Easter Lily Progress Report

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The Easter lily has been for years our traditional Easter flower, and an estimated 6.5 million plants are grown annually for this season. There are, however, a number of outstanding difficulties to be resolved in forcing this crop. At the present time it is extremely difficult to force lilies with the precision now possible with chrysanthemums and poinsettias. Obvious difficulties hindering the precise growing of lilies include the rather doubtful reaction of the plant to photoperiod, and the fact that Easter falls on a variable date.

The lack of uniformity in growth of the crop, not only from greenhouse to greenhouse but from bench to bench in the same house is a problem and may well be even more pronounced when the bulbs have been obtained from different sources. Much of this variability may be due to different treatments the bulbs receive before and during harvesting, during shipment across the country, or while they are in cold storage, but uneven or unsuitable greenhouse temperatures during the forcing period must bear much of the blame. Even if a grower does have accurate temperature control there is not a great deal of guidance available to him concerning suitable night and day temperatures, and their effect upon height, quality and time of flowering. So to produce a satisfactory crop of lilies correctly timed for Easter the grower still has to rely upon a considerable fund of experience.

These were some of the reasons why a preliminary study was begun in 1959 in an attempt to find the effect of different night and day temperatures and photoperiods on the growth and development of the Easter lily.

Cultural Details

Croft bulbs 8 to 9 inches in circumference were placed in cold storage at 34° F, where they remained for four weeks. This made a total cold storage period of nine weeks when added to the period they had received before delivery. On December 16, 675 bulbs were individually numbered and potted into five-inch clay pots. The soil mixture consisted of equal parts of sterilized loam, peatmoss and perlite, and had a pH of 7.2. The bulbs were planted with their tops one inch below the surface of the soil to ensure uniformity of recording.

The soil in the pots was kept moist, but not waterlogged, at all times. Since the soil mixture was low in nutrients, soluble fertilizers were applied from mid-January onwards. These applications were made weekly using calcium nitrate and every third application was replaced by potassium nitrate. All were at the rate of 2½ lbs. of material in 100 gallons of water. When signs of leaf scorch

Lily Report

(*continued from page 1*)

appeared in late February its spread was checked by increasing the frequency of the fertilizer applications to twice weekly and maintained at this level until the plants flowered.

All pests were controlled by an application of systox (Demeton) to the pots at the rate of one pint of a 23% formulation in 100 gallons of water when the plants became over six inches tall.

Temperature Treatments

Five greenhouse compartments were maintained at temperatures of 50°, 60°, 65°, 70° and 80° F. Day and night combinations of these five temperatures were used which gave a total of 25 treatments. Ten plants were grown in each treatment. The plants were moved at 8:00 am and 4:30 pm daily. For example, the five treatments grown at a *day* temperature of 50° were moved at 4:30 pm to the 50°, 60°, 65°, 70° and 80° houses. Similarly, the five treatments grown at a *night* temperature of 50° were moved at 8:30 am to the five constant temperatures.

Photoperiodic Treatments

Fifty plants were placed at each of the five temperatures (50°, 60°, 65°, 70° and 80° F) in order to record the growth and flowering response to daylength. Half of the plants at each temperature were given a 9-hour photoperiod, and the other half were given an 18-hour photoperiod. Black cloth was pulled over all the plants at 5:00 pm and removed at 8:00 am. This produced a 9-hour photoperiod. The 18-hour photoperiod was obtained by using 60-watt incandescent lamps to provide a light intensity of from 10 to 20 foot-candles for 9 additional hours. This amount of incandescent light was not sufficient to raise the temperature under the black cloth more than one degree F.

Results

The flowering date was recorded when the first flower was open on half of the 10 plants in each treatment. Height was measured from the rim of the pot to the top of the stem. The number of flowers obtained was the average of the 10 plants. The results for the flowering date, height and number of flowers are shown in Table 1.

If we regard 100 to 125 days forcing time and an average of not less than 4.4 blooms per plant as being satisfactory, and bearing in mind those treatments which produced the best plants in terms of appearance and foliage color, then the most desirable plants were those produced under the nine treatments in the bold print in Table 1.

This preliminary work on lilies has given us answers to some of the forcing problems and has also presented new ones.

Timing

From Table 1 we can see that temperature had an effect on the speed of flowering. The warmer temperatures used during either the night or day decreased the length of time necessary for flowering. Night temperature had the greatest effect. The photoperiods used in this work had only a slight effect, with the long (18-hour) photoperiod plants blooming faster.

Height

Again from Table 1 we can see that generally temperature was not too important in determining height of the lily. The greatest variation was 11 inches, but there was no consistency or trend in the treatments. The problem is then, what is controlling the height? There appears to be some correlation with the moisture level of the soil and this will be investigated this year. The work with the two photoperiods (9- and 18-hours) did show that photoperiod was important in the control of height in the lily (Figure 1). The 18-hour photoperiod produced

(*continued on page 6*)

Table 1. The effect of day and night temperatures on number of days to flower, height in inches and average number of flowers on Croft lilies. The numbers in the bold print were considered the most desirable plants.

Night Temperature (°F)	Day Temperature (°F) 50	60	65	70	80
50	155*	141	137	133	132
	4.1†	4.6	4.8	4.7	4.6
	14‡	15	14	14	16
60	**124**	**110**	**109**	**101**	**107**
	4.6	**4.5**	**4.8**	**5.1**	**4.4**
	14	**16**	**17**	**18**	**18**
65	**116**	**105**	**106**	106	103
	4.4	**4.8**	**4.7**	3.4	3.6
	14	**17**	**16**	12	17
70	**103**	95	96	86	87
	4.7	3.9	2.5	2.5	2.4
	15	17	13	19	21
80	83	81	78	81	75
	3.0	2.3	1.7	1.7	1.7
	17	17	16	17	23

* Number of days to flower
† Average number of flowers
‡ Height in inches.

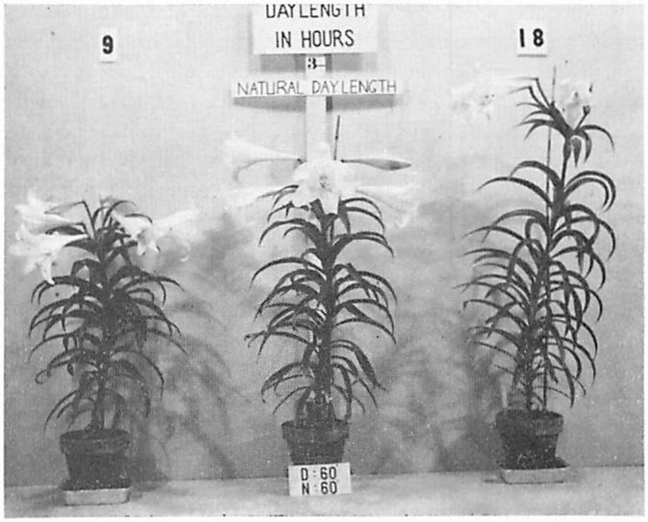

Figure 1. The effect of photoperiod on the growth of lilies. The plant on the left was grown under a 9 hour photoperiod, the plant in the middle under natural photoperiods and the plant on the right under 18 hour photoperiods. These lilies were grown with a 60° F constant temperature.

Lily Report

(*continued from page 2*)

plants which were just about twice as tall as the 9-hour treatments. This was true at all of the five temperatures used (50°, 60°, 65°, 70° and 80° F).

Bud Count

This is perhaps the most interesting and most important aspect of this problem. The effect of temperature on the bud count can be seen in TABLE 1. High night temperatures and/or high day temperatures reduced the bud count; none of the other temperatures greatly affected the bud count. It must be remembered that these plants were started and run to flowering at the same temperatures, which is not the treatment given to most commercially grown lilies. The problem now is to find the effect of these temperatures on the various stages of lily development.

There were only three blasted buds (buds of visible size that turn brown and die) in all of these treatments, in spite of the fact that plants were moved from 50°F days to 80°F nights or vice versa. This indicates that blasting is not directly related to temperature. More work is, however, being done with this problem as many times it is a problem with commercial growers.

Another problem that was rather puzzling was the limited number of buds that we were able to achieve. The greatest average bud count was 5.1 and the largest single plant count was 6. This was interesting because the lily is an indeterminate plant and should produce many flowers. The limiting factors should be available water, nutrients and light. A more careful check into this problem showed us that this maximum number of 6 flowers was determined when the plants were only a few inches tall (this was done by dissection and inspection under the microscope). Why then were the bulbs limited on the number of flower buds? The answer appears to be in the conditions during the period from when the bulbs were dug in the field until the shoots had started to grow. Our educated guess is the storage period. This phase of lily forcing is being investigated this year.

Conclusions

Since this was a preliminary study definite recommendations cannot yet be made. However, some of the treatments used produced results so undesirable that recommendations can at least be made regarding greenhouse conditions which should *not* be employed for forcing Easter lilies.

We caution against the use of high night temperatures (70° and 80° F) and high day temperature (80°F) especially during the early stages of growth, since they produce such a drastic reduction in bud count. At the other extreme, a low night temperature of 50°F did not greatly increase the bud count while, at the same time, it did slow growth considerably. 60°F appeared to be the best night temperature to use.

The factors affecting plant height are still not definitely known, although it appeared from this work that temperature was not playing a big part. Photoperiod has given us the best lead toward controlling height, and it can now be suggested to growers of lilies for cut flowers that they try long photoperiods (18 hours) on a trial number of plants to increase stem length.

We hope to report on answers to many of the outstanding problems next year.