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Evaluation of Yield Performance of Some Local Chickpea Varieties In Silifke Ecological Conditions

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Abstract: This study was conducted in 2022 in the arid conditions of Silifke district, Mersin. The experiment included 14 chickpea varieties planted in a randomized complete block design with three replications. According to the research results, flowering time average to 130.74 days, pod setting time to 141.30 days, plant height to 39.98 cm, first pod height to 23.80 cm, number of branches per plant to 2.79 pieces, number of pods per plant to 9.14 pieces, number of seeds per pod to 0.75 pieces, pod length to 2.24 cm, thousand seed weight to 301.86 g, grain yield per decare to 80.14 kg, harvest index to 35.09%, root length to 9.05 cm, disease degree to 0.67, protein content to 16.14%, starch content to 42.14%, fat content to 5.41%, ash content to 2.56%, fiber content to 6.49%, and moisture content ranging to 11.40%. In conclusion, the Aksu variety was found to be more suitable under Silifke ecological conditions based on the evaluated characteristics and demonstrated higher yield compared to other varieties. Further scientific research on the Aksu variety suggests its potential widespread cultivation under Silifke conditions.

Bazı Nohut Ceşitlerinin Silifke Ekolojik Kosullarında Verim Performansının Değerlendirilmesi

Anahtar Kelimele
Cicer arietinum L.,
Adaptasyon,
Verim,
Verim unsurları,
Silifke

Öz: Bu çalışma, 2022 yılında, Mersin'in Silifke ilçesinde kıraç şartlarda kurulmuştur. Denemede 14 adet nohut çeşidi kullanılmış olup, tesadüf blokları deneme planına gore 3 tekerrürlü olarak ekimi yapılmıştır. Araştırma sonuçlarına göre, çiçeklenme süresi ortalama 130.74 gün, bakla bağlama süresi 141.30 gün, bitki boyu 39.98 cm, ilk bakla yüksekliği 23.80 cm, bitkide dal sayısı 2.79 adet, bitkide bakla sayısı 9.14 adet, baklada tane sayısı 0.75 adet, bakla uzunluğu 2.24 cm, bin tane ağırlığı 301.86 g, dekara tane verimi 80.14 kg, hasat indeksi 35.09%, kök uzunluğu 9.05 cm, hastalık derecesi 0.67, protein oranı 16.14%, nişasta oranı 42.14%, yağ oranı 5.41%, kül oranı 2.56%, lif oranı 6.49% ve nem miktarlarının 11.40% olarak tespit edilmiştir. Sonuç olarak, Silifke ekolojik koşullarında nohut çesitlerinin incelenen özelliklerine göre Aksu çeşidi daha uygun bulunmuş ve verim açısında diğer çeşitlere göre daha çok verim verdiği görülmüştür. Aksu çeşidi üzerinde daha çok bilimsel araştırmalar yapılarak Silifke koşullarında yaygın olarak ekimi yapılabileceği öngörülmektedir.

1. INTRODUCTION

Currently, our planet is home to approximately 8 billion people [1], and it is estimated that by 2030, this number will reach 8.6 billion, and by 2050, it will almost exceed 9.8 billion [2]. We will increasingly face the demand to produce more food for more people with fewer resources, and to meet this growing demand, we will need to prioritize high-quality products. Chickpea is one of the important products, and it is a good source of energy, protein, minerals, vitamins, and fiber. It also contains potentially beneficial phytochemicals for health. [3]. Chickpeas play a leading role in global food security by filling the protein gap in the daily food rations of the populations in India and Sub-Saharan Africa [4]. The designed chickpea-based infant follow-on formula meets the WHO/FAO requirements for complementary foods and the EU regulations for follow-on formulas with minimal additions of fat, minerals, and vitamins. It uses chickpeas as a common source of carbohydrates and protein, making it more economical and affordable for developing countries without compromising nutritional quality [5].

Chickpea plant is a very important vegetable protein source, although the amount of use varies depending on the development status of the countries. Among legumes, chickpea is preferred to legumes in some regions due to its multiple uses [6]. Chickpea is considered unique because of its high protein content, which accounts for almost 40% of its weight. Furthermore, chickpeas have health beneficial effects that include reducing cardiovascular, diabetic and cancer risks.

This species is widely distributed in the world and is cultivated almost everywhere [7]. Turkey is an important gene center [8]. However, according to TEPGE (Tarimsal Ekonomi ve Politika Gelistirme Enstitüsü), 2023 data, it was cultivated on 15 million ha in the world. World cultivation areas have increased by 3.00% in the last five years. Accordingly, when evaluated on a country basis, the country with the highest cultivation area in 2021 is India with 10.90 million ha. This value constitutes approximately 73.00% of the total chickpea cultivation area. Other countries with significant cultivation areas are Pakistan, Russia, Turkey, Iran, Iran, Myanmar, Australia and Ethiopia. Turkey accounts for only 4.00% of the total chickpea cultivation area in the world. While there has been an increase in the world's cultivation areas in the last five years, Turkey ranks 4th with an area of 482,000 ha-1 and constitutes approximately 3.20% of the total cultivation areas in the world [9].

Chickpea is a very important food source for human and animal nutrition and plays an important role in soil sustainability, especially in arid and semi-arid regions. Chickpea can grow in arid and semi-arid areas with rainfall without the need for irrigation. Thanks to this feature, chickpea is included in the crop rotation and reduces fallow areas. Thus, in 2018, by receiving incentives for agricultural production, chickpea is being cultivated in many areas from sea level to high areas [10]. However, the yield obtained varies greatly depending on genotype, year and environmental factors. This situation has led researchers to work on the selection of suitable conditions, suitable cultivation methods and suitable varieties.

Mersin is one of the provinces with significant chickpea production. According to TUIK (Türkiye İstatistik Kurumu) data, Mersin was the leading province with the highest chickpea production in Turkey until 2012, while in 2022 it ranked 11th with 97,356 cultivation area according to TEPGE [11]. In this context, the steady decline in chickpea cultivation areas in Mersin stands out.

In the province of Mersin, the highest chickpea production is carried out in the districts of Gulnar and Silifke" [12]. The lands used as agricultural land in Silifke are concentrated in Goksu Valley, Goksu Delta and coastal areas. The agricultural land is more in Goksu Delta due to the high amount of alluvial soils. With the effect of irrigation, strawberries, citrus fruits, peanuts and various vegetables are grown in these areas. In the areas where the elevation increases, cereals and legume crops (wheat, barley, chickpea) come to the forefront due to the inadequacy of temperature and irrigation [13].

In this context, the aim of this study is to examine 14 different varieties of chickpea plants in terms of yield and yield elements in Silifke ecological conditions and to determine which variety is suitable for the conditions of the region. The aim is to develop this selected variety through scientific research and to ensure its widespread cultivation in this region.

In this context, the importance of this study is as follows; chickpea plant is a plant with adaptation limitations and not all varieties give the same yield everywhere. Therefore, measuring the adaptation abilities of the improved varieties to the region, determining their yield potentials, and identifying suitable varieties will provide a scientific basis for breeding studies to be conducted in the region and inform producers about varieties suitable for the region.

The first objective of this research is to determine the feasibility of chickpea cultivation in the coastal and barren regions of Silifke. Accordingly, it has been determined which variety adapts better and whether the yield obtained will be satisfactory for the producers

2. MATERIAL AND METHOD

This study was carried out between October-December 2022 as winter sowing under Silifke conditions. 'Aksu, Seckin, Inci, Kusmen-99, Damla-89, Cevdetbey-98, Canitez, Ubet, Gulumser, Borabey, Zuhal, Sezenbey, Sari-98 and Yasa-05' varieties were used in the study.

When examining the long-term climate data (1991-2020) and the climate data for the year 2022 for the Silifke district of Mersin [14], it was found that the average

monthly temperature during the growing season (October, November, and December) of 2022 was 21.15°C, while the long-term average was 19.6°C. Comparing these, it was observed that the temperature was 1.5°C higher." During the growing season encompassing September, October, November, and December, the average monthly maximum temperature was 30.8°C, while the long-term average was 34.7°C. Comparing these, it was observed that the temperature was 4.7°C lower. While the total rainfall was 115.4 mm, the long-term average total rainfall was 274.8 mm, indicating a 58% decrease in total rainfall in 2022 compared to long-term averages. During the growing season, the average relative humidity was 52.12%, whereas the long-term average relative humidity was 56.15%. It was recorded that the relative humidity in 2022 showed a 7% decrease compared to long-term averages.

In the study, the selected varieties were sown in 3 replications according to the randomized blocks experimental design. In the sowing process; the distance between rows of each plot was set as 45 cm, the distance between rows was set as 5 cm, the number of rows in the plot was set as 4, and the length of the plot was set as 4 m.

According to the results of the soil analysis of the cultivation area, it was found that it had a calcareous structure, insufficient organic matter, alkaline, and very poor drainage. It was observed that plant roots could not develop comfortably in this soil, which was very dense due to the lack of cultivation for a long time. Therefore, 18-46 DAP fertilizer was applied at the rate of 6 kg phosphorus per decare during sowing, and before flowering, 46% urea was applied at a rate of 3 kg per decare.

In the study, various traits such as flowering duration, Pod Setting Time, plant height, first pod height, number of branches per plant, number of pods per plant, number of seeds per pod, pod length, thousand-seed weight, seed yield, root length, disease degree, protein content, starch content, oil content, ash content, fiber content, and moisture content were examined. Observations were made from 5 plants selected from each plot according to the Technical Instructions for Agricultural Values Measurement Trials determined by the Turkish Ministry of Agriculture and Rural Affairs, General Directorate of Protection and Control, Seed Registration and Certification Center Directorate.

2.1. Statistical Analysis

The values of the examined traits were subjected to analysis of variance using SAS package program according to the randomized block design and the differences between the averages were tested according to DUNCAN multiple comparison method at $p<0.01$ significance level. In addition, correlation analysis and Principal Component Analysis (PCA) of the relationships between traits were performed using PAST 4 program.

3. RESULTS AND DISCUSSION

The results obtained from this study, which evaluated the performance of various chickpea varieties in the coastal regions near Silifke, are presented below.

3.1. Flowering Time (days)

The presence of differences in flowering timetimes and the statistical analysis results for the grouping of these differences are presented in Table 1. According to the variance analysis results, the flowering time of the varieties were found to be statistically significant at the 1% significance level. On the other hand, differences were also observed between the blocks, but these differences were found to be significant at the 5% level.

Table 1. Analysis of variance, mean values, and groupings for flowering duration, pod setting time, and plant height of chickpea varieties

No	Varieties	Flowering Duration (days)	Pod Setting Time (days)	Plant Height (cm)
1	Aksu	128.67 ef	139.67 ef	**46.70 a**
2	Seckin	128.67 ef	140.50 c-f	38.13 ef
3	Inci	**133.33 a**	**143.53 a**	40.83 de
4	Kusmen-99	131.00 a-e	**138.70 f**	**29.77 ı**
5	Damla-89	129.33 c-f	141.73 a-d	41.50 cd
6	Cevdetbey-98	**133.33 a**	141.67 a-d	43.33 b-d
7	Aydin-92	131.33 a-d	140.00 d-f	45.93 ab
8	Ubet	129.00 d-f	**139.40 f**	41.53 cd
9	Gulumser	132.67 ab	142.03 a-c	45.30 ab
10	Borabey	131.00 a-e	142.10 a-c	33.55 h
11	Zuhal	130.50 b-f	141.50 b-e	34.85 gh
12	Sezenbey	**128.50 f**	143.00 ab	43.73 bc
13	Sari-98	131.67 a-c	142.80 ab	36.33 fg
14	Yasa-05	131.33 a-d	141.50 b-e	38.20 ef
Average		**130.74**	**141.30**	**39.98**
% CV		**0.98**	**0.70**	**3.83**
F Value	**Varieties**	**5.31****	**6.33****	**32.60****
	Blocks	**5.10***	**0.31**	**0.79**

**: $p<0.01$; *: $p<0.05$ statistically significant within error limits.

When examining the average values of the flowering time of chickpea varieties, it was determined that the flowering time varied between 125.50 and 133.33 days, with the average flowering duration of the varieties being 130.74 days. Among these varieties, 'Sezenbey' was the variety with the shortest flowering period and was in a separate group from the other varieties. On the other hand, the varieties with the longest flowering period were 'Inci' and 'Cevdetbey-98'.

The findings we obtained regarding the duration until flowering were evaluated with previous studies. Accordingly, it has been stated in various studies conducted under Adana conditions that the flowering duration can vary between 97.70 and 171.30 days depending on the genotypes [15; 16; 17]. However, under Sırnak-İdil conditions, the average flowering duration was determined to be 139.90 days [18]. On the other hand, in a study conducted under Ankara conditions, Aydogan [16] reported that the number of days to flowering ranged from 59.00 to 67.3 days, Gurbuz [17] reported 55.8 days under Bingol ecological conditions, Patan [18] reported 56.7 to 67.0 days under

Erzurum conditions, and Karakan Kaya [19] reported 57.0 to 62.3 days under Elazıg conditions.

In general, it has been observed that flowering time differ in each study. This is thought to be significantly influenced by the selection of varieties, planting time, agricultural procedures, and the climatic and soil characteristics of the growing location. Thus, both similarities and differences with other studies have been observed. However, it is clearly evident from the comparison of this study with other studies that the number of days until flowering is more or less similar in similar ecologies and with the same genotypes.

3.2. Pod Setting Time (days)

The variance analysis results and average values related to pod setting times are given in Table 1. Accordingly, it was found that the pod setting times of the examined varieties were statistically very significant ($p<0.01$). It was determined that the pod setting times of the varieties varied between 138.70 - 143.53 days and the average pod setting time of all varieties was 141.30 days. It was observed that the variety 'Kusmen-99' had the shortest pod setting time, and the second shortest Pod Setting Time was found to be 'Ubet' with 139.40 days. It was also noted that these two varieties were not statistically different from each other. The variety 'Inci' had the longest pod setting time and was placed in a separate group from all other varieties.

The data obtained in this study are similar to the data of Oztas [20], who stated that the pod setting time varied between 164.00-177.00 days for chickpea varieties sown in November in Harran Plain. Additionally, it also shows similarity to the data expressed by Yigit [21], who reported the pod setting periods of chickpea varieties to be 82.00-111.00 days in a study conducted to determine the yield performance of some chickpea varieties under the ecological conditions of Kırsehir. However, it is found to be higher than the data of Ozgun et al. [22] who reported that the pod setting time varied between 50.00-11.00 days in their study sown in April. This may be due to the fact that the vegetation season in summer is shorter than in winter and therefore the pod setting time is shortened [23].

3.3. Plant Height (cm)

The results of the variance analysis, mean values, and formed groups of the data related to the plant heights of the varieties are presented in Table 1. Accordingly, it was observed that the variation among the varieties was statistically significant at the $p<0.01$ level, indicating high diversity in this area. The average plant height values varied between 29.77 - 46.70 cm and the average plant height of all varieties was 39.97 cm. The highest plant height was found to be 'Aksu' variety and the lowest plant height was found to be 'Kusmen-99' variety. Both varieties were in separate groups. The second lowest plant height value was observed in 'Borabey' variety and 'Borabey' was in a separate group. All other varieties were in intermediate groups.

In studies related to plant height values, Erden [24] found that plant heights ranged from 38.1 to 52.8 cm under Siirt conditions, while Beysari [25] found that plant heights ranged from 41.4 to 46.6 cm under Bingol conditions. Additionally, Beykara [26] reported plant heights ranging from 37.42 to 44.00 cm, Gurbuz [17] from 30.3 to 42.3 cm, Dinc [27] from 28.96 to 41.26 cm under Van conditions, Yasar [28] from 34.17 to 42.53 cm under Diyarbakir conditions, and Karakan Kaya [19] found plant heights ranging from 41.2 to 56.9 cm under Elazıg conditions. All these studies indicate that plant height values vary greatly, and these variations are significantly influenced by genotype and environment.

3.4. First Pod Height (cm)

The variance analysis results of the first pod height data for chickpea varieties grown in Silifke district are presented in Table 2. According to the results of this analysis, the variation among varieties for first pod height was found to be statistically significant at the $p<0.01$ level. first pod height values varied between 20.85 - 28.37 cm and the average was 23.80 cm. The variety with the highest first pod height was 'Aydin-92', followed by the 'Aksu' variety with 28.07 cm. These two varieties were found to be in the same group, statistically indistinguishable from each other. The lowest first pod height was obtained from the 'Zuhal' variety.

When the studies conducted by other researchers on the first pod height were examined, it was seen that Dinc [27] determined that the first pod height varied between 19.13-25.33 cm under Van ecological conditions, Beysari [25] determined 20.80-29.90 cm under Bingol conditions, Yasar [28] determined 15.27-20.20 cm under Diyarbakir ecological conditions, and Gurbuz [17] determined 14.00-28.20 under Bingol conditions. The first pod height values obtained by researchers are in parallel with the values obtained in this study. However, in studies conducted by Bakoglu and Aycicek [29] under Bingol conditions, by Bicer and Anlarsal [30] under Diyarbakir conditions, by Vural and Karasu [31] under Isparta ecological conditions, and by Canci and Toker [32] under Antalya conditions, the average first pod height was determined to be 17.8 cm, 16.63 cm, 16.70 cm, and 18.50 cm, respectively. These values are lower than the values obtained in our study. The first pod height characteristic is related to plant height, and both characteristics are directly related to the genetic potential of the variety. They are also significantly influenced by cultural practices during the growth period and especially by rainfall [33].

3.5. Number of Branches Per Plant (pieces)

Data on the number of branches of the varieties used in the experiment were obtained and subjected to analysis of variance. The results obtained are given in Table 2. According to this table, it was seen that the variation between varieties was significant at $p<0.05$ level. According to the data obtained, the number of branches per plant of each variety varied between 1.80 - 4.10 pieces and the average number of branches was 2.79

pieces. In terms of number of branches, the lowest value was obtained from 'Yasa-05' and the highest value was obtained from 'Sezenbey' cultivar. Except for these two varieties, all other varieties were in the transition groups in terms of this trait.

When the studies conducted were evaluated, Demirci and Bildirici [34] determined the number of branches of 2.00-3.30 pieces in 14 chickpea varieties under Sanliurfa conditions, Sozen and Karadavut [35] determined 1.40-3.50 pieces in 62 chickpea genotypes, Tetik [36] determined 4.60-6.80 piecesin 16 chickpea varieties.

Bakoglu and Aycicek [29] reported that the number of branches varied between 2.30-3.53 pieces in a study conducted with 8 chickpea varieties under dry conditions in Bingol; Bicer and Anlarsal [30] obtained the number of main branches as 1.8-3.2 pieces in a study conducted with 48 chickpea genotypes in Diyarbakır. Onder and Ucer [37] found that the number of main branches per plant for 5 chickpea varieties ranged from 3.50 to 9.50 pieces under Konya ecological conditions; Karakoy [38] determined that the number of branches per plant varied between 2.85 and 4.65 pieces in a study conducted under Adana conditions. In other studies on the number of main branches per plant, Bicer [39] obtained values between 1.80-3.20 pieces, Arshad et al. [40] between 2.40-3.95 pieces and Kacar et al. [41] obtained values between 2.58 and 3.23 pieces. The values for the number of main branches per plant obtained by the researchers are similar to those obtained in this study. However, when examining the study conducted by Aydogan [42] under Eskisehir ecological conditions, it is observed that the number of main branches per plant in the chickpea varieties included in the study ranged from 6.50 to 12.80 pieces. The values obtained for this characteristic in our study are lower than those obtained by the researcher, and it was concluded that these values were obtained as a result of different ecological and climatic factors, although the other varieties were different and the Inci variety was common.

3.6. Number of Pods Per Plant (pieces)

The presence of differences in the number of pods per plant and the statistical analysis results aimed at grouping these differences are presented in Table 2. According to the results of variance analysis, the number of pods per plant of the varieties was found to be statistically significant at $p<0.01$ significance level.

It was recorded that the average values of pods per plant among the varieties varied between 2.47 - 13.10 pieces, and the general value of these values was 9.14 pieces (Table 2). The lowest number of pods was obtained from Kusmen-99 and the highest number of pods was obtained from 'Sezenbey' variety. These varieties were placed in different groups because they showed significant differences from each other and from all other varieties. However, the varieties 'Aksu', 'Seckin', 'Inci', 'Cevdetbey-98', and 'Gulumser' were found to have the same number of pods statistically. The varieties 'Aydin-92', 'Zuhal', and 'Yasa-05' also shared the same values statistically.

The number of pods of a plant is one of the most important traits determining grain yield compared to other yield components and has a positive and significant relationship with the number of grains in the plant [43]. Although various environmental and climatic factors influence the number of pods in a plant, many studies suggest that the genetic potential of the variety is the determining factor.

Some researchers have reported varying numbers of pods per plant in their studies. For example, Demirci and Bildirici [34] found that the number of pods per plant ranged from 6.90 to 13.00 for 14 genotypes under Sanliurfa conditions. Sozen and Karadavut [35] reported a range of 8.00 to 32.00 pods per plant for 62 genotypes. Aydogan [42] observed a range of 23.80 to 75.30 pods per plant for 11 chickpea genotypes under Eskisehir conditions. Tetik [36] found that the number of pods per plant ranged from 11.10 to 23.50 for 16 different genotypes. Bicaksiz [44] reported that the number of pods per plant varied from 15.60 to 19.90 pieces under Eskisehir conditions. Patan [18] observed a range of 12.70 to 25.90 piece pods per plant under Erzurum conditions. Bakoglu [29] found that the number of pods per plant ranged from 6.10 to 15.00. Although the findings of the researchers were slightly above the values obtained in this study, they were partially similar. However, in the study conducted under Erzurum conditions, the average number of pods per plant was 29.00 [45], in the study conducted in Sanliurfa it was 26.40 [20], in the research conducted under Bursa ecological conditions it was 29.50 [41], in the study conducted in Bingol it was 12.42 [29], and in the study conducted under Diyarbakir ecological conditions, the average number of pods per plant was 19.05 [46]. These values are observed to be higher than the values obtained in our study. The discrepancy between the results of the literature and the results of the current study can be attributed to the genotypic differences among the varieties and environmental conditions.

3.7. Number of Grains Per Pod (piece)

A grouping analysis based on averages was performed due to significant variability in the number of grains per pod among the varieties, and the results are presented in Table 2. When examining the table, it could be seen that the number of grains per pod varied between 0.54 and 1.08 piece, and the average number of grains per pod of the varieties was 0.75 piece. It was recorded that the highest number of grains per pod was found in the ‘Damla-89’ variety, while the lowest value was found in the ‘Cevdetbey-98’ variety. Additionally, it was determined that these two varieties significantly differed from each other and from the other varieties, placing them in separate groups. All other varieties were found to be in transitional groups.

The number of grains in the pod may show different characteristics depending on the genotype of the variety.

Mostly, there may be two pods with small seeds and one pod with large seeds [47]. In this context, a review of the literature reveals that studies have reported the number of seeds per pod as follows: Demirci and Bildirici [34] 1.00-1.30 seeds pod^{-1}, Ceran [48] 0.86 seeds pod^{-1}, Patan [18] 0.94 seeds pod^{-1}, Beysari [25] 1.03 seeds pod^{-1}, and Erdemci [49] 1.01-1.03 seeds pod^{-1}. Additionally, other studies have reported values ranging from 0.82 to 1.15 seeds per pod [50] [51] [29]which are largely similar to our findings.

3.8. Pod Length (cm)

Data on pod length for different varieties were subjected to variance analysis, and the results are presented in Table 3. According to this, it was determined that there was no statistical difference in pod length among the varieties and that all had the same pod length. However, The average values of pod length of the varieties are given in Table 3. As seen in the table, pod length values varied between 1.96 (Damla-89) - 2.50 (Sari-98) cm, however, the overall average of the varieties was 2.24 cm. Differences at the 5% level were observed between the blocks.

When the literature is reviewed, Ozgun [22] in his study conducted under Diyarbakir conditions reported pod lengths ranging from 2.27 to 3.00 cm. This finding is similar to the findings of our study.

3.9. Thousand Grain Weight (g)

After the harvest, the thousand grain weight data for each variety was obtained and variance analysis was conducted. The results are presented in Table 3. According to these results, significant differences ($p<0.01$) were found in the thousand grain weights of the varieties.

The average values of thousand grain weights for the varieties and the groups formed according to Duncan's multiple comparison test are detailed in Table 3. The thousand grain weight values varied between 258.17 - 395.33 g according to the varieties and the average was 301.86 g. The lowest thousand grain weight was obtained from 'Inci' variety. However, it was determined that there was no statistical difference between the following varieties 'Kusmen-99' (260.08 g), 'Damla-89' (261.42 g), 'Gulumser' (265.08 g) and 'Borabey' (265.08 g) and they were in the same group. On the other hand, the highest thousand grain weight was obtained from 'Cevdetbey-98'.

In many cereal and edible legume crops, thousand grain weight values are one of the most important parameters related to yield. In this respect, thousand grain weight values are especially examined in the studies. When examining the studies of other researchers on this subject, Demirci and Bildirici [34] determined the thousand grain weight as 98.20-295.50 g in 14 different chickpea genotypes, Aydogan [42] as 246.00-427.00 g in 11 different genotypes, Sozen and Karadavut [35] as 267.00-470.00 g in 62 chickpea genotypes, while Erden [24] reported the hundred seed weight as 27.90-39.60 g and Bicaksiz [44] as 40.40-44.00 g. In general, it has been understood that both our findings and the findings of other researchers show great variability. This situation suggests that it is due to genotypic differences, ecological conditions, and cultural practices.

3.10. Grain Yield Per Decare (kg)

The values for grain yield per decare, which is one of the most important characteristics in cultivation, were subjected to variance analysis to investigate the significance of differences among varieties, and the results are presented in Table 3. With the emergence of significant differences, a grouping analysis of the average values was conducted, and the results are also given in Table 3. As seen in Table 3, the grain yield per decare for the varieties was found to be statistically highly significant.

When Table 3 was analyzed, it was observed that grain yield values varied between 23.84 - 116.91 kg and the general average value of the varieties was 80.14 kg. It was recorded that the best variety in terms of grain yield per decare was 'Aksu'. The other varieties with the highest values were 'Seckin' with 116.26 kg and 'Ubet' with 110.41 kg, but these two varieties were in the intermediate group after 'Aksu'. The lowest grain yield was obtained from 'Kusmen-99' variety.

Grain yield is a criterion examined in all studies since it is the main element of cultivation and production. In this regard, when evaluating all studies related to chickpea cultivation, considering different genotypes, ecologies, and cultural practices for grain yield, Mart et al. [52] reported values between 117.60-202.30 kg da^{-1}, Topcu and Akcura [53] reported 327.00 kg da^{-1}, Gunes et al. [54] reported 400.00 kg da^{-1} and above, Demirci and Bildirici [34] reported values between 140.70-398.70 kg da^{-1}, Topcu [55] reported values between 97.50-327.00 kg da^{-1}, Tetik [36] reported values between 45.60-103.10 kg da^{-1}, Aydogan [42] reported values between 72.00-197.00 kg da^{-1}, and Gundogdu Gurbuz [56] reported values between 26.20-85.20 kg da^{-1}. Grain yield significantly increases with agricultural procedures such as irrigation and fertilization, especially with sufficient irrigation during the branching process, flowering, and pod-setting periods [57].

3.11. Harvest Index (%)

The variance analysis results and the average values for harvest index for different varieties are provided in Table 3. The analysis indicates that the harvest index shows statistically significant differences at the $p<0.05$ significance level for all varieties (Table 3).

On the other hand, the average harvest index of the varieties varied between 26.35 - 42.72% and the average of all varieties was 35.09% (Table 3). The highest harvest index value was obtained from 'Seckin' variety, while 'Ubet' variety with 42.71% and 'Aksu' variety with 40.78% were the varieties with the highest harvest index

and were statistically in the same group. The lowest harvest index value was obtained from 'Kusmen-99' variety and all other varieties were in the intermediate group.

Another parameter related to yield is the harvest index. Researchers' findings on this criterion vary. In some studies, it was recorded that the harvest index value in Sırnak-Idil conditions was between 26.00-41.50% [58], the average harvest index values in Siirt conditions were between 34.70 and 44.50% [24], and in the study conducted in Central Anatolia, it was between 39.67-45.82% [44]. Tetik [36] also reported that the harvest index varied between 12.60-33.30% and Yigitoglu [59] between 45.20-49.07%. Our findings are similar to the findings of other researchers in terms of the similarity of our research conditions.

Table 2. Variance analysis, mean values, and groupings of chickpea varieties for first pod height, number of branches per plant, number of pods per plant, and number of seeds per pod

No	Varieties	First Pod Height (cm)	Number of Branches per Plant (pieces)	Number of Pods per Plant (pieces)	Number of Seeds per Pod (pieces)
1	Aksu	**28.07 a**	2.73 b-e	10.73 c	0.79 b-d
2	Seckin	21.67 de	2.53 b-e	10.20 c	0.84 bc
3	Inci	23.20 b-e	2.33 c-e	10.13 c	0.82 bc
4	Kusmen-99	22.47 c-e	2.20 de	**2.47 f**	1.00 ab
5	Damla-89	25.07 bc	3.07 a-d	11.13 bc	**1.08 a**
6	Cevdetbey-98	23.17 b-e	2.73 b-e	10.40 c	**0.54 d**
7	Aydin-92	**28.37 a**	2.20 de	8.20 d	0.68 cd
8	Ubet	21.77 de	3.20 a-d	12.47 ab	0.64 cd
9	Gulumser	25.80 ab	2.70 b-e	10.30 c	0.69 cd
10	Borabey	22.05 c-e	3.50 a-c	5.80 e	0.76 b-d
11	Zuhal	**20.85 e**	3.60 ab	8.30 d	0.63 cd
12	Sezenbey	24.55 b-d	**4.10 a**	**13.10 a**	0.67 cd
13	Sari-98	22.87 b-e	2.40 b-e	7.07 de	0.77 b-d
14	Yasa-05	23.35 b-e	**1.80 e**	7.70 d	0.65 cd
Average		**23.80**	**2.79**	**9.14**	**0.75**
% CV		**6.80**	**23.19**	**9.01**	**17.76**
F Value	**Variety**	**5.31****	**2.88***	**34.67****	**3.62****
	Block	**5.10***	**0.77**	**0.20**	**2.53**

**: p<0.01; *: p<0.05 statistically significant within error limits.

Table 3. Analysis of variance, mean values, and formed groups for pod length, thousand grain weight, yield per decare, harvest index, root length, and disease degree of chickpea varieties

	Varieties	Pod Length (cm)	Thousand Grain Weight (g)	Yield per Decare (kg)	Harvest Index (%)	Root Length (cm)	Disease Degree
1	Aksu	2.327 a-c	321.582 c	**116.91 a**	**40.8 a**	8.500 bc	**0.000 e**
2	Seckin	2.278 a-c	305.167 d	116.26 ab	**42.721 a**	**11.500 a**	0.500 c-e
3	Inci	2.207 a-c	**258.167 f**	87.07 a-e	36.042 ab	**12.375 a**	1.000 a-d
4	Kusmen-99	2.267 a-c	**260.083 f**	**23.84 f**	**26.347 b**	8.889 bc	1.500 ab
5	Damla-89	**1.958 c**	**261.417 f**	88.91 a-e	35.519 ab	8.556 bc	0.633 c-e
6	Cevdetbey-98	2.317 a-c	**395.333 a**	91.22 a-d	33.284 ab	9.653 b	1.067 a-c
7	Aydin-92	2.240 a-c	301.167 de	65.34 c-e	30.379 ab	**7.942 c**	**0.000 e**
8	Ubet	2.053 bc	348.000 b	110.41 ab	**42.711 a**	**7.633 c**	0.500 c-e
9	Gulumser	2.290 a-c	**265.083 f**	79.90 b-e	35.361 ab	8.583 bc	**0.000 e**
10	Borabey	2.200 a-c	**265.083 f**	53.52 ef	33.423 ab	8.800 bc	**0.000 e**
11	Zuhal	2.390 ab	290.833 e	67.19 c-e	32.898 ab	8.650 bc	0.267 de
12	Sezenbey	2.120 a-c	309.917 d	101.07 a-c	31.755 ab	**8.167 c**	0.800 b-d
13	Sari-98	**2.500 a**	343.750 b	59.65 de	37.498 ab	8.783 bc	**1.667 a**
14	Yasa-05	2.180 a-c	300.417 de	60.64 de	32.583 ab	8.625 bc	1.500 ab
Average		**2.238**	**301.857**	**80.14**	**35.093**	**9.047**	**0.674**
% CV		**8.975**	**2.017**	**23.89**	**18.458**	**7.944**	**59.071**
F Value	**Variety**	**4.91***	**131.96****	**5.87****	**1.55***	**10.14****	**6.80****
	Block	**1.39***	**0.71**	**1.42**	**0.28**	**0.49**	**1.54**

**: p<0.01; *: p<0.05 statistically significant within error limits.

3.12. Root Length (cm)

The results of the analysis of variance, average values and the distribution of these values among the groups obtained after determining the root lengths of the varieties are given in Table 3. According to the results of analysis of variance, root lengths of the varieties showed significant (p<0.01) differences.

Table 3 shows that the average root length values of the varieties varied between 7.63 - 12.38 cm and the overall average was 9.05 cm. Accordingly, it was determined that the variety with the highest root length was 'Inci', followed by 'Seckin' with 11.50 cm and these two varieties were statistically indistinguishable from each other. The lowest root length value belonged to the variety 'Ubet', while 'Aydin-92' (7.94 cm) and 'Sezenbey' (8.17 cm) were in the same group with 'Aydin-92' (7.94

cm) and they were statistically indistinguishable from each other.

When the previous studies were examined, Sanlı and Kaya [58] reported that the root length value was between 10.60-13.30 cm in their experiments. Our findings are similar to the findings reported by the researchers. Kacar [59] stated that depending on the plant species and growing season, if there is not enough moisture in the soil surrounding the root, the root may increase its vertical or horizontal elongation with the same force to reach water. Therefore, it is understood that irrigation conditions and soil structure also have important effects.

3.13. Degree of Disease

The data related to the degree of disease were made according to the 1-5 scale and the evaluation was made based on these data. Variance analysis results of the obtained data are given in Table 3.

According to this, it was recorded that the degree of disease of the varieties was statistically significant at 1% significance level.

The table (Table 3) showing the averages of the disease degrees of the varieties and their distribution among the groups is given below. Accordingly, it was determined that the disease degrees varied between 0.00 - 1.67 according to the varieties. The general disease degree of all varieties was determined as 0.67. It was recorded that the variety with the highest tolerance to the disease agent was 'Sari-98' and the most sensitive varieties were 'Aksu, Aydin-92, Gulumser and Borabey'.

When the previous studies were examined, Baylan [60] tried to determine the response of chickpea to anthracnose disease by sowing chickpea population suitable for the regional conditions at different times in Diyarbakir. As a result of the research, it was determined that the disease index of 'ILC-482' variety increased in 1997 compared to the previous year and was 7.67-7.00-6.75 and 6.50 in December, January, February and March, respectively, and varied depending on the air temperature and humidity. Yasar [28], in his study conducted under Diyarbakir conditions, reported that he detected moderate damage (small spots of burns on the lower leaves) in 'EGE-3002, EGE-3012 and Diyar 95' varieties.

3.14. Protein Content (%)

The results of the analysis in which the differences in protein ratio were determined according to the varieties are given in Table 4. According to this table, it was determined that the differences in protein ratio were statistically very significant.

According to the average values of the protein ratios of the varieties and the duncan multiple comparison test of these averages, it was determined that the protein ratios varied between 14.22 – 19.48% among the varieties and the general average of the varieties was 16.14%. While the lowest protein rate was observed in 'Aksu' variety, the highest protein rate was observed in 'Kusmen-99' variety. In general, it was determined that all varieties except 'Seckin' (15.35%) and 'Inci' (15.36%) were in different groups, but 'Seckin' and 'Inci' were in the same group and statistically indistinguishable from each other. Regarding protein ratios, Mart et al. [52] reported that the protein ratios of genotypes in their study conducted in Sanliurfa ranged between 21.7% and 26.5%. Gurbuz [17] found protein ratios between 16.6% and 22.1% under Bingol conditions, Sari [61] reported protein ratios between 13.60% and 18.90% under Samsun conditions, Dinc [27] found protein ratios between 20.32% and 24.35% under the ecological conditions of Van, and Yagmur and Kaydan [62] reported protein ratios in chickpea genotypes grown in Van province ecology ranging between 10.30% and 15.30%. The values obtained by these researchers were found to be partially consistent with the findings of our experiment. It is believed that the differences in findings are due to factors such as genotype, environment.

3.15. Starch Content (%)

The results of variance analysis and the distribution of groups based on the average starch ratio of chickpea varieties are presented in Table 4. According to these results, the starch ratios were found to be statistically significant among the varieties at the $p<0.01$ level.

Starch ratios varied between 38.00 - 44.69% depending on the varieties and the general average was 42.14%. While the variety with the lowest starch ratio was 'Kusmen-99', the highest value was obtained from 'Ubet' variety. However, 'Zuhal' variety with 44.64% was the variety with the second highest starch ratio and it was determined that it was statistically no different from 'Ubet' variety since it was in the same group with 'Ubet' variety.

When other studies were examined, In their study on chickpea yield quality, Karayel et al. [63] reported that the starch content of the seeds ranged between 48.5% and 50.23%. These values are partially similar to the values obtained in our study. Aksakalli [64] reported in his study that changes in starch content are related to protein content, indicating that higher protein content correlates with higher starch content.

Table 4. Analysis of variance, average values, and grouping of chickpea varieties for protein content, starch content, fat content, ash content, fiber content, and moisture content

No	Varieties	Protein Content (%)	Starch Content (%)	Fat Content (%)	Ash Content (%)	Fiber Content (%)	Moisture Content (%)
1	Aksu	**14.22 m**	41.05 f	5.42 c	2.64 b	**6.93 a**	**12.02 a**
2	Seckin	15.35 h	40.14 g	5.24 g	2.57 b-d	**6.96 a**	11.37 de
3	Inci	15.36 h	43.15 c	5.33 de	2.50 c-e	6.257 e	11.57 b
4	Kusmen-99	**19.48 a**	**38.00 h**	**4.56 h**	**2.93 a**	**6.94 a**	11.33 d-g
5	Damla-89	14.84 k	42.90 c	**5.69 a**	**2.44 e**	6.02 f	11.36 d-f
6	Cevdetbey-98	17.12 d	41.24 f	5.31 ef	2.56 b-d	**5.87 g**	11.44 cd
7	Aydin-92	16.46 g	43.77 b	**5.75 a**	2.48 c-e	6.41 d	**11.07 ı**
8	Ubet	14.33 l	**44.69 a**	5.55 b	2.47 de	6.04 f	11.42 c-e
9	Gulumser	15.05 j	42.18 d	**5.70 a**	**2.45 e**	6.74 b	11.30 e-g
10	Borabey	17.38 c	42.06 de	5.38 cd	2.61 b	6.59 c	11.52 bc
11	Zuhal	15.24 ı	**44.64 a**	5.25 fg	2.57 bc	6.46 d	11.57 b
12	Sezenbey	17.74 b	41.89 e	**5.70 a**	2.48 c-e	6.38 d	11.15 hı
13	Sari-98	16.77 e	41.11 f	5.29 e-g	2.63 b	6.81 b	11.20 gh
14	Yasa-05	16.56 f	43.14 c	5.60 b	2.52 c-e	6.41 d	11.23 f-h
Average		**16.14**	**42.14**	**5.41**	**2.56**	**6.49**	**11.40**
% CV		**0.38**	**0.35**	**0.72**	**1.99**	**0.84**	**0.634**
F Value	**Variety**	**1786.94****	**459.16****	**188.18****	**18.01****	**129.47****	**31.66****
	Block	**0.01**	**1.19**	**0.12**	**0.48**	**4.56***	**2.94**

**: p<0.01; *: p<0.05 statistically significant within error limits.

3.16. Fat Content (%)

The results of the variance analysis for the fat content of the varieties, the average values for each variety, and the resulting groups are presented in Table 4. According to these results, the fat content showed significant (p<0.01) differences among the varieties.

Here, it was observed that the fat content values among the varieties varied between 4.56 - 5.75% and the overall average was 5.41%. 'Kusmen-99' was recorded as the variety with the lowest fat content. On the other hand, the highest fat content was observed in 'Aydin-92' and it was in the same group with 'Gulumser' (5.70%), 'Sezenbey' (5.70%) and 'Damla-89' (5.69%).

When previous studies are examined, Dinc [27] reported that the fat content in seeds ranged between 4.01% and 4.93%. Research indicates that fat content in edible legumes is generally low. However, Ozdemir [65] stated that the fat content in chickpeas is around 5%. In this context, it is observed that the values obtained in our study are consistent with those obtained in previous studies.

3.17. Ash Content (%)

Variance analysis results of the ash content data for some chickpea varieties grown under Silifke ecological conditions are presented in Table 4. Accordingly, it was determined that the ash content values showed significant (p<0.01) variability among the varieties.
It was determined that the average ash content values varied between 2.45 – 2.93% according to the varieties and the general average of the varieties was 2.56%. The lowest ash content was obtained from the 'Gulumser' variety and the second lowest ash content value was obtained from the 'Damla-89' variety with 2.44% and these two varieties were statistically indistinguishable from each other. On the other hand, the highest ash content was obtained from 'Kusmen-99' variety.

Sarimurat [66], in his study conducted under the ecological conditions of Van, reported that the ash content values ranged from 3.83% to 6.00%. Karayel et al. [63] found that the ash content varied between 2.88% and 3.00%. Sepetoglu [67] reported that the average ash content in seeds was around 3.5%. The results from these studies show some similarity with the findings of our research.

3.18. Fiber Content (%)

The results of the analysis of variance for the fiber content data of chickpea varieties, the average values of the fiber content data of the varieties and the groups formed are given in Table 4. As seen in the table, the fiber content of the varieties were significantly (p<0.01) different from each other.

It is observed that the average fiber content of the varieties varied between 5.87% and 6.96% and the general average was 6.49%. The variety with the highest fiber content was 'Seckin', followed by 'Kusmen-99' with 6.94% and 'Aksu' with 6.93% and they were in the same group. 'Cevdetbey-98' variety had the lowest fiber content.

When other studies were examined, Deshpande et al. [68] reported that the average rate of fiber in chickpea was 3.9% and Ertas [69] reported that the fiber content was 3.65%. El-Adawy [70] reported that the amount of fiber in the seed was 3.82%. These results were found to be lower than the findings of our study.

3.19. Moisture Content (%)

The results of the analysis of variance, average values and statistical distribution of moisture content among cultivars are given in Table 4. When the table is examined, it is noted that the moisture content varied significantly among the varieties.
It was observed that the moisture content values varied between 11.07% and 12.02% according to the varieties

and the general average was 11.40%. The lowest moisture content was obtained from 'Aydin-92' and the highest moisture content was obtained from 'Aksu' variety.

When the studies were examined, Ghavidel and Prakash [71] reported that the moisture content of chickpea was 9.90% and Kilincer [72] reported that the moisture values of the samples varied between 4.47-11.13%. These results are similar to the findings of this study.

3.20. Correlation Analysis

The relationships between the yield and quality characteristics of the varieties used in the trial were determined by correlation analysis, and the results are presented in Table 5.

When Table 5 is examined, it can be seen that there is a positive and significant ($p<0.01$) correlation between pod setting time and flowering time (r = 0.402**); plant height and first pod height (r = 0.6976**), number of pods per plant (r = 0.7381**), yield per decare (r = 0.5946**), and oil content (r = 0.7202**). These findings are consistent with those reported by Gurbuz [17], Yasar [28], Yesilgun [73], and Eser et al. [74].

It has been determined that there is a significant positive correlation between the height of the first pod and the oil content (r = 0.4302**); the number of branches per plant and the number of pods (r = 0.3940**); the number of pods per plant and grain yield per decare (r = 0.8157**), harvest index (r = 0.4132**), starch content (r = 0.4436**), and oil content (r = 0.6733**); grain yield per decare and harvest index (r = 0.7127**) and oil content (r = 0.4021**); disease degree and protein content (r = 0.4375**); protein content and ash content (r = 0.5869**); starch content and oil content (r = 0.6664**); ash content and fiber content (r = 0.5604**). Our findings are similar to those of Yasar [28].

It has been determined that there is a significant negative correlation between flowering duration and grain yield per decare (r = -0.4366**); plant height and protein content (r = -0.5154**) and ash content (r = -0.6541**); the number of pods per plant and protein content (r = -0.6255**), ash content (r = -0.6938**) and fiber content (r = -0.4533**); the number of seeds per pod and thousand seed weight (r = -0.4444**); grain yield per decare and protein content (r = -0.5971**) and ash content (r = -0.4482**); harvest index and protein content (r = -0.5122**); protein content and starch content (r = -0.5697**), oil content (r = -0.4999**) and moisture content (r = -0.4413**); starch content and ash content (r = -0.7130**) and fiber content (r = -0.5917**); oil content and ash content (r = -0.8485**) and fiber content (r = -0.4166**). It has been observed that when one of these values increases, the other significantly decreases. The negative and significant correlation between grain yield and thousand seed weight found in our study is consistent with the results obtained by Guler et al. [75] and Altinbas and Tosun [76]. In contrast, Beysari [25], Yucel et al. [77], Hassan et al. [78] and Saleem et al. [79] have reported a positive and significant correlation in their findings.

The statistically positive and significant ($p<0.05$) relationships between the traits are as follows. These are: Pod Setting Time and oil content (r = 0.3226*); plant height and starch content (r = 0.3301*); number of branches per plant and grain yield per decare (r = 0.3795*) and harvest index (r = 0.3279*); number of pods per plant and thousand seed weight (r = 0.3195*); pod length and fiber content (r = 0.3103*); thousand seed weight and grain yield per decare (r = 0.3373*); disease severity and ash content (r = 0.3228*). These findings are consistent with the results obtained by Yesilgun [73].

On the other hand, a negative relationship at the 5% significance level was determined between flowering duration and harvest index (r = -0.3778*); Pod Setting Time and ash content (r = -0.3585*); plant height and disease severity (r = -0.3532*); first pod height and disease severity (r = -0.3074*); number of seeds per pod and starch content (r = -0.3570*); disease severity and starch content (r = -0.3048*); and oil content (r = -0.3647*).

3.21. Principal Component Analysis (PCA)

In this study, where the performance of different chickpea varieties was evaluated based on yield and quality characteristics in Silifke district, the PCA (Principal Component Analysis) was applied to the obtained data. The results are presented in Table 6, and the graphical representation of these values is shown in Figure 1.

The first three principal components calculated for yield and quality characteristics explained approximately 59.00% of the total variation among the evaluated traits. Respectively, the number of pods per plant (0.37), ash content (-0.35), oil content (0.34), plant height (0.32), grain yield per decare (0.32), and protein content (-0.30) made significant contributions to the first principal component (PC1), which explained about 33.00% of the total variation.

The second component (PC2) accounted for approximately 14.42% of the total variation. The traits contributing the most to the variation among the varieties were moisture content (0.41), harvest index (0.36), fiber content (0.35), and flowering duration (-0.34). The third component (PC3) explained about 11.35% of the total variation. Root length (0.41), pod length (0.38), and thousand grain weight (0.37) were found to significantly influence the distribution of the varieties along the third axis based on their differences.

Table 5: Correlation of the examined characteristics of the varieties with each other

	Flowering Duration	Pod Setting Time	Plant Height	First Pod Height	Number of Branches per Plant	Number of Pods per Plant	Number of Seeds per	Pod Length	Thousand Grain Weight	Yield per Decare	Harvest Index	Root Length	Disease Degree	Protein Content	Starch Content	Fat Content	Ash Content	Fiber Content
Pod Setting Time	0.402**	1.0000																
Plant Height	-0.0813	0.0636	1.0000															
First Pod Height	-0.1149	-0.1399	0.6976**	1.0000														
Number of Branches per Plant	-0.2592	0.2120	0.0327	-0.2855	1.0000													
Number of Pods per Plant	-0.2593	0.2383	0.7381**	0.1873	0.3940**	1.0000												
Number of Seeds per	-0.1446	-0.2163	-0.2690	0.0951	-0.2152	-0.2688	1.0000											
Pod Length	0.0911	-0.0602	-0.1022	0.0315	0.0069	-0.2355	-0.0162	1.0000										
Thousand Grain Weight	-0.0259	-0.0852	0.2948	-0.0237	0.0132	0.3195*	-0.4444**	0.2046	1.0000									
Yield per Decare	-0.4366**	0.0859	0.5946**	0.1176	0.3795*	0.8157**	-0.2141	-0.0768	0.3373*	1.0000								
Harvest Index	-0.3778*	0.0019	0.2319	-0.1317	0.3279*	0.4132**	-0.0843	0.1504	0.2238	0.7127**	1.0000							
Root Length	0.2472	0.2552	-0.1292	-0.2660	-0.1743	-0.0211	0.1763	0.0917	-0.1455	0.1350	0.1899	1.0000						
Disease Degree	0.1674	0.2010	-0.3532*	-0.3074*	-0.2156	-0.2483	-0.0727	-0.0501	0.1649	-0.1694	-0.1216	0.1231	1.0000					
Protein Content	0.1956	-0.0083	-0.5154**	-0.1669	-0.0643	-0.6255**	0.0651	0.0892	-0.0532	-0.5971**	-0.5122**	-0.0623	0.4375**	1.0000				
Starch Content	0.0224	0.2118	0.3301*	0.0225	0.1983	0.4436**	-0.3570*	-0.1959	0.0304	0.1906	0.1092	-0.2241	-0.3048*	-0.5697**	1.0000			
Fat Content	-0.0798	0.3226*	0.7202**	0.4302**	0.1951	0.6733**	-0.2578	-0.2437	0.0801	0.4021**	0.1588	-0.2925	-0.3647*	-0.4999**	0.6664**	1.0000		
Ash Content	0.0204	-0.3585*	-0.6541**	-0.2134	-0.1177	-0.6938**	0.2271	0.2472	-0.0859	-0.4482**	-0.2518	0.0288	0.3228*	0.5869**	-0.7130**	-0.8485**	1.0000	
Fiber Content	-0.1650	-0.2235	-0.2908	0.0869	-0.1770	-0.4533**	0.2217	0.3103*	-0.2948	-0.1864	0.0255	0.0833	-0.0390	0.1624	-0.5917**	-0.4166**	0.5604**	1.0000
Moisture Content	-0.1586	-0.1338	0.0750	0.0586	0.0940	0.0904	-0.0072	0.0809	0.0138	0.2944	0.2579	0.1774	-0.2405	-0.4413**	-0.0289	-0.2233	0.1911	0.1549

Table 6: Principal Component Analysis Results for Examined Traits According to Research Findings

Traits	PC 1	PC 2	PC 3
Flowering Time	-0.11	**-0.35**	0.30
Pod Setting Time	0.08	-0.31	0.24
Plant Height	**0.32**	-0.01	-0.01
First Pod Height	0.14	0.03	-0.28
Number of Branches	0.15	0.01	-0.15
Number of Pods per Plant	**0.37**	0.04	0.09
Number of Seeds per Pod	-0.14	0.23	-0.29
Pod Length	-0.16	0.07	**0.38**
Thousand Seed Weight	0.10	-0.03	**0.37**
Yield per Decare	**0.32**	0.26	0.17
Harvest Index	0.22	**0.36**	0.26
Root Length	-0.06	0.11	**0.41**
Disease Degree	-0.21	-0.19	0.24
Protein Content	**-0.30**	-0.24	-0.09
Starch Content	0.27	-0.23	-0.03
Oil Content	**0.34**	-0.20	-0.15
Ash Content	**-0.35**	0.21	-0.01
Fiber Content	-0.20	**0.34**	-0.04
Moisture Content	0.05	**0.41**	0.14
Eigenvalues	6.35	2.74	2.16
Variance (%)	33.40	14.42	11.35
Cumulative Variance (%)	33.396	47.819	59.173

The differences between varieties in terms of the examined traits were quite high (Figure 2). Different varieties stood out for different traits. Figure 1 shows that varieties numbered 1, 2, 4, 7, 8, 12, and 14 are distributed at extreme points concerning the examined traits. Evaluating the traits, the 'Aksu' (1) variety showed significantly high values for plant height, first pod height, harvest index, yield per decare, moisture content, and fiber content compared to other varieties. However, it had lower values for protein content and disease degree. The 'Kusmen-99' (4) variety had high values for ash content and protein content but very low values for pod setting time, plant height, number of pods per plant, thousand seed weight, harvest index, yield per decare, starch content, and oil content. The 'Ubet' (8) variety excelled in harvest index and starch content, but showed lower values for pod setting time and root length. The 'Sezenbey' (12) variety had high values for the number of branches per plant and the number of pods per plant, but low values for flowering duration and root length. In the 'Aydin-92' (7) variety, the first pod height was high, while root length, disease degree, and moisture content were low. The 'Seckin' (2) variety was distinctly different from others due to its high values in fiber content, root length, and harvest index. Lastly, the 'Yasa-05' (14) variety stood out from other varieties due to its low values in the number of branches per plant, seed yield per decare, moisture content, and harvest index.

4. CONCLUSIONS

When the results of the research were evaluated in general, it was determined that 'Aksu' variety was more suitable for the conditions of the region and showed superior characteristics compared to other varieties in terms of many traits examined. After 'Aksu', 'Seckin', 'Inci' and 'Aydin-91' varieties were the most suitable varieties. Since the lowest values were obtained from 'Kusmen-99' variety, its cultivation is not recommended. In addition, it is thought that Zuhal, Yasa-05, Borabey, Sari-98 and Cevdet-98 varieties should not be preferred. As a result of the study, it is predicted that the cultivation of 'Aksu' variety may be useful in barren and infertile soils in the region. However, in order to obtain more detailed and precise results, it is recommended that the experiment should be repeated for at least two more years and/or different studies should be carried out in different locations.

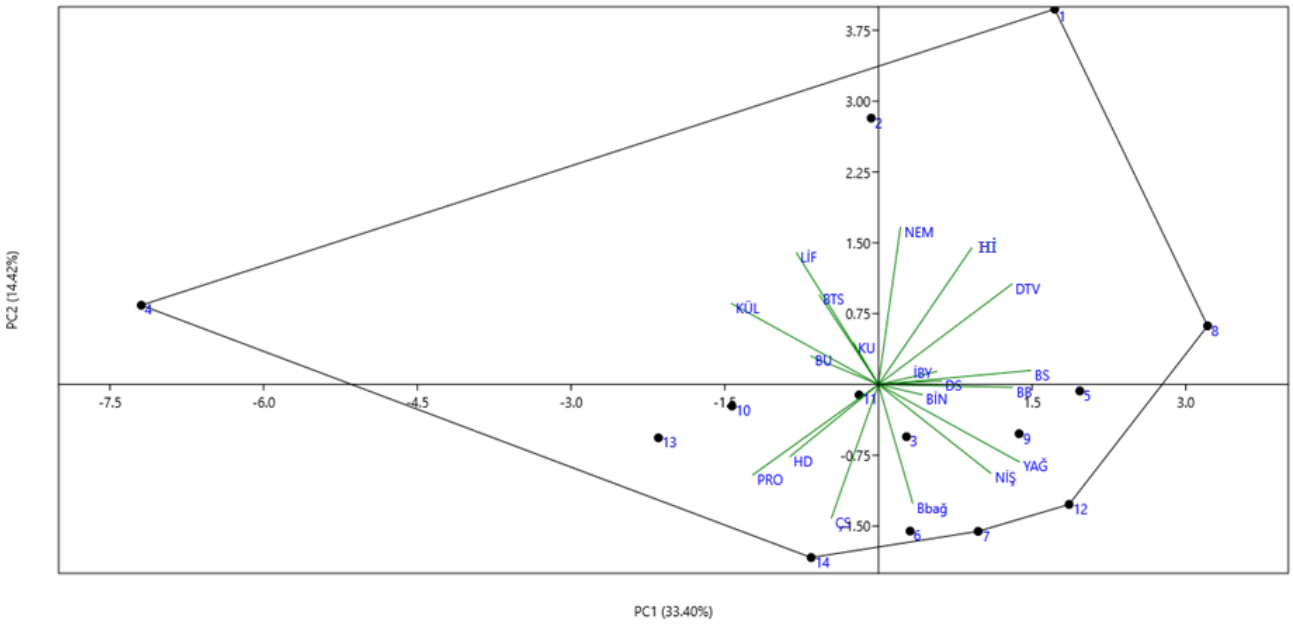

Figure 1. Principal Component Graph of the Examined Traits of the Varieties

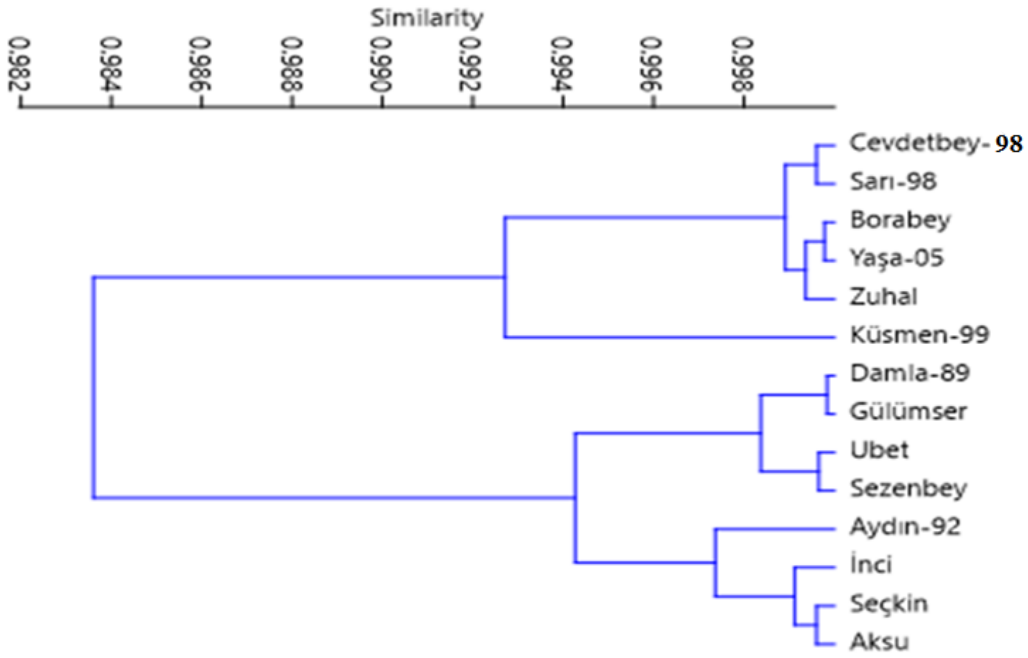

Figure 2. Cluster analysis based on the examined characteristics of the varieties

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REFERENCES

[1] UNFPA. Dunya nufus durumu raporu. 2023 [cited 2023 Oct 29]. Available: https://turkiye.unfpa.org/tr/swop-%C3%B6zet-2023.

[2] Anonymous. Tarim ve Orman Bakanlıgı. Ankara, 2021a.

[3] Wood J, Grusak M. Nutrional value chickpea. Chickpea Breeding and Management, CAB International. Wallingford. 2007; 101-142.

[4] Dogan A. Yoksullar lehine buyumede tarimin rolu: Sahra-altı Afrika ornegi. Karamanoglu Mehmetbey Universitesi İktisadi ve İdari Bilimler Fakultesi Dergisi. 2009; 11(16): 21-38.

[5] Malunga LN, Bar-El Dadon S, Zinal E, Berkovich Z, et al. The potential use of chickpeas in development of infant follow-on formula. Nutrition Journal. 2014; 22(13): 8.

[6] Siddique M, Hamid A, Islam M. Drought stress effects on water relation of wheat. Botanical Bulletin- Academia Sinica Taipei. 2000; 41(1): 35-39.

[7] Singh S, Singh I, Kapoor K, Gaur P, Chaturvedi S, Singh N, Sandhu J. Chicpea. Broadening the Genetic Base of Grain Legumes. 2014; 51-73.

[8] E. Karagul, «Turkiye yemeklik tane baklagil genetik kaynakları,» ANADOLU Ege Tarımsal Arastırma Enstitusu Dergisi, cilt 27, no. 1, p. 56 – 70, 2017.

[9] Burucu D. Urun Raporu NOHUT 2021. TEPGE Yayın No: 342, 2021.

[10] Sayilgan C, Kocaturk M. Sahil ve gecit kusagına uygun tescilli ve yerel nohut cesitlerinin Bati Akdeniz Bolgesi'nde yazlik ekim verim performanslarinin degerlendirilmesi. Derim. 2019; 36(2): 207-216.

[11] TEPGE. T.C. Tarim ve Orman Bakanligi Tarimsal Ekonomi ve Politika Gelistirme Enstitusu Mudurlugu. 2023. Available: https://arastirma.tarimorman.gov.tr/tepge/Menu/27/Tarim-Urunleri-Piyasalari.

[12] Mart D, Cansaran E, Karakoy T, Simsek M. Cukurova ve Orta Anadolu bolgesinden toplanan yerel nohut (Cicer arietinum L.) populasyonlarinin bazi onemli agronomik ve morfolojik ozelliklerinin belirlenmesi, seleksiyonu ve kalitatif karekterlerinin karakterizasyonu. Tarla Bitkileri Merkez Arastirma Enstitusu Dergisi. 2007; 16(1-2): 61-72.

[13] Anonymous. Mersin İl Tarim Mudurlugu. Mersin, 2009.

[14] Anonymous. Mersin Meteoroloji Il Mudurlugu. Mersin, 2021.

[15] Anlarsal A E, Yucel C, Ozveren D. Cukurova kosullarinda bazi nohut (Cicer arietinum L.) hatlarinin verim ve verimle ilgili ozelliklerinin saptanması uzerine bir arastirma. Turkiye 3. Tarla Bitkileri Kongresi, 15-20 Kasım, Adana. 1999.

[16] Mart D. Cukurova kosullarinda nohut (Cicer arietinum L.)'de bazi onemli ozellikler yonunden genotip x cevre interaksiyonlari ve uyum yeteneklerinin saptanmasi uzerine bir arastırma. Adana: Cukurova Universitesi, Fen Bilimleri Enstitusu; 2000.

[17] Karakoy T. Cukurova ve Orta Anadolu Bolgelerinden toplanan bazı yerel nohut (Cicer arietinum L.) genotiplerinin verim ve verimle ilgili ozelliklerinin belirlenmesi uzerine bir arastirma. Adana: Cukurova Universitesi, Fen Bilimleri Enstitusu; 2008.

[18] Matur I. Sirnak-Idil kosullarinda bazi nohut hat ve cesitlerinin verim ve verim unsurlarinin

degerlendirilmesi. Sirnak: Sirnak Universitesi, Fen Bilimleri Enstitusu; 2021.
[19] Aydogan A. Genis ve dar yaprakli kabuli tip nohut (Cicer arietinum L.) cesit ve hatlarinda verim ve kalite ozelliklerinin belirlenmesi. Ankara: Ankara Universitesi Fen Bilimleri Enstitusu; 2012.
[20] L. G. Gurbuz, Bingol ekolojik kosullarında bazı nohut (Cicer arietinum L.) cesitlerinin verim ve kalite ozelliklerinin belirlenmesi, Bingol: Bingol Universitesi Fen Bilimleri Enstitusu, 2018.
[21] Patan F. Tescilli bazi nohut (Cicer arietinum L.) cesitlerinin Erzurum ekolojik kosullarina adaptasyonu. Erzurum: Ataturk Universitesi, Fen Bilimleri Enstitusu; 2014.
[22] Karakan Kaya F. Bazi nohut (Cicer arietinum L.) cesitlerinin Elazig kosullarindaki verim ve adaptasyon yeteneklerinin belirlenmesi. Bingol: Bingol Universitesi, Fen Bilimleri Enstitusu; 2014.
[23] Oztas E, Bucak B, Al V, Kahraman A. Farklı nohut (Cicer arietinum L.) cesitlerinin Harran ovası kosullarinda kisa dayaniklilik, verim ve diger ozelliklerinin belirlenmesi. Harran Universitesi Ziraat Fakultesi Dergisi. 2007; 11(3/4): 84-85.
[24] Yigit M. Bazi nohut cesitlerinin farkli tohum iriligi ve ekim zamanlarinda verim ve kalite performanslarinin belirlenmesi., Kirsehir: Kirsehir Ahi Evran Universitesi Fen Bilimleri Enstitusu; 2018.
[25] Ozgun O. Diyarbakir Bismil kosullarinda damla sulama ve farklı ekim tarihlerinin nohutta (Cicer arietinum L.) verim ve verim ogelerine etkisi, Erzurum: Ataturk Universitesi Fen Bilimleri Enstitusu; 2004.
[26] Yurur N, Karasu A. Ekim zamaninin nohutun bazi agronomik ozelliklerine etkisi. Uludag Universitesi Ziraat Fakultesi Dergisi. 1995; 11: 95-107.
[27] Erden Z. Siirt ekolojik kosullarinda nohudun (Cicer arietinum L.) cesit ve adaptasyon ozelliklerinin belirlenmesi. Van: Yuzuncu Yıl Universitesi Fen Bilimleri Enstitusu; 2014.
[28] Beysari V. Bazi nohut (Cicer arietinum L.) cesitlerinin Bingol kosullarindaki verim ve adaptasyon yeteneklerinin belirlenmesi. Bingol : Bingol Universitesi Fen Bilimleri Enstitusu; 2012.
[29] Beykara İ. Bingol ekolojik kosullarinda farkli ekim zamanlarinin bazi nohut (Cicer arietinum L.) genotiplerinde verim ve verim ozelliklerine etkisi. Bingol : Bingol Universitesi Fen Bilimleri Enstitusu; 2019.
[30] Dinc A. Turkiye'de tescil edilmis bazi nohut (Cicer arietinum L.) cesitlerinin Van kosullarinda verim ve verim ogelerinin belirlenmesi. Van: Yuzuncu Yıl Universitesi Fen Bilimleri Enstitusu; 2014.
[31] Yasar M. Diyarbakir ekolojik kosullarinda bazi nohut (Cicer arietinum L.) hat ve cesitlerinin verim ve verim ogelerinin belirlenmesi uzerine bir arastırma. Adana: Cukurova Universitesi, Fen Bilimleri Enstitusu; 2010.
[32] Bakoglu A, Aycicek M. Bingol ekolojik kosularinda bazi nohut (Cicer arietinum L.) cesitlerinin verim ve verim ogeleri uzerine bir arastırma. Firat Universitesi Fen ve Muhendislik Bilimleri Dergisi. 2005; 17(1): 107-113.
[33] Bicer B T, Anlarsal A E. Bazı nohut (Cicer arietinum L.) koy cesitlerinde bitkisel ve tarimsal ozelliklerin belirlenmesi. Ankara Universitesi Ziraat Fakultesi Tarım Bilimleri Dergisi. 2004; 10(4): 289-396.
[34] Vural H, Karasu A. Variability studies in chickpea (Cicer arietinum L.) varieties grown in Isparta of Turkey. Revista UDO Agricola. 2007; 7(1) 35-40.
[35] Canci H, Toker C. Evaluation of annual wild Cicer species for drought and heat resistance under field conditions. Genetic Resources and Crop Evolution. 2009; 56: 1-6.
[36] Peker G N. Ileri duzey nohut genotiplerinde verim ve kalite calismalari. Kirsehir : Kirsehir Ahi Evran Universitesi Fen Bilimleri Enstitusu, 2022.
[37] Demirci O, Bildirici N. Sanliurfa ekolojik degerlendirmelerinde yetistirilen nohut (Cicer arietinum L.) cesitlerinin verim ve verim unsurlarının belirlenmesi. Avrupa Bilim ve Teknoloji Dergisi. 2020; 20: 656-662.
[38] Sozen O, Karadavut U. Kırsehir ekolojik kosullarinda yetistirilen bazi nohut genotiplerinin verim ogeleri korelasyon ve path analizi. 21. Yuzyilda Fen ve Teknik Dergisi. 2019; 6(12): 29-40.
[39] Tetik S. Turkiye'de tescil edilmis bazi nohut cesitlerinin Bolu sartlarinda verim ve bazi verim ogelerinin tespit edilmesi. Bolu: Bolu Abant İzzet Baysal Universitesi Fen Bilimleri Enstitusu, 2019.
[40] Onder M, Ucer F. Konya ekolojik sartlarinda bazi nohut cesitlerinin ikinci urun olarak yetistirilmesi. Selcuk Universitesi Ziraat Fakultesi Dergisi. 1999; 13(18): 1-8.
[41] Bicer B T. Diyarbakir yoresinde toplanan bazi nohut yerel cesitlerinde onemli bitkisel ve tarimsal ozelliklerin belirlenmesi uzerine bir arastirma. Adana: Cukurova Universitesi Fen Bilimleri Enstitusu, 2001.
[42] Arshad M, Bakhsh A, Ghafoor A. Path coefficient analysis in chickpea (Cicer arietinum L.) under rainfed conditions. Pakistan Journal of Botany. 2004; 36(1): 75-81.
[43] Kacar O, Goksu E, Azkan N. Bursa'da kislik olarak yetistirilebilecek nohut (Cicer arietinum L.) hatlarinin belirlenmesi. Uludag Universitesi. Zir. Fak. Dergisi. 2005; 19(2): 33-45.
[44] Aydogan Y. Eskisehir ekolojik kosullarinda bazi nohut (Cicer arietinum L.) cesitlerinin tarimsal ozelliklerinin ve ozellikler arası iliskilerin belirlenmesi. Kirsehir : Kirsehir Ahi Evran Universitesi, Fen Bilimleri Enstitusu, 2019.
[45] Talebi R, Fayaz F, Jelodar N. Correlation and path coeficients analysis of yield and yield components of chickpea (Cicer arietinum L.) under dry land condition in the west of Iran. 2007; 6(7): 1151-1154.
[46] Bicaksiz Y. Bazi Nohut (Cicer arietinum L.) cesitlerinin orta Anadolu kosullarina adaptasyonu, Eskisehir:Eskisehir Osmangazi Universitesi, 2010.
[47] Babagil G E. Erzurum ekolojik kosullarinda bazi nohut (Cicer arietinum L.) cesitlerinin verim ve verim ozellikleri incelenmesi. Anadolu Tarım Bilim Dergisi. 2011; 26(2): 122-127.

[48] Bicer BT, Anlarsal AE. Diyarbakir yoresi nohut (Cicer arietinum L.) koy populasyonlarinin tarimsal, morfolojik ve fenolojik ozellikler icin degerlendirilmesi. Harran Universitesi Ziraat Fakultesi Dergisi. 2005; 9(3): 1-8.
[49] Eser D. Yemeklik tane baklagiller. Ankara: Ankara Universitesi Ziraat Fakultesi Ders Notu, 1978.
[50] Ceran F. Farkli zamanlarda ekilen nohut cesitlerinin (Cicer arietinum L.) bazi tarimsal ozelliklerinin belirlenmesi. Konya: Selcuk Universitesi-Fen Bilimleri Enstitusu, 2015.
[51] Erdemci I. Guneydogu Anadolu Bolgesi kosullarinda farkli nohut (Cicer arietinum L.) genotiplerinin yazlik ve kislik ekimlerinde bazi tarımsal ve teknolojik ozelliklerinin belirlenmesi. Adana: Cukurova Universitesi-Fen Bilimleri Enstitusu, 2012.
[52] Altinbas M, Sepetoglu H, Karasu A. Nohutta verim ogelerinin farkli cevre kosullarinda verime etkileri uzerinde bir calisma. Turkiye III.Tarla Bitkileri Kongresi, Adana, 1999.
[53] Altınbas M, Sepetoglu H H. Kislik ekime uygun nohut gelistirmede bazi tarımsal ozellikler icin genotipik ve cevresel etki degerlendirmesi. Ege Universitesi Ziraat Fakultesi Dergisi. 2002; 39(3): 33-40.
[54] Mart D, Oktem A, Akın R, Turkeri M, Atmaca E, Mart S, Karakoy T. Sanliurfa'da tescilli bazi nohut (Cicer arietinum L.) cesitlerinin verim, morfolojik ve kalite ozelliklerinin degerlendirilmesi. Turk Tarım ve Doga Bilimleri Dergisi. 2023; 10(1): 152-160.
[55] Topcu M, Akcura M. Bazi nohut cesitlerinin verim ve verim unsurlarinin incelenmesi. COMU, Ziaraat Fakultesi Dergidi. 2022; 10(1): 191-198.
[56] Gunes A, Tekatlı M, Erturk E, Kilinc C. Kahramanmaras kosullarinda bazi ileri nohut (Cicer arietinum L.) genotiplerinde tarimsal ozelliklerin incelenmesi. Turk Tarim ve Doga Bilimleri Dergisi. 2022; 9(1): 119-131.
[57] Topcu M. Bazi nohut (Cicer arietinum L.) cesitlerinin Edirne kosullarinda verim ve verim unsurlarının incelenmesi. Canakkale: COMU, Fen Bilimleri Enstitusu, 2019.
[58] Gundogdu Gurbuz L. Bingol Ekolojik Kosullarinda Bazi Nohut (Cicer arietinum L.) Cesitlerinin Verim ve Kalite Ozelliklerinin Belirlenmesi. Bingol: Bingol Universitesi Fen Bilimleri Enstitusu, 2018.
[59] Yagmur M, Engin M. Nohut (Cicer arietinum L.)'ta fosfor ve azot dozlari ile bakteri (Rhizobium ciceri) asilamanin bazi morfolojik ozellikler ile tane verimi uzerine etkileri ve bazi bitkisel ozellikler arasındaki iliskiler. Yuzuncu Yil Universitesi Ziraat Fakultesi Tarım Bilimleri Dergisi. 2005; 15(2): 103-112.
[60] Sakar S. Sırnak-İdil kosullarinda kislik ve erken ilkbaharda yetistirilen nohut cesitlerinin verim ve verimle ilgili ozelliklerinin belirlenmesi. Sırnak: Sırnak Universitesi Lisansustu Egitim Enstitusu, 2022.
[61] Yigitoglu D. Kahramanmaras kosullarinda farkli bitki sikliklarinin kislik ve yazlik ekilen bazi nohut cesitlerinde (Cicer arietinum L.) verim ve verim ile ilgili ozelliklere etkisi. Adana: Cukurova Universitesi Fen Bilimleri Enstitusu, Tarla Bitkileri Anabilim Dalı, 2006.
[62] Sanlı A, Kaya M. Tohum Uygulamalari İle Farkli Ekim Zamanlarinin Nohut Cicer arietinum L.' un Bazi Agronomik Ozellikler Uzerine Etkileri. Suleyman Demirel Universitesi Ziraat Fakultesi Dergisi. 2008; 3: 42-51.
[63] Kacar B. Bitki fizyolojisi. Ankara: Ankara Universitesi Ziraat Fakultesi Yayınları 1153, 1989.
[64] Baylan B. Diyarbakir kosullarinda nohut ekim zamanı ile antraknoz hastaligi (Ascochyta rabiei (pass) labr.) arasındaki iliskinin belirlenmesi. Diyarbakır: Dicle Universitesi, Fen Bilimleri Enstitusu, 1998.
[65] Sari H. Bazı yemeklik tane baklagillerin gelisme donemlerine gore farkli bitki kisimlarinda ham protein iceriklerinin belirlenmesi. Samsun: Ondokuz Mayıs Universitesi Fen Bilimleri Enstitusu, 2015.
[66] Yagmur M, Kaydan D. Plant growth and protein ratio of spring sown chickpeawith various combinations of rhizobium inoculation, nitrogen fertilizer and irrigation under rainfed condition. African Journal of Agricultural Research. 2010; 6(12): 2648-2654.
[67] Karayel R, Uzun A, Bozoglu H. Nohut (Cicer arietinum L.)'un verim ve kalitesine ahir gubre dozlarinin etkisi. BSEU Fen Bilimleri Dergisi 7, Milli Mucadele ve TBMM'nin Acılısının 100. Yılı Anısına-100. Yıl Ozel Sayisi. 2020; 279-288.
[68] Agsakallı A. Farkli ekim sikligi ve gubre dozlarinin bazi nohut genotiplerinde verim, verim unsurları ve kalite uzerine etkileri. Erzurum: Ataturk Universitesi, Fen Bilimleri Enstitusu, 1995.
[69] Ozdemir S. Yemeklik Baklagiller. İstanbul: Hasad Yayıncılık., 2006.
[70] Sarimurat M S. Van ekolojik kosullarinda yetistirilen bazi nohut (Cicer arietinum L.) cesitlerinin verim ve kalite ozelliklerinin belirlenmesi. Van: Van Yuzuncu Yıl Universitesi, Fen Bilimleri Enstitusu, 2017.
[71] Sepetoglu H. Nohutta cesit ve bitki sikliginin buyume ve verim uzerine etkisi. Ege Universitesi, Ziraat Fakultesi Dergisi. 1988; 19(2): 71-76.
[72] Deshpande S S, Damodaran S. Structure digestibility relationship of legume 7S proteins. Advanced in Cereal Science and Technology. 1990; 10(3): 156.
[73] Ertas N. Nohut (Cicer Arietinum L.) fasulye (Phaseolus vulgaris L.) ve soya fasulyesinden (Glycine max L.) uretilen baklagil bulgurlarinin uretim metotlarinin standardizasyonu ile bazi kalitatif ve besinsel ozelliklerinin belirlenmesi. Konya: Selcuk Universitesi, Fen Bilimleri Enstitusu, 2010.
[74] El-Adawy T A. Nutritional composition and antinutritional factors of chickpeas (Cicer arietinum L.) undergoing different cooking methods and germination. Plant Foods for Human Nutrition. 2002; 57(83): 97.
[75] Ghavidel RA, Prakash J. The impact of germination and dehulling on nutrients, antinutrients, in vitro iron and calcium bioavailability and in vitro starch

and protein digestibility of some legume seeds. LWT-Food Science and Technology. 2007; 40: 1292-1299.

[76] Kilincer F. Cimlendirilmis bazi tahil ve baklagillerin besinsel ve fonksiyonel ozellikleri uzerine bir arastırma. Konya: Necmettin Erbakan Universitesi Fen Bilimleri Enstitusu, 2018.

[77] Yesilgun S. Cukurova bolgesinde bazi kislik nohut (Cicer arietinum L.) hat ve cesitlerinin bitkisel ve tarimsal ozelliklerinin saptanması. Adana: Cukurova Universitesi, Fen Bilimleri Enstitusu, 2006.

[78] Eser D, Gecit HH, Emekliler HY. Evaluation of chickpea landraces in Turkey. Chickpea Newsletter Jun. Icn. 1991; 24: 22-23.

[79] Guler M, Adak M, Ulukan H. Determining relationships among yield and some yield components using path coefficient analysis in chickpea (Cicer arietinum L.). European Journal of Agronomy. 2001; 14: 161-166.

[80] Altınbas M, Tosun M. Nohutta ileri generasyonlarda verim ile verim ogeleri arasindaki iliskiler uzerine bir degerlendirme. Journal of Agriculture Faculty of Ege University. 2002; 39(2): 33-40.

[81] Yucel D, Anlarsal AM, Yucel C. Genetic variability, correlation and path analysis of yield and yield components in chickpea (Cicer arietinum L.). Turkish Journal of Agriculture and Forestry. 2006; 30: 183-188.

[82] Hassan M, Atta BM, Shah TM, Haq MA, Syed H, Alam SS. Correlation and path coefficient studies in induced mutants of chickpea (Cicer arietinum L.). Pakistan Journal of Botany. 2005; 37(2): 293-298.

[83] Saleem M, Tahir MHN, Kabir R, Javid M, Shahzod K. Interrelationships and path analysis of yield attributes in chickpea (Cicer arietinum L.). International Journal of Agriculture & Biology. 2002; 4(3): 404-406.