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THE EARLY-FORCING OF DAFFODILS

BY

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de forage des narcisses

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The Early Forcing of Daffodils

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After the early crocus the daffodils give color to our bulb fields, depending on the weather conditions of the preceding winter and early spring, and the fields become yellow in different shades beginning about the 15th of March or the first of April. The first hyacinth blooms follow about a fortnight later and they again are succeeded by the brilliant colors of the tulips.

Until about eight years ago the succession of flowers and colors in our glass-houses, on our flower markets and at our exhibitions was quite different from the sequence observed in the bulb fields.

In December the prepared hyacinths and a few tulips came first, succeeded by more hyacinths and tulips and with only a few exceptions we were not able to bring the daffodils into bloom before the second half of January. Most of the daffodils arrived after the first of February.

How can this discrepancy in precocity of the flowers on the fields and in the forcing-houses be explained? The bulb growers certainly had done everything that seemed possible to bring all kinds of bulb-flowers on the early market, but all methods, applied successfully to the other flower-bulbs to influence favorably the precocity of the flowers, practically failed with the daffodils.

The first attempts to force bulbous plants into flower were made by the Dutch bulb growers themselves before any official scientist had given any attention to the problem. The principle of "preparing" the flower-bulbs for early forcing was discovered by the Dutch bulb-grower, Nicolaas Dames, more than thirty years ago. He was the first to apply jarovisation or vernalisation to bulbous plants. Various methods of preparing flower-bulbs for early forcing have been applied.

(a) The bulbs may be planted in a milder climate, where they can flower earlier, can be lifted earlier, and thus gain somewhat in precocity as compared with the bulbs grown in our climate.

(b) The bulbs may be planted in glass-houses and thus giving them an artificial climate, which also makes them flower earlier and better fitted for early forcing.

(c) The bulbs may be planted in the open above heating tubes or electric cables buried in the soil. In this case the bulbs have all the advantages of the growing conditions in the open, and this is desirable for the production of proper sized bulbs, and in addition to this, during the last weeks of the growing season, before the lifting, the ripening of the bulbs in the soil and flower formation can be favorably influenced by a higher soil temperature than that provided by the natural climate.

The object of these three methods is to correct, during the growing period of the bulbs, adverse influences of the natural climate on the forcing capacity of the bulbs for the next season. It was the ingenious idea of Nicolaas Dames to improve the forcing capacity of his hyacinths by lifting them prematurely and by ripening them under artifi-

cial conditions instead of depending on the whims of the natural climate. Through a great number of experiments he succeeded in bringing hyacinths into bloom about four weeks earlier, lengthening in this way the period of sale for his products by about a month.

To make clear why this method did not give any satisfaction for daffodils, I am obliged to point out in brief some differences between the flower formation and development in hyacinths, tulips and daffodils. My explanations are based on the climatic conditions and the experiences in our climate. Later on we shall be able to secure an idea of the significance of these facts for other regions, where daffodils are grown.

The formation of the flower for the next season in hyacinths normally starts in July. By prematurely lifting the bulbs in June and applying different storage temperatures, the normal formation of the leaves in the bud for the next season can be stopped, and the formation of the flower initiated. In this way to a certain extent it is possible to start the formation of the flower of the hyacinth when it seems desirable.

With tulips, lifting and storing at a higher temperature does not determine the beginning of the flower formation as with the hyacinths, but here the completion of the leaves first has to take place.

A great number of experiments, first by the bulb growers themselves, later on by Blaauw and his cooperators, by Beyer, and the writer in our laboratory for flower-bulb research at Lisse, have been concerned with the optimum storage conditions for influencing the formation and further development of the flower, and the forcing capacity of hyacinths and tulips.

Hyacinths and tulips are lifted in June and July, depending on the varieties and the desire to improve the forcing capacity. The premature lifting of tulip bulbs sooner leads to deterioration of flower quality than similar treatment of hyacinths. Most of the tulips are lifted in July, before the formation of the flower inside the bulb has begun. In the case of daffodils, however, the formation of the flower already starts in the beginning of May, about two and half months before the bulbs can be lifted. At lifting time the formation of the flower is practically ended and after lifting only extension growth takes place.

Premature lifting of daffodil bulbs very soon leads to excessive dwarfing of the flowers for the next season and mostly spoils the crop. For this reason the period of flower formation cannot be influenced artificially and this depends entirely on the natural climatic conditions of the district where the bulbs are grown. Most important for the forcing capacity of the daffodils is the fact that optimum storage temperatures for early forcing of the lifted bulbs are much lower than for the hyacinths and tulips, and even lower than the normal average temperature of our climate. The method applied most successfully for hyacinths and tulips, the applying of an artificial climate during flower formation in the bulb, therefore cannot be used for daffodils.

The three methods mentioned, planting in another climate, in glass-houses, or on top of heating units in the soil, are also of much less importance for daffodils since the optimum temperature for flower formation is so much lower than for hyacinths and tulips that the soil temperature may easily be made too high for the optimum development of

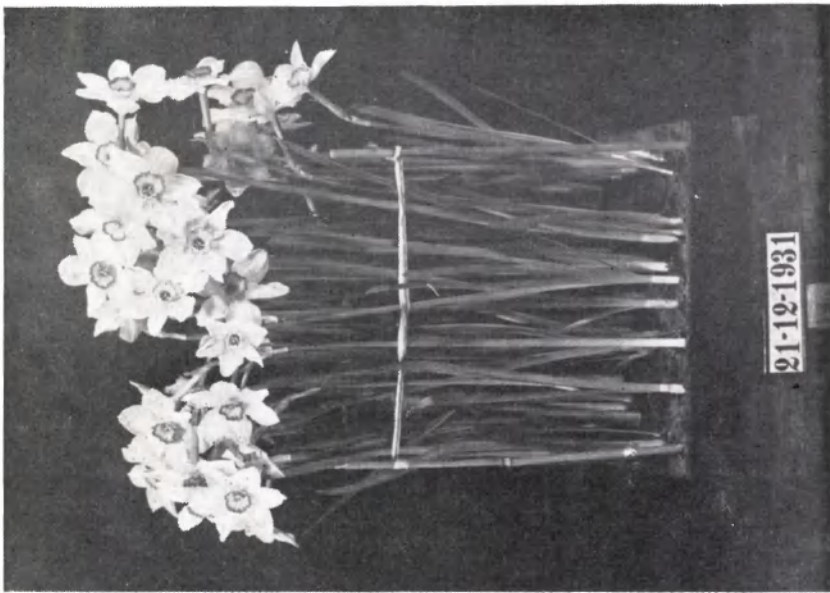
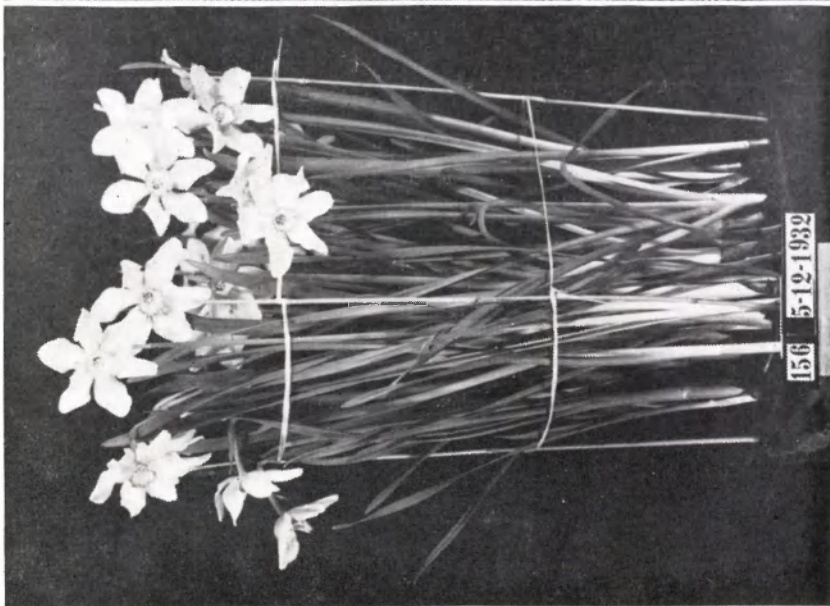


Prof. Dr. E. van Slogteren

Upper, *Narcissus Golden Spur*, both boxes lifted June 16; No. 176 kept for 2 weeks at 62.5 degrees F.; No. 168 at 48 degrees F., until forcing, Nov. 25.

Lower, *Narcissus Mignon*; No. 1285 lifted June 27; No. 1298 July 15; both kept at 48 degrees F., until forcing, Nov. 28.

Plate 120



Prof. Dr. van Slogteren

Left, *Narcissus Brilliancy*; lifted July 15, Planted Sept. 13 at 48 degrees F.; in glass-house Nov. 7; in flower Nov. 28.

Right, *Narcissus Early Surprise*; lifted July 16; stored 2 weeks at 62 degrees F.; in glass-house Dec. 1; in flower Dec. 14; photo Dec. 21.

Plate 121

the flower. Planting in a milder climate can make them bloom much earlier than in our regions, but the early summer following the spring here is mostly very hot and has a retarding influence and therefore the advantage attained during the winter, is again lost.

At present, after our investigations and experiments of the last ten years, we know that by treating daffodils as we did formerly, we only made them less fit for early forcing. (See Plates 120, 121, 122, and 123.) Generally we can say that daffodils lifted in our region, must be stored at a temperature of 46° to 48°F., while the average outside temperature in our country in July and August is about 65°F.

The growers had already found out by experience that storage indoors together with hyacinths and tulips retarded the flowering still more. By leaving them out-of-doors in the field the greatest precocity was attained, but this still excluded the possibility of forcing them before the second half of January or later. Now after lifting we put them in refrigerated storage of about 46°-48°F., when we wish to have them as early as possible. For a somewhat later date we prefer to keep them at 62°F. during July and August and at 59°F. during September.

Griffiths complained about excessive dwarfing when he stored the bulbs immediately after lifting at 48°F. This may be due to the fact that the period of storage is too long when the bulbs are lifted earlier than takes place in this country. The stage of development of the flower, too, due to climatic influences, may not be far enough advanced at lifting time when they have been grown in a warmer climate and in this case I should certainly prefer to store the bulbs at about 62°F. until the second half of July or about the first of August.

In Table 1 the average monthly day temperatures together with the optimum temperatures for early and later forcing of daffodils under our climatic conditions, are indicated for a number of locations. With us, as I have stated before, flower formation has normally been completed when we store the bulbs at 46°-48°F. For other climatic conditions than in Holland one has to keep in mind that for early forcing it does not seem necessary to bring most of the varieties into cold storage (46°-48°F.) before the first of August.

TABLE 1.
Average monthly day temperatures, degrees Centigrade (Means for 24 hours)

	July	Aug.	Sept.	Oct.	Nov.	Dec.
De Bilt, Netherlands	16.8	16.6	13.8	9.6	5.0	2.6
New York City, U. S. A.	23.1	22.3	19.2	13.1	6.7	1.3
Washington, D. C., U. S. A.	24.9	23.6	20.1	13.6	7.2	2.3
St. Louis, Mo., U. S. A.	26.2	25.2	21.1	14.7	6.3	1.9
Chicago, Ill., U. S. A.	22.4	21.8	18.1	11.7	3.9	-1.5
Portland, Ore., U. S. A.	19.8	18.8	15.9	11.8	7.6	5.2
Los Angeles, Calif., U. S. A.	19.7	20.3	19.2	16.8	14.6	12.9
Greenwich, England	17.1	16.7	14.2	10.0	6.7	4.7
Optimum temperature for <i>early</i> forcing						
of daffodils	17.0	8.0	8.0	8.0	8.0	
to		to	to	to	to	
17.9		9.0	9.0	9.0	9.0	
Optimum temperature for <i>later</i> forcing						
of daffodils	17.0	17.0	15.0	9.0	9.0	

When the bulbs are lifted one has to investigate the stage of development of the flower-bud inside the bulb. If all the parts of the flower have not yet been formed it is advisable, to store the bulbs at a temperature of about 62°-65°F. When all parts have been formed and only extension-growth is still necessary, the bulbs can be stored at a lower temperature as mentioned above. (46°-48°F.). By following this procedure we have demonstrated that the period of sale for daffodils can be lengthened 4 to 6 weeks. Many varieties can be had easily by about the 15th. of December, and not less important from an economic point of view is the fact that the period of forcing in glass-houses has been shortened considerably at the same time.

The new methods of treating daffodils have given both agreeable surprises as well as disappointments with reference to the response of different varieties to this treatment. Some varieties, like *Croesus* and *Bernardino* have lost a part of their popularity. One of our most beautiful varieties however, Mrs. E. H. Krelage, Plate 95, formerly seemed of no use for early forcing and was considered to be one of the latest of our daffodils. It responds however very well to cold storage and now gives a great number of flowers of excellent quality early in January.

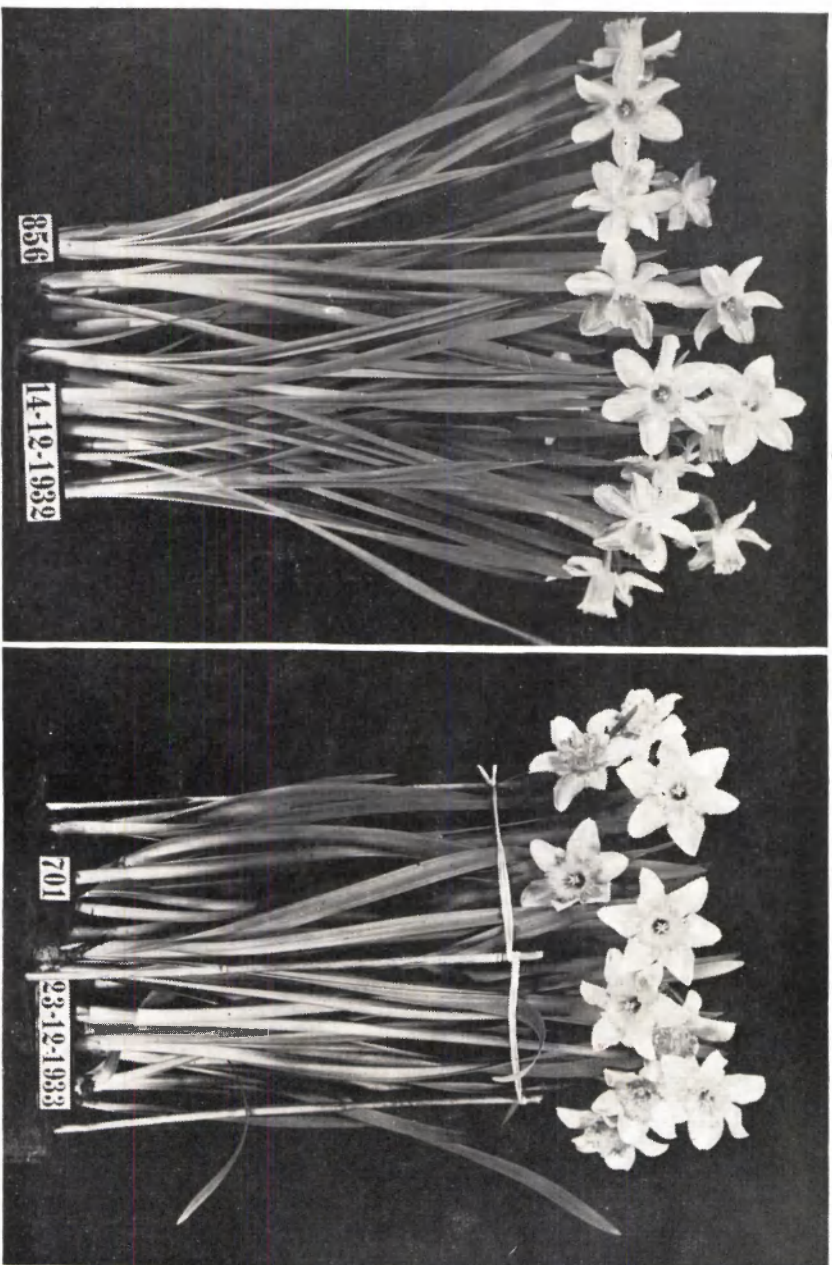
It is clear that for optimum results with early forcing, the potting of daffodils has to take place at a low temperature, preferably not higher than 46°-48°F. The bulbs must not be planted before the soil temperature is sufficiently low.

It is possible to keep the bulbs dry in storage at 46°-48°F. until the end of September or the beginning of October, if the root development is kept back sufficiently by regulating the moisture in the storage room. If the soil temperature is too high and root growth is too rapid, the bulbs can be planted in pots or boxes that can be stored indoors at 46°-48°F. In this case great care must be taken that the boxes are sufficiently watered during this period.

Varieties which make roots easily later in the season, like *Sir Watkin* or *Helios*, may be kept dry at 46°-48°F. until rather late in the season, (we have kept them like this until October 16th, and had them in flower on Dec. 22), before planting them out of doors. At this date the soil temperature is usually low enough, certainly it is in our climate. Other varieties, like *Poeticus ornatus*, which do not make roots well enough if planted late, are better planted early under artificial temperature control.

When the bulbs have to be shipped one also has to take into account the possibility of climatic conditions before, during or after the voyage, influencing fitness for early forcing. Practically throughout the whole northern hemisphere where daffodils are forced, the high temperatures of July or August absolutely ruin the capacity of daffodils for early forcing. The forwarding of the bulbs in most cases should be delayed until the climatic conditions are more favorable.

Formerly we needed from 4 to 6 weeks forcing at 65°F. or higher to secure the blooms by February 1-15th. Now, at a temperature of 60°F., we bring a great number of varieties in bloom in about 10 to 20 days. We prefer not to force them at a higher temperature. If one is in doubt about the right date of setting them in the forcing house, it is advisable

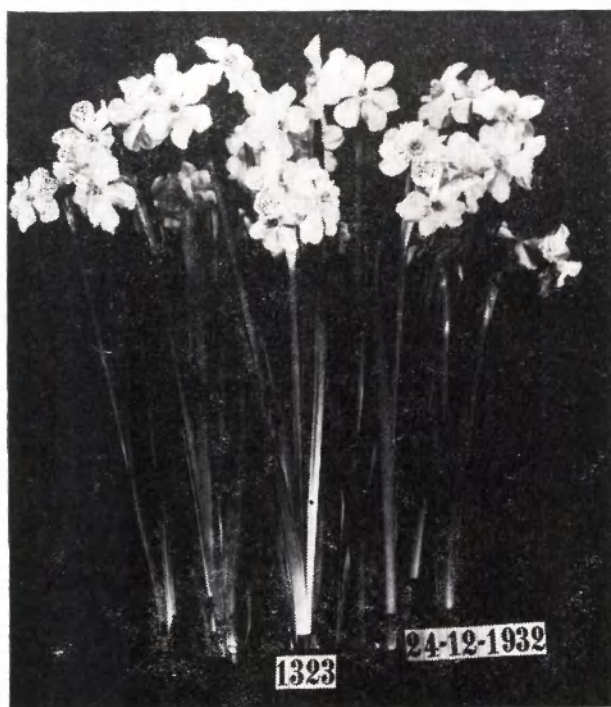


Prof. Dr. van Slogteren

Left, *Narcissus incomparabilis* Helios; lifted July 18; stored at 48 degrees F.; planted Sept. 15 at 48 degrees F.; in glass-house Nov. 18; in flower Dec. 5; photo Dec. 14.

Right, *Narcissus Orange Glow*; stored at 48 degrees F. from Aug. 2; planted Sept. 22 at 48 degrees F.; in glass-house Nov. 11; in flower Dec. 19

Plate 122



Prof. Dr. van Slogteren

Upper, *Poeta* Narcissus White's Hybrid; lifted July 15; stored at 48 degrees F.; planted Sept. 15 in boxes outdoors; in glass-house Nov. 30; in flower Dec. 17; photo Dec. 24.

Lower, Narcissus Spring Glory; effect of glass-house culture (645); soil-beating (650); and field culture (657).

Plate 123

to start forcing at 55°F. When the foliage starts to grow and the flower-buds appear outside the bulb, the temperature can be raised to 60°F. or a little higher. If growth stops and the flower-stalks do not grow, it is very dangerous to raise the forcing temperature. In most cases this indicates that the potted bulbs have been brought into the glass-house too early and it is better to drop the temperature. If too much harm has not already been done, one should start forcing again in about one to two weeks later at 60°F.

One has to keep in mind that the morphological development and the size of the flower-bud are not always a reliable criterion as to the early forcing capacity of any particular variety. A somewhat higher storage temperature in July and August may be more favorable for the extension growth of the flower-bud in some cases. Other bulbs, stored at a lower temperature, may show smaller flower-buds and therefore less advanced extension growth, yet the latter may flower about a month earlier than the former. This indicates that other factors also determine the fitness for early forcing and for this reason in our laboratory we have studied the biochemical processes that take place in the bulbs during storage. The carbohydrate metabolism is largely influenced by the storage temperature and we are studying this side of the problem to secure a better insight into the physiological processes that take place in the bulbs.

SUMMARY

The formation of the flower of daffodils begins much earlier than with other flower-bulbs and may start about two and a half months before the bulbs can be lifted. The optimum temperature of this development of the flower in the bulb before it is lifted is rather low.

If the flower has been completely formed at lifting time the bulbs can be stored at 46°-48°F. If necessary a short period at about 62°F. may be advisable, until all parts of the flower are completed.

In a very early climate there may be danger of too long cooling. Starting at 46°-48°F. at the end of July is sufficient for early forcing. Preferably bulbs should not be planted before the soil temperature has dropped to 46°-48°F.

By applying these methods daffodil flowers can be had about 4 to 6 weeks earlier than heretofore in excellent quality, and the period of forcing can be cut down to about half the time formerly needed.

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