

# Characterization of Avocado Improved Creole Varieties of Nuevo León, México

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**Abstract:** The avocado is native to central and eastern Mexico, and the highlands of Guatemala. Three races of avocado are recognized: the Mexican race (*Persea americana* var. *drymifolia*), the Guatemalan race (*Persea americana* var. *guatemaltensis*) and the Antillean race (*Persea americana* var. *americana*). The state of Nuevo León is part of the primary center of origin for *P. americana* var. *drymifolia*, where the varieties used have been selected by the producers based on their production, quality and size of the fruit. These cultivars are grafted trees with genotypes of interest called “Improved Creole Varieties”. In this study, some characteristics of a group of these varieties are presented. Collection of the fruits for their characterization was carried out in commercial Creole avocado orchards under irrigation conditions in the municipalities of Aramberri and Zaragoza in the southern region and in Sabinas Hidalgo and Bustamante in the northern region of the state of Nuevo León. A duplicate sample of ripe avocado fruits of ten genotypes was evaluated. The following characteristics of ripe fruits were determined: total oil content, fruit and seed weight, fruit shape, skin and pulp color when ripe, skin appearance and texture, etc. A great diversity was detected in the characteristics evaluated in the improved native varieties of avocado, highlighting the importance in its preservation and use of the diversity of Creole avocados cultivated in Nuevo León.

**Key words:** diversity, oil content, fruit weight

## 1. Introduction

The avocado is native to the mountainous areas of central and eastern Mexico, and the highlands of Guatemala [1], from where it has spread to the rest of the world [2]. Three races of avocado are currently recognized: the Mexican race (*Persea americana* var. *drymifolia*), the Guatemalan race (*Persea americana* var. *guatemaltensis*) and the Antillean race (*Persea americana* var. *americana*). According to the findings of primitive avocados in areas of the Sierra Madre Oriental, the southern region of the state of Nuevo León is also part of the primary center of origin of *P. americana* var. *drymifolia* [3].

The multiple hybridizations that occurred in different ecological environments of Mexico and

Central America originated the edible avocado in the American regions, where it has been cultivated since pre-Columbian times. Production comes from sources other than native or creole trees and select cultivars reproduced asexually, in which the flavor and nutritional values vary according to the botanical race [4].

The Mexican race of avocado includes Creole varieties, known by local names, whose fruits are consumed and marketed locally, grown in most of the states of Mexico. However, its dispersion occurred after the conquest of the Spaniards, who brought the avocado to Spain in 1600 and subsequently began its worldwide distribution [5].

In Mexico, even though exploration and collection activities had already begun by researchers from the California Avocado Society, in search of outstanding materials, the statistics on production and cultivated area that are available start from 1927. The registered

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area for the most part it refers to Creole materials. In Uruapan, Michoacán, it has been pointed out that at this time most of the avocado trees were from backyards because they were considered to have no economic value.

Currently, Creole avocado cultivation is carried out in most states, from Baja California Norte to Yucatan, in backyards and in some cases commercially, mainly in areas with tropical and subtropical climates.

In Nuevo León, the varieties used consist of local selections of plants that have been cultivated for several years and that the producers have selected mainly based on their production, quality and size of the fruit. These cultivars are trees grafted with genotypes of interest and are called “Improved Creole Varieties” [6].

Based on the above, since 2009 research studies were carried out with the aim of determining the genetic diversity of improved creole varieties of avocado, in relation to the phenological, morphological and chemical characteristics of the fruit in Nuevo León [7].

In addition to the well-known nutritional and economic importance of the cultivation of creole varieties of avocado in Nuevo León, the fruit has an excellent flavor that has earned it recognition in many parts of the world as a “gourmet” fruit or “butter” of the vegetables.

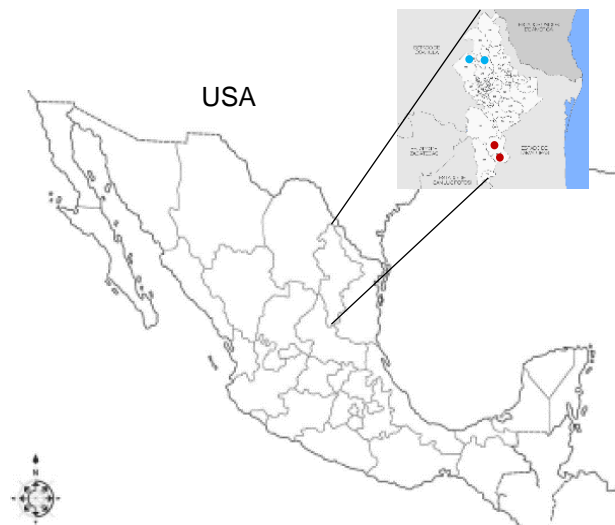
In order to help preserve and take advantage of the diversity of Creole avocados grown in Nuevo León, this paper presents some characteristics of a group of ten promising varieties as donors of plant buds and one variety as a possible source of rootstock.

The objective of the study is to provide information both to Creole avocado producers in Nuevo León, as well as to technicians and professionals of agronomic sciences, nurserymen and the general public, interested in the cultivation of Creole varieties of avocado and in the knowledge of their phenological, morphological and chemical characteristics.

## 2. Materials and Methods

The collection of the fruits for their characterization was carried out in commercial Creole avocado orchards under irrigation conditions and that presented good characteristics of adaptation to the area, fruit production and good phytosanitary status in the municipalities of Aramberri and Zaragoza (27°49' north latitude, 98°26' west longitude and 1160 masl) in the southern region and in the municipalities of Sabinas Hidalgo (26°29'59" north latitude, 100°9'48" west longitude and 313 masl) and Bustamante (26°31'30" north latitude, 100°28'24" west longitude and 425 masl) in the northern region of the state of Nuevo León (Fig. 1).

A duplicate sample of ripe avocado fruits of each genotype was evaluated. The total oil content was determined using the 920.85 method described by the Official Association of Analytical Chemists [8]. The weight of fruit and seed was determined with a weighing machine with approximation to grams. The color of the skin and the pulp were determined visually in mature fruits. The texture and appearance of the skin were recorded by touching the fruits.



**Fig. 1** Map of Mexico showing the Nuevo León state and the municipalities where the collection of the avocado fruits was carried out (blue dots and red dots represent the northern and southern location of commercial creole avocado orchards, respectively).

### 3. Results and Discussion

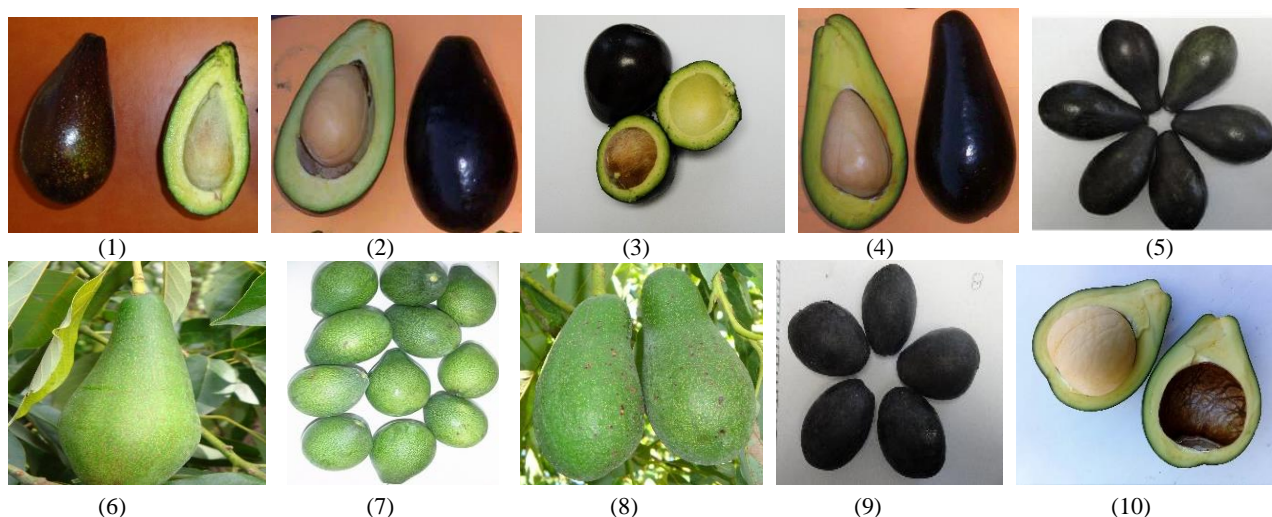
Results of previous research indicate that there is a great genetic diversity of the Mexican genus *Persea* in the state of Nuevo León. Alvarez et al. (2018) [9], record a level of genetic diversity of 84%, which is considered high. The foregoing is of particular interest for the Creole avocado from the State of Nuevo León, whose marketing problem is its short shelf life, therefore, finding great genetic variation increases the possibility of generating new materials whose shelf life is longer, enhancing its commercial value. Currently, 43 avocado improved creole varieties have been

identified, of which 27 correspond to the southern region and 16 to the northern region, all of them with different characteristics [10-13].

Of these materials, the characterization of a group of ten avocado improved creole varieties is reported, among which a wide range was observed in several of their fruit characteristics, such as oil content, which varied from 35.0% to 60.7%, standing out the variety “Plátano Grueso”. Fruit weight ranged from 74 to 249 g fruit<sup>-1</sup>, the “Calabo” variety standing out for its size. The weight of the seed also showed great variability, from 24 g in the variety “Plátano Temprano” to 57 g in “Huevo de Toro” (Table 1 and Fig. 2).

**Table 1** Fruit characteristics of the avocado improved creole varieties of Nuevo León, México.

Avocado Creole variety	Oil Content (%)	Skin color at maturity	Fruit weight (g)	Availability	Fruit form	Seed weight (g)	Skin aspect	Pulp color	Texture at maturity
Plátano Temprano	49.75	Brown to black	108	June to July	Elongated	24	Smooth-soft-flexible	Pale green to yellow	Pressure sensitive
María Elena	57.50	Purple to black	88	June to July	Oval	28	Smooth-soft-flexible	Pale green to yellow	Pressure sensitive
Floreño	36.20	Black	96	June to July	Pear-shaped	39	Smooth-soft-flexible	Pale green to yellow	Pressure sensitive
Plátano Grueso	69.70	Purple to black	146	July to august	Elongated	40	Smooth-soft-flexible	Pale green to yellow	Pressure sensitive
Larralde de Sabinas	41.00	Purple to black	135	July to august	Elongated	36	Smooth-soft-flexible	Pale green to yellow	Pressure sensitive
Huevo de Toro	35.0	Green	206	July to august	Elongated	57	Smooth-soft-flexible	Pale green to yellow	Pressure sensitive
Mantequilla	60.8	Green to bright yellow	81	Sept. to October	Pear-shaped	26	Rough soft-flexible	Pale green	Pressure sensitive
Calabo	65.2	Green	249	Oct. to February	Elongated	40	Soft-thin	Pale greenish yellow	Pressure sensitive
Negro Santos	38.2	Purple to black	144	Oct. to November	Oval	46	Smooth-soft-flexible	Pale green to yellow	Pressure sensitive
Leonor	48.0	Purple to black	74	June to July	Pear-shaped	37	Smooth-soft-flexible	Pale green to yellow	Pressure sensitive



**Fig. 2** Fruit aspect of improved avocado creole varieties from Nuevo León, México. 1= Plátano Temprano; 2= María Elena; 3= Floreño; 4= Plátano Grueso; 5= Larralde de Sabinas; 6= Huevo de Toro; 7= Mantequillas; 8= Calabo; 9= Negro Santos; 10= Leonor.

#### 4. Conclusions

A great diversity was detected in the fruit characteristics evaluated in the avocado improved creole varieties from the state of Nuevo León, in terms of oil content, skin color when ripe, weight and shape of fruit, weight of seed and time of availability, among others attributes. Due to the above, the importance of preserving and taking advantage of this diversity of Creole avocados grown in Nuevo León is highlighted, in order to reduce the risk of their disappearance due to environmental causes (low temperatures) or genetic erosion, mainly if the population is composed of by a small number of individuals.

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