

Subirrigating Seed Geraniums with Bonzi

Subirrigation of PGRs on seed crops gives growers a new way to control growth.

By Douglas Cox

A number of new and innovative methods of applying plant growth regulators (PGRs) have gained EPA approval in recent years. PGRs may be applied by “sprench” (combination of spray and drench applied as a high volume, low concentration spray to the media surface), media spray before planting (a higher concentration, lower volume spray applied to the media), controlled residue (applied to the inside of the container before planting), watering in as plants are irrigated or subirrigation. However, practical recommendations are needed for growers on how to apply PGRs by these new methods.

The Bonzi (paclobutrazol) label has been expanded to include a number of “chemigation” methods including injection through overhead sprinklers, fog systems, spaghetti tube systems and watering in with dosing equipment or application by ebb and flow subirrigation systems or saucers. Application of PGRs by subirrigation has not been widely researched despite the existence of permissive labeling.

WHY SUBIRRIGATE

As greenhouse labor becomes increasingly scarce and expensive, growers are looking for methods to more quickly and efficiently accomplish time-consuming and repetitive tasks like watering, fertilizing and applying PGRs. Growers of all sizes are installing subirrigation and other automated irrigation systems in their greenhouses, which can potentially do all three tasks at once. While Bonzi and other PGRs may be applied by chemigation, it is an option that has not been extensively evaluated for practical use. The advantages of being able to treat large numbers of similar plants at one time with PGRs while also watering and fertilizing are obvious.

Much less active ingredient is required when subirrigation is used to apply PGRs. According to tests at the University of Florida, subirrigation appears to be a more efficient way to apply PGRs than sur-



Top: 'Ringo 2000 Red' geraniums subirrigated 11 times over four weeks with Bonzi beginning when the plants were about 2-3 inches in diameter. Bonzi solutions were diluted to a concentration of 10 percent of those applied one time. Left to right: No treatment, 0.011, 0.022 and 0.033 ppm Bonzi. Photo was taken 50 days after Bonzi treatments began; Bottom: 'Ringo 2000 Red' geraniums subirrigated once with Bonzi when plants were about 2-3 inches in diameter. Left to right: No treatment, 0.11, 0.22 and 0.33 ppm Bonzi. The photo was taken 50 days after the Bonzi treatment was made. (Photos courtesy of Douglas Cox)

face applications because chemicals applied to the surface slowly leach down to the root zone while PGRs applied by subirrigation get to the root zone faster.

Application of PGRs by subirrigation seems to be a method that promotes greater uniformity of plant response and, since less active

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Figure 1. Affect of Bonzi applied by subirrigation on the growth of 'Ringo 2000 Red' geranium.

Treatment	Plant height (inch)	Plant diameter (inch)	Pedicle length (inch)	Leaf area (inch ²)	Shoot fresh weight (lb.)
Control	7.4	9.7	8.4	11.5	.29
Plants subirrigated with Bonzi once					
0.11 ppm	5.5	8.4	7.1	6.2	.25
0.22 ppm	4.4	8.2	6.1	5.6	.23
0.33 ppm	4.1	7.8	6.5	5.1	.22
Plants subirrigated with Bonzi 11 times*					
0.11 ppm	5.4	8.3	6.6	6.6	.26
0.22 ppm	5.0	8.1	6.4	6.4	.24
0.33 ppm	4.5	7.5	6.1	6.2	.23
Overall effect of application method					
One application	4.7	8.2	6.7	5.6	.23
Eleven applications	5.0	8.0	6.4	6.4	.24

*Average measurements include all stock solution dilution treatments.

ingredient is required, a savings in chemical costs can be realized, as well as a reduced risk of over-application. However, an important factor, which has not been studied, is how the effectiveness of PGRs applied by subirrigation changes as the stock tank solution becomes more dilute when water or fertilizer solution is added to replace what is absorbed by the plants.

This article reports the results of a study, funded by a grant from the New England Greenhouse Conference, that compared the response of 4-inch seed geraniums (a plant sensitive to Bonzi) to several levels of Bonzi applied by subirrigation in a single application or in repeat applications at low levels of active ingredient and calculated the effect of stock tank dilution on the growth-inhibiting effect of Bonzi.

HOW THE PLANTS WERE GROWN

Seeds of 'Ringo 2000 Red' geraniums (S&G Flowers) were sown in plug trays. Seedlings were transplanted into 4-inch pots of Fafard 3B containing superphosphate fertilizer January 23 and February 21. Plants were grown using standard commercial practices and watered and fertilized with a 20-0-20 fertilizer at 200 ppm nitrogen by subirrigation from potting to finish. Pots were subirrigated from 5-inch saucers.

Plant response to Bonzi applied by subirrigation was studied by making one or multiple treatments. Bonzi treatments began March 25 when plants were about 2-3 inches in diameter. Bonzi solutions were applied at 3.4 fl.oz. per pot (100 ml) in all treatments; in every instance, this amount of solution was completely absorbed by the growth medium when the saucers were filled. Control plants were subirrigated but received no Bonzi in the fertilizer solution.

Some plants were subirrigated once with either 0.11, 0.22 or 0.33 ppm Bonzi. Other plants were subirrigated 11 times over four weeks with fertilizer solutions that contained Bonzi concentrations with 10 percent less active ingredient than that applied to the plants getting one treatment. Both of these treatments were called "full strength" referring to the fact that the solution in the stock tank was not adjusted (diluted) to the original volume to replace what was used to treat the plants, and thus, the levels of PGRs remained constant, at full strength, over the four-week treatment period.

Another set of plants was treated 11 times with Bonzi, but the PGR levels were gradually diluted from full strength over the four-week treatment period by the addition of fresh fertilizer solution to the stock tanks to maintain volume. This approach simulated the normal operation of a greenhouse subirrigation system where water

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Figure 2. Stock tank dilution effects on the growth of 'Ringo 2000 Red' geranium subirrigated with Bonzi.

Treatment	Plant height (inch)	Plant diameter (inch)	Pedicle length (inch)	Leaf area (inch ²)	Shoot fresh weight (lb.)
Control	7.4	9.7	8.4	11.5	.29
Full strength	4.6	7.8	6.2	5.9	.23
80% of full strength	4.8	8.0	6.3	6.1	.24
60% of full strength	4.7	7.8	6.3	6.5	.24
40% of full strength	5.2	8.2	6.6	6.7	.25
20% of full strength	5.4	8.3	6.4	6.9	.26

or fertilizer solution is added to the stock tank to replace what is absorbed by the plants. Four dilution treatments were tested, resulting in a final dilution at the 11th (last) application of 80, 60, 40 or 20 percent of full strength.

The study was concluded May 15, one month after the 11th application of Bonzi. Time to flowering was recorded at the opening of the first floret. Plant height, plant diameter, pedicel (flower stalk) length, leaf size (area of the leaf at the first flowering node) and shoot fresh weight were recorded on May 15.

RESULTS

This study included 19 different treatments when all possible treatment combinations are taken into account; for the sake of simplicity, I have chosen to report the major effects of Bonzi level, application method and stock tank dilution in this article.

Bonzi level and method of application. Time to flowering was not affected by Bonzi treatments. On average, the first floret of the control plants and the Bonzi-treated plants opened within 93-95 days after sowing.

Plant growth, however, was significantly affected by subirrigation with Bonzi. Bonzi-treated plants were shorter and smaller in diameter and had shorter pedicels than the control plants (See Figure 1, page 32). Bonzi-treated plants also had smaller leaves, and the shoots weighed less than plants subirrigated without Bonzi.

Plants were smaller as the concentration of Bonzi increased, regardless of whether Bonzi was applied once or in 11 subirrigation treatments. There were no large differences in plant growth between plants subirrigated once or 11 times with Bonzi, but plants subirrigated 11 times tended to be slightly taller and had slightly larger leaves and greater shoot fresh weight than plants subirrigated once. Overall, the size of Ringo 2000 Red geraniums was effectively suppressed by all levels of Bonzi, whether applied once or 11 times over four weeks. The amount of growth suppression, however, was desirable and not excessive.

Stock tank dilution effects. Stock tank dilution treatments simulated the effects of the commercial greenhouse practice of maintaining a constant volume of solution in the stock tank and measured its affect on the degree of growth control by Bonzi. It's notable that, regardless of the degree of dilution, Bonzi treatments were effective in suppressing the growth of Ringo 2000 Red geraniums compared to the control (See Figure 2, above). Plants subirrigated with full strength Bonzi solutions (i.e., the stock tank solutions were not diluted by adding fresh fertilizer solution) and Bonzi solutions gradually diluted to 60 percent of full strength had the greatest suppressive effects on plant growth. Plants subirrigated with Bonzi solutions gradually diluted to 40 and 20 percent of full strength were taller and larger in diameter and had bigger leaves and greater shoot fresh weight than plants receiving the full strength solution. These results demonstrate the

potential for less growth control with Bonzi applied by subirrigation when the stock tank solutions are significantly diluted by water or fertilizer solution.


CONCLUSIONS

The results of this study show that the growth of seed geraniums can be successfully controlled by subirrigating from saucers with 3.4 fl.oz. per pot of Bonzi solutions at 0.11, 0.22 or 0.33 ppm once when the plants were 2-3 inches in diameter. Subirrigating with lower levels (10 percent of the active ingredient applied to the plants getting one subirrigation treatment) of Bonzi 11 times over a four-week period was as effective as one subirrigation treatment for controlling growth.

Stock tank dilution with fresh fertilizer solution to replace the volume of solution used to treat the plants affected the degree of growth suppression from Bonzi solutions. Over the four-week trial, plants grew larger when they were subirrigated with very dilute Bonzi solutions (40 or 20 percent of full strength) compared to plants that received less dilute solutions (80 or 60 percent of full strength) or a solution not diluted (full strength).

In this study, I created the different levels of dilution by using stock tanks with different volumes. Stock tanks for the 80- and 60-percent treatments had the largest starting volumes, and thus, the solution added to maintain volume would have less diluting effect on the concentration of Bonzi compared to the 40- and 20-percent treatments, which had much lower starting volumes and needed more solution to maintain volume.

Based on the results of this study, commercial growers subirrigating with Bonzi should not allow their stock tank solution to become diluted to a level more than about 60 percent of full strength. If the stock tank becomes more dilute, the effectiveness of Bonzi may be reduced. Significant dilution could result in little or no growth control, especially for

species less responsive to Bonzi than geranium and at minimal Bonzi concentrations. 

Douglas Cox is associate professor and extension specialist in

the Plant and Soil Sciences Department at the University of Massachusetts, Amherst, Mass. He can be reached by phone at (413) 545-5214 or by E-mail at dcox@pssci.umass.edu.

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