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**PJBS**

ISSN 1028-8880

**Pakistan  
Journal of Biological Sciences**

**ANSI***net*

Asian Network for Scientific Information  
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

## Determination of Fruit Characteristics of "Marsh seedless" Grapefruit Cultivar in Izmir (Turkey)

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**Abstract:** The investigation was conducted in 1997 and 1998 at Ege University, Faculty of Agriculture, Department of Horticulture to determine some important fruit quality characteristics of "Marsh seedless" grapefruit cultivar in Izmir (Turkey). Fruits harvested from young and old trees at two different dates (end of November and mid of December) were analyzed in terms of quality characteristics. The average fruit weight ranged between 351 and 385 g, fruit juice content was between 36.9 percent and 43.1 percent, the total soluble solids content of fruit juice was between 9.5 percent and 12.6 percent, total titratable acidity as citric acid was 1.40 and 1.69 g/ml and pH value was between 2.89 and 3.12. It was determined that there were More significant differences between old and young trees in terms of fruit quality characteristics than between two different harvest dates statistically. There were no statistical differences between 1997 and 1996 years in respect to quality.

**Key word:** Marsh seedless, Turkey, Izmir, characteristics

### Introduction

Grapefruit (*Citrus paradisi* Macf.) appears to have originated in the New World, most probably in the West Indies, possibly in Barbados. Grapefruit is probably not a true species but a mutation or hybrid of the shaddock and sweet orange (Scora, 1988). It has been introduced and grown in Europe and Turkey during the recent years (Davies and Albrigo, 1994).

Marsh seedless is the most widely planted white-fleshed commercial cultivar of grapefruits in the world and as well as in Turkey. The major reason for the popularity of "Marsh" is its seedlessness and the fact that it holds well on the tree without significant loss of fruit quality, thus extending the harvest season if desired. Fruit characteristics are therefore quite important, especially the composition of the fruit. This cultivar possess the most desirable fruit characteristics, such as fruit size, shape, color, smoothness of peel, pulp texture, juiciness and flavor. Fruits are used for processing, but are grown primarily for the fresh market (Economdides, 1976).

The fruit characteristics of grapefruit vary with climate, soil, variety, cultural practices and rootstocks. Climate exert so strong effects that the locality where the trees are grown, must always be kept in mind when evaluating any data on fruit characteristics of grapefruit (Reuther and Rios-Castano, 1969). This investigation was carried out to determine some important fruit characteristics determining the quality of "Marsh seedless" grapefruit cultivar under ecological conditions present in Izmir (Bornova) province of Turkey.

### Materials and Methods

The investigation was carried out in the Citrus plantation located in the experimental orchard at Ege University, Faculty of Agriculture, Department of Horticulture in 1997 and 1998. Fruits were harvested at the end of November and in the mid of December in both years. Ten fruits harvested from young (20 years old) and old (34 years old)

grapefruit trees on sour orange (*Citrus aurantium* L.) rootstock were analyzed chemically and physically. The average fruit weight (g), width (mm), length (mm), peel thickness (mm), roughness, color, seed and segment number, water content (%), total soluble solids (%), acidity (as citric acid) (g/ml), pH and ease of peeling were determined. These analysis were carried out as four replications (Yesilsoy *et al.*, 1993).

### Results and Discussion

Data obtained from physical and chemical analysis to determine fruit quality characteristics of "Marsh seedless" grapefruit variety were analyzed statistically. There were no interactions between 1997 and 1998 years. For this reason, two years' statistical results are presented as different tables.

Larger and heavier fruits were obtained in the mid of December in both years (Table 1 and 2). The weight and size of grapefruits generally showed that great increase between August and January. This increase was slightly more in December than in November. After January, the increase in weight and size was less rapid (Sinclair, 1972). Average fruit weight of grapefruits harvested in November were 385 g in 1997 and 381 g in 1998 (Table 1 and 2). Fruit size may be improved through the rootstock. An investigation about performance of Marsh seedless grapefruit on different rootstocks, the biggest and heaviest fruits (420 g) were on heaviest-yielding trees on rough lemon. Generally, lemon-type rootstocks will produce larger fruit than less vigorous rootstocks such as sour orange or Poncirus trifoliolate (Hutchinson, 1977). Sour orange as rootstock was used in this investigation. For this reason, fruits were not as heavy as fruits on rough lemon. Moderate-sized grapefruits are demanded in the Japanese market, while large grapefruits are demanded in the United

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Table 1: Some fruit quality characteristics of "Marsh seedless" grapefruit cultivar at different harvest dates in 1997

H. date	F. weight (g)	F. width (mm)	F. length (mm)	P. thickness (mm)	J. content (%)	TSS (%)	Acidity (g/ml)	pH
No. 29, 97	351.11b*	67.45b	50.66b	8.83a	37.87	11.01	1.60	3.05
De. 15, 97	385.00a	80.26a	64.24a	6.80b	40.96	11.08	1.55	3.04*

\*Mean separation, within columns, by Duncan's multiple range test, 5%

Table 2: Some fruit quality characteristics of "Marsh seedless" grapefruit cultivar at different harvest dates in 1998

H. date	F. weight (g)	F. width (mm)	F. length (mm)	P. thickness (mm)	J. content (%)	TSS (%)	Acidity (g/ml)	pH
No. 29, 98	354.23b	60.60b	50.25b	8.80a	38.19	11.03	1.65	3.06
De. 15, 98	381.24a	75.01a	66.13a	6.60b	41.70	11.10	1.60	3.06

Table 3: Some fruit quality characteristics of "Marsh seedless" grapefruit from young and old trees in 1997

Tree age	F. weight (g)	F. width (mm)	F. length (mm)	P. thickness (mm)	J. content (%)	TSS (%)	Acidity (g/ml)	pH
Old	351.2813*	65.78b	53.82b	8.86a	36.71b	9.89b	1.47b	2.85b
Young	384.83a	79.94a	66.08a	6.70b	43.13a	12.00a	1.69a	3.10a

\*Mean separation, within columns, by Duncan's multiple range test, 5%

Table 4: Some fruit quality characteristics of "Marsh seedless" grapefruit from young and old trees in 1998

Tree age	F. weight (g)	F. width (mm)	F. length (mm)	P. thickness (mm)	J. content (%)	TSS (%)	Acidity (g/ml)	pH
Old	356.06b	61.82b	50.95b	8.91a	36.99b	9.95b	1.40b	2.95b
Young	379.40a	76.79a	66.43a	6.30b	42.90a	12.60a	1.68a	3.12a

Table 5: Other fruit quality characteristics of "Marsh seedless" grapefruit cultivar

Tree age	TSS/TA ratio	Peel roughness	Peel color	Segment number	Seed number	Ease of peeling
Old	6.90	Little roughly	Dark yellow	12-14	1-3	Easy
Young	7.30	Smooth	Light yellow	12-13	1-2	Easy

States market (Davies and Albrigo, 1994).

Peel thickness of fruit changed significantly, generally decreasing from 8.8 mm for fruits harvested at November to 6.6 mm harvested in December in both years (Table 1 and 2). The thickness of the peel changes during the growth and maturation of the fruit. As the fruit matured, thickness of peel decreased (Sinclair, 1972).

There were no statistically significant differences between November and December harvest in terms of juice content, total soluble solids, acidity and pH (Table 1 and 2). It was determined that percentage of juice and total soluble solids increased, but acidity decreased as the harvest date advanced from November to December in 1997 and 1998. The percentage of juice by weight increased as the season advanced, then leveled off in January (Wutscher and Dube, 1977). Many investigators have reported that sugars increase and acids decrease gradually as the season advances (Sinclair, 1972).

The pH values in November were approximately equal or slightly higher in December (Table 1 and 2). There were no differences in pH values of grapefruit juice between November and December but beginning in January, pH values increased gradually (Sinclair, 1972).

All the fruit quality characteristics investigated were

significantly affected by the age of grapefruit trees (Table 3 and 4). Fruits harvested from younger trees (20 years old) were bigger and heavier than old trees (34 years old). Peel thickness was thinner in fruits from younger trees (6.30 mm) than old trees (8.91 mm). The characteristics of fruit composition (juice content, TSS, acidity and pH) in younger trees were superior to the old trees (Table 3 and 4).

Fruit weight, size and external and internal fruit quality characteristics usually increase gradually peaking around 20-25 years in Mediterranean-type climates. But cultural practices such as irrigation, fertilization, pest and disease control, freeze protection and pruning also affect these characteristics (Davies and Albrigo, 1994). Because young trees were in good condition, their fruit quality characteristics were higher than the older trees in this study. Cultural practices were generally insufficient in the older trees, especially the pruning.

As one of the quality characteristics, the ratio of total soluble solids to acid content was calculated. The solids/acid ratios of the fruit from young trees were higher (7.30) than fruits from old trees (6.90) in 1997 and 1998 (Table 5). The ratio of total soluble solids to acid is a practical mean of assessing fruit quality and also a good

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indicator of palatability (Harding and Fisher, 1945). But fruit palatability is also a function of culture and tradition. Grapefruit grown widely in Japan, USA and northern European is preferred red as highly acid and low sugar, whereas the Chinese, Thai and Turkish prefer lower acidity and higher sugar content.

Grapefruits from young trees had bright yellow peel coloration and had generally 12-13 segments (Table 5). Peel color in grapefruit results from yellow carotenoid synthesis in white-fleshed cultivars. Besides climate (temperature) and tree vigour also has a pronounced effect on fruit color. Grapefruits from young vigorous trees are generally poorly colored than those from slow growing older trees (Davies and Albrigo, 1994).

Grapefruits from young trees generally contain one or two seeds (Table 5). Degree of seediness is also important in some markets. In general, commercially seedless fruits (averaging to less than 9 seeds per fruit) are more desirable than seedy fruits. Perhaps a seed in every other segment is acceptable (Hensz, 1971).

In recent years, grapefruit production in the world has shifted away from "Marsh seedless" (white-fleshed) to pink or red cultivars (especially "Duncan" cultivar), which are more popular in the market and demanded more by consumers, in spite of Marsh's desirable fruit quality characteristics.

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