

EASTER lily bulbs require 1000 hours (six weeks) of cooling at 40°-45°F to induce normal flower initiation and development. Three cooling methods are commonly used to meet this requirement: case cooling, natural cooling, and control temperature forcing (CTF). All three techniques require both cold and moisture for proper flower induction.

Case-cooled bulbs are cooled on arrival, in the shipping case in which they are packed. Root development occurs after potting during forcing.

By contrast, natural-cooled and CTF bulbs are potted first and then cooled. Naturally cooled bulbs are potted and placed outside, relying on cool weather to provide appropriate temperatures for cooling. Since outside temperatures are not consistently in the 40°-45°F range, some root development occurs.

CTF is a procedure by which bulbs are potted first and temperatures are intentionally maintained at 63°F for one to three weeks to promote rooting. The potted bulbs are then cooled using a cooling facility.

Technique Affects Plant Shape

Case-cooled plants typically have short lower leaves with long lower internodes, which gives these plants an "ice cream cone" appearance. However, longer lower leaves and shorter lower internodes are characteristic of natural-cooled and CTF lilies.

Rooting lily bulbs with a warm period prior to cooling has long been associated with longer lower leaves, shorter lower internodes, and an increased flower bud and leaf count. Natural-cooled and CTF cooling normally produces superior plants compared to plants grown from case-cooled bulbs. The presence of roots before and during cooling has always been accredited with these benefits.

We questioned if the increase in flower and leaf number of pot-cooled bulbs was due solely to the presence of roots during cooling, or if the period of three weeks at 63°F itself af-

To produce better Easter lilies . . .

Keep Roots Healthy During COOLING

by NATHAN LANGE and ROYAL HEINS

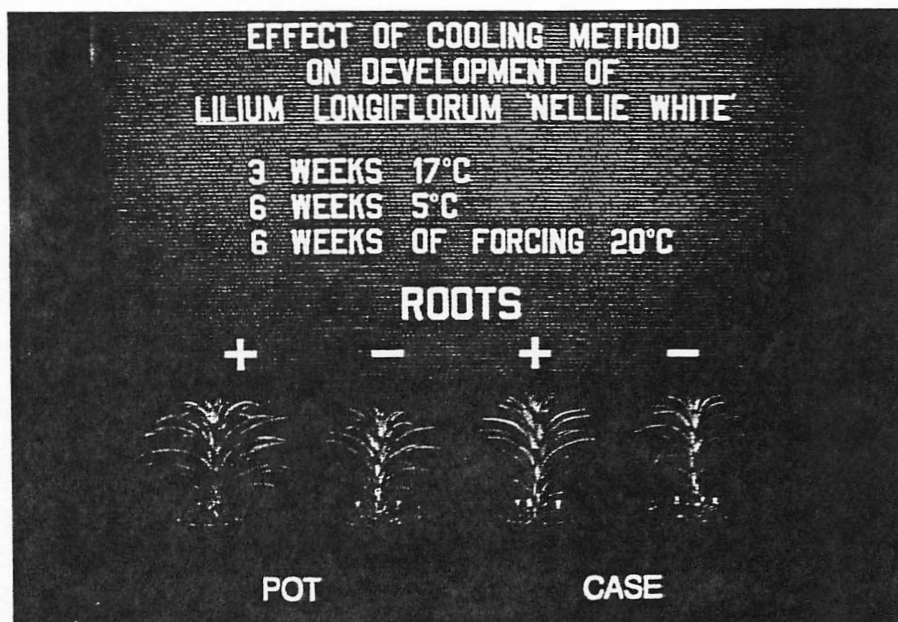


Figure 1. The effect of removing roots from CTF (pot) and case-cooled lilies after 3 weeks at 63°F on plant growth and development after 6 weeks of forcing at 68°F. Bulbs were cooled for 6 weeks at 40°F after root removal.

fects the bulbs by increasing the number of leaf primordia in the meristem.

The Experiment

We, therefore, conducted an experiment to determine the importance of roots compared to exposure of bulbs to warm temperatures near 63°F prior to cooling.

Size 8/9 lily bulbs were either

case-cooled or pot-cooled prior to forcing. Case-cooled conditions consisted of placing 20 Easter lily bulbs in a plastic bag with 4 liters of Bacto Mix potting medium from Michigan Peat Co. Pot-cooled lilies were planted in 6-inch standard plastic pots using the same medium.

All bulbs (case and pot) were then placed at 63°F for either zero, one, two, three, four, or five weeks. At

8(9)

Table 1. Influence of 3 weeks at 63°F on lily morphology at flower and time to flower. Roots were removed from bulbs on arrival or after 3 weeks at 63°F.

Characteristics	Difference between 3 weeks and 0 weeks of roots
Time to flower (days)	-9 (-11%)
Leaf number	+2 (+2%)
Length of 10th leaf (inches)	-0.3 (-14%)
Height of 10th leaf (inches)	-0.1 (-6%)
Total plant height (inches)	0 (0%)

the end of each week, bulbs were prepared for cooling. Half of the selected bulbs in pots were unpotted and all roots were cut off at the basal plate. These bulbs were then repotted as before. Half of the case-cooled bulbs also had their roots removed, and the bulbs were replaced in the plastic bag. Bulbs were then placed at 41°F for six weeks.

After cooling, bulbs were forced in a glass greenhouse maintained at 68°F until flowering. The time of visible bud, flowering, final plant

height, leaf number, and flower number were determined for all plants. In addition, the length of the 10th, 20th, and 30th emerged leaf as well as their heights above the soil line were determined at flowering.

The four programming/rooting treatments will be referred to as case-cooled with or without roots, and pot-cooled with or without roots.

The Results

The relative effects of rooting time at 63°F versus the presence or ab-

sence of root was determined by comparing characteristics of plants from different treatments. The effect of rooting time was determined by comparing pot-cooled bulbs without roots that were cooled immediately (zero weeks rooting) versus pot-cooled bulbs without roots which were cooled after three weeks of rooting. Other than plants flowering earlier, the three-week rooting period had no significant horticultural effect on leaf number, leaf length, plant height, and flower number (see Table 1).

In contrast, the presence or absence of roots had a profound influence on plant appearance (Figure 1). Removal of all roots prior to cooling decreased lower leaf length while it increased lower leaf internode length and total plant height (Table 2). Leaf number increased slightly, while time to flower and flower number decreased.

All responses to root removal were magnified on plants rooted for three weeks, in comparison to removing



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Table 2. Influence of root removal just prior to cooling on lily morphology at flower and time to flower. Roots were removed from bulbs on arrival or after 3 weeks at 63°F.

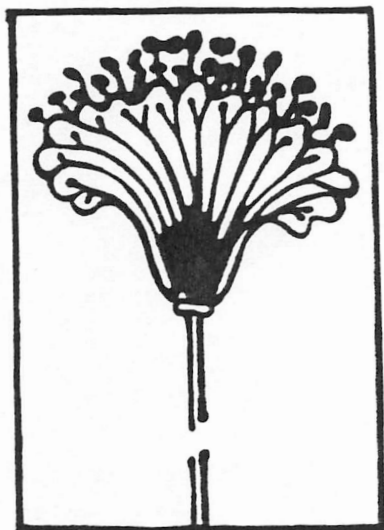
Characteristics	On Arrival		After 3 Weeks	
Time to flower (days)	-1	(-1%)	-9	(-11%)
Leaf number	+3	(+4%)	+6	(+7%)
Length of 10th leaf (inches)	-0.3	(-18%)	-1	(-33%)
Height of 10th leaf (inches)	+0.25	(+11%)	+0.6	(+68%)
Total plant height (inches)	+2.8	(+13%)	+3.5	(+18%)
Flower number	0	(0%)	-2.8	(-33%)

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roots from bulbs without any rooting time.

Many growers often produce CTF-programmed lilies which look like case-cooled lilies — i.e., the plants have short lower leaves and long lower internodes. These results indicate the lack of a CTF response is due to poor root development during the warm rooting period.

Why Poor Development?

Poor root development can be caused by several factors. Lack of oxygen is a likely cause in many situations: Some growers pot their bulbs directly on the bottom of the pot, then water them heavily. Such irrigation will create a saturated media zone at the bottom of the pot where the bulb's basal plate rests. Oxygen diffuses very slowly through saturated soils. Root development is slowed and/or inhibited by the low oxygen.

To avoid slow root growth due to low oxygen, bulbs should be planted with some medium under the bulb, and/or enough water should be applied to just wet the media without creating a saturated zone at the bottom of the pot.

The results from this experiment confirm the benefits of the CTF system of lily programming. They show the benefits of the CTF system come from root development, not from the warm period prior to cooling. This is an important point because following the CTF potting and temperature program does not in itself guarantee longer lower leaves and higher bud counts. **GG**

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