

PUERTO RICO SEEDLESS ORANGE SELECTIONS

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During the months of August and September, 1928, the senior writer visited the principal fruit-growing districts of Puerto Rico in order to study the varieties of citrus fruits grown and to introduce improved methods for the propagation of selected strains of the commercial citrus fruits. This visit was made in response to an invitation by the Commissioner of Agriculture and Labor of Puerto Rico and with the cooperation of the Bureau of Plant Industry of the U. S. Department of Agriculture. The selection and propagation study of citrus problems was cut short by a severe hurricane that occurred on September 13 and 14 but important information had been obtained before the terrific storm known locally as the San Felipe hurricane, interrupted the investigation. During the search for a superior orange amongst the so-called "wild" or seedling trees an outstanding tree bearing seedless oranges of apparent commercial value was discovered and propagated. This report will contain an account of the discovery and the description of the characteristics of this tree and its fruit and of three others that were found and propagated subsequently.

DISCOVERY OF SEEDLESS ORANGE

Upon his arrival at San Juan, Puerto Rico, in August, 1928, the senior writer met with Hon. C. E. Chardon, then Commissioner of Agriculture and Labor, at his office in the Insular Experiment Station at Río Piedras, in order to decide upon a plan for investigating citrus-bud-selection problems. At this meeting the senior writer proposed amongst other things a systematic search for superior orange trees, particularly amongst the plantings of the so-called "wild" orange trees that are located on various coffee plantations of the hill districts and in the gardens of Puerto Ricans, many of whom have shown a special interest in the planting and study of orange varieties.

During a previous visit to Puerto Rico, in 1905, the senior writer has been impressed by the marked variation in the commercial quality of the Puerto Rican oranges that came under his observation at that time. This experience together with a similar one in California citrus orchards during the past twenty-three years were the reasons that led to the proposal of study of the seedling orange trees in Puerto Rico during the Fall of 1928 from the standpoint of determining, so far as possible, the nature of variations, if any, in the trees and their fruits and particularly to look for individual trees that were apparently superior to the average for commercial propagation and culture in Puerto Rico.

A searching party was organized early in September 1928 to carry out a systematic search for a superior orange in certain citrus-growing districts of Puerto Rico. The members of the expedition consisted of Mr. O. W. Barrett, then in charge of farm demonstration work for the Puerto Rico Department of Agriculture and Labor and whose knowledge of local agricultural conditions and familiarity with the Spanish language were valuable in this work, Mr. A. Mayoral of the Plant Propagation Station at Trujillo Alto, and the senior writer. The equipment included a supply of sphagnum moss and suitable containers for budsticks in order to insure the proper care for any budwood that might be obtained from any outstanding tree that might be discovered.

Several days were spent in studying orange trees in various locations on the Island but without finding any particularly valuable orange trees of interest from the commercial standpoint. A few selections of budwood from interesting trees that were thought to be better than the average were made but these trees were considered to be of minor commercial importance by the senior writer. While the fruits of these selected trees were apparently superior in one or more commercial characteristics to the average, the fruit and foliage characters did not meet all of the requirements that were considered to be essential for a superior orange variety.

Finally, on September 11th, 1928, a visit was made to a coffee plantation owned by Don Francis Martínez, located in the hill country above the city of Mayagüez and about 1,200 feet above sea level. The orange trees on this plantation, probably more than a thousand in number, were planted for the most part alongside the coffee fields and as a shade for the coffee plants. They were about forty years old, according to the superintendent of the plantation who accompanied us during our study of these trees. They were typical so-called "wild" or mountain orange trees, i. e. apparently seedlings of

the varieties introduced by the Spanish explorers and settlers during the early history of the colonization of Puerto Rico. The principal crop on this plantation was coffee and the maintenance of the orange trees was incidental to the main business of the plantation. In addition to those planted alongside and in the coffee fields, small groups of orange trees were found growing near the houses of the employees as was frequently the case on similar plantations in other districts that were visited during the course of the survey.

At the time of this reconnaissance, the fore part of September 1928, the fruits of most of the orange trees observed were young and small, about the size of walnuts on the average. Now and then a tree was found with larger and more mature oranges while others had only very small fruits. All of the fruits examined from the most promising-looking trees contained several seeds and some of them had as many as 35 or more seeds each. In some instances the rinds were very thin and in others the peels were quite thick. Most of the oranges examined had a tender rag and were very juicy but some of them contained an excessive amount of coarse rag and were lacking in juice. In some instances the flavor of the juice was fair to good but in most cases it was insipid and poor.

Amongst the orange trees in the main border row of the Martínez plantation several apparently interesting ones were examined but upon close study they were found lacking in one or more of the characteristics essential for a superior commercial orange by reason of the undesirable shape, size, rough texture, poor flavor, lateness of maturity, excessive number of seeds or other characters of commercial importance. As a result no attempt was made to collect budwood from any of the trees that were first examined. After walking about half the length of the row, the senior writer noticed in the distance a conspicuous tree that stood out from the neighboring ones so that it attracted his immediate interest. The characteristics of this tree that were particularly noticeable to the senior writer while still some distance from it, included: an unusually large crop of apparently mature oranges having uniformly desirable commercial size and shape, the relatively large size of the tree and its dense, deep green foliage with large, clean, healthy appearing leaves. Instinctively, the senior writer felt at the time that this might be the tree for which he had been searching, but restrained his enthusiasm until it was possible to examine the foliage and the fruits more closely.

Upon reaching the conspicuous tree the senior writer picked an orange nearest at hand and cut it transversely across the mid section. The first glance at the cross section showed that the orange has a

medium thickness of peel, the flesh was firm and had an attractive texture and color, the core was very small and solid and no seeds were visible. Small sections were immediately cut from the two halves and handed to members of the party. After tasting these samples everyone present agreed that the flavor of the juice, texture of the flesh, and the bouquet or aroma of this fruit was superior to any of the samples tasted heretofore on this trip or to the best of their recollection in any previous tests. The fruit was found to be entirely without seed or any evidence of seediness. The senior writer then cut, in a similar manner, 24 other oranges that were picked from different branches of this tree and every one without exception proved to have very similar characteristics to those of the first one examined, including absence of seeds, firm and very tender flesh, no apparent core, an abundance of excellent flavored juice, medium thickness of rind and exceptionally desirable size and shape of orange from the commercial standpoint. The unanimous opinion of those present was that this was the best eating orange that they had tasted to the best of their recollection.

About 50 budsticks were then cut from this outstanding tree, each with one or more typical fruits attached. The fruits were cut off from the budsticks and their characteristics noted, particularly the absence of seeds. The budwood was carefully labelled and immediately packed in moist sphagnum moss. A few additional oranges were also picked from the tree for subsequent examination.

The remaining orange trees in the row were looked over before the party left the plantation but nothing of particular interest was observed. By this time darkness precluded any further field studies and the party returned to Mayagüez for the night. On the morning of September 12, 1928, a visit was made to several Mayagüez gardens and the party started on their return trip to San Juan. En route a stop was made at San Sebastián where several small garden orange plantings were looked over. One of the growers reported an orange tree located on his coffee plantation some distance from the city that produced characteristically seedless and desirable fruits. Arrangements were made to visit this planting subsequently in order to obtain further data and budwood for possible propagation but owing to circumstances the senior writer was unable to carry out this plan.

While at San Sebastián during the afternoon of September 12th one of the growers mentioned the fact that a hurricane had been reported from the Virgin Islands and that it was apparently approaching Puerto Rico. Accordingly haste was made to return to San Juan, but a short stop was made at Garrochales in order to visit one

of the larger Grape Fruit orchards. While at Garrochales showers began to fall and the southwestern sky developed a leaden or copy appearance that indicated, according to the experienced members of the party, the approach of a hurricane. San Juan was reached late in the evening of September 12th and about midnight the hurricane arrived, the first stages of which consisted of terrific gusts of wind that were accompanied by a torrential downpour. On the following day the hurricane persisted until about five o'clock when a calm period occurred. Later, about nine o'clock in the evening, the wind began to blow again with hurricane violence, tho not so strongly as during the first phase of the storm, and continued until about eight o'clock of the morning of September 14th. On the following day, September 15th, the buds from the outstanding Martínez Orange tree were inserted in seedling rootstocks in propagating grounds and nursery located at Trujillo Alto, near San Juan. The leaves of the young rootstocks had been badly whipped by the violent windstorm but the seedlings were still in fairly satisfactory condition for budding on account of the fact that they were located in a sheltered place. The young nursery trees resulting from this propagation were eventually distributed in the model farms and to growers for tests of the new variety for commercial orange production.

On account of the widespread damage to Agriculture as a result of the terrific hurricane further study of the native orange trees were abandoned for the time being and the senior writer returned to Washington, D. C. However, before leaving, the senior writer drew up a systematic plan for a study of these trees and when conditions became settled after the disaster further search was made for outstanding trees. Three additional selections have been made during recent years and descriptions of these outstanding trees and samples of fruits from them are included in this report.

In January, 1931, Edmund H. Twight, of Riverside, California, the junior author, was appointed Specialist in Fruits for the Insular Experiment Station by the Puerto Rico Department of Agriculture and Commerce. He has been instrumental in bringing together the other three Rico oranges and in collecting much of the data contained in this paper. On January 8, 1932, the senior author received at Riverside, samples of the four Rico oranges from the junior author. They were picked from the selected parent trees as noted in the description. Those fruits under California quarantine regulations were shipped to Riverside from Puerto Rico in care of the Riverside County Agricultural Commissioner, in whose office they

were examined and photographed after which they were carefully burned in order to eliminate any possibility of the introduction of insect pests or disease. In addition to the personal studies of these oranges, the senior writer obtained the services of three of the leading orange growers and packers in the Riverside district in order to secure their opinions as to the commercial value of each sample and particularly their judgment as to the most desirable one of the four varieties for a commercial orchard test. Fortunately the Agricultural Commissioners of the Southern California Counties were meeting where these fruits were examined and their opinions as to the fruit characteristics and their apparent commercial value were also obtained.

The circumference and weight of each orange in all of the samples were recorded, systematic notes were made as to the color, thickness and texture of the rinds, shape of the fruit, color of flesh, character of the rag, the amount and color and flavor of the juice, the size and nature of the core, the number of segments in a typical fruit of each sample, the number of seeds, if any, the presence or absence of a navel and the soluble solids-acid ratio of the juice of a composite sample made up from three oranges of each lot were recorded. Photographs of each sample of fruits were made but owing to the poor lighting conditions in the room where the photographing was done the resulting pictures are not as clear as would have been under more favorable conditions. Each sample was examined by all those present during these tests by tasting and thru systematic inspections of the inner and outer characteristics of the fruits. Ample time was available so that opportunity was given to study the oranges adequately and to consider their characteristics from different points of view.

Some of the outstanding characteristics of the samples of oranges were: the absence of seeds, their desirable shape, size and texture from the commercial point of view, the fine bouquet and flavor of the juice, the small amount and melting character of the rag, and the good outside color of the oranges even though they had not been washed or treated in any way in order to improve their appearance. Some smut from scale was found on most of the fruits but that could have been easily washed off. Treatment with Ethylene gas would doubtless have improved their color from the commercial standpoint, but at that time it was considered best to photograph and record the descriptive notes without any cleaning or other fruit treatment.

The writers know of only one commercial orange variety, the trees of which characteristically bear seedless fruits in the South-

west, the Washington Navel Orange, which is one of the most important orange varieties grown. For this reason, if for no other, the orange selections described in this report are of scientific interest and one or more of them are likely to be commercially important. The particularly attractive flavor and bouquet of the abundant juice, the melting and very tender nature of the small amount of rag and the desirable commercial sizes and shapes of the fruits makes them of more than ordinary interest.

Following are the descriptive notes obtained from the examination of the fruits of the Puerto Rico orange selections that were sent to the senior writer from Puerto Rico by the junior author of this report. In addition to the data obtained from a study of the samples of fruit, notes are presented that give the facts concerning the location, discovery and propagation of each parent tree together with the description of some of the most important parent tree characteristics from data obtained largely by the junior author in the course of his official duties in Puerto Rico during the season of 1931.

The parent-tree selections have been given temporary names and numbers in order to identify them, the first one found being called Rico No. 1, the second Rico No. 2, and the other two Rico No. 5 and Rico No. 6. No fruits have been produced by the progeny trees as yet but their foliage indicates that the characteristics of the parent trees have been probably perpetuated through bud propagation.

LOCATION AND CHARACTERISTICS OF THE RICO No. 1

This tree is located on the mountain coffee plantation owned by Don Francisco Martínez in the Mayagüez district of Puerto Rico at an elevation of about 1,200 feet above sea level. The soil on this plantation is red clay. The tree was discovered by A. D. Shamel on September 11, 1928, and the first progeny propagation was made on September 15, 1928, at Trujillo Alto in the nursery of the Plant Propagation Station. The nursery progeny was subsequently planted at the Propagation Station, the Insular Experiment Station, the various Model Farms and the Orchard of Hill Bros. at Sabana Llana. The young progeny tree had some fruit this year (1932) but the San Ciprián hurricane of September 26 (1932) shook them off; the trees, however, were not damaged. The parent tree is about forty years old, about 30 feet high, has a spread of about 30 feet, the diameter of the tree three feet from ground is about 12 inches. As the result of the hurricane of September 1928, the heavily laden tree was seriously injured and is now in very poor condition altho at the time of its discovery it was very vigorous. The habit of growth

of this parent tree is erect, the yield for 1932 was estimated at from 3 to 4 cases of oranges, the uniformity of the fruit is good and the commercial quality of the oranges is excellent. The tree is located on a shady mountain slope, one in a row of oranges that form a border for the adjacent coffee plantation.

DESCRIPTION OF SAMPLES OF RICO ORANGE No. 1

Individual Orange Number	Weight Ounces	Circumference Inches
1.....	11 $\frac{1}{2}$	10 $\frac{10}{16}$
2.....	11 $\frac{1}{2}$	10 $\frac{7}{16}$
3.....	11	10 $\frac{7}{16}$
4.....	10	9 $\frac{13}{16}$
5.....	9	9 $\frac{11}{16}$
6.....	8 $\frac{1}{2}$	9 $\frac{9}{16}$
7.....	8	9 $\frac{4}{16}$
8.....	8	9 $\frac{3}{16}$
9.....	8	9 $\frac{3}{16}$
Average.....	9.5	9.81

The color of the rinds of the fruits is deep yellow with a reddish tinge, the texture is smooth; the shape of the fruit is slightly obovoid; the peel is about $\frac{3}{16}$ of an inch thick, the flesh is firm, has a deep yellow color, exceptionally small amount of tender rag and excellent eating quality; the juice is abundant, 3 oranges producing about one pint; the color of the juice is yellow and more attractive than that of the other samples of Rico oranges examined, the flavor is excellent, eleven segments in one orange; small solid core; no seeds; no navel; soluble solid-acid ratio 11.8 to 1.

LOCATION AND CHARACTERISTICS OF THE RICO No. 2

The parent tree RICO No. 2 was located by Julio S. Simons, Superintendent of the San Sebastián Demonstration Farm during 1930 on the mountain coffee plantation owned by Don Francisco Roig in Barrio Perchos between San Sebastián and Lares, about one and half hour on horse back from the highway. The tree is located about 2,000 feet above sea level. The soil is a heavy reddish clay. The first progeny propagation of this tree was made by A. Mayoral at the San Sebastián demonstration farm and at the Plant Propagation Station of Trujillo Alto on February 15, 1930, and another was made in June, 1931, by E. H. Twight. The resulting nursery progeny trees were planted subsequently at the Plant Propagation Station of Trujillo Alto and at the San Sebastián Model Farm.

This parent tree is about 40 years old, has a height of about 30 feet and a spread of about 30 feet. The diameter of the trunk three feet above the ground is about 12 inches. The vigor of vegetative

growth is good and the crop for 1932 is estimated to be from 3 to 4 cases. The fruit is fairly uniform with the exception of that on the central growth. The tree has an erect habit of growth. It is growing on a steep hillside and in partial shade.

DESCRIPTION OF SAMPLES OF RICO ORANGE No. 2*

Individual Orange Number	Weight Ounces	Circumference Inches
1.....	12	10 ⁸ / ₁₆
2.....	11	10 ⁴ / ₁₆
3.....	11	10 ⁴ / ₁₆
4.....	10	10 ³ / ₁₆
5.....	10	9 ¹⁵ / ₁₆
Average.....	10.8	10.23

* 3 oranges badly effected with brown rot decay, not included.

The color of the rinds is deep yellow tinged with red, the texture is smooth; the shape of fruit is obovoid; the peel is 3/16 of an inch in thickness; the flesh is firm, has a deep yellow color, tender rag and good eating qualities; the juice abundant, 3 oranges producing a little less than a pint of juice and has a fine distinctive flavor; the core is small and solid; 9 segments in one fruit; small rudimentary navels in rinds at blossom ends of the fruit with very small navel opening or practically closed; no seeds; soluble solid-acid ratio: 14.5 to 1.

LOCATION AND CHARACTERISTICS OF THE RICO No. 5

This tree is located on the mountain coffee plantation owned by Don Ignacio Roig near Guayanilla in the southwestern part of the Island and about two hours by horseback from the highway (Kilometer 241) at an elevation of about 2,000 feet above sea level. The soil is a heavy clay loam. This parent tree was located by Félix A. Velasco, Agricultural Agent at Guayanilla, in the Fall of 1930. As in the case of the Rico No. 2 and of the Rico No. 6 parent trees, the owner had known for years that this particular tree was prolific and produced each year crops of commercially desirable and seedless oranges. Progeny propagation of this parent tree was first made during the Spring and Fall of 1931 at the Insular Station at Río Piedras and at the Plant Propagation Station at Trujillo Alto by the junior author, and again in 1932.

The parent tree is about 40 years old, about 30 feet high and has a spread of about twenty-five feet. The diameter of the trunk three feet above ground is ten inches. The vigor of vegetative growth is good and the yield of fruit is about 3 cases annually. The fruit is

uniformly good. The tree has an upright habit of growth but leans to the northwest on account of prevailing winds. It is located on a steep mountain slope and stands on a ledge that overhangs a dashing mountain stream.

DESCRIPTION OF SAMPLES OF RICO ORANGE No. 5

Individual Orange Number	Weight Ounces	Circumference Inches
1.....	15	11 ¹⁴ / ₁₆
2.....	14	11 ¹⁰ / ₁₆
3.....	13	11 ⁶ / ₁₆
4.....	13	11 ¹ / ₁₆
5.....	12½	10 ¹² / ₁₆
6.....	12	10 ¹⁶ / ₁₆
7.....	12	10 ¹³ / ₁₆
8.....	9	9 ¹⁵ / ₁₆
Average.....	12.5	11.06

The color of the rind is light yellow, the texture somewhat coarse; the shape of the fruit is slightly obovoid but more spherical than in the case with the other samples; the peel is about 4/16 inch thick; the flesh has a deep yellow color and the rag tender; the juice abundant and has a good color; 3 oranges produced one pint of juice; the core is open and about 10/16 inch in diameter; ten segments in one fruit; one large imperfect seed was found in 5 fruits; no navels; the soluble solid-acid ratio: 12.5 to 1.

LOCATION AND CHARACTERISTICS OF THE RICO No. 6

The parent tree of the Rico No. 6 is located on the mountain coffee plantation owned by Don Carmelo Albino Bisot near Sabana Grande and about two hours by horse back from Sabana Grande. The soil is a heavy reddish clay with a shallow covering of black loam. The tree stands at an elevation of about 2,000 feet above sea level.

It was located by Félix A. Velasco, Agricultural Agent, Guayana, and was propagated at the Insular Experiment Station at Río Piedras in March, 1931. The resulting progeny trees were planted at the Plant Propagation Station at Trujillo Alto in April, 1932, by the junior author. The parent tree is about forty years old, thirty feet high and has a spread of about thirty feet. The trunk diameter three feet above ground is about 12 inches. The vigor of vegetative growth is good, the production fair and the fruits are fairly uniform. The habit of tree growth is erect and the tree is growing on a shady mountain slope. As with the other selected parent trees, Rico No. 1, Rico No. 2 and Rico No. 5, no pruning, cultivation, spraying, soil fertilization or other care has been given this tree.

DESCRIPTION OF SAMPLES OF RICO ORANGE No. 6

Individual Orange Number	Weight Ounces	Circumference Inches
1.....	11½	10 13/16
2.....	10	10 6/16
3.....	9½	9 12/16
4.....	9	9 11/16
5.....	9	9 7/16
6.....	9	9 7/16
7 Very flat.....	7½	9 6/16

The color of the rind of fruit is deep yellow tinged with red and the texture is smooth, the shape of the fruits is somewhat flattened as with the Marsh Grape fruit; the peel is about 4/16 of an inch thick; the flesh is deep yellow in color and has a tender rag; the juice is abundant and of exceptionally fine flavor, three and one-half oranges produced a pint of juice; 4 fruits had a total of four perfect and two imperfect seeds and two fruits were seedless; no navel; soluble solid-acid ratio: 12 to 1.

EXPLANATION OF PLATES

- Plate VI. Typical fruits from seedless orange selection Rico No. 1. Original tree near Mayagüez, Puerto Rico.
- Plate VII. Typical fruits from seedless navel orange selection Rico No. 2. Ranch of Mr. Roig, San Sebastián, Puerto Rico.
- Plate VIII. Typical fruits from seedless orange selection Rico No. 5.
- Plate IX. Typical fruits of seedless orange selection Rico No. 6. Sabana Grande.

PLATE VI.

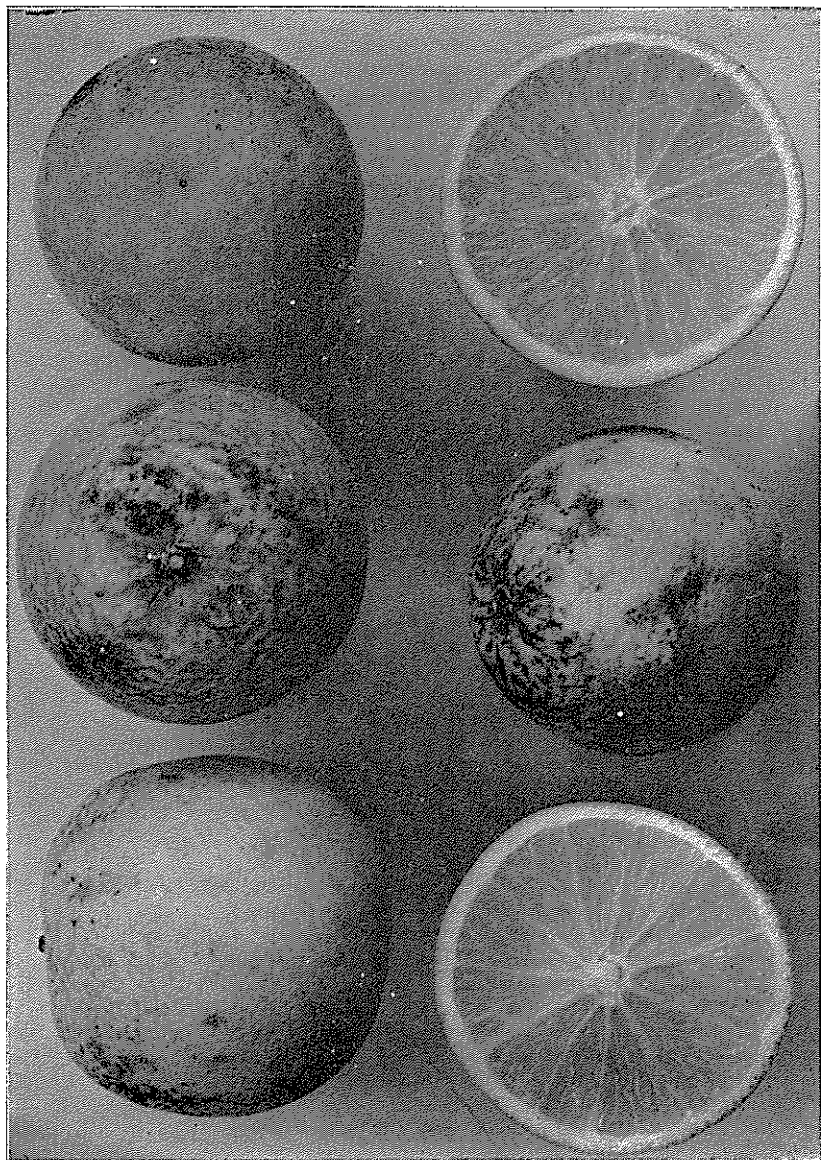


PLATE VII.

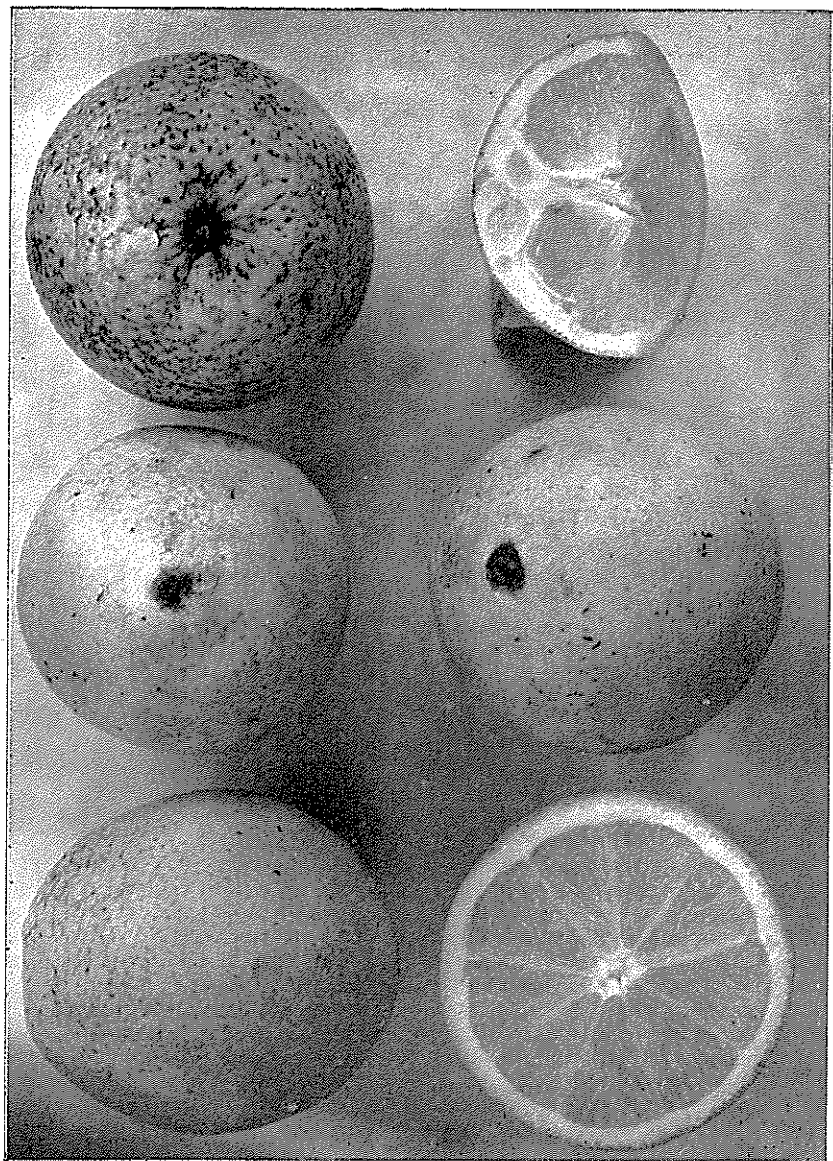


PLATE VIII.

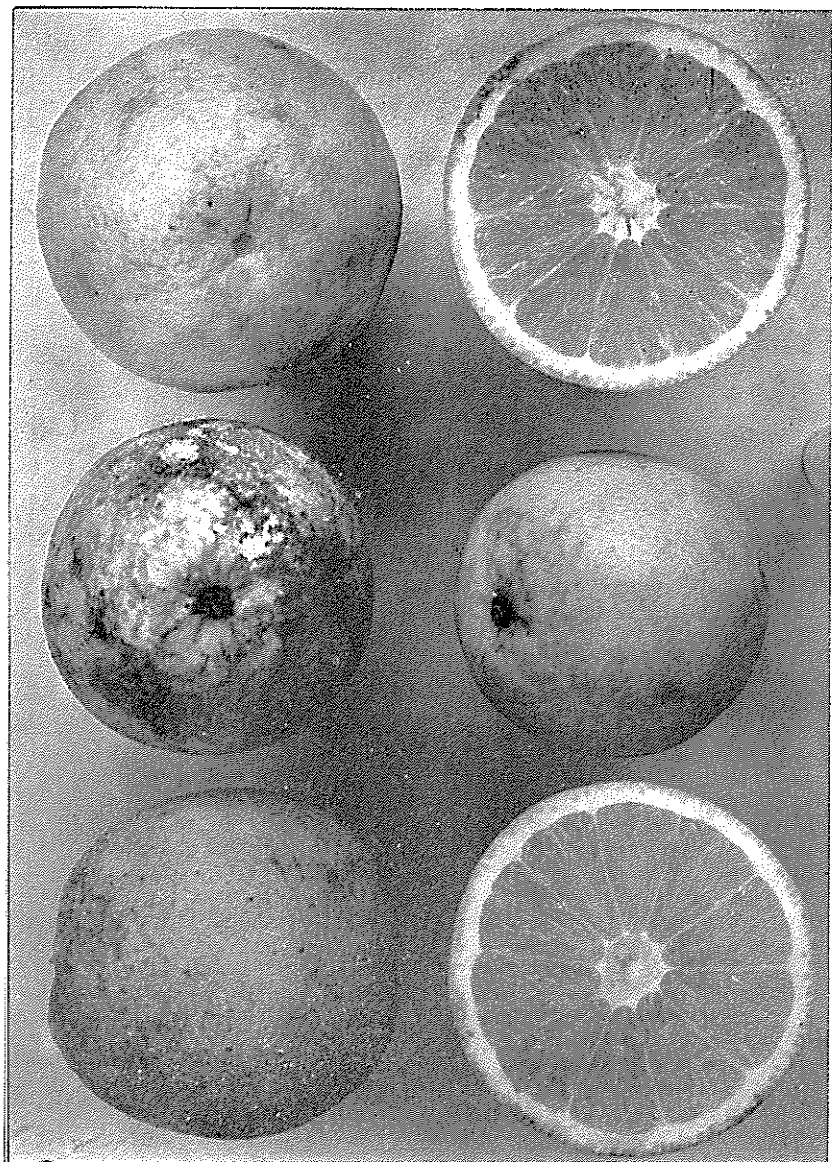


PLATE IX.

