

Alternatif Kokulu Nergis Çeşitlerinin Bayındır Ekolojik Koşullarındaki Floristik Özellikleri ve Soğan Veriminin Belirlenmesi

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ÖZ

Bu araştırma, 2021-2023 yılları arasında Ege Üniversitesi Bayındır Meslek Yüksekokulu deneme tarlalarında yürütülmüştür. Çalışmada, 13 farklı kokulu nergis çeşidinin Bayındır bölgesine adaptasyonu incelenmiştir. Tesadüf parselleri deneme desenine göre düzenlenen çalışmada, her parselde 50 adet soğan dikilmiştir. Fenolojik gelişim evreleri, floristik özellikleri ile soğan verimi parametreleri değerlendirilmiştir. Elde edilen bulgular, çeşitler arasında önemli varyasyonlar olduğunu ortaya koymuştur. ‘Grand Soleil d’Or’, her iki yetiştirme sezonunda da en erken çıkış yapan ve çiçeklenen çeşit olmuştur. Bu çeşit en uzun çiçeklenme süresine sahip olurken, ‘Minnow’ ve ‘White Cheerfulness’ en kısa çiçeklenme periyodu göstermiştir. ‘Babymoon’ ve ‘Cornish Dawn’ en yüksek toplam çiçek sayısını verirken, ‘Tripartite’ bu en düşük değeri sergilemiştir. Çiçek karakterizasyonunda, ‘Avalanche’ bir çiçekteki en yüksek kandel sayısına, ‘Rosemoor Gold’ ise en büyük çiçek çapına sahip olmuştur. Çiçek boyu ve sap kalınlığı bakımından ‘Geranium’, ‘Grand Soleil d’Or’ ve ‘Cornish Dawn’ öne çıkmıştır. Soğan verimi değerlendirmesinde ‘Avalanche’ en yüksek performansı gösterirken, ‘Tripartite’, ‘White Cheerfulness’, ‘Hillstar’, ‘Quail’, ‘Babymoon’ ve ‘Minnow’ düşük verim sergilemiştir. Soğan sayısı analizinde, ‘Tripartite’ en yüksek sonucu vermiş fakat tüm soğanlar küçük kalmıştır. Bu sonuçlar ışığında, Bayındır yöresinde hem kesme çiçek hem de soğan yetiştiriciliği için özellikle ‘Cornish Dawn’, ‘Garden Opera’ çeşitleri önerilmektedir. ‘Babymoon’ çeşidi, yüksek çiçek sayısı nedeniyle peyzaj alan tasarımlarında ve saksılı süs bitkisi olarak değerlendirilme potansiyeline sahiptir.

Anahtar Kelimeler: Nergis, floristik özellikler, soğan verimi

Determination of Floristic Characteristics and Bulb Yield of Alternative Fragrant Narcissus Varieties under Bayındır Ecological Conditions

ABSTRACT

This research was conducted in the trial fields of Ege University Bayındır Vocational Training School from 2021 to 2023. The study investigated the adaptation of 13 different fragrant daffodil cultivars to the Bayındır region. Fifty bulbs were planted in each plot using a randomized plot experimental design. Phenological developmental stages, floristic characteristics, and bulb yield parameters were evaluated. The findings revealed significant variations among the cultivars. ‘Grand Soleil d’Or’ was the earliest emerging and flowering variety in both growing seasons. This cultivar also had the longest flowering period, while ‘Minnow’ and ‘White Cheerfulness’ exhibited the shortest. ‘Babymoon’ and ‘Cornish Dawn’ produced the highest number of flowers, while ‘Tripartite’ showed the lowest. In floral characterization, ‘Avalanche’ had the highest number of florets per stem, and ‘Rosemoor Gold’ had the largest flower diameter. ‘Geranium’, ‘Grand Soleil d’Or’, and ‘Cornish Dawn’ excelled in flower length and stem thickness. ‘Avalanche’ showed the highest performance in bulb yield, while ‘Tripartite’, ‘White Cheerfulness’, ‘Hillstar’, ‘Quail’, ‘Babymoon’, and ‘Minnow’ had low yields. In bulb number analysis, ‘Tripartite’ produced the highest count, though all bulbs remained small. Based on these results, ‘Cornish Dawn’ and ‘Garden Opera’ are recommended for both cut flower and bulb cultivation in the Bayındır region. The ‘Babymoon’ cultivar has potential for use in landscaping and as a potted ornamental plant due to its high flower count.

Keywords: Narcissus, floristic characteristics, bulb yield

INTRODUCTION

Narcissus, often recognized for its captivating aesthetic and aromatic properties, represents a significant genus within the Amaryllidaceae family,

comprising approximately 85 genera and 1100 species globally [1]. Narcissus, as they are commonly known, exhibit a wide distribution from Western Europe to East Asia, with the Iberian Peninsula serving as their centre of diversity. While Türkiye is

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home to several native and naturalized *Narcissus* species, the commercial cultivation of *Narcissus* in the country has largely been limited to *Narcissus tazetta* subsp. *tazetta*. This subspecies is well-known for its strongly fragrant flowers and ability to bloom outdoors during autumn and winter, making it a popular choice for cut flower production in various regions of Türkiye, including Samsun, Ordu, Izmir, Antalya, and Mersin [2].

Türkiye, with its diverse climatic and ecological conditions, possesses substantial potential for ornamental plant production, particularly bulbous plants like *Narcissus*. However, the reliance on a single subspecies has restricted the wider application of *Narcissus* in Turkish horticulture [3]. In contrast, countries with established *Narcissus* industries, such as the Netherlands, the United Kingdom, and Germany, cultivate a diverse array of *Narcissus* species, including trumpet, large-cup, small-cup, and double *Narcissus* cultivars. This diversity offers a broad spectrum of options for various horticultural applications, including cut flower production, potted plant cultivation, and landscape design [4].

In Bayındır, *Narcissus tazetta* subsp. *tazetta* has long been the predominant cultivar, prized for its aromatic flowers and winter-blooming characteristics. However, the increasing demand for extended flowering seasons and diverse floral displays necessitates the introduction of new cultivars that can provide market availability beyond the traditional flowering window of *N.tazetta* subsp. *tazetta*. The evaluation of alternative *Narcissus* cultivars is essential for diversifying the local floriculture industry. By introducing and adapting new cultivars to the Bayındır district, there is potential to extend the flowering season, enhance product diversity, and improve the region's competitiveness in both domestic and international cut flower markets.

Adaptation studies are crucial in identifying suitable cultivars for specific regions, as plant performance can vary considerably based on environmental conditions [5]. Such studies not only contribute to the development of local production but also promoting sustainable horticultural practices [6].

The importance of bulb yield in *Narcissus* cultivation cannot be overstated, as it directly influences the potential for successive flowering cycles. Bulbs serve as the primary propagation material, and their yield and size are critical determinants of commercial viability [4]. Prior studies have demonstrated that the vegetative and reproductive success of *Narcissus* is closely linked to the quality and management of bulbs [7]. Therefore, evaluating new cultivars for their bulb yield and size

under the specific agronomic conditions of Bayındır becomes essential for optimizing production practices.

The present study aims to evaluate the adaptation of 13 *Narcissus* cultivars new to the Bayındır district of Türkiye, focusing on their floristic performances, bulb yields, and sizes. By examining these cultivars' growth characteristics, flowering patterns, and bulb production under the specific environmental conditions of Bayındır, this research seeks to provide valuable information for local growers, horticulturists, and landscape designers. The introduction of these cultivars may potentially extend the flowering period beyond that of *N.tazetta* subsp. *tazetta*, thereby addressing the market demand for a more prolonged availability of *Narcissus* flowers and strengthening the district's position in the cut flower industry.

The objectives of this study were to: (1) assess the adaptation of 13 *Narcissus* cultivars to the Bayındır district's environmental conditions, (2) evaluate their floristic performances, including stem characteristics, and flower attributes, (3) determine bulb yield and size distributions for each cultivar, (4), identify cultivars with flowering periods that complement or extend beyond that of *N.tazetta* subsp. *tazetta*.

MATERIAL AND METHODS

Material

The research was conducted at Ege University Bayındır Vocational School in Bayındır district, Türkiye. The area has a typical Mediterranean climate characterized by mild, wet winters and hot, dry summers. The soil was classified as loamy sand with alluvial characteristics, comprising 79.1% sand, 19.1% silt, and 1.8% clay. Thirteen fragrant *Narcissus* cultivars were studied. Variety name, division and bulb diameter are given in Table 1. The experiment employed a randomized block design with three replications. Each plot was 50 cm × 100 cm in size and contained 50 bulbs.

Methods

Bulbs were first weighted and planted in December 2021 and harvested in July 2023. Fertilization was carried out in three stages. First, 50 g/m² ammonium sulphate fertilizer was applied when the first leaves emerged. Next, 10 g/m² calcium nitrate was added when the first flower stem began growing. Finally, 20 g/m² potassium nitrate was applied at the end of flowering.

Several parameters were measured throughout the study. Total flower count was determined by counting all flower stems at the end of flowering. Florets per

stem were counted on five randomly selected stems in each plot. Flower height and diameter were measured after one floret bloomed on five random plants, with length recorded in centimeters and diameter in millimeters. Flower diameter was measured on five random flowers in millimeters when perianth segments reached full expansion. The flowering period was quantified in weeks, measured from the initial week of flower emergence within each plot until the week when all flowers had completely wilted.

Table 1. Classification, bulb size diameters and average bulb weight of thirteen *Narcissus* cultivars used in the study

No	Variety	Division	Bulb diameter (cm)	Average bulb weight per plot (g)
1	Avalanche	<i>Tazetta</i>	13-15	2019,0
2	Baby Moon	<i>Jonquilla</i>	8-10	361,3
3	Beautiful Eyes	<i>Jonquilla</i>	10-12	1112,0
4	Cornish Dawn	<i>Tazetta</i>	10-12	1062,0
5	Garden Opera	<i>Jonquilla</i>	12-14	1523,0
6	Geranium	<i>Tazetta</i>	14-16	2053,0
7	Grand Soleil d'Or	<i>Tazetta</i>	13-14	2180,0
8	Hillstar	<i>Jonquilla</i>	10-12	1011,0
9	Minnow	<i>Tazetta</i>	10-12	868,0
10	Quail	<i>Jonquilla</i>	10-12	957,0
11	Rosemoor gold	<i>Jonquilla</i>	10-12	1291,0
12	Tripartite	<i>Split corona</i>	12-14	1234,0
13	White cheerfulness	<i>Double daffodil</i>	12-14	1091,0

At the end of the research, bulbs were harvested, washed, and left to dry. Bulb yield was determined by weighing the dried bulbs. Bulb sizes were then calibrated into categories of <8, 8-10, 10-12, 12-14, and >14 cm. The bulb performance parameters evaluated were: relative bulb yield increase (percentage change from planted to harvested weight)

and size distribution of harvested bulbs based on diameter measurements.

Data analysis was conducted using GraphPad Prism 10 software. An analysis of variance (ANOVA) was employed to evaluate differences among cultivars. To identify significant differences between means, Tukey's Honest Significant Difference (HSD) post-hoc test was applied.

RESULTS

Floristic and bulb characteristic results are presented in Table 2-a, mean bulb size distribution is given in Table 3.

Shoot Emergence Date and Count

In the first year, 'Grand Soleil d'Or' emerged earliest (December 27), while 'Tripartite' emerged last (February 15). In the second year, 'Grand Soleil d'Or' and 'Babymoon' emerged earliest (November 2), with 'White Cheerfulness' emerging last (January 25). Out of 50 planted bulbs per plot, 'Tripartite' had the highest shoot emergence date in the first year (45.0), while 'Babymoon' had the lowest (37.0). Second year 'Beautiful Eyes' had 56 emergences and 'Babymoon' had 29 (Figure 1).

Flowering Duration

'Grand Soleil d'Or' demonstrated the longest flowering duration, lasting 7 weeks in the first year and 8 weeks in the second year (Figure 1). 'Quail' maintained a consistent 6-week flowering duration in both years. 'Minnow' and 'White Cheerfulness' exhibited the shortest flowering duration, lasting only 3 weeks in both years.

Table 2. Analysis results of total flower count, florets per stem, flower height and stem diameter of 13 *Narcissus* cultivar

	Total Stem Count		Florets per Stem		Flower Height (cm)		Flower Diameter (mm)		Stem Diameter (mm)	
	1y	2y	1y	2y	1y	2y	1y	2y	1y	2y
Avalanche	34,3 ef	37,0 g	5,4 a	9,8 a	35,2 e	41,0 cd	37,1 f	40,9 f	8,50 cd	9,02 bd
Baby Moon	44,3 de	192,0 a	2,9 cd	3,4 de	21,9 f	43,3 cd	27,5 g	31,0 g	4,29 g	3,59 g
Beautiful Eyes	61,7 cd	100,3 c	2,1 e	2,5 f	48,6 bc	50,3 ab	55,9 d	53,1 d	8,27 cd	9,53 b
Cornish Dawn	75,7 bc	172,0 a	2,2 e	1,7 gh	54,9 a	55,1 a	60,3 bc	60,9 b	8,79 cd	7,69 e
Garden Opera	95,7 a	147,0 b	3,1 c	2,5 fg	42,8 d	46,5 bc	58,5 cd	60,5 b	9,80 ab	9,42 bc
Geranium	66,3 c	61,3 ef	4,7 b	3,7 d	45,3 cd	56,5 a	63,0 b	56,5 cd	10,61 a	9,35 bc
Grand Soleil d'Or	35,3 ef	40,0 fg	4,4 b	6,4 b	44,7 cd	56,1 a	49,5 e	43,7 ef	8,42 cd	10,48 a
Hillstar	67,3 c	74,7 de	2,5 de	2,9 ef	34,0 e	38,3 de	63,4 b	59,7 bc	7,31 e	6,18 f
Minnow	86,7 ab	42,7 fg	2,8 cd	4,9 c	24,1 f	32,1 e	29,5 g	30,0 g	4,77 fg	5,76 f
Quail	64,0 c	141,7 b	2,4 de	2,7 ef	41,8 d	45,4 bc	61,6 bc	59,7 bc	7,97 de	8,34 de
Rosemoor Gold	66,3 c	95,0 cd	1,4 f	1,3 h	51,2 ab	55,9 a	78,2 a	75,9 a	8,70 cd	8,55 d
Tripartite	20,3 f	0,0 h	1,3 f	0,0 i	32,4 e	0,0 f	51,5 e	0,0 h	5,30 f	0,00 h
White Cheerfulness	27,3 ef	27,3 g	3,1 c	2,9 ef	43,3 d	46,9 bc	47,9 e	46,6 e	8,90 bc	8,64 cd

Different letters within a column indicate statistically significant differences among means ($p < 0.05$), as determined by Tukey's Honest Significant Difference (HSD) test

Total Flower Count

Significant differences were observed among cultivars (Year 1: $p < 0.001$; Year 2: $p < 0.001$).

'Garden Opera' produced the most stems in the first year (95.67), while 'Babymoon' showed a dramatic increase from 44.33 to 192.00 stems in the second

year and produced the highest number of stems with ‘Cornish Dawn’ (172). ‘Tripartite’ had the least number of stems in both years (20.33 and 0.00) (Table 2).

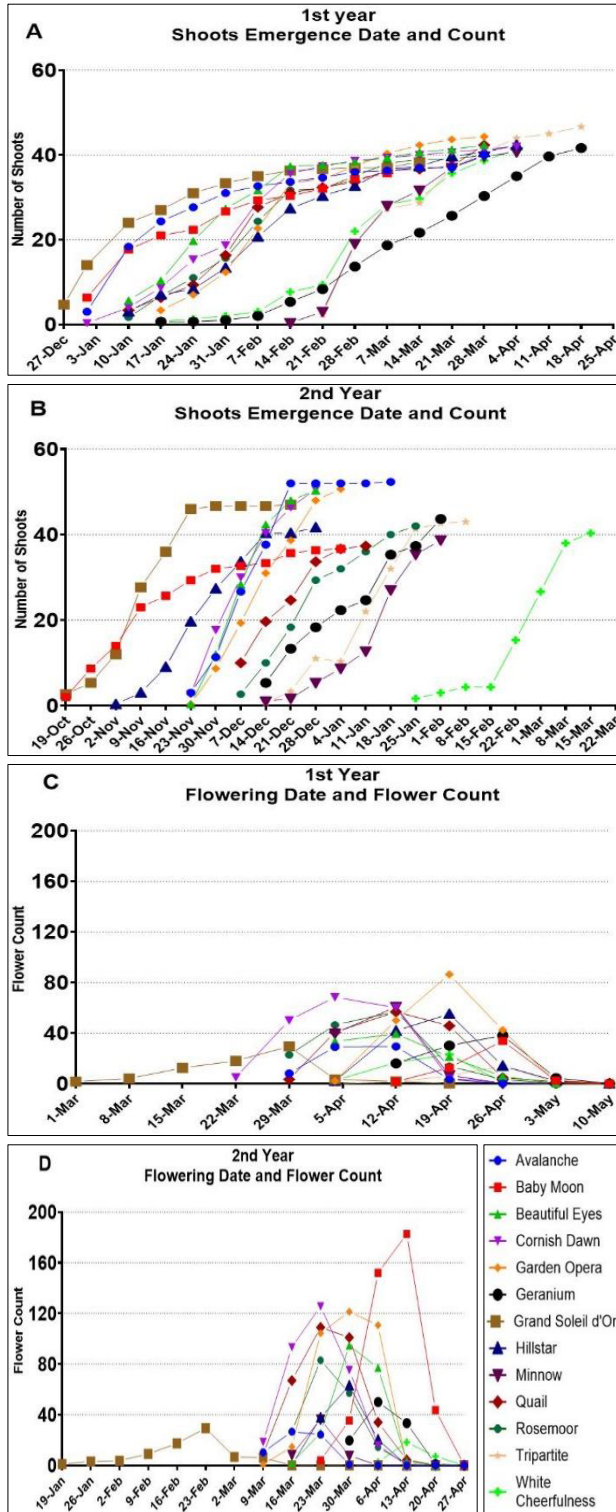


Figure 1. Shoot emergence count and date in the first (A) and second year (B) and flowering time and flower count in the first (C) and second year (D) for 13 Narcissus cultivars

Florets Per Stem

Significant differences were observed among cultivars in both years (Year 1: $p < 0.001$; Year 2: $p < 0.001$). ‘Avalanche’ produced the highest number of florets per stem, increasing from 5.40 in the first year to 9.80 in the second year. ‘Tripartite’ showed the poorest performance, with 1.33 florets in the first year and no flowering in the second year. ‘Grand Soleil d’Or’ (4.40 and 6.40) consistently produced high floret numbers in both years (Table 2).

Flower Height (cm)

Significant variations were observed (Year 1: $p < 0.001$; Year 2: $p < 0.001$). In the first year, ‘Cornish Dawn’ had the longest flowers (54.93 cm), with ‘Babymoon’ the shortest (21.93 cm). The second-year saw ‘Geranium’ (56.47 cm), ‘Grand Soleil d’Or’ (56.13 cm), ‘Rosemoor Gold’ (55.93 cm) and ‘Cornish Dawn’ (55.07 cm) produce the longest flowers, while ‘Minnow’ had the shortest (32.13 cm) among productive cultivars (Table 2).

Stem Diameter (mm)

Stem diameter varied significantly (Year 1: $p < 0.001$; Year 2: $p < 0.001$). ‘Geranium’ had the thickest stems in the first year (10.61 mm), while ‘Grand Soleil d’Or’ had the thickest in the second year (10.42 mm). ‘Babymoon’ consistently had the thinnest stems (4.29 mm and 3.59 mm in years 1 and 2, respectively) (Table 2).

Flower Diameter (mm)

Flower diameter showed significant variations (Year 1: $p < 0.001$; Year 2: $p < 0.001$). ‘Rosemoor Gold’ consistently produced the largest flowers (78.20 mm and 75.93 mm in years 1 and 2). ‘Babymoon’ and ‘Minnow’ had the smallest flowers (27.53 and 30.00; 29.53 and 31.00 cm in years 1 and 2, respectively) (Table 2).

Bulb Yield Increase (%)

Bulb yields increase varied significantly ($p < 0.001$). ‘Beautiful Eyes’ and ‘Rosemoor Gold’ showed the highest increase (106% and 94%, respectively), while ‘Tripartite’ and ‘White Cheerfulness’ had the lowest (-60% and -58%, respectively) (Figure 2).

Total Bulb Count and Distribution of Harvested Bulb Counts by Diameter

The number of harvested bulbs varied significantly ($p = 0.006$). ‘Tripartite’ produced the highest number of bulbs (344.33), while ‘Quail’ produced the least (62.67) (Table 3).

The distribution of bulb diameters showed apparent variations among thirteen *Narcissus* cultivars, though no statistical analysis was performed on this dataset. Based on the observed values, small-sized bulbs (<8 cm) were predominantly produced by Tripartite (343.7), Minnow (162.7), and Baby Moon (97.3). In contrast, cultivars such as Avalanche, Beautiful Eyes, and Grand Soleil d'Or appeared to favor larger bulb production (>14 cm), each yielding approximately 31 bulbs in this size category.

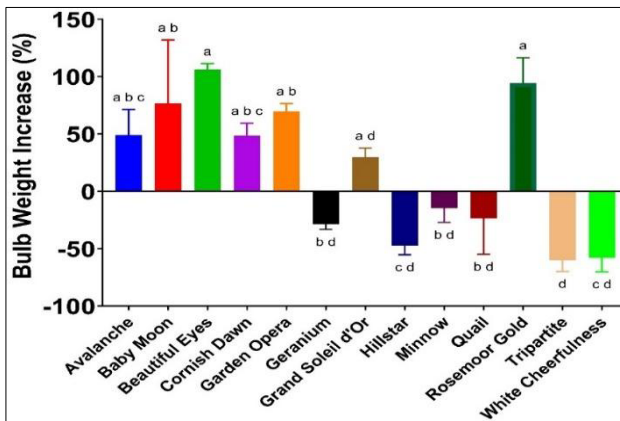


Figure 2. Analysis results of percentage increase in bulb yield among thirteen *Narcissus* cultivars. Different letters indicate statistically significant differences among means ($p < 0.05$), as determined by Tukey's Honest Significant Difference (HSD) test

Table 3. Distribution of harvested bulb counts by diameter; total bulb counts and yield for 13 *Narcissus* cultivars

Cultivars	Bulb Diameter (cm)						Average Yield (g)
	<8	8-10	10-12	12-14	14<	Total	
Avalanche	3,0	11,3	11,0	19,0	31,3	75,7	2768,0
Baby moon	97,3	27,7	9,7	2,0	1,7	138,3	576,5
Beautiful eyes	7,7	14,0	11,7	10,0	30,3	73,7	2009,0
Cornish dawn	19,3	19,0	15,7	24,7	19,7	98,3	1380,0
Garden opera	28,3	36,0	23,3	28,3	26,3	142,3	2340,0
Geranium	34,7	29,0	15,3	10,7	14,3	104,0	1271,0
Grand Soleil d'Or	8,7	10,3	11,3	22,3	31,3	84,0	2570,0
Hillstar	54,7	13,7	7,3	4,0	1,7	81,3	443,0
Minnow	162,7	20,3	1,7	0,0	0,3	185,0	628,3
Quail	28,3	11,7	10,3	6,3	6,0	62,7	473,8
Rosemoor gold	3,0	6,7	14,7	19,0	27,3	70,7	2077,0
Tripartite	343,7	0,7	0,0	0,0	0,0	344,3	381,4
White cheerfulness	60,7	10,3	9,3	5,0	1,7	87,0	397,8

DISCUSSION

The results reveal significant variations in performance among the 13 *Narcissus* cultivars, indicating differential adaptation to local environmental conditions in the Bayındır district.

Floral Characteristics

The outstanding performance of 'Avalanche' in terms of florets per stem, particularly its improvement from the first to the second year (5.40 to 9.80), initially suggests excellent adaptation to local conditions. However, this cultivar's potential for commercial cut flower production is significantly mitigated by its low total flower production. The discrepancy between high floret count per stem and low overall flower yield indicates that 'Avalanche' may not be economically viable for large-scale cultivation in this region. Conversely, the poor performance of 'Tripartite', particularly its failure to flower in the second year, indicates its unsuitability for the local climate.

The variations in flower height and diameter among cultivars and between years highlight the influence of both genetic factors and environmental conditions on these traits. The longer and thicker stems of 'Geranium', 'Grand Soleil d'Or', 'Cornish Dawn' and 'Garden Opera' make them particularly suitable for cut flower production, where stem strength is crucial [8]. Flower height and stem diameter are crucial factors for cut flower production. The minimum flower height for cut flowers and the stem diameter should be sufficient to maintain an upward flower position in vases [9]. Based on these criteria, 'Babymoon' and 'Minnow' are not suitable for cut flower production due to their short and thin stems. Even though the 'Babymoon' cultivar showed an increase in flower length during its second year of cultivation, the stem diameter remained small. However, their high flower counts make them potential candidates for use as landscaping and as a potted ornamental plant in ornamental parks and landscaped areas. Between these two cultivars, 'Babymoon' demonstrates a longer flowering period (4-5 weeks) compared to 'Minnow' (3 weeks), making it a more suitable choice for ground cover applications in the Bayındır district. This versatility in cultivar use highlights the importance of considering multiple factors when selecting daffodil varieties for different horticultural applications.

Increase in total flower production by 'Babymoon', 'Beautiful Eyes', 'Cornish Dawn', 'Garden Opera', 'Quail' and 'Rosemoor Gold' from the first to the second year is particularly interesting. This might be attributed to a vernalization effect, where the bulbs require a period of cold exposure to optimize their performance [10]. This suggests that these cultivars may require an adaptation period to reach its full potential in the local conditions.

The native *Narcissus* cultivar, currently grown under ecological conditions in Bayındır, has a flowering period that extends until February. The

consistent high flower production of ‘Cornish Dawn’, especially in the second year, suggests this cultivar as reliable choice for growers in the region. Additionally, the ‘Garden Opera’ and ‘Quail’ cultivars show promise as potential alternatives, exhibiting similar flowering periods and high flower yields. Six weeks long flowering in the second year makes these cultivars an excellent choice for extending the market-available flowering period from the first week of March to the second week of April and potentially increasing market availability. ‘Grand Soleil d’Or’, with its flowering period from the second week of January to the first week of March, could potentially fill the gap between the local cultivar and the aforementioned cultivars. However, its low total flower production should render this option economically unfeasible.

Bulb Yield and Production

The differential bulb weight increases observed among fragrant *Narcissus* cultivars under Bayındır ecological conditions reflect complex interactions between genotype and local environmental factors. The outstanding performance of ‘Beautiful Eyes’ is particularly noteworthy, as this cultivar belongs to the *Jonquilla* division, which typically demonstrates good adaptation to Mediterranean climate conditions due to their Spanish and Portuguese origins. The moderate performance of ‘Geranium’, ‘Grand Soleil d’Or’ and ‘Minnow’, in *Tazetta* divisions, which is historically grown in Mediterranean regions, suggests that even traditionally adapted divisions may show variable responses under specific local conditions. This highlights the importance of cultivar-specific growth patterns and adaptation to local conditions in bulb production [11]. When examining the bulb weight increase, we observe a decrease in ‘Geranium’, ‘Hillstar’, ‘Minnow’, ‘Quail’, ‘Tripartite’, and ‘White Cheerfulness’ cultivars. This decline in bulb weight may indicate that these cultivars are not only poorly adapted but also potentially less resilient to the environmental stresses specific to the Bayındır region such as summer heat and low precipitation. The consistent reduction in bulb weight across these cultivars could result in diminished long-term productivity and economic viability.

The observed bulb weight changes should be evaluated within the context of our two-year cultivation period, although commercial *Narcissus* bulb production typically spans 2 growing seasons in which depend on the target market and cultivar characteristics [4]. The substantial weight increases in *Beautiful Eyes*, *Garden Opera*, and *Baby Moon* reflect successful adaptation over two seasons, while

the decreases in *White Cheerfulness* and *Tripartite* suggest these cultivars may require longer establishment periods or different growing conditions for optimal bulb development. This two-year cultivation period provided sufficient time to assess initial adaptation patterns, considering the biennial nature of flower bud formation in *Narcissus*, though responses might vary under different cultivation durations.

The ‘Tripartite’ cultivar produced the highest number of bulbs; however, the bulb sizes remained below 8 cm. Furthermore, as it failed to produce any flowers, this cultivar is not suitable for any production purposes. Similarly, the ‘Minnow’ cultivar exhibited a high bulb count with small bulb sizes and produced fewer flowers in second year. In contrast, the ‘Garden Opera’ and ‘Cornish Dawn’ cultivars demonstrated the highest performance in terms of both bulb quantity and flower production. These cultivars are recommended due to their favorable results for both bulb and flower production objectives. The case of ‘Tripartite’-producing the highest total bulb count but failing to produce enlarged bulbs-illustrates a trade-off between bulb quantity and size. This trade-off is a common phenomenon in geophytes and can be influenced by various environmental and genetic factors [12].

The distribution of harvested bulb sizes among the 13 *Narcissus* cultivars reveals critical insights for cut flower production. Larger bulbs are associated with taller flowers and thicker stems, essential attributes for cut flower production. Cultivars like ‘Garden Opera’ and ‘Cornish Dawn,’ which had a significant proportion of larger bulbs, also demonstrated superior flower height and stem diameter, reinforcing their suitability for commercial cultivation. In contrast, cultivars like ‘Minnow’ and ‘Tripartite,’ which predominantly produced smaller bulbs, showed lower performance in flower height and stem thickness, limiting their viability for high-quality cut flower production.

CONCLUSION

This two-year study of 13 daffodil cultivars in the Bayındır district revealed significant variations in performance, providing insights for Mediterranean climates. Findings from this study suggest that the ‘Cornish Dawn’ cultivar can be recommended to extend the market-available flowering period. Additionally, the ‘Garden Opera’ and ‘Quail’ cultivars show promise as potential alternatives, exhibiting similar flowering periods and high flower yields. ‘Beautiful Eyes’, ‘Avalanche’, ‘Grand Soleil d’Or’ ‘Garden Opera’ excelled in bulb production,

suggesting their suitability for sustainable cultivation. ‘Babymoon’, while unsuitable for cut flowers, showed promise as landscaping and as a potted ornamental plant. ‘Tripartite’ displayed poor adaptation. ‘Garden Opera’ and ‘Cornish Dawn’ is suitable for both floriculture and bulb production. These findings provide a foundation for knowledge-based decision making in *Narcissus* cultivation, offering opportunities to extend the flowering season and diversify product offerings. Future research should focus on long-term adaptation, environmental factors, and climate change scenarios to further optimize *Narcissus* production in the region.

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KAYNAKLAR

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