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ARAŞTIRMA MAKALESİ **RESEARCH ARTICLE**

Determination of some quality and production characteristics of peanut with different market types (*Arachis hypogaea* L.) in second crop culture in the eastern Mediterranean passage zone

Doğu Akdeniz geçit kuşağında farklı pazar tipi yerfıstıklarının (*Arachis hypogaea* L.) ikinci ürün yetitiriciliğinde bazı kalite ve özelliklerinin belirlenmesi

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ABSTRACT

This study was carried out in Osmaniye location of Oil Seed Research Institute in 2020-2021 in order to determine some yield and quality characteristics in second crop cultivation of peanuts with different market types in the Eastern Mediterranean transition zone. Eleven different genotypes of Runner (Georgia Green) Virginia (NC 7, Masal, Halisbey, Wilson, Çom, Brantley, Sultan, Düziçi 1) Spanish (Florispan, Nigeria 1) types of peanut were used in the study. In the study, number of pods per plant, 1st quality pod ratio, pod weight per plant, 100 pod and seed weight, shelling percentage, pod yield, oil content and, protein content parameters were investigated. The number of pods per plant is between 20.8 (Nigeria 1) and 51.4 (Düziçi 1); pod weight per plant varied between between 12.3 g (Nigeria-1) and 64.9 g (Halisbey). It was determined that 100 pod weight and 100 seed weights varied between 66.8-289.0 g and 29.6-106.5 g, respectively. Pod yield varied between 1963 kg ha^{-1} (Nigeria 1) and 4846 kg ha^{-1} (Düziçi 1). As a result, it was determined that Düziçi 1 genotype, Brantley and Halisbey cultivars came to the fore in terms of the investigated characteristics in the Eastern Mediterranean Passage zone. In the study, while the second crop peanut variety suitable for the Eastern Mediterranean Transition zone was determined, the varieties to be used as breeding material were also determined.

ÖZET

Bu araştırma, Doğu Akdeniz geçit kuşağında farklı pazar tiplerine sahip yerfıstığı hat ve çeşitlerin ikinci ürün yetiştiriciliğinde bazı verim ve kalite özelliklerini belirlemek amacıyla 2020-2021 yıllarında Yağlı Tohumlar Araştırma Enstitüsü lokasyonunda yürütülmüştür. Çalışmada; Runner (Georgia Green) Virginia (NC 7, Masal, Halisbey, Wilson, Çom, Brantley, Sultan, Düziçi 1) Spanish (Florispan, Nijerya 1) pazar tipine sahip 11 farklı genotipi kullanılmıştır. Çalışmada bitki başına meyve sayısı, 1. kalite meyve sayısı oranı, bitki başına meyve ağırlığı, 100 meyve ve tohum ağırlığı, iç oranı, meyve verimi, yağ oranı ve protein oranı parametreleri incelenmiştir. Bitki başına meyve sayısı 20.8 (Nijerya 1) ile 51.4 (Düziçi 1) arasında; bitki başına meyve ağırlığı ise 12.3 g (Nijerya-1) ile 64.9 g (Halisbey) arasında değişmiştir. 100 meyve ağırlığının 66.8-289.0 g ve 100 tohum ağırlığının 29.6-106.5 g arasında değiştiği tespit edilmiştir. Meyve verimi 1963 kg ha^{-1} (Nijerya 1) ile 4846 kg ha^{-1} (Düziçi 1) arasında değişmiştir. Sonuç olarak Doğu Akdeniz Geçit kuşağında incelenen özellikler açısından Düziçi 1 genotipi, Brantley ve Halisbey çeşitlerinin öne çıktığı belirlenmiştir. Çalışmada Doğu Akdeniz Geçiş kuşağına uygun ikinci ürün yerfıstığı çeşidi belirlenirken, ıslah materyali olarak kullanılacak çeşitler de belirlenmiştir.

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INTRODUCTION

Peanut (*Arachis hypogaea* L.), is a significant oil plant for humans and animals owing to its oil, protein, carbohydrate, and mineral content (Arıoğlu, 2014). Depending on the cultivar, peanut seeds contain 44-56% oil (Arıoğlu, 2014; Aşık et al., 2018). Peanut oil outperforms many vegetable oils in terms of flavor and survivability (Yaşlı et al., 2022; Yılmaz, 2022).

After the oil is removed, the extract includes roughly 45% crude protein, 24% nitrogen-free basic substances, and 5.5% mineral substances (Arıoğlu, 2014). As a result, peanut meal is used to make compound feeds in developed countries (Arıoğlu, 2014). It contains approximately 18% carbohydrates in its seeds (Arıoğlu, 2014; Onat et al., 2017). K, Ca, Mg, P, and S are examples of nutrients. Furthermore, peanuts are high in vitamins A, B, and E (Arıoğlu, 2014; Şahin et al., 2022).

Peanut, like other legumes, fixes free nitrogen from the air to the soil, leaving a rich soil rich in nitrogen and organic matter for the plant that follows it (Aşık et al., 2018). According to research, the peanut plant releases free air during its growing period, thanks to the Rhizobium bacteria that exists in its roots (Arıoğlu, 2014; Aşık et al., 2018). It was determined that accumulated 45-150 ha of nitrogen (Aşık et al., 2018; Yılmaz & Jordan, 2022).

Peanut is an anchor plant (Arıoğlu, 2014). During the growing season, the soil is hoed. Weeds are cleaned and the soil is aerated because the soil is hoed during the growing season. As a result, it is an excellent crop rotation plant. Peanut is the most produced oilseed crop in the world between; comes in fourth place after soybean, cottonseed, and rapeseed (Arıoğlu, 2014; Yılmaz et al., 2022).

In 2020, 31.6 million hectares around the world produced 53.7 million tons of peanuts with shells. About 90% of the overall production came from Asia and Africa, with the remaining 10% generated in the Americas. China and India were the two major producing nations, together accounting for more than half of the overall output (18 million tonnes and 10 million tonnes, respectively). In the same year, Turkiye contributed 215 927 tonnes or around 54 775 hectares to the overall production. Even though Turkiye contributed little to output, it doubled the global average yield (FAO, 2022; TUIK, 2022).

Peanut is widely cultivated in Turkiye, especially in the Mediterranean Region and Southeastern Anatolia Region. The scarcity of new peanut varieties does not fully meet the Turkiye market. Therefore, it is important to introduce new peanut varieties to the market and to make adaptation trials.

The aim of this study was to determine some quality and production characteristics of peanuts in different market types (*Arachis hypogaea* L.) in second crop cultivation in the Eastern Mediterranean Transition Region.

MATERIAL and METHODS

Materials

Used in the experiment were peanuts market kinds included Runner (Georgia Green), Virginia (NC 7, Masal, Halisbey, Wilson, Çom, Brantley, Sultan, and Düziçi 1), and Spanish (Florispan, Nigeria 1).

Climatic conditions

The Osmaniye State Farm's agro-meteorological station provided the daily climate data. Table 1 shows the site's air temperature, humidity, and precipitation data.

Methods

The trial was set up in the second crop period in 2020 (37°07'28" N, 36°11'38" E; 50 m) and 2021 (37°07'89" N, 36°11'33" E; 50 m) in Cevdetiye locations controlled by Oil Seed Research Institute. The three replications of each trial were set up in accordance with the randomized blocks trial design. Between rows, there were 70 x 15 cm of

sowing space. Each row in each plot was 5 m in length and included a total of 4 rows. Every plot was calculated to be 14 cm^2. Before planting, 25 kg da^{-1} of DAP (Diammonium Phosphate) was applied. 15 kg da^{-1} of urea was applied before to the first irrigation, and 10 kg da^{-1} of urea was applied prior to the second irrigation. It was done manually on June 20, 2020, for the first year of the trial and on June 15, 2021, for the second year. The sprinkler system was used to water five times during both seasons.

Table 1. Weather patterns factors in the research region (2020, 2021, and long-year average)
Çizelge 1. Denemenin yürütüldüğü lokasyonun iklim verileri (2020, 2021 ve uzun yıllar ortalaması)

Months	Precipitation (mm)			Temperature (°C)			Relative Humidity (%)		
	LY	2020	2021	LY	2020	2021	LY	2020	2021
April	86.5	123.9	32.3	17.0	17.1	17.7	64.2	69.4	64.8
May	72.6	83.5	4.6	21.3	22.1	22.9	63.2	62.4	59.8
June	42.4	5.5	1.8	25.2	24.0	25.0	60.6	68.7	65.9
July	19.8	2.0	15.7	27.9	28.4	28.9	66.4	71.7	64.6
August	10.7	21.5	19.7	28.6	28.6	29.3	64.9	64.0	62.8
September	34.5	0.9	14.0	25.7	28.6	25.9	60.7	61.8	60.8
Total/Av.	266.5	237.3	88.1	24.3	24.8	25.0	63.3	66.3	63.1

Av.: Average; LY: Long Year.

On ten randomly chosen plants in the two mid-rows of plots, harvest parameters were assessed, side effects were discarded, and hand harvesting was used. In yield pod, the whole parcel was harvested. The harvest was done by hand. The first year's harvest was finished on September 15, 2020, while the second year's harvest was finished on September 25, 2021. The experiment employed a clay soil typical to the area (10% sand, 20% silt, 70% clay) with a pH of 8.2 and 2.0% organic content.

Table 2. Results of the analysis of variance for the experiment's parameters
Çizelge 2. İncelenen özelliklere ait varyans analiz sonuçları

SV	DF	NP	FQP	PW	HPW	HSW	SP	PY	OC	PC
Block	4	ns	ns	ns	ns	ns	ns	ns	ns	ns
Year	1	**	**	ns	ns	ns	ns	**	**	ns
Cultivars	10	**	**	**	**	**	**	**	**	**
Y x C	10	**	ns	**	ns	ns	ns	ns	**	ns
CV (%)		7.2	7.8	6.5	8.6	6.2	2.9	7.1	3.0	2.3

SV: Source of variation, DF: Degree of freedom, CV: Coefficient of variation, ** $p < 0.01$, NP: Number of pods per plant FQP: 1st Quality pod ratio, PW: Pod weight per plant, HPW: 100-pod weight, HSW: 100-seed weight, SP: Shelling percentage, PY: Pod yield OC: Oil content, PC: Protein content

Statistical analysis

With the use of MSTAT-C and SPSS v22, experimental data were subjected to analysis of variance in line with the Randomized Complete Block Design (RCBD) joined years. With the help of the Duncan's multiple range test, means were compared (Steel & Torrie, 1980).

RESULTS and DISCUSSIONS

Number of pods per plant

Number of pods per plant was statistically significant ($p < 0.01$) between years, cultivars and years x cultivars (Table 2). According to the two-year data, the highest number of pods per plant was found in the Düziçi 1 cultivar with 51.4 while the Nijerya 1 cultivar was found the least with 20.8 (Table 3). Calışkan et al. (2008) found that the number of pods per plant cultivars between 43-65; Onat et al (2017) found that the number of pods per plant cultivars between 26.7 and 95; Yol & Uzun (2018) determined that the number of pods per plant cultivars between 33.9-77.6; Yaşlı et al. (2020) found that number of pods per plant cultivars between 32.95-48.68. In the study, the number of pods per plant Calışkan et al. (2008) and Yaşlı et al. (2020), it was found to be lower than the results of Onat et al. (2017) and, Yol & Uzun (2018). It is thought that the difference between the numbers of pods per plant is caused by ecological and genotypic conditions.

1st quality pod ratio

1st quality pod ratio was statistically significant ($p < 0.01$) between years and cultivars (Table 2). According to the two-year data, the highest 1st quality pod ratio was found in the Masal cultivar with 77.7%. While Nigeria 1, Wilson and Çom cultivars was found the least with 51.4%, 51.3%, 47.4% respectively (Table 3). Arıoğlu et al. (2016) found that the 1st quality pod ratio cultivars between 70.84-86.80%; Yaşlı et al. (2020) found that the 1st quality pod ratio cultivars between 27.33% and 30.33%; Karabulut & Tunçtürk (2019) determined that 1st quality pod ratio cultivars between 49.6% - 72%. While 1st quality pod ratio obtained in this study was similar to the studies done by Arıoglu et al. (2016); Karabulut & Tunçtürk (2019), Yaşlı et al. (2020) have varied. The difference in the 1st quality pod ratio may be due to the different cultivars used in the experiments and the different ecological conditions.

Pod weight

Pod weight per plant was statistically significant ($p < 0.01$) interactions between years, year x cultivars (Table 2). It was determined that the average pod weight per plant in the second crop peanuts cultivars between 12.3-64.9 g (Table 3). Canavar & Kaynak (2013) pod weight per plant 35.90-120.43 g; Kurt et al. (2016) found pod weight per plant cultivars between 41.40-77.51 g; Yousif & Hussain (2019) reported pod weight per plant values 12.1-17.8. Onat et al. (2017) reported that pod weight per plant is directly proportional to pod yield. In this study in the experiment were similar to the literature studies.

100-pod weight

It was determined that 100-pod weight was statistically significant ($p < 0.01$) among cultivars (Table 2). It was determined that the average 100-pod weight in the second crop peanuts cultivar between 66.8-289.0 g (Table 3). Aşık et al. (2018) discovered 100-pod weight ratio 113.05-312.67 g; Karabulut &Tunçtürk (2019) found that 100-pod weight ratio varied between 18.2-247.2 g; Yaşlı et al. (2020) reported 100-pod weight values 248.83-363.00 g. While the 100-pod weight in this study findings was similar to Karabulut & Tunçtürk (2019), it was found to be lower than Aşık et al. (2018) and Yaşlı et al. (2020). The 100-pod seed differences in the experimental findings may be due to the different cultivars used and ecological conditions.

100-seed weight

100-seed weight was statistically significant ($p < 0.01$) cultivars (Table 2). According to the two-year average values, the lowest 100-seed weight was determined as Nigeria 1 (29.6 g), and the highest was determined as NC 7 (106.5 g) (Table 4). In this study 100-seed weight findings in the experiment were found to be similar to the

studies done by Çalışkan et al. (2008), Canavar & Kaynak (2016), Aytekin & Çalışkan (2016), and Gabisa et al. (2017).

Table 3. Averages and groups of number of pods per plant, 1st quality pod ratio, pod weight per plant, 100-pod weight of peanut varieties

Çizelge 3. Bazı yerfıstığı çeşitlerinde belirlenen bitki başına meyve sayısı, I. kalite meyve sayısı oranı, bitki başına meyve ağırlığı ve 100 meyve ağırlığı özelliklerine ilişkin ortalama değerler ve oluşan gruplar

Cultivars	Number of pods per plant	1st quality pod ratio (%)	Pod weight per plant (g)	100-pod weight (g)
Brantley	44.4 b	66.3 bc	45.6 c	203.6 cd
Çom	31.7 d	47.4 e	46.2 c	205.4 cd
Düziçi 1	51.4 a	66.8 bc	47.7 c	218.0 c
Florispan	25.7 e	71.5 ab	25.3 f	80.4 ef
Georgia Green	40.9 c	67.3 bc	35.6 e	94.3 e
Halisbey	44.6 b	58.6 d	64.9 a	255.7 ab
Masal	33.8 d	77.7 a	41.5 d	194.0 d
NC 7	24.3 ef	65.8 c	32.4 e	289.0 a
Nigeria 1	20.8 f	51.4 e	12.3 g	66.8 f
Sultan	33.6 d	54.3 de	60.5 b	241.8 b
Wilson	38.4 c	51.3 e	58.6 b	219.7 c
Years				
2020	34.2±1.65 B	60.1±1.91 B	42.9±2.74	185.1±11.34
2021	36.5±1.53 A	63.3±1.58 A	42.7±2.53	191.1±12.31
Mean	35.4±1.13	61.7±1.24	42.8±1.85	188.1±8.63

Letters show different groups; a, b, c, d… for varieties in each column.

Shelling percentage

Shelling percentage was statistically significant ($p < 0.01$) cultivars (Table 2). Shelling percentage ratio averages were found between 60.6% (Halisbey) and 72.2% (Georgia Green) (Table 4). Kurt et al. (2016) reported that the shelling percentage rate is one of the most important parameters affecting pod yield. Kurt et al. (2016) reported that the shelling percentage varies between 59-91-76.58%. Gabisa et al. (2017) observed that the shelling percentage varied between 51-78.4%. Onat et al. (2017) mentioned that the shelling percentage varies between 64.2-65.8%. Yol & Uzun (2018) revealed that the shelling percentage varied between 55.1-71.2%. The current study is similar to other studies.

Pod yield

Pod yield was statistically significant ($p < 0.01$) years, cultivars (Table 2). Nigeria 1 cultivar was the lowest with a two-year pod yield of 1963 kg ha^{-1} and Düziçi 1 was the highest with 4846 kg ha^{-1} (Table 4). Arıoglu et al. (2018) mentioned that it is one of the most important parameters in pod yield and quality in peanut cultivation. Canavar & Kaynak (2013) the pod yield varied between 3300-5210 kg ha^{-1}; Arıoğlu et al. (2018), reported that pod yield 3060-7615 kg ha^{-1}; Aşık et al. (2018), noted that pod yield 2345-6554 kg ha^{-1}; Yaşlı et al. (2020) determined that pod yield varied between 3654-6018 kg ha^{-1}. Baran & Andırman (2022) reported that pod yield 4189.8-6668.2 kg ha^{-1}. This difference may be due to the fact that the peanut market types used in the trials were different and the environmental conditions were different.

Oil content

Oil content was statistically significant ($p < 0.01$) between years, cultivars and years x cultivars (Table 2). According to the two-year data, the highest oil content was found in the Brantley cultivar with 51.01% while the, Çom cultivar was found the least with 47.55% (Table 4). Peanut seed oil content is an essential quality characteristic. The oil content of peanut seed is impacted by genetic variability, growing conditions, and maturity. In this study was similarity Kurt et al. (2016); Onat et al. (2017); Yol et al. (2017); Yaşlı et al (2020).

Protein content

It was determined that protein content was statistically significant ($p < 0.01$) among cultivars (Table 2). It was determined that the protein content in the second crop peanuts cultivar between 23.15-26.68% (Table 4). Aytekin & Çalışkan (2016) discovered protein content 17.3-22.5%; Arıoğlu et al. (2018) found that protein content ratio varied between 23.17-25.84%; Kaya & Kılınç (2020) reported protein content values 22.98-30.59%. The protein content in our experimental findings was similar to Aytekin & Çalışkan (2016) and Arıoğlu et al. (2018). The findings in this study were found to be lower than the protein content found by Kaya & Kılınç (2020). Changes in protein ratio may be caused by changes in cultivars and environmental conditions.

Table 4. Averages and groups of 100-seed weight, shelling percentage, pod yield, oil content, protein content of peanut varieties

Çizelge 4. Bazı yerfıstığı çeşitlerinde belirlenen 100 tohum ağırlığı, iç oranı, meyve verimi, yağ oranı ve protein oranı özelliklerine ilişkin ortalama değerler ve oluşan gruplar

Cultivars	100-seed weight (g)	Shelling percentage (%)	Pod yield (kg ha^{-1})	Oil content (%)	Protein content (%)
Brantley	98.0 bc	69.6 ab	4684 b	51.01 a	25.26 bc
Çom	80.4 d	63.7 e	2985 d	47.55 e	23.41 ef
Düziçi-1	98.9 ab	68.0 bc	4846 a	50.75 ab	25.88 b
Florispan	44.9 e	64.5 de	2423 e	49.15 bcde	24.18 d
Georgia Green	43.8 e	72.2 a	2286 ef	50.24 abc	25.03 c
Halisbey	100.6 ab	60.6 e	4679 b	48.49 cde	24.07 de
Masal	92.5 c	70.2 ab	3190 d	48.46 de	25.22 bc
NC 7	106.5 a	72.0 a	3856 c	48.85 cde	24.32 d
Nigeria 1	29.6 f	69.8 ab	1963 f	48.03 e	26.68 a
Sultan	98.2 bc	63.5 e	3169 d	50.65 ab	23.98 de
Wilson	97.1 bc	66.4 cd	3618 c	49.92 abcd	23.15 e
Years					
2020	80.9±4.88	67.2±0.72	3308±15.59 B	49.94±0.47 A	24.67±0.19
2021	81.9±4.53	67.4±0.58	3538±14.39 A	48.81±0.20 B	24.63±0.21
Mean	81.4±3.31	67.3±0.46	3423±10.62	49.38±0.26	24.65±1.41

Letters show different groups; a, b, c, d… for varieties in each column.

As a result of the 2-year field trial, it was determined that there are environmental conditions and genotypic differences in terms of some quality and yield characteristics in the second peanut cultivation. One of the most important criteria in the breeding of peanut is the pod yield. It was determined that Düziçi 1 genotype, which is the village population used in the experiment, gave the highest yield in both years. According to the data obtained, it was decided to include the Düziçi 1 genotype into the breeding program. However, it was determined that Halisbey, Brantley and NC 7 cultivars were in the foreground compared to other cultivars in the second yield crop in the Eastern Mediterranean transition zone.

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STATEMENT OF CONFLICT OF INTEREST

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. At ISPEC 1st International Agricultural Research Congress, a part of this study was orally presented, and it was published as an abstract.

STATEMENT OF ETHICS CONSENT

Ethical approval is not applicable, because this article does not contain any studies with human or animal subjects.

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