BURSA ULUDAĞ ÜNİVERSİTESİ ZİRAAT FAKÜLTESİ DERGİSİ
Journal of Agricultural Faculty of Bursa Uludag University
e-ISSN 2651-4044
https://dergipark.org.tr/tr/pub/bursauludagziraat
http://www.uludag.edu.tr/ziraatdergi
Eylül/2020, 34(Özel Sayı/Special Issue), s. 327-336.

ARAŞTIRMA MAKALESİ RESEARCH ARTICLE

Geliş Tarihi (Received): 25.10.2019
Kabul Tarihi (Accepted): 22.06.2020

A Study on the Evaluation of Commercial Narcissus Varieties as Potted Ornamental Plants[A]

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Abstract: The research was carried out over a vegetation period between December 2014 and June 2015 at Ege University, Bayindir Vocational School to investigate the floristic properties of different cool-climate narcissus varieties grown in pots under greenhouse conditions. Twenty-two different *Narcissus* cultivars (Professor Einstein, Tête-à-Tête, Carlton, Precocious, Furbelow, Ice Follies, Strong Gold, Dellan, Carbineer, Tamsyn, Actaea, Golden Harvest, Cheerfulness, Sempre Avanti, Scarlett O'Hara, Monal, Fortissimo, Pink Silk, White Lion, Fortune, Salome) were examined in terms of their floral quality in Mediterranean ecological conditions. For this purpose, different *Narcissus* cultivars were scrutinized through a set of visual criteria for their first flowering time, flowering duration, flower length, stem height and width together with the amount and diameter of their flowers.

A Bilim, Sanayi ve Teknoloji Bakalnlığı SAN-TEZ Projesi; 0329.STZ.2013-2 This study does not require ethics committee permission.

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Citation:. Zeybekoglu, E., Salman, A., Alp, Ş., Ozzambak, M.E., Wallace, M.Y. 2020. A Study on the Evaluation of Commercial Narcissus Varieties as Potted Ornamental Plants. *Bursa Uludag Üniv. Ziraat Fak. Derg.*, 34(Özel Sayı), s. 327-336.

As a result, in accordance with each cultivar, rather different outcomes were demonstrated; the flowering times were within 48 and 79 days, the flower longevity was between 20 and 44 days. In addition, plant length 24.0 - 64.6 cm, stem lengths varied between 17.75 cm and 54.28 cm, stem diameters were within 0.70 cm and 1.35 cm. The largest flower diameter was measured at 12.1 cm and the highest number of florets counted was 3. All varieties used in the experiment were different from each other in terms of development speed, color, form and general appearance. It was concluded that all varieties used in the research could be evaluated as a potted ornamental plant.

Keywords: Floristic features, Potted ornamental plants, Narcissus.

Ticari Nergis Çeşitlerinin Saksılı Süs Bitkisi Olarak Değerlendirilmesi Üzerine Bir Araştırma

Öz: Araştırma, Ege Üniversitesi Bayındır Meslek Yüksekokulu'nda sera koşullarında saksıda yetiştirilen farklı nergis çeşitlerinin floristik özelliklerini incelemek amacıyla Aralık 2014 – Haziran 2015 tarihleri arasında bir vejetayson döneminde yürütülmüştür. Araştırmada 22 farklı nergis çeşidi (Professor Einstein, Tête-à-Tête, Carlton, Precocious, Furbelow, IceFollies, Strong Gold, Dellan, Carbineer, Tamsyn, Actaea, Golden Harvest, Cheerfulness, SempreAvanti, ScarlettO'Hara, Monal, Tahiti, Fortissimo, Pink Silk, White Lion, Fortune, Salome) incelenmiştir. Çeşitlere ait ilk çiçeklenme başlangıcı, çiçekte kalma süresi, bitki boyu, sap uzunluğu, sap kalınlığı, çiçek çapı ve bir saptaki çiçek sayısı özellikleri değerlendirilmiştir.

Elde edilen verilere göre; çiçeklenme başlangıç süreleri soğanların dikimden 48 - 79 gün sonrası belirlenmiştir. Çiçekte kalma süreleri 20 - 44 gün, bitki boyları 24,0 - 64,6 cm, sap uzunlukları 17,75 - 54,28 cm, çiçek çapları 4,2 - 12,1 cm, sap kalınlıkları 0,7 - 1,35 cm ve saptaki çiçek adedi 1 - 3 adet olarak belirlenmiştir. Denemede kullanılan tüm çeşitler gelişme hızı, renk, form, genel görünüm gibi birçok özellik açısından farklılık göstermiştir. Araştırmada kullanılan tüm çeşitlerin saksılı süs bitkisi olarak değerlendirilmesinin mümkün olacağı sonucuna varılmıştır.

Anahtar Kelimeler: Saksılı Süs Bitkisi, Floristik özellik, Nergis.

Introduction

The genus Narcissus L. belongs to the Monocotyledon family Amaryllidaceae, to which it contributes some 80 species to its total of about 850 species in 60 genera (Meerow and Snijman, 1998). The taxonomy of Narcissus is difficult because of the ease with which hybridization occurs naturally, accompanied by extensive cultivation, breeding, selection, escape and naturalization (Webb, 1980; Kaya, 2014). Narcissus has a mainly Mediterranean

distribution, with a centre of diversity in the Iberian Peninsula, and the genus also occurs in south-western France, northern Africa and eastwards to Greece, while *Narcissus tazetta* is found not only in Spain and North Africa but also in a narrow band to China and Japan (Grey-Wilson and Mathew, 1981).

Turkey has two native and five naturalized species, of which *N. tazetta* is the most notable (Alp et al., 2016). *Narcissus tazetta*, with strongly scented single and double flowers, is well admired throughout the aforementioned geography. It is grown as a cut flower in many places in Turkey (Samsun, Ordu, Izmir, Antalya, and Mersin) due to its characteristic of blooming outdoors in autumn and winter.

With different species and cultivars, bulbous ornamental plants are not only used as cut flowers but also for landscaping and planting in pots (Menguc and Zencirkiran, 1991; Zeybekoglu, 2010). Narcissus species and its cultivars have a range of forms, colors, scents and flowering times, and are prominent among bulbous plants when used with trees, bushes and ground cover plants. Although there has been an effort to increase its usage in Turkey, it cannot be claimed that the improvement is sufficient.

In countries like The Netherlands, Great Britain and Germany where narcissus production is steadier there are many types of *Narcissus pseudonarcissus* with striking trumpet-shaped flowers of many colors, different habitats and a variety of flowering times (Alp et al., 2016). This richness allows for a wide range of options and convenience in applications from every sector (floriculture, pot, landscape).

Turkey's dependence on *N. tazetta* limits the wider use of narcissus in Turkish horticulture. It is the simplest way to import bulbs but not the right approach as species will behave diversely in relation to their environment. Even within the same environment, they may appear different. Determining the developmental and floral characteristics together with the adaptation capacity of these plants in warmer climates and identifying the cultivation techniques is an important measure to be taken before starting commercial production.

Flower and bulb production is strongly determined by agronomic and environmental factors. However, there are not enough studies on plant adaptation (Khan et al., 2013). As an indicator of adaptation and preference, *Narcissus pseudonarcissus* 'Dutch Master' and 'Ice Folies' are the most sought after cultivars in The Netherlands while 'Tête-à-Tête' is the highest-selling narcissus cultivar in the United States (Hanks, 2002). The first two cultivars have a shorter vegetation period when compared to other narcissus allowing them for example, to adapt to different, saline environments (Veatch-Blohm et al., 2013) and increase their usage as pot flowers (Zanjani, 2017). Cantor et al. (2013) indicate through their research in Romania that among cultivars 'Professor Einstein', 'Salome', 'Mount Hood', 'Cum Laude', 'Fortune', 'Golden Harvest' narcissus cultivars 'Salome', 'Golden Harvest' and 'Cum Laude' are most successful in terms of flower quality, quantities and the bulb yield.

Therefore, in this research, the aim is to determine the morphological and phenological characteristics of imported narcissus cultivars in Turkey and to identify the optimum usage for production. With this objective, the study was carried out in the ecological conditions of Bayindir, Izmir where *Narcissus tazetta* production is abundant and the Mediterranean climate is dominant to determine alternative narcissus varieties as a pot plant for similar environments.

Material and Method

The research was carried out over a vegetation period between December 2014 and June 2015 at Ege University, Bayindir Vocational School to investigate the floristic properties of different narcissus varieties grown in pots under greenhouse conditions. 22 different varieties of daffodil (Professor Einstein, Tête-à-Tête, Carlton, Precocious, Furbelow, Ice Follies, Strong Gold, Dellan, Carbineer, Tamsyn, Actaea, Golden Harvest, Cheerfulness, Sempre Avanti, Scarlett O'Hara, Monal, Fortissimo, Pink Silk, White Lion, Fortune, Salome) were examined in terms of sprouting time, flowering longevity, plant height, stem height, stem width, the diameter of flowers and the number of flowers on a stem.

Plant production was carried out in 12 cm pots with 80% peat + 20% perlite growing mixture. Three bulbs were planted in pots and represented by 10 pots of all varieties. The top of the bulbs are planted so that 2 cm remains on the flowerpot. The research was evaluated as a randomized plot design with 3 replications. In order to maintain the pot moisture, irrigation was performed when necessary. In pots where no additional fertilization was added, plant development was accomplished in the greenhouse.

The research criteria were based on the following specifications of the cultivars:

1. First flowering time (when 20 % of the perianth segments were showing color in days)
2. Flowering duration (from tepalcoloring to wilting in days)
3. Flower length (from ground level to the apex of flower in cm)
4. Stem height (from ground level to the base of pedicel in cm)
5. Stem width (in cm)
6. Flower diameter (in cm)
7. Number of flowers on each stem

Statistical analysis was conducted by using TOTEMSTAT Statistical program (Acikgöz et al., 2004). Probabilities equal to or less than 0.05 were considered significant. If, TOTEMSTAT indicated differences between treatments means an LSD test was performed to separate them.

Results

1. First flowering time: The data on the first flowering time of the research carried out under greenhouse conditions are given in Table 1. As it can be seen from an examination of the table, differences were found in terms of flowering start times between the varieties.This period varied from 48 days to 79 days from the bulb planting (29.12.2014) depending on cultivar characteristics. The first flowering was determined in Tête-à-Tête and Monal varieties on 15.02.2015, 48 days after planting bulbs. They were followed by Golden Harvest 53 days after planting and Strong Gold varieties after 54 days. Semper Avanti varieties reached 56 days and Dellan and Carbineer varieties reached 58 days. Among the varieties evaluated, Precocious cultivar reached the latest

flowering period on 18.03.2015, 79 days after bulb planting. In Actea and Cheerfulness varieties, this period was determined as 72 days.

One of the first criteria to be addressed for potted Narcissus varieties is early flowering. Early flowering will shorten the growth period of the plant, the time it will spend in the greenhouse, and economically reduce the growth inputs. In this respect, varieties with an ability to flower within 60 days (Tête-à-Tête, Charton, Ice Folies, Strong Gold, Dellan, Carbineer, Tamysyn, Golden Harvest, Sempre Avanti, Monal, Fortissimo, Fortune) may be the preferred choice for potted daffodil cultivation (Table 1). Özzambak et al. (2019) found in their study that 'Professor Einstein' was the only cultivar to bloom within 60 days while both 'Ice Folies' and 'Golden Harvest' bloomed within 90 days. This may have been due to the impact of environmental conditions and/or bulbs not belonging to the same year.

Table 1: The result of flowering start times of different narcissus varieties

Cultivars	Sowing Date	Flowering Date	First flowering times
Professor Einstein	29.12.2014	07.03.2015	68
Tête-à-Tête	29.12.2014	15.02.2015	48
Carlton	29.12.2014	27.02.2015	60
Precocious	29.12.2014	18.03.2015	79
Furbelow	29.12.2014	09.03.2015	70
Ice Follies	29.12.2014	26.02.2015	59
Strong Gold	29.12.2014	21.02.2015	54
Dellan	29.12.2014	25.02.2015	58
Carbineer	29.12.2014	25.02.2015	58
Tamysyn	29.12.2014	26.02.2015	59
Actaea	29.12.2014	11.03.2015	72
Golden Harvest	29.12.2014	20.02.2015	53
Cheerfulness	29.12.2014	11.03.2015	72
Sempre Avanti	29.12.2014	23.02.2015	56
Scarlett O'Hara	29.12.2014	28.02.2015	61
Monal	29.12.2014	15.02.2015	48
Tahiti	29.12.2014	28.02.2015	61
Fortissimo	29.12.2014	27.02.2015	60
Pink Silk	29.12.2014	07.03.2015	68
White Lion	29.12.2014	09.03.2015	70
Fortune	29.12.2014	27.02.2015	60
Salome	29.12.2014	29.02.2015	62

2. Flowering duration: The values of the end of flowering and flowering duration in different daffodil varieties carried out under greenhouse conditions are given in Table 2. As seen from an examination of the table, there were differences in terms of flowering end dates and flowering duration. Tête-à-Tête variety reached the earliest flowering end date on 14.03.2015. Monal (15.03.2015), Golden Harvest (17.03.2015), Ice Follies, Strong Gold and Dellan (18.03.2015) followed this variety next. The end date of flowering in Precocious variety was recorded on 15.04.2015 while Cheerfulness and Tahiti were recorded on 10.04.2015.

When flowering duration was evaluated; the longest period of 44 days was witnessed in Salome, followed by 41 days in Tahiti and 40 days in Sempre Avanti. Among the cultivars used in the research, the shortest duration of flowering was in Actea at 20 days and Carlton, Dellan and Scarlett O'Hara at 21 days. The duration of the flowering of other varieties used in the experiment remained between these values.

Long-term flowering in Narcissus and other potted ornamental plants is an important parameter which increases the marketing elasticity of the product. The varieties that stand out in terms of this criterion are not early flowering varieties (Tahiti, Salome, Semper Avanti and Cheerfulness). Carbineer has been determined as the cultivar that harbours both characteristics of moderately early blooming (on the 58th day) and a thirty-three-day flowering period. Another study conducted in Bornova stated that the flowering period was shorter, and that flowering was completed within an average of 16.4 days (Özzambak et al., 2019). In this study, it can be stated that the mean period of flowering at 27.7 days was a positive outcome.

Table 2: The result of the flowering duration of different narcissus varieties

Cultivars	Beginning of flowering date	End of Flowering	Flowering duration
Professor Einstein	07.03.2015	30.03.2015	23
Tête-à-Tête	15.02.2015	14.03.2015	27
Carlton	27.02.2015	20.03.2015	21
Precocious	18.03.2015	15.04.2015	28
Furbelow	09.03.2015	07.04.2015	29
Ice Follies	26.02.2015	18.03.2015	20
Strong Gold	21.02.2015	18.03.2015	25
Dellan	25.02.2015	18.03.2015	21
Carbineer	25.02.2015	30.03.2015	33
Tamysyn	26.02.2015	24.03.2015	26
Actaea	11.03.2015	31.03.2015	20
Golden Harvest	20.02.2015	17.03.2015	25
Cheerfulness	11.03.2015	10.04.2015	30
Sempre Avanti	23.02.2015	04.04.2015	40
Scarlett O'Hara	28.02.2015	21.03.2015	21
Monal	15.02.2015	15.03.2015	28
Tahiti	28.02.2015	10.04.2015	41
Fortissimo	27.02.2015	25.03.2015	26
Pink Silk	07.03.2015	02.04.2015	26
White Lion	09.03.2015	08.04.2015	30
Fortune	27.02.2015	24.03.2015	25
Salome	01.03.2015	14.04.2015	44

3. Flower length: Data on the plant length of different daffodil varieties grown in pots under greenhouse conditions is given in Table 3. According to the results of the statistical analysis evaluation, it was seen that the varieties were statistically different in terms of plant length data. The highest value in terms of plant length obtained by measuring the highest point of the plant from the soil surface was measured at 64.63 cm in the Fortune variety followed by the plant length of Fortissimo variety at 63.75 cm and Semper Avanti variety at 62.83 cm. The shortest plant length value was determined in Tête-à-Tête (24 cm) variety. The plant height data of the other cultivars used in the experiment are as indicated in Table 3.

Flower length is one of the most important features of potted Narcissus varieties. The stem must be short and strong for a compact appearance. For this reason, 'Tête-à-Tête' with the shortest flower length has been determined as the most suitable cultivar with an average of 24.0 cm. Professor Einstein (42.0 cm), Ice Folies (50.0 cm), Cheerfulness (53.6 cm), Dellan (53.7 cm) and Tamysyn (56.03 cm) may be chosen as varieties with medium suitability for potted daffodil cultivation. In terms of stem length, Özzambak et al. (2019) identified 'Professor Einstein', 'Ice Folies' and 'Yellow Cheerfulness' as being equally suitable for potting cultivation.

4. Stem height: When the stem height data was examined, the differences between the varieties were statistically significant and the values obtained were reported in Table 3. The longest stem height values of different narcissus varieties used in the study were measured in Tahiti (55.05 cm) and Furbelow (54.28 cm) varieties and they were followed by Fortune (51,75 cm), Carlton (51,60), Precocious (49,10 cm) and Fortissimo (49,00 cm) varieties. Shortest stem height values were measured at 17.75 cm in Tête-à-Tête cultivar. The stem height values of the other cultivars were determined between 32 cm and 49 cm.

The stem height values resembled the flower length values. The shortest stem height value was obtained from the Tête-à-Tête variety, followed by 'Professor Einstein', 'Ice Folies', 'Cheerfulness' and 'Dellan'. A short flower length together with a short stem is eye-catching. Similarly, Özzambak et al. (2019) found 'Professor Einstein' and 'Ice Folies' to be short-stemmed cultivars.

5. Stem width: Although stem width values in different daffodil varieties show similar values, differences were observed in the results of the statistical analysis (Table 3). While the highest value of stem width was measured in Carbineer (1.35 cm) cultivar, Carlton (1.30 cm), Dellan (1.30 cm), Semper Avanti (1.30 cm) and Scarlett O'Hara (1,30 cm), Golden Harvest (1,28 cm) and Pink Silk (1,28 cm) varieties followed in the same statistical group. The lowest stem width values were found in Professor Einstein (0.70 cm) and Tête-à-Tête (0.70 cm) varieties. Tahiti (0.93 cm), Actea (0.93 cm), Ice Follies (0.93 cm) and Precocious (0.88 cm) varieties also fell into the same statistical category. Stem width values of the other varieties evaluated in the study showed a value difference between 0.93 cm and 1.28 cm.

The stem width indicates the robustness of the flower in potted cultivation. In the study, varieties with long flower stalks are shown to have thicker stems, whereas the varieties with short stems tended to have thin stalks. 'Ice Folies' was identified as the only cultivar that features a short and relatively thick stem.

6. Flower diameter: Flower diameter data of the different daffodils used in the experiment are expressed in Table 3. It can be understood from an examination of Table 3, that there are statistical differences between varieties in terms of flower diameter. Among the varieties, the widest flower diameter values are measured in Scarlett O'Hara (12.1 cm), Fortissimo (11.3 cm) and Strong Gold (11.0 cm), while the narrowest flower diameter variety is Tête-à-Tête (4.2 cm) followed by Professor Einstein (9.7 cm). As can be seen in Table 3, flower diameter values of other varieties were measured between 9.7 cm and 11 cm.

In terms of flower size, 'Tête-à-Tête' and 'Professor Einstein' bearing small flowers can be stated as a negative feature of these cultivars. It is obtained from the study that the short cultivars generally have small flowers.

7. The number of flowers on each stem: The nature of narcissus tends towards the plant producing one single flower on each stem. Among the twenty-two cultivars, only two showed otherwise, these being 'Tête-à-Tête' and 'Cheerfulness'. Both varieties showed up to three flower heads on each stem (Table 3).

All varieties used in the experiment differ from each other in terms of many properties such as development speed, color, form and general appearance. Veath – Blohm et al. (2013) and Cantor et al. (2013) found in their research, that cultivars differed in development, flowering and physiological characteristics.

Table 3: The results of flower length, stem height, flower diameter, stem width and number of flowers in a stem

Cultivars	Flower Length	Stem Length	Flower Diameter	Stem Width	The number of flowers on each stem
Professor Einstein	42,00 k	32,00 k	9,7 g	0,70 h	1
Tête-à-Tête	24,00 l	17,75 l	4,2 m	0,70 h	1-2
Carlton	62,55 abc	51,60 b	11,0 bc	1,30 ab	1
Precocious	55,65 efgh	49,10 c	10,1 ef	0,88 g	1
Furbelow	59,25 bcde	54,28 a	8,7 j	1,00 efg	1
Ice Follies	50,15 ij	39,55 i	10,2 def	0,93 g	1
Strong Gold	58,25 cdefg	48,05 cd	11,0 bc	1,10 cde	1
Dellan	53,75 ghi	43,70 gh	10,4 de	1,30 ab	1
Carbineer	59,40 bcde	46,75 de	9,2 hi	1,35 a	1
Tamysyn	56,03 defgh	46,20 ef	8,2 k	1,13 cde	1
Actaea	61,83 abc	46,15 ef	8,8 ij	0,93 g	1
Golden Harvest	59,00 abc	47,80 cd	10,6 cd	1,28 ab	1
Cheerfulness	53,63 hi	45,00 fg	4,9 l	0,95 fg	1-2-3
Sempre Avanti	62,83 abc	51,25 b	10,5 de	1,30 ab	1
Scarlett O'Hara	59,00 cdef	46,25 ef	12,1 a	1,30 ab	1
Monal	59,25 bcde	44,25 g	9,7 g	1,13 cde	1
Tahiti	60,33 abcd	55,05 a	8,8 ij	0,93 g	1
Fortissimo	63,75 ab	49,00 c	11,3 b	1,20 bcd	1
Pink Silk	46,25 jk	34,55 j	9,1 ij	1,28 ab	1
White Lion	54,63 fghi	42,53 h	9,6 gh	1,08 def	1
Fortune	64,63 a	51,75 b	10,4 de	1,20 bcd	1
Salome	53,43 jk	44,00 gh	9,9 fg	1,23 abc	1
LSD (%5)	4,60	1,50	0,44	0,13	
V.K	5,92	2,37	3,32	8,35	

Discussion and Conclusion

The Narcissus cultivars observed in this study are suitable and usable for different purposes. It has been determined that most of the 22 cultivars can be used both as cut flowers and landscape plants. The most prominent variety in terms of potted daffodil cultivation is 'Tête-à-Tête', but besides its good characteristics in

terms of early short stem and number of flowers in one stem, negativities such as small flowers and shortness of flower stalks should be mentioned.

The 'Professor Einstein' and 'Ice Folies' cultivars, with large showy flowers, relatively short-thick stems, could be evaluated as a pot daffodil. Similarly, Özzambak et al. (2019) indicate that together with these cultivars, 'the Strong Gold' and 'Dutch Master' are also suitable for pot growing. The reason for not choosing 'Strong Gold' and 'Dutch Master' as potted varieties was due to this research being conducted in a different ecology without exposing the bulbs to pre-application in the manner of Özzambak et al. (2019). Therefore, in future studies, preparation techniques applied to bulbs through programming as indicated by Acarsoy and Özzambak (2006) will provide a more compact plant. It is suggested that in addition to applying plant growth regulators, it is necessary to focus on the natural varieties and hybridization to develop domestic cultivars and prevent foreign dependency.

Acknowledgments

This study does not require ethics committee permission. The article has been prepared in accordance with research and publication ethics. The authors contributed jointly to the study and there were no conflicts of interest among the authors.

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