Growth Retardant Effects on Hydrangeas

Douglas A. Bailey and Bernadette Clark
Department of Horticultural Science, NCSU

One of the major cultural problems encountered during summer production of dormant hydrangeas is height control. Much research has been conducted on growth retardant applications during the forcing phase of hydrangeas (Anonymous, 1973; Bailey, 1989; Bailey et al., 1986; Scott, 1982; Tjia et al., 1976), but only a few studies have targeted height control during summer vegetative growth (Jung, 1964; Ulery, 1978). There is little known about how hydrangea cultivars differ in height, and no information is available on cultivar response differences to growth retardants. Another area of concern regarding summer height control is the possibility of carry over effects of growth retardant applications on subsequent greenhouse forcing; effects such as a delay in flowering, inflorescence size reduction, and reduced elongation could be possible, especially for the long lasting triazole compounds Bonzi (paclobutrazol) and Sumagic (uniconazole).

This study was undertaken to 1) compare B-Nine with Bonzi and Sumagic as height control treatments during summer production of seven hydrangea cultivars; 2) note any differences in response to the growth retardant treatments among the cultivars; and 3) record any carry over effects of the growth retardant treatments during spring forcing of the plants. We are very appreciative of the cooperation and assistance given by Sam Franklin and his staff at Franklin Brother's Nursery and Greenhouse, for their donations to this study and for allowing us to conduct our summer vegetative growth research at their establishment in Henderson, N.C.

Materials and Methods

On 23 May 1990, terminal cuttings of 'Böttstein', 'Enziandom', 'Kasteln', 'Mathilde Gütges', 'Merritt's Supreme', 'Red Star', and 'Schenkenburg' were dipped in 8000 ppm IBA/ talc, stuck in 1:1 perlite:vermiculite, and rooted under mist using 72°F bottom heat. The cuttings were well rooted by 21 June 1990, when they were pinched back to 2 nodes per cutting and potted one cutting per 6" pot in a 3 bark: 1 sand: 1 peat moss substrate amended with 12 lbs dolomitic limestone/yd^3, 4 lbs 0-20-0 superphosphate/yd^3, and 3 lbs gypsum/yd^3. After a 3 week establishment period in the greenhouse, plants were placed outdoors in full sun and irrigated as needed using a drip tube system. Plants were fertilized at every irrigation with 225 ppm N supplied from ammonium nitrate + calcium nitrate + potassium nitrate. Iron deficiency chlorosis became a problem, and plants were drenched with 4 oz of iron chelate (10% Fe) per 100 gallons during August to correct the chlorosis.

The growth retardant treatments applied to the plants were 1) a no-spray control; 2–3) 5000 ppm B-Nine spray 1× or 2×; 4–5) 62 ppm Bonzi spray 1× or 2×; and 6–7) 5 ppm Sumagic spray 1× or 2×. The first sprays were made 24 July 1990 and the second sprays were made 17 August 1990. All sprays were made applying 1/2 gallon of spray per 100 ft^2 of production area. Treatments were replicated 5 times using a randomized complete block design.

Plants were removed from the field 29 October 1990 and placed into a 65°F/75°F (night/ day) greenhouse. From 3–5 November 1990, the plants were defoliated by placing them in a 75°F room equipped with an ethylene generator. After the ethylene treatment, the plants were moved back to the greenhouse to allow remaining leaves to drop off prior to placing plants into a dark 40°F cooler on 12 November 1990. Fall height measurements were taken just prior to placement into the cooler. All heights were measured from the upper rim of the pot to the top of the tallest shoot.

Hydrangeas have a 6 week cold storage requirement, and plants were removed from the cooler 28 December 1990 and placed in a 62°F/ 68°F (night/day) greenhouse. Plants were fertilized with 200 ppm N at each watering supplied from 20-20-20 and treated monthly with 3.5 oz iron chelate per 100 gallons to prevent iron deficiency chlorosis. The date of anthesis (when pollen was present) for the first flower on each plant was recorded. Plant height and number of flowering shoots (as compared to blind shoots which had no inflorescences) were also recorded for each plant at anthesis.

Results and Discussion

Summer Height Control. The cultivars used in this study differed from each other in plant height attained during the summer production period, and they also responded differently from each other to the growth retardant treatments applied (Figure 1). 'Böttstein' controls were the shortest unsprayed plants; but even an 8" fall height is undesirable for hydrangeas. Most hydrangeas will more than double their height during greenhouse forcing. For example, a plant that is 8" tall at the beginning of forcing will probably be 18" tall at flowering; add the 6" pot height, and the total height would be 24". Given that 24" is too tall for hydrangeas in most markets, it was concluded that the cultivars we tested require some height control during summer production to produce plants of acceptable height during forcing.

As mentioned above, the cultivars responded differently to the growth retardant treatments. B-Nine 1× and 2× treatments effectively reduced summer elongation for plants of all seven cultivars. However, Bonzi 1× was only effective on 'Kasteln' and 'Mathilde Gütges' plants. The 2× Bonzi treatment was only slightly more effective, reducing height of 'Enziandom', 'Kasteln', 'Mathilde Gütges', and 'Schenkenburg' plants. Sumagic 1× was effective on plants of 'Böttstein', 'Enziandom', 'Kasteln', 'Red Star', and 'Schenkenburg'; 2× Sumagic

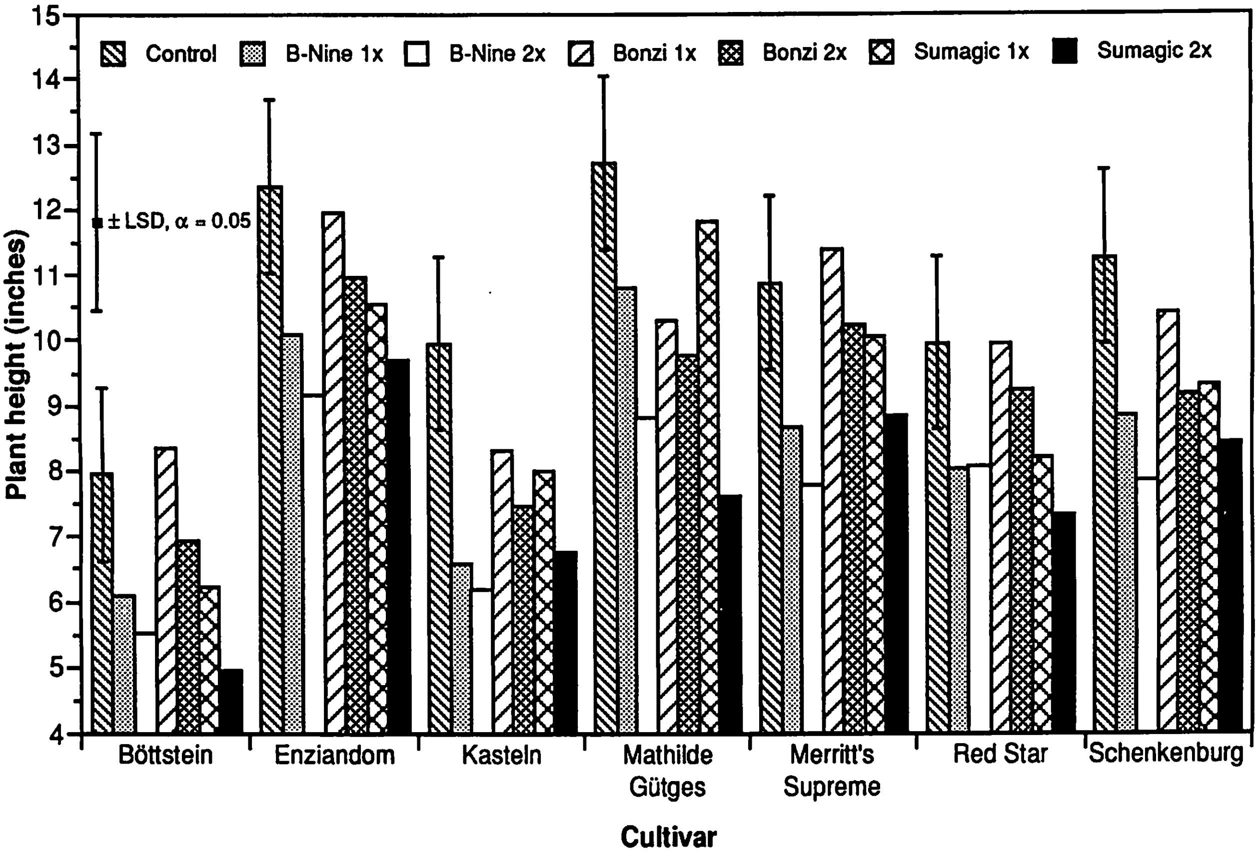

Figure 1. Plant height at the end of the summer growing season.

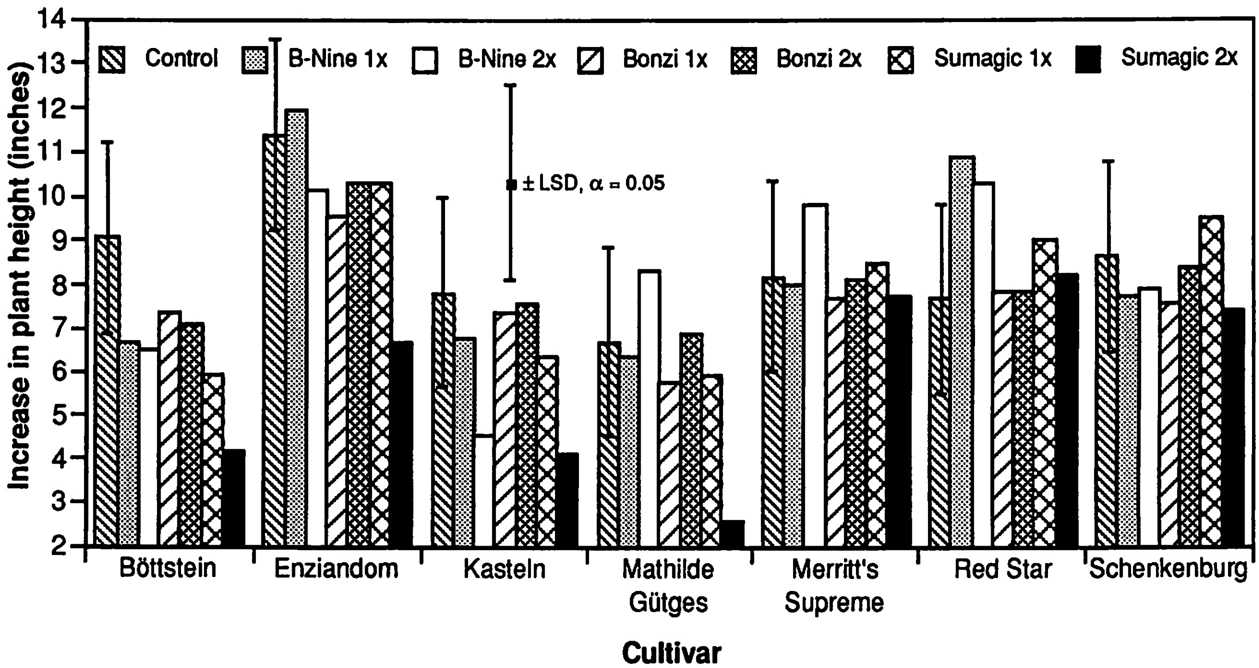

Figure 2. Increase in height (height at anthesis – height at beginning of forcing) attained during forcing.

was effective on plants of all the cultivars tested. From examining only the effects on height control during summer production, B-Nine and 2× Sumagic seem the best treatments to recommend. However, comparison of treatment effects on plants during greenhouse forcing revealed that summer height control is not the whole story.

Before moving on to discuss the results upon greenhouse forcing, two observations are worth noting. First, of the seven cultivars used in this study, 'Schenkenburg' plants appeared more susceptible to Botrytis leaf blight during propagation and the summer production period. The problem was more widespread on 'Schenkenburg', with more plants affected, and greater damage visible on infected plants. Second, 'Böttstein' plants displayed earlier and more severe iron deficiency chlorosis than plants of the other cultivars. However, all plants responded to iron chelate treatments and the problem was corrected in all cases.

Effects During Forcing. The B-Nine and Sumagic treatments did exhibit carry over effects on some cultivars, resulting in less elongation during forcing (Figure 2). The B-Nine 1× treatment resulted in less elongation during forcing for 'Böttstein' plants, more elongation for 'Red Star' plants, but did not affect elongation of the other five cultivars. The B-Nine 2× treatment decreased elongation for 'Böttstein' and 'Kasteln' plants, increased elongation for 'Red Star' plants, but did not affect elongation of the other four cultivars. The increase in plant height seen with B-Nine on 'Red Star' is at best difficult to explain, and we do not know why the extra elongation occurred. We did not count the number of nodes produced by plants in the different treatments, but if the B-Nine caused more nodes to be formed prior to the flower buds the previous fall, the extra height may have been due to elongation of those nodes/internodes. Sumagic 1× spray resulted in less elongation during forcing only for 'Böttstein' plants; Sumagic 2× sprays decreased elongation for 'Böttstein', 'Enziandom', 'Kasteln', and 'Mathilde Gütges' plants. The decrease in stretching during forcing achieved with some of the treatments may be desirable, as height control is usually required during forcing. Given that there is the possibility of carry over effects, it may be useful to know what height control treatments were used the previous summer in order to anticipate any effect on elongation during forcing. Perhaps less height control will be needed during spring forcing if multiple B-Nine or Sumagic applications were made the previous summer.

Growth retardant treatments also affected inflorescence size for some cultivars (Figure 3). B-Nine 1× increased the inflorescence diameter for 'Schenkenburg' plants (another puzzling result), but did not significantly affect inflorescence size for the other cultivars. B-Nine 2× decreased the diameter of 'Böttstein' inflorescences, but had no effect on other plants. Bonzi 2× decreased the diameter of 'Red Star' inflorescences, but this was the only carry over effect of either Bonzi treatment on any cultivar tested. Sumagic 1× reduced inflorescence diameter for 'Böttstein' plants, and Sumagic 2× reduced the inflorescence diameter for 'Böttstein', 'Mathilde Gütges', and 'Red Star' plants. This decrease in inflorescence diameter may be undesirable, but some flower size reduction might be the trade off for better height at flowering. Unfortunately, the better summer height control treatments (B-Nine 1×, B-Nine 2×, and Sumagic 2×) were also the treatments that tended to affect inflorescence diameter the most, especially the Sumagic 2×. If the market demands larger inflorescences, then perhaps a larger-flowering cultivar, such as 'Red Star' should be grown. Although 'Red Star' inflorescence size was reduced by growth retardant treatments (even up to 20%, as caused by the Sumagic 2× treatment), the inflorescences were still larger than all other control plants with the exception of 'Böttstein' controls.

Growth retardant treatments did not affect the number of flowering shoots developing on plants, and cultivars did not differ in their number

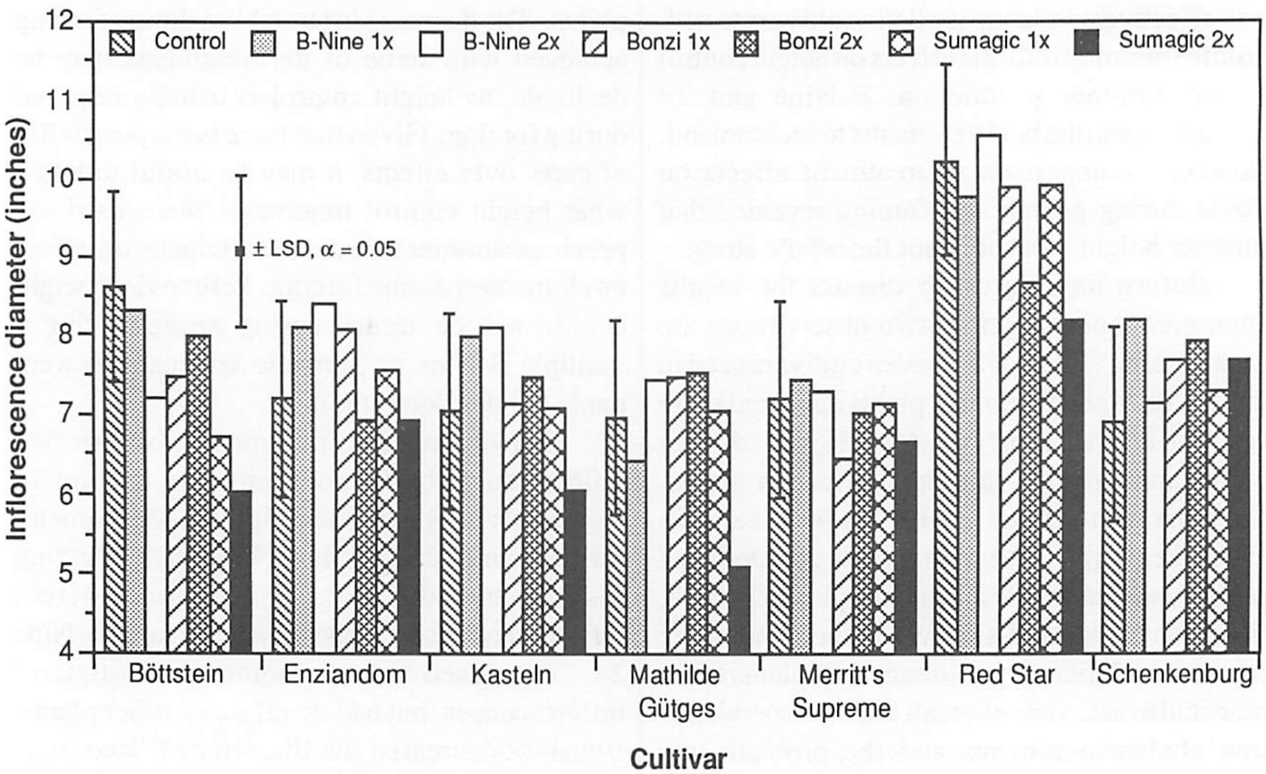

Figure 3. Inflorescence diameter at flowering.

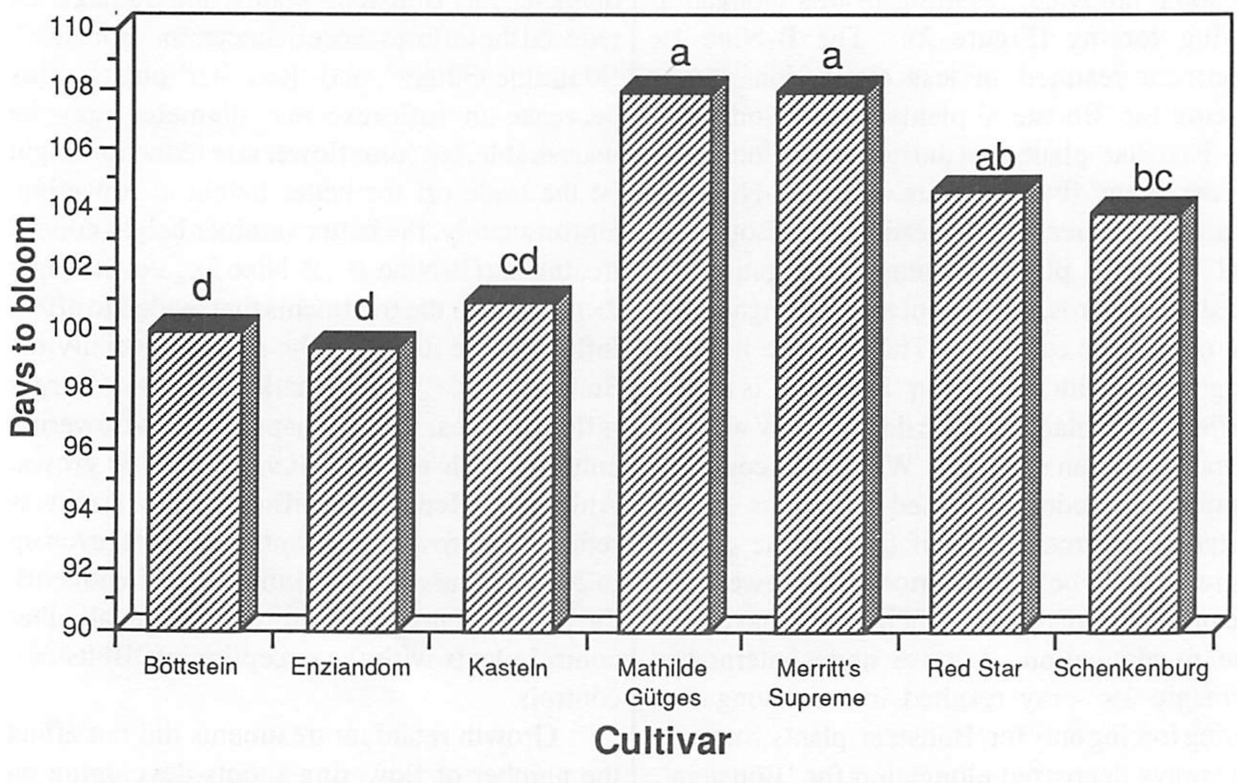

Figure 4. Days from start of forcing (28 December 1990) until anthesis (pollen first present).

of flowering shoots; the overall experimental average was 3.6 $\pm$ 0.7 flowering shoots per plant. There was no growth retardant treatment effect on days to anthesis (from start of forcing), but cultivars did differ in their forcing timing (Figure 4). 'Böttstein' and 'Enziandom' reached anthesis more rapidly, while 'Mathilde Gütges' and 'Merritt's Supreme' plants were the slowest to flower. Keep in mind that Figure 4 represents days to anthesis, and not days to salable color. In general, plants were in salable color approximately 10 days before anthesis, so subtracting 10 days from Figure 4 numbers gives forcing times (from start to sale) for these cultivars when a 62°F night temperature is used under our growing conditions.

Our experiences suggest that hydrangea cultivars differ in response to a given growth retardant treatment. This means that growers may have to treat cultivars differently to achieve the same results with respect to height control and flower size upon forcing. Also, forcing time varies significantly with cultivar.

The most effective growth retardant treatment for hydrangea height control will vary with cultivar. In general, multiple applications of B-Nine and Sumagic appear to be the best height control method during the summer growing season. The need for height control during forcing may be dependent on how plants were treated the previous summer, and hopefully that information can be made available to forcers so that the height control program during forcing can be adjusted appropriately.

Perhaps the most interesting result of this study is the big difference between cultivars with respect to final plant size and inflorescence diameter. It may be desirable for forcers to experiment with some of the lesser known/grown cultivars. A good example is 'Red Star', which has a very large inflorescence, but does not have a tall growth habit as do 'Enziandom' and 'Rose Supreme'. With over 100 cultivars of hydrangea available, it may be time to evaluate the potential of the lesser known ones for greenhouse forcing.

Literature Cited

Anonymous. 1973. Good results achieved with growth regulators on hydrangeas. Grower (London) 80:647.

Bailey, D.A. 1989. Uniconazole effects on forcing of florists' hydrangeas. HortScience 24:518.

Bailey, D.A., T.C. Weiler, and T.I. Kirk. 1986. Chemical stimulation of floral initiation in florists' hydrangea. HortScience 21:256–257.

Jung, R. 1964. The status of hydrangea growing today. Florists' Rev. 135(3486):13–14, 35–37, 40.

Scott, B. 1982. Hydrangeas respond to new growth regulator. N.C. Flower Growers' Bul. 26(4):10–12.

Tjia, B., L. Stoltz, M.S. Sandhu, and J. Buxton. 1976. Surface active agent to increase effectiveness of surface penetration of ancymidol on hydrangea and Easter lily. HortScience 11:371–372.

Ulery, C.J. 1978. Quality hydrangea production. Ohio Florists' Assn. Bul. 582:3–4, 9.