

University of Minnesota Easter Lily
Research Report: Paper No. IV

LEAF COUNTING
A NEW CONCEPT IN TIMING EASTER LILIES

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The greatest concern in the mind of the greenhouse operator when forcing potted lilies for Easter is the date of flowering. "Will I make Easter?" University researchers and commercial jobbers traditionally have published forcing schedules. These schedules told when to pot the bulbs, when emergence should take place, when the plants should be at specific heights, when flower buds should be visible, and dates for the stages of development of these buds. Unfortunately, height varied from one greenhouse to the next, even with similar bulb sources and sizes. A greenhouse operator may have thought that the lily crop was on schedule and all was well, as his crop was 4 inches tall on February 1. However, some days later he was still unable to feel or observe flower bud formation, the reason being that his bulbs had not had an adequate cold treatment (the bulbs were not completely saturated with cold treatment). Therefore, when the plants did flower, they had more leaves than did plants from bulbs that had been completely saturated with the cold treatment. The key words are then leaf number; i.e., the number of leaves initiated and the ultimate number of leaves to be developed and unfolded on the stem. Blaney et al. showed the close correlation between leaf count and the number of days to flower. The leaf number and the number of days to get the leaves "out of the bulb" in order to expose the buds are important. Blaney et al., also suggested using the correlation between leaf number and days to flower for timing the Easter lily crop by a leaf remainder method. Plant height is not important in this timing technique.

Dissecting and Leaf Counting Techniques

The basis for scheduling a lily crop is then dependent upon knowing in advance the average leaf number on the flowering plant. How can this be determined on February 1? Simply select at random and cut off at soil level 10 average plants per clone when they are 4-6 inches tall. At this height the flower buds should be initiated and the total leaf complements are present. Plants of "Ace" and "Nellie White" clones should be counted separately, as the former has a higher leaf count.

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Take these shoots to a well-lighted area and count the total number of leaves. A large needle will aid in removing the very small scale-like leaves near the apex. The embryo-like flower buds should be present at the apex. Keep a record of the average number of leaves per plant. A hand lens or reading glass will aid in the unfolding and leaf counting process.

Greenhouse Leaf Counting and Forcing Steps

After the average total number of leaves to be unfolded per plant is known, randomly select 10 average plants per clone in the greenhouse and count the number of leaves that have unfolded to at least a 45° angle. Average the number of unfolded leaves per plant. These 10 plants in the greenhouse must be labeled, as they will be the reference plants for the rest of the forcing period. Their leaves will be counted and recorded on a routine weekly schedule from this point until the flower buds are visible, which should be 30 days prior to Palm Sunday. Subtract the average number of leaves that have unfolded from the average total number to be unfolded. This figure will tell you how many leaves must yet be unfolded. Since the date of emergence is known, you can calculate the average number of leaves that have unfolded on a daily basis and the number of leaves that must be unfolded on a daily basis from the date of counting to the first visible bud date.

If it has been 30 days since emergence and there is an average of 30 unfolded leaves per plant, 1 leaf has unfolded daily. If you found out that the average total complement of leaves will be 89, for example, then 59 leaves remain to unfold between this date and 30 days prior to Palm Sunday. Thus, 59 leaves must unfold in 42 days, or 1.4 leaves per day. Since the total forcing time available between emergence date and the date flower buds became visible was 72 days and the total number of leaves to unfold is 89, an average of 1.2 leaves must unfold daily.

Repeat the process at weekly intervals with the same 10 "Ace" plants. You knew last week, for example, that you had 40 leaves unfolded. This week, you find on the average 49.8 unfolded leaves. Hence, leaf unfolding progressed at the rate of 9.8 leaves in 7 days or 1.4 daily and the crop is on schedule. If fewer leaves unfolded, you are behind schedule and temperatures should be increased. Detailed information from actual trials is shown in tables 1 and 2.

Table 1. Easter 1969 data on number of leaves unfolded to a 45° angle. Ten 'Ace' and 'Nellie White' lily plants were selected at random in a commercial greenhouse

<u>'ACE'</u>				
Date	Total leaves unfolded	Average no. of leaves/plant	No. of leaves produced per period	No. of leaves per day
1-1-69	emergence			
1-27-69	573	57.3	57.3	2.12
2-3-69	707	70.7	13.4	1.96
2-10-69	780	78.0	7.3	1.04
2-22-69	982	98.2	20.2	1.84
3-4-69*	1,141	114.1	15.9	1.59

Steps:

1) From 1-27-69 to 3-30-69 (Palm Sunday) was 62 days. 2) Thirty (30) days were subtracted from the remaining 62 days for bud, thus 32 days remained for leaf unfolding. This also established that the first visible buds should be observed on 3-1-69. (Note: actually flower buds were first visible on 3-4-69, which was 26 days prior to Palm Sunday.) 3) Total number of leaves to unfold was 114.1 per plant. On January 27, 57.3 leaves had unfolded, leaving 56.8 leaves to unfold in the 32 remaining days to first visible bud date. Hence, an average of 1.79 leaves must unfold daily.

<u>'NELLIE WHITE'</u>				
Date	Total leaves unfolded	Average no. of leaves/plant	No. of leaves produced per period	No. of leaves per day
1-1-69	emergence			
1-27-69	316	31.6		
2-3-69	424	42.4	10.8	1.54
2-10-69	486	48.6	6.2	.89
2-22-69	701	70.1	21.5	1.95
3-4-69*	829	82.9	12.8	1.28

Steps:

1) From 1-27-69 to 3-30-69 (Palm Sunday) was 62 days. 2) Thirty (30) days were subtracted from the 62 remaining days for bud development, thus 32 days remained for leaf unfolding. This also established that the first visible buds should be observed on 3-1-69. (Note: actually flower buds were first visible on 3-4-69, which was 26 days prior to Palm Sunday.) 3) Total number of leaves to unfold was 82.9 per plant. 4) On January 27, 31.6 leaves had unfolded, leaving 51.3 leaves to unfold in the 32 remaining days to first visible bud date. Hence, an average of 1.63 leaves must unfold daily.

Table 2. Average total number of leaves expected on plants of clones of 'Ace' and 'Nellie White' lilies. Data are from University of Minnesota and Michigan State University studies. All figures for bulbs 8 to 9 inches in circumference.

'ACE'		
	Cooled in the case	Cooled by C.T.F. ¹ method
	90 leaves	103 leaves
	89 leaves	103 leaves
	98 leaves	107 leaves
'NELLIE WHITE'		
	Cooled in the case	Cooled by C.T.F. ¹ method
	58 leaves	77 leaves
	74 leaves	89 leaves
	72 leaves	98 leaves
	65 leaves	98 leaves

¹ C.T.F. - Controlled Temperature Forcing - (see October 1969 Minnesota State Florists' Bulletin). Note: High leaf counts mean your bulbs have been delayed in switching from the leaf to the flower bud making process. Hence, you should contact the proper authority, as your plants will require special forcing considerations.

Suggested Steps and Predictions for Easter 1970 Forcing Schedule

1. Potting Date: Dependent upon bulb cooling method used.
2. Emergence Date: By January 1, 1970.
3. Dissection and Leaf Counting Steps: By January 21, 1970, plants should be between 4 and 6 inches tall. At this time, dissect and count leaves for total leaf complement data. When all the leaves are removed, the embryonic buds should be seen as "bumps" on the apex or growing point. If these buds are not seen, contact the proper authority for further information. Your plants may require special forcing considerations.
4. Greenhouse Leaf Counting and Forcing Steps: It is 52 days between January 1 and February 21, the latter date is the predicted "first visible bud date." We can also predict that 'Nellie White' plants cooled by the CTF method will have on the average a total of 90 leaves. Then 1.7 leaves should be unfolded daily or 11.9 leaves per week. We also can predict that the 'Ace' plants cooled by the CTF method will have on the average a total of 104 leaves. Then 2 leaves should be formed daily or 14 leaves per week. Adjust temperatures according to your leaf unfolding data for forcing.
5. First Visible Bud Date: February 21, 1970. In all of our studies it has taken 30 days from first visible bud to first open flower on Palm Sunday at 65/70°-75° temperatures.
6. Palm Sunday: March 22, 1970.
7. Easter Sunday: March 29, 1970.

References

1. Blaney, L.T., D.E. Hartley, and A.M. Roberts. 1963. Preheating before pre-cooling benefits Easter lily bulbs. Florists' Review 133(3439):23-24, 70-71.
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