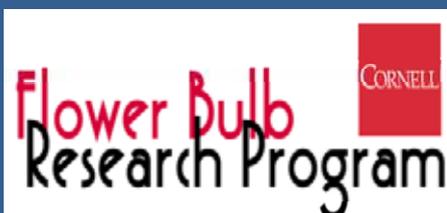




# RESEARCH NEWSLETTER



This Flower Bulb Research Program Newsletter is published by Anthos, Royal Trade Association for Nurserystock and Flowerbulbs in cooperation with Dr. Bill Miller of Cornell University.



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## Topflor and Bulb Crops

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Topflor (fluprimidol) is a plant growth regulator that is relatively new to the US market. It is marketed by SePRO as a 0.38% active ingredient (3,800 mg/l or 3,800 ppm) liquid. The material is a very attractive blue liquid with a rather strong sweet odor. Topflor has been used in Europe for many years as a general floriculture PGR (plant growth regulator), but has been sold in the US market only since about 2005. Topflor is not yet available in Canada. SePRO is currently evaluating the possibility of Canadian registration with Topflor, but at this point an exact timeline is unknown.

Topflor and similar growth regulators (for example, Bonzi, Piccolo, Sumagic, etc.) act by reducing gibberellin synthesis within the plant. Since gibberellins are important for cell growth (elongation), using an "anti-gibberellin" caused cells to stay shorter...thus the entire plant stays shorter. The positive effects of PGRs, in addition to producing shorter, more compact plants, often include darker green color, "tougher" plants, reduced water requirement (sometimes due to smaller or more "stacked" leaves on crops such as lily). Negative effects of PGRs are generally few, with a notable exception being the promotion, under certain circumstances, of leaf yellowing in Easter and hybrid lilies. (This is why Fascination is so useful for lilies, see Newsletter 16, May 2008).

Usage patterns of anti-gibberellin chemicals have changed dramatically over the past 35 years.

The early 1970's gave us A-Rest, which was very effective on lilies (spray, drench) and tulips (drench). In the late 1980's Bonzi, then later, Sumagic became available. Sumagic rapidly became a prominent product for Easter lily crops, as a foliar spray and as a pre-plant bulb dip for many lilies. De Hertogh trialed Bonzi on tulips and it was found very effective, at low rates, as a drench treatment.

When the Flower Bulb Research Program began at Cornell in 1998, we began systematic trialing of Bonzi (and/or Piccolo, the most prominent generic equivalent) on "new" tulip cultivars, and confirmed it's useful activity to be in the range of 0.5-1 mg/pot (or 4 to 8 ppm for a 6" pot). When Topflor became available to us as an experimental compound in the 2003 forcing season, we began trialing it on lilies, daffodils, tulips and hyacinths. Many trials have been conducted with preplant bulb dips or soaks (usually 10 minute dips), at planting drenches (that is, plant, drench, then cool), as drenches in the greenhouse during forcing, or, in some cases, as foliar sprays. Ongoing summaries of all experiments to date can be found on the annual CD's and full reports will be published in forthcoming newsletters.

In this newsletter, we'll review and summarize some of our Topflor results, and provide basic guidelines for Topflor use on bulb crops. Additional information is available at SePro's main information page, <http://www.sepro.com/default.php?page=topflor>.

## Tulip

Topflor is an extremely effective PGR on tulips, especially as a soil drench, and will probably emerge in the coming years as the main PGR to use on pot tulips. In the last 10 years, Bonzi or Piccolo (pacloutrazol) have become the major PGR on tulips, edging A-Rest out of the market. The main reason has been cost, where Bonzi/Piccolo had a distinct cost advantage over A-Rest. Topflor is proving to be even more cost effective than Bonzi/Piccolo, where most growers will find effective rates to cost less than half of the typical Bonzi cost. As a very broad summary, Topflor is active on a range of cultivars at about half the concentration (or mg/pot dose) as one would use with Bonzi. For example, a cultivar normally treated with 1 mg/pot (8 ppm) Bonzi would likely respond similarly to 0.5 mg/pot (4 ppm) Topflor. This is a broad generalization, and individual experience and trial might indicate otherwise.

Some examples of Topflor use in tulips are given below.



Piccolo (Bonzi) and Topflor drenches on 'Bright Parrot' tulips. 16 cold weeks, housed 20 January, 2009. L to R: Control, 1 or 2 mg/pot Piccolo drench, 0.5, 1 mg/pot Topflor drench. Image 1200.



Closeup of Topflor drenches on 'Bright Parrot' tulips. 16 cold weeks, housed 20 January. 2009. L to R: Control, 0.5, 1 mg/pot Topflor. Image 1203.



Piccolo (Bonzi) and Topflor drenches on 'King's Cloak' tulips. 20 cold weeks, housed 22 March. 2004. L to R: Control, 1 or 2 mg/pot Piccolo drench, 0.5, 1 mg/pot Topflor drench. Image 1317.



Piccolo (Bonzi) and Topflor drenches on 'Cairo' tulips. 18 cold weeks, housed 26 January. 2008. L to R: Control, 1 or 2 mg/pot Piccolo drench, 0.5, 1 mg/pot Topflor drench. Note different length of top internode. Topflor is usually very effective in reducing top internode length. Image 0654.



Piccolo (Bonzi) and Topflor drenches on 'Zorro' tulips. 19 cold weeks, housed 15 March. 2004. L to R: Control, 1 or 2 mg/pot Piccolo drench, 0.5, 1 mg/pot Topflor drench. Image 2385.



Preplant dips of Topflor on 'Passionale' tulips. 15 cold-weeks, housed 27 January. L to R: Control, 25, 50 ppm dips for 10 minutes. Clearly, an overdose, and lower concentrations are needed. Image 1298.

Overall, our work suggests that commercial rates and trials with Tete-a-Tete should be at 50 ppm Topflor, with a dip length of 10-30 minutes. Initial work in 2008 and 2009 is suggesting Ice Follies, Primeur, Exception and Carlton are well suited to treatments of 10-25 ppm or 10 minute soaks.

We have seen examples of phytotoxicity from lengthy, high concentration Topflor dips, especially in Tete-a-Tete. The rate suggested, 50 pm for 10-30 minutes, has been safe in our trials (see photos).



Preplant dips of Topflor on 'Spryng' tulips. 15 cold-weeks, housed 27 January. L to R: Control, 25, 50 ppm dips for 10 minutes. Clearly, an overdose, and lower concentrations are needed. Image 1312.



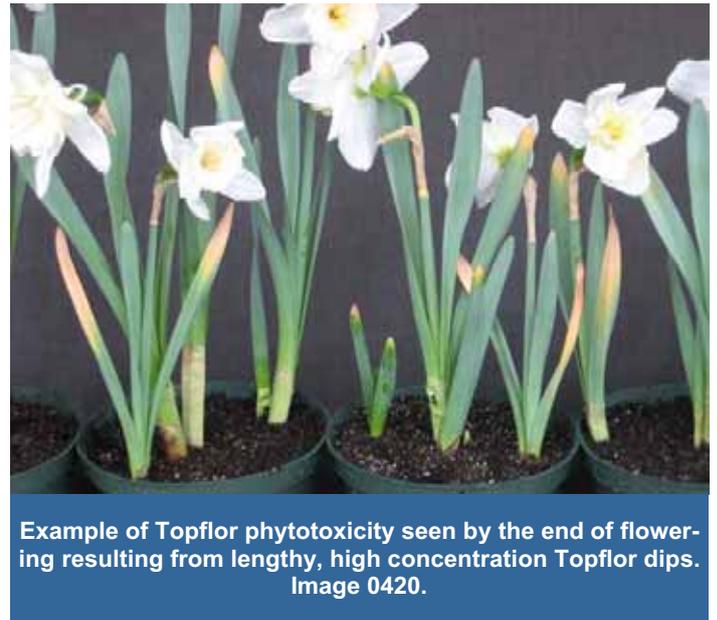
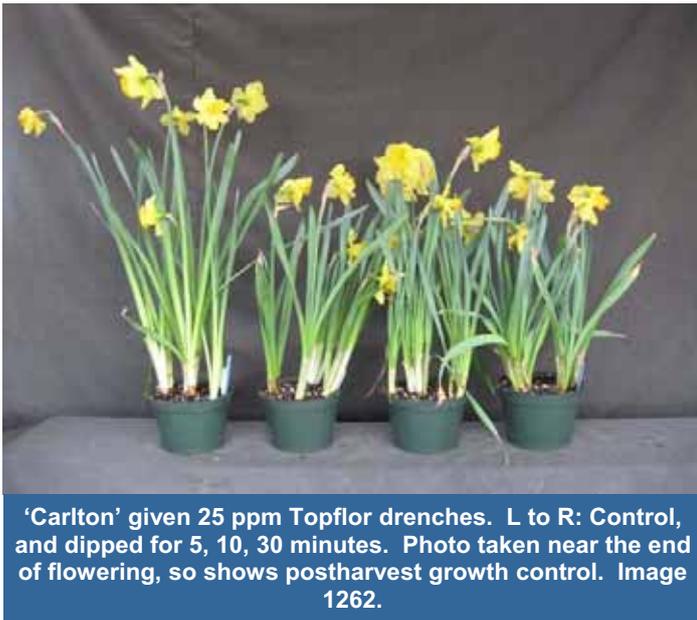
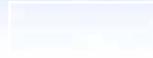
Postharvest. 'Tete-a-Tete' narcissus give pre -plant dips in 50 ppm TopFlor for L to R: 0 (water control), 10, 30, 60, or 120 minutes. Image 0267.

### Narcissus

Most of our narcissus work has been with Tete-a-Tete, and mainly in the context of treatments to reduce postharvest stretch. We have seen the most activity as a 10 to 30 minute pre-plant bulb dip. Soil drenches (either pre-cooling, immediately after planting, or post-cooling, during forcing) while effective, are probably less cost effective than dips, especially when application cost is considered.



'Exception' given 10 ppm Topflor drenches. L to R: Control, and dipped for 5, 10, 30 minutes. Image 1090.



## Hyacinth

Height control, especially in the postharvest phase, remain a potential problem in hyacinth. During forcing, hyacinths are commonly sprayed with Florel for height control, and to reduce stem floppiness. Rates are commonly in the range of 1,000-2000 ppm, for 1 or 2 sprays. While generally effective, some growers report problems with Florel sprays, including lack of effect and non-uniformity.

We have conducted a variety of Topflor trials on hyacinths and pre-plant dips, pre-cooling drenches, greenhouse drenches and greenhouse sprays. Our trials have consistently shown, by a large margin, that preplant dips give the best overall results. For example, the photos show Polar Giant dipped in 20 ppm Topflor for 10, 30, 60, or 120 minutes.



After dipping, bulbs were planted and cooled for 19.5 weeks, housed on 5 March. The first photo shows early in the flowering phase and the second shows longer-term postharvest effects.

Hyacinth response to Topflor dips is dramatic. Flowering is usually delayed by 1 to several days, as seen in the first picture. We actually look at this delay as being a benefit, as it can be used in a positive manner for retailing hyacinths. It seems to us that anything that delays flower opening by a reasonable margin is a potential benefit for this crop. Postharvest stem and leaf elongation is also excellently controlled by Topflor dips, as seen in the second picture.

Across several cultivars, starting points for commercial trials would be to dip hyacinth bulbs into 20 ppm Topflor or 10 minutes.



Topflor preplant dips on Polar Giant. Left to right: Control, 20 ppm Topflor for 10, 30, 60, or 120 minutes. 2007. Image 0307.

This concentration works well across a number of cultivars and cooling durations, and should give good results in most cases. For very late forcing (long cold durations), a longer dip (30 minutes) would be suggested as there is usually a stronger effect with longer dips.



Topflor preplant dips on Polar Giant. Postharvest effects. Left to right: Control, 20 ppm Topflor for 10, 30, 60, or 120 minutes. 2007. Image 0366.

## Lily

Since 1999, we have conducted numerous trials on pre-plant dips with hybrid lilies with Bonzi, Sumagic and Topflor. As is apparent from the extensive information on the annual CD, there are large cultivar differences in response to PGR dips, overall, and the specific response to Topflor will also vary by cultivar. In most cases, the Topflor rate we have chosen for experimentation have been too high, as seen in the photos below, where the "right" rate is lower than our lowest tested rate.

More information is available on the CD, but most Asiatics and LA-hybrids will need <10 ppm Topflor as a 5 minute dip. Orientals in general require Topflor dip rates in the 20-50 ppm range.



Effect of pre-plant bulb dips on size 14/16 LA-hybrid lilies. Top to bottom: Amarone, Ceb. Dazzle and Royal Perfume. Treatments are (L to R): Control, Bonzi at 50, 100, 200, or 300 ppm, Sumagic at 2.5, 5, 7.5 or 10 ppm, and TopFlor at 10 or 50 ppm, given as a 1 minute dip.

### Thoughts on Topflor use

- Recipes. The nearby tables show recipes for preparing Topflor solutions for dip or drench use.
- Cultivar effects. As with most all PGRs, there are differences in cultivar response to any given Topflor treatment. These need to be evaluated on a grower-by-grower, and cultivar-by cultivar basis, and specific protocols developed per grower. The guidelines presented in this newsletter, however, are good starting points.
- Dip solution longevity. Our earlier research has shown that a PGR dip solution can be dipped into repeatedly with hybrid lilies without losing effectiveness (at least 50 hybrid lilies can be dipped repeatedly into a liter of Bonzi with the solution retaining its effectiveness). While we have not done such studies on tulips, daffs or hyacinths (since these bulbs are much cleaner it is logical to think dip solutions will maintain effectiveness as with lilies), researchers at NC State, have, however, done such research, and the result is as expected: you can use a dip solution repeatedly without any loss of

activity. This does not, however, address the long-term longevity in a dip tank (that is, over a period of many days or weeks). As far as I know, this is a totally unknown factor.

- Dip temperature. Other researchers have also confirmed that dip temperature, in the range of 8 to 24C has no effect on Topflor efficacy.
- Dip safety. Concerns are often raised about dipping hyacinths and spreading bacterial disease. While a concern, to date we have not experienced any problems along this line, but our small scale studies permit inspection of each bulb.  
Large-scale users of hyacinth dips would be dipping bulbs by the crate or even pallet, and bulbs could not be inspected individually before dipping. This is a potential concern, and must be evaluated on a case-by-case basis.

<b>Guidelines for preparing Topflor solutions as pre-plant bulb dips.</b>		
<b>Concentration of active ingredient required (ppm)</b>	<b>Fluid ounces Topflor per US gallon of water</b>	<b>ml Topflor per liter of water</b>
2.5	0.08	0.66
5.0	0.16	1.3
7.5	0.25	2.0
10	0.33	2.6
25	0.83	6.6
50	1.66	13.2

- We are not endorsing Topflor or promoting its use over other worthy products, but feel growers should examine this product to see if it fits into their production scheme, and evaluate it based on its merits in their own operation.

<b>Guidelines for preparing Topflor solutions as soil drenches.</b>						
<b>Pot Diameter</b>	<b>Active ingredient Required</b>	<b>Concentration (ppm or mg/L)</b>	<b>Number of pots treated</b>	<b>ml/120 liters</b>	<b>fl. oz./32 gal.</b>	<b>Liquid ounces per pot</b>
<b>6 inch (15 cm)</b>	0.25	2.1	1,000	66	2.2	4
	0.5	4.2	1,000	132	4.4	4
	1.0	8.4	1,000	264	8.8	4
<b>4 inch (10 cm)</b>	0.25	4.2	2,000	132	4.4	2
	0.5	8.4	2,000	264	8.8	2
	1.0	16.8	2,000	526	17.6	2