

AGRONOMICAL CHARACTERISTICS OF SOME COWPEA ECOTYPES (*VIGNA UNGUILATA* L.) GROWN IN TURKEY; VEGETATION TIME, SEED AND POD CHARACTERISTICS

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Abstract. This study was carried out to observe the yield and yield components of cowpea cultivars available and cowpea lines, which are grown in nine local areas in Turkey. The study including two cultivars and nine ecotypes, was carried out with randomized block design with three replications in 1996-1997. Significant differences were observed between the cultivars as in the seed yield, biological yield and vegetation time, according to the two years' combined results. The data indicate great variation within the cowpea, regarding all characters. Factor analysis based principal component (PCA) showed two factors, representing 99.13 % of the total variation. PC1 explaining 98.69 % of the total variance is highly correlated with seed and pod size factors. PC2 may be considered as the time of vegetation time and yield per plant. Eleven examined cultivars were separated in two groups by factor analysis and cluster analysis.

Key words: cowpea, cultivar, factor analysis, cluster analysis

INTRODUCTION

The importance of plant genetic resources and the need for adaptation characteristics have been increasingly emphasized in the last years. Their vital significance for the maintenance of genetic improvement and biodiversity has been worldwide-recognized (Lester et al., 1986). Important initiations to document the global genetic cowpea have been carried out in certain countries. Adaptation characterization and evaluation is a priority task for successful breeding programs.

The cowpea is an important crop especially in some developing and less developed countries. In Turkey, some researchers conducted studies on cowpea breeding (Sepetoğlu and Ceylan, 1979; Ceylan and Sepetoğlu, 1983; Altınbaş and Sepetoğlu, 1993). These researches are about to develop cowpea quality factors and crop yield.

This investigation approached cowpea variability, when grown under the ecological conditions of the West Anatolia region with respect to vegetation time, seed and pod characteristics and ultimately, crop yield.

MATERIAL AND METHODS

The most important 11 local cowpea cultivars grown in Turkey were studied from 1996 to 1997. These cultivars were collected from 9 local areas and examined under Isparta City conditions. Isparta City is one of the most important regions for cowpea agriculture in Turkey (Anonymous, 1996).

The average air temperature of the years 1996-1997 ranged between 12.5-13.4°C, while average precipitation, 541.6-496.4 mm (Anonymous, 1997a). The soil is clay-silt, insipid, more limely, average in phosphorus and organic matter (Anonymous, 1997b). All cultivars were subjected to standard fertilization and spraying.

The ecotypes were named for statistical analysis, as Karagöz: V₁, Akkiz: V₂, Burdur: V₃, Aydın: V₄, Bursa: V₅, Denizli: V₆, Antalya: V₇, Fethiye: V₈, İzmir: V₉, Isparta: V₁₀ and Balıkesir: V₁₁.

Factor analysis with principal component and cluster analysis (STATISTICA package) were used to determine the descriptors' suitability to characterize data variation and find natural groups among cultivars studied (Johnson and Wichern, 1992; Jolliffe and Ringrose, 1998, Ding and Hwang, 1999).

RESULTS AND DISCUSSION

The cultivars were classified into two categories based on their vegetation period. Mean values, over 2 years, for each cultivar were used in the comparative assessment:

Categories	Vegetation	Harvest time of cultivars (days)
Early	97 – 109	End of August
Mid-early	110-120	September

Examined fifth and eleventh cultivars are grown in the North-west Anatolia region of Turkey, and others are grown in the West and/or South Anatolia region.

Factor analysis indicated two principal components with eigen values < 1 accounting for 99.13 % of the overall variance. The first and most important principal component (PC₁), accounting for 98.69 % of the total variance, could be characterized as seed and pod size factors. As such, the first eigen value is sufficient to explain found out data. The seed and pod size parameters, such as pod height from the ground, seed number, 1000 seed weight, biological yield, bunch number, plant length, pod weight highly contribute to this factor. Communalities (h_i^2) are generally high and consequently similarities among the ecotypes are high (table 2). Plotting the cultivars over the 1 st and 2 nd principal component grouped the early and late maturity cultivars in separate areas (Figure 1).

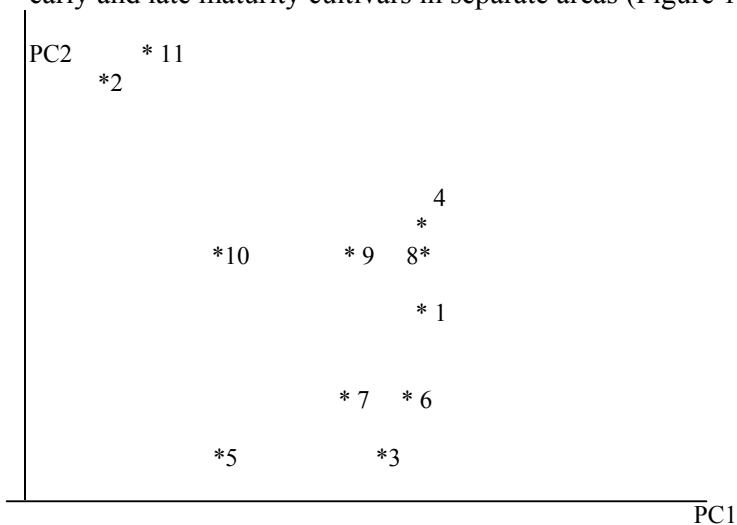


Figure 1. Projection of cultivars on PC1 and PC2

Table 1

Categories of cultivars, quantitative characteristics of pods and seeds

Var.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
V ₁	56.9	10.6	5.4	7.9	33.7	4.6	158	36.5	21.8	7.3	103	12.6	51.0	0.78	55.3
V ₂	70.9	11.5	5.9	8.0	40.5	5.0	137	36.2	19.3	8.7	105	11.9	48.0	0.77	53.2
V ₃	49.1	8.9	4.5	6.0	25.9	4.4	178	41.5	17.8	5.7	106	11.6	52.5	0.79	59.3
V ₄	62.9	11.2	5.6	6.1	32.4	5.1	188	42.7	21.2	8.1	108	12.1	47.7	0.78	51.2
V ₅	50.9	11.6	5.3	6.6	34.2	5.1	150	40.2	19.3	8.0	108	10.8	50.0	0.77	53.3
V ₆	55.1	11.5	5.9	7.1	36.6	5.2	158	40.8	19.2	9.2	112	12.1	51.0	0.77	56.0
V ₇	49.2	10.5	5.4	5.9	31.2	5.1	174	41.2	18.3	6.7	108	12.3	52.2	0.74	56.2
V ₈	65.8	14.6	6.2	7.2	36.9	5.2	174	44.5	22.0	9.0	118	11.0	49.0	0.80	51.2
V ₉	68.0	11.8	6.6	7.7	38.0	4.6	177	38.2	19.7	9.9	111	11.6	44.8	0.81	50.2
V ₁₀	69.1	13.2	6.8	6.7	35.2	5.3	185	40.5	22.7	9.2	100	12.3	45.5	0.82	50.7
V ₁₁	71.6	13.6	6.6	7.6	40.3	5.1	167	40.0	22.2	9.9	113	11.9	44.3	0.78	48.8

Note: 1. Yield per plant (kg/da). 2. Biological yield (gr/plant). 3. Seed yield per plant (gr). 4. Pod number per plant. 5. Seed number per plant. 6. Seed number per pod. 7. 1000 seed weight (gr). 8. Length of plant (cm). 9. Height from ground of first pod (cm). 10. Bunch number. 11. Vegetation period (day). 12. Length of pod (cm). 13. Maturation of pod (day). 14. Width of pod (cm). 15. Flowering 50 %.

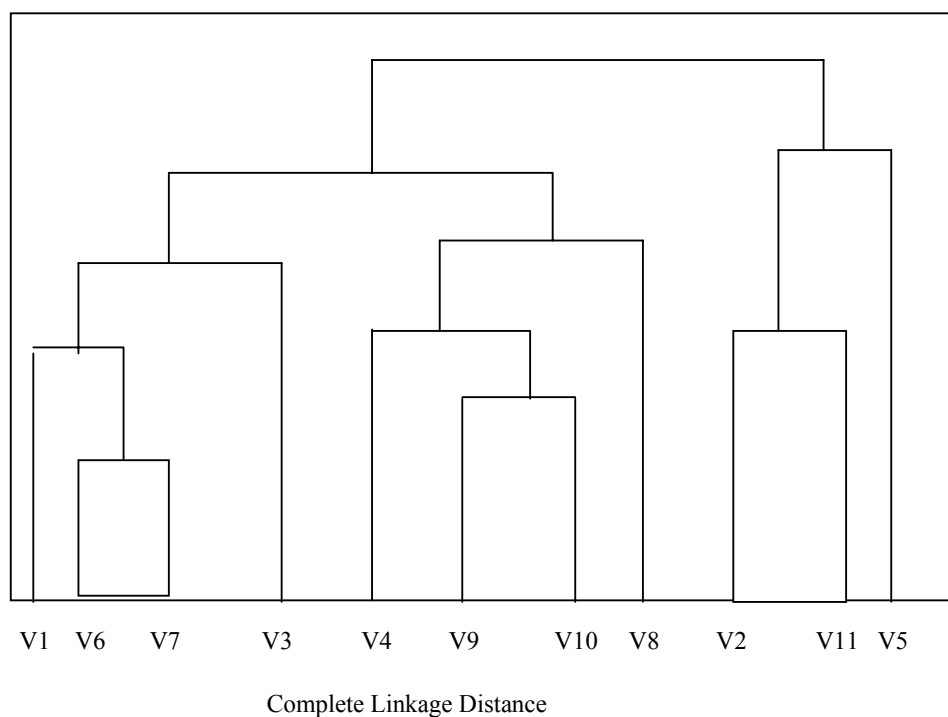


Figure 2. Dendrogram obtained by cluster analysis on the initial data

The dendrogram produced by cluster analysis also grouped the early and mid-early planted cultivars in separate areas (Figure 2). Cultivars were grouped into 3 clusters. Especially, some ecotypes, which have the highest crop yield, were grouped in same cluster (2 sd and 11 th cultivars).

Two principal component shows that results should be explained in two-dimensional space (R). The second principal component (PC_2), accounting for 0.44 % of the total variance could be characterized as vegetation time and seed yield per plant.

Table 2

Accounted principal components and communalities rates for variables

Variant	1. Principal Component	2. Principal Component	Communalities (h_i^2)	Variance Matrix (ϵ_i, ψ)
V ₁	0.997	- 0.121	0.994	0.006
V ₂	0.989	0.103	0.977	0.023
V ₃	0.994	- 0.723	0.987	0.013
V ₄	0.996	0.026	0.992	0.008
V ₅	0.990	- 0.970	0.979	0.021
V ₆	0.997	- 0.063	0.993	0.007
V ₇	0.996	- 0.059	0.991	0.009
V ₈	0.995	0.016	0.990	0.010
V ₉	0.994	0.021	0.998	0.012
V ₁₀	0.992	0.116	0.985	0.015
V ₁₁	0.989	0.004	0.979	0.021

As the agronomical characteristics of included cultivars are recognized on accounts of a great variation in all ecotypes, the variation for these traits seems promising.

CONCLUSIONS

The results clearly show that there is a wide variation among the 11 accessions, with regard to important characteristics, which could be effectively used for vegetation time, seed and pod factors and crop yield. Included varieties in this study were separated into two basic group, according to factor and cluster analysis. Apart from these, there are three different groups (3 sub cluster), according to cluster analysis.

REFERENCES

1. Adam, D., J. T. G. Hwang, 1999, Prediction intervals, factor analysis models and high dimensional empirical linear prediction, Vol. 94, No. 446, Theory and Methods, 446-455.
2. Altınbaş, M., H. Sepetoğlu, 1993, Bir börülce (*Vigna unguilata* L.) populasyonunda dane verimini etkileyen öğelerin belirlenmesi üzerinde bir çalışma, Doğa-Türkish Jour. of Agr. and Forestry, 17, 775-784.
3. Anonymous, 1996, Agricultural Structure and Production, State Institute of Statistical, Turkey.
4. Anonymous, 1997(a), Climate data of Isparta province, Regional Office of Isparta Meteorology, Turkey.
5. Anonymous, 1997(b), Isparta Province Office of Village Services, Turkey.
6. Ceylan, A., H. Sepetoğlu, 1983, Börülcede (*Vigna unguilata* L. Walp) çeşit ve ekim zamanı üzerinde araştırmalar, Ege Üni. Ziraat Fak. Dergisi. (Jour. of Agr. Fac. Univ. of Ege), 20/1, 25-40, İzmir, Turkey.
7. Jolliffe, I., T. J. Ringrose, 1998, Canonical correspondence analysis. In S. Kontz and N. L. Johnson eds. Wiley, Encyclopedia of Statistical Sciences, 91-97.
8. Johnson, R. A., D. W. Wicherin, 1992, Applied Multivariate Statistical Analysis, 3rd edition, Prentice Hall Inc. Englewood Cliffs, N. J. 07632 London, UK.
9. Kahn, B. A., P. J. Stoffella, 1989, Distribution pattern of seed yield in cowpea, Crop Science, 29, 981-985.
10. Karasu, A., 1999, A research on the agronomical characters of some cowpea (*Vigna unguilata* L.) cultivars and ecotypes in ecological condition of Isparta area, Turkey 3 Tarla Bitkileri Kongresi, 15-18 Kasım 1999, Adana, Vol. 3, 371-376.

11.Lester, N., J. Hakiza, N. Stavropoulos, M. Taxeira, 1986, Variation patterns in the African Scarlet Eggplant *Solanum aethiopicum* L. In: Styles, B. T. (Ed), Intraspecific Classification of Wild and Cultivated Plants, Oxford University Press, Oxford, U.K., 283-307.

12.Sepetoğlu, H., A. Ceylan, 1979, Bornova ekolojik koşullarında bitki sikliğinin börülcede (*Vigna sinensis* L.) verim ve bazı verim komponentlerine etkileri üzerinde bir araştırma, Ege Üniv. Ziraat Fak. Dergisi, İzmir. Turkey, 16, 2, 1-16.

REZUMAT

STUDIUL CARACTERISTICILOR AGRONOMICE ALE UNOR SOIURI DE FASOLIȚĂ (*VIGNA UNGUILATA* L.) CULTIVATE ÎN TURCIA; PERIOADA DE VEGETAȚIE, CARACTERISTICILE SEMINȚELOR ȘI PĂSTĂILOR

În studiu s-a analizat producția și caracteristicile de producție la cultivarurile și liniile de fasoliță cultivate în nouă zone din Turcia. S-au utilizat două cultivaruri și nouă ecotipuri, testate într-o experiență amplasată după metoda blocurilor randomizate, cu trei repetiții, în perioada 1996-1997. Conform rezultatele obținute în cei doi ani, diferențe semnificative au fost înregistrate între genotipuri pentru producția de semințe, producția biologică și durata de vegetație. Datele au indicat o amplă variabilitate a tuturor caracteristicilor. Analiza factorială bazată pe principalii componenți analizați (PCA) a demonstrat că doi factori reprezintă 99,13% din totalul variației. PC1 a asigurat 98,69% din totalul varianței și a fost puternic corelat cu mărimea seminței și păstăii. PC2 poate fi considerată durata sau perioada de vegetație și producția pe plantă. Cele unsprezece genotipuri analizate au fost separate în două grupuri prin analize factoriale și în mănunchiuri.