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Growth and Fruit Quality of Some Foreign Loquat Cultivars in the Subtropical Climate of the Turkish Mediterranean Region

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Abstract

Loquat is an important fruit for the Mediterranean Region of Turkey. Four loquat cultivars ('Kanro', 'Baffico', 'Dr. Trabut' and 'Gold Nugget') were evaluated from 2001 to 2004. Growth, phenology and fruit characteristics were determined in Hatay, on the eastern Mediterranean coast of Turkey. The trunk diameter and annual shoot growth were significantly higher in 'Kanro' than 'Baffico' and 'Dr. Trabut'. The highest yield was from 'Kanro' and 'Gold Nugget'. Harvest dates ranged from 18 May to 27 May. The earliest maturing cultivars were 'Dr. Trabut' and 'Baffico', while the latest maturing cultivar was 'Kanro'. 'Dr. Trabut' had significantly higher fruit weight than 'Baffico'. Mean seed weight ranged between 3.9 and 6.0 g and average number of seeds per fruit ranged between 2.8-4.5; 'Dr. Trabut' had significantly higher values than 'Kanro' for both of these variables. The flesh/seed ratio in 'Kanro' was significantly higher than 'Gold Nugget'. 'Baffico' had the highest total soluble solids content while 'Gold Nugget' had the lowest. The results suggest that these cultivars can be grown in Mediterranean climate successfully. Adaptation of the cultivars to the region is most likely to increase the production and quality of loquat as well.

Introduction

Loquat is an evergreen fruit species which can be grown successfully in subtropical climates: especially in regions suitable for growing citrus (7). Unlike other subtropical species, the loquat flowering period is in winter, and fruits can be harvested 152-189 days after flowering (8). Therefore, loquat fruits can be sold for higher prices since there is no fruit in the market when they go in spring months, with the exception of strawberries, some plum and almond cultivars which are consumed as immature fruits (12). While loquats meet the demand when there are not many fresh fruits available, it also has an important place in nutrition with its high A, B and C vitamins, minerals and sugars (5).

In recent years there has been an increased demand for loquats and therefore a desire to increase production. Turkey's loquat production has increased from 3,000 tons in 1980 to 12,000 tons in 2003 (1). Turkey's production ranks behind only China, Japan and Pakistan (2). In Turkey, loquat is produced in certain parts of the Mediterranean, Aegean and Black Sea regions which have subtropical climates. About 97% of the production is in the Mediterranean region, becoming highly concentrated along the coastal belt. In the Mediterranean region the Antalya province is in first place, followed by the Mersin and Adana provinces, respectively. The fourth province is Hatay (13).

Loquat farming in Hatay is done with untidy single or groups of trees. Loquat plantations, as opposed to orchards, are located only in certain places. In this region, most trees are not grafted; grafted ones are unknown cultivars. For this reason, the best suitable cultivars should be determined for Hatay's climate (13).

The purpose of this study was to evaluate loquat cultivars that may be better adapted to the condition in the Hatay province. Several

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phenological and pomological parameters were evaluated, and the performance of the four loquat cultivars were compared.

Materials and Methods

The evaluation was conducted at the experimental orchard of the Department of Horticulture, Faculty of Agriculture, University of Mustafa Kemal, Hatay, located on the eastern Mediterranean cost of Turkey. The mean annual temperature of Hatay is 18.1 °C and annual rainfall is 112 cm.

'Baffico', 'Kanro', 'Dr. Trabut' and 'Gold Nugget' cultivars were budded on seedling rootstocks and planted at 6 x 6 m in 1994. A randomized complete block design was used with five single-tree replicates of each cultivar.

Phenological Observations: Flower buds were observed from full rest until fruit set. Five percent open flowers was considered first flowering; 70% open flowers was considered full flowering and 90% petal drop was considered the end of flowering. Maturation criteria used to decide on harvest date were specific properties of the fruits such as colors, and flavor (4).

Pomological Analyses: Thirty fruits were randomly sampled from each tree (cultivar) when fruits matured. These fruits were divided into three groups of 10 fruits per replicate. Fruit were evaluated according to the pomological specifications of Durgac et al. (4) and Polat et al.(14): fruit weight (g), fruit dimensions (mm), width/length index, seed weight (g) and number, flesh/seed ratio, total soluble solids (TSS) (%), pH, and titratable acidity in juice (TA) (g/100 ml juice).

Trunk diameter and annual shoot growth: Trunk diameter was measured 10 cm above the bud union and the length of two annual shoots from 4 different directions of each tree each year was measured in January.

Data Analysis: Variance analyses of the data were conducted according to Randomized Complete Block Design (15) and the mean comparisons were made by Tukey test. The initial analysis where the data from all four years were evaluated together indicated significant year x cultivar interactions. Therefore, data from each year was analyzed separately in the further analyses.

Results

Phenological Data: Flowering of the cultivars was completed between 1 Dec. and 8 Feb. (Table 1). Harvest dates differed according to years. The variables were affected by both genotype and environment as environment (i.e., years, in our experiments) has a certain effect on fruit maturity. Harvest dates of the cultivars ranged from 18 May to 27 May. The earliest maturing cultivars were 'Dr. Trabut' and 'Baffico', while the latest maturing cultivar was 'Kanro'(Table 1).

Pomological Characteristics: In 2001, 'Dr. Trabut' had the highest fruit weight, whereas the weight of 'Kanro' was the lowest (Table 2). The fruit widths of the cultivars did not differ but the fruit length of 'Dr. Trabut' and 'Kanro' were higher than other two cultivars. 'Dr. Trabut' had the highest seed weight and seed number whereas 'Kanro' had the lowest. However, the flesh/seed ratio in 'Kanro' was

Table 1. Some phenological observations of loquat cultivars (average of years 2001-2004).

Cultivar	First blossoming	Full bloom	End of flowering	Ripening dates[z]
'Dr. Trabut'	18 Dec.	14 Jan.	08 Feb.	18 May
'Gold Nugget'	27 Dec.	17 Jan.	08 Feb.	21 May
'Baffico'	01 Dec.	31 Dec.	24 Jan.	19 May
'Kanro'	26 Dec.	24 Jan.	04 Feb.	27 May

[z]Ripening dates were determined by averaging first and the last harvest dates.

higher than other cultivars. The TSS content in 'Dr. Trabut' was higher than 'Gold Nugget' and 'Kanro'. The acidity in 'Baffico' and 'Dr. Trabut' was lower than 'Gold Nugget' and 'Kanro'.

In 2002, 'Dr. Trabut' had the highest fruit weight and the fruit width of 'Dr. Trabut' and 'Gold Nugget' were higher than 'Baffico' and 'Kanro' (Table 3). The least number of seeds/fruit was found in 'Kanro' and 'Baffico'. 'Gold Nugget' had the lowest TSS and the highest acidity.

In 2003, the highest fruit weight was from 'Kanro', while the lowest seed weight and the least number of seeds/fruit were from 'Baffico' (Table 4). 'Gold Nugget' had the lowest flesh/seed ratio and 'Baffico' had the highest TSS.

In 2004, 'Dr. Trabut' had the highest fruit weight, whereas 'Baffico' had the lowest. The fruit length of 'Dr. Trabut' and 'Kanro' were higher than the other two cultivars (Table 5). 'Dr. Trabut' had the highest seed weight whereas 'Kanro' and 'Baffico' had the lowest. The seed number per fruit of 'Baffico' was lower than 'Dr. Trabut' and 'Gold Nugget'. The flesh/seed ratio in 'Kanro' was significantly higher than others. The TSS content in 'Baffico' and 'Dr. Trabut' was significantly higher than 'Gold Nugget' and 'Kanro'.

Vegetative Growth: In 2001, annual shoot growth was higher for 'Kanro' and 'Gold Nugget' than the other cultivars. 'Kanro' had the greatest trunk diameter and 'Baffico' had the smallest (Table 2). In 2002, the annual shoot growth of the cultivars did not differ. 'Kanro' had the greatest trunk diameter and 'Dr. Trabut' had the smallest (Table 3). In 2003, the annual shoot growth of 'Dr. Trabut' was greater than that of 'Kanro'. The greatest trunk diameter was in'Kanro' while the smallest was in 'Dr. Trabut' (Table 4). In 2004, the annual shoot growth of the cultivars was similar. 'Kanro' had the greatest trunk diameter and 'Dr. Trabut' had the smallest (Table 5).

Productivity: In 2001, the yield per tree in 'Kanro' and 'Gold Nugget' was higher than 'Baffico' and 'Dr. Trabut' while 'Gold Nugget' had the highest yield per unit trunk cross-sectional area (Table 2). In 2002, 'Kanro' was the highest yielding for both yield/unit trunk cross-sectional area and yield/tree (Table 3). However, in 2003, 'Gold Nugget' was the highest yielding for both yield/unit trunk cross-sectional area and yield/tree (Table 4). In 2004, 'Kanro' had the highest yield per tree, whereas 'Dr. Trabut' had the lowest. The yield/unit trunk cross-sectional area of 'Gold Nugget' and 'Kanro' cultivars was higher than other two cultivars (Table 5).

Discussion

Phenological Data: 'Baffico' completed flowering much earlier than the other cultivars. There were some annual differences for the harvest time due to characteristics of cultivars and ecological conditions affecting ripening of fruits. In general, the cultivars ripened in the second half of May. The earliest ripening cultivars were 'Dr. Trabut' and 'Baffico', and the latest one 'Kanro'. These results agree with the previous findings of Durgac et al. (4).

Pomological Characteristics: When the results from all four years were considered together, the fruit weights were 19.7 g - 47.2 g, fruit widths were 28.6 mm - 38.2 mm, fruit lengths were 32.9 mm- 44.9 mm, fruit index were 0.73-1.01. 'Dr. Trabut' had larger fruit than the other three cultivars but it did not significantly differ from 'Gold Nugget' and 'Kanro'. However, it is significantly higher than 'Baffico'. These data are similar to that found by Durgac et al.(4).

Fruit size is an important issue for marketing, and is related to tree age and number of fruits on the tree. In Adana (10, 11), fruit weight of 'Gold Nugget' was higher than the other three cultivars; in other research (18), 'Dr. Trabut' had heaver fruit than the other

Table 2. Tree trunk diameter, annual shoot length yield/tree, and yield/unit trunk cross-sectional area (g/cm^2) and some fruit quality characteristics of experimental loquat cultivars in 2001.

Cultivars	Fruit weight (g)	Fruit width (mm)	Fruit length (mm)	Width/ length	Total seed weight (g)	Seed number	Flesh/ seed ratio	TSS (%)	pH	Acidity (%)	Annual shoot length (cm)	Tree trunk diameter (mm)	Yield/ tree (kg)	Yield/ unit trunk cross-sect. area (g/cm^2)
Baffico	35.4 c[Z]	35.5	40.3 b	0.88 b	6.0 b	3.6 b	4.9 b	12.0 ab	3.6	0.45 b	24.3 b	56.6 c	6.5 b	259.9 c
Dr. Trabut	47.2 a	38.2	43.8 a	0.86 bc	7.9 a	4.9 a	5.0 b	13.1 a	3.8	0.41 b	23.5 b	48.0 d	4.5 c	250.3 d
Gold Nugget	39.0 b	37.6	39.1 b	0.98 a	7.5 ab	4.1 b	4.2 b	9.6 c	3.7	0.64 a	26.8 a	60.8 b	9.7 a	329.2 a
Kanro	31.4 d	35.2	44.9 a	0.78 c	2.6 c	1.9 c	11.3 a	10.7 bc	3.4	0.68 a	28.4 a	65.9 a	9.9 a	290.2 b
Mean	38.3	36.6	42.0	0.9	6.0	3.6	6.4	11.3	3.6	0.5	25.7	57.8	7.6	282.4
STD	6.2	2.2	2.9	0.1	2.3	1.2	3.0	1.5	0.3	0.1	2.3	6.9	2.4	32.2
Significance	**		*	*	*	**	**	*		*	*	**	**	**
$LSD_{0.05}$	3.29	NS	3.18	0.09	1.52	0.63	1.08	1.40	NS	0.12	2.46	2.15	0.94	5.92

*,** and NS mean significant at 5% and 1% and not significant, respectively.

[Z]Means within a column followed by different letter are significantly different at the 1% or 5% by Tukey test.

Table 3. Tree trunk diameter, annual shoot length, yield/tree, and yield/unit trunk cross-sectional area and some fruit quality characteristics of experimental loquat cultivars in 2002.

Cultivars	Fruit weight (g)	Fruit width (mm)	Fruit length (mm)	Width/ length	Total seed weight (g)	Seed number	Flesh/ seed ratio	TSS (%)	pH	Acidity (%)	Annual shoot length (cm)	Tree trunk diameter (mm)	Yield/ tree (kg)	Yield/ unit trunk cross-sect. area (g/cm^2)
Baffico	23.9 c[(Z)]	31.9 b	36.9 b	0.87 ab	3.7 b	2.8 c	5.5	11.0 a	3.7	0.5 c	27.6	64.2 c	10.7 b	330.1 c
Dr. Trabut	32.0 a	35.4 a	42.1 a	0.84 b	5.4 a	5.0 a	4.9	10.6 a	3.6	0.6 c	29.7	56.2 d	9.3 b	373.9 b
Gold Nugget	27.8 b	35.8 a	38.9 ab	0.93 a	4.7 a	3.8 b	4.9	8.2 b	3.3	1.1 a	27.1	69.6 b	10.5 b	275.9 d
Kanro	24.8 c	30.3 b	41.3 a	0.73 c	3.7 b	2.7 c	5.7	10.1 a	3.5	0.8 b	28.1	72.0 a	16.8 a	414.1 a
Mean	27.1	33.4	39.8	0.8	4.4	3.5	5.3	10.0	3.5	0.7	28.1	65.5	11.8	348.5
STD	3.6	2.8	2.7	0.1	0.8	1.1	0.6	1.3	0.4	0.2	1.6	6.4	3.2	53.7
Significance	*	*	*	*	*	*		*		**		**	**	**
$LSD_{0.05}$	2.91	3.15	3.64	0.07	0.72	0.90	NS	1.34	NS	0.12	NS	1.85	1.55	6.91

*,** and NS mean significant at 5% and 1% and not significant, respectively.
[Z]Means within a column followed by different letter are significantly different at the 1% or 5% by Tukey test.

Table 4. Tree trunk diameter, annual shoot length, yield/tree, and yield/unit trunk cross-sectional area and some fruit quality characteristics of experimental loquat cultivars in 2003.

Cultivars	Fruit weight (g)	Fruit width (mm)	Fruit length (mm)	Width/ length	Total seed weight (g)	Seed number	Flesh/ seed ratio	TSS (%)	pH	Acidity (%)	Annual shoot length (cm)	Tree trunk diameter (mm)	Yield/ tree (kg)	Yield/ unit trunk cross-sect. area (g/cm2)
Baffico	21.0 c[Z]	33.3 b	33.0 b	1.01 a	3.8 b	3.3 b	4.6 a	15.9 a	3.6	0.70 ab	20.3 ab	68.8 c	3.9 c	105.9 c
Dr. Trabut	29.3 b	34.4 ab	40.6 a	0.84 b	5.4 a	3.9 ab	4.5 a	13.3 b	3.6	0.67 b	22.2 a	61.3 d	3.7 c	122.5 b
Gold Nugget	22.0 c	32.7 b	32.9 b	0.99 a	5.5 a	4.4 a	3.0 b	10.5 c	3.7	0.67 b	20.3 ab	72.8 b	9.1 a	218.7 a
Kanro	33.7 a	36.6 a	43.0 a	0.85 b	5.9 a	4.2 a	4.8 a	13.3 b	3.5	0.9 a	20.0 b	86.3 a	6.3b	108.3 c
Mean	26.5	34.2	37.4	0.9	5.1	3.9	4.2	13.2	3.6	0.7	20.7	72.3	5.8	138.9
STD	5.7	2.1	4.9	0.1	1.0	0.5	0.8	2.1	0.3	0.1	1.2	9.6	2.3	48.6
Significance	**	*	**	*	*	*	*	*		*	*	**	**	**
$LSD_{0.05}$	3.32	3.18	2.64	0.11	1.13	0.64	0.76	1.68	NS	0.20	1.89	2.94	0.84	4.25

*,** and NS mean significant at 5% and 1% and not significant, respectively.

[Z]Means within a column followed by different letter are significantly different at the 1% or 5% by Tukey test.

Table 5. Tree trunk diameter, annual shoot length, yield/tree, and yield/unit trunk cross-sectional area and some fruit quality characteristics of experimental loquat cultivars in 2004.

Cultivars	Fruit weight (g)	Fruit width (mm)	Fruit length (mm)	Width/ length	Total seed weight (g)	Seed number	Flesh/ seed ratio	TSS (%)	pH	Acidity (%)	Annual shoot length (cm)	Tree trunk diameter (mm)	Yield/ tree (kg)	Yield/ unit trunk cross-sect. area (g/cm^2)
Baffico	19.7 c[(Z)]	28.6 c	35.3 c	0.81 b	3.1 c	2.4 c	5.5 b	12.3 a	3.34 a	1.0	24.1	63.2 c	7.1 c	232.0 c
Dr. Trabut	38.2 a	37.3 a	45.6 a	0.82 b	5.6 a	4.2 a	5.9 b	12.1 a	3.25 b	1.1	25.1	55.3 d	5.8 d	248.9 b
Gold Nugget	28.2 b	35.5 ab	37.4 b	1.00 a	4.7 b	3.9 ab	5.0 b	10.1 b	3.26 b	1.2	24.7	67.8 b	9.7 b	274.6 a
Kanro	28.3 b	33.6 b	44.7 a	0.75 c	3.3 c	2.5 bc	7.7 a	10.6 b	3.33 a	1.2	25.5	74.7 a	11.0 a	270.9 a
Mean	28.6	33.8	40.8	0.8	4.1	3.2	6.0 b	11.3	3.3	1.1	24.8	65.2	8.4	256.6
STD	7.0	3.6	4.7	0.1	1.1	1.1	1.1	1.2	0.1	0.1	1.0	7.5	2.2	18.3
Significance	**	*	**	**	*	*	*	*	*			**	**	**
$LSD_{0.05}$	3.12	2.56	1.86	0.05	0.86	1.43	0.94	1.45	0.05	NS	NS	3.28	1.01	6.23

*,** and NS mean significant at 5% and 1% and not significant, respectively.

[Z]Means within a column followed by different letter are significantly different at the 1% or 5% by Tukey test

three cultivars. In Erdemli (19), 'Gold Nugget' had heavier fruits than 'Baffico' and 'Kanro'. Other researches have shown fruit sizes to vary from 23 to 120 gram (6, 9, 16, 17, 20). Considering these standards, fruit sizes of the cultivars in our trial are slightly smaller these published results.

Width/length index value varied from 0.96 in 'Gold Nugget', to 0.75 in 'Kanro'. 'Kanro' had the greatest fruit length; 'Baffico' had the lowest.

Another important factor affecting fruit quality in loquat is number of seeds and seed weight. Higher quality fruits have fewer seeds. Also, in recent years some trials were conducted with hormone applications to get seedless fruits, but fruits were found shapeless and small compared to normal (3). Number of seeds depends on the pollination and also the cultivar characteristics. In our study, mean seed weight ranged between 2.6-7.9 (g/fruit) and average number of seeds per fruit ranged between 1.9 and 5.0. In general, both of these values were higher in 'Dr. Trabut' and 'Gold Nugget' than other two cultivars. This is similar to the findings found in Adana (10, 18) and in other studies of Hatay (4).

The flesh/seed ratios of the cultivars were 3.0% - 11.3% and the flesh/seed ratio in 'Kanro' is generally higher than other cultivars. In other trials conducted in Adana and Erdemli flesh/seed ratio of these four cultivars varied between 3.4% and 5.8% (10, 11, 18, 19).

In our study, TSS were 8.2–15.9%, acidities were 0.56-0.80g/100ml. TSS was lower in 'Gold Nugget' than other three cultivars while acidity was higher in 'Gold Nugget' and 'Kanro' than 'Baffico' and 'Dr. Trabut.' In other locations (Adana, Erdemli and Hatay) 'Baffico' had the highest TSS compared to 'Gold Nugget', and 'Kanro' (4, 10, 11, 19). While these acidity values were lower than the values found by Paydas et al. (11) in Adana, and Yilmaz et al. (19) in Erdemli they were higher than the values reported by Yalcin and Paydas (18) in Adana. The values were similar to those reported by Durgac et al. (4) under conditions in Hatay.

Vegetative Growth: 'Annual shoot lengths of the cultivars were 20.0 cm-29.7cm and tree trunk diameters of cultivars were 48.0 mm-86.3 mm. There were some annual differences for the annual shoot lengths and trunk diameters of the cultivars due to characteristics of cultivars and ecological conditions affecting growing of the trees. However, in general, 'Kanro' had higher values than the other three cultivars for both annual shoot length and tree trunk diameter.

Productivity: 'The results from 2001-2004 indicated that average yield was higher in 'Kanro' than 'Dr. Trabut'. This contrasts with previous findings where 'Kanro' or 'Gold Nugget', or 'Baffico' had the highest yield per tree (10, 18, 19). In our study, 'Gold Nugget' had higher yield per unit trunk cross-sectional area than 'Baffico'. Similarly, our results for yield per unit trunk cross-sectional differ from those of Yalcin and Paydas (18) in Adana and Durgac et al. (4) in Hatay. This may be due to differences in tree age and other factors.

In Turkey 97% of total loquat production is in the Mediterranean Region. The amount of production in Hatay is low, 4.91%. In this district production is limited because of seedling trees and only one or two cultivars. In conclusion, the results revealed that all the cultivars appeared to be promising in terms of various pomological and phonological properties. 'Baffico', 'Kanro', 'Gold Nugget' and 'Dr. Trabut' have fruit that is large, showy and suitable for shipping, storage and export. 'Baffico' is an early maturing cultivar with a high flesh/seed ratio and TSS, 'Dr. Trabut' has good fruit size and TSS, 'Gold Nugget' has high yields and dark orange fruit color, and while 'Kanro' has high yield, a high flesh /seed ratio and is later maturing. Adaptation of the cultivars to the region is most likely to increase the production and quality of loquat.

Literature Cited

1. Anonymous. 2003. Agricultural Structure (Production, Price, Value). State Inst. of Statistics Prime Ministry Republic of Turkey. 544 p.
2. Caballero, P. and M.A. Fernández. 2003. Loquat, production and market. I. Internat. Symp. on Loquat, 11-13 April, 2002, Valencia (Spain). Options Méditerranéennes : Série A. Séminaires Méditerranéens; no. 58:11-20.
3. Demir, S. 1989. Physiological, biological and morphological studies in loquats. Cukurova Univ., Inst. of Natural Sci., Dept. Hort. Ph.D. Dissertation. 231 p,
4. Durgaç, C., A. Polat, and O. Kamiloglu. Determining performances of some loquat cultivars under Mediterranean costal conditions in Hatay, Turkey. N. Z. J. Crop and Hort. Sci.(in press).
5. Gross, J., M. Gabai, and A. Lifshitz. 1973. Carotenoids of *Eriobotrya japonica*. Phytochem. 12:1775-1782.
6. JianPing, P., L. GuoQiang, X. GuoCheng, C. ZhenMing, and C. ZongQi. 2002. Puxinben, a new high quality and large-fruited loquat variety. South China Fruits 31:27.
7. Laure, R. 1976. The Loquat. Division of Hort. Sci. Univ. of Calif. Leaflet 2488.
8. Lupescu, F., T. Lupescu, A. Khelil, and G. Tnislav. 1980. Performances agrobiologiques de quelques varietes d' *Eriobotrya japonica* Lindl. Cultivees a la station horticole de L' Institut National Agronomique d' Alger. Fruits 35: 251-261.
9. Nakai, S., S. Yahata, and S. Morioka. 1990. Characteristics of new loquat (*Eriobotrya japonica* L.) cultivars "Satomi" and "Fusahikari". Bull. Chiba Hort. Exp. Sta. No: 14:1-7.
10. Paydaş, S., N. Kaşka, and H. Gübbük. 1991. Adaptation of some local and foreign loquat (*Eriobotrya japonica* Lind.) varieties to Adana ecological conditions (in Turkish) (Experimental years 1987-1989). J. Agriculture Faculty CU., 6 :17-26.
11. Paydas, S., N. Kaska, A.A. Polat, and H. Gübbük. 1992. Adaptation of some local and foreign loquat cultivars to Adana ecological conditions (in Turkish) (Experimental years 1990-1991) Turkish First National Horticultural Congress, Vol: 1, p: 509-513, 13-16 October, 1992, Izmir- Turkey.
12. Polat, A.A. 1996. An important fruits species for Mediterranean region: Loquat. (in Turkish with an English summary). J. Agric. Faculty MKU., 1:39-46.
13. Polat, A.A. 1997. The present situations, problems and improvement possibilities of loquat production in Hatay (in Turkish with an English summary). J. Agric. Faculty MKU., 2:37-52.
14. Polat, A.A., C. Durgaç, O. Kamiloglu, and O. Çalıskan. 2003. Effect of high density and protected cultivation on the precocity, yield and fruit quality of loquat. TUBITAK, Sci. and Tech. Res. Council of Turkey. Agric., Forestry and Food Technol. Res. Grant Comm., Project No: Tarp-2336, 68s.
15. Ott, L.R. 1992. An introduction to statistical methods in data analysis. Wadsworth, Inc, Fourth Edition, USA, 1051 p.
16. WinXiang, X., and Z. ChuanXiang. 1998. Several loquat varieties and their cultural techiques. South China Fruits, 27(5):32.
17. Xu, Y. L. 1993. 'Santan' loquat in Anhui province. J. Fruit Science, 10:176-178.
18. Yalcin, H., and S. Paydaş. 1995. Adaptation of some local and foreign Loquat cultivars to Adana ecological conditions (in Turkish) (Experimental years 1995). Turkish Second National Hort. Cong., Vol:1, p: 648-652, 3-6 Sept., 1995, Adana- Turkey.
19. Yilmaz, H., B. Sen, and H. Ayanoglu. 1995. Investigation on adaptation of some local and foreign loquat cultivars to Erdemli ecological conditions. Turkish Second National Hort. Cong., Vol:1, p: 638-642, 3-6 Sept., 1995, Adana- Turkey.
20. Yi Jie, Z., C. XueJin, J. XinGuan, W. CongMei, Z. ShaoQuan, and C. HuaQin. 2001. The botanical characteristics and phenological phases of loquat variety Donghuzao. South China Fruits, 30:29-30.