September 2017

RESEARCH NEWSLETTER

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

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Research Newsletter No. 38
Bill Miller, Cornell University

Preparing for the Coming Season

In this newsletter;

Questions? Contact Bill Miller at Cornell

The Flower Bulb Research Program at Cornell exists to 1) generate new research-based information useful to the export sector in the Netherlands and their forcing and landscape customers in North America, 2) to communicate this information to these same parties and 3) to be a point of contact for technical information regarding bulbs and perennials in North America. As such, forcers, wholesalers, landscapers and retailers are encouraged to contact me with any questions they may have regarding (especially) Dutch bulb products. Usually I have a good answer. If not, I'll try to find an answer and get back to you. The best way of contact is email: wbm8@cornell.edu My cell phone is 607-227-2780.

Under-Grass Bulb Planting to be an Additional Dry Sale Research Focus at Cornell

The advent of small and relatively inexpensive machines to plant bulbs under existing grass opens up interesting areas for research and demonstration trials. Bulb trading companies in Europe have used these machines for years

to install swaths of bulbs that provide excellent large-scale color in the landscape. A video of the machine in action can be found here: https://www.youtube.com/watch?v=Mbhcglsf1-g

By varying the color, cultivar and species composition, beds of nearly any imaginable look can be achieved with a long color period. Some fine examples on "undergrass planting" can be seen on websites of a number of bulb companies in Holland. They have fine-tuned bulb species mixes to provide bloom succession (from crocus to allium and camassia) that provide excellent color and landscape appeal. In addition, maintenance costs are reduced as these areas are not mowed until mid-summer, or potentially into the fall is summer wildflowers are incorporated. Thus, we can have a highly diverse landscape, serving pollinating insects and providing color while reducing mowing costs. And, the machine reduces installation costs dramatically.

In fall 2017, Cornell will import a bulb planting machine from Holland, as in the picture below. We will set up a number of demonstration at Cornell in publically accessible areas. With it, we will also establish trials to evaluate earliest feasible mowing spring-summer mowing date and to compare longevity (perennialization potential) of species planted "under grass" versus in traditional beds. Regarding mowing, everyone knows that the leaves of spring bulbs must be left intact to build the bulb after flowering. But, must the leaves be left until they are fully yellow, or is some earlier mowing acceptable? This would be useful to know.

Another opportunity is for bulbs to play a key role in allowing part of a large swath of turfgrass to become a slightly less maintained area, with less mowing. Doing so will increase pollinator, butterfly and beneficial insect diversity, will reduce CO2 emissions from less passes with a mower, while providing early season color and continuing interest from late blooming bulbs. A win-win for everyone!

Example of a single-row (18" wide) in-grass bulb planting machine that can be mounted on a small (25-30 hp) tractor. This machine can plant thousands of bulbs in just a few minutes into established grass, leaving the grass intact.

Example of the flowering result of undergrass planting

Preparing for Arrival of Forcing and Drysale Bulbs

By now, most people have heard of the challenges with the current tulip crop. Many bulbs did not size up well and like last year, there has been more Fusarium than anyone would like. As customers, there are a number of steps you must take to give your incoming bulbs the best possible storage and treatment for maximizing performance.

First, as always, ventilate bulbs on arrival, especially bulbs that are shipped at temperatures above 9C. What does this mean? First, remove any plastic wrappings from the pallets. Many bulbs are shipped with netted shrink wrap, when bulbs arrive to your facility, it is important to remove this wrapping.

Set up large fans to vigorously blow air around the pallets and stacks of bulbs. These steps are necessary for two reasons. First is to dry the bulbs out, as humidity control in the reefer may have allowed moisture to be higher than desired. This will reduce surface mold development and reduce any tendency for premature rooting. Secondly, the ventilation removes ethylene that may be present in tulip bulb crates or boxes. The ethylene comes from the Fusarium fungus that is invariably present at some level in nearly every shipment. Ethylene is a problem for tulips bulbs at any stage before dry precooling or "wet- planted-cooling" begins. Among other symptom, ethylene exposure before cooling can cause flower abortion, reduced rooting, shorter plants and distorted and mal-formed flower petals. Some examples of ethylene injury symptoms are shown below.

Figs. 1-4. Some symptoms of ethylene exposure to bulbs (in October, in Ithaca). Bulbs were exposed to ethylene at 20C for 2 weeks in October in Ithaca. After ethylene exposure, bulbs were held at 17C, then planted and cooled at 9C for 27 weeks (temperature was reduced as needed to prevent excessive shoot growth), then forced in a 17C greenhouse.

Fig. 1. Note distorted petal tip that failed to grow. Image 9189

Fig. 2. Note distorted petal remnant on left and distorted anthers. Image 9193

Fig. 3. Note distorted petal tissue that failed to grow. Image 9194

Fig. 4. Note aborted anthers (thin, dried-up "threads" and 1 normal anther. Image 9156

Soil Temperature: Forcing and Landscape!

In the course of working on effects of planting tulips into pots with warm soil, as could easily happen in southern nurseries, we realized the findings are very well applicable to landscape customers.

The photos show Carloa in 6" pots. The control was bulbs held dry at 17C until planting and placing immediately into 9C. The 4 treatments were to plant the bulbs in pots, water them in and hold for 1 week at 15, 20, 25 or 30C. After treatment, pots were transferred to 9C for cooling. The controls were planted and put into 9C on the same day and all plants started their cold period. Note the uniformity of the controls compared with the overall variability and increasing leaf yellowing and disease problem as temperature increases. This shows importance of planting into cool soil and has direct application for both forcing and landscape customers. Conclusion? Delay planting into landscape sites until soil temperature is at least under 15C, and preferably lower. If possible, cover beds with a 1-2" layer of mulch to help keep soils cooler after planting.

Control (9C) Image 5452

1 week 15C Image 5453

1 week 20C Image 5454

1 week 25C Image 5455

1 week 30C Image 5456

The Importance of the Right Planting Mix

Last forcing season we were presented with an interesting case of potted tulips with essentially no root growth. It looked like the roots had started to grow, but then when they were less than 1" long, the tips of the roots died and stopped growing. There were several possibilities, but a quick soil test showing the pH at 3.9 pointed to the fact these plants were suffering from severe calcium deficiency. Calcium is critical for root health, elongation and cell division. We presume the mixing equipment failed or at some moment the lime hopper ran out. A couple of lessons here. First, tulips and most other spring bulbs "do not have all the nutrients they need", as we sometimes like to think. Granted, the need for micronutrient application is very rare in forcing, especially in non-hydroponic situations. However, appropriate fertilization, and especially calcium application (also important later in the crop against stem topple) is im-

portant. The usual advice is to use biweekly applications of 2 lbs calcium nitrate /100 gallons water. Essentially, this means 2-3 applications during a normal tulip crop. Also, growers should always be advised to monitor soil mixing equipment as a couple hours of inattention can affect thousands of pots.

More on temperature effects on bulb rooting

The basic schedules for managing rooting rooms of spring bulbs are well known, thanks for the extensive work done by Gus de Hertogh from the inception of the Dutch-sponsored research program. Basically, a temperature sequence of 9C (48F) followed by 5C (41F) and eventually to 1C (33F) is used. The changes in temperature are theoretically according to growth stage of the crop. So, the switch from 9C to 4C occurs when the roots grow out the holes in the pot and the switch from 5C to 1C is then the shoots are about 1" long. The reduced temperature prevents the shoots from growing up into the crates and pots stacked on top.

However, shoot growth is not the only growth parameter that is affected by temperature! The pictures below highlight the very powerful effects on root growth, and clearly point out that root growth is highly dependent on temperature. These experiments show root development that happened in the first ca. 60 days after planting. Bulbs were planted and watered in and held at 1, 4, 7 or 10C (about 33, 40, 45 and 50F) then roots washed and photographed.

Clearly, tulips, hyacinths and daffodils make very little root growth below 40F (4C) and narcissus is the most affected by the lowest temperature. Both Tete-a-Tete and Primeur had essentially zero root growth after 60 days at 1C. All bulbs rooted freely at 10C (50F) and in most cases 7C (45F) was nearly as good. The usual starting temperature for rooting rooms 48F (9C), is right in this range.

Conclusion? If you have tulips and want to reduce root growth then lowering the temperature after roots are pushing out of the holes is a good practice. However, if you put late planted crops into this same cooler, whether they are tulips, hyacinths or daffodils, they will root very slowly or not at all. Be aware of this as you are managing your planting schedules and coolers.

Fig. 5. Hyacinth Aiolos planted and held about 60 days at (L to R): 1, 4, 7, 10C (33, 40, 50 or 50F). Image 7622.

Fig. 6. Hyacinth Pink Pearl planted and held about 60 days at (L to R): 1, 4, 7, 10C (33, 40, 50 or 50F). Image 7617.

Fig. 7. Narcussis Primeur planted and held about 60 days at (L to R): 1, 4, 7, 10C (33, 40, 50 or 50F). Image 7619.

Fig. 8. Narcissus Tete-a-Tete planted and held about 60 days at (L to R): 1, 4, 7, 10C (33, 40, 50 or 50F). Image 7618.

Fig. 9. Tulip Leen vd Mark planted and held about 60 days at (L to R): 1, 4, 7, 10C (33, 40, 50 or 50F). Image 7621.

Fig. 10. Tulip Oscar planted and held about 60 days at (L to R): 1, 4, 7, 10C (33, 40, 50 or 50F). Image 7620.

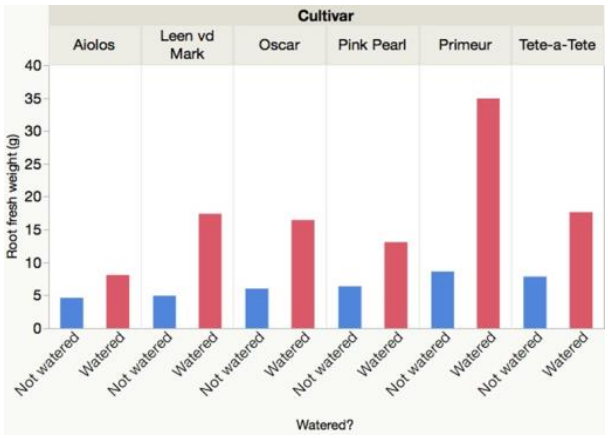
Soil moisture level and tulip root growth

This topic was covered extensively in the October 2016 newsletter (which you can find at http://www.flowerbulbs.cornell.edu/newsletter/35 2016 october.pdf

Our research on this was prompted by the need to find ways to reduce very excessive rooting with tulips which can lead to greater susceptibility to root disease. Our essential finding was that the wetter the soil when pots go into the cooler the heavier the root growth during cooling. In the October 2016 newsletter, we showed the figure below, and show it again due to its importance and interesting result.

Essentially pots had dried up in the cooler and some were given more water on 30 December. Pots were taken out of the cooler on 5 February and the roots harvested. The graph shows final root weight as a result of the additional water. Blue bars are pots that remained dry, red bars are pots given water on 30 December. You can clearly see that in the additional 5 weeks in a moist pot, roots resumed growth and were significantly larger. As long as the pot has moisture, tulip roots will grow!

This does not mean that you should massively reduce water in pots going into the cooler. Many operations have coolers that tend to dry pots out quickly, other operations have coolers that do not. But, knowing the relationship of soil moisture and root growth and the equipment you have available can help you determine your best management strategies. And, there is some risk of having pots too dry initially, leading to root and plant damage from dry soils in the cooler.



Treatment of Bulbs and Crates: Sanitation and Ozone

I am often asked for a recipe for fungicide drenching or dipping prior to planting spring bulb crops. My advice is to consider using products effective against the major disease problems likely to be encountered, Generally, these are Fusarium, Rhizoctonia, Pythium and Botrytis. All four diseases can affect the main bulb crops in some manner. However, fungicides are not always effective. In few, if any cases, will a fungicide treatment cure an infected bulb, so the issue becomes protecting bulbs from future infection or damage. Secondly, there are likely many strains of the major diseases that are resistant to the main fungicide active ingredients.

Undoubtedly a more effective use of time and effort is to sanitize crates, coolers and work surfaces before planting begins. The repeated use of crates leads to a buildup of soil residue and disease spores that are waiting to infect the next batch of bulbs put into that crate. A pressure washing line with hot water and an effective oxidizing agent will do wonders for your overall crop quality. While important for pots and cut flowers in crates, it is absolutely essential for hydroponic forcing. For large growers, an investment in crate washing and sanitizing will quickly pay off. Similarly, rooting room walls and equipment and work surfaces (handling equipment, belts and any surface bulbs might contact) should be sanitized each season.

Many growers have installed ozone generating equipment and the reviews to date are excellent. As a strong, gaseous oxidizing agent, ozone can contact any surface in an enclosed room and can be used for preseason treatment of coolers and storage rooms and for bulbs before planting. Numerous installations in bulb grower and exporter facilities in Holland and in forcing operations in Canada and the US point to the usefulness and efficacy of ozone in the bulb industry.

Reminder on Trichoderma

There is not of new information on Trichoderma in tulips. A couple of points bear repeating, however. People often ask about certain biological soil treatments that contain strains of Trichoderma (example: Root Shield). These are not the same organism, and Root Shield products are perfectly safe to consider in a tulip rootzone management program. This link (http://www.flowerbulbs.cornell.edu/newsletter/Trichoderma_May_2004.pdf) will take you to our fact sheet on tulip Trichoderma, and review the suggested steps to avoid this problem. It also summarizes cooler management, soil moisture and other factors related to limiting excessive tulip root growth.