

SUMMARY OF THE FINAL EVALUATION

Combination Planting Trials 2004-2007

Flower Bulbs and Perennials



**International
Flower Bulb
Centre**

Hillegom, December 2007

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Foreword

Enclosed are the results of the combination trials conducted from 2004 to 2007. These trials involved planting combinations of perennials and flower bulbs in the Netherlands (Boskoop and Wolfheze), Germany (Höxter), Sweden (Enköping) and Italy (Brera). This report provides the results for the flowering seasons during the years of the trials and gives a final evaluation regarding the varieties used, climate, habitat, etc.

These three-year trials were initiated by the International Flower Bulb Centre and were a follow-up to a research project into the applicational value of flower bulbs in regard to their perennial flowering capacity that was conducted at five sites in Europe and three sites in the US. These trials tested flower bulbs alone. The flowers bulbs that performed best in these trials were then used in the project reported on here in which they were planted along with 200 varieties of perennials. This, therefore, involved a practical approach to planting that was quite similar to how large-scale users and consumers use flower bulbs in their parks and gardens

Applied Plant Research (PPO) in Lisse and Boskoop was closely involved in assisting with the trials and following the results.

- How can colourful flower bulbs brighten up certain locations in parks and gardens during the early spring?
- Which flower bulbs and perennials make the best combinations for plantings in the various climate/temperature zones?
- How do these groups strengthen each other's positive aspects and how do they compete with each other?

The varieties that finished the trials with flying colours can rightfully be called **perennials**. Our term for this is 'perennial flowering'. What we mean by this is that once these spring-flowering bulbs are planted and flower, they can be left undisturbed in the ground, where their foliage will senesce and the bulb will prepare for flowering during the next growing season!

These spring-flowering bulbs thus follow the same cycle as perennials. The varieties used in this way can be included in an existing perennial planting such as a border made up of herbaceous perennials, shrubs or roses.

We hope the results you see here will inspire you to combine flower bulbs and perennials!

Frans M. Roozen
International Flower Bulb Centre

1. Description of the trial

1.1 Objective

The objective of the trials was to obtain more information about ways to combine flower bulbs with perennials in which the growth and flowering of these plants would display aesthetic results when their growth and flowering occurred together or in succession. How they performed in the three different climate/temperature zones was yet another facet of the trials.

1.2 Planting sites

The planting sites satisfied the following criteria:

- a perennial border established for at least 3 growing seasons
- a minimum surface of 200 m²
- composed of both sunny and shaded habitats for testing purposes
- existing plants included could vary according to climate/temperature zone
- maintenance provided had to be similar to standard garden/border care
- had to be available for the three-year trial period

The following planting sites were chosen:

	Planting period
• The Netherlands: Sortimentstuin Harry van der Laar, Boskoop (maritime climate / temperate)	October 2003
• The Netherlands: De Boschhoeve, Wolfheze (continental climate / temperate)	November 2003
• Sweden: Enköping (continental climate / cold-temperate)	September 2003
• Germany: Hörter (continental climate / temperate)	September 2003
• England: Eltham Palace (continental climate / temperate)*	October 2003
• Italy: Brera (Mediterranean climate / warm)	November 2004

*The site in England was eliminated from the trials after the first season when it was discovered that the site could not satisfy the dimensions criterion.

1.3 Choice of flower bulbs

The choice of flower bulbs was determined for each climate/temperature zone as based on the findings from the previous tests for perennial flowering capacity conducted from 1996 to 2001.

The quantities planted were as follows:

Tulips	100 bulbs
Hyacinths	50 bulbs
Daffodils	100 bulbs
Special bulbs (small)	250 bulbs/corms/tubers
Special bulbs (large)	50 bulbs/corms/tubers

The possibility of replanting the bulbs during the second autumn if extreme conditions had occurred during the first flowering season was considered but discarded.

1.4 Choice of perennials

Jacqueline van der Kloet drew up a proposal of perennials and their suitability for planting in sunny and shaded habitats. This list was used by the researchers in making combinations in their own existing plantings. The combinations were supplemented with perennials that were already thriving in their local situations.

1.5 Planting instructions

- The pattern for planting was similar to that created by scattering bulbs onto an open surface. The result was that some bulbs landed alone and some in groups among the perennial plants.
- The distances between bulbs and perennials had to appear natural. As long as a trowel could be pushed into the soil, the distance apart was not considered too close.
- If the soil was dry at the time of planting, water was provided immediately afterward to ensure good rooting before winter.
- The bulbs were planted at the following depths: at least 15 cm for tulips/daffodils/hyacinths and 10 cm for special bulbs

1.6 Measurements

Measurements were taken at each location. The project group determined what had to be measured and then which method would be used for measuring and recording the results.

The following were measured:

- The number of shoots
- The number of flowers
- The size of the flowers (diameter in cm)
- Height of the plant
- Number of flowers per stem
- How the leaves of the bulbous plant senesced in comparison with the development of the surrounding perennials (done by keeping track of the dates using a flowering calendar)
- Whether diseases were transmitted from bulbs to perennials or vice versa
- Added value provided by bulbous plants during senescence (fading of leaf colour, production of seedpods)
- The dates between which the specific combination was attractive

Registration forms

The sites were provided with a number of forms to record the results of the trials. They were also given a digital camera to record images of the results.

Forms to be completed:

- List of combinations (to be completed once before the trials began)
- Flowering calendar (containing information about emergence, flowering and senescence)
- Measurements taken (how many bulbs produced shoots, how many flowers were produced, size of flowers, etc.)
- Best/poorest combinations (this assignment was added during the second year)

2. Trial sites

The researchers at each trial site worked with the site's own existing perennial planting in various conditions (soil, climate and amount of sun/shade). This section sets forth the combinations and the conditions.

2.1 Soil types and pH

The Netherlands:	Boskoop	peat soil with a pH of 5.0
The Netherlands:	Wolfheze	sandy soil with a pH of 5.3-5.5
Sweden:	Enköping	sandy/loamy soil with a pH of 7.0
Germany:	Höxter	light sandy soil with a pH of 6.2
Italy:	Brera	soil rich in humus with a pH of 7.0

2.2 Climate

The Netherlands:	Boskoop	marine climate - temperate
The Netherlands:	Wolfheze	continental climate - temperate
Sweden:	Enköping	continental climate - cold/temperate
Germany:	Höxter	continental climate - temperate
Italy:	Brera	Mediterranean climate - warm

2.3 Combinations

Combinations were created as based on the existing planting. They were also considered ahead of time to be promising in a number of different ways:

- Ornamental value
- Succession of growth and flowering
- Competition between flower bulbs and perennials

The Netherlands – Boskoop

The Sortimentstuin Harry van der Laar in Boskoop had drawn up its own list of combinations based on its large, existing groups of perennials in the experimental garden in Boskoop. Due to renovations made to the garden, some combinations were partially or totally eliminated during the second year of the trial. These were not included in the evaluation.

The Netherlands – Wolfheze

De Boschhoeve had drawn up its own list of combinations based on its existing borders. The quantities of flower bulbs planted in combination with perennials varied greatly due to the space available.

Germany – Höxter

Höxter had sometimes used the flower bulbs of one cultivar to make two or more combinations. This made the number of its combinations greater than those at other sites.

Sweden – Enköping

In Enköping, the flower bulbs were planted in various borders in public gardens and parks in the city. This provided a realistic picture of flower bulbs used in public plantings.

Italy – Brera

The flower bulbs in the Gardens of Brera were planted in various borders that had much more shade in comparison with the other sites.

3. Final results for the perennial flowering of tulips

A number of graphs were used to evaluate the capacity of tulips for perennial flowering. The tulips used for each site were chosen as based on a previous set of trials conducted in various climate/temperature zones. The successful tulips from that series were then used in these trials in combination with perennials in a mature border.

3.1 Criteria

The criteria for evaluating the results during the third flowering season were as follows:

<20% flowering during the third year: unsatisfactory/poor (red in the graph)

>20% flowering during the third year: satisfactory (orange in the graph)

>50% flowering during the third year: very good (green in the graph)

If the bulbs produced more than a 100% flowering over the years, this meant that they had produced more bulbs than had been planted during the first year.

3.2 The Netherlands - Boskoop

In Boskoop, 24 tulip varieties chosen from the various groups of tulips were planted that first year. By the third growing season, 9 of these had failed to emerge. Another 14 received a poor score (<20% flowering). Only 'White Triumphator' received a score of "good". Boskoop has a peat soil with a pH of 5. This acidic soil is also very moist (and thus cool) during the summer. Previous experience had shown that these conditions are not a problem for the first flowering season but that perennial flowering cannot be expected under these conditions. No difference was noted between plantings in sun and shade.

3.3 The Netherlands - Wolfheze

In Wolfheze, 25 tulip varieties chosen from the various groups of tulips were planted that first year. By the third growing season, 2 of these had failed to emerge. Only 1 cultivar received a poor score (<20% flowering) and 3 cultivars were evaluated as "good". All of the other 17 cultivars received an evaluation of "very good"; at least 50% of them were flowering in the third year. Many of these were even flowering at a rate exceeding 100% since they had produced more bulbs. Warm dry sandy soil gave these tulips the perfect summer conditions for perennial flowering.



Tulipa 'Negrita'



Tulipa tarda



Tulipa 'Orange Emperor'



Tulipa 'Candela'

3.4 Germany – Hörter

In Hörter, 27 tulip varieties chosen from the various groups of tulips were planted that first year. By the third growing season, 11 of these had failed to emerge. Seven cultivars received a poor score (<20% flowering) and 6 cultivars were evaluated as "good". Only 3 cultivars received a "very good" score for flowering. Although the type of soil and climate at Wolfheze and Hörter are fairly similar, the results of the trials showed considerable differences. These were due mainly to the difference in soil quality. The borders in Wolfheze were maintained better and were better fertilised than the more natural borders in Germany.



Tulipa 'Toronto'



Tulipa 'Orange Emperor'



Various Tulipa varieties

3.5 Sweden – Enköping

In Sweden, 15 tulip varieties that had proven themselves during previous testing for perennial flowering under these cold conditions were planted. This time, these 15 cultivars were planted in borders with a perennial planting at least three years old. After three years, not one of these tulip cultivars had failed to emerge although three cultivars failed to receive a score of "good". Five cultivars scored >20% and <50% flowering during the third flowering season and could thus be considered good for perennial flowering. No fewer than 7 different plantings received the score of "very good" and would thus be suitable candidates for perennial flowering in a cold climate. The warm summers in Scandinavia encourage a continued growth process among the

small bulbs and a good development of Stage G beneath the soil. The cold winters have little if any adverse effects; in addition, the ground is usually somewhat insulated by a layer of snow.



Tulipa 'Golden Apeldoorn'



Tulipa 'Purissima'



Tulipa 'Toronto'



Tulipa 'Don Quichotte'

3.6 Italy – Brera

Previous trials conducted in southern Europe at locations having a climate similar to Italy had produced a lengthy list of tulips for perennial flowering. As long as the soil temperature during the winter drops below 9°C, these tulips thrive in the warm dry summers typical of this climate/temperature zone. Twenty-five cultivars were tested at 48 planting sites in combination with various perennials and under conditions of both sun and shade during the flowering period. Only a few cultivars at a single planting site failed to emerge in the third growing season. In most cases, these same cultivars performed well elsewhere in the third year. More than 50% of the tulips planted scored "good" to "very good".



Tulipa 'Showwinner'



Tulipa 'Purissima'



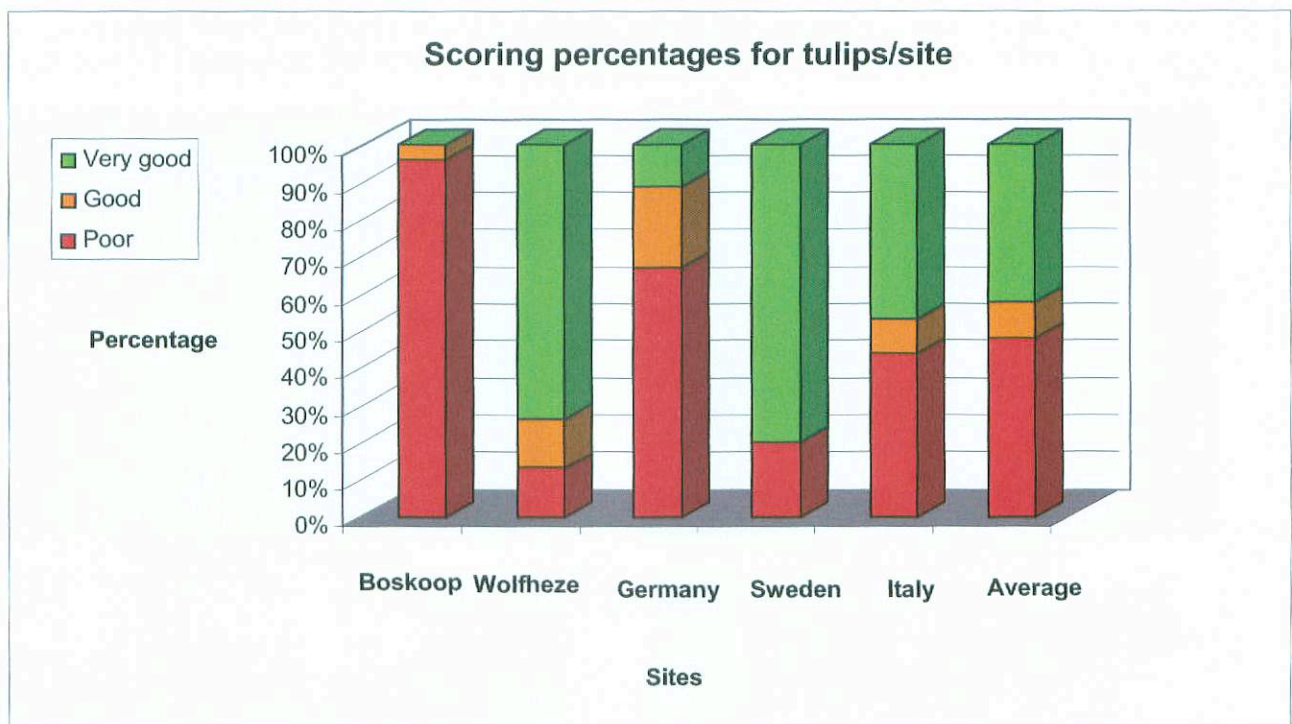
Tulipa 'Yokohama'



Tulipa turkestanica

3.7 Average score for tulips grown at all sites

The following graph presents the scores obtained at all the sites.



The flower bulbs selected for these trials had proven themselves suitable for perennial flowering in their respective climates during a previous long-term trial. This most recent trial involving planting bulbs in combination with perennials showed that factors other than just the perennials had a major impact on how tulips would score as perennially flowering bulbs.

- Moist peat soil with a low pH is not suitable for the perennial flowering of tulips. The first year yielded excellent results but these conditions failed to provide a sufficient basis for the growth of the bulbs in a second year.
- Tulips need to be properly maintained and fertilised in order to survive for longer than one year.
- A cold spring and a cold/wet summer will have an adverse effect on the growth of tulip bulbs.

4. Final results for the perennial flowering of daffodils

A number of graphs were used to evaluate the capacity of daffodils for perennial flowering. The daffodils used for each site were chosen on the basis of a previous set of trials conducted in various climate/temperature zones. The successful daffodils from that series were then used in these trials in combination with perennials in a mature border.

4.1 Criteria

The criteria for evaluating the results during the third flowering season were as follows:

>50% flowering during the third year: very good

If the bulbs produced more than a 100% flowering over the years, this meant that they had produced more bulbs than had been planted during the first year.

4.2 The Netherlands - Boskoop

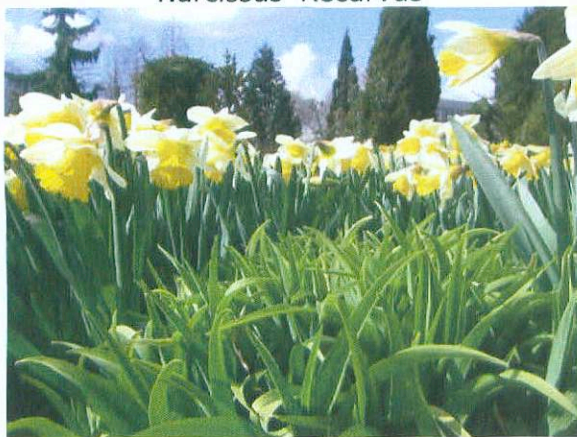
In 2003, 51 daffodil cultivars that had been selected from the various groups of daffodils were planted. By the third year, only one cultivar had failed to emerge. More than 40 cultivars received the score of "good" because more than 50% were still flowering. Only 9 cultivars received the score of "poor" according to this criterion. There was no observable difference between plantings in sun and shade. Cultivars such as 'Tête-à-Tête', 'Jetfire', 'White Plum' and 'Jack Snipe' scored "very good"; these could easily compete with the perennials in their borders.



Narcissus 'Recurvus'



Narcissus 'Ice Follies'



Narcissus 'Foresight'



Narcissus 'White Plume'

4.3 The Netherlands - Wolfheze

In 2003, 51 daffodil cultivars that had been selected from the various groups of daffodils were planted in combinations with perennials in the sandy soil of the border in Wolfheze. Of all the cultivars planted, only 5 combinations received a score of "poor". All the others were still producing flowers at a rate of more than 50% by the third year and could thus be given a score of "very good". The more open planting in Wolfheze gave the daffodils every opportunity to senesce properly and generate new bulbs.



Narcissus 'Jetfire'



Narcissus 'Fortissimo'



Narcissus 'Manly'



Narcissus 'February Gold'

4.4 Germany – Hörter

In Hörter, 47 combinations were made using a wide assortment of daffodils. By the spring of 2006 (the third flowering season), 10 combinations had failed to receive a score of "good" and fewer than 50% were still producing flowers. For daffodils, flower bulbs with a great capacity for perennial flowering, this was unsatisfactory. All the other daffodils used in the various combinations scored "very good", whether planted in sun or shade. Not one daffodil failed to emerge.

4.5 Sweden – Enköping

At the various parks in Enköping, experiments with daffodils combined with perennials were carried out at 83 different planting spots. Nine of these plantings had entirely disappeared by the third year, particularly the plantings that contained 'Actaea' and 'Dutch Master'. Seventeen combinations failed to receive the best score for >50% flowering in the third year. All the other combinations succeeded with flying colours! Both 'Flower Drift' and 'Primeur' scored well in various plantings.



Narcissus 'Flowerdrift'



Narcissus 'Gigantic Star'



Narcissus 'Fragrant Breeze'



Narcissus 'Jack Snipe'

4.6 Italy – Brera

During the autumn of 2007, 79 combinations were created using a wide assortment of daffodils and perennials in Italy. Ten of these plantings failed to emerge in the third season. The score of "poor" (<50% flowering by the third year) was given to 19 plantings. This meant that 50 plantings satisfied the criterion for >50% flowering in the third flowering season. The selection of daffodils that performed this well included many different cultivars.



Narcissus 'Bridal Crown'



Narcissus 'Standard Value'



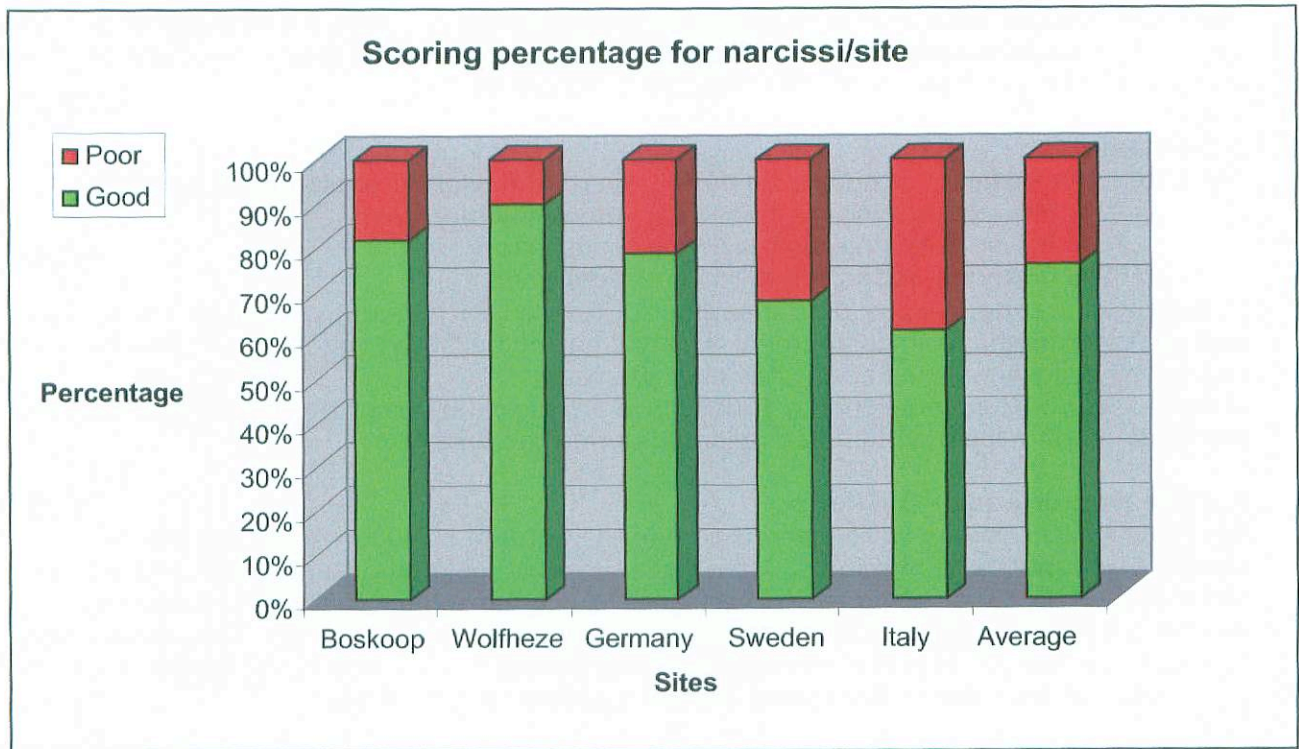
Narcissus 'Flower Drift'



Narcissus 'Primeur'

4.7 Average scores for daffodils grown at all sites

The following graph presents the scores obtained at all the sites.



The daffodils selected for these trials had proven themselves suitable for perennial flowering in their respective climates during a previous long-term trial. In this trial period, too, the daffodils exhibited excellent performances for perennial flowering at all locations and in various climate/temperature zones. Also shown in these recent trials was that daffodils, when combined with perennials, did not grow as well after a short hot spring. The flowering percentages were lower in Italy than in the other countries after three years.

5. Final results for the perennial flowering of hyacinths

A number of graphs were used to evaluate the capacity of hyacinths for perennial flowering. The hyacinths used for each site were chosen on the basis of a previous set of trials conducted in various climate/temperature zones. The successful hyacinths from that series were then used in these trials in combination with perennials in a mature border.

5.1 Criteria

The criteria for evaluating the results during the third flowering season were as follows:

<20% flowering during the third year: unsatisfactory/poor

>20% flowering during the third year: satisfactory

>50% flowering during the third year: very good

In judging flowering, comparing the number of bells on each stem as based on the first year was not considered. For measurements, simply having bells was counted as "flowering". The number of bells diminished at all sites over the years.

If the bulbs produced more than a 100% flowering over the years, this meant that they had produced more bulbs than had been planted during the first year.

5.2 The Netherlands - Boskoop

Seven hyacinth cultivars were planted here in the autumn of 2003. These included both standard and multiflora hyacinths. After three years, it could be observed that all the hyacinths still met the criteria for being rated "very good" since more than 50% of them were still flowering even though the size of their flowers diminished over the years. This characteristic, however, usually gave them a more natural appearance to their use in the border. In Boskoop, the number of bells per flower cluster had increased by the third year.



Hyacinthus 'Splendid Cornelia'



Hyacinthus 'City of Haarlem'

5.3 The Netherlands - Wolfheze

Eight hyacinth cultivars were planted in combination with various perennials in Wolfheze in 2003, all of them in sunny locations. Only one cultivar was scored as unsatisfactory; for the rest, the flowering rate was more than 50%. All cultivars produced smaller flowers in the third flowering season. In a number of cases, flower size stabilised during the third season.



Hyacinthus 'Splendid Cornelia'



Hyacinthus 'White Pearl'

5.4 Germany – Höxter

Experiments with planting four hyacinth cultivars in perennial plantings were conducted in Germany. One cultivar failed to reach the level of 20% flowering during the third season. The rest scored "very good" (>50% flowering). Flower size diminished starting in the second season but appeared to stabilise during the third flowering season.

[Unfortunately, no photographs are available of these hyacinths]

5.5 Sweden – Enköping

In a previous round of trials conducted in a cold northern climate, hyacinths did not perform very well in regard to perennial flowering. For this reason, this trial was limited to H. 'Atlantic', the only one left during the previous testing. In this more recent trial, it appeared that planting hyacinth bulbs among perennials made no difference. Even when planted in combinations, they failed to perform well. It can thus be concluded that hyacinths are not suitable for perennial flowering in a cold climate.

5.6 Italy – Brera

Eleven cultivars, including multiflora hyacinths, were tested in Italy. The results were quite diverse. A number of hyacinths received an unsatisfactory rating, most scored "good", and six combinations scored "very good". Unlike the other sites, what we saw in some cases in Italy was that the flower size increased during the second flowering season. This is difficult to explain because a freshly planted bulb generally displays the highest level of vitality. It could be that the late spring and their position in the shade stretched the flowers more.



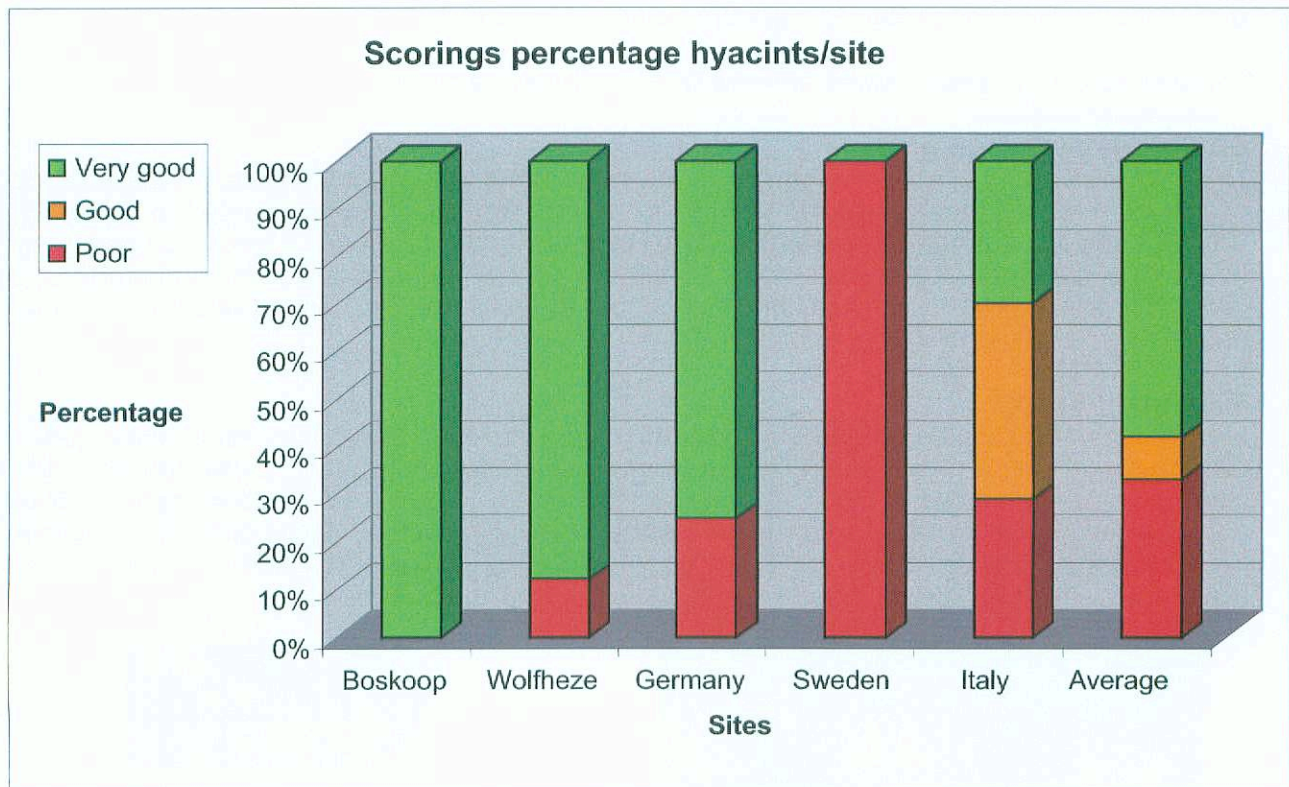
Hyacinthus 'Delft Blue'



Hyacinthus 'Fondant'

5.7 Average scores for hyacinths grown at all sites

The following graph presents the scores obtained at all the sites.



In general, we can conclude that the hyacinths planted in the previous trials that performed well in regard to perennial flowering provided satisfactory perennial flowering results again when planted with perennials.

In Boskoop, the flowering results were even 100%. It should also be mentioned, however, that to be counted as "flowering", the number of bells,- and thus the aesthetic appearance of the flower as a whole - was not considered.

In Sweden, the only hyacinth cultivar planted was 'Atlantic', which was the only cultivar to have produced flowers for more than a year during a previous trial. Once again, 'Atlantic' failed to perform well during this 3-year period. Hyacinths are not suitable for perennial flowering in cold climates.

6. Final results for the perennial flowering of special bulbous plants

A number of graphs were used to evaluate the capacity of special bulbous plants for perennial flowering. The special bulbous plants used for each site were chosen on the basis of a previous set of trials conducted in various climate/temperature zones. The successful special bulbous plants from that series were then used in these trials in combination with perennials in a mature border. The number of special bulbous plants planted was limited only in one site: Italy.

6.1 Criteria

The criteria for evaluating the results during the third flowering season were as follows:

<20% flowering during the third year: unsatisfactory/poor

>20% flowering during the third year: satisfactory

>50% flowering during the third year: very good

If the bulbs produced more than a 100% flowering over the years, this meant that they had produced more bulbs than had been planted during the first year.

6.2 The Netherlands - Boskoop

The findings regarding the ten special bulbous plants planted in Boskoop were disappointing. What's more, stray chickens tore up a number of these products just as they emerged during the first year. Only *Muscari latifolium* and *Muscari tubergenianum* received a "very good" score. *Leucojum aestivum* 'Graveteye Giant' scored a "good" with its 39% flowering rate; all the others either failed to emerge or scored a "poor".

We can thus conclude that a pH of 5 and a moist cold soil during the summer do not encourage perennial flowering among special bulbous plants.

6.3 The Netherlands - Wolfheze

The findings reported from Wolfheze in regard to the 7 special bulbous plants planted there ranged from good to very good. *Leucojum aestivum* 'Graveteye Giant' disappeared altogether. This may be related to the dry sandy soil at this site.

6.4 Germany – Hörter

In Germany, only the crocuses failed to perform well in their plantings; all the other special bulbous plants were flowering very well by the third flowering season. The sunny locations here generally produced better results than the shaded ones.

6.5 Sweden – Enköping

The results in Sweden were particularly disappointing. Only *Erythronium* 'Pagoda' and *Scilla mischtschenkoana* survived to the third year to produce a good flowering percentage. These flower bulbs, however, thrived and increased in number. All the other bulbs strove just to survive.

6.6 Italy – Brera

The only special bulbous plant tested in Italy was *Leucojum aestivum* 'Graveteye Giant'. It was used in various combinations, all of which performed well.

6.7 Average scores for special bulbous plants grown at all sites

Comparing the various sites and the results obtained at each one was very difficult in the case of the special bulbous plants. One reason for this was the limited assortment that was planted. The differences were also great because so many combinations were tried.

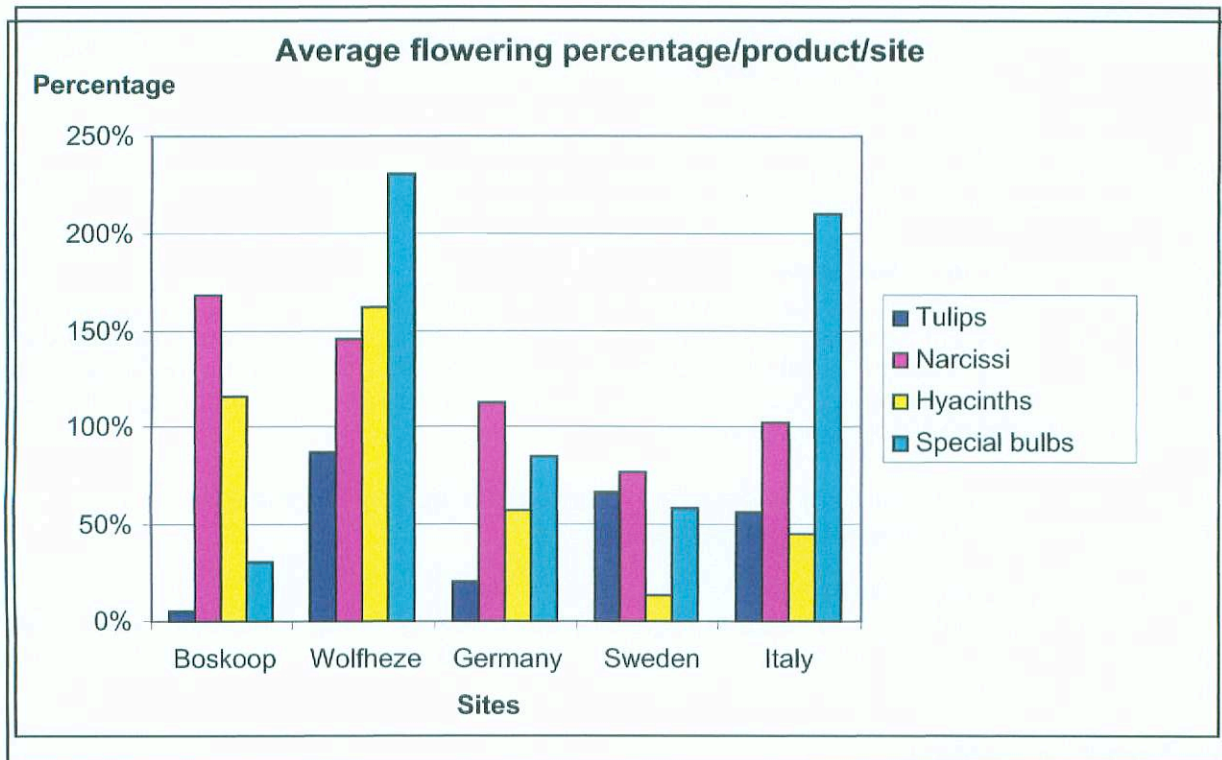
On average, all countries scored a >50% flowering rate for special bulbous plants by the third year; only Boskoop (with a pH of 5 and damp soil during the summer) fell far behind this mark. Average scores at Wolfheze (sandy, warm soil during the summer) and Italy (warm summers) even reached more than 100% flowering.

7. Results for all bulbs as a group

This section provides brief summaries for the purpose of drawing conclusions based on three years of observations.

7.1 Average flowering percentage/product/site

Using a graph showing all the sites and products makes it possible to draw a number of conclusions:



- Tulips and special bulbous plants do not thrive at a low pH and in a moist soil during the summer.
- Hyacinths are not suitable for perennial flowering in a cold climate zone.
- As expected, on average, daffodils perform best in a perennial planting.

7.2 Average flower size/product/site

Flower size says something about the vitality of the plant and/or bulb. A large flower means that beneath the soil surface, a healthy bulb and flower have developed during the summer months.

Tulips

On average, the tulip flowers became somewhat smaller - but we do not refer here to a large difference. Aesthetically, the size of the flowers was certainly still acceptable by the third year. On average, flower size stabilised in the third year.

Daffodils

On average, flower size among daffodils did not change at most sites. At one site (Boskoop), however, flower size was actually reduced compared to the other sites. The evaluation committee suspected that the method of measuring was the reason for the clearly different flower sizes in Boskoop. The cultivars planted in Boskoop were not too dissimilar from those planted at the other sites, so this factor could not explain this substantial difference.

Hyacinths

As expected, the flowers produced by hyacinths became smaller over the years. This meant that, compared to the flowers produced during the first flowering season (flowers that many observers described as being "top heavy"), the smaller ones produced during the second and third seasons were actually an improvement. By the third year, the flower was one-third smaller. Besides being smaller, the flower cluster was not as full (fewer bells), which led its appearance to be more natural but less recognisable as a hyacinth.

7.3 The impact of climate types and temperature zones

The impact of the type of climate (marine/continental/Mediterranean) on the perennial flowering of spring-flowering flower bulbs could not be demonstrated by means of the findings of this study. There were no differences indicating the impact of climate type.

The impact of temperature zones (hardiness zones for plants), however, was an important factor. This could be seen in the findings related to the product groups (e.g. hyacinths in Sweden) and the assortment within a single product.

8. The 'best of the best' in each temperature zone

As a result of this study, we can propose a list of bulbs that can be grown successfully in each climate zone. Appendix 1 shows a map of the European hardiness zones and where the trial sites were located.

One remark should be made about certain flower bulbs that has nothing to do with climate: tulips and special bulbous plants have difficulty growing in soils with a low pHs (peat soils) and/or soils that are moist and cold during the summer.

8.1 Cold climate

A cold climate can be characterised as follows:

- Temperatures can drop to approx. -20°C (-4°F, similar to zone 6) during the winter.
- Winters are long and often accompanied by heavy snowfall.
- Springs are short.
- Summers are hot and dry.

The following tulips would be good choices for perennial flowering in combination with a perennial planting:

Couleur Cardinal	Parade
Don Quichotte	Purissima
Golden Apeldoorn	Showwinner
Orange Emperor	Toronto

The following daffodils would be good choices for perennial flowering in combination with a perennial planting:

Barret Browning	Jetfire
Carlton	Las Vegas
Cassata	Manly
Chanterelle	Mount Hood
Dickcissel	Obvallaris
Dutch Master	Orangery
Exception	Peeping Tom
February Gold	Pink Charm
February Silver	Primeur
Flower Drift	Recurvus
Foresight	Rip van Winkle
Fortissimo	Salome
Fragrant Breeze	Serola
Gigantic Star	Slim Whitman
Golden Ducat	Sorbet
Golden Harvest	Spellbinder
Holland Sensation	Standard Value
Ice Follies	Tahiti
Ice King	Tête-à-Tête
Jack Snipe	White Lion
Jenny	

We advise not planting any hyacinths for perennial flowering in a cold climate. Flowering during the first year is not a problem.

8.2 Temperate climate

A temperate climate can be characterised as follows:

- Temperatures can drop to approx. -10°C (-14°F, similar to zones 7/8) during the winter.
- Springs are long.
- Summers are temperate, with regular precipitation.

The following tulips would be good choices for perennial flowering in combination with a perennial planting:

Ad Rem	Oriental Beauty
Ballade	Parade
Candela	Purissima
Cape Cod	Shirley
Don Quichotte	Spring Green
Golden Apeldoorn	Spring Song
Maureen	Toronto
Menton	White Triumphator
Mount Tacoma	linifolia
Negrita	tarda
Orange Bouquet	turkestanica
Orange Emperor	

The following daffodils would be good choices for perennial flowering in combination with a perennial planting:

Accent	Jetfire
Actaea	Las Vegas
Barret Browning	Manly
Bridal Crown	Mount Hood
Carlton	Obvallaris
Cassata	Orangery
Chanterelle	Peeping Tom
Cheerfulness	Pink Charm
Dickcissel	Pipit
Dutch Master	Primeur
Exception	Recurvus
February Gold	Rip van Winkle
February Silver	Salome
Flower Drift	Serola
Foresight	Slim Whitman
Fortissimo	Sorbet
Fragrant Breeze	Spellbinder
Geranium	Standard Value
Gigantic Star	Sundisc
Golden Ducat	Sweetness
Holland Sensation	Tahiti
Ice Follies	Tête-à-Tête
Ice King	White Lion
Jack Snipe	White Plume
Jenny	

The following hyacinths would be good choices for perennial flowering in combination with a perennial planting:

Borah	Pink Pearl
City of Haarlem	Snow White
Delft Blue	Splendid Cornelia
Fondant	White Pearl

8.3 Warm climate

A warm climate can be characterised as follows:

- Temperatures can drop to approx. -5°C (23°F, similar to zones 8/9) during the winter.
- Summers are hot and dry.

The following tulips would be good choices for perennial flowering in combination with a perennial planting:

Ad Rem	Purissima
Ballade	Shirley
Candela	Showwinner
Cape Cod	Spring Green
Couleur Cardinal	Toronto
Golden Apeldoorn	linifolia
Menton	turkestanica
Orange Bouquet	

The following daffodils would be good choices for perennial flowering in combination with a perennial planting:

Accent	Golden Ducat
Actaea	Hillstar
Barret Browning	Holland Sensation
Bridal Crown	Ice Follies
Carlton	Ice King
Cassata	Las Vegas
Cheerfulness	Orangery
Dickcissel	Peeping Tom
Dutch Master	Pink Charm
February Gold	Primeur
February Silver	Serola
Flower Drift	Sorbet
Foresight	Spellbinder
Fortissimo	Standard Value
Fragrant Breeze	Sweetness
Geranium	White Lion
Gigantic Star	

The following hyacinths would be good choices for perennial flowering in combination with a perennial planting:

Atlantic	White Pearl
City of Haarlem	Woodstock
Delft Blue	
Fondant	Multiflora Blue
Pink Pearl	Multiflora White

9. Successful neighbouring plants

This section provides a list of perennials that the study showed to be the best neighbouring plants for bulbs planted for perennial flowering. It should be mentioned, however, that not all perennials were tested as neighbouring plants; only those already present at the various sites were tested.

For tulips and daffodils, 20 perennials are listed; for hyacinths and special bulbous plants, 10. These lists are far from complete since many more combinations would be possible. Even so, the perennials listed here performed well at various sites and under various climate conditions.

9.1 Good companion plants

Companion plants for tulips

Geranium (various species and cultivars including versicolor, macrorrhizum, psilostemon, 'Philippe Vapelle')
Alchemilla
Aster hybrids
Origanum hybrids
Veronica longifolia
Viola odorata
Pulmonaria officinalis
Stachys grandiflora 'Superba'
Astilbe chinensis 'Pumila'
Kalimeris
Liatris
Veronicastrum
Helianthus 'Lemon Queen'
Carex muskingumensis
Lythrum
Sidalcea hybrids
Thalictrum polygamum
Dicentra formosa
Astrantia
Inula

Companion plants for daffodils

Hosta
Alchemilla
Chelone
Darmara
Lysimachia punctata
Lysimachia clethroides
Salvia nemorosa
Gillenia
Hemerocallis
Geranium (various species and cultivars including magnificentum, endressii, macrorrhizum)
Bergenia
Astilbe
Carex
Solidago flexicaulis
Brunnera
Waldsteinia
Epimedium
Tellima
Omphalodes
Ligularia dentata

For daffodils, it was difficult to choose. The list of perennials given above includes only a few of the many possibilities offered by a wide assortment of perennials that would be suitable as companion plants for daffodils. In other words, daffodils can easily compete with perennials.

Companion plants for hyacinths

Ophiopogon
Hosta
Campanula poscharskyana
Geranium (various species and cultivars such as psilostemon, sanguineum)
Alchemilla
Salvia nemorosa
Campanula 'Sarastro'
Solidago flexicaulis
Nepeta faassenii
Teucrium hispanicum

Companion plants for special bulbous plants

Astilbe
Heuchera
Campanula portenschlagiana
Campanula sarmatica
Aruncus
Walstenia
Bergenia
Lamium orvala
Geranium (various species and cultivars such as sanguineum, wlassovianum)
Hemerocallis

9.2 Aesthetically pleasing neighbouring plants

The best visual results were considered as well. Judging focused particularly on the interrelationships between the bulbous plants and the perennials. The following combinations supplement one another without either plant visually overpowering the other, and the bulbs are also distributed both uniformly and in a natural way among their neighbouring plants.

In Boskoop

Narcissus poeticus recurvus with Solidago flexicaulis 'Flexi-Belle'
Narcissus 'Standard Value' with Carex morrowii 'Ice Dance'
Narcissus 'Fortissimo' with Carex morrowii 'Ice Dance'
Hyacinth 'Borah' with Campanula poscharskyana 'Stella'
Narcissus 'Pink Charm' with Waldsteinia ternata
Muscari latifolium with Campanula sarmatica 'Hemelstraling'
Narcissus 'Sorbet' with Hemerocallis 'Double River Wye'
Narcissus 'Chanterelle' with Waldsteinia ternata
Narcissus 'Salomé' with Geranium endressii

In Wolfheze

Unfortunately no mention of the varieties of bulbs with the photos

In Germany

Narcissus 'February Silver' with Omphalodes verna
Erythronium 'Pagoda' with Waldsteinia ternata
Narcissus 'White Lion' with Astilbe thungergii
Narcissus 'Jetfire' with Vinca minor
Narcissus 'Peeping Tom' with Brunnera macrophylla
Narcissus 'Jack Snipe' with Waldsteinia geoides
Tulipa 'Toronto' with Geranium versicolor
Narcissus 'Serola' with Rudbeckia fulgida 'Goldstrum' and Symphytum grandiflorum

In Sweden

In addition to the rare combinations with emerging leaves of perennials, this site also offered many combinations with last year's stems - a much more attractive sight than simply bare earth. The distribution of the bulbs among the perennials was also easily visible and provided a pleasant view. Here, therefore, the important factor in many cases was not the combination of perennials and bulbs but rather the fact that the perennials would later be shielding the senescing bulbous plants from view.

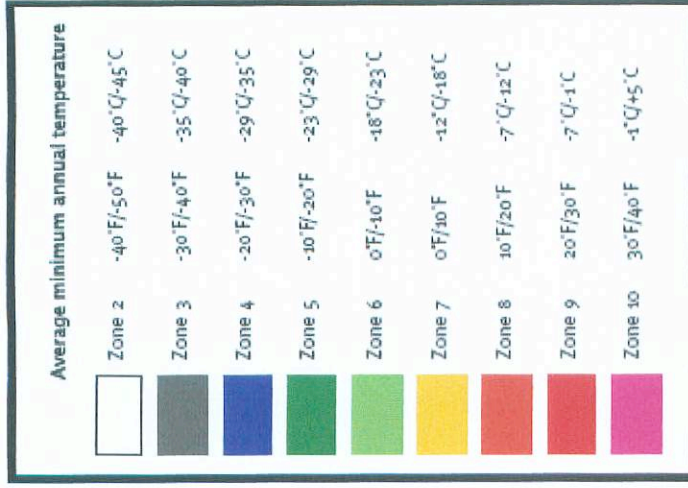
With leaves:

Scilla siberica with Anemone hupehensis
Narcissus 'Flower Drift' with Alchemilla mollis
Narcissus 'Golden Harvest' with Geranium magnificum
Tulipa 'Golden Apeldoorn' with Dicentra
Tulipa 'Couleur Cardinal' with Lythrum
Narcissus 'Tête-à-Tête' with Pulmonaria
Tulipa 'Don Quichotte' with Sidalcea

With last year's stems:

Tulipa 'Purissima' (with Veronica)
Narcissus 'Mount Hood' (with Persicaria)
Narcissus 'Spellbinder' (with Persicaria)
Narcissus 'Cassata' (with Sanguisorba)
Tulipa 'Don Quichotte' (with Liatris)
Scilla siberica (with Ligularia)
Narcissus 'Foresight' (with Lysimachia)
Narcissus 'Salomé' (with Hemerocallis)
Tulipa 'Purissima' (with Carex)

Appendix 1: Hardiness zones in Europe



1. Enköping sweden
2. Höxter Germany
3. Wolfheze Netherlands
4. Boskoop Netherlands
5. Breira Italy

