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Post-harvest Development of Cut Tulip Flowers[1]

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Abstract

The senescent characteristics of cut tulips at 23.5° C were studied. The data show that tulips vary in vase-life from as little as 3 to 4 days to more than 6 days. Also, the stems and perianth of tulips continue to elongate after cutting. It was found that the last internode accounted for the greatest part of the elongation of the stem. This is a highly undesirable trait. On the other hand, the elongation of the perianth is desirable. Flower shape varied between cultivars. The overall water uptake pattern of cut tulips was similar but large differences existed in the quantity of water absorbed. A set of standards for evaluating cut tulips is proposed.

Introduction

Commercially, tulips are widely used as cut flowers. The documentation of the senescent characteristics of forced tulips is important in dictating the use of existing tulip cultivars. Cut tulip post-harvest physiology should be of value to the tulip breeder who must select lines for hybridizing and evaluate the progeny against some set of standards to determine if improved lines are being produced.

The purpose of the studies reported in this paper was to establish some of the parameters for evaluating cut tulips.

These studies were carried out in an artificially lighted room at a temperature of 23.5° C. These conditions were selected because they represent an environment which exists widely in United States and Canadian homes and one which will become more commonplace throughout the world.

Materials and Methods

The flowers used in these studies were forced utilizing the procedures outlined by De Hertogh et al. (1967) and the Dutch Bulb Manual (1969). All cultivars were evaluated during their period of maximum availability.

All flowers were removed from the forcing flats, with the bulbs attached, when the tepals were half colored and stored dry in an upright position at 2° C. When a sufficient number of flowers of a given cultivar were accumulated the bulbs were cut off, the flowers bunched, wrapped in paper and stored dry in a horizontal position at 2° C for either 72 or 96 hours.

When an experiment was initiated the flowers were placed in a 23.5° C room, the stems recut and the lengths of the entire plant, last internode and flower were recorded. Flowers not intended for use in water uptake studies were subsequently rewrapped and conditioned for two hours in 22° C water prior to being placed in vases. Flowers used in water uptake experiments were recut and immediately placed in 100 ml graduate cylinders in a holder especially designed to hold the flowers in an upright position. During the course of the studies the water was never changed only refilled as necessary. Floral preservatives were not added to the water.

In the controlled temperature room the tulips received no natural light, but were continuously illuminated by 40 watt cool-white fluorescent tubes at an intensity of 50 ft. C.

Results and Discussion

Keeping quality - Five criteria were utilized to determine the vase-life of tulip flowers. Not all criteria were applicable to all cultivars. These were: (1) excessive flaring of the tepals, the condition where the tepals had separated and light was observed between adjacent tepals, (2) discoloration, large deviations from the color of the tepals at the time of anthesis: (3) tepal drop, naturally occurring tepal drop, (4) shaking test, the unnatural tepal drop caused by moving the plant and (5) stem bending, the condition whereby the stem would not maintain the flower in an upright position. Based on these criteria a cut tulip flower can be classified as (1) poor, 3 to 4 days of vase-life; (2) fair, 4 to 5 days; (3) good, 5 to 6 days and (4) excellent, greater than 6 days.

A total of 77 cultivars have been evaluated using these criteria (Benschop and De Hertogh, 1969). A few examples are

Insert Table 1

presented in Table 1. These cultivars demonstrate the wide range of vase-life which can be obtained with cut tulips. In general, most tulips will last approximately 5 days at 23.5^{o} C. The notable exception is the Darwin Hybrid Class, most of which normally average only 3 to 4 days.

For breeding future cultivars it would be desirable to select for the longer lasting cultivars. An example of this type of selection can be seen in Table 1. The cultivar Purple Star is an offspring of a cross between William Copland and Korneforos (Rassenlijst, 1968). As seen in Table 1 both Purple Star and Rose Copland, a mutant of William Copland, have vase-lifes of greater than 6 days. The same can be observed for Pax which has William Pitt as a parent.

It has also been noted (Benschop and De Hertogh, 1969) that the cup shaped tulips tend to have a longer vase-life than either semi-cup or open flowers. This may be another factor to consider in the development of new cultivars.

A factor which is very important in determining vase-life of cut tulips is the stability of the flower color. While no data is presented we have observed that the highly pigmented flowers, e.g. reds, rose and lavenders, discolor markedly as the flowers age. On the other hand, the yellows and whites do not. It would be important to select for progeny which have highly stable pigments. This would greatly improve the value of the flowers.

Insert Figure 1

Flower Shape - A schematic diagram of the three basic flower shapes is presented in Figure 1. The data presented in Table 1 show that the shapes of the tulip flower changes during senescence. There are differences not only the rate of change but also in the extent of opening of the tepals. Cultivars such as Apeldoorn and Gudoshnik change much more than Rose Copland or Pax. This should also be an important factor in selecting tulips. It is not so important that the tulip assumes a specific shape but the shape should remain constant over a given period of a few days.

In our work, we have arbitrarily selected the shape at the 72 hour time period as the time to classify the tulips. This is the approximate half-life of most tulips at 23.5° C and the flowers are usually in their best show condition at this time.

It is important that a fixed temperature be set to evaluate flower shape and flower-life since temperature plays an important role in relation to these two factors (Hekstra, 1966 and Wood, 1953).

Insert Table 2

Post-Harvest Growth of the Tulip - As seen in Table 2, all tulips continue to elongate after cutting. It is not known whether this is cell elongation or division. There are differences between cultivars in the amount of stem elongation. In general, a small amount of growth would be acceptable. It would, however, be desirable to have as little elongation as possible providing the flower is above the upper leaf at the time of anthesis. It is interesting to note that the last internode grows considerably in most cultivars. An average of the 77 cultivars studied (Benschop and De Hertogh, 1969) revealed that this internode accounted for 52% of the total post-harvest stem elongation. The range varied from a low of 43% to a high of 81%.

A highly desirable trait, however, was the continued growth of the perianth (Table 2). In all cases, the tepals increased in length during the transition from the bud stage of development to full flower, the greatest rate of enlargement occurring during the first 24 hour period. For most cultivars the tepals elongate about 2.0 cm after cutting. Increases in tepal width have also been observed.

Insert Figures 2 and 3

Water Uptake - Figures 2 and 3 illustrate that the overall pattern of water uptake is probably similar for most cultivars. The total quantity of water taken up will vary with the cultivar (Table 3, Fig. 2 and 3). Initially, there was a rapid rate of uptake of water during the first hour and then a slow decline which after about 5 hours becomes a steady rate. A marked drop in water uptake was noted 24 hours prior to the end of the vase-life of the tulip. This was observed for all cultivars examined and supports the findings of Aarts (1962). Since the volume of water absorbed by cut tulips is extremely great, it would be desirable to select cultivars which have a reduced water uptake as well as a long vase-life. This would be extremely valuable when the flowers are used by

Insert Table 3

florists since the need for replacement of the water would be decreased.

Conclusions

It is obvious that the existing cultivars of tulips differ markedly in their senescent characteristics (Tables 1 and 2, Figure 3). It would, therefore, be desirable to create a set of standards by which to evaluate cut tulips. Since it is known that the vase-life of cut tulips is increased as temperature is decreased (Hekstra, 1966), the temperature selected for such evaluations is very important. We have chosen 23.5° C since it is a temperature which is widely used where central heating is available. In addition, the use of a higher temperature has little effect on vase-life of cut tulips (Hekstra, 1966). Using this temperature it is proposed that tulips be selected which have a vase-life of at least 5 days. continue here While the exact flower shape is not important, the flowers should not open beyond 60°. ~~(Figure 1)~~. The shape of the flower should remain fixed throughout the life of the flower. The color of the flower should remain stable throughout the life of the flower. This particularly true for ~~[illegible]~~ the red, orange, and lavender tulips. It is desirable to have flowers in which the tepals continue to enlarge. The elongation of the stem after cutting and particularly the last internode should be minimal, i.e., less than 5 cm. This would help to reduce stem bending. Lastly, the cultivars should be selected for reduced water uptake. This would be of value to the florist industry since the water would not have to be replaced frequently.

We realize that the post-harvest development of the cut tulip is but one factor that must be integrated into a complete tulip breeding program. Other factors that should be considered include, total plant height in the bud stage of development, flower size, position of the flower in relation to the upper leaf, ability to be forced, bulb production characteristics, adaptability to either the conventional forcing techniques or the 5° C system and disease and insect resistance.

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Legends for Figures

Figure 1. Schematic diagram showing representatives shapes of cup, semi-cup and open tulip flowers.

Figure 2. Cumulative 96 hour water uptake patterns for Apeldoorn and Gudoshnik tulip cultivars at 23.5° C.

Figure 3. The 24 hour water uptake pattern for Apeldoorn and Gudoshnik tulip cultivars at 23.5° C.

use actual values

Table 1

Vase-Life and Flower Shape of Cut Tulips at 23.5° C.

Cultivar	Average Vase-Life (days)	Flower Shape (degrees) 24 hrs	72 hrs	Last Day	Classification at 72 hrs
Rose Copland	6	8	13	20	cup
Red Pitt	5 to 6	14	23	27	cup
Apeldoorn	3 to 4	21	37	43	semi-cup
Gudoshnik	4 to 5	21	36	48	semi-cup
Purple Star	6	7	13	18	cup
Pax	6	15	22	27	cup

Table 2

Post - Harvest

Growth of Total Plant, Last Internode and Flower of Cut Tulips at 23.5°C.

Cultivar	Total Plant Growth (cm)	Growth Last Internode (cm)	Growth of Flower (cm) Initial Length	After 24 hr	Last Day	Total Growth
Rose Copland	12.3 ± 2.0	6.0 ± 0.6	5.0 ± 0.3	5.9 ± 0.3	7.1 ± 0.2	2.1
Red Pitt	14.7 ± 1.5	10.9 ± 1.4	5.1 ± 0.2	5.8 ± 0.3	6.9 ± 0.2	1.8
Apeldoorn	12.3 ± 2.1	9.5 ± 2.6	6.4 ± 0.4	7.4 ± 0.5	8.6 ± 0.4	2.2
Gudoshnik	13.6 ± 1.9	8.9 ± 1.2	5.9 ± 0.3	7.0 ± 0.2	8.1 ± 0.3	2.2
Purple Star	17.1 ± 0.6	7.4 ± 0.8	5.4 ± 0.0	6.4 ± 0.1	7.6 ± 0.2	2.2
Pax	9.0 ± 0.9	4.7 ± 0.5	4.7 ± 0.1	5.3 ± 0.1	6.4 ± 0.1	1.7

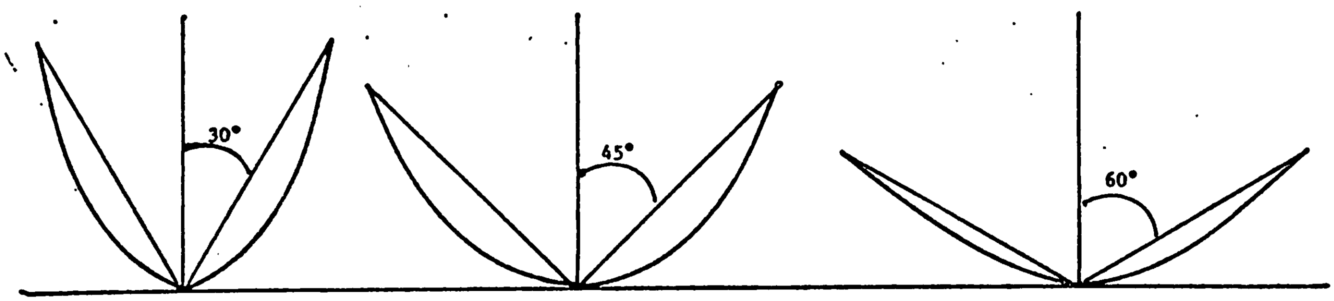

Figure 1

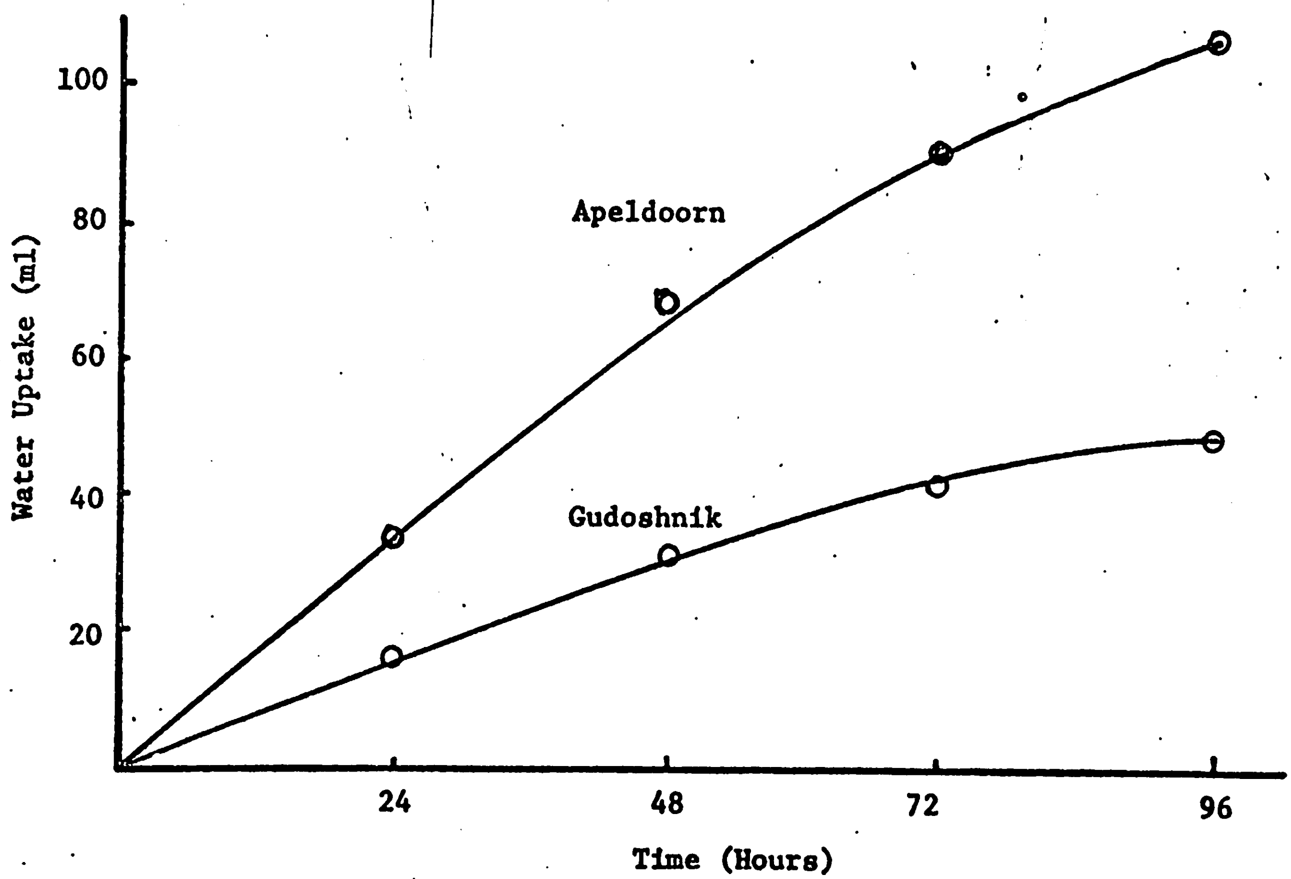
Water Uptake (ml)
100
80
60
40
20
Apeldoorn
Gudoshnik
24
48
72
96
Time (Hours)

Figure 2

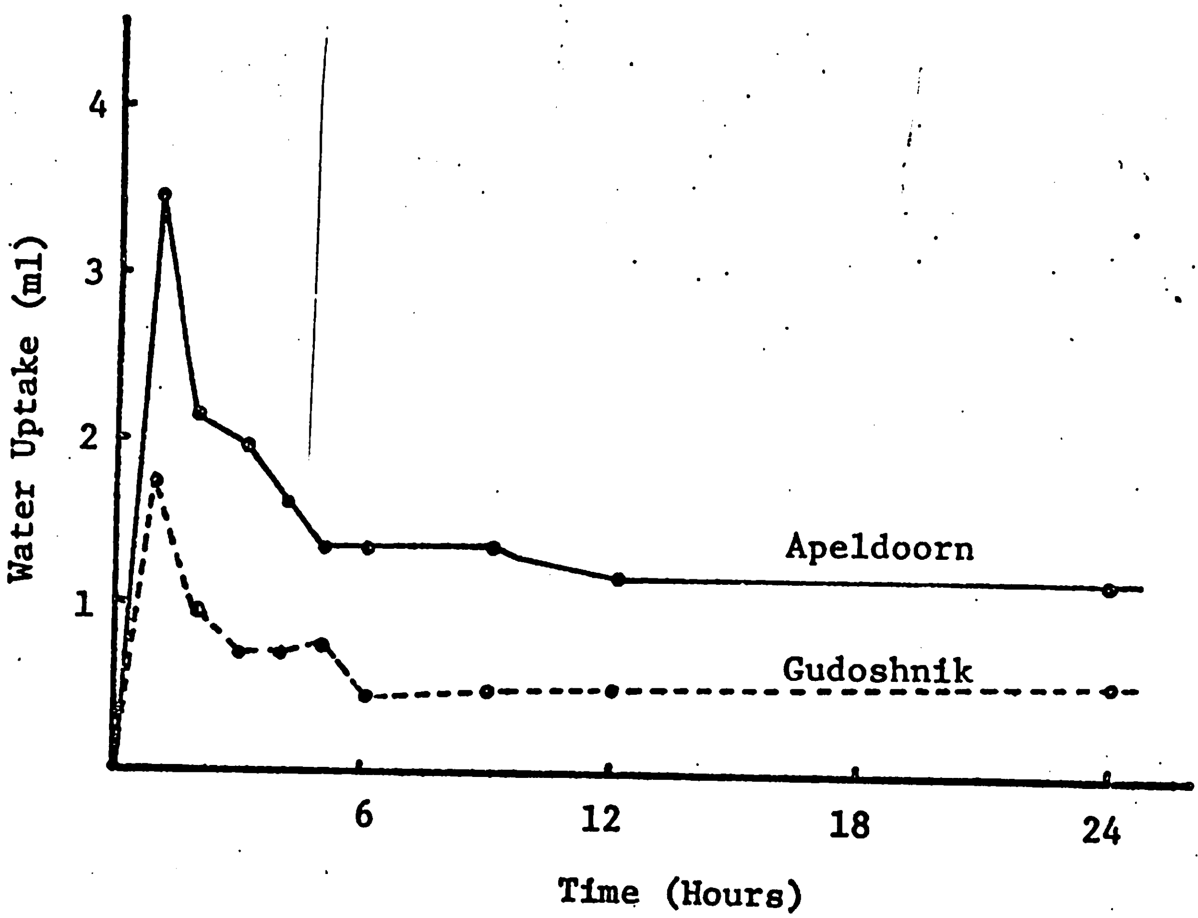
Water Uptake (ml)
4
3
2
1
Apeldoorn
Gudoshnik
6
12
18
24
Time (Hours)

Figure 3