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Araştırma Makalesi – Research Article

Determination of Some Characteristics Related to Yield Components of Advanced Bredding Chickpea Lines and Varieties in Konya Ecological Conditions*

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Abstract

The aim of this study was to determine yield and yield components of some breeding chickpea lines in Konya ecological conditions.

Total, 5 line that obtained from different Research Institutions and Stations with 2 varieties (Azkan, Gökçe) were included as research materials.

The experiments were carried out according to Randomized Complete Block Design with 4 replications in experimental field of Bahri Dağdaş International Agricultural Research Institute in 2011-2012. The periods of blooming and ripening, first pod height, plant height, grain yield, and hundred-seed weight were analyzed within the study.

For all components excluding first pod height, differences among the genotypes were determined as statically important ($p<0.01$). As a result of study, shortest vegetation period was recorded for EN 1721 and Azkan varieties (88.25 days) planted in 2012 while longest blooming period was recorded for EN 1999 (in 2011) and EN 2001 (in 2011) genotypes with 56.5 days. The first pod height (29.5 cm) and plant height (43.25 cm) values of EN 1780 lines were found over than other genotypes in 2011 cultivations. The heaviest hundred-seed weight was determined from EN 1721 (in 2012) with 40.85 g, the highest grain yield was determined from genotype of EN 2000 with 132.52 kg/da in 2012 trials.

In addition, positive correlations (at 1% eror level) were detected between blooming days number and maturing days number (r= 0,859**); first pod height and vegetation period (r= 0.546**); and first pod height and plant height (r= 0.553 **).

Keywords: Chickpea, breeding, grain yield, yield components

İleri Kademe Nohut Hatlarının ve Çeşitlerin Konya Ekolojisindeki Bazı Verim Karakterlerinin Belirlenmesi

Özet

Bu araştırma, ıslah çalışmalarının ileri kademelerindeki durulmuş hatlarının Konya ekolojik koşullarında verim karakterlerinin belirlenmesi amacıyla yürütülmüştür.

Araştırmada materyal olarak farklı Araştırma Enstitüsü ve İstasyonlarından temin edilen 5 nohut hattı ve 2 tescilli çeşit (Azkan, Gökçe) kullanılmıştır. Denemeler tesadüf blokları deneme desenine göre 4 tekrarlamalı olarak 2011-2012 yıllarında, Bahri Dağdaş Uluslararası Tarımsal Araştırma Enstitüsü Müdürlüğü deneme alanlarında yürütülmüştür. Çalışmada çiçeklenme süresi, vejetasyon süresi, ilk bakla yüksekliği, bitki boyu, tane verimi ve yüz tane ağırlığı özellikleri incelenmiştir.

Denemede; çalışılan bütün parametrelerde genotipler arasındaki farklılıklar istatistiki olarak ($p<0.01$) önemli bulunmuştur. Deneme sonucunda; en kısa vejetasyon süresi 88.25 gün ile EN 1721 ve Azkan çeşidinin 2012 yılı ekiminde gözlenirken en uzun çiçeklenme süresi 56.5 gün ile EN 1999 ve EN 2001 nolu genotiplerin 2011 yılı ekişlerinde tespit edilmiştir. EN 1780 hattının 2011 yılı ekilişlerinden ölçülen ilk bakla yüksekliği (29.5 cm) ile bitki boyu (43.25 cm) değerleri diğer genotiplerin üstünde yer almıştır. 100 tane ağırlığı en yüksek olan hat 2012 yılı değerleri olarak EN 1721 (40.85 g) olurken en yüksek tane verimi 132.52 kg/da ile EN 2000 hattının 2012 yılı ekilişinde tespit edilmiştir.

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Ayrıca çalışmada çiçeklenme gün sayısı ile olgunlaşma gün sayısı arasında (r= 0,859**), ilk bakla yüksekliği ile vejetasyon süresi arasında (r= 0.546**) ve ilk bakla yüksekliği ile bitki boyu arasında (r= 0.553 **) %1 hata seviyesinde önemli pozitif korelasyon belirlenmiştir

Anahtar Kelimeler: Nohut, ıslah, tane verimi, verim ögeleri

Introduction

Since the increasing of world population, uneven use of limited production resources and changes in environmental conditions, about a billion people starving in the world, and the half of the world's population is fed unbalanced and insufficient. In both world and our country, edible legumes which comes at first as vegetable protein source, is a very important agricultural crop subsequent to the cereals. In the world, edible legume has 77 million hectares of growing area and its annual production is about 66 million tones (FAO, 2014).

In Turkey, chickpea production area is about 416.242 ha and its annual production about 518 000 tones (yield 124 kg/da). Konya constituted nearly 5% of this chickpea production area with 20 384 ha growing area and annual yield is about 28 376 tones (yield 139 kg/da). Konya comes as third for chickpea production and growing area (Anonymous, 2012). Even though Konya takes place in front regarding to production amount and growing area, average chickpea yield (139 kg/da) is not still at intended level.

In the region, chickpea has an important role as a key rotation plant. In this study, it was aimed to yield characteristics and regional performances of breeding chickpea lines. Besides, single plant selections were made to compose breeding materials for further studies.

Material and Method

In this study which was conducted in Konya Bahri Dağdaş International Agricultural Research Institute, 7 chickpea breeding lines (EN 1721, EN 1999, EN 2000, EN 2001, EN 1846) with 2 varieties (Azkan, Gökçe) included as plant materials. The experiment was set up according to "Randomized Complete Block Design" with 4 replications in 2011-2012 years (Düzgüneş et al. 1987).

In 2011-2012 in chickpea vegetation period (April, May, June, July, August) that was the study was conducted through, the precipitations were recorded respectively as 94,2 mm and 93,4 mm which were below the average of long years (136 mm).

In terms of temperature, there was no difference detected between the years of study conducted in and long years average. The trial was set up with four replications in a randomized complete block design (Düzgüneş et al., 1987). Trial plot size was 1.8 x 5 m = 9 m^2 and planted wheat in the previous year field trial plowed with furrow plow after that seed bed was prepared with the appropriate combination of rake crowbar. The seeds was sown by hand in the parcels (as 45 cm between rows and 8-10 cm above rows) which was prepared by a marker. Trial was conducted in dry conditions and before blooming hoeing was done for weed control.

Table 1. Some physical properties with some micro and macro soil nutrient composition of the field trial (2011)

Depth (cm)	Structure				pH	Organic substances (%)	Lime (%)	Salt (µS/cm)	P_2O_5 (mg/kg)	K_2O (mg/kg)	Zn (mg/kg)
	Sand (%)	Clay (%)	Silt (%)	Class							
0-30	30.83	41.62	27.55	Clayey	7.82	2.28	29.26	272	4.64	92.31	0.262

The trials were set up on 18th of April in 2011, 21st of April in 2012 and 10 kg of DAP (as 1,8 kg/da N, 4.6 kg/da P2O5) was applied and mixed to soil while planting. Harvesting was done by harvesting machine following hand picking, and started on 11st of Aug. (2011) and 18th of Aug. (2012) depending on maturation time of varieties and lines and in 5 days it was completed. In the study, data were recorded regarding to vegetation and blooming periods, first pod height, plant height, grain yield, and 100-seed weight.

The statistical analysis of results was done according to "Randomized Complete Block Design" and in all statistical analysis; JUMP statistical package program was used. By JUMP statistical package program were analyzed combining years .In the statistical outcomes, means of which had significant "F" value, were grouped with reference to LSD significance test (P<0.01) (Düzgüneş et al. 1987). The results were analyzed by combining JUMP statistical package program with the years.

Results and Discussion

For grain yield capacity, the difference year x genotype interaction was determined as significant at p<0.01 levels and the highest grain yield was obtained from line of EN 2000 with 132.52 kg/da in 2012 trials. According to LSD test results, EN 2000 was grouped as "a", while EN 2000 line and Azkan varieties grouped as "f" for the lowest grain yield capacity (Table 2). The lowest grain yield was obtained from EN 2000 line and Azkan varieties with 65.40 kg/da and 68.31 kg/da respectively in 2011.

EN 1721 and EN 1846 (in 2011) lines showed yield capacity by giving above the average yield. Our results demonstrated compliance with the studies of researchers who worked on grain yield, thus, the min and max yields in their studies were reported as 123.3- 221.5 kg/da by Altınbaş and Sepetoğlu (2001), 131.6-185.1 kg/da by Türk and Koç (2003), 121.5-166.6 kg/da by Biçer and Anlarsal (2004), 60,82-136,7 kg/da by Önder and Üçer (1999), 172-285 kg/da by Uzun et al. (2012), 66.6-132.52 kg/da by Bayrak et al. (2014). The yield difference between varieties might be due to variety feature environmental adaptation or climatic changes through the growing season (Gökkuş et al., 1996). The grain yield capacity of a variety can be effected by planting time (winter or spring planting), soil and climatic conditions, genetics of variety, pest&disease.

Table 2. Data of grain yield, plant height, first pod height, blooming periods, vegetation periods, 100 grain of Chickpea Lines and Varieties in Konya Conditions and LSD Analysis Results

	Blooming (day)		First Pod (cm)		Plant Height (cm)		Vegetation Period (day)		Yield (kg/da)		100 grain (g)	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
En 1721	56.25 a	43.75 d	18.25 d	18.6 d	31.75 d	36.22 bc	118.75 a	88.25 e	120.21 ab	109.06 abc	37.96 bc	40.85 a
En 1999	56.5 a	54.25 ab	24 b	18.2 d	35.13 d	35.8 bcd	118.25 a	100.25cd	94.57 cde	108.99 abc	38.81 bc	37.7 cd
EN 2000	55 ab	56.25 a	28.75 a	19.65 d	40.13 ab	31.8 d	112.75 b	103.5 c	65.40 f	132.52 a	38.5 bc	35.7 de
EN 2001	56.5 a	51.25 c	26.25 ab	16.68 d	38.38 bc	36.57 bc	114 b	98.75 d	83.38 d-f	70.92 ef	37.9 c	30.75 f
EN 1846	56 a	43.75 d	24.125 b	20.05 cd	37 bc	38 bc	114 b	91.25 e	120.90 ab	108.12 bc	39.03abc	35.3 e
Azkan	54.5 ab	41.5 d	29.5 a	19.23 d	43.25 a	37.45 bc	118.5 a	88.25 e	68.31 f	102.95bcd	39.12abc	30.7 f
Gökçe	56.25 a	53.5 bc	23.5 bc	19.78 d	36.38 bc	38.7 bc	118.25 a	100.75 d	109.71abc	76.83 ef	39.96 ab	30.8 f
Ort	55.85	49.17	24.91	18.88	37.42	36.36	116.35	95.85	94.64	101.34	38.75	34.54
CV	3.4		12.1		8.3		2,6		16.8		3,8	
LSD	2.3		3,8		4.4		3.9		23,6		2.0	

The plant height difference year x varieties interaction was found at 1% level of statistical significance. The max plant height obtained from Azkan varieties with 43.25 cm, and EN 2000 followed as second with 40.13 cm in 2011. The shortest plants were obtained from EN 1721 line (31.75 cm) planted in 2011 and EN 2000 line (31.8 cm) planted in 2012. According to LSD test results, Azkan (2011) varieties was taken to "a" group, EN

2000 (2011) was included in "ab" group. The lines of EN 1721 (2011) and EN 2000 (2012) which had the shortest average plant, were included in the last group "d" (Table 2).

The results of the study showed similarities with the studies of researchers who worked on chickpea plant height that were reported as 22.2-32.8 cm by Bakaoğlu and Ayçiçeği (2002), 35.3-40.0 cm Altınbaş and Sepetoğlu (2001), 16.8-38.3 cm by Biçer and Anlarsal (2004), 38-47 cm by Öztaş et al. (2004)', 34-40.25 cm by Uzun et al. (2012), 31.80-39.15 cm by Bayrak et al. (2014). The plant height differences between varieties might be due to mainly feature of variety, planting density, environmental and climatic conditions through the growing season.

The difference for first pod height year x genotype interaction was statistically determined as 1% significance level. The max first pod height was obtained from Azkan varieties with 29.5 cm and EN 2000 line with 28.75 cm (in 2011 plantings). The min first pod height was recorded for EN 2001 line with 16.68 cm in 2012. According to LSD test results, Azkan (2011) and EN 2000 (2011) were categorized in group "a", while EN 2001 (2012) line was taken to last grouped "d" (Table 2).

Regarding to first pod height, the results of this study showed consistency with the studies on chickpea first pod height that were reported as 24.84-30.77 cm by Önder and Üçer (1999), 14.60-20.93 cm by Bakaoğlu and Ayçiçeği (2002), 16.9 cm by Ağsakallı (1995), 14.3-21.53 cm by Bayrak et al. (2014). First pod height is a yield component affected by genetics and environmental factors (Fehr, 1987). Long first pod height is a desired feature due to its compatibility for machinery harvesting. So that, the recommendation potential of the variety that has long first pod height to the farmers increases. The first pod height feature might be affected by some factors such as plant height, feature of variety, soil and climatic conditions, winter and spring planting time.

As seen in Table 2, for blooming period, the difference year x genotype interaction was statistically found at 1% level of significance. The longest blooming period was recorded for EN 1999 (in 2011) and EN 2001 (in 2011) lines with 56.5 days, while the shortest blooming period was shown by Azkan (in 2012) with 41.5 days. According to LSD test results, EN 1999 (in 2011) and EN 2001 (in 2011) lines were included in group "a", and Azkan (in 2012) which had shortest average plant height was taken to last group "d". The results of this study showed parallelism with the studies on blooming periods that were recorded as 47-61 days by Eser et al. (1989), 58–94 days by Singh et al. (1990), 145–166 days by Öztaş et al. (2004), 29-35 days for spring planting by Yürür and Karasu (1997), 57.5-65.5 days by Uzun et al. (2012) and 41.25-60.5 days by Bayrak et al. (2014).

For the vegetation periods, the statistical difference year x genotype interaction was recorded as $p<0.01$ level of significance. The longest vegetation period was observed on EN 1721 (118.75 days) line and Azkan (118.5 days) Gökçe (118.25 days) varieties planted in 2011, while the shortest vegetation period was recorded for EN 1721 line and Azkan varieties (88.25 days) planted in 2012. According to LSD test results, EN 1721 (2011), Azkan (2011) and Gökçe (2011) were included in group "a", EN 1721 (2012) and Azkan (2012) that had shortest vegetation periods were categorized in group "e" (Table 2). The results of our study showed compatibility with the studies on vegetation periods that were recorded as 82-117.8 days by Ağsakallı (1995), 98-141 days by Biçer and Anlarsal (2003), 118 -129.75 days by Uzun et al. (2012).

The difference year x genotype interaction for 100-grain weight was found statistically significance of 1% level. The max 100-grain weight was obtained from EN 1721 (in 2012) with 40.85 g, the min 100-grain weight was recorded for Azkan and Gökçe (in 2012) with 30.7 g and 30.08 g respectively. According to LSD results, EN 1721 line was grouped in "a", Azkan and Gökçe varieties that had min 100-grain weight were

included in "f" group (Table 2). These results were compatible to previous studies on 100-grain weight of chickpea that were determined as 85-491 g by Kumar ve ark. (1991), 10.5-39 g by Dumbre ve Deshmuch (1984), 12.6-48.1 g by Eser et al. (1989), 36 g by Jana and Singh (1993), 22.59-48.76 g by Akman (1993), 38-48 g by 34-40.25 g by Uzun et al. (2012). The difference for 100-grain weight between the varieties/lines might be related to variety feature, planting density, climatic and environmental conditions.

Results and Discussion

Regarding to grain yield capacity results, EN 2000 lines and Azkan varieties came forwards among the plant materials. For plant height, EN 1780 line showed higher value when evaluated 2 years. EN 1846 line reached earlier harvesting maturity than other liens and varieties.

Table 3. Data of grain yield, plant height, first pod height, blooming periods, vegetation periods, 100 grain of Chickpea Lines and Varieties Correlatiosns Analysis Results

	Blooming Periods	F. Pod Height	Plant Height	Veg. Periods	Grain Yield
F. Pod Height	-0.0498				
Plant Height	-0.2278	**0.4612****			
Veg. Periods	**0.9713****	-0.0599	-0.1848		
Grain Yield	-0.0109	0.0354	-0.3676	-0.0355	
100 grain	-0.0934	-0.0371	-0.2180	-0.2048	**0.5401****

In addition, positive correlations (at 1% eror level) were detected between blooming days number and maturing days number (r= 0,859**); first pod height and vegetation period (r= 0,546**); and first pod height and plant height (r= 0,553 **).

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