

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

Leaf Counting:

1. A New Technique in Timing Easter Lilies
2. Suggested Steps and Predictions for Easter 1971 Forcing Schedule
3. Recapitulations of Easter 1970 - Leaf Counting Data

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1. A New Technique in Timing Easter Lilies

The time honored method used to determine if the lily crop was on schedule for Easter was to observe the heights of the plants. This method has several basic flaws in that heights vary between greenhouses, geographical regions, clones, sources, methods of cooling, and years. Further, no attention was paid to the basic leaf number or total leaf complement. If bulbs have had the proper cold temperature treatment, the basic leaf number is similar or stable between greenhouses, geographical regions, clones, sources, methods of cooling, and years (Table 1).

The knowledge of the basic leaf number can be very useful. For example, if the total leaf number for the 1970-71 lily crop is unusually higher than normal this means that the bulbs had not received the proper cold treatment. Hence, the bulbs were in the leaf making or vegetative condition for a longer period of time, will have more leaves to develop and unfold, and thus will take longer to flower. Therefore, the forcer should begin high temperature forcing immediately for rapid growth and flowering. Further, the basic leaf number information can be formulated into data on how many leaves have been unfolding and consequently how many leaves must be unfolded on a future daily or weekly basis in order to reach visible bud stage and the consequent first open flower stage. This type of data can be formulated early in the forcing period, weeks before it is obvious that there may be a serious problem in forcing for Easter flowering.

The concept of the importance of leaf number and their rate of development in correlation to days to flower was formulated by Blaney et al in 1963 and 1967 (1,2). Wilkins and Roberts (4) formulated a practical guide to follow the leaf development/counting technique in 1969. Roberts also published a report in 1969 on this subject stating, "We foresee the time when bulbs with predictable leaf counts can be delivered to the greenhouse grower All that is needed is to practice using the method and develop precision in its use." (3)

The key words are total leaf number; i.e., the total number of leaves initiated, or the ultimate total number of leaves to be developed and

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unfolded by the flowering plant. The basis for scheduling is thus dependent upon knowing in advance the average leaf number for the 1971 Easter lily crop. When the total average leaf count is determined, the number should be compared to Table 1 to see if the number is abnormal. If, for instance, the leaf number is abnormally high, elevated temperature forcing must commence immediately.

Steps in Dissecting and Leaf Counting Technique

1) Observe and record an estimated date of shoot emergence. 2) When the plants are 4 - 6 inches tall flower buds should be initiated and the total leaf complement present. 3) Cut shoots off at soil level. Random sample lots of ten should be taken for every 2000 bulbs from each clone and bulb source. 4) Take these shoots to a well-lighted area, count, record, and average the total number of leaves per sample lot. A large needle and magnifying lense (reading glass) will aid in removing the very small scale-like leaves near the growing point. The embryo-like flower buds should be present. An estimate of the future bud count can also be made at this time if desired.

After the plants have flowered it is interesting to take a survey and to determine what the actual leaf counts were and how did these data compare to your predicted data taken weeks before. All this information should be recorded for future reference and personal comparative information.

Greenhouse and Leaf Counting Steps

- 1) Return to the greenhouse, randomly select and mark ten average plants which will correlate to the individual sample lots whose total leaf counts were just determined. Count and average the number of leaves that have unfolded to a 45° angle from these plants. A bamboo stake with an attached paper label wired to the stake will aid in marking the representing plants and in recording the weekly individual leaf data. These plants will have their leaves counted and recorded on a routine weekly schedule from this point until the flower buds are visible, which should be 30 to 35 days prior to Palm Sunday.
- 2) On a routine weekly basis count and record the number of leaves unfolded to a 45° angle from the stem. The last individual leaf counted can be marked weekly by a paper punch or some method to avoid repetitious counting.
- 3) Subtract the average number of leaves that have unfolded from the predicted average grand total of leaves. This will tell how many leaves there are yet to be unfolded.
- 4) Divide the number of leaves already unfolded by the number of days from the emergence date, to date. This will tell how many leaves have been unfolding on a daily basis.
- 5) Determine the visible bud date. This date is 30 to 35 days prior to Palm Sunday. It takes 30 days, at a minimum, to develop an open flower from the date first visible buds are seen.

- 6) Divide the number of leaves left to be unfolded by the number of days left from date of counting to 30 days prior to Palm Sunday or visible bud date. This figure will tell you how many leaves you must unfold on a daily basis in order to make the estimated visible bud date.
- 7) On a routine weekly basis count, record, and determine the average number of leaves unfolded on a daily basis for the previous week. Compare the data and determine if the leaf number was greater or smaller than the desired number which were required to keep the crop on time.

2. Suggested Steps and Predictions for Easter 1971 Forcing Schedule:

- 1) Potting Date: Depends on bulb cooling method used.
- 2) Emergence Date: No later than January 15, 1971.
- 3) Dissection and Leaf Counting Steps: By January 29, 1971, plants should be between 4 and 6 inches tall. At this time dissect and count leaves for the total leaf complement. If embryonic flower buds (bumps) are not seen on the apex, contact the proper authority for further information.
- 4) Greenhouse Leaf Counting and Forcing Steps: It is 49 days between January 15, date of emergence, to March 5, 1971, the date of predicted first visible buds. For example, we can also predict that 'Nellie White' plants will have on the average 89.6 leaves, 1.82 leaves should be unfolded daily or 12.74 leaves per week. Calculate the average number of leaves unfolded daily from emergence date to date of observation. Adjust temperatures for rate of forcing according to your leaf unfolding data by comparing the rate which the leaves have unfolded to the rate which the leaves must unfold to make Easter.

5) Leaf Counting Dates:

Date	Days before Visible Bud Date	Days to Palm Sunday
January 29, 1971	35	65
February 5	28	58
February 12	21	51
February 19	14	44
February 26	7	37
March 5	Visible Bud Date	30

- 6) First Visible Bud Date: March 5, 1971. In all our studies it has required 30 days at a minimum for first visible buds to first open flowers on Palm Sunday at 65° / 70° - 75° F. temperatures.
- 7) Palm Sunday: April 4, 1971 - First Open Flower
- 8) Easter Sunday: April 11, 1971 - Sold Out

Table 1

Average total number of leaves expected on plants from the 'Ace' and 'Nellie White' clones. Data are from University of Minnesota and Michigan State University¹ and collected over a period of three years. All data are from 8 to 9 inch circumference bulbs.

'Ace'			
	Cooled in case		Cooled by C.T.F. ² method
	90 leaves		103
	89 leaves		103
	98 leaves		107
	102 leaves		103
Average	95.75 leaves	Average	104 leaves
'Nellie White'			
	Cooled in case		Cooled by C.T.F. ² method
	58 leaves		77
	74 leaves		89
	72 leaves		98
	65 leaves		98
	79 leaves		86
Average	69.6 leaves	Average	89.6 leaves

1. The author is indebted to Dr. A. A. DeHertogh, Michigan State University, for his aid.
2. C.T.F. - Control Temperature Forcing - (see October 1969 Minnesota State Florists' Bulletin). Note: High leaf counts means the 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.

3. Recapitulation of Easter 1970 Forcing Season

- Leaf Counting Data -

Easter 1970 data on the average number of leaves unfolded to a 45° angle are shown below. Thirty 'Ace' and fifty 'Nellie White' lily plants from 8 - 9 inch bulbs were selected at random from five commercial greenhouses. All bulbs had been cooled by the C.T.F. method.

'Ace': Estimated 85.87 leaves per plant. This was determined on 1-21-70 by dissecting plants and counting leaves. Actually 103.20 leaves per plant appeared at maturity.

Date	Average no. leaves per plant unfolded	Estimated no. leaves to unfold	Average no. leaves unfolded in period	Average no. leaves per day unfolded	Estimated no. leaves to unfold per day to make visible buds on 2/22/70
1-10-70	Average emergence date				
1-21-70	24.20	61.67	24.20	2.20	1.93
1-28-70	37.43	48.44	13.23	1.89	1.94
2- 4-70	52.30	33.57	14.87	2.12	1.87
2-11-70	69.43	16.44	17.13	2.45	1.49
2-18-70	84.70	1.17	15.27	2.67	.29
2-22-70	Estimated date of visible buds. However, there was a six day delay until 2/28/70, which was only 24 days to Palm Sunday				
2-28-70	103.20	Underestimated by 17.33 lvs.	18.50	2.05	---
3-22-70	Palm Sunday - by in large 98% of the crop made open flower by desired date				
3-29-70	Easter Sunday				

'Nellie White': Estimated 82.44 leaves per plant. This was determined on 1-21-70 by dissecting plants and counting leaves. Actually 85.50 leaves per plant appeared at maturity.

Date	Average no. leaves per plant unfolded	Estimated no. leaves to unfold	Average no. leaves unfolded in period	Average no. leaves per day unfolded	Estimated no. leaves to unfold per day to make visible buds on 2/22/70
1-10-70	Average emergence date				
1-21-70	20.80	61.64	20.80	1.89	1.93
1-28-70	35.01	47.43	14.21	2.03	1.90
2- 4-70	47.50	34.94	12.45	1.78	1.94
2-11-70	62.68	19.76	15.18	2.17	1.80
2-18-70	76.90	5.54	14.22	2.03	1.39
2-22-70	Estimated date of visible buds - little or no delay.				
	85.50	Underestimated by 3.06 lvs.	8.60	2.15	---
3-22-70	Palm Sunday - by in large no difficulty in forcing crop into open flower				
3-29-70	Easter Sunday				

Steps:

1) From 1-21-70 to 3-22-70 (Palm Sunday) was 62 days. 2) Thirty (30) days were subtracted from the 62 days for bud development. Thus, 32 days remained for leaf unfolding. This also established the estimated date of first visible buds, which was to have been on 2-22-70. 3) Total number of leaves to unfold was estimated at 85.87 per plant for the 'Ace', and 82.50 for the 'Nellie White'. 4) On 1-21-70 the 'Ace' had unfolded 24.20 leaves, leaving 61.67 leaves to unfold in the 32 remaining days to first visible bud date. Hence, an average of 1.93 leaves must unfold daily. The 'Nellie White' had unfolded 20.80, leaving 61.64 leaves to unfold in the 32 remaining days to first visible bud date. Hence, an average of 1.93 leaves must unfold daily.

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