

Lighting Up Pansies

Michigan State University researchers are making pansies flower faster with extra lighting.

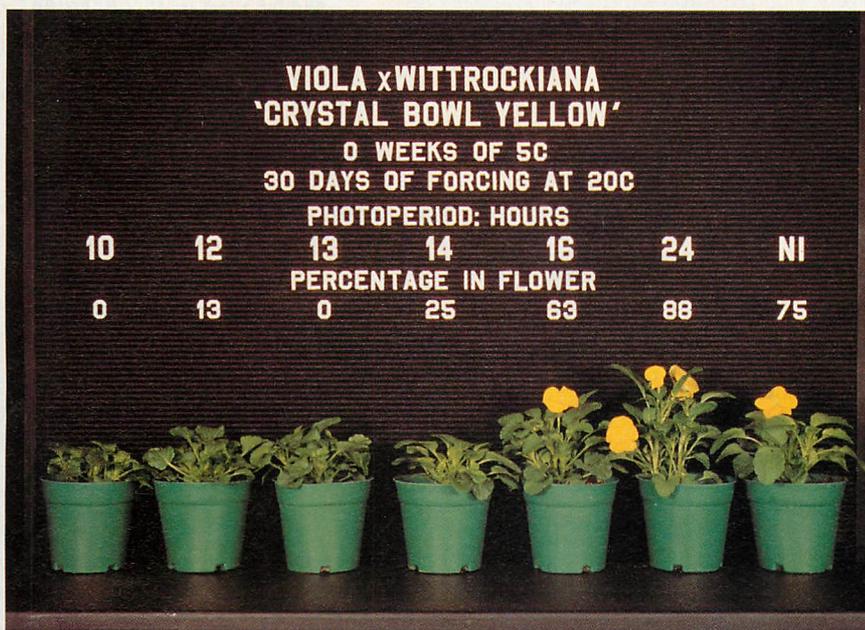


Figure 1. Photoperiod plays an important role in flowering of 'Crystal Bowl Yellow' pansy. Photoperiods consisted of 9-hour natural days and were completed with incandescent lamps. NI stands for night interruption, in which lights were switched on from 10 p.m. to 2 a.m. The flowering percentage indicates the proportion of plants that were flowering after 30 days in a 68°F (20°C) greenhouse.

by **ERIK S. RUNKLE** and **ROYAL D. HEINS**

PANSY production has increased dramatically during the past several years, particularly in the fall. Surveys show that pansies are among the most popular bedding plants to grow.

Pansy (*Viola xwittrockiana*) is a facultative long-day plant – one that eventually flowers under short days, but actually prefers long days. But how

and when are the best ways to provide long days to accelerate flowering? For the past 3 years, we have conducted experiments at Michigan State University (MSU) to uncover the answers.

The natural photoperiod varies over time, based on the latitude and time of year (Graph 1). In East Lansing, MI, for example, the shortest days are just less than 10 hours, and the longest days are slightly more than 16 hours. But the photoperiod varies less in lo-

cations nearer to the equator. In Athens, GA, for instance, the extremes in photoperiod are approximately 10¹/₂-15 hours. Growers who know their natural daylengths will be able to determine when lighting is necessary for fastest pansy flowering.

There are several lighting strategies that provide long days to plants. One technique – day-extension lighting – is lighting from sunset until the desired photoperiod is reached. The most common method of providing long days is to light for several hours during the middle of the natural dark period (10 p.m. to 2 a.m.). This is called night-interruption (NI) lighting.

Our studies were designed to determine what photoperiod is considered a long day, how much long days can accelerate flowering, and how a pansy's stage of development influences flowering response to long days.

In the first series of experiments, 6-week-old 'Crown Blue,' 'Crystal Bowl Yellow,' and 'Majestic Blue' were received in 288-cell plug trays. Eight seedlings of each cultivar then were transplanted into 4-inch containers and placed under the following photoperiods: 10, 12, 14, 16, or 24 hours of continual light or 9-hour days with a 4-hour NI. All photoperiods consisted of 9-hour natural days that were completed (as day extension or NI) with incandescent lamps, which provided 10-30 footcandles at plant level. The greenhouse temperature setting was a constant 68°F (20°C). Plants that did not flower within 8 weeks of transplanting were considered nonflowering and discarded. The experiment was repeated a second year for

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'Crystal Bowl Yellow.'

What Is A Long Day?

A long day, for horticultural purposes, is the photoperiod resulting in rapid, uniform flowering of a plant population. Less than $\frac{2}{3}$ of 14-week-old 'Crystal Bowl Yellow' and 'Crown Blue' plants flowered under 10-hour photoperiods. The flowering percentage increased as the photoperiod increased from 10 hours

(Graph 2).
Photoperiod did not affect flowering percentage of 'Majestic Blue' as dramatically. For all three cultivars, some plants under 10- or 12-hour photoperiods initiated visible buds, but the buds failed to develop into open flowers.

While the flowering percentage varied slightly among cultivars, most plants flowered under 14-hour photoperiods. Nearly all plants flowered under 16 or 24 hours of light or under NI. For uniform pansy flowering, long days are those with a daylength of at least 14 hours.

Accelerating Flowering

Photoperiod also affected time to flower. Plants grown under photoperiods of 14 hours or greater flowered a week faster than flowering plants under 10- or 12-hour photoperiods.

In addition, plants under long days flowered more uniformly than those under short days. Figure 1 shows the flowering response of 'Crystal Bowl Yellow.' Typical of the cultivars studied, this shows faster flowering under long days. For the most rapid and uniform flowering at a particular temperature, provide pansies with long days – or a daylength of at least 14 hours.

Plants under 24 hours of light were horticulturally unacceptable because stems elongated excessively and caused plants to fold over in their pots. The elongation was due, in part, to using incandescent lamps, which often promote stem extension more than other light sources. No growth retardant was applied.

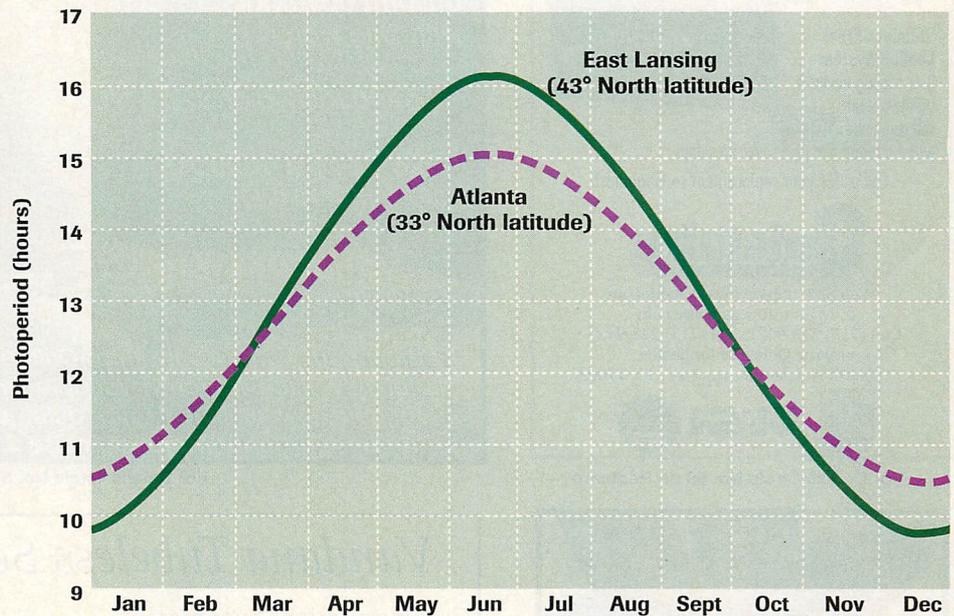
By using Graph 1, we can determine when natural photoperiods delay and reduce uniformity of pansy flowering. If 14 hours is selected as the minimum desirable daylength for rapid, uniform flowering, then a grower in Michigan should light the crop from September 1 through mid-April. A Georgia grower should use lighting from mid-August until late April.

Lighting becomes most important during the winter, when the natural daylengths are less than 12 hours. Pansies will flower during the short days of winter, but flowering is delayed and uneven.

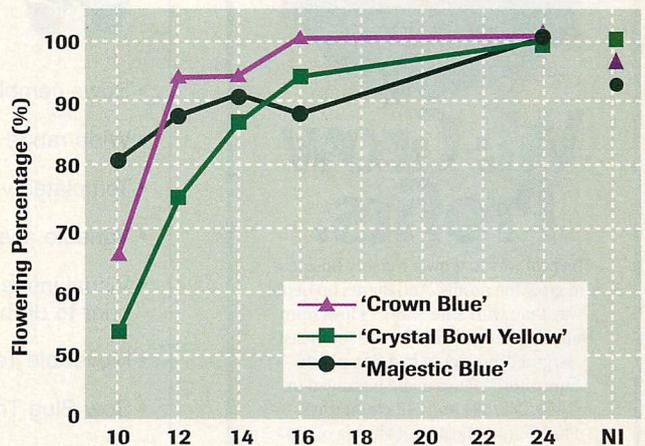
Determining How Long To Light

For pansies, photoperiodic lighting is not necessary once flower initiation has occurred. The duration of lighting required for flower initiation depends on plant age at the start of photoperiodic lighting.

We conducted a separate experiment to determine how the stage of pansy development influenced the response to

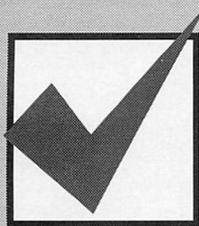


Graph 1. The approximate natural biological daylengths on clear days vary by latitude. Photoperiods are about 40 minutes longer than the sunrise-to-sunset duration, since plants perceive light before sunrise and after sunset.

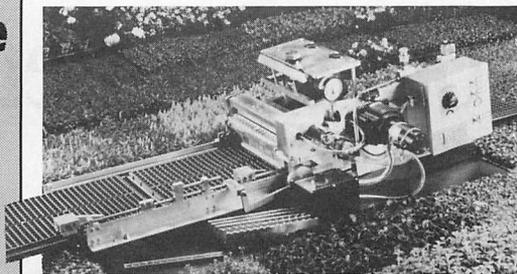


Graph 2. The flowering percentage of three cultivars of pansy under 10- to 24-hour photoperiods or night interruption (NI). Photoperiods of at least 14 hours or a 4-hour NI induces the highest flowering percentage. Plants that did not flower within 8 weeks of forcing were considered nonflowering.

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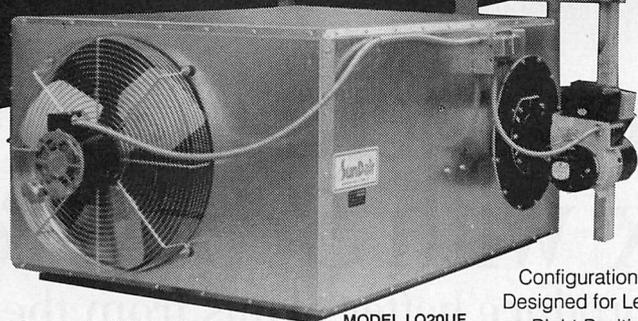
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long days and how many weeks of long days were needed to promote flowering at each stage. 'Crystal Bowl Yellow' and 'Majestic Blue' were sown into 288-cell plug trays and shipped to MSU, where they were placed under short days (9 hours of light).

When seedlings averaged one fully expanded leaf, they were transplanted into 48-cell packs. Plants were grown under short days, except during lighting treatments. Plants that averaged approximately 1, 3, 4¹/₂, 6, or 7¹/₂ leaves were provided with a 4-hour NI for 1, 2, 3, 4, or 5 weeks.

Twenty-four plants of each cultivar were grown for each developmental stage and lighting duration for a total of 25 treatments. Each cultivar was grown under continual short or long

“For rapid, uniform flowering at a particular temperature, provide pansy with long days – those with a daylength of 14 hours.”

*Erik S. Runkle and Royal D. Heins
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days. Plants that did not flower within 80 days of the one-leaf stage were considered nonflowering and discarded.

Few plants grown under continual short days or with only 1 week of long days flowered. Plants became more sensitive to long days as their size increased. For rapid and uniform flowering, larger plants required fewer weeks of long days than plants with fewer leaves. Lighting plants with fewer than three leaves did not promote flowering any more than using mature plants at the start of long days.

Long-day lighting should begin no earlier than the three-leaf stage. If the

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minimum flowering percentage for sales is 80%, then 2-5 weeks of long days are required, depending on plant size (see Table 1 for specific recommendations).

For example, to flower four- to five-leaf 'Majestic Blue' plants fastest, we recommend providing long days for 4 weeks. For both cultivars, plants with six or more leaves need only 2 weeks of long days for the most rapid flowering.

By following these recommendations, flowering will occur after the start of long days in 7-8 weeks for 'Crystal Bowl Yellow' and 8-9 weeks for 'Majestic Blue' at 68°F. If long-day conditions are not used, then flowering percentage will be relatively low, and time to flower will be delayed.

Regardless of plant size, lighting for durations longer than recommended will not improve flower timing or uniformity and may cause undesired stem elongation, especially if

Table 1.

A Guide To Fast Pansy Flowering

Number of leaves at the start of long days	Recommended number of weeks of long days for $\geq 80\%$ flowering	
	'Crystal Bowl Yellow'	'Majestic Blue'
1.0	4	5
3.0	4	4
4.5	3	4
6.0+	2	2

Table 1. For fast flowering of pansies, provide the following duration of long days, either with ≥ 14 -hour photoperiods or by using a 4-hour night interruption.

incandescent lamps are used.

Getting Good Results

Pansies will flower most rapidly and uniformly when photoperiods are at least 14 hours long or when 4 hours of light is provided during the middle of long nights.

When natural photoperiods are less than 14 hours, turn lights on at sunset

until a total of at least 14 hours of light has been delivered, or use 4-hour NI lighting. Light for 2-4 weeks, depending on plant size. **GG**

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