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RESEARCH NEWSLETTER

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Hyacinth Height Control with Topflor (flurprimidol)

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Pot hyacinths are enjoyed for their color, fragrance and elegance. Bulbs are produced almost exclusively in Holland and are shipped worldwide for greenhouse forcing as a winter to spring pot plant or cut flower. In Europe, potted hyacinths are also available in late fall as a result of special bulb production, temperature treatment, and forcing techniques. While such potential also exists for North America, to date the late fall market for hyacinths has not been developed adequately to this point in time.

Over the past few years we have conducted extensive trials with a number of hyacinth cultivars, especially in the context of developing better height control measures (see newsletter No. 19, March 2009). Historically, Florel (ethephon; an ethylene releasing growth regulator), has been used as the main height control technique in hyacinths. In hyacinths, ethephon acts by causing a change in cell growth. Rather than elongating ("stretching"), cells of hyacinths sprayed with Florel tend to be shorter and thicker (fatter). In this way, height of the stem is reduced. Depending on the cultivar and moment in the season, foliar sprays of 500-2,000 ppm Florel (one or two sprays) are recommended.

However, growers sometimes report variable effects with Florel on hyacinths and this has stimulated our interest in developing production information on other PGRs, mainly those that work by reducing gibberellin (GA) production in the plant. Gibberellin is the catch-all term for a range of molecules in higher plants that are naturally occurring plant hormones that are involved in many areas of plant growth, but also of stem and cell elongation. There are well over 125 different gibberellins in higher plants. Growth regulators such as A-Rest, Bonzi, Sumagic and Topflor all act to reduce gibberellin levels in the plant thereby causing less cell stretch and shorter plants. Essentially, while Florel and the anti-GA PGRs work differently in the plant, the final result is often the same: a shorter plant, better able to withstand the figors of shipping and handling.

In the last few years, Topflor (flurprimidol, from SePRO Corp.) has emerged as an excellent product for use on hyacinths, and has proven useful as a pre-plant bulb dip, or as an in-greenhouse drench very shortly after forcing begins.

Topflor 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.

What We Did

In our trials, we have evaluated Topflor as a pre-plant dip, or as in-greenhouse drenches, at two different cold durations (15 and 18 weeks). Plants (generally 17/18 cm bulbs) are grown 1 bulb per 4" pot, cooled for 15 or 18 weeks, then forced at a temperature of 63F nights (17C) and 63-72F days (17-20C). While 18 weeks is more cold than needed for proper flowering of most cultivars, we have chosen to evaluate it, since it is relatively common in North American forcing that late season hyacinths are over-cooled. This is because greenhouses typically grow a wide variety of crops, and bulb planting in the fall is often shoehorned into the ongoing greenhouse work schedule.

Our typical Topflor pre-plant dip treatments have been 20 or 40 ppm Topflor for 10 to 60 minutes. We prepare groups of bulbs and dip them into the solution for the required time at typical room temperature (20C). After draining and drying, bulbs are planted as usual, watered in, then cooled until forcing. Recipes for preparing Topflor dips at these concentrations are found in Table 1.

Drench treatments have been 1, 2, 3 or 4 mg Topflor/pot, given in the greenhouse generally within 2-3 days of the start of forcing.

Again, the plants are growing in 4" (10 cm) pots, so a normal drench volume would be 2 ounces (60 ml) per pot. Therefore, this works out to 16, 33, 50, or 66 ppm given as a 2 ounce drench per 4" pot to get 1, 2, 3, 4 mg/pot, respectively. Recipes for preparing Topflor drench solutions are given in Table 2.

Results: Dip Treatments

- Selected photos show effects of dip treatments on different cultivars, and show plant appearance near flowering and also a "postharvest" photo when the plants are nearing senescence. All data, results and cultivar pictures can be seen at the Flowerbulb Research Program Website at www.flowerbulbs.cornell.edu and clicking "Potted Hyacinths".
- The longest dip durations generally reduced shoot growth in the cooler during cold treatment. Usually, this effect was more pronounced with the longer cooling period (when there was more shoot growth) and it varied by cultivar.
- Forcing time was also lengthened by the longest dips. Forcing times typically increased by 3 to 4 days with the 60 min dip treatments. With the longer cold duration, flowering delay was less; on average 1-2 days. *This flowering delay may actually be an advantage if it is used to lengthen the retail marketability period!*
- The growth reduction effects of pre-plant Topflor dips are very significant, but vary by cultivar, concentration, dip length, and time of forcing. At concentrations of 20 and 40 ppm Topflor, compact plants can be obtained by dip durations of 10 to 60 minutes for a wide variety of cultivars (Table 3).
- Since plants were shorter due to PGR use, hey were better able to support themselves, and presented better during the postharvest evaluation. Leaf presentation was markedly improved by the Topflor dip treatments.
- The 20 ppm Topflor treatment represents a 190-fold dilution of the 3,800 mg/L commercial product, making this an economically attractive option for height control. Assuming a Topflor cost of $113/liter, and preparation of 100 liters

of 20 ppm dip solution, that each bulb absorbs 5 ml of solution, and that the solution is used until half of it (50 liters) is consumed, it can be calculated that at least 10,000 bulbs can be treated, with a cost of slightly more than 0.5 cents per bulb (less than 2 cents per 6" pot with 3 bulbs). In real practice, it is likely the final chemical cost per bulb would be lower than this.

- While this was a large experiment, there was no repeated dipping into the PGR solutions, and bulbs were hand selected for the experi ment, both of which avoids diseased bulbs. In a commercial setting, thousands of bulbs would be dipped multiple times into a dipping solution, increasing the potential of bacterial disease spread. The effectiveness of pre-plant PGR bulb dips for hyacinth is established. Whether it can be safely used in the Indus try remains to be seen.
- Specific use rates must always be determined by each grower under local conditions. Growth temperature, soil, bulb size and many other factors all affect plant response to any growth regulator.

Results: Drenches

- All cultivars showed good response to Topflor drenches in the greenhouse, although Wood stock was less responsive than the others. In these experiments, we used 4" pots, and drenched with 2 ounces (60 ml) within 2-3 days of placing into the greenhouse.
- For most cultivars, good effects were seen on stem height and leaf length at bud color/first open flower stage. The rates used generally did not delay flowering very much (perhaps by 1-2 days at most).
- Most treatments showed excellent control of postharvest stem and leaf growth.
- Table 4 gives suggested use rates (in mg/pot) for the 9 cultivars tested over the past two years, for each cooling duration. Most cultivars fall into the 1.5-2 mg/pot range with less cold (15 weeks of cold), so a very generalized treat ment of 1.5-2 mg/pot on most cultivars would be appropriate (if the grower determined it is necessary) for VD to early Easter flowering.
- As is well known, hyacinths grow much faster with longer cooling, and require more PGR. For mid-Easter flowering, most cultivars would need 2-2.5 mg/pot. For late Easters, even higher rates are probably needed (probably 2.5 -3 mg/pot).
- Topflor comes as a 0.38% active ingredient l i q uid (3,800 mg/liter). Assuming a cost of $113/ liter container, the chemical cost of Topflor comes to $113/3,800 mg = $0.0297 per mg a.i. Thus, the chemical cost of a 1, 2, or 3 mg/pot drench is 3, 6, or 9 cents (U.S). per pot, re spectively. These costs are probably too high for 4" pots, but are more reasonable for 6" or larger containers.
- Specific use rates must always be determined by each grower under local conditions. Growth temperature, soil, bulb size and many other factors all affect plant response to any growth regulator.

Conclusions

- Pre-plant Topflor dips show excellent promise for hyacinth growth regulation. A starting point for commercial trials would be to dip hyacinth bulbs into 20 ppm Topflor for 10-30 minutes (See Table 3). This concentration works well across a number of cultivars and cooling dura tions, and should give good results in most cases. A slight (1-4 day) flowering delay might be observed, but this is potentially a benefit as it could be used to extend marketing/retail dis play time periods. Shorter stems and more compact leaf growth are also to be expected in the postharvest phase. For very late forcing (long cold durations), higher concentrations (up to 40 ppm) and longer dips (10-30 min utes) might be needed, again per cultivar.
- In-greenhouse Topflor drenches are also very effective, but are overall more expensive and somewhat less effective than pre-plant dips. Suggested rates are in Table 4. It would be interesting to evaluate Topflor drenches *before cooling* to see whether this might lead to a more robust treatment. Such studies are planned for the 2011 forcing season.

Table 1. Guidelines for preparing Topflor solutions for use as pre-plant bulb dips.		
Concentration of active ingredient required (ppm)	Fluid ounces Topflor per US gallon of water	ml Topflor per liter of water
10	0.33	2.6
25	0.83	6.6
40	1.32	10.4

Table 2. Guidelines for preparing Topflor solutions as soil drenches.						
Pot diameter	Active ingredient per pot	Concentration (ppm or mg/L)	Number of pots treated	ml/120 liters	fl. oz./32 gal.	Liquid ounces per pot
6-inch (15 cm)	1	8.4	1	265	8.8	4
	2	16.7	1	525	17.5	4
	3	25	1	790	26.3	4
	4	33.3	1	1050	35	4
4-inch (10 cm)	1	16.7	2	525	17.5	2
	2	33.3	2	1050	35	2
	3	50	2	1575	52.5	2
	4	66.7	2	2100	70	2

Table 3. Suggested concentrations and dip durations of Topflor (flurprimidol) dips for height control in 9 Hyacinth cultivars. These data were generated for 17/18 cm bulbs (except Pink Pearl, 18/19 cm) in 4" pots, and for 15 or 17.5 weeks of cold, with the aim of generating plants that showed restrained postharvest growth. Less emphasis was placed on control of growth in the greenhouse. Forcing 20 or 25 January (15 cold-weeks) or 6 or 9 March (18 cold-weeks). Updated July 2010.

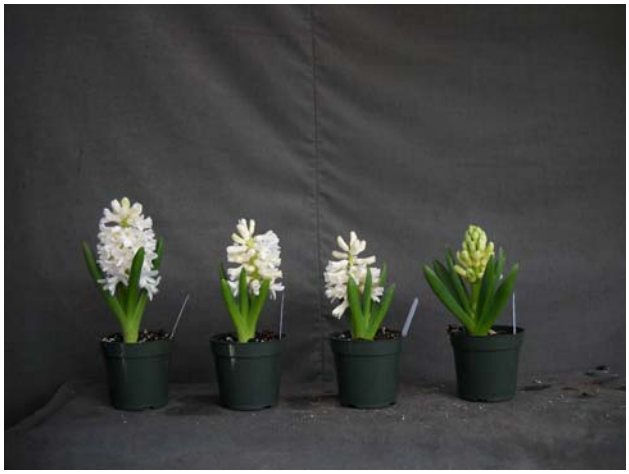
	Topflor concentration, preplant dips		
Cultivar	20 ppm Topflor	40 ppm Topflor	Comments
Aiolos	10 min	10 min	Very responsive to Topflor dips. Same rate can be used for both cold durations.
Anna Marie	10-30 min	10-30 min	Higher rate is better for longer cold periods. Less responsive than Aiolos.
Blue Jacket	10-30 min	10 min	Strong regrowth in postharvest, even when treated. Topflor dip keeps leaves shorter, nicer.
Blue Star	10-30 min	10-30 min	Topflor shows excellent suppression of postharvest leaf growth.
Fondant	30-60 min	30-60 min	Much less responsive cultivar. With cooling durations more than 17-18 weeks, it is difficult to hold back!
Pink Pearl	10 min	10 min	Increase dipping time to 30 min for longer cold durations.
Pink Surprise	10-30 min	10 min	Very responsive to Topflor dips.
Top Hit	30 min	10-30 min	Excellent control of leaf growth.
Woodstock	10 min	10 min	Responsive to Topflor dips, but with less postharvest stem control. Stems and flowers are usually way above leaves, leaves pretty thin in pots.

Table 4. Suggested Topflor (flurprimidol) drench rates (in mg/ pot dosage), for 8 hyacinth cultivars. These data were generated for (mostly) 17/18 cm bulbs in 4" pots. Note that required rates increase as cooling length increases. Forcing dates were 13 and 26 January for the 15 cold-week forcing, and 9 or 10 March for the 18 cold-weeks, respectively. Updated July 2010.

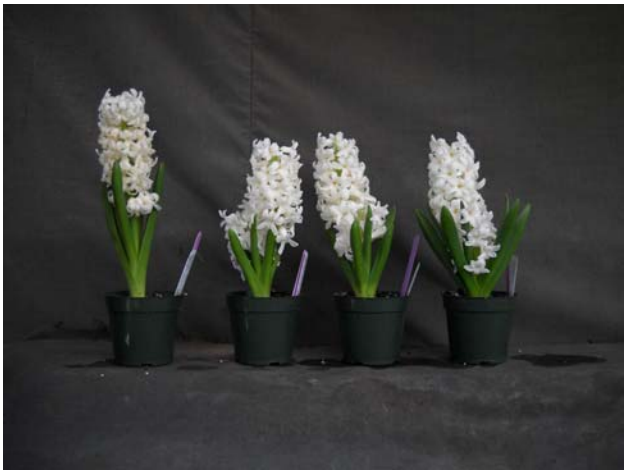
	Suggested Topflor dose, per pot		
Cultivar	15 cold weeks	18 cold weeks	Comments
Aiolos	1-1.5	1.5-2	Very responsive to Topflor. Leaves also well-controlled.
Anna Marie	2	2	Leaves controlled much less with longer cooling.
Blue Jacket	2	2	Leaves well-controlled. Excellent pots with Topflor.
Blue Star	1	1-1.5	Both stems and leaves are extremely responsive.
Fondant	2	3-3.5	Very floppy with 18 cold weeks.
Pink Pearl	1	1-1.5	Nice and compact plants.
Pink Surprise	1-1.5	1.5-2	Topflor controls postharvest growth very well.
Top Hit	1-1.5	2-2.5	Topflor keeps leaves upright, sturdy with longer cold.
Woodstock	1-1.5	2-3	Less responsive than most other cultivars.

Pre-plant dips. Aiolos. 15 cold-weeks. Left to right: Control, 40 ppm Topflor dips for 10, 30 or 60 minutes. 2009

Pre-plant dips. Aiolos. 15 cold-weeks. Posthar-vest. Left to right: Control, 40 ppm Topflor dips for 10, 30 or 60 minutes. 2009.



Pre-plant dips. Aiolos. 18 cold-weeks. Left to right: Control, 40 ppm Topflor dips for 10, 30 or 60 minutes. 2010.



Pre-plant dips. Aiolos. 18 cold-weeks. Posthar-vest. Left to right: Control, 40 ppm Topflor dips for 10, 30 or 60 minutes. 2010.

Pre-plant dips. Pink Surprise. 15 cold-weeks. Left to right: Control, 20 ppm Topflor dips for 10, 30 or 60, minutes; 40 ppm Topflor for 10, 30 or 60 minutes. 2009.

Pre-plant dips. Pink Surprise. 15 cold-weeks. Post-harvest Left to right: Control, 20 ppm Topflor dips for 10, 30 or 60, minutes; 40 ppm Topflor for 10, 30 or 60 minutes. 2009.

Pre-plant dips. Top Hit. 18-cold weeks. Left to right: Control, 40 ppm Topflor dips for 10, 30 or 60 minutes. 2009.

Pre-plant dips. Top Hit. 18-cold weeks. Postharvest. Left to right: Control, 40 ppm Topflor dips for 10, 30 or 60 minutes. 2009.

Pre-plant dips. Blue Jacket. 15 cold-weeks. Left to right: Control, 20 ppm Topflor dips for 10, 30 or 60 minutes. 2009.

Pre-plant dips. Blue Jacket. 15 cold-weeks. Postharvest. Left to right: Control, 20 ppm Topflor dips for 10, 30 or 60 minutes. 2009.

Greenhouse drenches. 18 cold-weeks. Left to right: Control, 1, 2, 3, 4 mg/pot Topflor drench in the greenhouse. 2010.

Greenhouse drenches. 18 cold-weeks. Postharvest. Left to right: Control, 1, 2, 3, 4 mg/pot Topflor drench in the greenhouse. 2010.

Greenhouse drenches. 15 cold-weeks. Left to right: Control, 1, 2, 3, 4 mg/pot Topflor drench in the greenhouse. 2009.

Greenhouse drenches. 15 cold-weeks. Postharvest. Left to right: Control, 1, 2, 3, 4 mg/pot Topflor drench in the greenhouse. 2009.

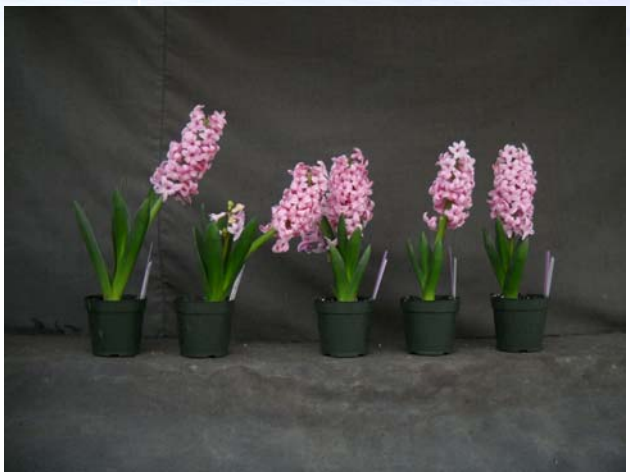
Greenhouse drenches. 15 cold-weeks. Left to right: Control, 1, 2, 3, 4 mg/pot Topflor drench in the greenhouse. 2010.

Greenhouse drenches. 15 cold-weeks. Postharvest. Left to right: Control, 1, 2, 3, 4 mg/pot Topflor drench in the greenhouse. 2010.

Greenhouse drenches. 18 cold-weeks. Left to right: Control, 1, 2, 3, 4 mg/pot Topflor drench in the greenhouse. 2009.

Greenhouse drenches. 18 cold-weeks. Postharvest. Left to right: Control, 1, 2, 3, 4 mg/pot Topflor drench in the greenhouse. 2009.

Greenhouse drenches. 18 cold-weeks. Left to right: Control, 1, 2, 3, 4 mg/pot Topflor drench in the greenhouse. 2010.



Greenhouse drenches. 18 cold-weeks. Postharvest. Left to right: Control, 1, 2, 3, 4 mg/pot Topflor drench in the greenhouse. 2010.

Lilytopia

The first Lilytopia was held at Longwood Gardens in May. What an event and what a venue to show off the latest and best lilies. Many commented the majesty of the conservatory and its permanent plantings were the perfect foil to display lilies, and most found easy and favorable comparisons to the Lily Parade at the Keukenhof.

From my perspective as the Keynote speaker, it was an excellent opportunity to present our past and present lily research, and to generally promote the Flowerbulb Research Program to a new audience. The attendees of the Lilytopia symposium were bulb growers, exporters, US and Canadian forcers, distributors, academics, and members of several allied trades. Congratulations are due to all cooperating organizations, from Anthos to the breeders, forcers, shippers, airlines, etc. who worked together and donated money and time to make this world-class event happen. And, special kudos are certainly due to Jurgen Steininger, the Longwood horticulturist who led the charge in the conception and execution of the event.

The symposium was a special part of Lilytopia. After making the point that there are literally dozens of plants named “lily”, we were actually limiting our scope to “just” the genus *Lilium*. No matter, there were plenty of issues to present, from growth regulator use for pot lilies, to postharvest treatments, and the ability of Fascination to so effectively lengthen flower life and reduce leaf yellowing. John Dole from NC State University presented additional data and information on commercial floral foods and treatments to lengthen cut flower lifespan. Ron Beck of the Fred C. Gloeckner Company gave a wonderful historical review of the US lily industry especially bringing out the richness of the west coast growers. And, Arie Peterse gave the finest presentation on lily breeding I have ever seen…his enthusiasm and dedication to the industry as a whole were apparent, and everyone thoroughly enjoyed seeing the L’s. A’s, O’s and T’s flying across the room as new cultivars leapt from the screen.

From less technical point of view, Talmadge McLaurin, Publisher of Florist’s Review, presented a design seminar highlighting the latest design trends. Finally, Chris Beytes from GrowerTalks magazine lead a panel discussion with 4 major retailers or flower wholesalers that highlighted purchasing trends from the point of view of large floral buyers.

What’s next? Presumably, “we” can do it again next year. What is needed is a renewed effort from exporters and others in the US industry to get “your customers” there to see new varieties and to become inspired. See you in 2011!