



Figure 1. Sumagic was applied twice to the plugs of 'Surfinia Blue Vein,' the first at 40 ppm and the second at 20 ppm.

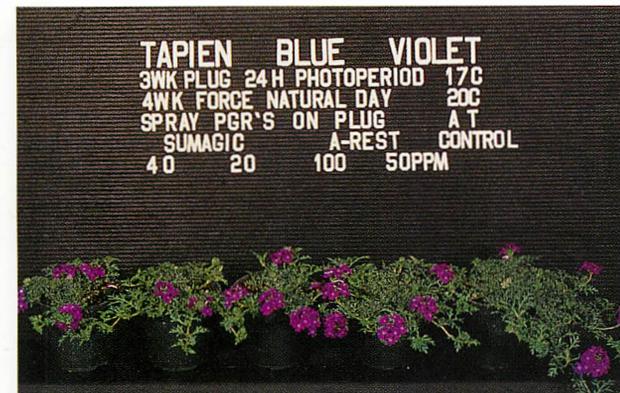


Figure 2. A compact, finished four-inch pot of 'Tapien Blue Violet' can be produced with one application of Sumagic or A-Rest on the plug.

Proven PGRs

Michigan State University researchers have discovered which plant growth regulators (PGRs) work best with Proven Winners. Here are the results.

by HONGWEN GAO, SHI-YING WANG, ROYAL HEINS, ARTHUR CAMERON, and WILL CARLSON

MANY attractive, high-value plants have been introduced to the industry in recent years by Proven Winners growers. Their plants have become very popular for hanging baskets and bedding plants. Anyone familiar with Proven Winners knows they include a range of species that grow very vigorously and can be difficult to ship when in flower.

Retailers have found compact, good-looking plants in flower sell well. Customers prefer a plant in bloom for immediate show and want a vigorous growth response after they plant

Proven Winners in their gardens. It is therefore very important for producers to have proper height control of finished plants, without influencing their flowering and subsequent growth (see Figure 1).

The common plant growth regulators (PGRs) used in floriculture are ancymidol (A-Rest), daminozide (B-Nine), paclobutrazol (Bonzi), chlormequat (Cycocel), and uniconazole (Sumagic). They all reduce stem elongation of some crops, but none reduce stem elongation of all species and little is known about their effectiveness on Proven Winner species. As part of our ongoing research program with Proven Winners at Michigan State University (MSU), we have screened several PGRs to determine their effectiveness on a variety of Proven Winner species and cultivars.

The Experiment

We conducted experiments at MSU during the 1998 and 1999 spring seasons. All crops were

Table 1. Proven Winners' Response To PGRs*

Species & Cultivars	A-Rest 100 ppm	B-Nine 5,000 ppm	Bonzi 80 ppm	Cycocel 3,000 ppm	Sumagic 40 ppm
Argyranthemum 'Butterfly'	TR	NR	MR	SR	TR
Argyranthemum 'Summer Melody'	NR	NA	NR	NA	MR
'Million Bells Cherry Pink'	TR	SR	TR	MR	TR
'Million Bells Trailing Pink'	NR	NR	MR	SR	TR
Scaevola 'New Wonder'	TR	NR	TR	NR	TR
'Surfinia Blue Vein'	SR	MR	SR	NR	MR
'Supertunia Purple Sunspot'	MR	NA	NA	NA	TR
'Tapien Blue Violet'	TR	NR	SR	NR	TR
'Tapien Pink'	TR	NR	SR	NR	MR
'Temari Bright Red'	MR	NR	SR	NR	SR
Torenia 'Summer Wave Violet'	NR	NR	NR	SR	NR
Nemesia 'Blue Bird'	SR	NR	NR	NR	SR
Nemesia 'Compact Innocence'	SR	NR	NR	NR	SR

*All applications were made by spraying one gallon per 150 square feet on eight-week old plugs. NR = no response; SR = slight response; MR = moderate response; TR = strong response; and NA = no application

PRODUCTION

PROVEN WINNERS

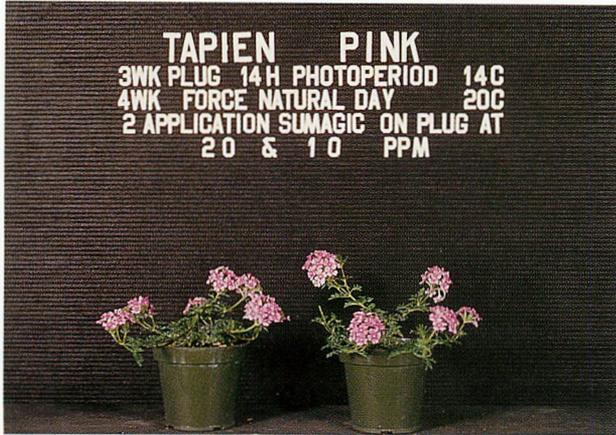


Figure 3. Sumagic was applied twice to the plugs of 'Tapien Pink,' the first at 20 ppm and the second at 10 ppm.

started from five-week-old, vegetatively-propagated plugs in 84-cell plug trays from Four Star Greenhouses in Carleton, MI.

All plugs were first grown at 57°F (14°C) under a 14-hour long photoperiod (400 footcandles of high-pressure-sodium supplemental light) for three weeks, and then transplanted into four-inch pots and grown under natural daylengths at 68°F (20°C) until finished. PGRs were applied to six- to eight-week-old plugs by spraying at one gallon per 150 square feet. Plant height, shoot number, bud and flower number, and days from forcing to flowering were recorded and used to evaluate the effectiveness of the growth regulators.

We first tested the relative effectiveness of five growth regulators on 13 Proven Winners varieties. High application rates were used during testing to evaluate if a plant responded (100 ppm A-Rest; 5,000 ppm B-Nine; 80 ppm Bonzi; 3,000 ppm Cycocel; and 40 ppm Sumagic). Plant response varied among PGRs (see Table 1).

No single growth regulator effectively controlled the height of every species, although most species responded to at least one chemical.

Argyranthemum 'Butterfly' and 'Summer Melody,' 'Million Bells Cherry Pink' and 'Trailing Pink,' scaevola 'New Wonder,' 'Surfinia Blue Vein,' 'Supertunia Purple Sunspot,' and 'Tapien Blue Violet' and 'Pink' responded strongly to Sumagic.

Argyranthemum 'Butterfly,' 'Million Bells Cherry Pink,' scaevola 'New Wonder,' 'Tapien Blue Violet,' and 'Temari Bright Red' responded strongly to A-Rest.

Argyranthemum 'Butterfly,' 'Million Bells Cherry Pink' and



Figure 4. A-Rest was applied twice to the plugs of 'Temari Bright Red,' the first at 100 ppm and the second at 50 ppm.

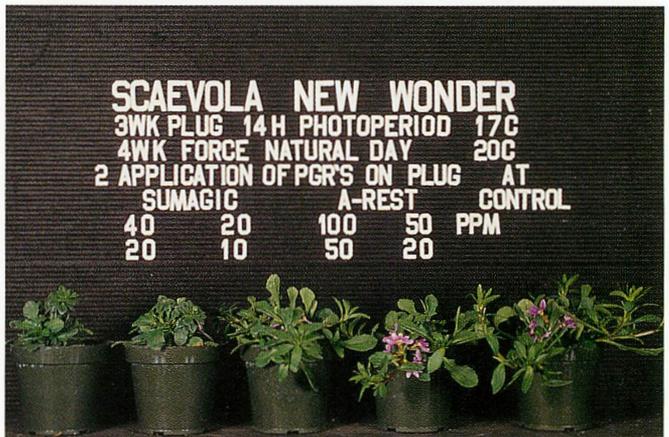


Figure 5. Scaevola 'New Wonder' responds dramatically to Sumagic and A-Rest. Using Sumagic caused a significant flowering delay and a decrease in shoot numbers.

Table 2. PGR's Effect On Plant Height Of Proven Winners

Species & Cultivars	One Application ^a				Two Applications ^b			
	Sumagic ppm		A-Rest ppm		Sumagic ppm		A-Rest ppm	
	40	20	100	50	40+20	20+10	100+50	50+20
Argyranthemum 'Butterfly'	30% ^c	30%	15%	8%	42%	39%	30%	17%
Argyranthemum 'Summer Melody'	27	27	0	0	NA	NA	NA	NA
'Million Bells Cherry Pink'	15	0	0	0	45	0	0	0
Scaevola 'New Wonder'	43	43	0	0	59	53	25	25
'Supertunia Purple Sunspot'	46	36	23	20	60	60	30	30
'Surfinia Blue Vein'	7	0	0	0	35	24	24	15
'Tapien Blue Violet'	50	38	45	36	NA	NA	NA	NA
'Tapien Pink'	25	17	0	0	46	30	0	0
'Temari Bright Red'	0	0	20	0	60	42	51	37

a = The application was made on six-week old plugs.

b = First and second applications were made on six- and eight-week old plugs, respectively, by spraying at one gallon per 150 square feet.

c = Percentage of plant height reduction

NA = No application of PGRs

PRODUCTION

PROVEN WINNERS

Trailing Pink, and scaevola 'New Wonder' responded strongly to Bonzi.

The height of torenia 'Summer Wave Violet' was not affected by most growth regulators tested. B-Nine and Cycocel were the least effective chemical for height control of most species tested.

Based on these results, Sumagic and A-Rest were chosen for further study. We conducted an experiment to determine their effectiveness based on the same application times and rates (see Table 2).

We found that 1) Sumagic was the most effective chemical for plant height control of most species tested at the rates applied; 2) A-Rest is effective for plant height control of 'Tapien Blue Violet' (see Figure 2), 'Temari Bright Red,' and 'Supertunia Purple Sunspot'; 3) 'Surfinia Blue Vein' was relatively less sensitive to PGRs, especially at low rates; 4) effective plant height control can be achieved with one application of PGRs for argyranthemum 'Butterfly' and 'Summer Melody,' scaevola 'New Wonder,' 'Tapien Blue Violet' (Figure 2), and nemesia 'Blue Bird' and 'Compact Innocence'; and 5) a second application of PGRs is needed for effective height control of 'Million Bells Cherry Pink,' 'Supertunia Purple Sunspot,' 'Surfinia Blue Vein,' 'Tapien Pink' (see Figure 3), and 'Temari Bright Red' (see Figure 4).

We also evaluated the timing of flowering, flower number, and shoot number. Treating with Sumagic delayed flowering of 'Supertunia Purple Sunspot' and scaevola 'New Wonder' eight to 14 days (see Figure 5).

The bud number of finished plants was reduced 15% to 35% by applying Sumagic or A-Rest for most species tested. The response of shoot number to growth regulators varied among species (see Table 3). The shoot number of most species was reduced by application of Sumagic and A-Rest.

No long-term carryover effect of PGRs on plant height was observed in any treatment in the experiment. All plants resumed normal growth five to six weeks after growth regulators were applied.

Recommended Rates

Using PGRs for proper height control of Proven Winners plant species is an effective strategy to increase their attractiveness. Suggested plant growth regulators and application rates are summarized in Table 4.

The suggested times for first and second applications are on six- and eight-week-old plugs, respectively. The second application also can be made by spraying at a low rate (5 or 10 ppm) for two to three times starting at week eight while tracking plant height. **GG**

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“Customers prefer a plant in bloom for immediate show and want a vigorous response after they plant Proven Winners in their gardens. It is therefore very important for producers to have proper height control of finished plants.”

Michigan State University researchers

Table 3. **PGR's Effect On Shoot Number Of Proven Winners**

Species & Cultivars	One Application ^a				Two Applications ^b			
	Sumagic ppm		A-Rest ppm		Sumagic ppm		A-Rest ppm	
	40	20	100	50	40+20	20+10	100+50	50+20
Argyranthemum 'Butterfly'	0	0	0	0	-15 ^c	-11	-18	0
Argyranthemum 'Summer Melody'	0	-9	+12	0	NA	NA	NA	NA
'Million Bells Cherry Pink'	-30	-10	-12	-17	-52	-34	-30	-29
Scaevola 'New Wonder'	0	0	+20	+20	-70	-65	+20	+32
'Supertunia Purple Sunspot'	-34	-25	0	0	-70	-57	-46	-40
'Surfinia Blue Vein'	-20	-27	-19	-18	-49	-35	-35	0
'Tapien Blue Violet'	-74	-44	-57	-44	NA	NA	NA	NA
'Tapien Pink'	-28	-16	0	0	-69	-60	-37	-38
'Temari Bright Red'	-16	-15	-16	-15	-37	-44	-37	-30

a = The application was made on six-week old plugs.

b = First and second applications were made on six- and eight-week old plugs, respectively, by spraying at one gallon per 150 square feet.

c = Percentage of shoot number change: '-' decrease and '+' increase

NA = No application of PGRs

Table 4. **Suggested PGRs And Application Rates For Proven Winners**

Species & Cultivars	First Application*	Second Application*
Argyranthemum 'Butterfly'	Sumagic 20 ppm	Not needed
Argyranthemum 'Summer Melody'	Not needed	Not needed
'Million Bells Cherry Pink'	Sumagic 20 or A-Rest 50 ppm	Sumagic 10 or A-Rest 20 ppm
Scaevola 'New Wonder'	Sumagic 20 ppm	Not needed
'Supertunia Purple Sunspot'	Sumagic 20 ppm	Sumagic 10 ppm
'Surfinia Blue Vein'	Sumagic 40 ppm	Sumagic 20 ppm
'Tapien Blue Violet'	Sumagic 20 or A-Rest 50 ppm	Not needed
'Tapien Pink'	Sumagic 20 ppm	Sumagic 10 ppm
'Temari Bright Red'	A-Rest 100 ppm	A-Rest 50 ppm
Nemesia 'Blue Bird'	Sumagic 40 ppm	Not needed
Nemesia 'Compact Innocence'	Not needed	Not needed

*Suggested time for first and second applications are on six- and eight-week old plugs, respectively, by spraying at one gallon per 150 square feet.