

# RESEARCH NEWSLETTER



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

Some examples:

In one experiment planting stock from 4 cultivars was treated with 15 ppm ethylene for 2 months continuously. Half of the bulbs were treated with FreshStart every 12 days. The bulbs were planted in November and lifted next summer. As a consequence of the ethylene treatment the yield of saleable sizes was reduced by 80 to 90% (!). In the bulbs that were treated with FreshStart the yield of saleable sizes was as high as in the clean air control, while they had been subjected to the same ethylene concentrations. This shows that FreshStart protects planting stock from ethylene-induced splitting for 100%.



Effects of ethylene on rooting. Left: ethylene plus FreshStart.

In the coming storage and shipping season FreshStart will be tested on a practical scale at a limited group of growers, forcers and exporters.

Table. The effects of ethylene and ethylene plus FreshStart during storage on flower quality after forcing (Christmas Marvel).

Bulbs stored in	Weight per flower	Length per flower	Number of additional	% Flower abortion
Air	21	24	4.9	1
Ethylene	15	17	5.3	39
Ethylene + FreshStart	21	25	3.6	1



Ethylene-induced gummosis can be prevented with FreshStart.

## 4<sup>th</sup> Year Narcissus Ratings in Ithaca, Long Island, and Clemson

by Bill Miller, Cornell University

One of the long-term objectives of the Cornell University Flowerbulb Research Program sponsored by Group 1 is to evaluate and recommend bulb cultivars with exceptional performance in various areas of North America. This is a huge task, as there are nearly 3,000 tulip cultivars available, more than 20,000 daffodil, and hundreds of hyacinth and special bulb cultivars and species. Added to this is the issue of widely varying climatic zones in North America, ranging from the warm, humid areas of the southeastern United States, to the cool and wet pacific northwest, to the cold winters and warm, humid summers in many northern states. In all of these areas, a wide range of microclimates (temperature, rainfall, snow cover, summer heat and humidity, sunlight, fog, soil condition, and horticultural management) may be expected to be encountered.

To approach this problem, in the fall of 1999 we initiated a 4-year experiment on perennialization potential of a wide range of bulbous plants. In this report, the results on narcissus perennialization are presented. The information presented here should be extremely valuable to exporters and importers of flowerbulbs, and their landscaper, retailer, and homeowner customers.

### Procedure

Overall, the trials consisted of 60 cultivars of narcissus, 17 cultivars of hyacinth, 69 cultivars of tulip, 11 species tulips, and 43 kinds of special bulbs. The experiment was located in Ithaca, NY (central New York, zone 5, cool summers), on Long Island (ocean climate, zone 6-7, moderate summers), and in Clemson, SC (zone 7, hot, humid summers).

Plots were planted in full sun (2 plots per location) or shade (2 plots per location) in the late fall of 1999. For narcissus, we used 20 bulbs per plot, and bulbs were planted in holes ca. 4" deep. All plots were mulched (3-4" deep, on average) the first fall with a local wood/bark mulch, which obviously varied between the three locations. The plots were maintained relatively free of weeds (Roundup the first summer after all foliage had died back), and some hand weeding and hoeing thereafter. Plots were fertilized with recommended rates of Bulb Booster fertilizer in the first year, but were not fertilized thereafter. The plots were not irrigated, and relied on natural rainfall only. Half of the plots were in full sun; the other half were under ca. 50% shade cloth (saran) to simulate overhead tree shade. Typically, the shade was put over the plants in mid-May, and removed in mid-October (in the northern sites, and about a month earlier and later in the south). Therefore, it is important to realize that narcissus flowering was mostly finished by the time shade was placed over the plants.

We collected yearly data on the dates of emergence, start and end of flowering, and time of leaf wilting. Data were also taken on number of flowers or stems, and height. A key point is that in Clemson, all side bulbs were inadvertently removed prior to planting. Data were collected by plot, then the 2 sun or shade plots were averaged for each location.

The ultimate criteria for evaluation were quite simple: to be considered "successful", a cultivar should have 50% of more of its bulbs flowering after 4 years. Thus, for a cultivar to be judged successful, it must have at least 10 flowers (from 20 bulbs) in all three locations.

In another experiment, with saleable size bulbs, the protection from ethylene-induced flower abortion was studied. Saleable sizes of different cultivars were treated for 2 months with 30 ppm ethylene, 24 h every 3 days. Half of the bulbs were treated with FreshStart every 12 days. Ethylene had enormous harmful effects on the bulbs as appeared during forcing. All these harmful effects could be prevented by the use of FreshStart (see table and photos).

After FreshStart treatment the bulbs are fully protected from ethylene for 12 days. After these 12 days the ethylene sensitivity slowly returns to its original level. After 15 days the bulbs are still protected for 80% and after 3 weeks for 50 to 60%. This means that during a 3 week shipment (with FreshStart treatment on day 0) the risk of ethylene damage is very small compared with untreated bulbs.



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Table 1. An alphabetical listing of all narcissus cultivars, with the number of flowers per 20 bulbs in the 4<sup>th</sup> flowering season, per location in the sun plots.

Cultivar	Number of flowers per 20 bulbs		
	Ithaca	Long Island	Clemson
Accent	126	41	28
Actaea	67	31	0
Baby Moon	48	25	159
Barret Browning	47	29	43
Bridal Crown	79	25	40
Bulbocodium	0	3	14
Carlton	169	83	36
Cassata	64	36	20
Chanterelle	155	66	39
Cheerfulness	61	54	29
Dickcissel	84	47	25
Dutch Master	67	26	20
Exception	41	26	49
February Gold	91	59	38
February Silver	52	32	4
Flower Record	62	18	0
Flowerdrift	1	2	0
Foresight	73	34	18
Fortissimo	48	24	3
Fragrant Breeze	104	95	33
Geranium	105	62	48
Gigantic Star	79	49	40
Golden Ducat	71	36	0
Golden Harvest	25	29	3
Hawera	69	28	28
Hillstar	42	51	43
Holland Sensation	72	46	6
Ice Follies	123	53	45
Ice King	173	96	50
Jack Snipe	183	16	10
Jenny	143	94	82
Jetfire	140	94	0
Las Vegas	17	43	0
Manly	75	70	53
Minnow	6	10	35
Mount Hood	68	30	20
Obvallaris	54	44	33
Olorus plenus	43	55	26
Orangery	70	48	33
Peeping Tom	124	57	0
Pink Charm	138	42	29
Pipit	71	47	73
Primeur	65	21	16
Quail	121	45	96
Quince	32	32	13
Recurvus	124	46	22
Rip v. Winkle	89	35	15
Salomé	60	22	28

Serola	96	61	9
Slim Whitman	151	80	75
Sorbet	121	93	50
Spellbinder	41	40	4
Standard Value	70	35	9
Sundisc	109	67	14
Suzy	39	23	38
Sweetness	111	66	38
Tahiti	47	38	26
Tête à Tête	183	91	15
White Lion	76	57	46
White Plume	91	39	46



'Sweetness' from 2003 (4rd year of flowering) in Ithaca. Compare with nearby photo of year 3 flowering.

### Results

Note that for all the dates given here, they could be accelerated or delayed by as much as a week at each location, depending on weather that year.

### Date of emergence

Emergence dates ranged from mid-January to Mid-March in Clemson, 27 February to 10 April in Ithaca, from 1 March to 20 March in Long Island. These dates reflect the colder northern climates versus Clemson, but also differences in the Ithaca and Long Island climates. There was little, if any, notable effect of shading on emergence date.



Narcissus 'Mt. Hood', 4th year flowering from 20 bulbs, in Long Island. This cultivar was in the lower third of rankings of all cultivars (sun plots).



Narcissus 'Suzy', while very showy, suffers from frost/freeze injury on the leaf tips (Ithaca planting).

### Preventing ethylene problems in tulip bulbs with FreshStart

By Henk Gude and Marga Dijkema Applied Plant Research (PPO) (henk.gude@wur.nl)

Recently the ethylene inhibitor FreshStart, also known as Ethylbloc, EB-01, SmartFresh and 1-MCP has been approved for the use in tulip bulbs. At Applied Plant Research (PPO) the efficacy of the gas has been studied during the past 5 years. In the first experiment, in small glass jars, it was possible to prevent gummosis in tulip bulbs by pretreating the bulbs with FreshStart for 24 h and subsequently exposing the bulbs to high concentrations of ethylene. From that moment on it was clear that FreshStart is an extremely powerful ethylene inhibitor for tulips. In the following experiments the optimal concentration, exposure time and duration of the protection from ethylene were determined.

From these experiments it could be concluded that all negative effects of ethylene on tulip bulbs could be prevented by treating the bulbs with 0.2 ppm FreshStart during 12 to 24 h. For a



Christmas Marvel during forcing. Left: bulbs treated with ethylene. Right: bulbs treated with same amounts of ethylene, but treated with FreshStart every 12 days.

prolonged protection from ethylene the FreshStart treatment can be repeated every 12 days. Even high concentrations of ethylene cannot have harmful effects anymore. In the following years the chemical was tested in gastight climate chambers and eventually in storage rooms at a practical scale. These large scale experiments showed that FreshStart also protects from ethylene under practical conditions.



Table 3. Narcissus with more than 50% of bulbs flowering in the 4th year in all 3 sites for the shade plots. Numbers given are the number of flowers in the 4<sup>th</sup> season from 20 planted bulbs.

Cultivar	Number of flowers (shade plots)		
	Ithaca	Long Island	Clemson
Accent	82	37	28
Barret Browning	59	30	21
Bridal Crown	81	54	31
Carlton	145	55	24
Cassata	34	26	18
Cheerfulness	59	29	34
Dickcissel	60	46	61
Dutch Master	58	27	13
February Gold	89	50	41
Foresight	39	53	36
Fragrant Breeze	89	45	26
Geranium	102	69	40
Gigantic Star	79	25	23
Golden Ducat	66	24	24
Hillstar	12	24	25
Holland Sensation	71	18	32
Ice Follies	100	11	27
Ice King	107	15	48
Jenny	149	55	35
Jetfire	130	47	35
Manly	69	42	60
Minnow	10	26	32
Mount Hood	63	27	14
Obvallaris	58	23	10
Odorus plenus	42	20	40
Orangery	76	34	18
Peeping Tom	124	73	10
Pink Charm	93	50	22
Primeur	35	122	18
Quail	87	122	48
Rip v. Winkle	48	14	12
Salomé	75	16	21
Spellbinder	70	122	13
Standard Value	39	23	15
Sundisc	37	16	96
Sweetness	79	30	61
Tahiti	45	24	22
Tête à Tête	155	44	17
White Lion	97	20	37
White Plume	88	33	19

**Acknowledgments**

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University, Riverhead, Long Island) and Dr. Jim Faust and Kelly Lewis from Clemson University in Clemson SC. Dirk Warmerdam (our first Dutch intern) was involved in planting bulbs in each location in the fall of 1999, and later interns Jeffrey Wage-maker, Pieter Heemskerck and Rob de Groot also contributed to the project. Cornell undergraduate student Amy Bestic was deeply involved in the summarization of the data in the later phases of the project. Of course, we also thank Group 1 exporters of the Royal Dutch Wholesalers Association for Flowerbulbs and Nursery Stock (KBGBB) for their financial support and bulb donations.



Narcissus 'Jack Snipe', 4th year flowering in Ithaca, shade plot, with an excellent display.



'Sweetness' from 2002 (3rd year of flowering) in Ithaca. Compare with nearby photo of year 4 flowering.

**Date flowering starts**

Daffodils obviously flowered earlier in Clemson, beginning the last week of February, with the latest cultivars flowering beginning April 10-17. In Ithaca, cultivars came into flower from 10 April through 17 May, and on Long Island from 20 March until 7 May. There was no consistent or important effect of the shade in the date cultivars began flowering.

**Date flowering ends**

Depending on the cultivar, flowering ended from 14 March to 20 April in Clemson, 22 April to 7 June in Ithaca, and 16 April to 23 May on Long Island, again with no consistent effect of shade. Some cultivars varied by a few days in the shade or sun, but the results were variable and not consistent.

**Height**

In the north, plant height ranged from the tallest, 'Manly' topping out at 47-52 cm, to the small 'Tete-a-Tete' and 'Quince' at 15 cm.

At Clemson, 'Cheerfulness' towered at more than 60 cm, while *N. bulbocodium* was shortest at 14 cm. Plants tended to be taller at the Clemson site. There was no consistent effect of shade, which makes sense as the shade was applied after most of the plants had flowered (and leaves had grown).

**Day of leaf withering**

In Clemson, leaves withered from about mid-May to the first week of June. In the northern sites, dates of leaf withering ranged from 25 May to 25 July in Ithaca, and from 6 June to mid-August on Long Island. In this case, the shade tended to delay leaf senescence, that is, it occurred later, typically by 3-10 days, depending on the cultivar. In approximately half of the cultivars, however, shade did not change the leaf withering date.



Narcissus 'Ice King' from 2004 flowering in Ithaca. This was the third-highest rated cultivar in Ithaca, based on number of flowers.

**Number of flowers: The Good, the Bad, and the Ugly**

This was the major criterion for evaluation. Table 1 lists alphabetically the 60 cultivars in the study, and the number of flowers for each cultivar in the sun plots. It is easy to see that the number of flowers varied per location. Some, such as Actaea, Golden Ducat, Golden Harvest, Holland Sensation, Jetfire, Standard Value, Tete-a-Tete, Serola, Sundisc, and



Spellbinder did much better in the northern locations than in the south. Whether this is an accurate conclusion can only be confirmed with an additional study.

Table 2. Narcissus with more than 50% of bulbs flowering in the 4th year in all 3 sites for the sun plots. Numbers given are the number of flowers in the 4th season from 20 planted bulbs.

Cultivar	Number of flowers (sun plots)		
	Ithaca	Long Island	Clemson
Accent	126	41	28
Baby Moon	48	25	159
Barret Browning	47	29	43
Bridal Crown	79	25	40
Carlton	169	83	36
Cassata	64	36	20
Chanterelle	155	66	39
Cheerfulness	61	54	29
Dickcissel	84	47	25
Dutch Master	67	26	20
Exception	41	26	49
February Gold	91	59	38
Foresight	73	34	18
Fragrant Breeze	104	95	33
Geranium	105	62	48
Gigantic Star	79	49	40
Hawera	69	28	28
Hillstar	42	51	43
Ice Follies	123	53	45
Ice King	173	96	50
Jack Snipe	183	16	10
Jenny	143	94	82
Manly	75	70	53
Mount Hood	68	30	20
Obvallaris	54	44	33
Odorus plenus	43	55	26
Orangery	70	48	33
Pink Charm	138	42	29
Pipit	71	47	73
Primeur	65	21	16
Quail	121	45	96
Quince	32	32	13
Recurvus	124	46	22
Rip v. Winkle	89	35	15
Salomé	60	22	28
Slim Whitman	151	80	75
Sorbet	121	93	50
Sundisc	109	67	14
Suzy	39	23	38
Sweetness	111	66	38
Tahiti	47	38	26
Tête à Tête	183	91	15

White Lion	76	57	46
White Plume	91	39	46

In the pictures nearby, one can see the stunning performance that can result from 20 bulbs. Most of the pictures are from Ithaca, and are from the 4th year of flowering (spring 2003). One comparison showing ‘Sweetness’ from 2003 and 2003 is also shown for comparison.

Less important than the exact number of flowers per plot, is the ability a cultivar has to perform well in a variety of locations. Therefore, from the data, we developed lists of cultivars meeting the minimum flowering display (at least 1 flower from half the bulbs planted) in all three locations. These cultivars are given in Table 2 for the full sun plots, and Table 3 for the shade plots.

As pointed out above, the side bulbs were inadvertently removed from the mother bulbs before planting in Clemson, and this obviously reduced the total number of flowers produced per plot in Clemson. Therefore, this might have eliminated a couple of cultivars that were just under the cut in Clemson (e.g., Serola, Standard Value, Holland Sensation).



Narcissus ‘Chanterelle’ from 2004 flowering in Ithaca, 5th highest flowering cultivar.

Along with the good, we also must look at the “bad and the ugly”. For example, ‘Flowerdrift’ hardly lived up to its name, and averaged 2 flowers or less per plot of 20 bulbs, and was poor in each location. Similarly, ‘Minnow’ and *N. bulbocodium* were both poor, but seemed to perform a little better in the southern location than in the north. In these examples, many bulbs did not survive, as seen by a low number of surviving clumps (data not shown). Whether this was due to weak or diseased bulbs at the time of planting, is not known, but seems possible. Some plants had other problems, for example ‘Suzy’ (see photo), while very floriferous, suffered from cold injury to the leaf tips (because of its characteristic late-winter leaf emergence). The flowers, while attractive, are marred by the surrounding mass of brown-tipped foliage. Thus, this cultivar is not a good one for northern climates.

Listed below are cultivars not making the cut for individual locations. Each of these cultivars had less than 10 flowers from 20 bulbs after 4 years:

**Ithaca:** Minnow, Flowerdrift, Bulbocodium

**Long Island:** Bulbocodium, Flowerdrift

**Clemson:** Holland Sensation, Standard Value, Serola, February Silver, Fortissimo, Golden Harvest, Spellbinder, Actaea, Flower Record, Flowerdrift, Golden Ducat, Jetfire, Las Vegas, Peeping Tom

### Conclusions

In all, 44 (73% of those tested) cultivars met the minimum criteria in the full sun plots, and 40 (67%) in the shade plots. Some of the cultivars were truly outstanding in all three sites, and some were good in two sites, and less exceptional in the third. The utility of thinking about meeting a performance standard in all locations allows bulb suppliers and customers to select bulbs from a list of cultivars performing well in a diversity of locations.

This list could also be used to develop marketing programs for specific locations, for example specifically for Long Island and similar zone 6 climates (using the Long Island data), or for cold zone 5 climates of the northeast and upper midwest (using the Cornell, Ithaca data), or for many regions in the south east (zone 7, using the Clemson data).



Narcissus ‘Fragrant Breeze’, 4th year flowering from 20 bulbs in Ithaca. This was the 19th ranked cultivar in Ithaca, but still with a fantastic display.

It is obvious that the number of cultivars not performing well increased as one moves south (from 2 or 3 in Ithaca and Long Island to 14 in Clemson). However, there are plenty of excellent daffodils to go around, even for southern sites with climates similar to Clemson. The fact remains that Narcissus is one of the very best spring bulbs for perennializing, and have shown over the years to be generally resistant to deer.

The exceptional cultivars identified here should be promoted by the industry and incorporated into more gardens and commercial landscapes where they will provide years of bright spring color and enjoyment. More information on other species and cultivars in this trial will be presented in a future Research Newsletter.