Available online at www.sciencedirect.com
ScienceDirect
Scientia Horticulturae 110 (2006) 241–246
SCIENTIA HORTICULTURAE
www.elsevier.com/locate/scihorti

Seed characterisation of five new pomegranate (*Punica granatum* L.) varieties

J.J. Martínez [a,1], P. Melgarejo [a,*], F[a]. Hernández [a,1], D.M. Salazar [b], R. Martínez [a,1]

[a] *Departamento de Producción Vegetal y Microbiología, Escuela Politécnica Superior de Orihuela, Universidad Miguel Hernández, Ctra. de Beniel, km 3.2, Orihuela, Alicante, Spain*
[b] *Departamento de Producción Vegetal, ETSIA, Universidad Politécnica de Valencia, Camino de Vera 14, 46020 Valencia, Spain*

Received 6 May 2004; received in revised form 16 December 2005; accepted 5 July 2006

Abstract

This study evaluated the production of five new pomegranate varieties (ME14, ME15, PTO2, PTO7 and CRO1), being all indigenous to Southeastern Spain where the species shows high variability. A morphological and organoleptic characterisation of the edible portion of the seeds were investigated. Some chemical characteristics of the juice, including total soluble solids, pH, acidity and maturity index, were assessed. Morphological characteristics of both the edible and the woody portions of the seed were evaluated. Also productive and organoleptic characteristics of all varieties were considered, being ME14 and ME15 the highest yielders. Furthermore, PTO2 and CRO1 showed the heaviest seeds (both showing an average weight of 0.61 g) while ME15 the lightest one (0.37 g). Regarding seed juice content, there were significant differences among the evaluated varieties; whereas PTO2 and CRO1 showed the highest juice contents, PTO7 yielded the lowest one. However, the cultivar PTO7 showed a significantly higher acidity content than the others, along with the lowest maturity index at all. Finally, ME14 and ME 15 were very interesting because of their high production, large fruit size and excellent seed organoleptic characteristics.

Keywords: Acidity; Morphological characterisation; Maturity index; Seeds; Pomegranate; *Punica granatum*

1. Introduction

Pomegranate is a fruit tree with deciduous leaves, which in recent years has seen a great expansion in several countries, especially those with a Mediterranean-like climate, where fruit of excellent quality can be obtained.

There is growing interest in this fruit not only because it is pleasant to eat, but also because it is considered to be a functional product of great benefit in the human diet, as it contains several groups of substances that are useful in disease prevention (Melgarejo and Martínez, 1992; Melgarejo and Salazar, 2002). It has always been allocated for fresh consumption, but recently there is a huge demand for industrial processing to obtain pomegranate juice, jams, etc. Because of market demand, it has become increasingly important to characterise the different varieties and clones to obtain a high quality product with economical interest.

Pomegranate, a temperate climate species that requires high temperatures to mature properly, is cultivated in the Mediterranean Basin, Southern Asia and several countries of North and South America. Its successful adaptation to the Mediterranean climate has led to its wide dispersion and to the creation of a multitude of new individuals in time, which are sometimes grouped under the same denomination such as Mollar de Elche o Piñón Tierno de Ojós, among others (Melgarejo, 1993). The possibilities for its expansion in arid and semi-arid zones of the world are enormous, especially where salinity and water scarcity are limiting factors for other crops.

Since pomegranate consumption is driven by both fresh market and processing industry, it is crucial to acknowledge all fruit characteristics to not only classify varieties from a botanical point of view, but also to meet current market demand for quality fruits.

Several studies have been published on the morphological and biochemical characteristics of the seeds by, among others,

* Corresponding author. Tel.: +34 966749691; fax: +34 966749619.
E-mail addresses: juanjose.martinez@umh.es (J.J. Martínez), pablo.melgarejo@umh.es (P. Melgarejo).
[1] Tel.: +34 966749691; fax: +34 966749619.

0304-4238/$ – see front matter © 2006 Elsevier B.V. All rights reserved.
doi:10.1016/j.scienta.2006.07.018

Melgarejo (1993), Gözlekçi and Kaynak (1998), Barone et al. (1998, 2001) and Martínez (1999).

The current study evaluates the yielding potential as well as some morphological, chemical and organoleptic seed characteristics of five new pomegranate cultivars.

2. Materials and methods

2.1. Plant material

Five new pomegranate cultivars were studied: Mollar de Elche 14 (ME14), Mollar de Elche 15 (ME15), Piñón tierno de Ojós 2 (PTO2), Piñón tierno de Ojós 7 (PTO7), and Casta del Reino de Ojós 1 (CRO1). As indicated by experimental design, four replications per clone were taken. The selected plant material belong to the principal pomegranate germoplasm bank of the EU, which is located at the experimental field station of Miguel Hernandéz University in the province of Alicante, Spain (02°03′50″E, 38°03′50″N, and 25 masl). The pomegranate germoplasm bank contained 64 cultivars with four repetitions of each, cultivated under homogeneous conditions. The orchard was established in 1992.

The cultivars were selected according to four main criteria: namely that they were sweet, had a soft seed, produced large fruit size and were good yielders. Keeping all this in mind, individuals were selected from the most important varieties in Spain, the world's leading exporter of pomegranates (more than 55% of total yield being exported).

The cultivars ME 14 and ME 15 were selected from the population variety Mollar de Elche (ME), which is possibly the best cultivated variety in the world.

Cultivars PTO 2, PTO 7 and CRO 1 were chosen for their large fruit size, although they belong to two population varieties less important than the ME. The denomination PTO means it has a soft seed (''Piñón Tierno de Ojos'' in Spanish), and refers to the low degree of hardness of the woody part of the seed (the edible part of the fruit) and to the population where they belong. In addition, the CRO1 clone was also selected because of its sweet and soft seeds.

2.2. Production

The production of the five cultivars was assessed for the years 1999–2001 by counting and weighting pomegranates of four trees per clone, and indicating the number of pomegranates obtained each year. Since data was generated under homogeneous growing conditions, results are valid for comparative purposes.

All the cultivars studied had a similar maturity date, being all classified as mid-season ones (Melgarejo, 1993; Martínez, 1999). For all evaluated years harvesting took place from September 20th to the end of October, a period induced by the staggered flowering of the tree.

Fruit were harvested according to their external colour. Internal ripeness was reached about September15th, and fruit were picked slightly later when all greenness had disappeared from fruit rind surface and red or yellow colour appeared. The harvesting dates for each year were:

Year	First harvest date	Second harvest date
1999	Last week of September	Last week of October
2000	First week of October	Last week of October
2001	Last week of September	Last week of October

2.3. Characteristics of the seeds (edible part)

From each clone and replication 10 pomegranates were randomly picked every single year. After extracting the seeds by hand, 25 of them were randomly chosen from a homogenised sample every year. The following seed characteristics were studied:

- Maximum width (W) and length (L), measured by a digital caliper/caliper (Mitutoyo) with a 0.01 mm accuracy.
- Seed weight (Sw), determined by a precision weighing device (Mettler AJ50) with an accuracy of 0.0001 g.
- Juice content, using an electric extractor and a seed sample of 100 g.
- Total soluble solids (°Brix), determined by an Atago N-20 refractometer at 20 °C.
- Acidity expressed as citric acid (A), determined by acid–base poentiometer.

Maturity index (TSS/A). Up to date the following classification has been established for Spanish varieties (Melgarejo, 1993, 1998):

- Sweet varieties: MI = 31–98.
- Sour-sweet varieties: MI = 17–24.
- Sour varieties: MI = 5–7.

The parameters measured in the woody portion of the seeds were:

- Maximum width (w) and length (l), measured by a digital calliper as above.
- Weight of the woody portion (wpw) of each seed using the above precision balance.
- Woody portion index (wpi), determined from the wpw/Sw ratio × 100 (%).
- Moisture percentage of seeds, determined by oven drying until constant weight. Three repetitions per clone and year were carried out.

Seed hardness and other organoleptic and visual characteristics:

- To evaluate the hardness of the woody portion of the seeds, quality overall appreciation, taste and visual colour, a panel of 10 expert testers was set up. Seed hardness was scored on a scale of 0–10 in increasing order of hardness.