September 2013

RESEARCH NEWSLETTER

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The Upcoming Tulip Forcing Season: It's a Late One…
By Bill Miller

The 2013 field growing season in Holland was significantly colder than usual. When I was in Holland in May (week 21), tulips were flowering together that are normally never in flower at the same time. Mid season and late season cultivars were all doing well and, for the flower admirer, it was great. But, the late spring and continuing cool summer temperatures have led to a late maturation and late harvest season. Consequently, G stage will be up to 3 weeks later than usual, which in turn, leads to a later date when a tulip bulb can flower properly.

To review, tulip bulbs are vegetative when they are lifted (dug) from the field (usually in early to mid-July in the Netherlands). In a normal season, bulbs are dry stored at temperatures close to 63-68F (17-120C) after lifting. At this temperature, cell divisions inside the bulb can continue, and by late July, the initial formation of floral parts begins. You must have a microscope to see this, but it does happen, and takes several weeks to be completed. By late August (let's say August 20-25), many bulbs have reached the "G stage", which is when the sigma (female parts, hence G for gynoecium) has been fully formed. It is generally the case that cooling can be started once the G state has been reached. If bulbs are cooled before this stage, plants are very short when flowering and usually have misshapen flower parts or petal tips that are dried out and not fully formed.

Attainment of G-stage can be accelerated by heating the bulbs (close to 95F, 35C) immediately after digging. It is not well appreciated that tulips actually require heat for tine earliest stage of the flowering process, that of *floral induction*. Thus, for earliest flowering, after lifting, a heat treatment can be given for 2-3 weeks, and thereby advances flowering by 10-14 days. This is not a routine treatment, however, and is only used for the very earliest forcings in special cases.

Warm treated tulips are not generally available unless specially planned for and pre-arranged with your supplier.

It gets even more complicated, though. Over the years, research and industry have come to realize the existence of the tussentemperatuur (translation: "in-between temperature", referring to the in-between time after G-stage and before cooling),

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which is a period of 1-6+ weeks that specific cultivars must be held at 63F (17C) to more fully and completely allow flower and embryonic plant development inside the bulb. This is essentially a horticultural extension of the G-stage to allow better and easier forcing. Some cultivars have a short tussentemperatuur and are often the early flowering varieties. Those with a long tussentemperatuur are always late flowering. A given cultivar will flower once it is at the G-stage, but *better, more consistent and horticulturally superior* flowering will happen once the appropriate duration of tussentemperatuur is given.

The tussentemperatuur is usually built into forcing schedules and much of the burden for managing this falls on the supplier. And, it is really only an issue for very early flowering, or for very late harvest seasons, as we have now. Again, questions on scheduling details fall to your supplier.

In the Meantime…Clean up to Avoid Trichoderma and Other Problems

While it is going to be a late season, and early crops will be difficult to force, you must still be preparing for the crop and getting ready for planting and cooling operations.

It is important to start clean! A thorough cleaning of bulb handling, planting and cooling facilities will help to avoid problems in forcing, especially with diseases such as *Trichoderma* (Figs. 1 and 2). We have a fact sheet on *Trichoderma* on the website, which can be found at http://www.flowerbulbs.cornell.edu/newsletter/Trichoderma%20May%202004.pdf (or, more easily, go to the website at flowerbulbs.cornell.edu and type in “trichoderma” in the search box, and you’ll go right to it). This disease is promoted by very heavily rooted plants Fig 3). When tulips are massively rooted in pots, the lack of soil among the roots makes the roots more susceptible to drying out, salt accumulation or any number of other stresses, and weakened roots are thought to be more susceptible to the pathogen. *Trichderma* is a disease that only shows symptoms in the greenhouse. Symptoms will not show in the cooler because the roots are not damaged (as a result of drying out, high temperatures, etc.) yet. Use a labeled sanitizing product to clean all areas you will handle the bulbs. Thorough cleaning of planting surfaces, crates, carts, shelves can reduce inoculum sources and help to maintain crop health. This is the *first* step!

Next, consider the substrate. If growing cut flowers, place a 1/2” layer of coarse sand on the bottom of the forcing tray before planting. While the exact reason this is helpful is unknown, it may involve maintaining some contact of substrate and the root mass on the bottom of the crate. This technique is probably not practical for potted tulips, but a common recommendation is to add 20% of coarse, salt-free sand to the mix. The idea here is to reduce the total water content in the container, which will ultimately reduce root growth in the cooler somewhat.

Another way to reduce excessive root growth is to reduce the temperature in the cooler. Root growth is closely related to temperature. Normally, temperatures have been reduced gradually (over a 4-5 week period) from 9C to 1C as the roots develop. In recent years, more growers are reducing rooting room temperature more rapidly than before, and one result is less heavily rooted tulip plants. Quick initiation and healthy initial growth of tulip root systems takes place at 9 C. After this first growth phase, when roots are established on all cultivars, check slow-rooting cultivars such as Couleur Cardinal and Prinses Irene. When these are rooted, it is safe to lower temperatures in the cooler to limit excessive root growth.

Experience in Holland suggests that growing plants on closed surfaces, or in contact with concrete floors increases the *Trichoderma* problem. Any situation that allows roots to maintain growth outside of the pot are suspected to increase the potential for *Trichoderma.* So, in the greenhouse, growing on open bottom (expanded metal) benches allows close and rapid air pruning of the roots. If growing cut flowers, success has been seen by placing the crates on ca. 2” diameter pipes or 2-3” tall bricks (Fig. 4). The airflow beneath the crates allows root pruning and reduces *Trichoderma* problems. Air pruning of tulip root systems also will take place in coolers when pot bottoms are directly exposed to air. Pots placed in shuttle trays and closed surfaces on shelves or carts, often carry an overflow of roots exiting the bottom of the pots. Such root systems are most vulnerable to *Trichoderma* infection during the greenhouse phase."

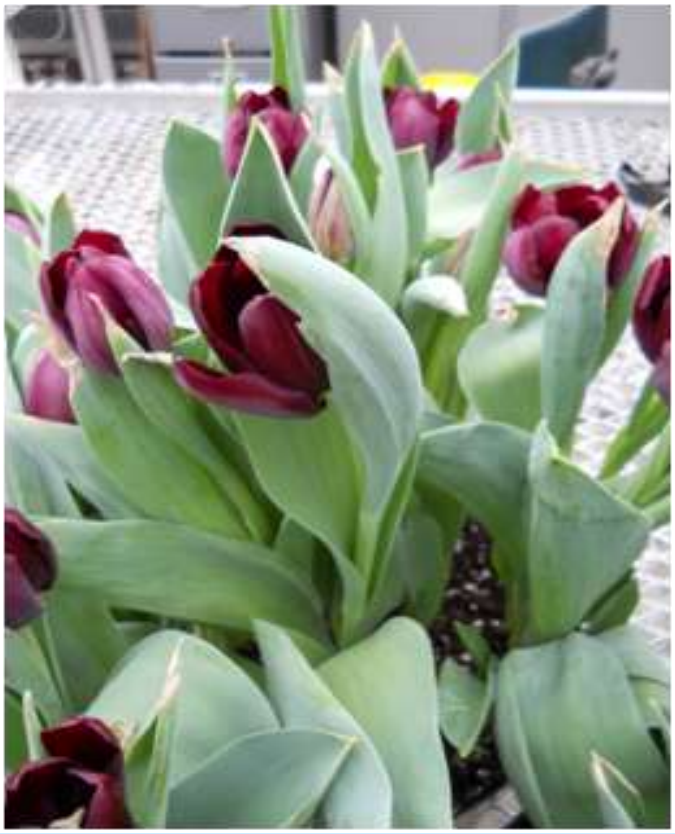

Fig. 1. Typical *Trichoderma* symptoms. Image 2025

Fig. 3. A very heavily-rooted pot tulip. The very heavy mass of roots, circling on the bottom of the pot without any soil adhering, is one of the suggested causes of *Trichoderma* infection. Image 2851

Fig. 2. Roots of a *Trichoderma*-infected tulip plant. Note the matted edge of roots that has no attached soil. The roots are "glassy" and slippery. Note also the white fungal mycelium on the roots. Image 5377

Fig. 4. Cut tulip crates grown on bricks to aid in rapid air pruning of the roots to help reduce *Trichoderma.* Image 7280

Cultivars and PGRs
If you are not aware, the website of the Flowerbulb Research Program (www.flowerbulbs.cornell.edu) has an extensive listing of tulip, hyacinth and narcissus cultivars, with suggestions of PGR use. For tulips, information is given on drench rates for A-Rest, Piccolo/Bonzi, and Topflor, by cultivar.

Updated List of "Deer Resistant Plants"
In Cooperation with Mohonk Mountain House, a National Historic Landmark in New Palts New York, Cornell has available a list of "rarely eaten plants, based on 21 years of observation at Mohonk. This list is available from the Flowerbulb Research Program Website at http://www.flowerbulbs.cornell.edu/landscape/mohonk_deer_list.pdf

Cornell Floriculture Field Day a Success
The yearly Cornell Floriculture Field Day was held August 13 this year, about 3 weeks later than in past years. About 110 people attended morning educational sessions on a range of topics, including Bill Miller's presentation on "Summer Bulbs for the Garden". The afternoon program featured lunch, time to inspect the extensive annual and perennial trials including two beds of summer flowering bulbs kindly donated by Netherlands Bulb Co. in Easton PA (Fig. 5). Dahlia, callas, canna, oxalis and other bulbs made a good show….to say nothing of *Eucomis* and *Agapanthus* (see elsewhere in the newsletter).

Fig. 5. Part of the summer flowering beds at the Cornell Floriculture Field Day in August

Potential for Gladiolus Growth Regulation in Containers
As a result of grower and exporter inquiries, we conducted some initial experiments on growth regulators for container production of gladiolus. The data are being looked at now, but it is clear that we can reduce gladiolus height to make this crop easier to transport and handle in the retail environment. More work is needed for next year, but Topflor drenches seem promising and it looks like ethephon (Collate or Florel) drenches are also effective. Please note, ethephon drenches are not currently labeled for this use.

Update on *Agapanthus* Perennializing in Ithaca!
In the last newsletter, I mentioned that bare roots of Agapanthus 'Blue Triumphator', 'Donau', 'Dr. Brouwer', 'Elisabeth', 'Pinnocchio', 'Polar Ice' and 'Sunfield' were planted in our zone 5b outdoor perennial trial facility in Ithaca in mid-summer of 2011. No special winter protection was given, other than the usual 5 cm of mulch that was applied when they were planted in the summer, and it should be mentioned the site has very well drained loamy soil (no excessive winter wetness!) After the winter of 2011-2012, *every single plant survived,* and most flowered. I can now report similar success in the summer of 2013…all plants came through the 2012-2013 winter very well, and have grown larger and have many flowers. They are really quite beautiful, as you can see from Fig. 6. Whether this is due to climate change, or simply from people "knowing" that these plants are not winter hardy…it seems like there is some real potential to adopt at least some Agapanthus into gardens that are as cold as Ithaca (zone 5b). Certainly, more cultivars should be tried, and for more years…and these results only apply to plants in the ground (plants in containers would have much less hardiness than when in the grown).

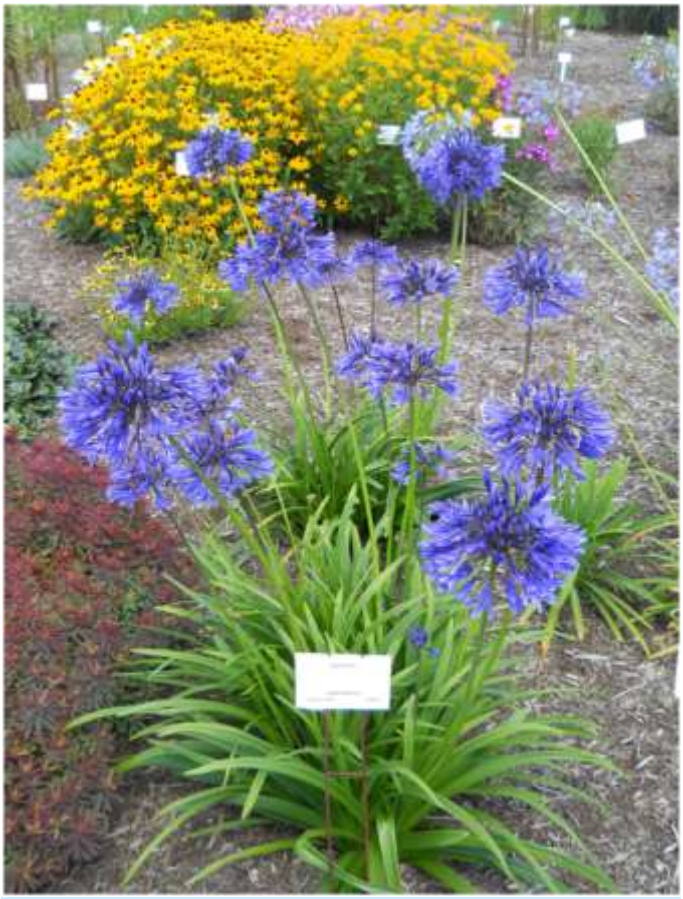

Fig. 6. One of the *Agapanthus* cultivars in Summer 2013, after coming through 2 winters in Ithaca NY. Image 8798

Is *Eucomis* (pineapple lily) winter hardy?

Bill Miller and Chris Wien
Cornell University
Ithaca NY

In mid-summer 2012, we planted 10-15 bulbs of three *Eucomis* cultivars originating from Eddie Welsh in New Zealand. While we do not know the details of the breeding, Eddie has said they are *Eucomis comosa* types.

The plants had been grown in 6" pots in the greenhouse for growth regulator trials using bulbs supplied by Jack DeGoede (Mossyrock, WA). After we collected our research data, the flower stems were cut off, and then planted in perennial trial beds at our Bluegrass Lane trial site. The site has very well drained loamy soil (rare for our immediate region but much appreciated!), and after planting, the area was mulched with 2" of double ground hardwood mulch. No further mulch, winter protection, fertilizer, or special care was given other than an occasional irrigation if needed. Separately, Chris Wien planted bulbs into his high tunnel cut flower research facility (high tunnels are unheated plastic greenhouse structures used to extend the growing season on the early and late ends). His bulbs came through in very excellent form, yielding 30+ inch long stems starting in early July.

Our outdoor-planted bulbs emerged in late spring 2013, grew slowly through early summer and were beautiful and healthy in mid-July (Fig. 7). Flowering began in early August (Figs. 8 and 9) with the white cultivar ('Innocence') being a bit later than the other cultivars.

Since we did not anticipate *any* survival, we really did not keep accurate records on the number of plants used, etc. But it is clear from the plots and photos that the plants were substantially hardy this past winter, and did not suffer any extensive winter damage. Leaves were excellent (no burned leaf tips, distorted growth, etc.) and more importantly, the flowers were flawless. Quite a surprise. Chris' findings suggest potential for cut flower production, using the high tunnels to accelerate flowering by at least a month with no heating cost.

But, is this a new and novel finding? Are *Eucomis* winter hardy? The website of the Pacific Bulb Society states: "In cultivation they have proved to be hardy to frost, especially if planted deeply or protected during their dormancy by snow" (http://www.pacificbulbsociety.org/pbswiki/index.php/Eucomis). While interesting, the term "frost" is ambiguous (much used in England and mainly irrelevant to really cold areas!) and "frost plus snow" in many areas of the western USA is invariably a milder degree of cold than what we see in normal upstate NY winters.

So…is *Eucomis* winter hardy? First, we had only a limited selection of varieties originating from one breeding program in New Zealand. Eddie Welsh (the breeder) tells us these are *E. comosa* types, so perhaps we can tentatively assume that other *E. comosa* cultivars might show the same degree of winter hardiness. We have no way of knowing about other *Eucomis* species or cultivars without additional trialing. And, this represents only one winter. We will leave the plants in place and observe for he next several winters. If the plants continue to thrive for another couple of winters, then we can be quite sure that these plants will deserve much wider landscape use (and as a perennial cut flower, perhaps in tunnels or in open ground plots!) in the future.

Trust us, we do not have a lock on global warming in Ithaca, but this just points out that plants can't read, and in the right place (well drained soil being essential as winter wetness is usually to blame for marginally hardy plants failing in the winter), many plants will do better than expected. For the record, Ithaca previously was in the cold end of zone 5 (zone 5a), and now resides in zone 5b with the winter hardiness revision from 2012 (http://planthardiness.ars.usda.gov/PHZMWeb/).

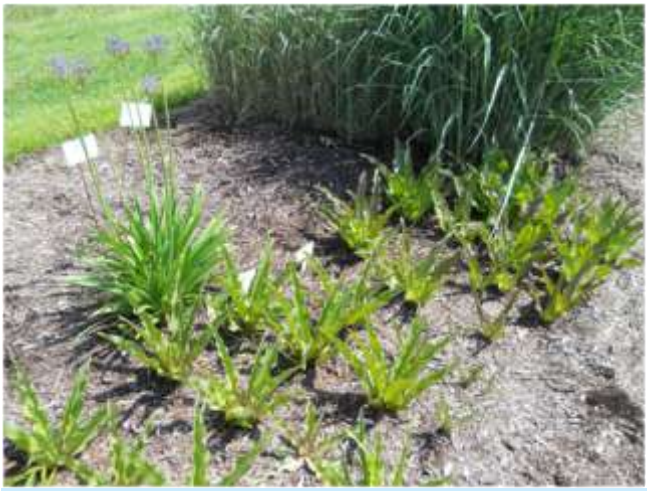

Fig. 7. *Eucomis* plot at Cornell's Bluegrass Lane trial area in mid-July, 2013. These plants overwintered (2012-2013) in the garden! Note also the *Agapanthus* ('Back in Black') in the background that had come through three winters. Image 7467

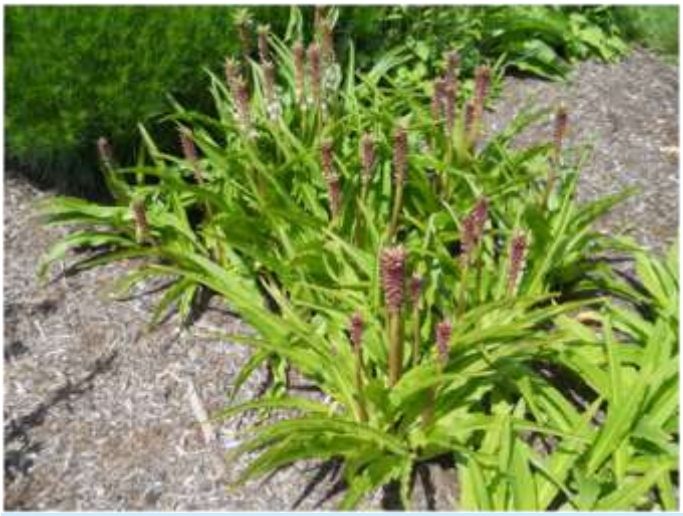

Fig. 8. *Eucomis* in mid-August 2013, having overwintered in the ground the winter of 2012-2013 in Ithaca NY. Image 8889

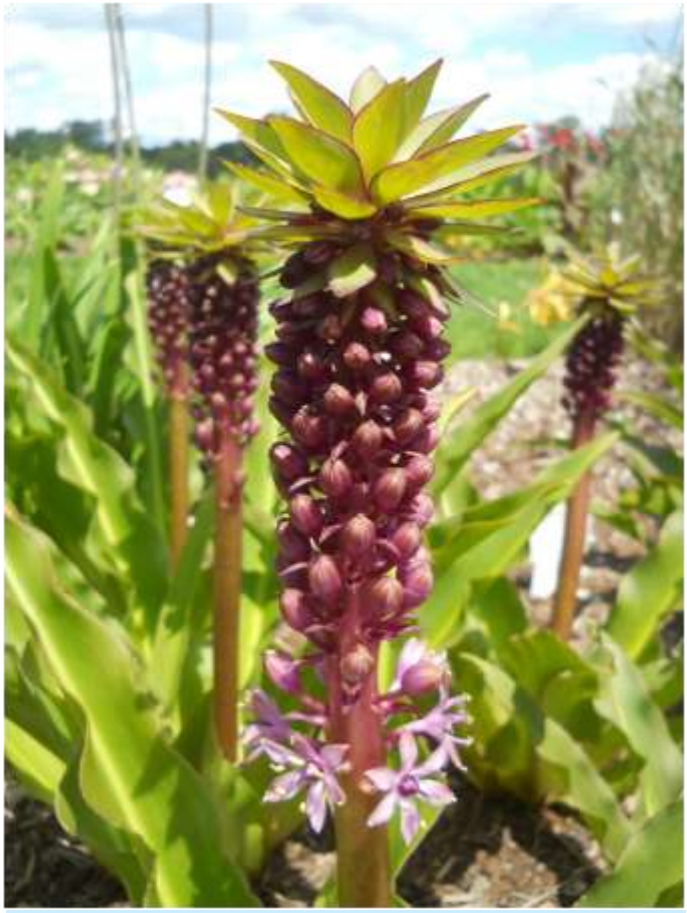

Fig. 9. *Eucomis* flowering in mid-August after overwintering from 2012-2013. Image 8884