

- Crop By Crop -

FORCING PERENNIALS

Species: *Oenothera fruticosa* 'Youngii-lapsley'

Common Name: Sundrops

Editor's note: Michigan State University and GREENHOUSE GROWER bring you our third series on forcing perennials to flower.

by EMILY CLOUGH, ARTHUR CAMERON, ROYAL HEINS, and WILL CARLSON

Figure 1.



Figure 1. *Oenothera fruticosa* 'Youngii-lapsley' makes a beautiful potted flowering plant.

THE genus *Oenothera* contains 124 herbaceous annual, biennial, and perennial species native to North and South America. In the early 1800s, many species of *oenothera* were collected and brought to England, where they became popular garden plants.

Commonly known as Sundrops, *O. fruticosa* (Figure 1) is a striking, day-flowering herbaceous perennial native to eastern North America. In the garden, these low-maintenance plants thrive in full sun, grow to a height of 1-2 feet (30-60 centimeters), and produce 1½-inch flowers in June. They can tolerate partial shade, but in full shade, they tend to grow taller and produce fewer flowers.

Oenothera fruticosa is hardy to USDA zone 4. It has an obligate cold requirement and does not perform well in zone 9 or other areas where the chilling requirement is not met.

Most of our research has been conducted on *O. fruticosa* 'Youngii-lapsley,' although we also have tested several other cultivars, including 'Fireworks,' 'Summer Solstice' ('Sonnenwende'), and 'Highlight' ('Hoheslicht'). In catalogs, many *O. fruticosa* cultivars, including those listed above, often are listed as *O. tetragona* but, according to M. Griffiths' *Index of Garden Plants* (1994), are in fact cultivars of *O. fruticosa*.

(Continued on page 52.)

Figure 2a.

OENOTHERA FRUTICOSA
'YOUNGII-LAPSLEY'
 0 WEEKS COLD 5C
 6 WEEKS FORCING 20C
 PHOTOPERIOD 16 HR
 0 PERCENT VISIBLE BUD
 0 PERCENT FLOWERING



Figure 2a. Plants of *Oenothera fruticosa* 'Youngii-lapsley' will not flower without a cold treatment.

Figure 2b.

OENOTHERA FRUTICOSA
'YOUNGII-LAPSLEY'
 3 WEEKS COLD 5C
 9 WEEKS FORCING 20C
 16 HR PHOTOPERIOD
 100 PERCENT FLOWERING

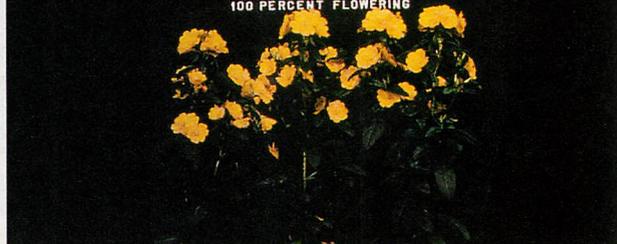


Figure 2b. 'Youngii-lapsley' requires a minimum of 3 weeks of cold treatment to flower.

PRODUCTION

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1. Propagation

'Youngii-lapsley' and other *Oenothera* clones are propagated commercially by shoot-tip cuttings or division. Approximately 4 weeks after plants flower, offsets produced from basal and root buds can be removed and rooted. In our experience, these offsets root quickly (1-2 weeks) and are im-

mediately ready for cold treatment.

Nonclonal *O. fruticosa* can be propagated by seed, which is easy to germinate and does not require any special treatment to achieve rates of 70% or higher. Seed should not be covered during germination and does best when given bottom heat at 70°-80°F (21°-27°C).

2. Plant Size

In 72-cell trays, plants with an average of 18-19 leaves are suitable for fin-

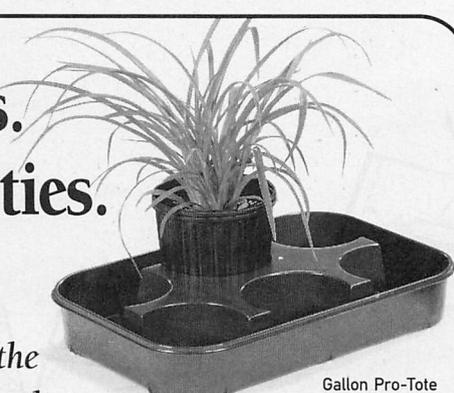
ishing in a 5- or 6-inch pot. On a few occasions, we received small bare-root divisions that required bulking before they could be used to produce finished plants with high flower counts. Very small rosettes can perceive cold treatment and subsequently flower, but the plants will produce only a few flowers. Plants can be bulked in the fall under any daylength, since they will not flower until after a cold treatment.

3. Cold Treatment

A cold treatment of at least 3 weeks at 35°-45°F (2°-7°C) is required for complete flowering of 'Youngii-lapsley' (Figures 2a and 2b). With few exceptions, plants will not flower if they are grown at a consistent 68°F (20°C) without cold treatment. Increasing cold duration from 3 to 15 weeks hastens flowering by about 10 days and increases the number of flowering lat-

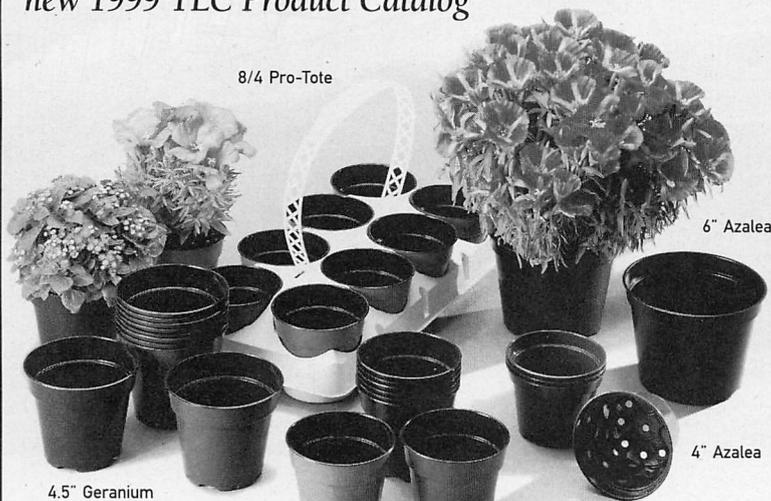
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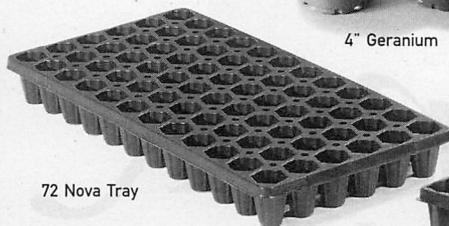
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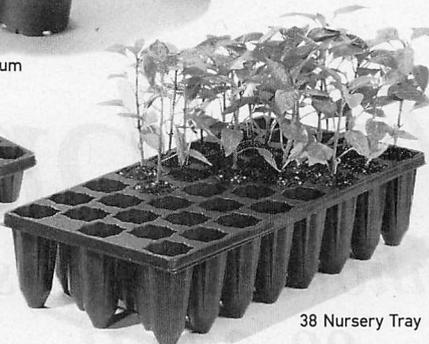
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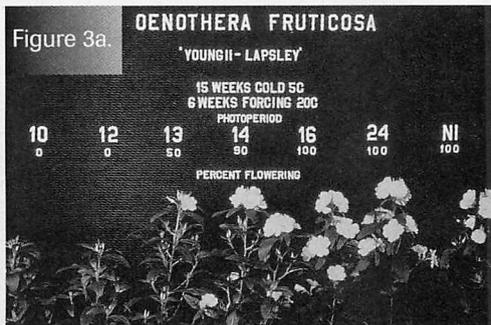


Figure 3a. Cold-treated 'Youngii-lapsley' plants flower under any photoperiod, but flower faster under longer ones. Flowering percentage refers to the proportion of plants with open flowers at the time the photograph was taken.



Figure 3b. 'Youngii-lapsley' plants grown under 10-hour photoperiods flower approximately 2 weeks later than plants grown under 24-hour photoperiods. In this photograph, plants grown under 16-hour, 24-hour, and night-interruption (NI) lighting already have finished flowering.

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eral shoots and the number of flowers.

Plant shape changes with increased cold duration. Plant height at first flower increases 3-5 inches as cold treatment duration increases. Height was maximized (16-21 inches) after 6 or 9 weeks of cold treatment at 41°F (5°C). The number of lateral shoots induced to flower increases with cold duration, giving the plants a fuller, stouter appearance. Plant height decreased slightly – 2-4 inches – as cold duration increased from 6 or 9 to 15 weeks. We recommend 12-15 weeks at 35°-45°F (2°-7°C) for maximum flower counts and more flowering laterals.

4. Photoperiod And Lighting

'Youngii-lapsley' is a facultative long-day plant, which means it will flower under any photoperiod, but it flowers fastest under longer ones. Flowering of 'Youngii-lapsley' occurred 2 weeks faster when plants were grown under a 24-hour photoperiod compared to a 10-hour photoperiod (Figures 3a and 3b).

Although plants flowered faster when grown under longer photoperiods, the number of flowering and vegetative lateral shoots decreased, drastically changing the plants' appearance. Photoperiods 16 hours or greater extended with incandescent lamps made plants spindly and inhibited flower production. Plants grown under photoperiods less than or equal to 16

Figure 4. 'Youngii-lapsley' Under The Lights

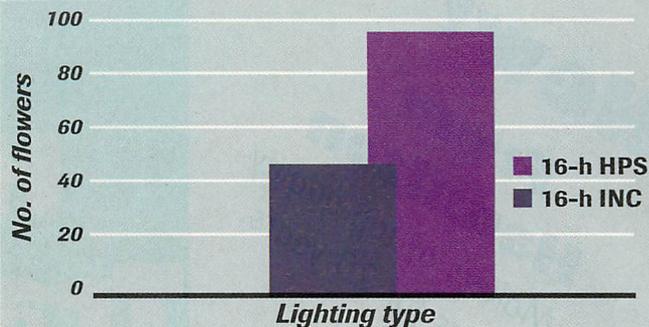


Figure 4. The number of flowers produced when 'Youngii-lapsley' plants are cooled for 15 weeks and grown under a 16-hour photoperiod delivered either by incandescent (INC) or high-pressure sodium (HPS) lamps

hours were leafier and more floriferous.

Another disadvantage of longer photoperiods is increased height. Night-interruption lighting from 10 p.m. to 2 a.m. using incandescent lamps was effective for flowering 'Youngii-lapsley,' but plants grown under night-interruption were similar in appearance to those grown under a 16-hour photoperiod. Tall plants had few vegetative or flowering lateral shoots.

'Youngii-lapsley' responds strongly to the amount of light it receives. When 16-hour photoperiods are provided by using high-intensity lights, such as high-pressure sodium, plants produce many flowers and appear similar to those grown under a 10-hour photoperiod delivered by incandescent lamps. In one experiment, when plants were grown with about twice the amount of light than the control received (supplemented by high-pressure sodium), they produced about two times the number of flowers per plant (Figure 4).

The time to flower for plants grown under high-pressure sodium lamps was 6 weeks, which is approximately the same amount of time plants flowered under a 16-hour photoperiod delivered by incandescent lamps. Because 'Youngii-lapsley' is so responsive to light, we suggest using supplemental lighting from high-pressure sodium lamps at 400-500 footcandles in high latitudes where there is limited natural light during winter. We recommend photoperiods greater than or equal to 14 hours if plants

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Figure 5. EFFECT OF PLANT GROWTH REGULATORS ON OENOTHERA FRUTICOSA 'YOUNGII-LAPSELEY'
15 WEEKS GOLD 5 C
6 WEEKS FORCING 20C
PHOTOPERIOD 16H
3 APPS/10 DAY INTERVAL



Figure 5. The effect of various plant growth regulators (PGR) on 'Youngii-lapsley'. Although it appears that both B-nine and Sumagic effectively reduced height, only Sumagic's effect was statistically significant.

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are grown in lower light or if incandescent lamps are used for day-extension lighting. If high light or high-pressure sodium lamps are available, photoperiods of 16 hours are acceptable. 'Youngii-lapsley' may be a perennial best suited for forcing in light-intensive locations or during summer.

5. Media, Fertilization, And Irrigation

In our experiments, we have had good results with pH levels between 5.8 and 6.2. At every irrigation, we typically apply a fertilizer solution containing 100-150 ppm N, 10-20 ppm P, and 100-150 ppm K, which has been sufficient for 'Youngii-lapsley's' growth and development. The plants are quite drought tolerant and will withstand multiple occurrences of wilting without detriment.

6. Spacing

Because of their strong response to light, 'Youngii-lapsley' should not be spaced close together since plants placed on the interior receive less light and produce fewer flowers. A spacing of two 5-inch square pots per square foot produced high quality plants.

7. Plant Height Control

'Youngii-lapsley's' natural height, 13-21 inches (33-54 centimeters), is on the tall side for production in a 5-inch contain-

Figure 6a.

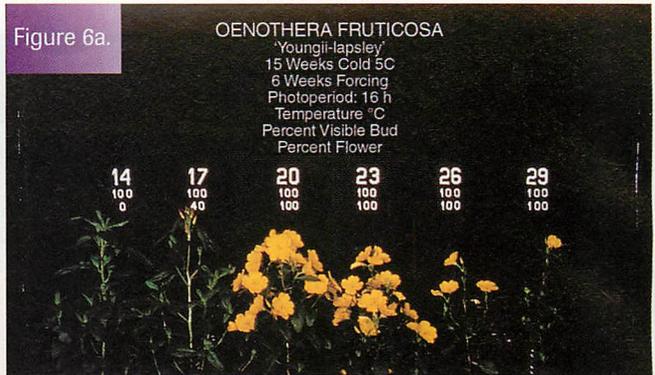


Figure 6a. Flowering of 'Youngii-lapsley' takes approximately 3½ weeks for plants grown at 84°F (29°C) and 8½ weeks at 57°F (14°C). Plant height and flower number increase at cooler temperatures.

Figure 6b.

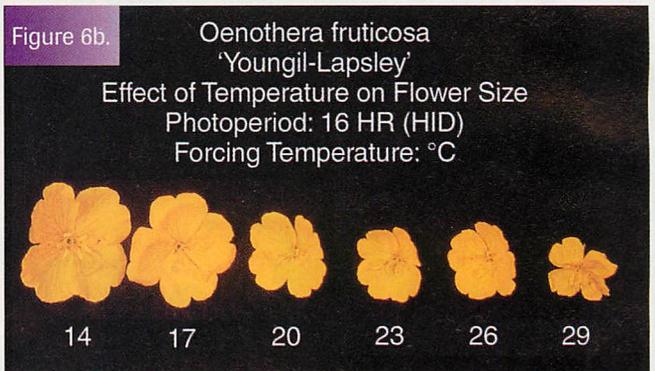


Figure 6b. Flower size of 'Youngii-lapsley' increases dramatically as temperature decreases. HID refers to photoperiod being delivered with high-intensity discharge, or high pressure sodium, lamps.

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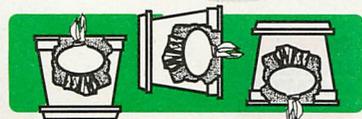
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Table 1.

***Oenothera fruticosa* 'Youngii-lapsley' Production Schedule**

Growing time	Cultural practice	Temperature	Photoperiod
1-2 weeks	Root stem cuttings or basal offsets	70°F (21°C)	Natural daylength
6 weeks	For rooted stem cuttings, grow on in plugs (rooted offsets are ready for cold treatment)	63°-68°F (17°-20°C)	Natural daylength
≥ 3 weeks	Cold treatment	35-45°F (2°-7°C)	Natural daylength or 9 hours of light in cooler
↓ ↓ ↓ ↓ 64°F (18°C) Flower in 6 weeks	Begin forcing ↓ ↓ 68°F (20°C) Flower in 5 weeks	↓ 73°F (23°C) Flower in 4 weeks (Note: This temperature is not recommended because fewer are produced.)	These times to flower were observed when plants were grown at 16 hours using high-pressure sodium lamps for supplemental lighting. Growing plants at photoperiods <16 hours will increase days to flower 2-10 days Number of days from visible bud to flower 64°F (18°C) - 19 days 68°F (20°C) - 16 days 73°F (23°C) - 13 days

er. In a screen of five commercially available plant growth regulators, only Sumagic at 15 ppm reduced final plant height (Figure 5). Plants sprayed with Sumagic were 30% shorter than the control plants, but their flowers were significantly smaller. In addition, the length of the lateral stems was reduced so that plant shape changed from its natural conical form to cylindrical.

8. Temperatures And Crop Scheduling

Flowering time is greatly decreased as forcing temperature increases. Plants grown at 73°F (23°C) flowered in 4 weeks, while those grown at 64°F (18°C) flowered in 6 weeks (Table 1). When plants were grown at 59°F (15°C), time to flower was increased to 8½ weeks. The number of flowers, plant height,

and flower size increased with decreasing temperatures (Figures 6a and 6b).

Plants grown at temperatures higher than 73°F (23°C) were spindly and less attractive. We suggest forcing temperatures between 64° and 68°F (18° and 20°C) to maximize the number and size of flowers while maintaining height control and limiting the finishing time.

9. Disease And Insect Pests

Uncooled plants grow as rosettes and are susceptible to Botrytis. When bulking uncooled plants, let the medium dry before rewatering and apply regular fungicidal drenches to control Botrytis. After a cold treatment, stems rapidly elongate and the rosette habit is lost. The lower leaves senesce and should be removed to prevent Botrytis. No other diseases were observed on 'Youngii-lapsley.'

The large, yellow flowers of 'Youngii-lapsley' were attractive to thrips. In some cases, crinkled petals may be an indication of thrip infestation early in floral development.

10. Postharvest Concerns

Once the first flower opens, 'Youngii-lapsley' continues to bloom in the garden or greenhouse for approximately 4 weeks. In a preliminary postharvest

Table 2.

Flowering characteristics of several cultivars of *O. fruticosa* and *O. fruticosa* ssp. *glauca*

	'Youngii-lapsley'	'Fireworks'	'Summer Solstice'	'Highlight'	ssp. <i>glauca</i>
Time to flower at 68°F (20°C)	6 weeks	7 weeks	7 weeks	6 weeks	6 weeks
Plant height at first flower under 16 hours	18 inches (45cm)	9 inches (24cm)	16 inches (40cm)	14 inches (36cm)	12 inches (31cm)
Number of flowers per plant under intense light	100	20	60	500	150

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screen, 'Youngii-lapsley' performed very well indoors. At room temperature and under fluorescent lighting, plants maintained a minimum of 20 open flowers a day for 10 days and at least 14 open flowers for 10 additional days. Plants should be shipped either just before or right after the first flower opens

since individual flowers last only 3-4 days on the plant, and the abscised flowers make an unsightly mess.

11. *Oenothera fruticosa* Cultivars

The *O. fruticosa* cultivars that we tested flowered in 6 or 7 weeks (Table 2). Plant height and number of flowers per plant varied greatly among cultivars. Like 'Youngii-lapsley,' other cultivars were quite responsive to

Formula For Success: 'Youngii-lapsley'

1. Cool plants for at least 3 weeks at 35°-45°F (2°-7°C). Increase cold duration for slightly faster flowering and a higher flower count. We recommend 12-15 weeks.

2. Force 'Youngii-lapsley' at 63°-68°F (17°-20°C) for increased flower number and size and overall higher plant quality.

3. Provide a photoperiod ≤ 14 hours if plants are growing under low light or incandescent lamps are used for day extension. Flower timing will be slightly slower under shorter photoperiods but plants will be leafier and more floriferous. If intense light or high-pressure sodium lamps are available, a 16-hour photoperiod is acceptable.

4. Provide lots of supplemental lighting during winter.

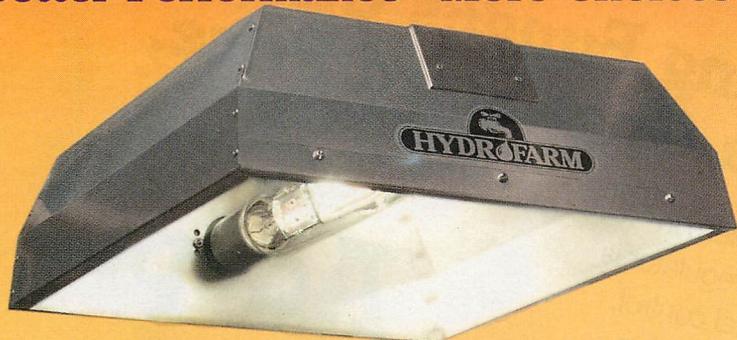
5. Don't space too closely or plants will elongate excessively and produce few flowers.

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light – some more than others – and supplemental lighting during winter production (in low-light areas) is recommended for all cultivars.

'Youngii-lapsley' was the tallest cultivar, with an average height of 18 inches, but it also produced numerous large flowers. 'Fireworks' and *O. fruticosa* ssp. *glauca* are both naturally short (9 and 12 inches, respectively), but in one of our studies, ssp. *glauca* flowered 1 week earlier and produced many more flowers.

In a preliminary study, rooted shoot-tip cuttings of 'Fireworks' (cooled for 8 weeks and grown under a 16-hour photoperiod provided by high-pressure sodium lamps) produced plants that flowered in 6 weeks and had as many flowers as ssp. *glauca*. 'Summer Solstice' was relatively tall (16 inches), spindly, and produced few flowers even under intense light. 'Highlight' was impressive for its vast number of small flowers (about 500 per plant) produced under intense light, but it wasn't drought tolerant. **GG**

About the authors: Emily Clough is a graduate research assistant and Arthur Cameron, Royal Heins, and Will Carlson are professors, Department of Horticulture, Michigan State University, East Lansing, MI 48824. Sources for this article are *Ball Perennial Manual*, *Propagation and Production*, and *Index of Garden Plants*.