# Use of Paclobutrazol to Regulate Flower Bud Initiation and Stem Elongation in *Rhododendron catawbiense* 'Boursault'

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## INTRODUCTION

For years, researchers have been experimenting with the plant growth regulator paclobutrazol to control stem elongation in rhododendron. This presentation, however, will attempt to demonstrate the feasibility of using paclobutrazol in a large-scale production setting.

Use of the Bonzi® formulation of paclobutrazol, marketed by Uniroyal Chemical Company, was initiated at Prides Corner Farms in 1991 by Dr. Martin Gent, a research scientist at the Connecticut Agricultural Experiment Station in New Haven, Connecticut. Dr. Gent's work at Prides Corner Farms and at his experimental plots in Hamden, Connecticut, prompted us to pursue the use of Bonzi in our production system. *Rhododendron catawbiense* 'Boursault' was selected as a cultivar that would benefit from applications of Bonzi, due to its typical growth habit of growing tall and setting very few flower buds. In a typical year, untreated 'Boursault' grown in a 2-gal container will produce flower buds on only about 5% of the plants, and those plants that do flower will usually have only one flower bud per plant. In addition, the vegetative growth of these plants is very vigorous and generally results in a tall, open plant structure. Why even grow such a cultivar? 'Boursault' roots easily from vegetative cuttings and its vigorous growth produces a large, husky liner. The stems are strong and upright, so the plant does not tend to lean as much as some other cultivars when grown in a container. The lack of flowering, however, has been a serious drawback, since a rhododendron will sell most readily when it is flowering. Therefore, our goal was to develop a system that would allow us to treat 'Boursault' efficiently on a large scale. We needed to produce 2-year-old plants in a 2-gal container that would consistently have at least two to three flower buds per plant and maintain an attractive, compact form.

## MATERIALS AND METHODS

When first experimenting with Bonzi on a small scale, a backpack sprayer was used to apply a spray treatment directed at the stems of the rhododendron. Bonzi as a foliar spray penetrates into plant stems and is translocated to the terminal where it has a growth regulatory effect. The amount of solution (and therefore the amount of paclobutrazol), was fairly accurately monitored for each plant. While this was effective and produced excellent results, it was also very time consuming and physically demanding.

Starting in 1994, we utilized a large capacity spray tank, a P.T.O.-driven diaphragm pump, and a 300 ft length of 1/2-in. spray hose terminating with a super-fine 0.5 gpm Fogg-It nozzle. With this system, the spray solution for an entire day is made all at once, so the concentration is consistent all day long, without the variability that can easily occur when making numerous smaller batches. This technique is very efficient in terms of labor cost, and it can be calibrated to give consistent, accurate

applications. The nozzle produces a wide angle spray pattern and good air turbulence which applies the spray to all stems of a plant. Because foliar absorption does not effectively occur, the spray must be directed at the stems of the plant to uniformly wet each shoot. The spray applications were made in middle to late June, after the first flush of growth had hardened off, and before any growth of the second flush. At this time, a 2-gal 'Boursault' is 10 to 12 in. tall and has enough plant surface to hold on to approximately 2 to 3 ounces of solution when sprayed as described.

We have used a solution of 20 ppm of 0.4% Bonzi. This concentration equals 0.619 mg paclobutrazol per ounce of spray solution. A 2-gal plant that receives 2 to 3 ounces of solution will therefore get 1.24 to 1.86 mg of paclobutrazol. This is well below the 100 ppm label recommendation. Ranney, et al. (1994) in a study done with Bonzi on *R.* 'Roseum Elegans' in 1992 at North Carolina State University, noted that foliar sprays were much less effective than drench applications in reducing shoot growth, and had no effect on flower bud initiation. This was based on foliar applications of 50 to 200 ppm. Our results with *R. catawbiense* 'Boursault' in 1993, 1994, and to a lesser extent in 1995 indicate that in New England, a desirable response can be achieved at the 20 ppm foliar application rate.

## RESULTS AND DISCUSSION

When comparing untreated control plants to plants treated in June 1994, the effect of the paclobutrazol was very evident. The typical untreated 2-gal 'Boursault' was 18 to 20 in. tall, quite open in growth habit, and had no flower buds (Fig. 1). The height of the plant was due to not only a long second flush of growth, but also a vigorous third flush in late summer. Treated plants, however, displayed both reduced vegetative growth and greatly enhanced flower bud development (Fig. 2). A darker green color of the foliage was also evident, and many plants had multiple

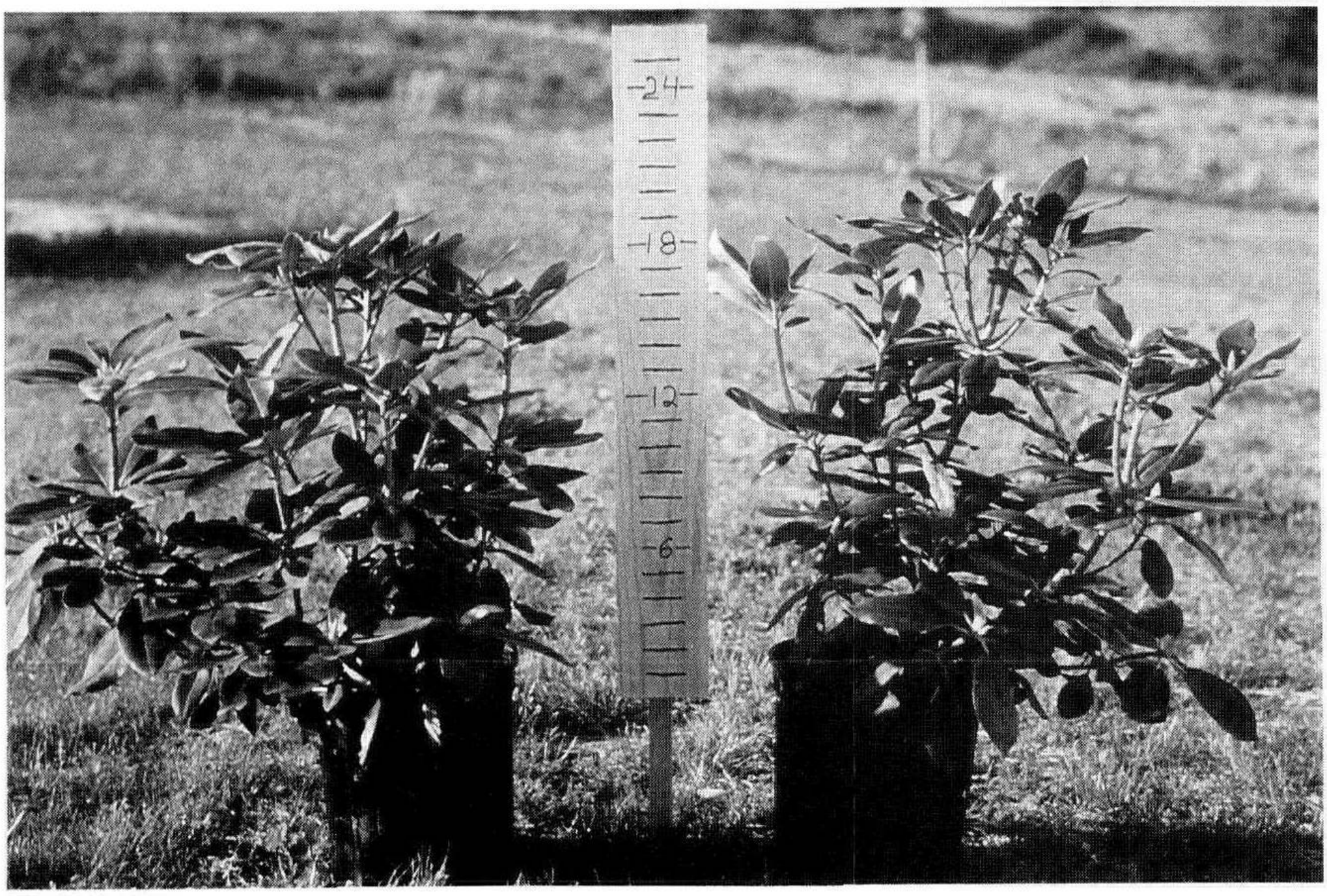


**Figure 1.** Typical untreated 'Boursault', tall with no flower buds.

flower buds on one shoot. The second flush was reduced from 4 to 5 in. on untreated plants to 1/2 to 1 1/2 in. on treated plants. A flower bud was then set on this second flush, and very little third flush growth occurred. The comparison became even more dramatic when the treated and untreated plants were viewed side by side (Fig. 3).

By early June, the treated plants supplied us with a gorgeous display of lavender flower clusters followed by the typical light green new growth. This first flush is important to note, because one of our concerns was the long-term effect of paclobutrazol on subsequent growth. On our treated plants, the first flush developed normally from dormant buds just below the flower bud, with little reduction in length. In some cases, we found as much as 7 in. of growth from the first flush. It should also be noted that we found no evidence of foliar phytotoxicity or deformity.

The results of our Bonzi applications of June 1995 were less dramatic then the previous year. Many of our 'Boursault' did not show the full desired response. Approximately one-half of the crop had reduced growth for the second flush, and subsequently flower buds were initiated. However, both the percentage of plants flowering and the number of buds per plant were significantly less then 1994. Most of the crop, including many plants which developed flower buds, had a fairly strong third flush as well. This is not desirable, as the foliage of this late growth tends to hide the flowers the following year. This third flush, though present, was at least suppressed and shorter than that found on our untreated plants, all of which had a vigorous third flush in 1995. In summary, about one-half of the crop in 1995 showed a long untreated first flush, a short second flush with a flower bud induced by the Bonzi treatment, and a reduced third flush developing from one to three vegetative buds just below the flower bud (Fig. 4).

The remaining one-half of the plants treated in 1995 displayed even less response to the paclobutrazol. Many had reduced second flush growth but only one or two


**Figure 2.** 'Boursault' treated the previous year, with numerous flower buds and compact growth.

**Figure 3.** Comparison of untreated plants on left to treated plants on right.

flower buds per plant. A discouragingly large portion of the crop, probably 30% to 35%, had no flower bud development at all. While these plants did have noticeably reduced second flush growth, as well as shorter stem length in the third flush, they had no flower buds. It could be argued that these plants, even without buds, are more marketable than the taller, less compact untreated plants. While this may be true, the treatments in 1995 were less successful than we had anticipated.

**Figure 4.** Short second flush with flower bud and reduced third flush.

There are four factors which have been identified as possibly contributing to the incomplete and inconsistent response in 1995. After the application was completed, the amount of paclobutrazol applied and the number of plants treated were used to compute the average dose per plant. It was found to be lower than the 1994 application, with each plant receiving only approximately 1.0 mg paclobutrazol. The date of application in 1995 was only 5 days later than the date of application in 1994, however, this crop may have been physiologically more mature and closer to the onset of the second flush. Another factor could have been the high temperature reached by the spray solution as it flowed slowly through

the 1/2-inch spray hose that lay on black plastic for up to 300 ft. The sun heated the solution in the hose to a very warm temperature by the time it got to the nozzle. Without knowing what temperature the solution had reached, a representative of Uniroyal Chemical Company could not say whether or not a breakdown of the paclobutrazol had occurred, or to what extent. Lastly, the very warm temperatures we experienced in southern New England in August 1995 may have been the largest factor. We had 12% more growing degree days in August 1995 than we did in August 1994. According to the Bonzi label, temperature can be the overriding factor in determining the amount of Bonzi needed to produce desired results, with higher rates needed during warmer months. The warmer than normal temperatures may have been enough to cause this crop to outgrow the effect of the paclobutrazol application.

In order to further study the response of 'Boursault' to applications of Bonzi, a group of plants from the 1994 crop were potted into 3-gal containers and held an extra year. Plants that had not received any growth regulator in either 1994 or 1995 were quite tall, measuring 24 to 26 in. They had a spreading, open growth habit and no flower buds. Plants treated in 1994 but not 1995 had flower clusters in the spring of 1995 and compact growth. This compact stature was then hidden by longer shoots of unregulated growth in 1995. A plant that was induced to form three flower buds in 1994 now has only two flower buds, despite the fact that the plant is 1 year older. Upon close inspection, it was often noted on plants treated in 1994 that the shoots of the first flush of growth in 1995 were shorter than shoots on untreated plants. This latent effect of the Bonzi treatment was only evident on the first flush. A normal second and third flush occurred without any reduction of growth.

Another category was plants treated in 1995 only. These were tall plants, averaging 20 to 22 in. in May 1995 due to the vigorous growth the previous year. Treating these plants with Bonzi this year produced numerous flower buds and totally suppressed the third flush.

Finally, plants treated in both 1994 and 1995 continued to display tight, compact growth and many flower buds. The dark green foliage and 18-in. height along with continued flower bud development made these plants very desirable. Once again, reduced first flush of growth was typical, followed by a second flush and a flower bud on top of that.

## CONCLUSION

It is clear that paclobutrazol can be an effective tool in the production of *R. catawbiense* 'Boursault'. Although the results of our Bonzi application in 1995 were not as we had hoped, we have perhaps learned more this year about this aspect of our production system. Our 20 ppm rate may need to be increased to 30 ppm next year. We can now feel confident that a moderately higher rate will not have any negative effect on our crop. A slightly higher rate would help assure that even in another hot summer, we should see more of the results that we are trying to achieve.

## LITERATURE CITED

**Ranney, T.G., R.E. Bir, J.L. Conner,** and **E.P. Whitman II.** 1994. Use of paclobutrazol to regulate shoot growth and flower development of 'Roseum Elegans' rhododendron. J. Environ. Hort. 12(3):174-178.