Case Study:
Kalamazoo Specialty Plants

Flowering Control:
Day Length Management to Control Flowering Times
Each 11W TotalGrow™ Night & Day Management Light bulb can control more than 100 sq ft of growing area, saving 90% of the power consumed by high pressure sodium lights!

The test:

TotalGrow™ conducted a test on the optimized photoperiodic spectrum of TotalGrow™ Night & Day Management Light bulbs to control the flowering of 26 varieties of mums at 100+ sq ft per 11W bulb.

The results:

- Across all 26 varieties, long day responses were successfully triggered by a 10 foot grid of TotalGrow™ Night & Day Management Light bulbs.
- Illuminated plant surfaces within an 8 foot radius of a light bulb exhibited controlled flowering timing.
- Light intensities of 0.5 µmole/m²/s or greater were fully effective, with intensities as low as 0.25 µmole/m²/s generally being sufficient as well.

The question:

- Can the optimized photoperiodic spectrum of TotalGrow™ Night & Day Management Lights control the timing of flowering of 100 sq ft or more?

From the grower:

“TotalGrow™ Night & Day Management Light bulbs were very effective at controlling flowering times across a large collection of my mum varieties this fall. The lights will allow me to greatly reduce my power consumption with better plant quality compared to my existing HPS lights.” – Rick Ouding, Owner
Observations and Notes:

- Mums are a short day plant, so Night & Day Management lighting prevents premature flowering.

- Mums require high light levels for effective flowering control, so results should be translatable to any crop.

- Flowering control can occur with degrees of success. A bare minimum level of lighting will successfully delay or force flowering in short or long day plants, respectively, but a higher intensity often delays flowering longer or forces flowering sooner.

- Flowering control is localized to the plant surfaces actually receiving the light. The mums under the test were large enough to block light from their far sides at distances more than a couple of feet from the last line of bulbs. Large plants require more care when placing lights to assure that all surfaces are effectively illuminated.

By The Numbers:

<table>
<thead>
<tr>
<th></th>
<th>TotalGrow™</th>
<th>High Pressure Sodium</th>
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</thead>
<tbody>
<tr>
<td>Power</td>
<td>11W</td>
<td>432W</td>
</tr>
<tr>
<td>Amps (120/240V)</td>
<td>0.09/0.05</td>
<td>3.6/1.8</td>
</tr>
<tr>
<td>Coverage</td>
<td>100+ sq ft</td>
<td>384-432 sq ft</td>
</tr>
<tr>
<td>Watts / sq ft</td>
<td>0.11</td>
<td>1.1-1.2</td>
</tr>
<tr>
<td>Weight</td>
<td>0.75 lbs</td>
<td>16 lbs</td>
</tr>
<tr>
<td>Hazards</td>
<td>None</td>
<td>Mercury</td>
</tr>
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Plants located 5-8 feet from the last light bulb show both the localization of flowering control and the effectiveness of 0.25 – 0.5 µmole/m²/s.

Increasing light levels cause a gradient of flowering control. Where maximum flowering control is desired, higher light levels are justified.

High pressure sodium lights were consuming 10X more energy than TotalGrow™ Night & Day Management Lights!
Kalamazoo Specialty Plants is a leader among greenhouse growers. Dedicating an unusual amount of time, space and resources to research and innovation allows leadership in valuable new markets and retention of satisfied customers. The innovative technology behind TotalGrow™ lights and their ability to custom-tailor products to match the needs of growers and plants have made them a natural fit in the KSP research and production greenhouses.

<table>
<thead>
<tr>
<th>Item</th>
<th>TG1A</th>
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<tbody>
<tr>
<td>Product Type</td>
<td>Light Bulb (E26)</td>
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<tr>
<td>Power Consumption</td>
<td>11W</td>
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<tr>
<td>Projected Service Life</td>
<td>20,000+ hours</td>
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<tr>
<td>Output Efficiency</td>
<td>1.3 pmol/eJ</td>
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Grower
Kalamazoo Specialty Plants, LLC

Location
Kalamazoo, MI, USA

Crop
Specialty bedding plants

Lights Tested
TotalGrow™ Night & Day Management Light TG1A, High Pressure Sodium

Results
- Each 11W TotalGrow™ Night & Day Management Lights controlled 100+ sq ft
- 90% energy savings potential
- Reduced maintenance