Effect of Genotype × Season Interaction on Yield and Quality Traits in Hybrid and Standard Summer Squash (*Cucurbita pepo* L.) Cultivars

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ABSTRACT

Background: Climate change has become a crucial factor affecting the timing and success of vegetable cultivation, especially in regions like the eastern Mediterranean where temperature and precipitation patterns are shifting. Summer squash (*Cucurbita pepo* L.), typically grown in warm seasons, is an important export crop in the Mersin province of Turkey. However, few studies have examined its performance under different seasonal conditions.

Methods: This study aimed to compare the yield and fruit quality traits of five hybrid (Alba F1, Amelthee F1, Hadra F1, Hürrem F1, Vildan F1) and five standard [Pelin, Nazlı (S), Black Squash Elite, Eskenderany, White Bush] summer squash cultivars grown in spring and autumn. The experiment was conducted under open-field conditions in Tarsus, Mersin in 2022 using a randomized plot design. Key yield parameters (fruit weight, fruit length, fruit diameter, number of fruits per plant, total yield) and quality traits (fruit flesh hardness, water-soluble dry matter, fresh and dry fruit weights) were evaluated using two-way ANOVA.

Result: Spring cultivation produced significantly higher yields (2595.12 g/plant) than autumn (635.51 g/plant), due to more favorable environmental conditions. 'Vildan F1' had the highest yield in both seasons, while 'Hadra F1' and 'Pelin' were notable for fruit firmness and size. Although spring cultivation remains advantageous, autumn conditions increased dry matter content, suggesting potential benefits under future warming. These findings underline the importance of cultivar selection and seasonal planning for sustainable squash production and export continuity amid climate change.

Key words: *Cucurbita pepo* L., Cultivation seasons, Quality, Yield.

INTRODUCTION

Squash (*Cucurbita pepo* L.), a polymorphic member of the Cucurbitaceae family, is widely cultivated as a summer vegetable under tropical and subtropical climates (Dunsin *et al*., 2019; Gülşen *et al*., 2022; Tartoura *et al*., 2014). Turkey, ranking eighth globally, produces squash both in open fields and under low tunnels, with greenhouse cultivation concentrated in the Mediterranean and Aegean regions (Nacar, 2022). With a short growth cycle (45-60 days), squash is primarily grown in spring and summer, though high summer temperatures often reduce yield and affect fruit color (Massolo *et al*., 2019). Valued for its low calorie content, high fiber and nutritional benefits, summer squash also holds medicinal potential (Nada and Metwaly, 2020). Global production reached 24.2 million tons in 2023, led by China, India and Ukraine (FAO, 2025). Turkey's production rose from 547,208 tons in 2020 to 615,000 tons in 2023 (TUIK, 2025). Exports also grew steadily, with Mersin serving as a major hub for markets such as Russia and the Middle East (Anonymous, 2022). Sustainable agricultural practices are increasingly vital in the face of climate change, resource depletion and environmental pressures. In vegetable production, balancing productivity with ecological responsibility is essential for long-term sustainability (Jamil *et al*., 2021). Research highlights that aligning cultivar selection and planting time with local agroclimatic conditions significantly boosts yield and stress tolerance (Bannayan *et al*., 2011; Khanum *et al*., 2021). According to the World Bank (n.d.), climate projections indicate a 2-3°C temperature rise in Mersin by 2040 and up to 4°C by 2070, suggesting that autumn may become a more suitable season for squash cultivation. Therefore, evaluating hybrids and standard cultivars across different seasons in terms of yield and fruit quality is increasingly important.

The integration of agricultural products into global markets is a key aspect of sustainability. For major producers like Turkey, maintaining stable quality and yield in export crops is essential for trade continuity. Extending the growing season of exportable vegetables such as squash can strengthen supply chain sustainability.

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Mersin stands out in Turkey for both squash cultivation and export. While production mainly occurs in spring, summer and autumn cultivation is also feasible (Okasha *et al*., 2020). As a warm-season crop, squash can be grown year-round if harvested immaturely (Abou El-Salehein *et al*., 2019). Despite its wide cultivation in Turkey, research on seasonal performance is limited.

Expanding squash production into autumn may support export sustainability in Mersin. This study compares spring and autumn cultivation periods for hybrid and standard cultivars, focusing on yield and fruit quality. Expanding squash production into autumn may support export sustainability in Mersin. This study compares spring and autumn cultivation periods for hybrid and standard cultivars, focusing on yield and fruit quality.

MATERIALS AND METHODS

Experiment location

This study was conducted in Tarsus, located on the eastern Mediterranean coast of Turkey (36°49′20.8″N, 34°53′9.1″E; 5/ m a.s.l.), during the spring and autumn of 2022. The region has a typical Mediterranean climate with hot, dry summers and mild, wet winters. Based on 30-year data, the annual average temperature is 20-21°C, with summer temperatures often exceeding 30°C and winter temperatures rarely falling below 10°C (MGM, 2022). Annual precipitation is 600-700 mm, mostly occurring in winter and spring. Fig 2 shows variations in temperature and weather conditions, providing environmental context for the study.

Mersin's low elevation and coastal location provide high humidity year-round, supporting an extended growing season for warm-season vegetables. Rising regional temperatures may enhance year-round production capacity (Bağçaci *et al*., 2021). Spring offers favorable conditions with higher temperatures and lower rainfall. Increasing autumn temperatures due to climate change may also allow for second-crop cultivation. Climate data for spring and autumn 2022 were obtained from the Turkish State Meteorological Service (MGM) and are shown in Fig 3.

Table 1: Trial area soil analysis results and evaluation (RTMA, 2022).

Soil properties	Analysis results	Analysis evaluation
Depth (cm)	0-30	-
pH	8.01	Light alkali
EC (dS/m) (salinity)	0.547	Salt free
Lime (%)	31.91	Too much lime
Organic material (%)	1.07	little
Potassium (K_2O_5) (kg/da)	110.31	Sufficient
Phosphorus (P_2O_5) (kg/da)	22.5	Too much

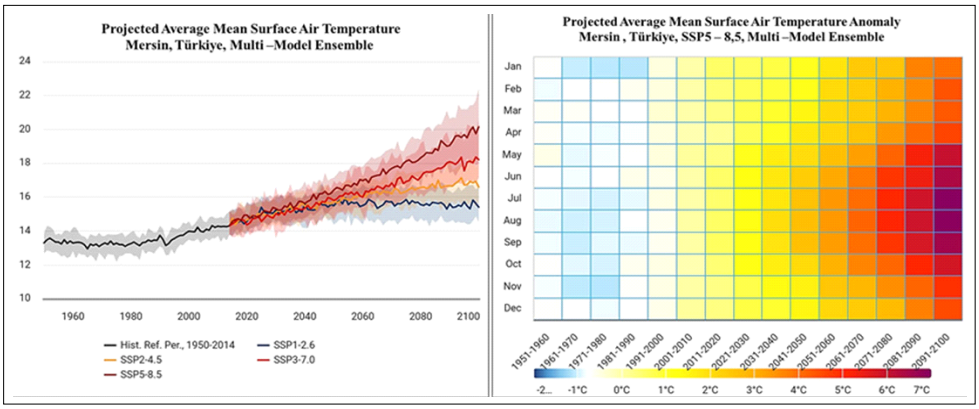


Fig 1: Temperature change in mersin province until the year 2100 (climate change knowledge portal).

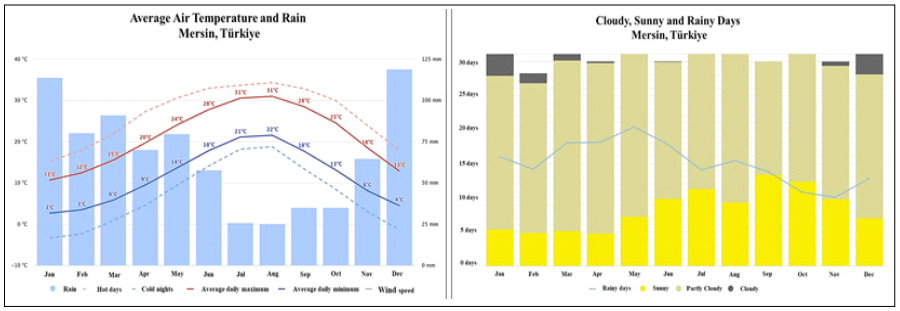


Fig 2: Average temperature and precipitation patterns in mersin province (Left figure), monthly distribution of cloudy, sunny and rainy days in mersin province (Right figure) (Meetoblue 2025).

The soil at the experimental site was slightly alkaline (pH 8.01) and non-saline (EC 0.547 dS/m), with high lime content (31.91%) and low organic matter (1.07%), indicating a need for fertility improvement. Potassium was adequate (110.31 kg/da), while phosphorus was excessive (22.5 kg/da) (Table 1). Although suitable for vegetable cultivation, the soil was amended in autumn or early spring with 2-4 tonsda of well-decomposed farmyard manure and 25-50 kg/da of elemental sulfur.

This study used 10 squash cultivars: 5 F1 hybrids (Alba F1, Amelthee F1, Hadra F1, Hürrem F1, Vildan F1) and 5 standard types (Pelin, Black pumpkin elite, Nazlı, White bush, Eskenderany). Seedlings were planted in spring and autumn using a randomized plot design (Acar, 2020), with three replications of 10 plants each (30 plants per cultivar). Plant spacing was 50 cm within rows and 80 cm between rows. The trial was conducted on 150 m^2 flat land with 8 kg/da of base fertilizer (20.20.0), drip irrigation and black nylon mulch (Kumar and Sharma, 2018; Farah *et al*., 2021). Emitters were spaced 30 cm apart (2 L/h) and irrigation was applied when 25% of available water was depleted. No topdressing was used. Spring planting occurred on April 10 with harvest starting May 15; autumn planting was on September 1 with harvest beginning October 10, both over four weekly harvests. Yield was evaluated by fruit weight, length, diameter, fruit number per plant and yield

Table 2: Two-way analysis of variance for yield-related measurements.

		Average fruit weight (g)	Fruit length (mm)	Fruit diameter (mm)	Number of fruits per plant (pieces/plant)
Season					
Spring (Sp)		308.17a	186.30a	56.87a	16.64a
Autumn (Au)		205.76b	164.44b	46.55b	9.62b
Cultivar					
Alba F1		230.93h	173.01f	50.77f	12.24h
Amelthee F1		185.74ı	148.89ı	45.94j	12.50g
Hürrem F1		250.41f	171.66g	49.41h	12.64e
Hadra F1		266.71e	164.53h	54.10c	14.54b
Vildan F1		276.06d	185.80c	50.17g	17.36a
Pelin (S)		294.82a	208.59a	51.17e	13.22c
Nazlı (S)		250.55f	183.73d	48.32ı	10.90ı
Black squash elite (S)		287.19c	196.40b	52.54d	12.54g
Eskenderany (S)		234.72g	146.51j	58.15a	12.90d
White bush (S)		292.54b	174.59e	56.57b	12.54f
Cultivar × Season					
Alba F1	Sp	293.88g	188.65ı	58.45c	15.36h
	Au	167.99r	157.37n	43.09q	9.12o
Amelthee F1	Sp	279.03k	177.08j	53.55ı	15.72f
	Au	92.45t	120.71s	38.33r	9.28m
Hürrem F1	Sp	328.58d	194.76e	53.52i	16.08e
	Au	172.24q	148.56p	45.30n	9.20n
Hadra F1	Sp	368.84a	191.80h	63.33b	19.56b
	Au	164.58s	137.27q	44.88p	9.52l
Vildan F1	Sp	328.96c	194.50f	57.24d	21.84a
	Au	223.17o	177.10j	43.11q	12.88ı
Pelin (S)	Sp	340.49b	213.77a	55.57g	17.40c
	Au	249.16m	203.41b	46.78m	9.04p
Nazlı (S)	Sp	260.55l	173.45m	51.57k	12.60j
	Au	240.55n	194.02g	45.07o	9.20n
Siyah kabak elite (S)	Sp	282.94ı	197.20c	54.85h	16.20d
	Au	291.45h	195.60d	50.23l	8.80q
Eskenderany (S)	Sp	295.73f	156.40o	64.25a	16.20d
	Au	173.71p	136.62r	52.06j	9.60k
White bush (S)	Sp	302.72e	175.40k	56.45f	15.48g
	Au	282.37j	173.78l	56.69 e	9.60k

**Significant at the p≤0.05 level (two-tailed), S: Standard, Sp: Spring, Au: Autumn.

per plant. Quality was assessed by flesh firmness, soluble solids, fresh and dry weight. Dry weight was measured after oven-drying fruits at 65°C to constant weight.

Yield measurements; fruit weight (g) was determined by weighing 5 randomly selected fruits per replicate using a digital scale (Seles Nhb 600 g, 0.01 g precision). Fruit length and diameter (mm) were measured with a digital caliper (0.01 mm accuracy). Harvests were carried out weekly for four weeks before rind hardening. Fruit number per plant was calculated by dividing the total fruit count by the number of plants per replicate and yield per plant (g/plant) was calculated by dividing total fruit weight by plant number. Data from three replications were averaged for statistical analysis and observations covered all growth and harvest stages.

Fruit quality; flesh firmness (FFH, kg/cm^2) was measured on 5 randomly selected fruits per replicate using a hand penetrometer with an 8 mm tip. Water-soluble dry matter (WSDM, %) was determined with an Atago PAL-1 refractometer using a drop of juice from the same samples. Fresh (FFW) and dry fruit weight (FDW) were measured with a precision scale (Seles Nhb 600 g, 0.01 g) and fruits were oven-dried at 65°C to constant weight. FDW was recorded in grams following Kaçar (1972). All measurements were performed on 10 fruits per replicate.

Data evaluation

Data were analyzed using SPSS 23 (IBM, 2022). Two-way ANOVA assessed the effects of season, cultivar and their interaction on yield and fruit quality. Data were checked for normality and variance homogeneity before analysis. Mean comparisons used Duncan's multiple range test at p≤0.05 (Duncan, 1955). Results are shown as means, with statistical differences indicated by different letters.

RESULTS AND DISCUSSION

Yield related measurements

Yield analysis showed that season, cultivar and their interaction significantly affected average fruit weight, length, diameter and fruit number per plant (Duncan's test, p≤ 0.05). Among varieties, the standard cultivar 'Pelin' had the highest average fruit weight (294.82 g), longest fruit length (208.59 mm) and most fruits per plant (13.22). 'Eskenderany' showed the largest fruit diameter (58.15 mm). These results indicate superior morphological traits in standard cultivars 'Pelin' and 'Eskenderany'. The season × cultivar interaction revealed the best yield traits in spring: 'Hadra F1' produced the heaviest fruits (368.84 g), 'Pelin' the longest (213.77 mm), 'Eskenderany' the widest (64.25 mm) and 'Vildan F1' the highest fruit number per plant (21.84) (Table 2).

Squash, a warm-climate crop, performs best under high light and moderate moisture (Dunsin *et al*., 2019; Tartoura *et al*., 2014; Massolo *et al*., 2019). Climate data showed spring had 0.1°C higher temperatures and 16.06 mm less precipitation than autumn. Increased autumn rainfall likely reduced sunlight, negatively affecting flowering

Table 3: Two-way analysis of variance regarding yield of squash varieties.

	Yield (g/plant)
Season	
Spring (Sp)	2595.12a
Autumn (Au)	635.51b
Cultivar	
Alba F1	1130.35h
Amelthee F1	987.49j
Hürrem F1	2148.27b
Hadra F1	1977.49c
Vildan F1	3062.18a
Pelin (S)	1799.00d
Nazlı (S)	1010.73ı
Black squash elite (S)	1193.52g
Eskenderany (S)	1534.64e
White bush (S)	1309.52f

**Significant at the p≤0.05 level (two-tailed).

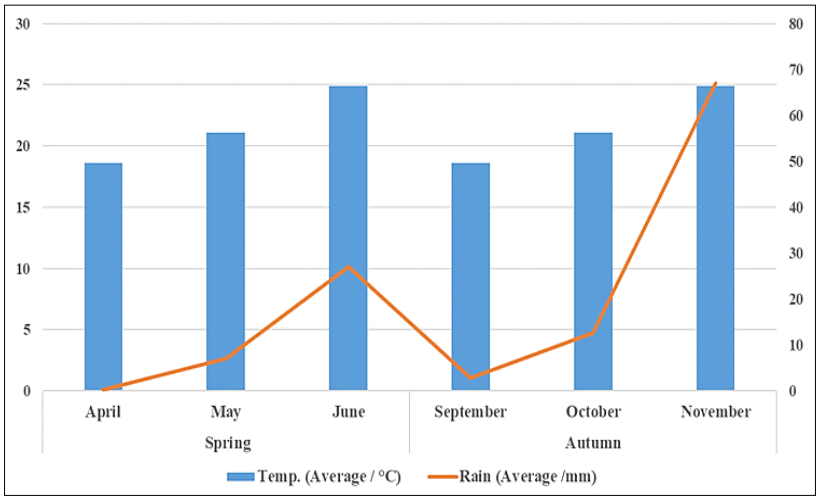


Fig 3: Average temperature and precipitation by season during the study period.

and fruit set (Bannayan *et al*., 2011). Fig 1-3 support that autumn's lower temperature and light availability led to reduced yields. Mersin's low elevation, coastal location and high humidity in spring created optimal conditions for early vigorous growth and higher yields.

Khanum *et al*. (2021) also reported that planting time significantly affects productivity and morphological traits like fruit weight, length, diameter and yield. In this study, average fruit weight ranged from 137.66 to 368.84 g, generally higher than the 54.35 to 229.6 g reported by Kuslu *et al*. (2014) and El-Gazzar *et al*. (2020). Fruit length ranged from 144.10 to 213.77 mm (14.41-21.38 cm), exceeding the 8.3 to 18.47 cm noted by Dunsin *et al*. (2019) and Shehata and Abdelgavad (2019). Fruit diameter (42.43-64.25 mm) was comparable to or slightly above the 13.9 to 56.7 mm reported by Hassan *et al*. (2016) and Shehata and Abdelgavad (2019). The number of fruits per plant (6.56-21.84) was substantially higher than the 6.08-11.02 and 6.00-7.60 ranges reported by El-Shoura (2020) and Shafeek *et al*. (2016), respectively.

Yield

Squash yield was significantly affected ($p \leq 0.05$) by season, cultivar and their interaction. The highest yield occurred in spring, averaging 2595.12 g/plant. Among cultivars, 'Vildan F1' had the highest mean yield at 3062.18 g/plant (Table 3).

Season × cultivar interaction showed consistently higher yields in spring than autumn. 'Vildan F1' had the highest yield in both seasons, with 4939.37 g/plant in

Table 4: Two-way analysis of variance regarding FFH (kg cm^{-2}), WSDM (%), FFW (g), FDW (g).

		FFH (kg cm^{-2})	WSDM (%)	FFW (g)	FDW (g)
Season					
Spring (Sp)		8.60a	3.17b	306.66a	9.52a
Autumn (Au)		7.72b	3.72a	206.06b	8.41b
Cultivar					
Alba F1		6.95g	3.59b	223.39h	8.43c
Amelthee F1		7.74e	3.76a	18.24ı	5.39d
Hürrem F1		9.94a	3.79a	250.41f	9.31c
Hadra F1		9.13b	3.43cd	266.71e	8.34c
Vildan F1		9.98a	3.38 de	276.06d	14.00a
Pelin (S)		6.58h	3.06g	294.82a	9.27c
Nazlı (S)		8.48d	3.40d	250.55f	8.60c
Black squash elite (S)		7.09f	3.33e	287.19c	11.68b
Eskenderany (S)		6.89g	3.23f	234.72g	5.50d
White bush (S)		8.86c	3.46c	292.54b	9.14c
Cultivar × Season					
Alba F1	Sp	7.60l	3.26h	278.80h	11.62c
	Au	6.30n	2.96j	167.99n	5.24h
Amelthee F1	Sp	7.83k	3.60de	279.03h	8.00efg
	Au	7.66l	3.96a	95.40p	2.79ı
Hürrem F1	Sp	10.33b	3.63cd	328.58c	9.10ef
	Au	9.56f	3.96a	172.24m	9.52de
Hadra F1	Sp	10.50a	3.46fg	368.84a	11.22c
	Au	7.76k	3.96a	164.58o	5.46h
Vildan F1	Sp	9.83d	3.23h	328.96c	17.24a
	Au	10.13c	3.53ef	223.17l	10.76cd
Pelin (S)	Sp	5.76p	3.03ıj	340.49b	9.46def
	Au	7.40m	3.10ı	249.16j	9.08ef
Nazlı (S)	Sp	8.66g	3.10ı	260.55ı	8.63ef
	Au	8.30h	3.70bc	240.55k	8.57ef
Siyah kabak elite (S)	Sp	7.96j	2.70k	282.94g	7.86fg
	Au	6.23n	3.96a	291.45f	15.50b
Eskenderany (S)	Sp	7.93j	2.73k	295.73e	5.53h
	Au	5.86o	3.73b	173.71m	5.47h
White bush (S)	Sp	9.66e	2.96j	302.72d	6.54gh
	Au	8.06ı	3.96a	282.37g	11.74c

**Significant at the $p \leq 0.05$ level (two-tailed). FFH: Fruit flesh hardness; WSDM: Water soluble dry matter; FFW: Fruit fresh weight; FDW: Fruit dry weigh; S: Standard; Sp: Spring; Au: Autumn.

spring and 1185 g/plant in autumn. Other high performers in spring were 'Hürrem F1' (3513.75 g/plant) and 'Hadra F1' (3423.33 g/plant), indicating better hybrid response to spring conditions. Yield reduction in autumn is likely due to climatic factors such as less solar radiation and increased rainfall, which negatively affect pollination and fruit set. The consistently high yield of 'Vildan F1' across both seasons indicates its lower sensitivity to environmental fluctuations, suggesting its genetic stability. This highlights the importance of multi-environment analysis tools such as AMMI and GGE biplot in identifying stable genotypes (Muniswamy *et al*., 2022); (Dolhey and Kandalkar, 2023).

Singh *et al*. (2020) reported pumpkin yields of 425 kg/ 100 m^2 in open fields. Similarly, Yeboah *et al*. (2020) and Khanum *et al*. (2021) highlighted the strong seasonal impact on squash productivity, with lower autumn yields. Bannayan *et al*. (2011) emphasized temperature's key role in summer squash growth, especially during pollination.

In this study, autumn rainfall was 16.06 mm higher than spring, likely reducing sunlight and shortening the photoperiod. This decrease in light may have hindered female flower formation and fruit set, lowering yields. These results align with previous findings that optimal temperature and solar radiation are critical for maximizing squash yield.

Fruit quality

The results showed that fruit flesh hardness (FFH), water-soluble dry matter (WSDM), fresh fruit weight (FFW) and fruit dry weight (FDW) were significantly affected ($p \leq 0.05$) by season, cultivar and their interaction. Spring had the highest values for all except WSDM, which was higher in autumn, consistent with reports that dry matter increases late in the season due to physiological accumulation (Rosales *et al*., 2023; Stoyanova *et al*., 2018). Higher autumn dry matter is linked to lower temperatures and shorter days promoting assimilate buildup.

'Vildan F1' and 'Hürrem F1' had the highest FFH (9.98 and 9.94 kg/cm^2). The highest WSDM (3.96%) was found in 'Amelthee F1', 'Hürrem F1' and 'Black Squash Elite' during autumn. 'Pelin' had the highest fresh fruit weight (294.82 g), while 'Vildan F1' had the highest dry weight (17.24 g) in spring. The cultivar × season interaction showed 'Hadra F1' had the highest FFH (10.50 kg/cm^2) and fresh weight (368.84 g) in spring. These findings highlight the importance of both genotype and season on squash fruit quality (Table 4).

Fruit quality deterioration often involves loss of firmness and wilting, linked to changes in tissue water potential (Rodríguez-Burgos *et al*., 2015). Özdüven (2016) reported squash fruit flesh hardness between 8.00 and 8.14 kg/cm^2 under limited water, influenced by irrigation and planting time, with higher firmness under hot, dry and well-lit conditions. This aligns with our finding of greater firmness in spring, when temperature and light were more favorable, supporting the impact of photothermal conditions on firmness and dry matter accumulation. Both Özdüven (2016) and Okasha *et al*. (2020) noted that water-soluble dry matter (WSDM) is affected by season and plant water status, consistent with higher WSDM in autumn squash due to cooler temperatures and slower growth. 'Hadra F1' (10.50 kg/cm^2) and 'Hürrem F1' (10.33 kg/cm^2) showed superior flesh firmness; 'Pelin' had the highest fresh fruit weight (340.49 g) and 'Vildan F1' the highest dry weight (17.24 g). These results align with Dunsin *et al*. (2019), who reported fresh weights of 248.5-488 g and dry weights of 9.13-16.97 g, confirming the reliability of our data and highlighting genotype × environment interactions in fruit quality. Spring's higher temperatures, lower rainfall and increased solar radiation created favorable photothermal conditions improving firmness and fresh weight. Cooler, more humid autumn conditions slowed growth, increasing dry matter accumulation. Thus, seasonal variations in quality reflect environmental influences.

CONCLUSION

This study shows that spring cultivation of summer squash (*Cucurbita pepo* L.) in Mersin's Mediterranean region yields significantly better results than autumn. Average spring yield (2595.12 g/plant) was about four times higher than autumn (635.51 g/plant), mainly due to favorable climate higher temperatures, 16.06 mm less precipitation and more solar radiation. These conditions improve photoperiod and light interception, supporting growth, flowering and fruit set. 'Vildan F1' was the most productive cultivar in both seasons, with 4939.37 g/plant in spring and 1185 g/plant in autumn. 'Hürrem F1' and 'Hadra F1' also performed well in spring, highlighting strong genotype × environment interactions.

Spring-grown fruits had higher flesh hardness and fresh/dry weight, while autumn fruits had higher water-soluble dry matter (WSDM), likely due to cooler temperatures slowing growth and increasing dry matter accumulation. 'Hadra F1' and 'Hürrem F1' showed the highest firmness in spring; 'Amelthee F1', 'Hürrem F1' and 'Black Squash Elite' had highest WSDM in autumn. Climate projections suggest rising autumn temperatures may improve autumn squash cultivation prospects.

Given Mersin's role in squash export, extending production into autumn could enhance sustainability and supply continuity. However, optimizing planting time, cultivar choice and soil management especially addressing high lime (31.91%) and low organic matter (1.07%) is essential for consistent autumn yields. Integrating seasonal climate and crop data emphasizes the need to align production with environmental conditions to maximize yield, quality and long-term sustainability amid climate change.

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Conflict of interest

All authors declared that there is no conflict of interest.

REFERENCES

Abou El-Salehein, E.H., Wahdan, H.M., Abo Khdeer, M. (2019). The sex expression and productivity of squash (*Cucurbita pepo* L.) as response of foliar spray with Ethrel. *Middle East J. Agric. Res.* **8(3):** 959-966.

Acar, M. (2020). Tarımsal deneme teknikleri. Samsun, Türkiye: Karadeniz Tarımsal Araþtırma Enstitüsü Eğitim Dökümanları.

Anonymous, (2022). Yaţ meyve ve sebze sektör raporu. Ankara, Türkiye: T.C. Ticaret Bakanlığı, ıhracat Genel Müdürlüğü, Tarım Ürünleri Daire Bąkanlığı. Accessed 15 Jan 2024.

Bağçaci, S.Ç.,Yücel, I., Düzenli, E., Yılmaz, M.T. (2021). Intercomparison of the expected change in the temperature and the precipitation retrieved from CMIP6 and CMIP5 climate projections: A Mediterranean hot spot case, Turkey. *Atmos. Res.* **256:** 105576.

Bannayan, M., Rezaei, E.E., Alizadeh, A. (2011). Climatic suitability of growing summer squash (*Cucurbita pepo* L.) as a medicinal plant in Iran. *Not. Sci. Biol.* **3(2):** 39-46. https://doi.org/10.15835/nsb325846.

Dolhey, N.K. and Kandalkar, V.S. (2023). AMMI and GGE biplot analysis for G×E interaction of wheat genotypes under different irrigation and sowing conditions. *Indian Journal of Agricultural Research.* **57(4):** 416-420. doi: 10.18805/IJARe.A-5603.

Duncan, D.B. (1955). Multiple range and multiple F tests. *Biometrics.* **11(1):** 1-42. https://doi.org/10.2307/3001478.

Dunsin, O., Aboyeji, C.M., Adekiya, A.O., Adegbite, K.A., Adebiyi, O.T.V., Bello, R.O., Joseph, A., Adesola, O.O., Ajiboye, B., Ndako, J.A., Dunsin, D.M.F. (2019). Growth, yield, fruit mineral and vitamin C content of *Cucurbita pepo* L. as affected by organic and NPK fertilizer. *Open Agric.* **4:** 795-802. https://doi.org/10.1515/opag-2019-0078.

El-Gazzar, T.M., Nada, M.M., Hussein, A.H., Dawood, A.R. (2020). Evaluation of new summer squash hybrids (*Cucurbita pepo* L.) compared with some commercial cultivars. *J Plant Prod (Mansoura Univ).* **11(9):** 841-845. https://doi.org/10.21608/jpp.2020.118044.

El-Shoura, A.M. (2020). Effect of foliar application with some treatments on summer squash (*Cucurbita pepo* L.) tolerance to high temperature stress. *Middle East J Agric Res.* **9(2):** 468-478. https://doi.org/10.36632/mejar/2020.9.2.37.

FAO. (2025). Food and Agriculture Organization of the United Nations. https://www.fao.org/faostat/en/#data/QCL/. Accessed 15 Jan 2024.

Farah, A.H., Al-Ghobari, H.M., Zin El-Abedin T.K., Alrasasimah, M.S., El-Shafei A.A. (2021). Impact of partial root drying and soil mulching on squash yield and water use efficiency in arid regions. *Agronomy.* **11(4):** 706. https://doi.org/10.3390/agronomy11040706.

Gülşen, O., Demirkaya, M., Aslan, F. (2022). Çerezlik kabak (*Cucurbita pepo* L.) hatlarının düşük sıcaklıkta çimlenme özelliklerinin belirlenmesi. *Erciyes Tarım ve Hayvan Bilimleri Dergisi.* **5(2):** 20-25.

Hassan, A.A., Abdel-Ati, K.E.A., Mohamed, M.I.A. (2016). Squash germplasm evaluation for some vegetative growth, flowering and yield characters. *Middle East J. Agric. Res.* **5(1):** 109-116.

IBM (2022). IBM SPSS Statistics for Windows, Version 23.0. IBM Corp.

Jamil, M., Bashir, S., Ullah, H., Ahmad, Z., Shah, M.K.N. (2021). Growth and yield performance of cucumber cultivars under variable sowing dates. *Pak J. Agric Sci.* **58(3):** 803-809.

Kaçar, B. (1972). Bitki ve toprağın kimyasal analizleri. II. Bitki analizleri. Ankara, Türkiye: Ankara Üniversitesi Ziraat Fakültesi Yayınları.

Khanum, M.M., Nuruzzaman, M., Huda, M.S., Muzahid, M.A.A.A.A. (2021). Effect of organic manures and planting time on growth, yield, quality and economics of squash under medium high land condition of Dinajpur region. *Sustainability Food Agric.* **2(1):** 40-43. https://doi.org/10.26480/sfna.01.2021.40.43sfna.org.my+2IDEAS/RePEc+2IndexCopernicus Journals+2.

Kumar, D. and Sharma, R. (2018). Effect of mulching on growth, yield and quality in different varieties of summer squash (*Cucurbita pepo* L.). *Int J Curr Microbiol Appl Sci.* **7(6):** 2113-2119. https://doi.org/10.20546/ijcmas.2018.706.251 ResearchersLinks+1IJCMAS+1.

Kuslu, Y., Şahin, Ü., Kızıloğlu, F., Memiş, S. (2014). Fruit yield and quality and irrigation water use efficiency of summer squash drip-irrigated with different irrigation quantities in a semi-arid agricultural area. *J Integr Agric.* **13(11):** 2518-2526. https://doi.org/10.1016/S2095-3119(13)60611-5.

Massolo, J.F., Zarauza, J.M., Hasperué, J.H., Rodoni, L.M., Vicente, A.R. (2019). Maturity at harvest and postharvest quality of summer squash. *Pesq Agropec Bras.* **54:** e00133. https://doi.org/10.1590/S1678-3921.pab2019.v54.00133. Meteoblue Weather. Available online: https://www.meteoblue.com/tr/hava/historyclimate/climatemodelled/g%C3%B6r%C3%BCkle_t%C3%BCrkiye_746552 (accessed on 15 Jan 2025).

MGM, (2022). Meteoroloji Genel Müdürlüğü. https://www.mgm.gov.tr/. Accessed 15 Jan 2024.

Muniswamy, M., Muralikrishna, G. and Pujeri, K. (2022). Stability of advanced medium duration genotypes across seasons for yield in pigeonpea [*Cajanus cajan* (L.) Millsp.]. *Indian Journal of Agricultural Research.* **56(2):** 129-134. doi: 10.18805/IJARe.A-5739.

Nacar, Ç. (2022). Yazlık kabak yetiştiriciliği. Mersin, Türkiye: T.C. Gıda, Tarım ve Hayvancılık Bakanlığı, Tarımsal Araştırmalar ve Politikalar Genel Müdürlüğü, Alata Bahçe Kültürleri Araştırma Enstitüsü.

Nada, M.M. and Metwaly, E.E. (2020). Response of growth, yield and fruit quality of squash plants to foliar application with potassium silicate and magnesium sulfate under high temperature stress. *J. Plant Prod. (Mansoura Univ).* **11(2):** 195-200.

Okasha, E.M., Hashe, F.A., El-Metwally, I.M. (2020). Effect of irrigation system and irrigation intervals on the water application efficiency, growth, yield, water productivity and quality of squash under clay soil conditions. *Plant Arch.* **20(2):** 3266-3275.

Özdüven, F.F. (2016). Salisilik asit uygulamalarının kısıtlı su koşullarında yetiştirilen yazlık kabakta (*Cucurbita pepo* L.) bitki gelişimi ve verime etkileri. [Doktora tezi]. Tekirdağ, Türkiye: Tekirdağ Namık Kemal Üniversitesi.

Rodríguez-Burgos, A., Carrillo-López, A., Osuna-Enciso, T., Báez-Sañudo, M., Sañudo-Barajas, A., Contreras-Martínez, R., Zazueta-Morales, J.J., Vega-García, M.O., Muy-Rangel, D. (2015). Growth dynamics and water potential components of three summer squash (*Cucurbita pepo* L.) cultivars. *Not. Bot. Horti. Agrobo.* **43(2):** 420-425. https://doi.org/10.15835/nbha4329827.

Rosales, R.J.G., Photchanachai, S., Khanobdee, C. (2023). Dry matter, adhesiveness and their relationship with other attributes as quality indicators for pumpkin consumption. *Hortic. J.* **92(4):** 464-475. https://doi.org/10.2503/hortj.QH-042.

RTMA, (2022). T.C. Tarım ve Orman Bakanlığı Alata Bahçe Kültürleri Araştırma Enstitüsü Müdürlüğü, Toprak Bölümü.

Shafeek, M.R., Helmy, Y.I., Ahmed, A.A. (2016). Productivity of squash plant to mineral and bio-nitrogen fertilizers on plant growth, total fruit yield and leaves mineral content on a sandy soil. *Int J. Chem. Tech. Res.* **9(3):** 66-75.

Shehata M.N. and Abdelgavat, K.F. (2019). Potassium silicate and amino acids improve growth, flowering and productivity of summer squash under high temperature condition. *Am-Eurasian J. Agric. Environ. Sci.* **19(2):** 74-86.

Singh, S. and Saxena, A.K. (2020). Protected cultivation of summer squash in mid-hills of Uttarakhand. *Journal of Horticultural Science and Research*. **3(1):** 82-85.

Stoyanova, A., Veleva, P., Valkova, E., Pevicharova, G., Georgiev, M., Valchev, N. (2018). Dry Matter Content and Organic Acids in Tomatoes, Greenhouse Grown under Different Manuring and Irrigation Modes. In: Proceedings of the 2nd International Conference on Food and Agricultural Economics; 2018 Apr 26-27; Alanya, Türkiye. p. 257-265.

Tartoura, E.A.A., El-Gamily, EI, El-Waraky Y.B.A., Mariam, K.Y.K. (2014). Effect of phosphorus fertilization and fruit thinning on seed production of summer squash plants. *J. Plant Prod. (Mansoura Univ).* **5(11):** 1807-1816.

TUIK, (2025). Türkiye ıstatistik Kurumu. https://www.tuik.gov.tr/. Accessed 15 Jan 2024.

Yeboah, M.A., Katoch, V., Akoto-Herimandimby, R.R., Rahantanirina, A., Rakotoarisoa, B. (2020). Effects of leaf harvest and season on the fruit yield of summer squash genotypes in Madagascar. *Afr. J. Agric.* **7(11):** 1-5.