

## **The Search for Avocado Varieties Adapted to the Rio Grande Valley**

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### **Introduction**

Avocado trees grown in the Rio Grande Valley are subject to hazards uncommon in other subtropical regions. To encourage the study of problems limiting the culture of avocados the Texas Avocado Society was organized in 1948. This Society initiated a research program in which nurserymen, and Experiment Station and U. S. D. A. research workers have participated. Studies to date have been concerned largely with the performance of varieties as scions or rootstocks, importations of varieties from California and Florida, numerous explorations into Mexico in search of superior varieties, freeze damage, and salt tolerance. These studies are reviewed in this paper. Variety recommendations based on the results of these studies are given elsewhere.<sup>1</sup>

### **IMPORTATIONS FROM CALIFORNIA**

#### **(Mexican, Guatemalan, and Mexican — Guatemalan hybrid varieties)<sup>2</sup>**

California avocado varieties were imported into Texas long before the formation of the Texas Avocado Society. In 1927 Everett Ballard of Weslaco imported 1500 grafted avocado trees of many named Mexican varieties. By 1955 only a single tree remained. In 1941 Karl Hoblitzelle obtained 1558 trees of 11 named varieties from Armstrong Nursery at Ontario, California, and planted them at his ranch at Mercedes (Coit, 1947). The varieties consisted of 6 Mexican (Duke, Leucadia, Jalna, Zutano, Middleton and Benedict), 3 Guatemalan (Nabal, Edranol and Hellen) and 2 Mexican — Guatemalan hybrids (Fuerte and Ryan). The trees were on Mexican rootstocks, used exclusively in California. Trees planted on flat clay land died, while those planted on sand hills with good subdrainage grew fairly well (Coit, 1947). However, the trees on sandy soil did not produce marketable crops. The Guatemalan varieties did not produce a single fruit; fruit set was poor on the Leucadia, Zutano, and Middleton; and anthracnose rot destroyed much of the fruit produced by the other varieties (Coit, 1947).

The foliage of Mexican and Mexican — Guatemalan hybrid varieties showed considerable leaf burn while that of the Guatemalan varieties showed very little. Cooper and Gorton (1950) found that leaf-burning of avocados at the Hoblitzelle Ranch was associated with a large accumulation of chlorides in the leaves and this chloride accumulation was greater in the Mexican and Mexican — Guatemalan hybrid varieties than in the Guatemalan varieties. Further studies (Cooper, 1951) revealed that grafted trees on Mexican rootstock, such as those at Hoblitzelle Ranch, accumulate more

<sup>1</sup> Chambers, J. B. 1955. Manuscript in preparation.

<sup>2</sup> Mexican and Guatemalan refer to races of avocados. West Indian is a third race referred to in this paper. These names are not used in this paper as adjectives describing the probable parentage of selections and varieties and do not refer to the countries where the selection was found.

chloride and show less salt tolerance than trees of the same scion grafted on West Indian rootstock. Therefore, the poor salt tolerance of the Mexican varieties on Mexican rootstock may have contributed greatly to their poor adaptability. Windy spring weather may have reduced fruit set and high humidity during the fruit-ripening period very likely contributed to the high incidence of anthracnose rot.

### **IMPORTATIONS FROM FLORIDA (Guatemalan — West Indian hybrid varieties)**

In 1948 a survey of bearing avocado trees in the Rio Grande Valley revealed a small planting of Lula (Guatemalan — West Indian hybrid) avocado trees at the Kennedy place near La Feria. These trees, on West Indian rootstock, had been imported from Florida. They were 40 feet high and bore heavy crops of fine fruit with no sign of anthracnose; there was little tip burn of leaves. The vigor of growth, apparent salt tolerance, and large yields of fruit by these trees prompted the Texas Avocado Society to recommend the planting of the Lula variety on West Indian rootstock (Cintron, 1948).

Several nurserymen began commercial propagation of Lula on West Indian rootstock. The West Indian seed was obtained from Cuba or Florida; Lula budwood came from the Kennedy place and from Coral Reef Nurseries at Homestead, Florida.

Coincident with this increased interest in the Lula variety in 1948, importations of grafted avocados of several other named varieties of Guatemalan — West Indian hybrids from Florida took place during 1948. These included Booth 1, Booth 7, Booth 8, Choquette, Herman, and Hickman. These trees were scattered over the Valley in small plantings and in dooryards. Trees of all varieties grew well and the foliage showed very little leaf burn except when they were grown in poorly drained soils or soils irrigated with saline water. However, many trees of these varieties were severely injured by the freezes of 1949, 1950 and 1951.

The freezes focused attention on cold hardiness as a factor in the selection of avocado varieties adapted to the Rio Grande Valley. Trees of a given variety may bear abundant crops of high-quality fruit during warm winters, but if the variety is not cold-hardy, it will not be profitable over a period of years. The moderate freeze of December 1950 (24-26°F for 4 hours) killed the tops of many young trees of the Lula and other Guatemalan — West Indian hybrids down to the banks. However, trees of these varieties made a remarkably rapid recovery. Two years after the 1951 freeze the size of new tops of Lula trees was larger than the average new tops made by freeze-injured grapefruit trees (Chambers, 1951). By 1955 the difference was even greater.

The Mexican and Mexican hybrid varieties on West Indian root-stock were considerably more cold-hardy than the Lula variety on the same rootstock. The December 1950 freeze caused no leaf or twig injury on many of the Mexican varieties and only partial defoliation of many of the Mexican hybrids (Cooper, 1952; Maxwell, 1954). It, therefore, appears that the search for an adapted variety should be directed towards hardier Mexican and Mexican hybrid types.

### **AVOCADO SEEDLINGS IN THE RIO GRANDE VALLEY**

While plant breeders have produced outstanding varieties of many other plants, the present-day California and Florida varieties of avocados resulted from seedling

selections, usually originating as dooryard seedlings. About 60 years ago the parent Fuerte avocado was a door-yard seedling at Atlixco, Mexico. This seedling tree, now dead, gave rise to the greater part of the present avocado industry in California. An avocado industry for Texas also might arise from an avocado seedling, grown locally or elsewhere. The superior qualities of an outstanding seedling could be perpetuated by grafting onto West Indian rootstock.

The survey of bearing avocado trees in the Rio Grande Valley made in 1948 revealed several hundred seedling trees of the Mexican and West Indian races. There were also a few seedlings of the Guatemalan race, and some trees presumed to be Mexican — Guatemalan and Mexican — West Indian hybrids. Most of these trees occurred in small dooryard plantings. The owners had presumably planted seed of fruit from California, Florida, Cuba and Mexico that they had purchased on the local market.

A few of the seedlings produced fruit of good quality and these selections were propagated on West Indian rootstock for testing. The named selections of the Mexican race which have produced well in the test plots include Pancho and R-1. One apparent Mexican — West Indian hybrid, named Amidon, also produces large crops of good quality fruit.

In 1949 two seedling plantings were made in the Rio Grande Valley to provide seedlings for selections in the future (Chambers and Padgett, 1953). The seed for these plantings were obtained from the selected Valley seedlings which produced fruit of good quality. One planting of 300 seedling trees was made by J. R. Padgett, Rio Farms, Inc., Monte Alto. The other plantings, consisted of 100 trees, were made by J. B. Chambers, Jr., at Stuart Place. Both plantings were irrigated with saline well water during 1953; some trees were killed, others completely defoliated and others showed only a slight amount of leaf burn. Thus considerable variation in salt tolerance is indicated.

### **SEARCH FOR AVOCADOS IN MEXICO**

While growing avocado seedlings in the Valley may give rise to a new variety, exploring for superior seedlings in Mexico, where many thousands of seedlings are bearing fruit, seems a more promising procedure. Propagation of avocado trees in Mexico is usually by planting seed from selected fruit. Fruit growers there commonly believe that budded trees are short-lived (Crawford, 1948). Named varieties of avocados are almost non-existent in Mexico; the names "Aguacate," "Aguátate de China," "Corriente," "Pagua" and "Aguacate Pagua," generally used in Mexico, designate types rather than varieties. "Aguacate" and "Corriente" refer to small Mexican fruit; "Pagua" to either West Indian or Guatemalan fruit of low oil content; "Aguacate de China" to superior hybrid fruits of the Fuerte type; and "Aguacate-Pagua" to Mexican — West Indian hybrids.

The most note-worthy avocado planting in Mexico is probably the grove founded by Sr. Adolfo Rodiles at the Hacienda de San Diego, about 3 miles south of Atlixco, in the state of Puebla. It is a collection of some 3500 bearing-age avocado trees grown from seed of selected fruits purchased in the various markets at various times since 1915. Cintron, Cooper and Padgett (1948), along with Dr. Wilson Popenoe and members of the California Avocado Society, inspected the trees in this seedling planting. They brought back to Texas budwood of 18 promising selections of Mexican — Guatemalan hybrids (Popenoe and Williams, 1948). Hundreds of trees of apparently Mexican and

Guatemalan races were observed in this planting, but there was no evidence of trees of the West Indian race.

At about the time of the Atlixco explorations, Chambers (1948) began a survey of avocados in the area near Victoria in the State of Tamaulipas. In this area seedlings of the Mexican and West Indian races were found in abundance, but there was little evidence of trees of the Guatemalan race. The interplanting of seedlings of the West Indian and Mexican races provided an excellent opportunity for cross-pollination. Mingled characteristics of both races were evident on many trees. In some trees the leaves had a moderate to faint anise scent characteristic of the Mexican race but the foliage resembled that of the West Indian. Trees with these characteristics are presumed to be hybrids. Very little has been reported elsewhere on the behavior of this class of hybrid; Florida has given most attention to West Indian — Guatemalan hybrids, while California has emphasized the Mexican — Guatemalan hybrids.

During the period 1948-1955 members of the Texas Avocado Society made 20 trips into northeast Mexico to locate, study, and import to Texas superior selections of the Mexican — West Indian hybrids. Interesting seedlings have been located at Hacienda Santa Eugracia (Chambers, 1948; Martinez, 1950); the Castro place in Victoria (Chambers, 1948, 1952); the Arsola planting at Llera (Chambers, 1949, 1950, 1951; Chambers and Maxwell, 1952; Cintron, Cooper and Olson, 1952); Gomez Ferios (Ballard, 1953); Musquiz and Monterrey (Chambers et al, 1951); Tamazunchale, Aguacatlan and Tuxpan (Cooper et al, 1954); and Sabinas Hidalgo and Reyones. These Mexican and Mexican — West Indian selections are listed and described in the Yearbooks of the Texas Avocado Society. In general only Mexican selections were found around Reyones, Monterrey, Sabinas Hidalgo, and Musquiz while mostly hybrid selections were made at Santa Engracia, the Castro place and the Arsola planting at Llera.

Fruit of selections of the Mexican race had purple skins and ripened from June to September. Individual fruit weighed 4 to 8 ounces. Fruit of the hybrid selections ripened from June to September; the size ranged from 8 to 12 ounces and the skin color varied from purple to green.

All selected trees bore fruit of excellent quality. Fruit varied from oval, pyriform, obovate, elliptical and necked. Trees with either green or purple-skinned fruits were selected since either has good consumer acceptance in Texas.

A primary objective was to find selections that were cold-hardy. The January 1951 freeze extended into northeast Mexico and caused varying degrees of damage to wood of avocado trees. When the Arsola planting of 600 six-year-old bearing trees at Llera was inspected in July 1952 wood killed by the 1951 freeze was still present, the amount varying from tree to tree. A survey (Cintron, Cooper and Olson, 1952) of dead wood and anise scent in leaves of the trees in this planting revealed no freeze injury on trees of the Mexican race, severe injury on trees of the West Indian race and variations in freeze injury on trees presumed to be Mexican — West Indian hybrids. Many of the hybrids with fruit of excellent quality showed considerable cold hardiness.

Tolerance to anthracnose was also considered in the selections. The Mexican and Mexican — Guatemalan hybrids varieties from California have been susceptible to

anthracnose under Texas conditions. In the Victoria and Llera areas of Mexico the relative humidity of the air during the ripening period is similar to that in the Rio Grande Valley; considerable anthracnose may be found on the fruit of some Mexican — West Indian hybrid trees while other adjacent hybrid trees are free of it. Some trees of the Mexican — West Indian hybrids, therefore, appeared to have anthracnose tolerance and selections of these types were made.

Determining the degree of tolerance to anthracnose is difficult. While the mature fruit on a tree may be free of anthracnose rot, it sometimes develops after they are held for several days in the grocery store or on the pantry shelf. Differences in weather from year to year at the same location also influences the incidence of anthracnose. Dry weather in the Valley during 1950 was not favorable for anthracnose development and most Mexican selections were free of it. During 1955, a wet year, many varieties developed anthracnose. In the area around Sabinas Hidalgo many Mexican avocados with large excellent fruit are free of anthracnose; the climate, however, is dry and anthracnose does not occur even on susceptible varieties. Selections from this area may possibly lack anthracnose tolerance. A method of testing anthracnose tolerance of fruit samples is highly desirable in the search for tolerant selections.

### **AVOCADO TEST PLOTS**

The new and promising selections of avocados from Mexico and in the Valley are being grown in trial plantings at six locations in the Valley. These are the J. B. Chambers and Stanley Crockett properties near Stuart Place; Hoblitzelle Ranch at Mercedes; the Texas Agricultural Experiment Station at Weslaco; Rio Farms, Inc. at Monte Alto; and Boone-LaGrande at Rio Grande City. The freezes of 1949 to 1951 and the droughts of 1951-53 slowed the development of these trees. However, many introductions from Mexico and local selections from the Valley were successfully grown and fruited in the Chambers and Experiment Station test plots. More favorable climatic conditions since 1953 have encouraged the establishment of many selections in other plots.

Nine of the 16 Atlixco (Mexican — Guatemalan) selections have been successfully established at the Experiment Station (Maxwell, 1954). These trees were planted in April 1950 and are now approximately 15 feet tall. They bloomed in 1954 and 1955 but set no fruit. In the spring of 1955 poor fruit set occurred on all varieties at this location; several more years trial may be required to determine whether a poor fruit set may limit the value of these Mexican — Guatemalan hybrid selections.

The Fuerte, a Mexican — Guatemalan hybrid, was propagated on West Indian rootstock and planted in the test plot of J. B. Chambers. The trees did not grow as well as the adjacent Mexican — West Indian hybrids and were injured more severely by the 1950 freeze. Other varieties from California should be propagated on West Indian rootstock and tested in the Valley for further evaluation of their adaptability.

Practically all of the Mexican — West Indian hybrid selections were grown in the Chambers test plots. Many selections were eliminated in 1951 and 1952 because they lacked cold hardiness and salt tolerance. Many selections bore fruit in 1954 and 1955; some were susceptible to anthracnose. The Castro and Pancho (selections of the Mexican race) appear to be cold-hardy and salt-tolerant and produce large yields of excellent fruit. The Pancho is free of anthracnose while the Castro is susceptible to it.

The Santa Engracia (Mexican — West Indian hybrid) produces large crops of good-quality fruit, but it has an alternate-bearing habit. The Diaz selection (Mexican — West Indian) produces large yields of excellent fruit, but a tendency to skin cracking may limit its successful commercial use. The Amidon (Mexican — West Indian) produces large yields of good-quality fruit with a green skin.

Most of the more promising Mexican — West Indian selections were made from the Arsola planting at Llera. These have been established in all the test plots; a few set fruit in 1955 and many more should do so in 1956. An evaluation of the usefulness of these selections awaits several more years of trial in the test plots.

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