FORCING PERENNIALS

Species: Stokesia laevis 'Klaus Jelitto'
Common Name: Stoke’s Aster

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

Stokesia laevis is an attractive member of Asteraceae, the sunflower family, and is native to the southeastern coastal plains of the U.S., from South Carolina to Louisiana (Figure 1).

The flowers are large — up to 4 inches diameter — and are usually pale lavender-blue. White-, yellow-, and purple-flowered cultivars also exist. Stokesia laevis is hardy to USDA zone 5. In northern climates, it flowers from July through October. In southern regions, it flowers almost all year long.

Stokesia laevis grows 15-20 inches (38-52 centimeters) tall and works well as a specimen plant. It also can be used as a cut flower. Although S. laevis tolerates partial shade, it performs best in warm, sunny, well-drained locations. Extremely moist areas should be avoided.

Figure 1. Under short photoperiods of 10-12 hours, Stokesia laevis ‘Klaus Jelitto’ remains short, produces many flowers, and makes an attractive flowering potted plant.

Figure 2a. Without a cold treatment, ‘Klaus Jelitto’ plants flower under photoperiods of 10-14 hours. A single plant flowered without cold under a 24-hour photoperiod. In the first year, plants flowered without a cold treatment only with photoperiods of 12-14 hours.
Most of our research has been on 'Klaus Jelitto.' We also have tested 'Alba' (white flowers); 'Blue Danube' (lavender-blue flowers); 'Mary Gregory' (small, pale yellow flowers); 'Purple Parasols' (bright magenta-purple flowers); and 'Wyoming' (small lavender-blue flowers).

1. Propagation

The S. laevis cultivars we tested do not come true from seed. They must be vegetatively propagated via crown divisions or root cuttings. Shoots develop readily from cut, exposed roots. Divisions are often made in spring but also can be done in the fall. Nonclonal S. laevis can be grown quite easily from seed. At 70°F (21°C) seeds germinate in 12 days and do not require covering.

2. Plant Size

Grown from seed, S. laevis has a juvenile period and will not flower the...
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under a 16-hour photoperiod provided by day extension from HPS lamps. Flower timing changed little with cold durations longer than 6 weeks, but variability continued to decrease with longer cold treatments.

After 15 weeks of cold treatment, plants flowered under all photoperiods, but flowering percentage was lower under photoperiods ≥ 14 hours and was extremely low (0%-10%) under 24-hour photoperiods.

Under 12- to 13-hour photoperiods provided by day extension with INC lamps, time to flower decreased by about 2 weeks after plants received a 15-week cold treatment at 41°F (5°C).

For the most consistent, rapid, and uniform flowering, we recommend 10-15 weeks of cold treatment at 41°F (5°C). If starting material is small, such as a 128-cell, longer durations of cold treatment (15-plus weeks at 41°F [5°C]) may be necessary for 100% flowering.

### 4. Photoperiod

‘Klaus Jelitto’ is best described as a facultative intermediate-day plant. It will flower under all photoperiods, but it flowers most consistently and rapidly at intermediate ones (Figure 3).

The highest flowering percentage and fastest time to flower occurred at photoperiods of 12 and 13 hours, both before and after cold treatment. Flowering under night-interruption lighting from 10 p.m. to 2 a.m. with INC lamps occurred only after a 15-week cold treatment, and the percentage was never higher than 90%.

Photoperiod also influenced flower timing, flower number, and

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**Figure 3.** After a 15-week cold treatment at 41°F (5°C), ‘Klaus Jelitto’ plants flowered under all photoperiods but was limited under 24-hour photoperiods. In the first year, no plants flowered under 24-hour photoperiods. In the second year, one plant flowered.
plant height at flower. After 15 weeks at 41°F (5°C), plants grown at 68°F (20°C) under photoperiods ≥ 12 hours flowered in approximately 10 weeks. Plants grown under a 10-hour photoperiod flowered in 18 weeks during the experiment’s first year and 11 weeks in its second.

Flower number decreased from 13 to four flowers per plant as photoperiod increased from 10 to 24 hours. Plant height at flowering dramatically increased with a longer photoperiod. Plants under a 10-hour photoperiod were 7-11 inches (17-27 centimeters) tall and at this height, would make acceptable flowering potted plants. Plants under a 16-hour photoperiod grew to about 18 inches (46 centimeters) tall. Plants under night interruption appeared similar to those under a 16-hour photoperiod.

**5. Media, Fertilization, And Irrigation**

In our experiments, we maintained pH levels between 5.8 and 6.2. At every irrigation, we applied a fertilizer solution containing 100-150 ppm N.

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**Table 1.**

<table>
<thead>
<tr>
<th>Growing time</th>
<th>Cultural practice</th>
<th>Temperature</th>
<th>Photoperiod</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 weeks</td>
<td>Root divisions/basal root cuttings</td>
<td>68°F (20°C)</td>
<td>Natural daylength</td>
</tr>
<tr>
<td>8-10 weeks</td>
<td>Grow in plugs</td>
<td>65°-68°F (18°-20°C)</td>
<td>Natural daylength</td>
</tr>
<tr>
<td></td>
<td>OR - Purchase plugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-15 weeks</td>
<td>Cold treatment</td>
<td>35°-45°F (2°-7°C)</td>
<td>Natural daylength or 9 hours of light in cooler</td>
</tr>
</tbody>
</table>

**Begin Forcing**

64°F (18°C) Flower in 11 weeks

70°F (21°C) Flower in 9 weeks

These times to flower were observed when plants were grown from January to April under 16-hour photoperiod using high-pressure sodium lamps. Plants grown under 12 hours using incandescent lamps in the same months took about 10 days longer to flower.

**Number of days from visible bud to flower**

64°F (18°C) - 41 days

70°F (21°C) - 34 days
10-20 ppm P, and 100-150 ppm K, which was sufficient for 'Klaus Jelitto's' growth and development. All cultivars of S. laevis grown in the greenhouse were drought tolerant and could withstand wilting without detriment. However, in the garden, S. laevis does not perform well, and plants are often short-lived if they are grown in moist locations.

6. Lighting And Spacing
In the garden, S. laevis prefers a bright, sunny location, but it will tolerate partial shade. In our experiments, 'Klaus Jelitto,' 'Blue Danube,' and 'Purple Parasols' responded to increased light levels. These cultivars produced 1 1/2 - 2 times more flowers when they were grown under a 16-hour photoperiod provided by day extension with HPS lamps rather than INC lamps – an increase from approximately 11 to 14 mol-m^{-2}day^{-1}.

Plants can be spaced quite close together initially, but as they grow during forcing, more space is required. At flower, 'Klaus Jelitto' plants are large, and flower stems can become tangled if the plants are not adequately spaced.

7. Plant Height Control
Naturally short cultivars of S. laevis,
such as 'Mary Gregory' (11 inches) and 'Wyoming' (13 inches) do not require height control. The height of taller cultivars, such as 'Klaus Jelitto,' may be best controlled by photoperiod. Again, photoperiod strongly influences 'Klaus Jelitto's' height at flower. Plant height doubles as photoperiod increases from 10 to 16 hours.

Although only 'Klaus Jelitto' was tested under the various photoperiods (all others were grown under 16 hours only), it is likely that other cultivars will behave similarly.

Forcing temperature also influences plant height. 'Klaus Jelitto' grown at 86°F (30°C) was approximately 8 inches tall, while those grown at 61°F (16°C) were 19 inches (48 centimeters). Temperatures above 70°F (21°C) are not recommended, because flowering percentage and plant quality decrease with higher temperature.

To our knowledge, the effectiveness of plant growth regulators on S. laevis has not yet been tested.

8. Temperatures And Crop Scheduling

Forcing temperature influences flower timing and plant quality. Time to flower decreased from 13 to 6 weeks as forcing temperature increased from 61°F to 86°F (16°-30°C) (Figures 4a and 4b). In our experiments, the flowering percentage also decreased with increasing temperatures. All plants flowered when they were grown at 61°F-70°F (16°-21°C). Flowering was 90% at 75°-81°F (24°-27°C) and 50% at 86°F (30°C).

Plant quality features, such as height and flower number, also decreased at warmer temperatures. Plants grown at 61°F (16°C) produced six times as many flowers as those grown at 86°F (30°C). We recommend forcing temperatures at 64°-70°F (18°-21°C) for optimizing flowering. 

9. Disease And Insect Pests

A notable problem with 'Klaus Jelitto' was interveinal chlorosis followed by necrosis of the leaves that appeared approximately 3 weeks into...
forcing (Figure 5a). In addition, there was leaf puckering (Figure 5b).

The symptoms were not associated with any mineral nutrient deficiency or toxicity. Although plants in every experiment exhibited symptoms, they were most severe when day extension lighting was provided by HPS lamps.

The least-severe symptoms were on plants grown under shorter photoperiods and day extension from INC lamps. There was no apparent effect of the leaf chlorosis, necrosis, or puckering on the flowers.

Other cultivars of *S. laevis*, including ‘Purple Parasols’ and ‘Alba’ also showed these same symptoms, but ‘Klaus Jelitto’ was affected the most. Only mild interveinal chlorosis was observed on ‘Blue Danube,’ and ‘Mary Gregory’ and ‘Wyoming’ showed no symptoms.

The only disease on ‘Klaus Jelitto’ or any *S. laevis* cultivar was Rhizoctonia. Occurrences may be reduced by watering only the soil.

As *S. laevis* comes into bud, the leaves around the bud form a cup, which can trap water and lead to increased occurrences of stem rot.

No insect was a pest on *S. laevis*.

### 10. Postharvest Concerns

Plants should be shipped just before or right after the first flower opens.

Individual flowers on the plant remain open for 4-5 days, closing at night and reopening the following day. ‘Klaus Jelitto’ in the greenhouse continues to bloom for approximately 3 weeks.

### 11. Stokesia laevis Cultivars

All cultivars of *S. laevis* that we tested flowered in 9-11 weeks, except for ‘Alba.’ It was notably slower than other cultivars, taking 16 weeks to flower (Table 2).

Among cultivars, flowering percentages varied from 20% to 100%. This may have been associated with initial plant size. The cultivars received as small, single-eye divisions or in 128-cell plugs generally had lower flowering percentages than those shipped in 2½-inch pots.

Flower number and plant height varied among cultivars. ‘Mary Gregory’ and ‘Wyoming’ were the shortest (11-13 inches), but they were also the least floriferous. ‘Mary Gregory’ produced an average of eight flowers per plant, while ‘Wyoming’ produced an average of six. ‘Alba,’ ‘Blue Danube,’ ‘Klaus Jelitto,’ and ‘Purple Parasols’ were tall – 15-20 inches (39-52 centimeters) at flower.

‘Blue Danube’ and ‘Klaus Jelitto’ were moderately floriferous (6-13 flowers per plant). Their flower number depended on the type of lighting. For these cultivars, flower number increased when HPS lamps were used for day extension rather than INC lamps.

‘Blue Danube’ was quite spindly and made a far less attractive potted plant than the multibranched ‘Klaus Jelitto.’ ‘Alba’ and ‘Purple Parasols’ were extremely floriferous and produced 17-24 flowers per plant. The flower number of ‘Purple Parasols’ was doubled when HPS lamps were used for day extension instead of INC lamps.

### About the author:
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**Table 2. Flowering characteristics of several cultivars of *S. laevis* after 15-week cold treatments**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Time to flower</th>
<th>Plant height at first flower under a 16-hr. photoperiod (14 mol-m⁻²-day⁻¹)</th>
<th>Number of flowers per plant under a 16-hr. photoperiod (14 mol-m⁻²-day⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Alba’</td>
<td>16 weeks</td>
<td>15 inches (39 centimeters)</td>
<td>17</td>
</tr>
<tr>
<td>‘Blue Danube’</td>
<td>9 weeks</td>
<td>16.5 inches (42 centimeters)</td>
<td>9</td>
</tr>
<tr>
<td>‘Klaus Jelitto’</td>
<td>10 weeks</td>
<td>20 inches (52 centimeters)</td>
<td>13</td>
</tr>
<tr>
<td>‘Mary Gregory’</td>
<td>10 weeks</td>
<td>11 inches (27 centimeters)</td>
<td>8</td>
</tr>
<tr>
<td>‘Purple Parasols’</td>
<td>9 weeks</td>
<td>16 inches (41 centimeters)</td>
<td>24</td>
</tr>
<tr>
<td>‘Wyoming’</td>
<td>11 weeks</td>
<td>13 inches (32 centimeters)</td>
<td>6</td>
</tr>
</tbody>
</table>