

Inside West Coast Easter Lily Production

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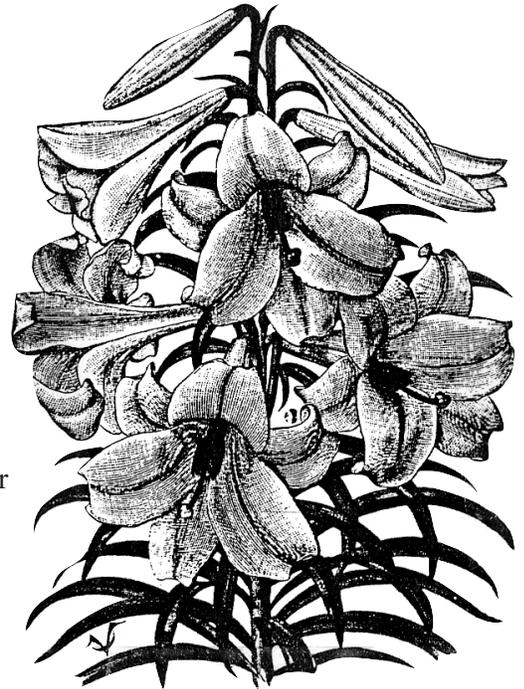
The North American Easter lily (*Lilium longiflorum*) industry is very unique. In the U.S., Easter lily ranks among the top five flowering potted plants in sales and stands apart from other major crops by having an extremely narrow marketing window (one week before Easter), one major cultivar ('Nellie White'), and nine bulb growers in a limited geographical area. We learned more about this crop firsthand when we attended the annual Easter Lily Research Foundation (ELRF) field days June 28 and 29th, 2002 in Brookings, Oregon. The purpose of our visit was to

gain a greater understanding of Easter lily bulb production and obtain grower feedback on some lily breeding ideas we are pursuing.

After World War I, lily production in the Smith River, CA / Brookings, OR region dramatically expanded due to severed trade with Japan, the previous source for most Easter lily bulbs in the United States. This limited coastal region (border of California and Oregon) is especially well-suited for Easter lily production and mimics the climate of Easter lily's native Japan. South-facing valleys

provide protection from cold North winds, along with the moderating effect of the ocean, creating a climate perfect for Easter lilies. Long cool summers with soil temperatures warmer than the air allows for optimum carbohydrate accumulation and bulb expansion. Warm soils helps to stimulate bulb growth, while cooler air temperatures help to reduce respiration in shoot tissues.

Many of the initial Easter lily



growers were dairy farmers that decided to diversify and take advantage of the high return possible from this alternative crop. In the 1940's bulbs were selling for \$1.00 each (Clark 1949), approximately what wholesale lily bulbs are selling for today! Growers were quite protective of their valuable crop and some would even guard their lilies with shotguns! Initially, many *L. longiflorum* genotypes were grown and consisted of any propagation material they could get their hands on. Eventually, superior cultivars emerged such as 'Ace', 'Croft', and 'Nellie White'. These genotypes are associated with, and named by, particular growers.

Over the years many growers left the lily business due to a saturated market, increased competition, and production challenges including pesticides

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being removed from the market without effective substitutes. Out of the hundreds of initial growers there are nine left. Only 4-5 of these growers have >80 acres in production and supply most of the North American market. 'Nellie White' is the primary cultivar raised by every grower. In addition to 'Nellie White', some growers have a small fraction of production in 'Eden' and 'Harbor', recent ELRF releases. 'Eden' and 'Harbor' consistently score higher than 'Nellie White', 'Croft', and 'Ace' in ELRF potted lily trials conducted each spring, but there is usually some production-related flaw that limit new cultivars from being widely accepted. 'Nellie White' is just too good of a balance of all desirable traits without having a major flaw, allowing it to remain the cultivar of choice (Fig. 1A). The main reason 'Nellie White' has displaced 'Ace' and 'Croft' is resistance to the disease "leaf scorch" while the other cultivars became susceptible.

'Nellie White' has been grown for decades and various selected mutations have accumulated, leading to variation. Since there is no central propagator, growers maintain their own mother stock, propagation material, and somaclonal variants. This, in combination with varying field production and storage conditions, has made it challenging for potted Easter lily forcers to have a consistent and uniform crop from year-to-year. Often forcers choose to purchase bulb lots from multiple Easter lily producers as insurance to have at least a portion of their crop being successful each year.

Bulb producers are aware that

mutations occur within their stock and undesirable variation builds up over time. To address this problem, periodically growers introduce a new line or somaclonal selection of 'Nellie White' into production. About every ten years, each bulb grower starts a new round of selections for the next new line. They go through the production fields at regular intervals and mark individual plants possessing desirable traits. In the beginning of the season over 2,000 plants may be marked, but by the end of the season typically 200 remain that made it through selection for important traits. Plants in the running at the end of the first season are propagated and observed in subsequent years in both field and greenhouse forcing tests. After a few years the best selection (tracing back to one bulb in the original year of selection) is mass propagated and then put into production.

Somaclonal variants are selected for a number of traits for efficient field production and greenhouse forcing. For instance, for bulb growers--late field emergence avoids hail damage from spring storms, little or no premature sprouting of daughter bulbs (summer sprouting); whereas greenhouse forcers want early emergence, high leaf unfolding rates, no visible virus symptoms, and high flower bud count. Another reason why 'Nellie White' is favored over other cultivars is it offers enough variation to take advantage of somaclonal selection, yet enough stability for production to be relatively consistent. Growers told us other cultivars have more "genetic drift" making them

challenging to produce and market. We visited one grower's block of 'Nellie White' somaclonal variants and were amazed to see how much phenotypic variability existed just for leaf morphology and summer sprouting!

Easter lily bulbs are typically two or three years old before they are sold. As production time to produce a salable bulb increases, profitability decreases and the possibility of contracting field borne diseases increases. Every year, bulbs are dug in September - October, graded, and then replanted or sold.

Most Easter lily propagation occurs using bulb scales, although bulblets (which form along the underground portion of the stem) are favored. Bulblets are relatively large with an established meristem and can save a year of production time. However, hand labor is needed to break them off of stems during a time of year when labor is at a premium. Scaling involves removing individual scales off the mother bulb, allowing adventitious meristems and new bulbs to form at the base of the scale. The Dutch have developed an efficient mechanical scaler that spins bulbs allowing centrifugal force to break off the scales. All major growers are using this device. Growers routinely experiment with different methods of scale handling to maximize growth rate and reduce production time. Harvesting, grading, and replanting occurs during a condensed period from August to October. Techniques that can help mechanize the process and reduce the limited labor available are greatly valued.

With rainy and foggy weather on the coast, it is difficult to protect lilies from *Botrytis*, nematodes (ELRF conducts trials to control nematodes, Fig. 1B), and bulb mites. Without pesticides it is nearly impossible to have a crop of viable lily bulbs at the end of the season. Before field planting, soil is fumigated to kill pathogens and weeds. Plants are continually sprayed to have a coating of copper on the foliage, giving the foliage a glowing neon blue-green color (Fig. 1A). During peak leaf unfolding, copper (Bordeaux mixture) is sprayed as often as once every five days. During a growing season, approximately 20 applications are made. Pressure from environmental groups, the high cost to maintain and label new pesticides for lilies has made it challenging to keep effective control measures available to growers.

The Easter lily market is stable in terms of number of annual bulbs sold, however, the end customer base is changing. At one time churches were the primary consumers of lilies and each church would buy multiple plants from retail florists. The majority of sales in recent years, however, are to individuals that purchase one lily at discount retailers.

Increasingly, Easter lily forcing is being done by large-scale greenhouses, which supply the mass markets. They demand large volumes of lower cost bulbs in the 7-8" circumference range. Larger bulbs (8-9", 9-10+") are favored by upscale retail florists due to increased bud count and potential for multiple flowering shoots. Field production must shift accordingly to be able to supply the desired volume of 7-8" circumference bulbs. The wholesale price of Easter lily bulbs has stayed stagnant for years, although production costs continually increase. Growers need to become increasingly efficient to remain profitable. Some growers are beginning to explore the production of Oriental and intersectional lily hybrids (Longiflorum-Asiatic [LA], Longiflorum-Oriental [LO]) to supplement bulb sales. In addition, one grower has diversified into tree seedling production that complements lily production; another still runs a dairy farm for year-round income.

Easter lily bulb producers face many challenges to remain profitable. As the original West coast lily growers got into lily bulb production as a profitable alternative crop, they will need to find cost-effective

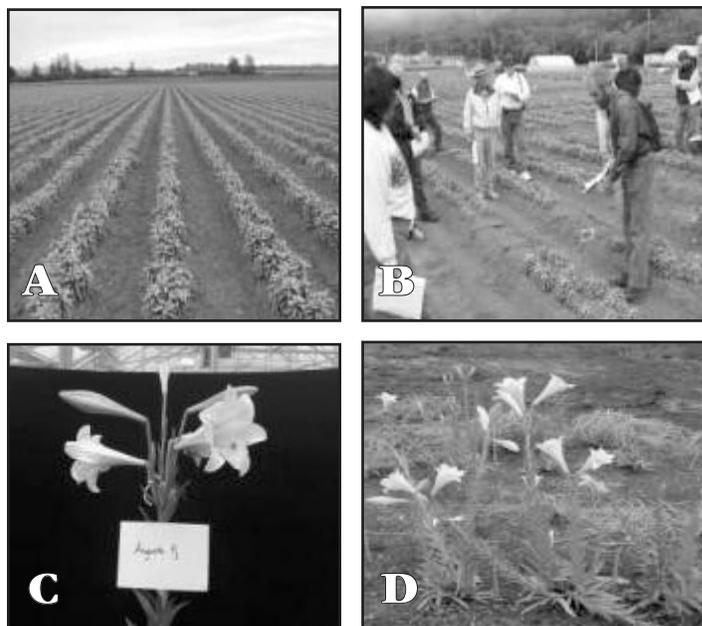


Figure 1. Easter lily production in Smith River, CA and Brookings, OR. (A) Fields of 'Nellie White' Easter lilies in cultivation. (B) Lee Riddle (right) discusses nematode trials with growers at the Easter Lily Research Foundation. (C) Seed-propagated hybrid lily seedling flowering under long days without any vernalization treatment. (D) Interspecific lily hybrids that reflower continuously in the field (photo taken in October!).

alternatives to standard bulb production. The University of Minnesota flower breeding program is developing an alternative to vegetative bulb production and adding valuable traits. We have interspecific hybrid Easter lilies (white trumpets) that flower in 250-300 days from seed (Fig. 1C; Anderson 2002)! Seed propagation would eliminate the costly bulb production. In addition, these lilies have new traits which means a greenhouse forcer could eventually purchase lily plugs and force a flowering crop without a cold treatment (vernalization) under any photoperiod (since they are

also day neutral). Added benefits include the ability to reflower continuously throughout the growing season, either in the greenhouse or field (Fig. 1D). Such traits could revolutionize both the Easter lily and the cut lily markets.

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