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FORCING PROGRAMS FOR EASTER LILIES

Following a series of relatively cool growing seasons (1973-76) accompanied by relatively small bulb harvests, we have had two seasons (1978 and 1979) when soil and air temperatures along the southern Oregon and northern California coast were warm and favorable for growing large bulbs. If we compare the 1973 season, when we had one of the smallest crops on record, with the very large bulbs produced in most fields the past two seasons, we find that the large crops were quite dormant (degree of daughter axis elongation at harvest), whereas bulbs in a number of fields in 1973 were actually sprouting in late September before harvest.

We have previously proposed that bulb maturity at harvest be evaluated on the basis of:

(1) Bulb weight or extent of scale filling;

(2) Degree of daughter dormancy remaining (correlative inhibition);

(3) The nature and extent of initiatory activity of apical meristems (daughter and mother axis); and

(4) The responsiveness of the daughter axis to flower-inducing cold and/or light treatments.

On the basis of a detailed study of weather records, crop yields and greenhouse forcing performances during the past several years we are now in a better position to evaluate the above criteria and modify our definition of bulb maturity. We will consider each index separately before considering the feasibility of using them in an integrated definition.

Bulb Size - Large bulb sizes and crops are associated with long, warm (soil temperatures) growing seasons starting in early March and continuing until early October. There is no substitute for early daughter development, when scale numbers are being determined, and early flowering (mother axis), when daughter scale initiation ceases, daughter leaf initiation starts, and scale filling increases in intensity. Flowering in late June is indicative of large bulb potential. The presence of large numbers of daughter scales and scale initials at this time are also indicative of large bulb potential. Continued warm air and soil temperatures (65-70°F) coupled with maintenance of a healthy leaf canopy into late September and early October will facilitate attaining full bulb potential. Scale filling will continue as long as the daughter axis remains dormant. When it starts to move (elongate) scale filling drops off rapidly, hence the positive correlation between large bulbs and high degree of daughter dormancy in warm seasons. This suggests that we can have very large and very mature bulbs that are also very dormant as far as daughter shoot elongation is concerned. However, it does not mean that the bulbs will not respond rapidly to dormancy - removing cold treatment. This was strikingly illustrated this forcing season.

Bulb Dormancy - Removal of daughter dormancy prior to or after harvest is enhanced by temperatures from 50-60°F. The bulbs become increasingly responsive to these dormancy-removing temperatures with increasing age or development (days from anthesis of mother axis). We believe this to be the result of mother axis perceiving the short days and falling temperatures of approaching autumn. We are finding that healthy foliage on the mother axis is critical during this phase, and crops defoliated prematurely by botrytis or other causes are significantly impaired in forcing programs. We, therefore, propose to measure the degree of bulb dormancy remaining at harvest on the basis of number of hours below 60°F (critical soil temperature) experienced by the bulb after a critical stage of plant development (mother anthesis), when the daughter becomes responsive to cold. It is also anticipated that respiration levels in the daughter bulb may reflect the acquisition of a chilling requirement for rapid daughter elongation.

It is significant that in both 1978 and 1979, when we had large, very dormant bulbs at harvest, following warm summer temperatures, the bulbs responded sharply to standard cold treatments and emerged without delay in forcing. This supports our contention that bulb dormancy is not indicative of immaturity and one can have large, dormant, mature bulbs or small, relatively immature, nondormant bulbs as we had in 1973. Or, put in another way, the degree of daughter dormancy or elongation at harvest is not a valid criterion for bulb maturity anymore than a green winter pear is necessarily immature at harvest. If both are capable of responding to environmental stimuli as they proceed into their next phase of development, they are mature.

Leaf Count - A leafy plant is desirable in a greenhouse-forced lily if it does not complicate forcing time. The leafy plant will usually present a better "plant picture" and has the potential to produce more flowers. Approximately half of the leaf primordia that will develop during greenhouse forcing are normally on the daughter axis at time of bulb harvest. The remaining leaves are initiated during storage and early stages of greenhouse forcing and their number is determined by the flower-inducing cold treatment given and <u>the responsiveness of the bulb</u> to treatment. We think the number of leaf primordia at harvest and the number initiated subsequent to this are indicative of daughter responses to soil temperatures in the field prior to harvest and during storage treatment, respectively. Evidence shows that field temperatures in vicinity of 50-60°F favor more rapid daughter shoot elongation, more rapid leaf initiation and as a consequence a larger apex diameter at harvest. The same temperatures in storage favor the same responses. Longer exposure to these temperatures in the field and/or dropping them to 40°F in storage will favor rapid flower induction, cessation of leaf initiation and beginning of flower initiation.

A high leaf primordia count at harvest is indicative of maturity for one. of two reasons or both:

(1) The crop is early, the mother axis flowered early and there has been an extended period from anthesis to harvest for leaf initials to be formed, or

(2) The daughter bulb has been experiencing considerable exposure to favorable leaf-making and sprout inducing temperatures, namely 50-60°F.

Either case or a combination of the two results in high leaf primordia counts at harvest which influences total leaf count, growth-rate and flower count during forcing and is thus a valuable maturity index. This combination of conditions occurred in 1978 and resulted in higher than normal leaf primordia counts (42). Primordia counts at harvest in 1976, 1977 and 1979 have been uniformly 30-35, for both 'Ace' and 'Nellie White.'

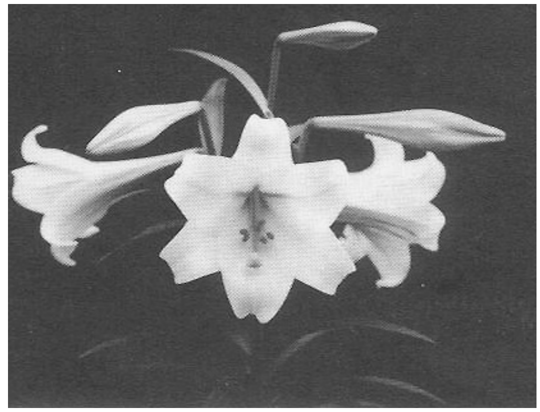
It should be evident to the reader by this time that there is no close correlation between bulb size, leaf primordia count and degree of bulb sprouting. However, large bulbs normally contain more daughter leaf initials at harvest and/or initiate and expand leaves more rapidly than small ones following dormancy-removing and flower-inducing cold treatments. In general the larger the bulb the higher the leaf initial count at harvest the larger the apical dome and the greater the flowering potential.

Responsiveness to flower-inducing cold treatment - Mature bulbs should respond sharply to flower-inducing cold treatment (40°F optimum) with marked reduction in number of leaf initials formed after harvest as a result. Thus in 1978 our 7 to 8" 'Nellie White' bulbs had 42 leaf primordia at October 1 harvest and with coldframe treatment produced 21 more leaf primordia before initiating flowers (total 63 leaves). This indicates sharp response to cold induction. In contrast, the 'Nellie White' crop this year (1979) had 30 leaf primordia in bulbs of comparable size at harvest and produced 40 more before flower induction. This could indicate differences in coldframe environment in the two years of forcing temperatures, but the induction response coupled with the lower initial count at harvest could indicate somewhat less mature bulbs at harvest.

Conclusions - Since our studies show dormant bulbs to respond nicely each year to standard dormancy-removing treatment (6-8 weeks at 40° to 50°F), we are inclined to drop degree of daughter dormancy remaining from our list of harvest maturity indices (HMI) and admit that we can have perfectly mature bulbs that have varying degrees of dormancy remaining. We will soon be in a position to give estimates on how many hours of dormancy-removing temperatures the bulbs have received prior to harvest. The degree to which the daughter sprout has elongated in the bulb is, in itself, a good indicator of growth activity.

This leaves us with the ratio of bulb size to number of daughter leaf initials in the bulb as our best harvest maturity index. The relative weight of daughter to mother scales is another factor to take into consideration. Although of little value in assessing bulb maturity at harvest, the number of leaves produced after harvest and before flower initiation is certainly indicative of bulb responsiveness to flower-inducing treatment and can be used as a measure of maturity, even if after the fact. Indications are that the larger the number of leaf initials at harvest the more responsive the bulb is to flower-induction stimulus and hence, the less leaf initials formed after harvest. These relations need further verification.

OSU 73-74, one of the Oregon State University Easter lily selections from the research program of Dr. A. N. Roberts, is being considered for release and propagation by the Pacific Bulb Growers Association.



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