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ARAŞTIRMA MAKALESİ **RESEARCH ARTICLE**

Determination of Important Agricultural Traits of Some Soybean (*Glycine max* (L.) Merr.) Genotypes and Adaptation in the Eastern Mediterranean Transition Zone

Doğu Akdeniz Geçit Kuşağında Bazı Soya (*Glycine max.* (L.) Merr.) Genotiplerinin Önemli Tarımsal Özellikleri ve Adaptasyonunun Belirlenmesi

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Abstract

This research was carried out to determine the yield and agronomic characteristics of some soybean genotypes under main crop conditions in the Eastern Mediterranean Transition Zone in the years 2021-2022. In the research, 13 varieties (Adel, AP-3773, Arısoy, Asya, Atakişi, Atlas-3616, J-112, Lider, Planet, Racer, Sonya, Winchester, Yemsoy) 1 genotype (Yeniköy-9) were used. The experiment was conducted in a randomized block design with three replications. It was determined that the average plant height varied between 64.05 cm (J-112) and 114.25 cm (Winchester). The lowest average first pods height (1.74 cm) was obtained from J-112 variety while the highest value (13.69 cm) was obtained from Yemsoy variety. The lowest number of branches per plant values i.e. 1.83 no. plant^{-1} and 2.13 no. plant^{-1} were recorded from J-112 and Planet variety respectively. In the experiment, the number of pods per plant varied between 72.20 pods plant^{-1} (Arısoy) to 105.61 pods plant^{-1} (AP-3773). However, the average weight of 100 seeds varied between 15.07 g (Asya) to 22.10 g (Lider). The lowest average protein content (33.58%) was obtained from Yemsoy variety while the highest value (41.50%) was obtained from J-112 variety. It was determined that the average seed yield varied between 379.74 kg da^{-1} (Arısoy) and 580.73 kg da^{-1} (Lider). According to the data obtained as a result of the experiment, Lider variety was come front with the highest seed yield (580.73 kg da^{-1}) and, J-112 variety had the high protein content with 41.50%, Planet (21.96 g) and Yeniköy-9 (20.87 g) varieties had the highest 100 seed weight. According to production goals, one of this superior varieties may be prefer to grow in the Eastern Mediterranean Transition Zone.

Keywords: Soybean (*Glycine max.* L.), Seed yield, Protein content, Agricultural traits, Adaptation

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Öz

Bu araştırma, 2021-2022 yıllarında Doğu Akdeniz Geçit Kuşağında bazı soya çeşitlerinin ana ürün koşullarında verim ve agronomik özelliklerinin belirlenmesi amacıyla yapılmıştır. Araştırmada 13 çeşit (Adel, AP-3773, Arısoy, Asya, Atakişi, Atlas-3616, J-112, Lider, Planet, Racer, Sonya, Winchester, Yemsoy) ve 1 genotip (Yeniköy-9) kullanılmıştır. Deneme tesadüf blokları deneme desenine göre 3 tekerrürlü olacak şekilde dizayn edilmiştir. Denemde ortalama bitki boyu 64.05 cm (J-112) ile 114.25 cm (Winchester) arasında değiştiği belirlenmiştir. En düşük ortalama ilk bakla yüksekliği 1.74 cm ile J-112 çeşidinden elde edilirken, en yüksek ortalama ilk bakla yüksekliği ise 13.69 cm ile Yemsoy çeşidinden elde edilmiştir. Bitki başına en düşük ortalama dal sayısı J-112 (1.83 adet/bitki) çeşidinden elde edilirken en fazla ise bitki başına ortalama dal sayısı Planet (2.13 adet/bitki) çeşidinden elde edilmiştir. Denemede ortalama bitki başına bakla sayısı 72.20 adet/bitki (Arısoy) ile 105.61 adet/bitki (AP-3773) arasında değiştiği belirlenmiştir. 100 tohum ağırlığı ise 15.07 g (Asya) ile 22.10 g (Lider) arasında değiştiği bulunmuştur. Ortalama protein oranı bakımından ise en düşük değeri %33.58 ile Yemsoy çeşidinden elde edilirken, en yüksek ortalama protein oranını %41.50 ile J-112 çeşidinden elde edilmiştir. Ortalama soya tohum verimi 379.74 kg da^{-1} (Arısoy) ile 580.73 kg da^{-1} (Lider) arasında değiştiği saptanmıştır. Deneme sonucunda elde edilen verilere göre en yüksek ortalama soya tohum verimine sahip olan Lider (580.73 kg da^{-1}) çeşidi, en yüksek ortalama protein oranı bakımından J-112 (%41.50) çeşidi ve en yüksek ortalama 100 tohum özellikleri bakımından Planet (21.96 g) çeşidi ve Yeniköy-9 (20.87 g) genotipinin öne çıktığı saptanmıştır. Üretim amaçlarına göre bu üstün çeşitlerden biri Doğu Akdeniz Geçiş Kuşağında yetiştirilmek üzere tercih edilebileceği saptanmıştır.

Anahtar Kelimeler: Soya (*Glycine max.* L.), Tohum verimi, Protein içeriği, Tarımsal özellikler, Adaptasyon

1. Introduction

Soybean (*Glycine max.* L.), a member of legume family, is one of the most valuable oil seed crop produced in the world as a source of protein for both human and animal as well as raw material for biodiesel production (Arıoğlu, 2014; Basal and Szabó, 2020; Deines et al., 2022; Şahin and İşler, 2022).

Soybean, known as yellow gold in Asia, is a very valuable industrial plant because of its high minerals and vitamin contents and is used in the production of more than 400 industrial products (Yıldırım, 2017). Furthermore, soybean contains an average of 36-45% high protein content, as well as 18-24% oil, 26% carbohydrates, and 8% mineral substances (Arslan and Arıoğlu, 2003; Arıoğlu, 2014; İlker et al., 2018; Şahin and İşler, 2021).

The remaining pulp of soybean seeds after oil extraction in the oil industry is very rich in crude protein (Arıoğlu, 2014). The digestion rate of amino acids in soybean meal is 97% and therefore it has a great value in animal nutrition (Arıoğlu, 2014; Carciochi et al., 2019). Soybean meal added to the ration mixtures of poultry increases the egg yield by 40% as well as meat yield by approximately 52% (Arıoğlu, 2014).

Although the country of origin of the soybean plant is Far East countries, soybean is mostly grown in USA and Latin American countries. According to the world production data of 2020, 34% of world soybean production is provided by Brazil, 31% by USA and 13% by Argentina. The statistics of 2020 show that 353 million tons of soybeans were produced in 126 million hectares of land in the world. Brazil is the leading soybean producing country with 121 million tons of production. After Brazil, the United States of America with 112 million tons and Argentina with a production of 48 million tons are the main soybean producer and exporter countries (Anonymous, 2023a). According to the statistics of 2020, the world average soybean yield is 278 kg da^{-1} whereas the average yield of soybean in Türkiye is 441 kg da^{-1}. 93% of Türkiye's soybean production is obtained from the Mediterranean Region and 3% from the Black Sea Region (Anonymous, 2023b).

This research was carried out to determine the agronomic and quality characteristics of some soybean genotypes as the main crop in the Eastern Mediterranean Transition Zone. This study was carried out to identify desirable genotypes in the Eastern Mediterranean Transition Zone of Türkiye.

2. Materials and Methods

2.1. Materials

In the research, 13 varieties (Adel, AP-3773, Arısoy, Asya, Atakişi, Atlas-3616, J-112, Lider, Planet, Racer, Sonya, Winchester, Yemsoy) and, 1 genotype (Yeniköy-9) were used. The Research was conducted at the Oil Seed Research Institute Application and Research location (37º07'38.87"N; 36º11'59.16"E, 65 m). The experimental area has clay texture and consists of soils with alkali (8.19) reaction and low organic matter ratio (1.67%). Some climate data for the cultivation period of 2021 and 2022 for Osmaniye province are given in *Table 1*.

Table 1. Climate parameters of the research field as of 2021, 2022 and long-year average

Months	Precipitation (mm)			Temperature (°C)			Relative humidity (%)		
	LY	2021	2022	LY	2021	2022	LY	2021	2022
May	39.1	6.4	89.8	25.2	25.1	25.4	62.2	66.5	72.6
June	18.3	0.8	0.0	28.0	29.1	28.2	65.5	65.1	66.1
July	10.7	11	0.0	28.6	29.4	28.9	64.3	62.8	69.6
August	33.6	9.6	72.4	25.7	25.7	26.1	59.8	60.7	65.6
September	68.7	9.2	12.4	21.1	21.5	21.9	58.4	49.1	62.2
October	91.5	24.2	33	14.6	16.5	16.5	61.7	60.4	66.1
Total/Av.	261.9	61.2	207.6	23.9	24.6	24.5	61.9	60.8	67.0

Av.: Average; LY: Long Year.

2.2. Methods

The field experiment was designed in a randomized block design with 3 replications and 4 rows in each plot. The plots were sown in rows with 70 cm row spacing, 5 cm plant to plant distance and 5 m long plots. Each plot area consists of 14 cm^2. The first year sowing of the experiment was done on May 30, 2021, and the second year was done

by hand on May 31, 2022. The experiment was harvested by hand on October 30, 2021, and in the second year on October 31, 2022. The experimental land was processed with a cultivator and the seed bed was made ready for planting. Before planting, 20 kg of Diammonium Phosphate (DAP 18-46-0) fertilizer was applied per decare and then 20 kg da^{-1} 33% ammonium sulfate fertilizer was applied before the first water. Weeds were removed from the plots by hoeing twice, by hoeing machine between the rows and manually over the rows. After the experimental land was prepared, irrigation, hoeing, disease and pest control operations were carried out in a suitable manner.

Plant height, first pods height, number of branches per plant, number of pods per plant, 100 seed weight and protein content were calculated based on 20 plants from the middle two rows of soybeans that reached harvest maturity. On the other hand, seed yield was calculated by manually harvesting the remaining two rows in the middle after the rows on the sides of each plot consisting of four rows were discarded as the edge effect. The yield per decare was found with the seeds obtained from the harvest.

2.3. Statistical Analysis

The data obtained in the study was subjected to analysis of variance (ANOVA) according to the randomized block experimental design, using the JMP statistical package program, and the parameters that were found to be statistically significant in the analysis were subjected to the LSD multiple comparison test.

3. Results and Discussion

The differences between soybean genotypes in terms of plant height according to the two-year average values were found to be statistically significant ($P < 0.05$) (*Table 2*). The plant height value for 2021 varies between 51.77 cm and 113.87 cm. In 2022, it was found to be between 53.29 cm and 114.63 cm. The highest plant height was obtained from Winchester (114.25 cm) varieties, while the lowest plant height value was obtained from J-112 (64.05 cm) variety in the mean of two years (*Table 3*). The plant height was recorded in this study was similar values obtained by Sevilmiş and Arıoğlu (2019), Çubukcu et al. (2020), Kulan et al. (2017), while it was found to be lower according to by Onat (2018), Bakal et al. (2016). The difference in plant height of varieties might be sourced of genetic, environmental differences.

Table 2. Results of the analysis of variance for characteristics studied in the present experiment

SV	df	PH	FPH	BP	PN	100-SW	SY	PC
Block	2	ns	ns	ns	ns	ns	ns	ns
Year	1	ns	ns	**	ns	ns	**	ns
Cultivars	13	**	**	**	**	**	**	**
Y × V	13	ns	ns	**	ns	ns	**	ns

SV: source of variation, df: degree of freedom, PH: Plant height, FPH: First pods height, BP: Branches per plant, PN: Pods number, 100-SW: 100-seed weight, SY: Seed yield, PC: Protein content, **: $P < 0.05$

According to the results of analysis of variance, the first pods height difference between genotypes was found to be statistically significant ($P < 0.05$) (*Table 2*). The average first pods height varied between 1.70 cm and 13.85 cm in 2021, whereas it was found to vary between 1.77 cm and 13.53 cm in the year of 2022. The maximum first pods height was obtained from Yemsoy (13.69 cm) and Planet (12.62 cm) genotypes, while the minimum first pods height was obtained from J-112 (1.74 cm) cultivar (*Table 3*). In soybean breeding programmes, varieties with high first pods height important in order to prevent the harvest losses during mechanical harvesting (Arıoğlu, 2014; Bakal et al., 2016). The first pods height in this study was found to be similar to Sevilmiş and Arıoğlu (2019), Çubukcu et al. (2020) but it was found to be lower than the first pods height reported by Kulan et al. (2017) and Aşık and Yıldız (2018). The difference in the height of the first pods may be due to the difference in genetical and, ecological conditions (Kınacı, 2011).

According to the analysis of variance, differences in the number of branches per plant among soybean genotypes were found to be statistically significant ($P < 0.05$) (*Table 2*). According to the average of the two years; highest number of branches per plant value was 4.60 no. plant^{-1} in Atakişi , whereas the lowest number of branches per plant values was 1.83 in J-112 (*Table 4*). On the other hand, Bakal et al. (2016), observed the number of branches per plant value between 1.63 no. plant^{-1} and 3.47 no. plant^{-1}, Kulan et al. (2017) obtained between 1.70 no. plant^{-1} and 5.50 no. plant^{-1}, Sevilmiş and Arıoğlu (2019) obtained between 2.80 and 5.30 no. plant^{-1}. The

differences in terms of the number of branches per plant might be sources of genetic characteristics of cultivars and climatic conditions are also considered to be effective.

Table 3. The plant height and, the first pods height data of the soybean varieties grown in the Eastern Mediterranean Transition Zone in 2021, 2022

Cultivars	Plant height (cm)			First pods height (cm)		
	2021	2022	Average	2021	2022	Average
Adel	90.59±3.82 bcd	86.67±3.99 bcd	88.63±1.96 c	6.96±0.38 c	7.60±0.18 de	7.28±0.53 e
AP-3773	95.16±2.92 bc	71.60±5.77 d	83.38±2.10 cde	9.60±0.33 b	10.87±0.97 bc	10.24±0.27 bc
Arısoy	69.70±2.95 g	72.80±2.81 d	71.25±2.86 f	8.88±0.81 b	8.95±0.83 cde	8.92±0.40 d
Asya	84.89±1.62 cdef	83.70±3.40 cd	84.30±0.97 cde	6.95±0.83 c	7.16±0.46 e	7.06±0.43 e
Atakişi	76.70±1.88 defg	85.47±2.47 cd	81.09±2.17 de	9.38±0.82 b	9.27±0.31 cd	9.33±0.86 cd
Atlas-3616	82.14±5.64 cdefg	80.40±4.69 d	81.27±1.24 de	9.30±0.95 b	8.93±0.93 cde	9.12±0.96 cd
J-112	51.77±3.02 h	76.33±2.02 d	64.05±1.69 g	1.70±0.25 e	1.77±0.62 g	1.74±0.25 g
Lider	88.07±3.04 bcd	83.27±3.24 cd	85.67±3.12 cd	4.63±0.11 d	4.65±0.58 f	4.64±0.10 f
Planet	86.59±3.00 bcde	88.03±1.50 bcd	87.31±1.16 c	12.23±0.18 a	13.00±0.97 a	12.62±0.18 a
Racer	81.89±2.11 cdefg	53.29±2.18 e	67.59±1.13 fg	9.15±0.98 b	10.69±0.70 bc	9.92±0.26 bcd
Sonya	71.46±3.27 fg	88.13±2.52 bcd	79.80±2.33 e	10.48±0.05 b	9.73±0.69 c	10.11±0.27 bcd
Winchester	113.87±0.97 a	114.63±0.87 a	114.25±0.90 a	10.03±0.40 b	10.43±0.61 bc	10.23±0.24 bc
Yemsoy	101.07±3.22 ab	102.74±1.40 ab	101.91±1.48 b	13.85±0.52 a	13.53±0.25 a	13.69±0.17 a
Yeniköy-9	72.67±4.63 efg	99.29±1.42 abc	85.98±2.94 cd	9.40±0.45 b	11.88±0.20 ab	10.64±0.31 b
Average	83.33±2.38	84.73±2.33	84.03±1.98	8.75±0.47	9.18±0.50	8.97±0.47
$LSD_{(0.05)}$	9.37	8.23	5.64	1.65	1.94	1.26
CV	6.70	5.79	4.00	11.20	12.64	8.36

a,b,c Values within a row with different superscripts differ significantly at $P < 0.05$

In this study, the analysis of variance of the number of pods per plant of soybean genotypes was given in *Table 2*. In 2021, the number of pods per plant of the genotypes varied between 71.95 pods plant^{-1} and 105.74 pods plant^{-1}, while in 2022 the number of pods per plant of the genotypes varied between 72.44 pods plant^{-1} and 105.48 pods plant^{-1}. Considering the average of the two the genotype AP-3773 had the highest number of pods per plant (105.61 pods plant^{-1}), while the Arısoy had the lowest number of pods per plant (72.20 pods plant^{-1}) (*Table 4*). Although the increase in the number of pods per plant affects the yield, it is not a unique criteria determining of the yield (Bakal et al. 2016). Aremu and Ojo (2005) stated that there is a significant relationship between environmental factors and the number of pods per plant. The number of pods per plant in our study was higher than the results of Onat (2018) and Sevilmiş and Arıoğlu (2019), whereas in this results were found to be similar with Kulan et al. (2017), Yıldırım (2017) and Gümüş and Beyyavaş (2020). The difference in the number of pods per plant in the studies may be due to the different genotypes and the differences of ecological factors.

According to the analysis of variance results, differences in the number of 100-seed weights among soybean genotypes were found to be statistically significant ($P < 0.05$) (*Table 2*). When the 100-seed weight data of soybean genotypes in 2021 was examined, it ranged between 15.11 g and 22.01 g, while the 100-seed weight data in 2022 changed between 15.02 g and 22.24 g. According to the average results of two years, minimum 100-seed weight value of 15.07 g was obtained from the Asya variety. The highest 100-seed weight value was obtained from the genotype Lider i.e. 22.10 g, followed by Planet with 21.96 g and Yeniköy-9 genotypes with 20.87 g, respectively (*Table 5*). 100 seed weight in soybean is affected by various factors such as sowing time, genotype difference, environmental conditions, cultural processes. 100 seed weight, which is also important in determining the amount of seed to be used per decare, is a factor that has a significant effect on grain yield per decare. The factors affecting yield in soybean vary according to the number of pods per plant, the number of plants per unit area, the weight of 100 seeds and the number of seeds per pod (Onat et al., 2017; Gümüş and Beyyavaş, 2020). In this findings of 100

seed weights were find to similar to the findings of Onat et al. (2017), Güllüoğlu et al. (2016), Choi et al. (2016), Dağtekin and Bilgili (2020).

Table 4. The branches per plant and, the pods number data of the soybean varieties grown in the Eastern Mediterranean Transition Zone in 2021, 2022

Cultivars	Branches per plant (no. plant^{-1})			Pods number (pods plant^{-1})		
	2021	2022	Average	2021	2022	Average
Adel	2.73±0.15 cd	3.63±0.13 b	3.18±0.07 bc	73.59±2.97 ef	75.83±2.20 gh	74.71±2.35 gh
AP-3773	2.31±0.10 de	2.67±0.18 de	2.49±0.09 de	105.74±3.01 a	105.48±1.54 a	105.61±2.64 a
Arısoy	2.35±0.13 de	2.48±0.08 ef	2.42±0.03 e	71.95±0.76 f	72.44±0.99 h	72.20±0.87 h
Asya	2.40±0.23 cde	2.07±0.10 fg	2.24±0.11 e	91.54±1.06 bc	93.33±1.28 bc	92.44±1.29 bc
Atakişi	4.80±0.09 a	4.40±0.07 a	4.60±0.12 a	96.27±1.53 b	91.78±1.54 bcd	94.03±0.38 b
Atlas-3616	2.50±0.14 cd	2.31±0.23 ef	2.41±0.02 e	90.30±2.06 bc	92.83±1.49 bc	91.57±2.15 bc
J-112	1.93±0.34 ef	1.73±0.19 g	1.83±0.23 f	92.97±1.43 b	96.44±2.02 b	94.71±0.99 b
Lider	4.54±0.13 a	4.27±0.10 a	4.41±0.03 a	85.70±1.40 cd	85.69±3.80 def	85.70±0.45 de
Planet	1.65±0.05 f	2.60±0.17 de	2.13±0.05 ef	85.83±1.45 cd	89.04±2.34 cde	87.44±1.29 cde
Racer	2.37±0.13 cde	3.32±0.20 bc	2.85±0.15 cd	79.87±3.87 de	84.04±4.48 ef	81.96±1.00 ef
Sonya	2.50±0.18 cd	3.19±0.09 bc	2.85±0.08 cd	89.90±3.74 bc	92.19±1.84 bc	91.05±3.72 bcd
Winchester	2.87±0.26 bc	3.04±0.32 cd	2.96±0.29 c	91.41±0.68 bc	94.86±1.59 bc	93.14±0.94 b
Yemsoy	3.32±0.15 b	3.39±0.12 bc	3.36±0.17 b	77.57±2.54 ef	80.50±0.59 fg	79.04±3.42 fg
Yeniköy-9	2.36±0.18 de	2.46±0.16 ef	2.41±0.14 e	76.72±3.81 ef	76.44±2.29 gh	76.58±2.67 fgh
Average	2.76±0.14	2.97±0.12	2.87±0.13	86.38±1.53	87.92±1.48	87.15±1.47
$LSD_{(0.05)}$	0.51	0.48	0.39	6.94	6.33	5.64
CV	10.87	9.43	8.01	4.79	4.29	3.86

[a,b,c] Values within a row with different superscripts differ significantly at $P < 0.05$

According to the results of analysis of variance, the differences between seed yields of soybean genotypes were found to be statistically significant ($P < 0.05$) (*Table 2*). When the seed data of soybean genotypes in 2021 was examined, the seed yield changed between 360.35 kg da^{-1} and 590.90 kg da^{-1}, while the seed yield value in 2022 varied between 399.13 kg da^{-1} and 570.55 kg da^{-1}. According to the average of two years, the highest seed yield was obtained from Lider variety i.e. 580.73 kg da^{-1}, and the lowest seed yield was obtained from Arısoy variety i.e. 379.74 kg da^{-1} (*Table 5*). Arıoğlu et al. (2015), showed that the seed yield varied between 428.80 kg da^{-1} and 537.70 kg da^{-1}, Likewise Bakal et al. (2016) found this value between 305.00 kg da^{-1} and 467.20 kg da^{-1}, Yıldırım (2017) recorded this value between 272.81 kg da^{-1} and 399.83 kg da^{-1}, Onat (2018) observed this value between 368.29 kg da^{-1} and 433.43 kg da^{-1} and Gümüş and Beyyavaş (2020) between 166.60 kg da^{-1} and 332.14 kg da^{-1}. The changes in the seed yield values of the different studies may be due to the different genetic structures and ecological conditions of the cultivars included in the trials.

According to the analysis of variance, the protein content differences of soybean genotypes were found to be statistically significant ($P < 0.05$) (*Table 2*). According to the years 2021, 2022 and the average of these two years, the highest protein content value was obtained from J-112 variety i.e. 41.50%, and the lowest protein content value was obtained from Yemsoy variety i.e. 33.58% (*Table 6*). The protein content value of our study is higher than the findings of Altınyüzük and Öztürk (2017), Bakal et al. (2016), Onat (2018) and Sevilmiş and Arıoğlu (2019) findings, but lower than the value recorded by Çubukcu et al. (2019).

Table 5. The 100-seed weight and, the seed yield data of the soybean varieties grown in the Eastern Mediterranean Transition Zone in 2021, 2022

Cultivars	100-seed weight (g)			Seed yield (kg da^{-1})		
	2021	2022	Average	2021	2022	Average
Adel	16.55±0.17 gh	16.71±0.21 de	16.63±0.19 ghı	554.14±28.95 ab	565.57±24.85 a	559.86±26.83 ab
AP-3773	18.41±0.19 def	19.14±0.06 c	18.78±0.08 ef	536.69±31.82 abc	537.77±26.64 a	537.23±27.57 abc
Arısoy	20.24±0.07 bc	20.90±0.33 ab	20.57±0.17 bc	360.35±31.68 f	399.13±30.67 d	379.74±30.76 h
Asya	15.11±0.27 ı	15.02±0.28 f	15.07±0.27 j	547.85±24.57 abc	552.68±24.29 a	550.27±18.17 ab
Atakişi	15.83±0.88 hı	16.11±1.02 ef	15.97±0.92 ıj	517.67±21.68 abc	523.62±27.39 ab	520.65±23.15 abcd
Atlas-3616	18.05±0.36 ef	18.06±0.21 cd	18.06±0.24 ef	471.97±24.47 cde	456.09±34.24 bcd	464.03±28.96 defg
J-112	17.67±0.17 fg	17.81±0.17 cd	17.74±0.17 efg	430.18±26.68 def	457.14±24.36 bcd	443.66±17.34 efgh
Lider	22.01±0.62 a	22.19±0.36 ab	22.10±0.49 a	590.90±25.59 a	570.55±24.88 a	580.73±22.30 a
Planet	21.67±0.57 a	22.24±0.46 a	21.96±0.48 ab	503.30±28.99 bcd	499.04±25.93 abc	501.17±27.46 bcdef
Racer	19.74±0.76 bcd	20.84±0.81 ab	20.29±0.78 cd	397.70±26.84 ef	447.50±23.65 bcd	422.60±17.43 gh
Sonya	16.39±0.64 ghı	16.05±1.12 ef	16.22±0.87 hij	488.79±24.54 bcd	457.43±30.91 bcd	473.11±26.92 cdefg
Winchester	19.12±0.18 cde	19.01±0.11 c	19.07±0.13 de	526.34±22.06 abc	514.22±29.20 abc	520.28±24.23 abcd
Yemsoy	17.39±0.27 fg	17.71±0.33 cd	17.55±0.30 fgh	433.52±25.51 def	439.58±26.57 cd	436.55±25.90 fgh
Yeniköy-9	21.02±0.61 ab	20.71±0.43 b	20.87±0.52 abc	502.51±30.66 bcd	513.86±26.61 abc	508.19±18.26 bcde
Average	18.51±0.35	18.75±0.37	18.63±0.36	490.14±11.43	495.30±9.98	492.72±10.26
$LSD_{(0.05)}$	1.42	1.52	1.41	79.59	70.73	70.78
CV	4.54	4.85	4.51	9.67	9.49	8.56

a,b,c Values within a row with different superscripts differ significantly at P < 0.05

Table 6. The protein content data of the soybean varieties grown in the Eastern Mediterranean Transition Zone in 2021, 2022

Cultivars	Protein content (%)		
	2021	2022	Average
Adel	37.02±0.32 def	37.31±0.24 efg	37.17±0.20 ef
Ap-3773	36.26±0.41 efg	36.16±0.93 g	36.21±0.24 f
Arısoy	38.25±0.59 cde	38.90±0.41 bcd	38.58±0.48 cd
Asya	34.50±0.53 gh	33.44±0.22 h	33.97±0.47 g
Atakişi	38.60±0.60 bcd	39.32±0.58 bcd	38.96±0.29 bc
Atlas-3616	35.42±0.56 fgh	36.46±0.46 fg	35.94±0.49 f
J-112	40.82±0.67 a	42.18±0.50 a	41.50±0.44 a
Lider	37.36±1.05 def	37.94±0.34 def	37.65±0.64 de
Planet	38.12±0.89 cde	39.85±0.55 bc	38.99±0.54 bc
Racer	39.01±0.80 abcd	39.33±0.44 bcd	39.17±0.30 bc
Sonya	38.67±1.15 bcd	39.53±0.45 bc	39.10±0.70 bc
Winchester	40.46±0.40 ab	39.98±0.44 b	40.22±0.34 b
Yemsoy	33.96±0.49 h	33.20±0.55 h	33.58±0.10 g
Yeniköy-9	39.78±0.19 abc	38.32±0.85 cde	39.05±0.38 bc
Average	37.73±0.35	37.99±0.40	37.86±0.35
$LSD_{(0.05)}$	2.01	1.58	1.29
CV	3.17	2.47	2.03

a,b,c Values within a row with different superscripts differ significantly at P < 0.05

4. Conclusions

The importance of soybean is increasing day by day, and intensive breeding studies have been conducted the development of new varieties. The important features in soybean breeding are the determination of varieties suitability for machine harvesting and, the selection of varieties that are resistant to shedding and high seed yield. This study was conducted to determine of yield and important agricultural characteristic of some soybean varieties and genotypes grown in Eastern Mediterranean Transition Zone. The Winchester (114.25 cm) and Yemsoy (101.91 cm) genotypes were found good in terms of plant height, similarly AP-3373 (105.61 pods plant^{-1}) in terms of pods number, Lider (22.10 g), Planet (21.96 g), and Yeniköy-9 in terms of 100 seed weight (20.87 g) were found good. In terms of seed yield, Lider and Asya varieties produced the highest yield. As a result of the experiment, it was determined that the varieties i.e. Lider, Adel, Asya and Yeniköy-9 provided more yield than the other varieties and J-112 variety was found to be important in terms of protein content.

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Ethical Statement

There is no need to obtain permission from the ethics committee for this study.

Conflicts of Interest

The author declares that they have no conflict of interest.

Authorship Contribution Statement

Concept; Design; Data Collection or Processing; Statistical Analyses; Literature Search; Review and Editing: Yılmaz, M.

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