University of Minnesota Easter Lily
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LIGHTING LILIES AT SHOOT EMERGENCE WILL OVERCOME INADEQUATE BULB COOLING

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Stories annually circulate about lily bulb forcers whose crops failed to flower by Easter. All commercial forcers fear this situation. To reduce this possibility, lily bulbs traditionally are acquired from several sources. The most common cause for a slow forcing crop is inadequately cold-treated bulbs. Lily bulbs from Oregon and California must be given a cold treatment for rapid forcing and flowering. The common commercial cold treatment is to place the bulbs in 35° F. for 6 or more weeks.

The bulb producers and jobbers face many problems. These problems are caused by many factors such as improper weather conditions, varied harvest dates, moisture levels of peat in which the bulbs are packed, and procurement of transportation and storage facilities with proper temperatures for cooling the bulbs. All of these factors can result in varied responses, including unpredictably slow growth during forcing.

Researchers and commercial men have long attempted to accelerate growth of the Easter lily by providing supplemental light at night. Lighting was applied when it was evident that the crop was behind schedule. Such attempts were not particularly successful. Normally, lighting accelerated flowering from 7 to 10 days, but these plants were taller and frequently had fewer flowers. The conclusion was that higher forcing temperatures were the only successful means of accelerating a slow crop.

Results and Discussion

A possible "insurance policy" against slow forcing crop has been devised. A long-day light treatment properly applied can be effective on lilies (tables 1, 2, 4, 5).

Table 1. Preliminary Florida field trial. Effects of incandescent lights on mean growth responses of 'Georgia' Easter lilies.

Lighting dates[a] 1963-64	No. plants/ plot bloomed for Easter[b]	Plant height (cm)	No. weeks to bloom	Bloom date
Nov. 24 to Dec. 22	15,000	62	26.5	3/21/64
Dec. 22 to April 22	5,000	91	28.5	4/4/64
No lights - control	0	62	30.0	4/15/64

[a] Average light intensity per plot was 6 foot candles.

[b] Each plot contained 19,000 bulbs size 4 to 5's.

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Requirements for the long-day flowering response are that plants must be from noncooled bulbs and that the long-days must be applied immediately upon shoot emergence. Shoots from properly cooled bulbs and older plants are not particularly responsive to long-days (tables 1, 3).

Since noncooled bulbs eventually will flower when grown at 60°-65° F. and will not flower at 70° F. or above, a 60° F. forcing temperature regime may be considered a "slow" cold temperature treatment. Hence, by the time a forcer realizes that his plants are late for Easter, the bulbs have had their cold temperature requirement fulfilled, but at a very slow rate. Thus, long-days given to large plants and applied late in the forcing schedule are not really effective.

Research in Minnesota (tables 2, 4, 5) indicated that if newly emerged shoots from noncooled bulbs were given a long-day treatment at 15 to 30 foot-candles from 10 p.m. to 3 a.m. (5 hours) for 6 weeks, the plants would flower at about the same date as plants from adequately cooled bulbs. Thus, there appears to be a day-for-day substitution of long-days for cold treatment (tables 4, 5).

Conclusions

What is the practical application of the substitution of long-days for cold treatment? The application is routine lighting of newly emerging shoots for 2 weeks at 15 to 30 foot-candles from 10 p.m. to 3 a.m. (5 hours). Why did the authors select 2 weeks of lighting to substitute for any possible inadequate cooling? Because we felt that under commercial conditions there would rarely be a cooling inadequacy greater than 2 weeks.

Plants from inadequately cooled bulbs given long-days at the start of forcing will be accelerated and will respond as if adequately cooled. If bulbs have been adequately cooled, the long day treatment given immediately upon emergence should not be injurious (table 5). Since the long-day treatment is applied concurrently with greenhouse forcing, there is no loss in time as in cooling. Long-day treatments can be especially useful in years with an early Easter.

Since the main reason for slow forcing, delayed flowering, and missing Easter is that the bulb has not been completely saturated with cold treatment, this routine lighting, as described, is an "insurance policy" that the plant will flower for Easter.

Table 4. The substitution of LD's for cold treatment on a week for week basis with 8-9 inch 'Nellie White' lilies. Bulbs were cooled in the pot at 40° F. All bulbs were noncooled when potted on 11/1/67. Ten bulbs per treatment.

Weeks of 40° F.	Weeks of LD's	Total weeks of treatment	Date of flower	Number of flowers	Height (inches)
0	0	0	5/14	13.0	17.6
0	6	6	3/27	6.2	15.8
1	5	6	4/3	7.0	15.7
2	4	6	3/31	7.7	15.5
3	3	6	3/28	6.7	15.6
4	2	6	4/6	6.1	14.1
5	1	6	4/8	6.4	14.3
6	0	6	4/11	6.7	14.8

Table 2. Effects of long days (LD's) on noncooled 8-9 inch 'Ace' lilies in Minnesota, 15 bulbs per treatment [a, b]

No. of LD's	Date LD's began	Date of bloom	Days to bloom from pot	Plant height (inches)	Buds per stem
0	11/30	7/10	265	33.2	10.1
30	11/30	4/30	194	22.6	8.9
45	11/30	4/4	168	20.3	8.8

[a] All bulbs potted and stored 10/19/66 for 6 weeks at an average temperature of 58° F.

[b] Plants emerged on 11/23.

Table 3. Effects of long days (LD's) on plants from cooled bulbs of 'Ace' and 'Nellie White' 8-9 inch Easter lilies in Minnesota, 10 bulbs per treatment.

No. of LD's	Date LD's began	Date of bloom	Days to bloom from pot	Plant height (inches)	Buds per stem
'Ace' (potted 11/29/66)					
0	1/5	4/10	151	16.0	8.1
30	1/5	4/6	147	24.3	6.6
45	1/5	3/30	140	24.0	6.7
'Nellie White' (potted 12/14/66 emerged 1/18/67)					
0	1/19	4/30	138	11.8	4.0
30	1/19	4/20	128	13.6	3.5
45	1/19	4/18	126	18.3	4.1

Table 5. The substitution of LD's for cold treatment on a week-for-week basis with 8-9 inch 'Nellie White' lilies. Bulbs were cooled in the pot at 40° F. All bulbs were noncooled when potted on 9/30/68. 5 bulbs per treatment (Tr. No. 1-13). 10 bulbs per treatment (Tr. No. 14-25).

Treatment	Weeks of Cold	Weeks of LD	Days to Emergence	Days to Visible bud	Days to Flowering	Date of emergence	Date of visible bud	Date of flowering	Number of flowers	Number of leaves	Height	Leaves per day
1	0	0	64	215	255	12/2	5/2	6/10	10.0	169.2	15.7	0.89
2	0	1	63	224	264	12/1	5/11	6/19	11.2	210.0	19.4	1.05
3	0	2	60	228	269	11/28	5/15	6/24	9.8	220.6	17.2	1.06
4	0	3	62	195	231	11/30	4/11	5/17	11.2	191.2	14.3	1.14
5	0	4	59	147	186	11/27	2/23	4/2	8.2	116.0	12.9	0.91
6	0	5	62	148	188	11/30	2/24	4/4	7.2	107.0	17.0	0.85
7	0	6	56	140	176	11/24	2/16	3/23	7.2	98.6	18.0	0.82
8	1	0	53	236	281	11/21	5/23	7/6	13.2	236.4	23.5	1.04
9	2	0	57	209	246	11/25	4/25	6/1	11.8	219.2	19.8	1.16
10	3	0	58	177	215	11/26	3/24	5/1	10.4	134.6	15.2	0.86
11	4	0	56	138	174	11/24	2/14	3/21	8.4	104.8	15.2	0.89
12	5	0	55	137	173	11/29	2/13	3/20	6.8	83.0	16.9	0.70
13	6	0	62	130	165	11/30	2/6	3/12	7.2	72.0	16.8	0.70
14	5	1	60	132	163	11/28	2/8	3/10	7.2	82.6	18.8	0.80
15	4	2	58	129	163	11/26	2/5	3/10	6.0	88.0	20.3	0.84
16	3	3	52	127	161	11/20	2/3	3/8	6.1	98.1	16.0	0.90
17	2	4	56	130	165	11/24	2/6	3/12	6.4	101.6	16.9	0.93
18	1	5	57	141	176	11/25	2/17	3/23	6.3	101.0	17.2	0.85
19	0	6	56	140	176	11/24	2/16	3/23	7.2	98.6	20.0	0.82
20	4	2	58	129	163	11/26	2/5	3/10	6.0	88.0	20.3	0.84
21	4	3	57	122	155	11/25	1/29	3/2	5.5	90.6	18.6	0.92
22	5	2	58	127	159	11/26	2/3	3/6	5.7	83.9	19.1	0.83
23	5	3	60	126	161	11/28	2/2	3/8	5.2	78.9	21.1	0.78
24	6	2	63	126	159	12/1	2/2	3/6	5.8	75.6	22.5	0.79
25	6	3	64	127	162	12/2	2/3	3/8	6.2	74.4	18.3	0.76