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Fresh Pod Yield and Some Pod Characteristics of Cowpea (*Vigna unguiculata* L. Walp.) Genotypes from Turkey

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Abstract: This study was conducted to evaluate the fresh pod yield, some plant and pod characteristics of eight local cowpea genotypes and two registered cowpea cultivars as control during 2001-2002 and 2002-2003 plant growth season in Samsun. Plant height, number of branches per plant, days to first pod setting, fresh pod harvest period, number of pods per plant, average pod weight, pod length, width, thickness, flesh thickness and seed coat, flower and pod colour were determined. Simple correlations were also calculated between fresh pod yield per plant and all investigated traits. The highest fresh pod yield per plant was in G10 genotype (110.23 g plant^{-1}). This was followed by registered cowpea cv. Karagoz-86 (81.92 g plant^{-1}), Akkiz-86 (58.12 g plant^{-1}) and Kirazlik1 (54.55 g plant^{-1}). Positive and highly significant ($P<0.01$) correlations were found between fresh pod yield per plant and fresh pod harvest period, number of pods per plant, average pod weight, length and width. There were also positive and significant ($P<0.05$) correlations among fresh pod yield per plant, number of branches per plant and pod thickness.

Key words: Correlation, cowpea, fresh pod yield, pod characteristics, *Vigna unguiculata*

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp.) is grown mainly in India and West Africa, but is also important in some areas of America and as green vegetable in the East Indies and China[1]. Cowpea, an annual legume, originated in Africa and is widely grown in Africa, Latin America, Southeast Asia and in the southern United States. Cowpea is a warm-season crop well adapted to many areas of the humid tropics and temperate zones. It tolerates heat and dry conditions, but is intolerant of frost[2]. Dry seeds and fresh pods of cowpea are used as human food and vegetative parts as feed for animals.

Dry cowpea sowing area and production of Turkey was 2900 ha and 2000 tons in 2001, respectively. Amount of cowpea production as a vegetable for fresh pods was 12000 tons for the same year. Cowpea is widely grown in Aegean and Mediterranean regions of Turkey. Leading vegetable cowpea producer provinces in Turkey are Izmir (3980 tons), Aydin (1967 tons), Manisa (1790 tons), Mugla (1242 tons), Hatay (1135 tons) and Balikesir (991 tons)[3]. In the middle Black Sea region, cowpea is cultivated in some provinces, districts and villages to supply only family requirements. These are Sinop, Kastamonu and some villages of Samsun's Carsamba district[4].

There has been limited research on cowpea cultivation in Turkey[4-13]. Except for Peksen *et al.*[12], most of current research is related to cowpea growing for dry seeds. Currently, there are two registered cowpea cultivars, namely Akkiz-86 and Karagoz-86, in Turkey. These are mainly cultivated for their dry seeds as human food.

The study was conducted to compare two registered cowpea cultivars and eight local genotypes from different locations in Turkey, in terms of fresh pod yield, some plant traits and pod related characters. In addition, correlations among all investigated characteristics were examined.

MATERIALS AND METHODS

The study was carried out in the experimental area of Faculty of Agriculture, Ondokuz Mayis University in Samsun during 2002 and 2003 years. Two registered cowpea cultivars (Akkiz-86 and Karagoz-86) as control and eight genotypes from different locations in Turkey were used in the study (Table 1). Days to first pod setting from sowing and fresh pod harvest period as days between first and last pod harvest were recorded. Plant height, number of branches and pods per plant, average pod weight, pod length, pod width, pod thickness, pod

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Table 1: The names and collection sites of cowpea genotypes in the study

Cowpea genotypes	Collection sites
Akkiz-86*	Izmir
Karagoz-86*	Izmir
Dalbahce	Dalbahce/Carsamba
Doganca	Doganca/Bafra
Duragan	Duragan/Sinop
G10	Manisa
G18	Turgutlu/Manisa
Igdir	Igdir
Kirazlik1	Kirazlik/Tekkekoy
Kirazlik2	Kirazlik/Tekkekoy

* Registered by Ege University, Faculty of Agriculture

flesh thickness and fresh pod yield per plant were determined in ten plants randomly selected from each plot. A total of 100 pods randomly selected from those ten plants were measured in order to determine pod related characteristics. Fresh pod yield was obtained by harvesting pods at the green mature stage three times a week over a period of 8-11 weeks. Seed coat, flower and pod colours of genotypes were noted. The soil of experimental area was heavy clay, slightly acidic, without lime and salt, medium in phosphorus and rich in potassium and organic matter. Seeds were sown by hand 5 row plots of 3 m length, with 60 cm between the rows and 10 cm between plants. Sowing was performed on 23 May 2002 and 20 May 2003.

The experimental design was a randomized complete block (RCBD) with three replications. Combined analysis of variance over years was performed. MSTATC PROGRAM (Michigan State University) was used to carry out statistical analysis. Means showing significance statistically were compared using Least Significance Difference (LSD) Test at 0.05 or 0.01 probability level related to significance level of means. The correlations between fresh pod yield per plant and investigated characteristics were also examined.

RESULTS AND DISCUSSION

Seed coat, flower and pod colour and some pod characteristics were given Table 2. It was determined that flower colours of registered cowpea cultivars of Akkiz-86 and Karagoz-86 were white. Kirazlik1 had light purple flowers and the rest of the cowpea genotypes had purple flowers. Green pod colour for vegetable purpose are preferred by consumers. Pod colour was yellowish-green in G10, while it was green in all of the other genotypes. However, G10 and Karagoz-86 had also purple coloured section at the end of the their pods. Heavy pigmentation was the typical characteristic for Karagoz-86. Pod shapes and lengths of cowpea genotypes are shown in Fig. 1. Harvest time has a great effect on the occurrence of strings in fresh cowpea pods. Pods were stringless in all genotypes, but stringiness occurred in fresh pods for all of them with delay in harvest time.

Table 2: Seed coat and flower colour and some pod characteristics of cowpea genotypes

				Presence of anthocyanins		
Genotypes	Seed coat colour	Flower colour	Pod colour	Pod	Stem	Stringiness
Akkiz-86	White	White	Green	-	-	-
Karagoz-86	White	White	Green	+	+	-
Dalbahçe	White	Purple	Green	-	+	-
Doganca	White	Purple	Green	-	-	-
Duragan	Mustard	Purple	Green	-	+	-
G10	Black	Purple	Yellowish-green	+	-	-
G18	Mustard	Purple	Green	-	-	-
Igdir	Mustard	Purple	Green	-	+	-
Kirazlik1	White	Light purple	Green	-	+	-
Kirazlik2	Mustard	Purple	Green	-	+	-

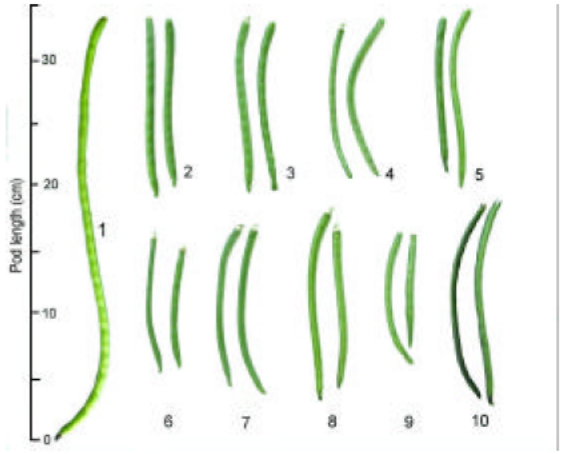

Fig. 1: Pod shapes and lengths of cowpea genotypes used in the study. (1) G10, (2) Kirazlik1, (3) Kirazlik2, (4) G18, (5) Igdir, (6) Dalbahce, (7) Doganca, (8) Duragan, (9) Akkiz-86, (10) Karagoz-86

The analysis of variance showed that there was highly significant differences among all investigated plant and pod characteristics with the exception of pod flesh thickness (Table 3).

Plant height varied between 62.80 cm in Kirazlik2 and 120.90 cm in G10. These results are in close agreement with earlier reports of Gulumser *et al.*[4]. Plant height of G10, Doganca, Duragan and Karagoz-86 had highly significantly higher than the others.

The highest number of branches per plant was determined in G10 (1.80) and Karagoz-86 (1.57). The rest of the genotypes had significantly lower number of branches per plant and there was no significant difference among them (Table 3).

Genotypes used in the study showed highly significant differences in terms of days to first pod setting and pod harvest period. G18 (57.83 days) was the most earliest genotype for days to first pod setting, while Igdir (76.00 days), Duragan (74.67 days) and Doganca (73.33 days) were the most latest. Gulumser *et al.*[4]

Table 3: Means for some phenological and morphological characteristics and fresh pod yield in cowpea genotypes

Genotypes	Plant height (cm)	Branches number per plant	Days to first pod setting (days)	Pod harvest period (days)	Pods number per plant	Average pod weight (g)	Pod length (cm)	Pod width (mm)	Pod thickness (mm)	Pod flesh thickness (mm)	Fresh pod yield (g plant^{-1})
Akkiz-86	83.60cd	1.28bc	64.17b	70.50a	27.68a	2.06c	10.90e	4.74cd	5.81bc	1.37	58.12bc
Karagoz-86	106.12abc	1.57ab	63.83b	70.00a	29.57a	2.66b	12.97b	4.77bcd	5.47d	1.32	81.92b
Dalbahçe	64.27d	1.17c	59.83bc	70.50a	18.00bc	2.32bc	11.77cde	4.66d	5.87bc	1.37	41.85c
Doganca	116.97a	1.27bc	73.33a	60.50bc	16.38bc	2.45bc	12.09bcd	4.89bcd	5.72c	1.56	40.37c
Duragan	112.63ab	1.22c	74.67a	59.00c	15.11bc	2.54b	12.20bc	4.97bc	6.01b	1.54	40.09c
G10	120.90a	1.80a	61.67bc	68.83ab	13.41c	8.15a	29.87a	5.83a	6.92a	1.46	110.23a
G18	89.62bc	1.15c	57.83c	68.67ab	17.22bc	2.43bc	11.73cde	5.01b	5.70c	1.37	42.56c
Igdir	88.45c	1.22c	76.00a	63.17abc	19.03bc	2.22bc	11.82cde	4.80bcd	5.80bc	1.34	42.30c
Kirazlik1	89.68bc	1.23bc	62.67bc	72.50a	22.32ab	2.41bc	11.88cde	4.69d	5.99b	1.34	54.55bc
Kirazlik2	62.80d	1.27bc	62.17bc	68.67ab	15.32bc	2.23bc	11.16de	4.88bcd	5.99b	1.39	35.18c
LSD	23.90**	0.340**	4.838**	9.394**	7.701**	0.4658**	0.993**	0.243**	0.216**	ns	27.560**

* and ** P<0.05 and P<0.01, respectively

Table 4: Simple linear correlations among fresh pod yield, some phenological and morphological characteristics

	Branches number per plant	Days to first pod setting (days)	Pod harvest period (days)	Pods number per plant	Average pod weight (g)	Pod length (cm)	Pod width (mm)	Pod thickness (mm)	Pod flesh thickness (mm)	Fresh pod yield (g plant^{-1})
Plant height (cm)	0.03	0.05	-0.49**	-0.25*	0.25*	0.28*	0.31*	0.28*	-0.13	-0.03
Branches number per plant	-	-0.16	0.09	-0.04	0.52**	0.49**	0.21	0.15	-0.03	0.28*
Days to first pod setting (days)	-	-	-0.01	0.19	-0.15	-0.13	-0.09	-0.11	0.35**	0.06
Pod harvest period (days)	-	-	-	0.48**	0.06	0.03	-0.11	-0.04	0.10	0.45**
Pods number per plant	-	-	-	-	-0.22	-0.24	-0.40**	-0.42**	0.00	0.55**
Average pod weight (g)	-	-	-	-	-	0.97**	0.78**	0.72**	0.11	0.61**
Pod length (cm)			-	-	-	-	0.81**	0.76**	0.11	0.60**
Pod width (mm)	-	-	-	-	-	-	-	0.84**	0.12	0.42**
Pod thickness (mm)	-	-	-	-	-	-	-	-	0.03	0.33*
Pod flesh thickness (mm)	-	-	-	-	-	-	-	-	-	0.21

* and ** represent P<0.05 and P<0.01, respectively

reported that days to first pod setting ranged from 69.33 and 76.00 days among seven cowpea landraces under Samsun ecological conditions. These findings of Gulumser *et al.*[4] support the results.

Pod harvest period was shortest in Duragan (59.00 days) and Doganca (60.50 days). The others were not statistically different from each other for pod harvest period. Pod harvest period shortened with delay in first pod setting (Table 3). Vural *et al.*[14] informed that the pod harvest period for cowpea is 5-9 weeks, depending on ecological conditions. Cowpea genotypes having a long fresh pod harvest period gave high pod numbers and fresh pod yield per plant, when compared with those having a short harvest period short.

The highest number of pods per plant was found in Karagoz-86, Akkiz-86 and Kirazlik1 and they were highly significantly higher than others. Although the lowest value for this variable was recorded in G10, the highest average pod weight (8.15 g), pod length (29.87 cm), pod width (5.83 mm) and pod thickness (6.92 mm) were also found in G10 genotype. Average pod weight was ranged from 2.06 g in Akkiz-86 and 8.15 g in G10. Mean values of cowpea genotypes varied between 10.90-29.87 cm for pod length (Fig. 1), 5.83-4.66 mm for pod width and 5.47-6.92 mm for pod thickness. There was no significant difference for pod flesh thickness among cowpea cultivars and genotypes used in this study (Table 3).

The highest fresh pod yield plant^{-1} (110.23 g plant^{-1}) was recorded in G10 genotype. This was followed by Karagoz-86 (81.92 g plant^{-1}), Akkiz-86 (58.12 g plant^{-1}) and Kirazlik1 (54.55 g plant^{-1}). The lowest fresh pod yield per plant was obtained from Kirazlik2 (35.18 g plant^{-1}). It was not statistically different from Duragan, Doganca, Dalbahce, Igdir and G18 genotypes (40.09, 40.37, 41.85, 42.30 and 42.56 g plant^{-1}, respectively) for this variable (Table 3).

Correlation analysis showed that fresh pod yield per plant was positively and highly significantly correlated with fresh pod harvest period, number of pods per plant, average pod weight, pod length and pod width. Positive and significant correlations were found between fresh pod yield per plant and number of branches per plant, pod thickness (Table 4). These results were in agreement with Jana *et al.*[15]. They found that pods number per plant had the highest direct effect on pod yield per plant. Kutty *et al.*[16] determined that number of pods per plant, number of picking, average pod weight and pod length had positively and significantly correlated with yield per plant. In order to select high yielding cowpea cultivars and to increase fresh pod yield, the pod harvest period, average pod weight and number of pods per plant should be taken into consideration. Similar results have been reported by Kutty *et al.*[16].

Tewari and Gautam[17] found that fresh pod yield was positively and significantly correlated with primary branches per plant, pods per cluster, clusters per plant, 100-seed weight and seeds per pod. In another study on pod yields and quality components, it was reported that pod length and fibre content were the major factors affecting pod yield in vegetable cowpea[18].

The number of branches per plant was positively and significantly correlated with average pod weight and pod length. These results were supported by Tewari and Gautam[17]. Fresh pod harvest period showed positive and highly significant correlation with number of pods per plant and fresh pod yield per plant (Table 4).

Negative and highly significant ($P<0.01$) correlation was found between plant height and pod harvest period, while plant height negatively and significantly correlated with pod number per plant. Correlations between plant height and average pod weight, pod length, pod width and pod thickness were positive and significant ($P<0.05$) (Table 4).

A preliminary study of consumer preferences for pod characteristics in vegetable cowpea showed a general preference for greener, longer, fleshier pods that are less seedy. Larger seeds, crowder pods and thin fibrous pod walls are characteristics of grain cowpea while they are often not preferred in vegetable cowpea[19].

In conclusion, G10 was the most favourable genotype due to its desirable pod characteristics for vegetable cowpea production. Although number of pods per plant was low in G10, the highest fresh pod yield per plant was obtained from G10. The greatest plant height, highest number of branches per plant, longest fresh pod harvest period, highest average pod weight, longest pods, widest pods and thickest pods were all obtained from G10. Karagoz-86, Akkiz-86 and Kirazlik1 were in same statistical group with G10 for fresh pod yield. G10 and Kirazlik1 can be recommended for fresh pod production as vegetable. However, Karagoz-86 and Akkiz-86 had some undesirable pod characteristics. Fresh pods of Karagoz-86 cultivar were restricted and it had larger seeds and crowder pods. In addition, there was a heavy purple pigmentation on pod surface of Karagoz-86, typical for it. Akkiz-86 had small pods ending conical section. Determined pod characteristics showed that Karagoz-86 and Akkiz-86 cowpea cultivars, registered mainly for dry seeds, were not suitable for use as vegetable cowpea.

REFERENCES

1. Phillips, R. and M. Rix, 1995. Vegetables (over 650 vegetables in superb colour). The Garden Plant Series. Macmillan Publishers Limited, London.
2. Davis, D.W., E.A. Oelke, E.S. Oplinger, J.D. Doll, C.V. Hanson and D.H. Putnam, 2004. Cowpea Alternative Field Crops Manual. http://www. hort. purdue. edu/ newcrop/afcm/cowpea. html
3. DIE, 2001. Agricultural Structure (Production, Price, Value). Republic of Turkey, Prime Ministry State Institute of Statistics (SIS), Ankara, Turkey.
4. Gulumser, A., F. Tosun and H. Bozoglu, 1989. A study on the production of cowpea under the ecological conditions of Samsun. J. Fac. Agric., OMU, 4: 49-65.
5. Sepetoglu, H. and A. Ceylan, 1979. An Investigation on the effects of plant densities on yield and some yield components in cowpea (*Vigna sinensis* ENDL.) under Bornova ecological conditions. J. Fac. Agric., Ege University, 16: 1-16.
6. Ceylan, A. and H. Sepetoglu, 1980. An investigation on some agronomic characteristics of cowpeas (*Vigna sinensis* ENDL.) with different origins under Bornova ecological conditions. Ege University, Fac. Agric. Publications, 387, 47 s.
7. Ceylan, A. and H. Sepetoglu, 1984. Agronomic studies on cowpea (*Vigna unguiculata* (L.) Walp.). J. Fac. Agric., 21: 5-19.
8. Altinbas, M. and H. Sepetoglu, 1993. A study to determine components affecting grain yield in cowpea (*Vigna unguiculata* L.). Tr. J. Agric. Forest., 17: 775-784.
9. Akdag, C., K. Gul and O. Duzdemir, 1996. To determine of adaptation to Tokat-Kazova conditions and favorable sowing time of cowpea (*V. sinensis* (L.) ENDL.). J. Fac. Agric., Gaziosmanpasa University, 13: 343-357.
10. Karasu, A., 1999. A research on the agronomical characters of some cowpea (*Vigna unguiculata* L.) cultivars and ecotypes in ecological condition of Isparta area. 3rd Field Crop Congress of Turkey (15-18 November 1999), pp: 371-376.
11. Peksen, E., A. Peksen, H. Bozoglu and A. Gulumser, 2000. Determination of some seed characteristics in different cowpea (*Vigna unguiculata* (L.) Walp.) genotypes. J. Fac. Agric., OMU, 15: 65-72.
12. Peksen, A., E. Peksen and H. Bozoglu, 2002. Effects of sowing dates on yield and quality of cowpea (*Vigna unguiculata* L. Walp.) genotypes grown in greenhouse. Acta Hort., 579: 351-354.
13. Ozturan, Y., 2003. The Effects of Different Row Spacing and Nitrogen Fertilization on Yield and Yield Components of Cowpea (*Vigna unguiculata* (L.) Walp.) Under Samsun Conditions. (Unpublished M.Sc. Thesis, Ondokuz Mayis University, Samsun-Turkey, pp: 66.

14. Vural, H., D. Esiyok and I. Duman, 2000. Cultivated Vegetables (Vegetable Cultivation). Ege University, Bornova, Izmir.
15. Jana, S., M.G. Som and N.D. Das, 1983. Correlation and path analysis of vegetable pod yield components in cowpea (*Vigna unguiculata* var. sesquipedalis). Hayrana J. Hort. Sci., 12: 224-227.
16. Kutty, C.N., R. Mili and U. Jaikumaran, 2003. Correlation and path coefficient analysis in vegetable cowpea (*Vigna unguiculata* (L.) Walp.). Indian, J. Hort., 60: 257-261.
17. Tewari, A.K. and N.C. Gautam, 1989. Correlation and path coefficient analysis in cowpea (*Vigna unguiculata* L. Walp.). Indian J. Hort. 46: 516-521.
18. Kar, N., T. Dasgupta, P. Hazra and M.G. Som, 1995. Association of pod yield and its components in vegetable cowpea. Indian Agriculturist, 39: 231-238.
19. Umaharan P., R.P. Ariyanayagam and S.Q. Haque, 1997. Genetic analysis of pod quality characteristics in vegetable cowpea (*Vigna unguiculata* L. Walp.). Scientia Hort., 70: 281-292.