

The 2015 Easter lily schedule

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The Easter holiday falls on April 5th in 2015. Easter Sunday always falls on date ranging from March 22nd at the earliest to April 25th at the latest. Holidays from April 3rd to April 15th are considered mid-date for the purpose greenhouse forcing. Mid-date lily forcing schedules are the least challenging in that there is enough time to complete all steps in the 23 week forcing program without cutting corners as is sometimes necessary with early Easter schedules. Mid-date schedules are also advantageous in that there is not a lot of extra time, requiring growers to hold the mature crop in the cooler or to use other stalling tactics to slow growth as is common with late Easter schedules. But perhaps the biggest advantage for growers in the northern tier is that lilies shipped at the end of March opens up production space for those all-important spring crops.

Just because mid-date Easters are less challenging doesn't mean the 2015 crop will be easy. As any experienced grower knows each Easter crop presents a new challenge, not just because of the changing schedule but also because of the unpredictable year-to-year variability in bulb quality, bulb maturity, and weather. Bulb response can be notoriously variable, even from batch-to-batch, due to variations in summer field conditions during bulb production and handling after the bulbs are dug. And, growers all know how a persistent, unseasonable weather pattern can impact a forcing schedule.

Bulb cooling for 2015: Start programming case-cooling bulbs at temperatures between 40-45F for 6-week beginning October 26 (23 weeks before Easter). If bulbs arrive later than October 26 and you are no able to complete the full 6-weeks of bulb cooling by December 7 (17 weeks before Easter), start the greenhouse forcing anyway and just substitute one week of insurance lighting for each week of cooling still needed. Insurance lighting refers to night break lighting used to produce a long day photoperiod. Apply insurance lighting immediately following shoot emergence to produce the same effect as bulb cooling.

For pot-cooled lilies (including CTF and natural-cooled) start bulb programming by October 26 and hold at 60-62°F for 3-weeks in order to stimulate root development. Then transfer the potted bulbs to the cooler on November 16 (20 weeks before Easter) to start the 6-weeks of cooling at 40-45F. Start greenhouse forcing by December 28 (14 weeks before Easter). Again if bulbs arrive late and you don't have time for the full 3-weeks of rooting prior to bulb cooling, just give them as much time as the schedule permits prior to November 16 and start the 6-week cooling period on schedule.

With naturally cooled bulbs temperatures can vary widely from the preferred range. Temperatures that are too low or too high are less effective. As a rule do not allow bulbs to freeze, and do not include hours accumulated over 50F as part of the total hours. Subtract hours accumulated over 70F. Monitor the temperature in the pot each day and once the targeted 6-week vernalization period is complete, reassess your schedule.

Regardless of the bulb cooling method you plan to use, inspect bulbs as soon as they arrive, discard any diseased or damaged bulbs and beginning bulb programming (cooling, or rooting and cooling) immediately. Maintain temperatures between 40-45F for the entire 6-week cooling period.

Greenhouse forcing and bud initiation: With both pot-cooled and case-cooled lilies, greenhouse forcing starts at the end of the bulb-cooling period. Typically this is 17-weeks before Easter for case-cooled bulbs and 14-weeks before Easter for pot-cooled bulbs. The difference in the two schedules just reflects the stage of shoot development. With pot-cooled bulbs the shoots are either at the soil surface or already emerged as soon as forcing begins (week 14). In contrast case-cooled bulbs, will take up to three weeks to emerge. So either way, the shoots on both crops should be emerging by about week 14 (December 28).

Bud initiation begins soon after lilies emerge, and should be completed no later than mid-January this year, when shoots are 3"-5" tall. The development of stem roots coincides with flower bud initiation. During bud initiation, a constant 63F temperature is ideal but day and night temperatures in the range of 60-65F are fine. It is important that temperatures do not exceed 65F until bud initiation is complete. If you determine that lily development is behind schedule, don't try to catch up forcing at high temperatures during this phase. Wait until bud set is complete before attempting to speed up plant development with higher temperatures.

Tracking lily development: Use the leaf counting technique to track lily development. You should be able to start an initial assessment as soon as bud initiation is complete, by week 11 or week 10. Run lower average daily temperatures (55-60F) if lilies

are ahead of schedule or higher temperatures (70F) if behind schedule. Typical leaf unfolding rates vary from approximately one leaf per day at 53F to 1.5 leaves per day at 63F, 2 leaves per day at 72F and 2.5 leaves per day at 82F. Forcing temperatures between 55-70F produce the highest quality lilies and are most fuel-efficient.

Taking an initial leaf count as early as possible will allow you get back on track with modest temperature adjustments. Don't wait until the schedule is at or near visible bud to assess crop development, or you may find yourself having to manage crop development using temperature extremes. Your control options will be much more limited if you wait until the final six weeks of greenhouse forcing to discover your lilies are far ahead or far behind schedule.

Once greenhouse forcing starts, lilies should reach the visible bud stage at about February 22nd or 6-weeks before Easter. Lilies at this stage will typically reach the open bud stage in 35 days at 65F, in time for shipping 1-week before Easter.

Visible bud to finish: Once at visible bud monitor crop development by measuring bud length. Adjust temperature as needed to stay on schedule. A 'bud stick' is a useful tool to gauge the rate of lily bud development and the temperature regime needed to finish at a specific date. If you don't have a bud stick, refer to **Table 1** to estimate the rate of bud development. I recommend you assess bud development early and adjust temperatures accordingly.

Table 1. To use this table, start by measuring the length of the longest bud on a representative sampling of plants and find that length in the first column. Move across the table horizontally to the column headed by the temperature you are running in your greenhouse. The number you see is where the row and column intersect, is the approximate number of days that it will take for buds to open at that temperature. For example if bud length is 3" and you are running an average daily temperature of 70F, your lilies are about 11 days from flower. If the projected finish time is too slow, run higher temperatures. If the projected finish time is too fast, drop the greenhouse temperature.

Length of lily buds (inches)	Greenhouse air temperature (24-hour average)				
	59F	64F	70F	75F	81F
	Approximate number of days to flowering at each temperature				
2"	24	20	17	15	12.5
3"	15	13	11	9.5	8
4"	9.5	8	7	6	5
5"	5	4.5	3.5	3	2.5

Uneven temperatures produce uneven crops. Use horizontal airflow to equalize greenhouse air temperatures. If you need to use temperatures above 80F to push lilies at the end, take care to maintain adequate soil moisture and humidity levels or lily development may stall and buds may abort.

Holding lilies in cold storage: Lilies can be stored for up to 14 days in the dark at 35-45F when buds turn white but before they open. A preventive spray treatment for Botrytis control is recommended prior to moving lilies to cold storage. An application of Fascination or Fresco prior to cold storage will prevent late-season leaf yellowing and post-harvest flower senescence. Spray 100/100 ppm to thoroughly cover all foliage and buds when buds are 3 to 3 1/2" long but not more than 14 days before shipping or cold storage. Water Easter lilies thoroughly before starting cold storage. After removing from the cooler, place lilies in a shady location to avoid excessive wilting.

Height control: Conventional PGR practices recommend a single application of a growth retardant plant growth regulator (PGR) when shoots are 3-5" tall, with a dose high enough to provide control for 3-5 weeks. The products A-Rest, Concise, Topflor or Sumagic are all effective growth retardants on Easter lilies. Note: paclobutrazol products such as Bonzi are not effective on Easter lilies. Use DIF to control lily height during flower initiation. Avoid using high dose PGR applications until after flower bud initiation is complete (around January 11 or soon after this season). Alternatively, equal day/night temperatures or cool morning temperatures will produce a DIF effect and keep lilies short.

Even if you choose to use more conventional PGR practices, split applications are preferred. Split applications produce the most desirable plants. With split applications, use half the normal dose at the first application and then a one-quarter to one-half dosage in subsequent applications (depending on the number of applications you plan to use and the amount of control needed). Lilies

exposed to high concentrations of growth retardants have a greater tendency to develop lower leaf yellowing in the later stages of production. Some growers have been applying growth retardants at low concentrations just as the shoot emerges and then following with a second application when bud initiation is complete. I prefer to allow bud initiation to be completed before altering natural hormone levels in the plant. Plus, by maintaining a constant 63F day and night during bud initiation you are imposing a zero DIF regime that will limit stretching. If you still wish to apply PGRs at this time, I recommend the lowest effective dose (1/8th – 1/4th the normal dose). Just apply enough to hold the plant for 7-10 days rather than the typical 3-5 weeks.

You can use weekly applications at very low dosages to either slow stem stretch with a growth retardant like Sumagic or increase stem stretch with products containing gibberellins such as in Fascination or Fresco. Fascination and Fresco can also be used to prevent leaf yellowing in closely spaced plants. With sequential, low dose treatments PGRs can be applied anytime during the greenhouse forcing cycle.

Nutrition:

Proper nutrition is important in early crop development. Limiting nitrogen early in development reduces leaf size and small leaves limit the potential for subsequent growth. To get plants off to a good start, provide a single application of 400-600 ppm nitrogen at first irrigation, when lilies begin to emerge after programming. This will help to stimulate early leaf development. Phosphorus is also important in early lily development by supporting strong root development. Growers sometimes withhold phosphorus out of fear of leaf scorch from fluoride toxicity (fluoride is found in phosphorus based fertilizers and some soil amendments). Use a complete fertilizer formulation, such as a 20-10-20, for the initial feed.

After the initial feeding use a 15-0-15 formulation, but if phosphorus was not added to the medium use the 20-10-20 formulation on an alternating basis with the 15-0-15. Fertilizer rates should range from 200-400 ppm. Do not allow medium EC to exceed 3-3.5 mS/cm based on a Saturated Media Extract. Periodic nutrient testing is advisable during the crop. Testing the nutrient status of young fully expanded leaves will provide the most accurate picture of lily nutritional health. Leaf tissue nutrient content should fall in the following ranges, 2.4-4% nitrogen, 0.1-0.7% phosphorus, 2-5% potassium, 0.2-4% calcium, 0.3-2% magnesium, 100-250 ppm iron, 50-250 ppm manganese, 30-70 ppm zinc, 5-25 ppm copper, 20-50 ppm boron.

For success in 2015, keep a close eye on development from the start. Follow the 2015 schedule to track development and the cultural recommendations to maintain proper plant health and vigor during greenhouse forcing. As always if you do spot a problem, react and make adjustments early to avoid more difficult adjustments later.



Figure 1. Bare stem following a leaf count shows buds about two weeks before visible bud in 2014. Note the compact nodes on this well-grown crop.



Figure 2: Easter was very late in 2014 (April 20) and the pressure production space for spring crops led many growers to double crop with baskets or move lilies to the cooler earlier than recommended.



Figure 3: The first PGR applications for height control should be applied when lilies reach a height of 3 to 5 inches, typically at about 12 to 11-weeks before Easter. Repeat applications at low dosage rates yield the best results. Reduced light levels increase reliance on PGRs to control stretching and leaf yellowing. DIF is an effective technique for managing lily height and can be used in combination with PGRs.



Figure 4. Do not allow lilies to experience water stress during late bud development, especially when high temperatures are being used to speed up development. Extreme water stress before visible bud can also be problematic and can delay plant development.

**The University of Connecticut
2015 EASTER LILY SCHEDULE**

Weeks Prior to Easter	Date	Forcing Method	
		Case-Cooled	Pot-Cooled (CTF & natural-cooled)
25	Oct. 12	<i>Bulbs dug, shipped & in hand by mid- to late-Oct. Programming starts immediately. Inspect and rogue out damaged and infected bulbs before cooling begins.</i>	
24-23	Oct. 19 –Oct. 26	Start bulb programming as soon as bulbs arrive but no later than 23 weeks before Easter. <i>Cool at 40-45F for 6 weeks</i>	
20	Nov. 16	---	<i>Pot and allow roots to grow at 60-62F for 3 weeks</i>
17	Dec. 7	<i>Pot no later than 17 weeks before Easter</i> Force in greenhouse at 60-62F in pot.	---
14	Dec. 28	<i>Roots visible by wk 15 & shoots emerge by wk 14.</i> <i>Early plantings emerging before wk 14 & buds beginning to set. Start fertilizing & keep moist</i>	Force in greenhouse at 60-62F in pot (no later than 14 weeks before Easter).
13	Jan. 4	1-2" tall. Keep lilies moist & use fungicide drench as needed.	
12	Jan. 11	2-3" tall. Bud initiation coincides with stem root development. Run 60-62F day/ night until bud set is complete.	
11	Jan. 18	3-4" tall. Apply growth regulator when 3-5" tall. Bud initiation nearly complete, maintain temperature below 65F until done.	
10	Jan. 25	Check for bud set. Begin leaf counting & graphical tracking. Keep greenhouse cool if ahead of schedule.	
9	Feb. 1	5-6" tall. Adjust temperatures as needed. Space lilies to avoid yellow leaves & stretching. Apply Fascination to lower leaves (7 to 10 days before visible bud) if leaf yellowing is evident.	
8	Feb. 8	Check for aphids & root problems. Apply insecticide drench sometime during weeks 10, 9, or 8. Soil test & if leaf scorch is evident, use calcium nitrate for balance of schedule.	
7	Feb. 15	7-8" tall. Lilies are about half final height. 42 days to sale. Buds can be felt. If buds are visible on early planting run lower temperatures until finish.	
6	Feb. 22	35 days to sale. Buds should be visible no later than 30 days prior to sale. Grade for uniformity as buds become visible.	
5	Mar. 1	Buds 1/2-1" long. Re-apply Fascination if necessary.	
4	Mar. 8	Buds 1-1 1/2", some bending down.	
3	Mar. 15	Buds 1 1/2-2" long. If aphids present, use a total release smoke or aerosol.	
2	Mar. 22	Buds 2-4" long., some turning whitish. Stop fertilizing just before sale & apply clear water once. Cool lilies at 35-45F to hold. Prior to cold storage, Fascination can be applied to entire plant.	
1	Mar. 29	Ready to sell. Shade lilies once removed from storage. If needed, use EthylBloc prior to shipping.	
0	Apr. 5	Easter 2015	

NOTES & COMMENTS ON THE 2015 EASTER LILY SCHEDULE

Easter 2015 outlook: Easter falls on a mid-date in 2015 (April 5). This is on the early end of the mid-date calendar but will allow enough time for proper programming and forcing. Average heights and times for forcing are presented in this schedule. Adjust schedule according to plant growth, bud development, starting time, and past experience. If you have problems contact your Extension Educator.

Pot-cooled bulbs are normally potted & held for 3 weeks at 63F before starting 6 weeks of bulb cooling at 40-45F (see the 2015 Easter Lily schedule for details). The bulbs then require 14 weeks of greenhouse forcing. This entire process requires 23 weeks from initial potting to Easter. This same process is used for both naturally cooled or CTF bulbs.

Case-cooled bulbs require six weeks of cooling followed by 17 weeks of greenhouse forcing to flower in time for Easter. Be sure that commercially case-cooled bulbs arrive & are planted by Dec 7, 2014. If you cool your own bulbs, start by Oct. 26 (23 weeks before Easter). Insurance lighting should not be needed this year but can be used if you can't complete the full 6-weeks of bulb cooling before greenhouse forcing begins.

Insurance lighting: Apply insurance lighting if you know or suspect that bulbs have not received the entire 6 weeks of cooling before greenhouse forcing is scheduled to begin. Insurance lighting is night break lighting used to produce a long day photoperiod. When used immediately at shoot emergence it produces the same effect as bulb cooling or vernalization. Therefore, insurance lighting can be used to substitute for inadequate bulb cooling. Provide one day of insurance lighting for each day of lost cooling. Incandescent, fluorescent, or HID lighting in excess of 10 f.c. from 10 pm to 2 am daily will provide the necessary night break.

Fertigation: Start fertilizing with soluble formulation when lilies emerge and continue to within 7 days of sale. Combine calcium nitrate (3 parts) with potassium nitrate (2 parts) to make a 15-0-18 soluble fertilizer, or use a commercial 15-0-15 formulation. If phosphorus was not added to the medium, 20-10-20 can be used on an alternating basis with a 15-0-15. Fertilizer rates should range from 200-400 ppm. Do not allow medium EC to exceed 3-3.5 mS/cm based on a Saturated Media Extract. Stop fertilizing just before sale. Provide one clear watering before shipping to this will reduce salt levels and maximize shelf life. Do not withhold water or fertilizer to slow development. Do not over water (i.e. water too frequently) or root rot problems may occur.

Decrease Leaf Yellowing & Delay Flower Senescence: To prevent early-season leaf yellowing (7 to 10 days before visible bud) & mid-season leaf yellowing (7 to 10 days after visible bud) spray Fascination or Fresco at 10/10 ppm. Apply only to lower leaves & cover thoroughly to protect leaves from yellowing for up to 14 days. To prevent late-season leaf yellowing and post-harvest flower senescence, spray 100/100 ppm to thoroughly cover all foliage & buds. Apply when buds are 3 to 3 1/2" long BUT NOT MORE than 14 days before shipping or cooling. Note: Avoid direct contact of spray to immature leaves during early- & mid-season applications unless you wish to induce stem stretching.

Disease and pest control: Before planting, clean bulbs of debris removing any scales showing evidence of infection or physical damage.

Once potted, root rots associated with Rhizoctonia, Fusarium, and Pythium are a concern. Drench immediately with Banrot, Pageant, or Empress, broad-spectrum fungicides, or you can treat to control these diseases separately by selecting from the fungicides specifically registered for Rhizoctonia, Fusarium and Pythium control on lily. Materials registered for Rhizoctonia and/or Fusarium include 26GT, 26/36 and many generics such as Pageant Intrinsic and Contrast (Rhizoctonia), and Terraclor (Rhizoctonia). Materials registered for controlling Pythium include Alude, Banol, Subdue Maxx (beware of using mefenoxam exclusively because of widespread fungicide resistance issues with this active ingredient), Segway, and Truban. Check with manufacturers regarding compatibility when tank mixing fungicides. Fungicides may need to be re-applied later in the crop, check labels for guidance. Preventative biological fungicides (RootShield, CEASE, Actinovate, Mycostop or Companion) may be applied at planting for disease suppression and to enhance root growth. Check with company or product labels information for safe time intervals between application of biological agents and chemical fungicides.

Aphids, fungus gnats and bulb mites are a major concern. Many chemicals are listed for aphid control, including: Safari, Flagship, Tristar, Marathon and many generics, DuraGuard, Enstar AQ, Suffoil X, Insecticidal Soap, Kontos, Endeavor and Aria. Fungus gnats can be controlled with some of these same chemicals as well as Citation, Distance, Adept, Pylon, insect parasitic nematodes (Nemasys, NemaShield, Scanmask, Etonem) and Gnatrol. Bulb mites, Rhizoglyphus robini, represent one of the more troublesome insect pests on lilies and effective management requires an integrated approach. Bulb mites are considered a secondary pest and are commonly associated with decay caused by fungus gnat damage and soil-borne fungal pathogens. The soil dwelling predatory mite, Hypoaspis aculeifer, may help suppress bulb mites. **Note:** Registration of pesticides varies by state so consult and follow labels for registered use. To avoid any potential phytotoxicity or residue problems, spot test before widespread use. No discrimination is intended for any products not listed.

Height Control: Monitor lily height regularly during forcing. If height exceeds the target size, run negative DIF or use a growth retardant such as A-Rest, Chlormequat E-Pro, Concise, Cycocel or Sumagic to slow stem elongation. If height is less than the target size, run positive DIF or use a gibberellin PRG such as Fascination or Fresco to increase stem elongation. Split applications of PGRs provide the best results. You can apply any of the PGRs at 1/2 to 1/4 the normal rate (or even less) and use multiple applications as needed. Reduce the concentrations of Sumagic used when combined with DIF. Use DIF, or cool morning DIP, to control lily height. Equal day/night temperatures, high night/low day temperatures or a cool morning temperature dip will produce a DIF effect and keep lilies short.

Lily storage: Lilies can be stored for up to 14 days in the dark at 35-45F when buds turn white but before they open. Spray for Botrytis control prior to moving lilies to cold storage. Fungicides labeled for botrytis control include Veranda O, Phytan 27 and the biofungicide CEASE. Always follow label directions and test fungicides on a small group of lilies for damage to or residue on lily buds before using on the entire crop. Water Easter lilies thoroughly before starting cold storage. After removing from the cooler, place lilies in a shady location to avoid excessive wilting.

If you have problems contact your Extension Educators.

All agrichemical/pesticides listed are registered for suggested uses in accordance with federal and Connecticut state laws and regulations as of the date of printing. If the information does not agree with current labeling, follow the label instructions. The label is the law. Contact the Connecticut Department of Environmental Protection for current regulations. Where trade names are used for identification, no product endorsement is implied nor is discrimination intended.

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