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AGRONOMICAL CHARACTERISTICS OF SEVERAL CHICKPEA ECOTYPES (*CICER ARIETINUM*) GROWN IN TURKEY

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Abstract. The chickpea is an important field crop for low quality fields and drought-enduring, in Isparta ecology, as a sowing duty covers a large area. This research has been conducted in oder to determine the most suitable chickpea line and varieties in the grain-chickpea sowing duty system of the Isparta city ecological conditions. Eleven cultivars and lines grown in Turkey were used in this two-year long study (between the years 1996 and 1997), which involved a randomize block experimental design with four replications. Data were analyzed by multivariate statistical methods. According to the two-year results, the differences between the lines and cultivars were found to be important in all components observed. The annual differences proved significant for all components, except the number of pods per plant and the height of the first pod from the ground. Anthracnose (*Ascochyta rabiei* pass. Lab.) was not found in any cultivar and line in natural conditions, in none of the tow years. One principal component (PC1) was found by factorial analyses. The eleven examined cultivars were separated in two main groups and three subclusters by cluster analyses.

Key words: Chickpea, breeding, factor analysis, cluster analysis

INTRODUCTION

In today's world, the nutrition problem is growing increasingly, paralleling to population growth. The production of high-range protein foods has been important for solving the nutrition problem, on a particular level. For this reason, growing the most productive and high-quality varieties to the regions is paramount.

Chickpea growing on low quality fields and drought-enduring proves important to these products. Chickpea, which benefits from a large market and enters to sowing duty with wheat pillar, is a demanded plant for dry and salty areas (Şehirali, 1988). It is a necessary product, whether processed in the food industry or consumed as a roasted chickpea, considering the roasted chickpea export (Anonymous, 1995).

In the Isparta ecology, chickpea (duty in the drought fields), grain-chickpea, grain-common vetch, grain-lentil, grain-fallow land implemented as a sowing duty, cover an important area (Anonymous, 1996). This research was carried out to determine the adaptation of some chickpea lines and cultivars under the ecological conditions of the Isparta province in Turkey. Adhikari and Pandey (1982), Doğangüzel (1998), Engin (1989), Karasu (1993), Khargade et al. (1985), Samal and Jagadev (1989) were studied and researched for different agronomical characteristics of some Chickpea cultures.

In this research, multivariate statistical methods were used for data determination to obtain more results than the variance analysis. Rudimentary, exploratory procedures are often quite helpful in understanding the complex nature of multivariate relationships. Analysis of

principal components is more of a means, rather than an end, because they frequently serve as intermediate steps in much larger investigations. For example, principal components may be inputs to a multiple regression or cluster analysis. Moreover, principal components are one 'factoring' of the covariance matrix for the factor analysis model (Johnson and Wicherin, 1992).

Cluster analysis when searching the data for a structure of 'natural' groupings is an important exploratory technique. Grouping can provide an informal means for assessing dimensionality, identifying-outliers and suggesting interesting hypotheses concerning relationships (Johnson and Wicherin, 1992).

MATERIAL AND METHODS

This research has been carried out in the 1996-1997, so as to determine suitable chickpea varieties and lines for the Isparta ecological conditions. In the research, conducted within different agricultural institutions; Eser 87 (V1), Akçin 91 (V2), Canitez 87 (V3), Diyar 95 (V4), ILC-482 (V5), AK-7112 (V6), ICC-5566 (V7), Red roasted chickpea (ecotype) (V8), 4N-495/2 (V9), Spanish Chickpea (ecotype growing in the region) (V10) and Aziziye (V11), variety and lines have been used as a material.

For the Atabey test area, where the research was carried out in 1996, the soil is axle-clay, silt, not salty, a little bit alkaline with much limely, average in phosphorus and medium level in organic matter. The Çünür Kampus area, where the research was carried out in 1997 is silt, slight alkaline, not salty, mostly limely, average phosphorus and poor in organic material (Anonymous, 1997a). The average precipitation of the years 1996-1997 was recorded to be different from the average long years (Anonymous, 1997b).

Studies have been set up twice a year, as randomize block experimental design with four replications. Sowing has been done in the middle of March. Data about productive elements have been gathered from counting and measurements from ten plants, which were taken from every parcel before harvest. Seed productivity has been found from whole test field (6 m^2) with added ten plant production.

So as to find the natural grouped between varieties and examining the changes in the data, principal component factor analysis and cluster analysis as multivariate statistical analysis methods have been used (Johnson and Wicherin, 1992; Adam and Hwangs, 1999).

Principal component analysis is concerned with explaining the variance-covariance structure through a few linear combinations of the original variables. Its general objectives are data reduction, and (2) interpretation.

Clustering (or grouping) is distinct from the classification methods. Cluster analysis is a more primitive technique in that no assumptions are made concerning the number of groups on the group structure. Grouping is done based on similarities or distances (dissimilarities).

RESULTS AND DISCUSSION

According to the two years analysis, results obtained from chickpea cultures, it is proved that for all examined features, varieties differences are important (Table 1). Except the height of the first pod from the ground and the number of pods on the plant, it has been proved that there are differences between years for the other features, as well. Except for the thousand seed weight and one unit field seed productivity, year and variety interaction have been statistically important.

Whereas the Akçin-91 variety (26.68 cm) has been found to produce the longest plant, Kirmizi Nohut (22.05 cm) presents smallest plant length. Tosun and Eser (1975) determined that plant length varied between 12.47 and 26.87 cm. Singh and Tuwafe (1981) obtained similar results (15-50 cm).

Accounted values of first pod height from the ground ranged between 14.8 and 19.14 cm. Eser et al. (1987) found these values as 13.0-33.6 cm.

If we look at the number of side brunch, Kirmizi Nohut (3.44) has the highest, while ICC 5566 (2.52) has the lowest values. Singh and Tuwafe (1981) and Eser et al. (1987) found similar results (0.3-22.7, respectively 1.4-6.4).

ILC482 has the highest (10) and Diyar95 has the lowest (5.53) values of pod number per plant. These results are close to researches of Singh and Tuwafe (1981) (4-100), Eser et al. (1987) (3-12), Samal and Jagadey (1989) (8.5-21.8), but they are smaller than the results of Dumbre and Deshmuch (1984) (14.4-67), Khargade et al. (1985) (53.5).

The largest number of the main brunch in the plant in the ILC-483 line and the smallest one are obtained from ICC-5566 and Akçin-91. Results have showed paralleling to the findings of Tosun and Eser (1975), Singh and Tuwafe (1981), Karasu (1993) and Eser et al. (1987).

When we look at seed numbers, ILC-482 has the highest; Diyar 95 has the lowest values. These results are close to the Singh and Tuwafe (1981), Eser et al. (1987), Samal and Jagadey (1989), but different from the findings of Dumbre and Deshmuch (1984), Khargade Et Al. (1985).

It was proven that Kirmizi Nohut has a high value (522.6 g); Eser 87 has a small value (311.6 g) for 1000 seed weight. Singh and Tuwafe (1981) obtained between 87-791 g, and Engin (1989) obtained between 240-360 g for this characteristic.

Table 1

Average values of quantitative characteristics (1996-1997)

Traits/ Varieties	1	2	3	4	5	6	7	8	9	10	11
Eser 87	24.38	16.93	2.99	2.92	9.70	10.52	311.6	3.07	0.52	115.3	20.98
Akçin 91	26.68	17.35	2.60	3.11	7.43	7.93	419.8	3.12	0.49	123.2	21.80
Canitez 87	23.87	15.52	2.79	3.31	7.22	7.60	516.4	3.59	0.49	110.9	19.08
Diyar 95	25.38	17.80	2.84	3.30	5.53	5.95	449.6	2.67	0.49	114.6	19.63
ILC 482	22.12	15.59	3.15	3.37	10.00	10.63	320.0	3.06	0.51	107.8	20.57
Ak 7112	23.88	15.47	2.78	2.83	6.81	7.35	368.4	2.76	0.47	111.5	19.41
ICC 5566	26.63	19.14	2.60	2.52	8.96	9.58	320.0	2.87	0.44	110.9	20.69
Kir.Nohut	22.05	14.80	2.70	3.44	6.93	7.25	522.6	3.56	0.51	111.3	19.36
4N-495/2	25.39	16.95	2.90	3.43	6.94	7.34	510.8	3.36	0.50	104.6	18.64
İspany.No	26.19	17.54	2.85	3.07	7.34	7.68	504.8	3.56	0.47	125.6	21.09
Aziziye	24.73	16.69	2.73	2.73	6.38	6.74	415.5	2.98	0.48	105.1	23.25
Average	24.66	16.70	2.81	3.08	7.56	8.04	423.6	3.14	0.49	112.8	20.41
LSD (5%)	0.543	0.45	0.22	0.35	0.88	0.88	6.2	1.09	1.85	6.9	0.49

Note: 1. Length of plant (cm), 2. Height from ground of first pod (cm), 3. Number of main brunch, 4. Number of side brunch, 5. Pod number per plant, 6. Seed number per plant, 7. 1000 seed weight (g), 8. Seed productivity per plant (g), 9. Harvest index (%), 10. Seed productivity (kg/da), 11. Protein ratio (%) (1997).

The Canitez 87 variety has the largest seed productivity value (3.59 g); Diyar 95 has the least value (2.67 g). These values are near to the values of Dumbre and Deshmuch (1984) (3.5-15.1 g) and Eser et al. (1987) (0.4-5.8 g), but they are smaller than the values of Tosun and Eser (1975) (5.58-21.67 g), Kumar et Al. (1981) (11.6g), Adhikari and Pandey (1982)

(8.94-37.3 g). Anthracnose (*Ascochyta rabiei* pass. Lab.) was not found in any cultivars and lines in natural conditions, in none of the two years.

When giving importance to seed productivity, it has been noticed that the Spanish chickpea (125.6 kg/da) which is grown by the producer and passed from natural selection and the Akçin 91 (123.2) varieties are suitable for Isparta conditions. While Eser et al. (1987) 200-208 kg, Poma et al. (1988) showed that 150-237 kg productivity has been obtained, Engin (1989) has informed that the largest 277 kg productivity has been obtained in 1989. Also, these varieties have the advantages for suitable consumer wishes, concerning the high thousand seed weight (Karasu et al. 1999).

Protein ratios of varieties were obtained for the 1997 products. When we look at the characteristic, the Aziziye variety has the largest value (23.25 %); the 4N-495/2 variety has the smallest value (18.64 %). Karasu (1993) (16.44 %) and Doğangüzel (1998) (19.95-24.3 %) obtained similar results.

According to the principal component factor analysis results, one principal component (PC1) has been obtained (it is explain 99.45 percent of the total variance) (Table 2). For this reason, ignorant information lost is of low degree in research (0.55%). Communality values showed that, examined cultures have an important degree of similar genetic features, while data are reliable. When ordering the varieties according to their important degree (how can they act in the group), they are enumerated as; V_2, V_4, V_{11}, V_6 and V_{10}, which are the more important varieties. The least important culture is V7 which has the smallest principal component coefficient.

When making of the principal component values rotation, the most important varieties of the whole group are in sequence, V4, V2 and V11. While V1 and V8 have the farthest and the most different features (Euclidean distance 301), the nearest two cultures are V3 and V8 (Euclidean distance 14). It shows that, similar cultures can be easily used for the others. When adaptation applications are conducted between varieties farthest from one another, different and new cultures will be obtained.

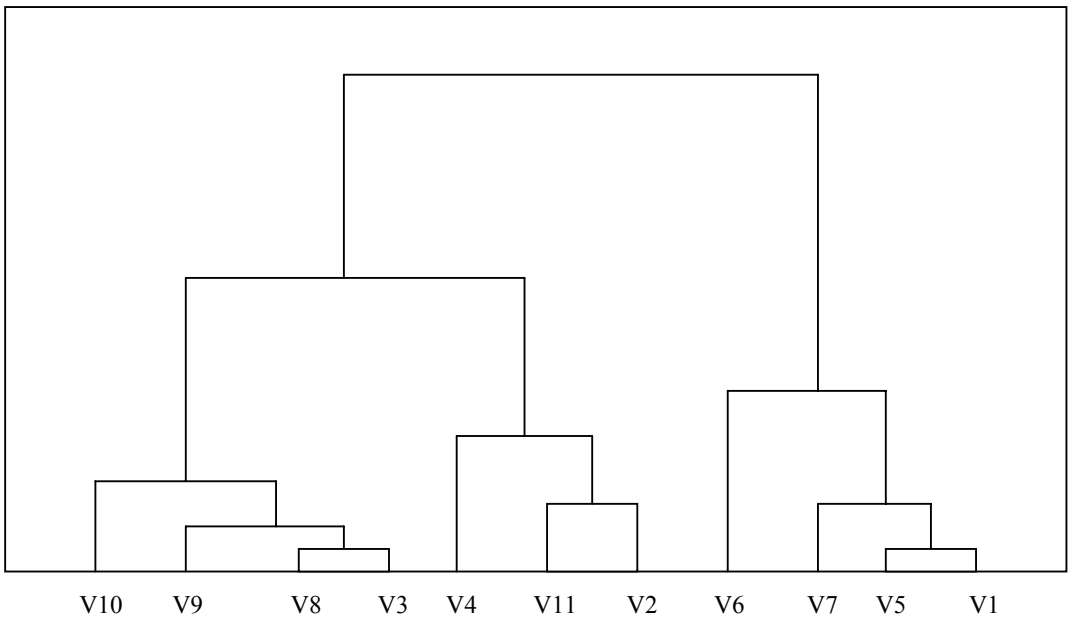
Table 2

Principal components and communalities rates

Varieties	Principal Components Coefficients	Communalities (h_i^2)	Variance matrix (ε_i ,Ψ)
V1	0.9945	0.9890	0.0110
V2	0.9998	0.9995	0.0005
V3	0.9967	0.9934	0.0066
V4	0.9998	0.9996	0.0004
V5	0.9963	0.9926	0.0074
V6	0.9986	0.9973	0.0027
V7	0.9938	0.9876	0.0124
V8	0.9958	0.9917	0.0083
V9	0.9962	0.9923	0.0077
V10	0.9986	0.9971	0.0029
V11	0.9996	0.9991	0.0009

According to the dendogram results produced by cluster analysis, varieties are separated into two main and three secondary groups (Figure 1). V1, V5, V7 and V6 cultures have formed the first population which is different from the others, while the second main group is formed by the other separates into two secondary groups. The most similar cultures are: V8 and V3, V11 and V2, V5 and V1. It has been noticed that, examined varieties are divided into three groups. Similar cultures have an importance for the preference richness of

producer. While the representation culture of the first group is V4 (and V2), the most important culture of the second group is V6.



Complete linkage

Figure 1. Dendogram obtained by cluster analysis on the initial data

CONCLUSIONS

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REZUMAT

CARACTERISTICILE AGRONOMICE ALE UNOR SOIURI DE NĂUT (*CICER ARIETINUM)* CULTIVATE ÎN TURCIA

Năutul este o importantă plantă de cultură, inclusiv datorită rezistenței plantelor pe terenuri mai puțin favorabile şi pentru rezistența lor la secetă. În Isparta, Turcia, cultura năutului se practică pe o zonă largă, astfel că prezentul studiu a fost efectuat pentru determinarea celei mai profitabile linii şi varietăți (soi sau cultivar) de năut pentru condițiile ecologice ale arealului. Unsprezece cultivaturi şi linii, cultivate în Turcia, au fost folosite şi testate în doi ani de cercetare (din 1996 până în 1997), utilizându-se ca metodă experimentală de lucru blocurile randomizate cu patru repetiții. Datele obținute au fost prelucrate şi analizate prin metode statistice adecvate. Conform rezultatelor obținute în cei doi ani de experimentare, diferențele dintre linii şi cultivaruri au fost semnificative pentru majoritatea caracteristicilor analizate. Între ani au existat diferențe semnificative pentru toate caracteristicile, cu excepția numărului de păstăi pe plantă şi înălțimii primei păstăi de la bază. În amândoi anii, antracnoza (*Ascochyta rabiei* pass. Lab.) nu a fost prezentă la cultivarurile şi liniile studiate în condiții naturale. Prin analize factoriale a fost găsit un component principal (PC1), iar cele unsprezece cultivaruri au fost separate în două grupe principale şi în trei submănunchiuri.