

Using growth regulators to control height of herbaceous perennials

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Keep perennial height in check with these guidelines

Anyone familiar with flowering herbaceous perennials knows they include a range of species that grow very tall, especially when forced in a greenhouse. Shorter species also may develop flowers on extremely tall

spikes. When in flower, these plants can be very difficult to ship and display. Retailers find that a good-looking perennial plant in flower sells; customers prefer a plant in bloom for the immediate show that its

flowers provide in the garden. However, even when in flower, a tall or floppy plant is not as appealing.

As part of ongoing research in perennials at Michigan State University, we have screened growth regulators to determine their effectiveness on a variety of herbaceous perennials. The objective has been to determine whether a growth regulator was

Table 1: Species where flowering was delayed by five or more days by applications of 5,000 ppm B-Nine every 10 days when compared to untreated plants.

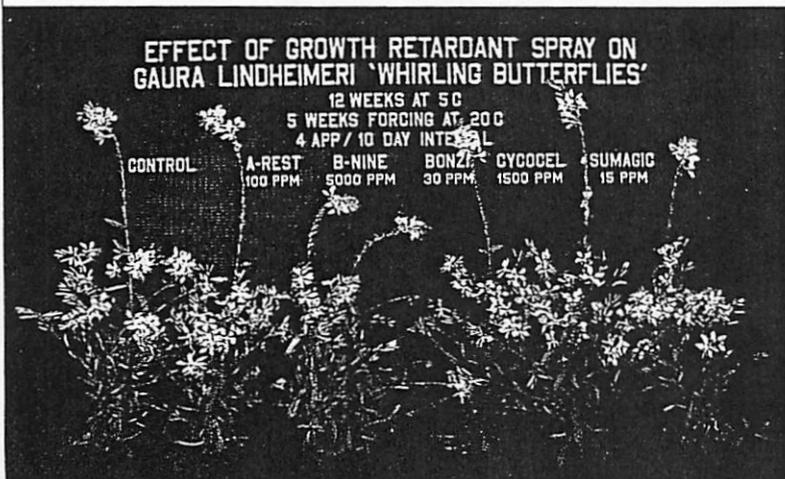


Figure 1: Whirling Butterflies *Gaura lindheimeri* was unresponsive to all chemical growth regulators.

Scientific name	Common name
<i>Achillea millefolium</i> Summer Pastels	Common yarrow
<i>Alcea rosea</i> Chater's Double Mix	Hollyhock
<i>Aster alpinus</i> Alpine Mix	Alpine aster
<i>Campanula carpatica</i> Blue Clips	Carpathian harebell
<i>Chrysanthemum coccineum</i> J. Kelway	Painted daisy
<i>Coreopsis grandiflora</i> Sunray	Tickseed
<i>Coreopsis verticillata</i> Moonbeam	Threadleaf coreopsis
<i>Heuchera sanguinea</i> Bressingham	Coralbells
<i>Lavandula angustifolia</i> Munstead Dwarf	Lavender
<i>Lobelia x hybrida</i> Queen Victoria	Cardinal flower
<i>Lobelia x speciosa</i> Compliment Scarlet	Sweet lobelia
<i>Perovskia atriplicifolia</i>	Russian sage
<i>Salvia x superba</i> Blue Queen	Sage

Table 2: The relative effectiveness of repeated applications of 100 ppm ancymidol (A-Rest), 5,000 ppm daminozide (B-Nine), 30 ppm paclobutrazol (Bonzi), 1,500 ppm chlormequat (Cycocel) or 15 ppm uniconazole (Sumagic) on 35 species of herbaceous perennials. The rates tested were high to determine qualitative plant response and are not necessarily recommended for use in commercial industry.

Herbaceous perennial response to growth regulators						
Species		Growth regulators				
Scientific name	Common name	A-Rest	B-Nine	Bonzi	Cycocel	Sumagic
<i>Achillea millefolium</i> Summer Pastels	Common yarrow	no response	slight response	slight response	no response	slight response
<i>Alcea rosea</i> Chater's Double Mix	Hollyhock	no response	slight response	slight response	slight response	slight response
<i>Asclepias tuberosa</i>	Butterfly weed	slight response	slight response	slight response	no response	slight response
<i>Aster alpinus</i> Alpine Mix	Alpine aster	no response	slight response	slight response	no response	no response
<i>Astilbe x arendsii</i> Bressingham Beauty	Astilbe	slight response	no response	slight response	slight response	no response
<i>Campanula carpatica</i> Blue Clips	Carpathian harebell	slight response	slight response	slight response	slight response	slight response
<i>Campanula persicifolia</i> Blue	Bellflower	slight response	slight response	no response	no response	no response
<i>Centaurea montana</i> Violet	Mountain bluet	no response	slight response	no response	no response	slight response
<i>Chelone glabra</i>	Turtlehead	no response	no response	no response	no response	no response
<i>Chrysanthemum coccineum</i> J. Kelway	Painted daisy	slight response	slight response	no response	slight response	slight response
<i>Coreopsis grandiflora</i> Sunray	Tickseed	slight response	slight response	slight response	slight response	slight response
<i>Coreopsis verticillata</i> Moonbeam	Threadleaf coreopsis	no response	slight response	no response	no response	slight response
<i>Delphinium elatum</i> Mix	Delphinium	slight response	no response	slight response	no response	slight response
<i>Echinacea purpurea</i> Bravado	Purple coneflower	slight response	slight response	slight response	slight response	slight response
<i>Gaillardia x grandiflora</i> Burgundy	Blanket flower	no response	no response	no response	no response	no response
<i>Gaura lindheimeri</i> Whirling Butterflies	Gaura	no response	no response	no response	no response	no response
<i>Gypsophila paniculata</i> Double Snowflake	Baby's-breath	no response	no response	slight response	slight response	no response
<i>Helenium autumnale</i>	Sneezeweed	no response	slight response	no response	no response	no response
<i>Hemerocallis</i> Hall's Pink	Daylily	slight response	no response	no response	no response	slight response
<i>Heuchera sanguinea</i> Bressingham	Coralbells	no response	slight response	no response	no response	slight response
<i>Hibiscus x hybrida</i> Disco Belle Mix	Mallow	slight response	slight response	slight response	slight response	slight response
<i>Lavandula angustifolia</i> Munstead Dwarf	Lavender	slight response	slight response	no response	no response	slight response
<i>Leucanthemum x superbum</i> Marconii	Shasta daisy	no response	no response	slight response	no response	slight response
<i>Linum perenne</i> Sapphire	Flax	slight response	no response	slight response	no response	no response
<i>Lobelia x hybrida</i> Queen Victoria	Cardinal flower	slight response	slight response	slight response	slight response	slight response
<i>Lobelia x speciosa</i> Compliment Scarlet	Sweet lobelia	slight response	slight response	slight response	slight response	slight response
<i>Perovskia atriplicifolia</i>	Russian sage	slight response	slight response	slight response	slight response	slight response
<i>Phlox paniculata</i> Eva Cullum	Summer phlox	no response	no response	slight response	slight response	slight response
<i>Physostegia virginiana</i> Summer Snow	Obedient plant	no response	no response	no response	no response	no response
<i>Rudbeckia fulgida</i> Goldsturm	Black-eyed Susan	slight response	slight response	slight response	slight response	no response
<i>Salvia x superba</i> Blue Queen	Sage	no response	slight response	no response	no response	slight response
<i>Sedum spurium</i> Dragon's Blood	Sedum	no response	no response	slight response	no response	slight response
<i>Veronica longifolia</i> Red Fox	Speedwell	slight response	slight response	slight response	slight response	slight response
<i>Veronica longifolia</i> Sunny Border Blue	Speedwell	slight response	slight response	slight response	slight response	slight response
<i>Veronica spicata</i> , Blue	Speedwell	slight response	slight response	no response	no response	slight response

no response
 slight response
 moderate response
 strong response

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effective on a particular species, not to determine recommended rates for that species.

While all five of the common growth regulators used in the floricultural industry, ancymidol (A-Rest), daminozide (B-Nine), paclobutrazol (Bonzi), chlormequat (Cycocel) and uniconazole

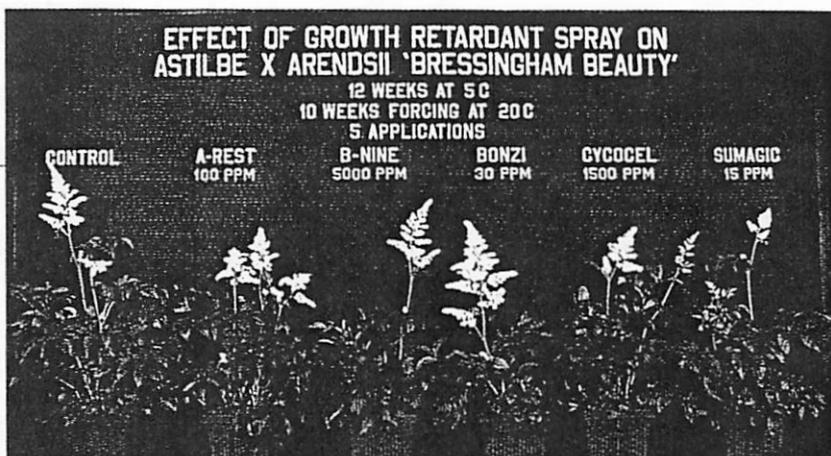
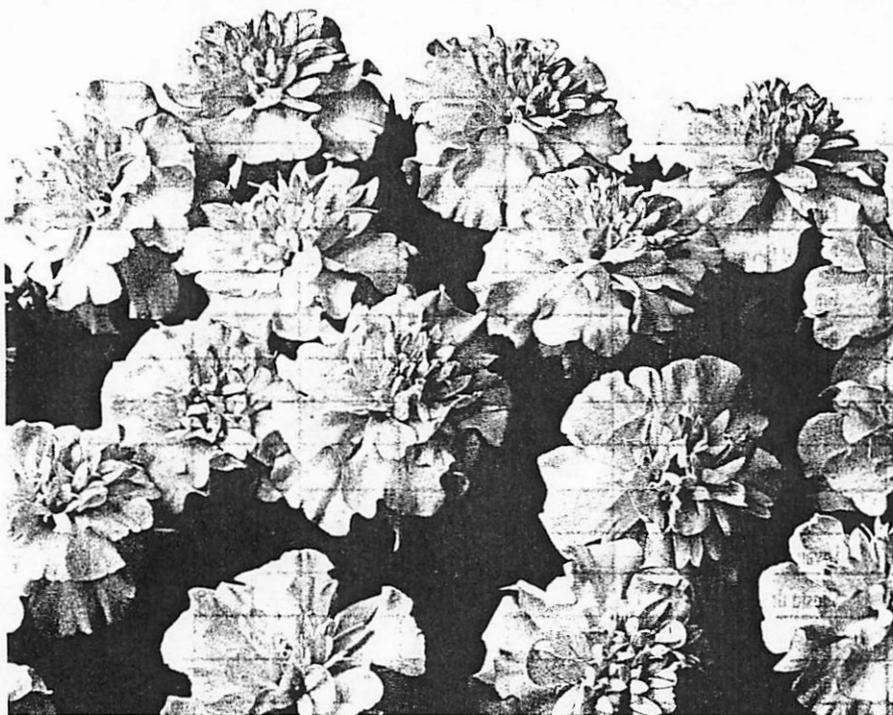


Figure 2: Bressingham Beauty *Astilbe x hybrida* was only slightly responsive to growth regulators probably because the sequence of applications missed the rapid elongation phase.

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(Sumagic), reduce stem elongation of some floricultural crops, none reduces stem elongation of all species and little is known about their effectiveness on perennials. How will they work on perennials?

The five growth regulators we tested as spray applications were 100 ppm A-Rest, 5,000 ppm B-Nine, 30 ppm Bonzi, 1,500 ppm Cycocel and 15 ppm Sumagic. The rates used during testing were high to assure plant response; they are not necessarily recommended for commercial height-

A single growth regulator did not effectively control the height of every species, although most species responded to at least one chemical.

control programs.

During the last three years, we've been able to determine growth response of 35 species to these five chemicals. Field-grown divisions or 50-cell plugs were planted into 1 gal. containers or 4- or 5-in. pots, respectively. All plants were grown at 68F under a 4-hour night interruption delivered from 10 p.m. to 2 a.m. by high pressure sodium lamps. Transplants were given time for establishment and then were sprayed with the growth regulators at 10-day intervals until flower. We

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measured height every 10 days. Time to visible bud and flower, number of inflorescences and final plant height were recorded for each treatment. We treated 10 plants with each growth regulator and compared them to untreated plants. If there was no discernible difference in height between treated and

EFFECT OF GROWTH RETARDANT SPRAY ON CAMPANULA CARPATICA 'BLUE CLIPS'

12 WEEKS AT 5C
9 WEEKS FORCING AT 20C
4 APP / 10 DAY INTERVAL

CONTROL	A-REST 100 PPM	B-NINE 5000 PPM	BONZI 30 PPM	CYCOCEL 1500 PPM	SUMAGIC 15 PPM
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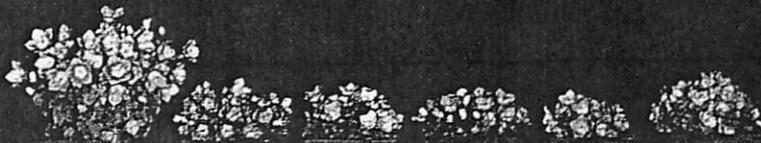
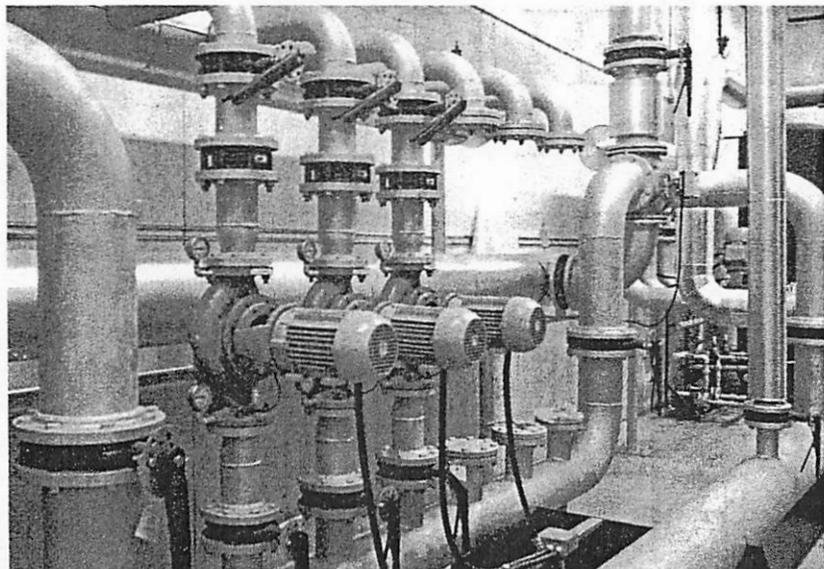


Figure 3: Species such as Blue Clips *Campanula carpatica* respond dramatically to chemical growth regulators. The excessive response of *C. carpatica* can be prevented through lower application rates or fewer applications.



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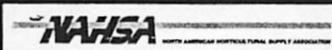
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untreated plants after at least three applications, we concluded that the growth regulator was not effective in controlling that species stem elongation.

Plant response varied among growth regulators (Table 2). A single growth regulator did not effectively control the height of every species, although most species responded to at least one chemical. B-Nine and Sumagic were the most effective growth regulator tested; reducing the height of 23 and 24 species, respectively. A-Rest, Bonzi and Cycocel were effective on 20, 21 and 13 species, respectively.

Seven species responded in some degree to all growth regulators. Unfortunately, four of the taller species, *Chelone glabra*, *Gaillardia x grandiflora*, *Gaura lindheimeri* (Figure 1) and *Physostegia virginiana*, were unresponsive to any spray treatments. Higher rates than those we used may be necessary to control the height of these species. The timing of a growth regulator application is critical on species that bolt or have extremely fast developmental rates from visible bud to flower, such as *Aster alpinus*, *Astilbe x arendsii* (Figure 2) and *Echinacea purpurea*. For these species, the growth regulator must be applied just at or just before the rapid elongation phase of development.

Another factor to consider is the degree to which some species' growth must be retarded. Rates used in this trial were designed to determine efficacy, and applications at the experimental rates may result in excessive height

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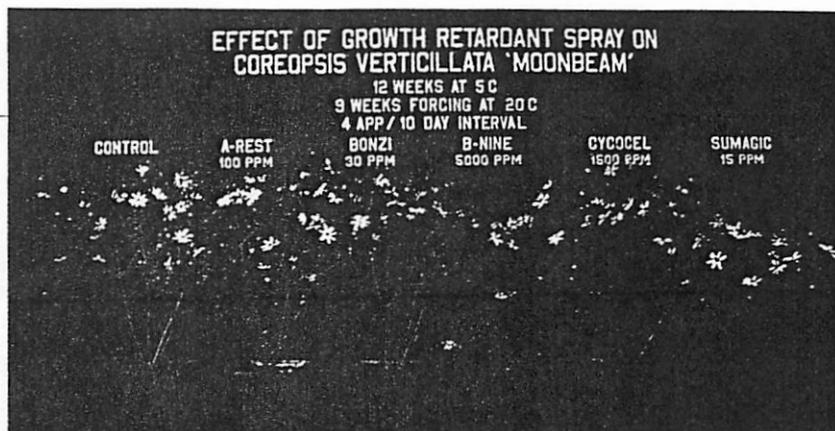
Figure 4: Growth regulators occasionally cause flowering delay. Applications of 5,000 ppm B-Nine effectively reduced height of Moonbeam *Coreopsis verticillata*, but delayed flowering compared to other treatments.

control. For example, Blue Clips *Campanula carpatica* (Figure 3) was severely stunted. However, it is possible to reduce the final height of a species slightly using growth regulators at lower rates.

Also included in the evaluation of responsiveness to different growth regulators were timing of bloom, flower number and physiological disorders caused by sensitivity to a specific growth regulator. In our experience, treating with 5,000 ppm B-Nine occasionally caused a flowering delay (Table 1), such as those of *Achillea millefolium* and *Coreopsis verticillata* (Figure 4). As is well documented on other species, Cycocel causes foliar chlorosis on a number of herbaceous perennials. Species with the most severe chlorosis were *Chelone glabra* and *Hibiscus x hybrida*.

The use of growth regulators to control the height of larger unruly species may be an effective strategy to increase their attractiveness. Specific application rates are difficult to recommend because of differences in climate, greenhouse, species, pot size, growing technique and final desired height. If you do test any of these growth regulators, we suggest initial applications be made at 50 ppm A-Rest, 2,500 ppm B-Nine, 15 ppm Bonzi, 1,500 ppm Cycocel or 10 ppm Sumagic. If height is shorter or taller than desired, adjust application frequency and rates based on your experience. □

Cheryl Hamaker is a graduate student, Beth Engle is a former graduate student and Royal Heins, William Carlson and Art Cameron are professors of horticulture, Department of Horticulture, Michigan State University, East Lansing, Michigan. They would like to thank generous industry supporters who made possible the research this article is based on, as well as Shannon Strauch, Cara Wallace, Tom Wallace and Kate Wanagat.



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