Height Control of Spring Bulbs with Preplant Soaks

Brian A. Krug, Brian E. Whipker, Ingram McCall, and John Dole

Bulb crops are important segment in the yearly rotation for a greenhouse. They help fill the gap between the poinsettia and the bedding plant seasons by adding bold color to the spring holidays. The short cropping time and limited amount of bench space required for a large amount of pots rounds out the advantages of producing flowering bulbs.

A concern for many of the bulb crops is stem stretch during the postharvest care by a consumer. Although this does not directly affect us as growers, it does have a major impact on the quality of the pot when it is in the hands of the consumer. Recommendations have been made for the use of various PGRs for height control as foliar sprays, substrate drenches, and preplant bulb soaks using the various PGRs available. Foliar sprays are easy to apply, but with the small amount of leaf area present at the time when PGRs need to be applied to most bulb crops it makes them often times ineffective. Substrate drenches can be effective for postharvest height control, but the amount of labor required for application may be prohibitive. Preplant bulb soaks have shown promise for an effective, easy to apply PGR treatment, but information about application concentrations and protocols is limited and sometimes vague. At North Carolina State we have been trialing preplant bulb soaks to better understand how to use the different PGRs with a wide variety of bulb crops. The following is a step by step guide on how to apply preplant bulb soaks.

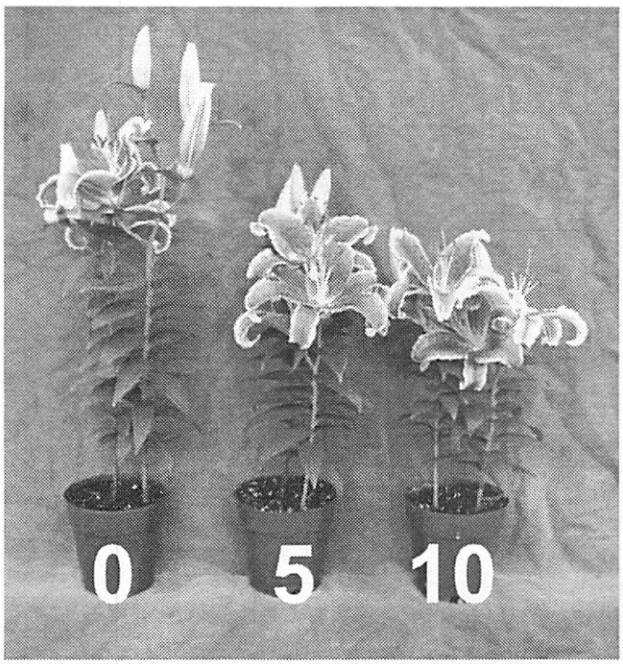
Preplant Bulb Soak Proceedure

Step 1: Unpack and inspect bulbs, and then store them in cool dry location until treatment. Remove packing material (peat, sawdust, etc.) prior to treatment with a PGR preplant bulb soak.
Step 2: Mix the appropriate amount and concentration of solution, see Table 1 for suggested concentrations. As a guideline, about 370 hyacinth bulbs can be treated with one gallon of solution, in batches of 10 to 20 bulbs at one time. As always wear the appropriate protective clothing.
Step 3: Soak batches of bulbs in small quantities to insure all bulbs are sufficiently submerged in the solution. (Quantities should be relative to the amount of solution mixed)
Step 4: Lift the bulbs from solution and allow the solution to drain back into the container.
Step 5: Wait at least one hour prior to potting the bulb.
Step 6: Pot as usual. Making sure your potting media is pre-moistened to prevent the need to heavily water in the pots, which can wash the PGR solution off the bulbs.
Step 7: Continue normal forcing schedule for the crop.

Below are some questions and concerns growers have asked about the bulb soak procedure.

Question: How long before potting can we soak the bulbs?
Answer: At least up to seven days before the day of potting your bulbs. In our trials, we soaked hyacinth bulbs the day of, the day before, and seven days before planting. After soaking we returned the bulbs to proper storage conditions until we potted. We found no differences in the amount of height control provided by any of the treatments. So the procedure allows some flexibility of when you can soak the bulbs.

Question: How many bulbs can we soak in a given amount of solution?
Answer: In our trials, we soaked 100 hyacinth bulbs, 5 at a time, in one liter of solution. When we finished soaking the last set of 5 bulbs there was not enough solution to physically soak another batch. Plus, we found no difference in the height control provided from the first to the last batch. On average each bulb utilized 4 to 8 mL of solution, or it would take about 370 bulbs to use up one gallon of solution; however, 370 bulbs will not fit in one gallon of solution all at one time. Based on our results, the solution will be used up before any loss of efficacy. Research ▶



Control of 'Stargazer' oriental lily growth with Sumagic pre-plant bulb soaks (left to right, 0, 5, and 10 ppm).

conducted with hybrid lilies and paclobutrazol at Cornell University also found similar results.

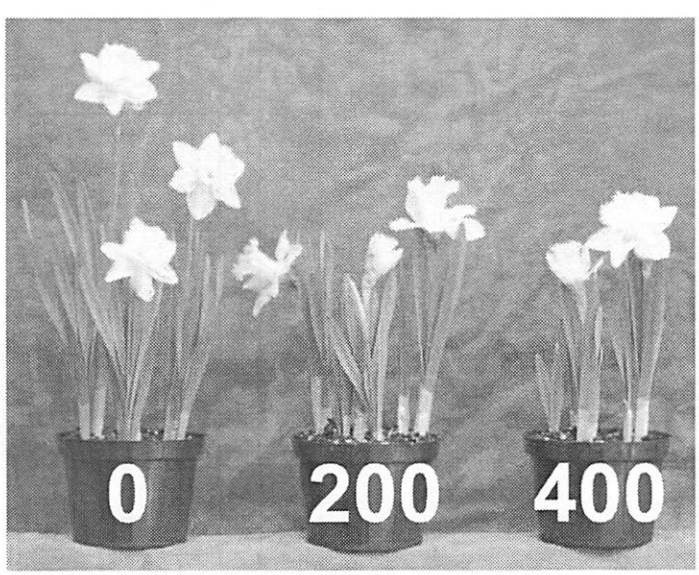
Question: How long do I need to soak the bulbs?
Answer: Many of the product labels and other recommendations suggest up to a 1 hour soak. Most of our experiments we soaked bulbs for 10 minutes. We also tested hyacinth bulb soak lengths of 1, 5, 10, 20, and 40 minutes. Height of the plants were the same if soaked for at least 2 minutes. We recommend soaking for at least 2 minutes with no need to worry if a customer calls and you have to walk away for few minutes while the bulbs soak. Other bulbs may vary. Freesias generally require a longer time (60 minutes) because of the outside tunic. We had excellent results with 10 minute soaks with tulips, narcissus, dahlias, 'Star Gazer' lilies, and Easter lilies.

Question: How can I dispose of unused solution?
Answer: We all know that we can not simply pour left over pesticides and PGRs down the drain; it is illegal and too expensive to waste. This may not be an issue at all if you accurately calculate how much total solution you will need (approximately 370 hyacinth bulbs per one gallon of solution). If you do have solution left over after soaking you can apply it as a substrate drench to another crop. We applied left over soak solution to 'Pacino' pot sunflowers and saw no difference in control as compared to freshly prepared substrate drench solution.

Question: Does efficacy vary with cultivar?
Answer: Yes, and No...let your experience by your guide. We've given a range of recommendations for a number of species (Table 1). To determine which end of the range to use for a particular cultivar consider its vigor. Notoriously tall cultivars are going to need concentrations on the high end of the range while the less vigorous cultivars can use the lower concentrations. Conduct a few trials of your own to determine what concentrations work best for you and your production system.

Question: Does it matter what the temperature of the solution is?
Answer: In our experiment we found that extremely cold (46 °F) or extremely warm (89 °F) water reduced the efficacy of paclobutrazol and flurprimidol on hyacinth bulbs. With temperatures between 60 and 75 °F we found consistent, acceptable height control.

Question: Do preplant soaks delay plant emergence, flowering date, or limit root development?
Answer: If there is any delay, it generally was less then 2 days, when optimal concentrations were used.



Control of 'Dutch Master' narcissus growth with Bonzi pre-plant bulb soaks (left to right, 0, 200, and 400 ppm).

The plants bloomed and grew normally. An exception was dahlias were the soaks delayed flowering by a week.

We have found that preplant bulb soaks have been an effective addition to the PGR toolbox for controlling the height of a number of bulb crops. Using these guidelines, you can begin to use preplant bulb soaks with confidence in your own production system. As with any new procedure, we recommend testing preplant bulb soaks on a small quantity of pots before you treat your entire crop. There is a limited amount of greenhouse height control of hyacinth tulips, and narcissus. You will need to conduct postharvest trials to evaluate the efficacy on these crops. For 'Star Gazers' differences in height were easy to evaluate in the greenhouse.

Table 1. Suggested beginning rates for plant growth regulator applications to bulbs.

Plant	Pre-Plant Bulb Soaks (ppm)				Substrate Drenches (mg a.i. per pot)				Foliar Sprays (ppm)				
	Flurprimidol	Ancymidol	Paclobutrazol	Uniconazole	Flurprimidol	Ancymidol	Paclobutrazol	Uniconazole	Flurprimidol	Ancymidol	Daminozide	Paclobutrazol	Ethephon	Uniconazole
Tulip	10-25z (10 min)		50 (10 min)	10 (10 min)	0.5 (8.5 ppm)	0.5 (8.5 ppm)	1 (16.9 ppm)	SR 1-3 ppm	> 80	NS				SR 2.5-20
Caladium	NR (1.25-40; 10 min)		NR (2.5-40; 10 min)	SR 1-10 (1-5 min)	2 (16.9 ppm)	SR 2 ppm	2 (16.9 ppm)	NR (0.25-4)		SR 25-50	2,500 3Xy	100-200x		SR 2.5-20
Hyacinth	10-25z (2-10 min)		100 (10 min)	20-40z (10 min)	1 (16.9 ppm)	SR 2 ppm	SR 10 ppm	SR 1-3 ppm		SR 25-50		SR 100	NR (250-2000)	SR 2.5-20
Tete a Tete	30 (10 min)		400 (10 min)	NR (5-10, 10 min)	0.69 (11.7 ppm)	SR 2 ppm	4 (67.6 ppm)	SR 1-3 ppm		SR 25-50			1,500	SR 0.5-20
Dutch Master	20 (10 min)		200-400 (10 min)	NR (5-10, 10 min)		SR 2 ppm	20-40ppmx	SR 1-3 ppm		SR 25-50				SR 2.5-20
Oriental Lily	25 (10 min)	4w (30 min)	100-200v (5 min)	5 (10 min)	0.5 (4.2 ppm)	0.125-1y,u (1.1-8.5 ppm)	4-30ppmx	0.05-0.3y,v,t (0.42-2.54 ppm)	> 80	0.5 mg a.i. per potw		200-500x		5-15s

SR (Suggested Rate) - Label lists no specific recommendation, only suggested experimental range.
NR (No Response) - at the concentrations trial there were no plant response (rates trialed).
ND (Not Determined)
z - Concentration range varies due to cultivar response
y - Dole and Wilkins, 1999
x - Product label
w - Wilkins and Gruber, 1983
v - Miller et al, 1998
u - Whipker and Hammer, 1993
t - Bailey and Miller, 1989a
s - Bailey and Miller, 1989b