept at 70°F or less.

If temperatures are consistently

On Using Table 1

From Table 1, you can determine the average temperature needed for a particular bud length and desired number of days to flower, and the timing of flowering given a particular bud length and average temperature. In addition, you can determine the temperature and timing relationships needed for buds to grow from one length to another. The latter can be very important because many cacti are sold with large, but unopened, buds.

To use Table 1, assume you measure several buds typical of the first ones which will flower on your plants and find them to be 5 millimeters. These buds will flower in approximately 43, 31, 24, or 19 days when grown at average daily temperatures of 59°, 65°, 70°, or 75°F, respectively.

Keep in mind that the temperatures used are a 24-hour average daily temperature. One grower who used this table based temperature on his night temperature setpoint, and as a result had warmer average daily temperatures because the greenhouse warmed up during the day, and had plants ready for market too early.

Assume flower buds are 10 millimeters long and you need to market plants just in flower in 21 days. The row with 10 millimeter bud length in Table 1 shows 10 millimeter buds will flower in 22 days at 65°F; temperatures must average just over 65°F.

Table 1 can also assist you with timing. Assume plants are sold with large (but not open) buds. If buds are 5 millimeters long and plants are to be sold with 50-millimeter-long buds (or about 3 days to open bloom), what should be the average greenhouse temperature if plants are to be marketed in 21 days? Subtracting days to flower for 50 millimeter buds from days to flower for 5 millimeter buds yields 38, 28, 21, and 17 days for 59°, 65°, 70°, and 75° F. Greenhouse temperatures must average near 70°F.

When using the information in Table 1, check the progress of your buds and adjust the schedule accordingly so they do not develop too quickly or fall behind schedule because temperatures are warmer or cooler than desired.

Bud Length (mm)	Temperature 59°F (15°C)	65°F (18°C)	70°F (21°C)	75°F (24°C)
1	70	50	39	32
2	58	41	32	26
3	51	37	28	23
4	47	33	26	21
5	43	31	24	19
6	40	28	22	18
7	37	27	21	17
8	35	25	19	16
9	33	24	18	15
10	31	22	17	14
11	30	21	17	14
12	28	20	16	13
13	27	19	15	12
14	26	18	14	12
15	25	18	14	11
16	24	17	13	11
17	23	16	13	10
18	22	15	12	10
19	21	15	12	9
20	20	14	11	9
25	16	12	9	7
30	13	9	7	6
40	8	6	5	4
50	5	3	3	2
60	2	1	1	1

Table 1. Influence of bud length and temperature on predicted time to flower of *Schlumbergera truncata*.

higher, continue pulling black cloth to maintain a 14-hour night until buds are 3-4 millimeters long.

It is important to provide short days 7 days a week during the first 3 weeks of flower induction and development. Missing one or two nights a week increases the amount of vegetative growth at the expense of reproductive growth (Figure 1).

To get Thanksgiving cacti to market in flower requires proper flower induction and timing. The rate of flower development is controlled by average daily temperature, increasing as temperature increases. Once the relationship between development rate and temperature is known, the days to flower for any bud at any temperature can be predicted.

We measured numerous flower bud lengths over time on several cultivars — 'Madisto,' 'Dark Marie,' and 'Camilla' — that were grown under four different temperatures. From these data, we developed a mathematical model relating bud size and temperature to flower (refer to Table 1).

The left column gives bud lengths in millimeters and the right four columns show predicted days to open flower for these lengths at 59°, 65°, 70°, and 75°F. We found no difference in time to flower from a particular bud size among the three cultivars. **GG**

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