

Potted flower bulbs po

Research organised on flower bulbs at the Cornell University specialises in developing techniques suited to the US market. Selected highlights from the past six years show a strong trend favouring pot plants.

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A highly specialized set of floricultural crops, flower bulbs, requires the production of the bulb as well as the forcing of that bulb into a flowering product. Flower bulb forcing requires specialized knowledge and equipment. Similarly, the research uses specialized equipment and techniques that are different from typical floriculture research. For this reason, the Dutch flower bulb export industry, through the Royal Dutch Wholesalers Association for Flower Bulbs and Nursery Stock (KBGGB) has been active in supporting a US-based research programme since the mid 1960's. Dr. Gus De Hertogh led the programme for approximately 30 years. Upon his retirement in the mid 1990's, the Flower

Bulb Research Programme was established at Cornell University in July 1998.

The major purpose of the programme is to conduct research aimed at developing a better understanding of the physiology, growth, development, and horticultural use of flower bulbs, bulb flowers, and perennial plants. The main goal is to provide information to the export industry and forcing sectors to promote greater use and appreciation of flower bulbs by consumers at all levels. We work in three major areas:

- Greenhouse horticulture (forcing).
- Post harvest physiology and handling of bulbs and bulb flowers.
- Use and/or adaptation of flower bulbs in the landscape.

PGR for potted tulips Our forcing work revolves around developing best techniques and procedures for forcing in North America. For example, we test a selected number of newer tulip cultivars for optimum cold requirement and for determining the correct rate of plant growth retardant (PGR) for use on pots. Since much of the North American tulip market is in pot plants, our work with growth regulators (Bonzi, Piccolo, Sumagic, and TopFlor) is critical for this market. Typically, tulips are drenched (application of the PGR to the soil; typically 120 ml for a 15-cm diameter pot) when within a few days of removal from the cooler. The PGR is then absorbed by the roots and inhibits stem elongation



All Seasons tulip in 15 cm pots treated with 120 ml of drench containing (left to right): 0, 1, or 2 mg/pot of Bonzi (paclobutrazole). Plants forced starting 1 April.



Effect of pre-plant growth regulator bulb dips on size 16/18 cm Helvetia Oriental hybrid lily. Treatments are (left to right): Control, Bonzi at 50, 100, 200, or 300 ppm, and Sumagic at 2.5, 5, 7.5 or 10 ppm given as a 10 minute dip.

Popular in North America



Flower bulb research underway at Cornell University. Countries with significant area devoted to bulb production include the Netherlands, the United States, Israel, England, New Zealand, Brazil, Chile, France and South Africa.

thereafter. If the PGR is applied too late, then too much growth has already occurred, and the desired effect is lost. The optimum rate varies by cultivar, length of cold (more PGR is needed for longer-cooled tulips), and market demands. At the moment, paclobutrazole (Bonzi or Piccolo) is the major PGR on tulips.

Height control in lilies

We also do extensive trials each year on PGRs on lilies. Again, many lilies are grown as pots in North America, and our growers are interested in adapting cut cultivars down to the right size for a 15-cm pot. For the US market, a lily plant should typically be 40-42 cm when grown in a 15 cm diameter pot, giving a total height of

Cornell University

Cornell is a major research university in central New York, about four hours drive from New York City. The university has about 12,000 undergraduate (B.Sc.) students and 6,000 graduate (M.Sc. and Ph.D. students) with a total operating budget of more than \$US 2.1 billion. Cornell has major programmes in agriculture and plant sciences, engineering and computer science, nanobiotechnology, genomics and the humanities. It is part of the renowned "Ivy League" of leading universities, but is the only member of the "Ancient Eight" that has agricultural research efforts.

Forcing research

Flower bulb research requires specialized equipment and techniques. At Cornell, we are well prepared for this, and have three walk-in coolers (ca. 25 m² each) that are capable of maintaining any required condition, from ven-



Temperature-controlled cooling and ventilation facilities at Cornell.

tilation at warm temperatures to below freezing for long-term lily or perennial storage. We have approximately 600m² of greenhouse space in four compartments, with more available if needed. Additionally, there are many smaller incubators, chambers and facilities for maintaining and monitoring the development of the bulbs during storage. Our post harvest evaluation room is ca. 90m² and we have fully equipped laboratories to conduct almost any kind of analysis imaginable.

plant plus pot of about 55 cm.

One of the keys to producing lilies in pots is to realize the dramatically different

growth patterns the various groups show. For example, oriental hybrids (Star Gazer, Mona Lisa, Helvetia, etc.) grow in height only in the first half to 2/3 of their growth cycle. The last third to half of the crop cycle, the plants are developing their buds and do not appreciably increase in height. Thus, early height control techniques, including pre-plant bulb dipping are crucial to adapt these crops to pot plant culture. In the US, Star Gazer and Mona Lisa are the main orientals grown in pots. Excellent results with pre-plant bulb dips can also be obtained on LA-hybrid lilies.

Upper leaf necrosis

A recent Ph.D. student, Alex Chang, (now an assistant professor at the National Taiwan University) worked out the causes and control measures for upper leaf "scorch" that is common on many oriental hybrid lily cultivars. Any lily grower



Effect of pre-plant bulb dips on size 14/16 Fangio LA-hybrid lily. Treatments are (left to right): Control, Bonzi (paclobutrazole) at 50, 100, 200, or 300 ppm, Sumagic (uniconazole) at 2.5, 5, 7.5 or 10 ppm, and TopFlor (flurprimidol) at 10 or 50 ppm, given as a 1 minute dip.



Star Gazer oriental hybrid lily showing typical symptoms of Upper Leaf Necrosis (ULN). The actual cause of the problem, calcium deficiency in the young leaves, occurs much earlier than these symptoms appear.



View of first-year flowering of bulbous plant perennializing trials at Cornell. Similar trials were conducted on Long Island (NY) and Clemson, SC.

worldwide has undoubtedly seen this problem, which is a deficiency of calcium in the very young, expanding leaves. The actual problem starts when the plants are only 20-25 cm tall, and is related to bulb size, temperature and the fact that oriental hybrid lily bulbs have very low levels of

calcium stored in their tissues when harvested in the field. We found that air blowing directly on the top of the plant from about 25-50 days after planting can almost entirely eliminate the problem, even on larger-size Star Gazer and Acapulco bulbs.

Post harvest handling

In the area of post harvest handling, our group in collaboration with Dr. Anil Ranwala, now at Floralife Co., have developed techniques to reduce leaf yellowing and browning as a result of cold-storage of potted hybrid lilies. Many lilies in North America are forced for a specific holiday. If the crop comes in too early, growers must store them at 4-5°C for up to two weeks to hold them at the proper developmental stage for sale. Our work resulted in a commercial product, Fascination, which can be applied as a spray to lilies, where it keeps leaves green and also increases flower life by about 25%. For this use, the main active ingredient is gibberellin 4+7. Industry personnel estimate that 80 to 90% of the pot lilies in North America are now treated with Fascination. The beneficial effects of

GA4+7 are also seen in cut lilies.

Landscape use

Finally, we have just finished a 4-year trial on perennializing bulbs in three climate zones in the US: Ithaca, NY (zone 5, northern cold), Long Island (zone 6, northern mild), and Clemson, SC (zone 7, southern hot). These studies were done with 200 cultivars of tulips, narcissus, hyacinth and special bulbs. Results have been publicized through the International Flowerbulb Center, and on our website. New studies on bulb perennializing in combination with perennial plants will begin soon. ■

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Effects of post harvest pulsing treatments on post harvest quality of oriental hybrid lily Sissi. Left to right: control (no chemicals), 25 ppm GA₄₊₇, 25 ppm benzyladenine (BA), and 25 ppm each GA₄₊₇ + BA (Fascination). For all the chemicals, pulsing was done at 20°C for 18 hours. After treatment, stems were held on water for 2 weeks at 2-3°C, then moved to a 20°C vase test room. Photograph taken after 10 days in the post harvest evaluation room.