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5th Floor, Hunt Library
Carnegie Mellon University
4909 Frew Street
Pittsburgh, PA 15213-3890
Telephone: 412-268-2434
Email: huntinst@andrew.cmu.edu
Web site: www.huntbotanical.org

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About the Institute

The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

Citrus Fruits.

It would be very easy to overestimate the amount of land in Porto Rico which is really suitable for the commercial culture of the orange and other citrus fruits. Orange trees will grow almost anywhere in the island, in the sense that they will not be killed by frost or other active enemies, just as the apple can be cultivated throughout the temperate regions of the United States, though there are comparatively small areas where the apple is profitably grown as a commercial crop. Similarly it will not be sufficient in Porto Rico that orange trees thrive in any given locality or that fruit is produced without the effort of cultivation. The final test of orange-growing capabilities must be in the production of fruit of sufficiently high grade to command remunerative prices in our markets, and it must be admitted that we have yet to await this demonstration. The question cannot be decided in advance by the shipment of a small surplus produced without the effort of regular cultivation. Much less can any general conclusions be drawn from the fact that such shipments as have already been made from the limited region about Yauco which may easily have special qualifications for raising oranges.

This discussion is not intended to discourage the undertaking of citrus cultures in Porto Rico, since the great diversity of soil and rainfall render highly probable ~~that~~ the existence of ideal conditions in some parts of the island; it is desired merely to impress upon those who take up this line of work the necessity of a careful choice of locations. Because frost is absent it is by no means to be inferred that there are no other dangers, and the easiest place to start an orange grove may not prove to be the best. Indeed, present indications seem to favor the drier southern slopes of the island than the more constantly humid north side, though even there there may be great difference in rainfall between places only a few miles apart.

Citrus fruits of Porto Rico.

(Copy).

August 13 1901.

Mr. J. R. Bradley,

117 Md. Ave, N. E.

Washington, D. C.

Dear Sir;

In reply to your favor of August 12 I beg leave to report that the culture of oranges on a commercial scale can be said to have scarcely begun in Porto Rico, ~~as~~ that answers to all of your questions are not practicable. I have nearly completed a paper on the subject in which the general situation is explained, and also the uncertainty which must exist until actual demonstration shows what can be done.

In brief it may be said that the climate of some parts of the island is probably too moist for the best results, while in others irrigation might be needed; local conditions of soil and rainfall differ greatly. Nursery stock can be purchased in Florida and the trees would probably come into bearing as soon or sooner than in the States.

Very respectfully,

(Signed) O. F. Cook.

(Copy)

No. 117 Md. Ave, N. E.

Washington, D. C., Aug. 12, 1901.

Mr. O. F. Cook,

Chief Botanist, Dept. of Agriculture.

Dear Sir: The publication of an interview with you in a recent number of the Washington Times concerning Porto Rico suggests to me that you may be able to give me some information concerning the culture of the orange in that island. It has been stated in the press that a number of Americans are interested in the planting and culture of the orange there, and I take it for granted that they would not invest in that field unless they had found sufficient encouragement to warrant them in doing so. May I ask you for some facts relating to this industry.

1. How long after planting before the trees come into bearing?
2. What are the size and quality of the fruit as compared with those of the Florida and California groves?
3. What is the cost per tree for nursery stock?
4. What is the price of land?
5. What is the approximate cost of planting and of caring for the orchard per acre, until it bears?
6. What is the earliest date annually that the fruit may be picked and prepared for shipment?
7. What is the cost per ton (or carload) for freight to New York?
8. Are the ports of the island accessible to orange lands?
9. In your judgement does the island present opportunities for investment in orange culture superior to those of Florida or of California?
10. If you answer yes to the last question, do you think it likely that Porto Rico oranges will ever supplant the California fruit in America markets?

Any information on these and kindred points that you may be able to give will be gratefully received by

Yours, respectfully,

(signed) J. R. Bradley

(Copy).

Lim of Trop Agr Letter trans

This Department has frequent requests for general advice and information regarding the prospects and conditions of tropical agriculture. ~~not only in the tropical territory of the United States but also in the various foreign countries, in which Americans have~~

Such inquiries can seldom be answered with ~~satisfactorily~~ in a letter of ordinary length without danger of misleading the correspondent, and ~~the present paper~~ ^{has been prepared} ~~the~~ ^{unpublished} accompanying paper, by ~~Mr. O. P. C.~~

Botanist on the above a means of meeting the above difficulty. I recommend that it be published ^{as} Bulletin No. — of this Division

Bulletin No.

U. S. DEPARTMENT OF AGRICULTURE.

Division of Botany.

CITRUS FRUITS IN PORTO RICO

by

O. O. F. COOK,

Special Agent for Tropical Agriculture.

WASHINGTON:

Government Printing Office.

1901.

Memorandum for Letter of Transmittal.

I have the honor to transmit herewith, for publication as a bulletin of this division, a report on the citrus fruits of Porto Rico by Mr. O. F. Cook.

This paper is not offered as a special study of citrus cultures in Porto Rico, the notes and photographs on which it was based having been secured as part of a general report on the useful plants of that island. The manuscript has, however, been read by Messrs Herbert J. Webber and William A. Taylor of this Department, and cultural suggestions based upon the special knowledge and extended experience of these gentlemen have been incorporated. Publication is recommended as a means of replying to numerous inquiries from correspondents interested in the present conditions and future possibilities of fruit-growing in Porto Rico.

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CITRUS FRUITS in Porto Rico.

The commercial citrus fruits, except the lime, do not belong in the same climatic category as the mango and avocado pear, since in the humid tropical climates they do not produce fruit of the best quality. The finest oranges come from semi-arid and semi-tropical regions like the Mediterranean countries, Florida and California. It is, however, to be said that the possibilities of particular localities in the tropics have been properly investigated in very few instances. The adaptation of methods of culture to local conditions is an especially important matter in the establishment of a commercial industry in citrus fruits. In Porto Rico the first steps in this direction have scarcely been taken, and a considerable period of experimentation may be expected to intervene before methods can be perfected so as to secure the best results. For several years it may remain doubtful whether Porto Rico can compete successfully with California, Florida, and the Mediterranean countries in the production of fruit of high quality. At present it can only be said that some of the oranges equal the best of the Jamaica fruit offered in our markets.

Antonia * This is the opinion of Mr. W. A. Taylor of the Division of Pomology to whom specimens of this and other Porto Rican fruits were submitted, and to whom acknowledgment is due for various facts and suggestions concerning fruits and the fruit trade.

The use of grafted stock, instead of variable, and frequently inferior seedlings is the first step toward the establishment of regular trade. The present supply of oranges, even if adequate in

quantity, would average extremely low in quality and only a very small part of the Porto Rican product would pay for marketing.

This, ^{to} of course, ~~is~~ no reflection on the possibilities of the country as a producer of ^{good} fruit, since with the exception of the fact that a few orange trees ^{may} ~~are~~ sometimes ^{be} found in a row, there is ^{nothing} ~~nothing~~ ^{at all} to indicate that the cultivation of citrus fruits ^{has} ~~ever~~ received a serious thought in Porto Rico. A vigorous, well kept, thrifty orange tree would ~~probably~~ be a new object for Porto Rican eyes accustomed only to the tangled and stunted growth of neglected and lichen-covered specimens. Only in the vicinity of Mayaguez had there been any noteworthy effort toward the planting of orange groves and the establishment of a regular trade.

The question as to which part of the island is best adapted for the growth of the citrus fruits is one which is receiving varied answers from the promoters. The trees will undoubtedly thrive almost everywhere, but this is not necessarily an indication that the conditions are favorable for the production of abundant fruit of high quality. In fact, it may be necessary to experiment with the same variety in different parts of the island before the relative merits of different localities can be determined. It is difficult to believe that in so small an island there could be such endless combinations of soil, temperature and humidity, factors of great importance with these fruits, to say nothing of such questions as the use of the proper stocks and varieties in the different situations, the use of fertilizers,

transportation facilities and numerous other elements likely to affect the success of a venture in orange-growing or kindred lines. It seems extremely probable, ~~at least~~, that the more humid climate and stiff soil prevalent on the north side of the island will require methods different from those which may be found applicable on the drier southern slope with its more porous limestone substratum, where if other circumstances are favorable fruit of better quality is to be expected.

It is, of course, important that the varieties best adapted to the various conditions be secured for budding, although it is by no means certain that the kinds most successful in California and Florida are suitable for general planting in Porto Rico. If really high grade native varieties can be found it would be, perhaps, safer to propagate from them than to import new stock the success of which would be, of necessity, somewhat problematical. Three-fourths of the Florida varieties are of local origin and are likely to be better adapted to Porto Rico than the Mediterranean sorts.

With regard to the possible competition of Porto Rico with Florida and California in the production of citrus fruits it should be remembered, as stated above, that there is but a small available supply of good quality, and that it would require several years to build up a new industry. Furthermore, should such an industry come into existence it must be largely through American energy, capital, skill, and adaptive ability. The people of Porto Rico have scarcely considered fruit-growing as a source of agricultural wealth and probably few of them will take it up with the necessary intelligence and persistence until they realize its possibilities by ocular demonstration. In this as in other lines, Porto Rico should be considered as an opportunity

for American enterprise, rather than as an opening for hurtful competition of foreign interest or even of recently adopted citizens. If any of the orange growers who have lost the results of years of labor and been driven from Florida by frost are able to utilize their experience in Porto Rico the fact should not be deemed a misfortune in any part of the country. Moreover it is very improbable that the production of Porto Rican fruit will increase faster than the demands of the market to the disadvantage of the existing industries of Florida and California.

Production for the Early Market.

5.

In the production of oranges for ^{export to} the United States, ^Dmarket Puerto Rico will enjoy at least one important advantage in the possibility of entering the market in autumn months, before the Florida and California crops are ready. At present ^{orange} the season ^{fruit} opens ^{in Puerto Rico} in October and November, but the oranges brought to ^{in them} market even when of reasonably good form, are inferior in texture and flavor and could not be shipped to advantage. Early native varieties may possibly exist but the probability is that it will be found desirable, as in Jamaica, to introduce the best early sorts from Florida. The variety most notable in this respect is Boone's Early, while Centennial and Parson Brown are but little later. These and some of the better of the very late varieties are the most promising for an advantageous beginning in shipments to the American market, since in the mid-season trade the ^tcompetition of Florida and California would need to be met. In Jamaica successful experiments are claimed with a large number of superior varieties, such as Jaffa, Washington Navel, and Pine Apple, but as yet few of these have been grown in quantities sufficient for shipment as special grades. It is also possible that varieties of recent tropical origin might do better in ^DPuerto Rico and Jamaica than those originated in Mediterranean countries or Florida. The fact that the profits depend largely upon the production of fruit of the highest possible quality should always be kept in mind by those undertaking the culture of citrus fruits. The cost of production is practically the same for the inferior as for the superior article and the difference in selling price is largely clear profit, or rather the reward of foresight and good judgment.

Limestone for Oranges. Limestone soils are favorable for the production of high-grade citrus fruits. In fact, unless the soil is naturally calcareous, applications of lime are generally considered necessary to the best results, it being extremely difficult to secure good oranges without it. In Florida fine aroma and high flavor are thought to be directly connected with the existence of lime and the same opinion is held in other orange-growing countries. Porto Rico has a considerable variety of limestone soils, with different admixtures of other materials, and diverse climatic conditions, so that there is reason to hope that some districts will be able ultimately to put on the market as good fruit as can be raised anywhere in the tropics.

Citrus Cultures and Hurricanes.

The danger and destructiveness of Porto Rican hurricanes is now commonly exaggerated by reason of the distress and loss of life occasioned by the exceptional storm of August 8, 1899. The damage was largely wrought by the water rather than by the wind, though some agricultural industries suffered severely from the direct effects of the storm. Bananas were everywhere badly injured and bearing was interrupted for an entire season. Coffee planters also lost heavily by the destruction of the crop then on the trees and the plantations were badly damaged by the destruction of the shade-trees. Cacao and many other tropical crops are even more susceptible to such injuries, but citrus trees enjoy the notable advantage in comparative immunity from destruction by wind. The hard and yet tough and flexible wood not only offers sufficient resistance to the wind, but even the fruits are not all blown down though though no doubt a severe storm would interfere with the production of a full crop. This would be, however, a merely seasonal danger and recovery would not take years as in the case of the bread-fruits and trees having soft, brittle wood.

7.
Budding Oranges in India.

- - - - -

The 48th report of the Jamaica Botanical Department contains the following notes on orange culture in India, detailing the ^{successful} experience of Superintendent Ridley of the Lucknow Horticultural Gardens. ^{by Dr. D. Morris} with a very simple method of budding. "Nearly all the orange trees grown and distributed by him are budded trees. The plan of budding oranges has been regularly practiced in the Lucknow Gardens for many years. It is carried out by native labor, and although there are naturally some failures, the supply of budded trees is always kept up to the demand."

"It may interest you to learn that stock plants are raised from seeds of sour orange and lime. These are raised in large numbers in open beds, as plants are raised in Jamaica, and they are grown on until they are about 18 inches to 2 feet in height. In the spring of the year on the advent of dry weather, the work of budding is commenced. During the month of March, and with bright, hot weather, just as is experienced at that season in the West Indies, suitable buds are taken from the best kinds of orange trees in the Garden, and these after being prepared are budded on to the sour seedling as they grow in the beds. The ^{lings} seed^{lings} are taken one by one, and a clean cut made in the upper part of the stem with a budding knife. The bark on each side of the cut is lifted, exactly as in budding roses, and the bud put in. A little binding with bast or banana fibre completes the operation. There is no need of wax, clay, or any preparation to cover the budded area."

"Mr. Ridley mentioned, first of all, that the slit in the bark of the stock is not T-shaped, as shown, for instance, by Dr. Nicholls in his book (~~English ed.~~) opposite p. 82. It is simply a cut down the stem, with no cross cut. Further, that the shield of bark attached to the

bud is cut squarely across top and bottom. It is not trimmed into a narrowed point either above or below. It is claimed that the bud is easier to manage when so left. When the bud is being inserted the stem of the stock is bent forward so as to open the slit, and so facilitate the admission of the bud."

Transplanting old trees.
^{tree}

1 Of all the cultures the citrus fruits offer, perhaps, the best opportunity for quick returns in a country like ^Puerto Rico where there are large numbers of wild or semi-wild trees and seedlings of all sizes. Groves ~~formed~~ from "picked up" stocks may never attain the beauty and regularity of those planted from carefully selected, budded trees grown in the nursery, but if transplanted with reasonable care even large trees do not lose their ⁱvigor; they can be brought into full bearing in two or three years and remain productive indefinitely. Transplanting should be undertaken in the wet season and watering must be practiced when necessary until new roots have been formed, and the plants well established. The whole top of the tree should be cut away at the time of transplanting, and buds are set in the new sprouts which come ^{out} up.

Of course the ^{raising} planting of budded seedlings, either grown at home or purchased from nurseries, should follow without loss of time. The details of the processes of propagation, sowing of the seed, the transfer to the nursery and the orchard, and the various methods of budding and grafting can be found in a paper published in the Departmental Yearbook for 1896 by Mr. H. J. Webber under the title "Methods of Propagating the Orange and other Citrus Fruits," which may be obtained as a separate pamphlet on application.

Species of Citrus in Porto Rico. Four citrus fruits are everywhere met with in Porto Rico, the sour orange, (naranja), the sweet orange (China), the lemon and the lime. Three others of less value and relative importance are occasionally found; these are the citron, the sweet lemon, ^{and} the toronja or shaddock. Other species or varieties may exist in private gardens, but they did not appear in the markets at the time of our visit, nor were they referred to by those familiar with the fruits of the island.

The Sour Orange. The most common of the citrus fruits is perhaps the sour orange, ^{or} "naranja" as it is universally called in Porto Rico. This is the regular Spanish name for the orange, but in Porto Rico it is reserved for the sour species leaving "China" or rarely "naranja China" for the sweet. The ordinary Porto Rican sour orange is believed to belong to the species "Citrus bigeradia" and is not the ^{as has been} Beville orange, reported by Mr. Hill as abundant in the wild state in Porto Rico, with what warrant it is impossible to state.

The seville orange is generally more compact, and has a smoother, thinner rind than the sour orange; in fact, it is more nearly related to the sweet orange rather than to the sour. The form shown in the photograph differs from the sour orange ^{of} in Florida only in having much smaller spines, a difference particularly apparent on the more vigorous shoots.

^{es-}
In Florida the sour orange is used for stocks in all plantings on moist land, for the reason that it ^{resists the} ~~exists a~~ foot-rot or mal di gomma ^{and} other diseases which effect other varieties when planting ^{ed} on heavy soils. This species is also planted in Florida as a street shade tree on account of its vigor and hardiness. The fruit is practically worthless except in the preparation of a refreshing drink like lemon^{ade}, and in the manufacture of marmalade. It may be distinguished from that of the sweet orange by the usually coarse, uneven and deeply pitted exterior, and in section by the large oil-glands, thick, loose rind, coarse juice-vesicles, large seeds and hollow centre. Some of the ^finferior sweet oranges of Porto Rico have a very thick skin which is, however, firm and smooth, and in such the solid central pith ^{is} firm and solid.

In their neglected, ^munkept condition the trees of the sweet and sour orange appear indistinguishable, even at a short distance. The fruiting branches and their leaves are also often very similar, but if the long, vigorous shoots or sucker branches be examined the

leaf stems will be found, in the sour orange, (Fig.) to be much larger broader and more triangular than in the sweet. (Figure) In Porto Rico the sweet orange has also a very much larger spine at the base of each leaf of the vegeta-^{tive} branch but this may not always be the case, since the Florida sweet orange is less spiny than the sour. On the fruiting branches of both species the spine and the wings of the petiole are very much reduced or disappear entirely, and the leaves become smaller and proportionally broader.

The Sweet Orange. The difference between the sour orange, or "naranja" and the sweet orange " china", have been stated above. The quality of the fruit is extremely variable, as might be expected from the absence of cultivation, and from the fact that all the trees are seedlings. Many fruits are small, thick skinned, pithy and contain, perhaps, an enormous number of seeds; (Fig.); or these disadvantages may be variously combined with larger size and fairly good texture and flavor. The great majority of oranges offered in the markets were, however, of such low grade that they would hardly have been placed before a public accustomed to fruit of good quality. External appearance was also very deceptive, large, attractive fruit being often found utterly insipid and of pithy or leathery texture. Samples indicating the existence of varieties combining desirable qualities in regard to size, texture and flavor, ^{were} ~~was~~ certainly extremely rare ~~at the time of our visit;~~ and even though due allowance be

made for the fact that the season had not fully opened it seems fairly well assured that exports based on the available supply of fruit could amount to little.

That a rather high grade orange does grow in Porto Rico was, however, demonstrated by a few specimens secured at San Juan and brought back to Washington for the inspection of the fruit specialists. The photographs (figures) show a fruit of desirable size, with a smooth, thin skin and dissipiments, and delicate, juicy, flesh of excellent flavor. The seeds are rather too numerous and the central pith or "rag" too pronounced, but some believe that under better cultivation these defects might tend to disappear, and that this variety, if no better ~~ones~~ exist, might profitably be used for propagation by budding. Mr. W. A. Taylor, of the Division of Pomology, whose kindly assistance ~~were with~~ other questions is thankfully acknowledged, permits himself to be quoted to the effect that this orange is at least the equal of any Jamaican fruit he has ever examined. Figure is from a photograph made at San Juan and is of interest in comparison with No. ^{thick} taken at Washington as showing how the ^{thick} ~~thin~~ness of the skin decreased during the journey.

According to Capt. Hansard a weed called "cojitre" placed around the roots of the orange-tree sweetens the fruit. This is believed to be a leguminous plant and suggests the possibility ~~of its~~

of its use as a substitute for the nitrogenous manure which is said to be necessary for the best results.

It may in some localities be possible to secure stocks of considerable size or to bud good varieties into old trees and thus secure a crop of good fruit in advance of nursery seedlings. It is understood that some orange nurseries have been planted already in anticipation of a demand for stocks in the near future. The extent of such a demand it is impossible, of course, to foresee; it will depend like other movements on political and commercial as well as upon agricultural conditions. From five to seven years must elapse before production on a commercial scale can be expected from new groves.. The orange season extends from October to July or August. A proper selection of varieties might make possible continuous production at least from the island as a whole, in view of the great difference of climate and soil.

Ten years are thought to be necessary for a tree to reach full bearing. It is claimed that a single tree will sometimes produce several thousand oranges. The local prices at the height of the season vary from 25 to 50 centavos per hundred.

The Limeb. The limes of Porto Rico seem to be quite normal and of good quality, while none of exceptional size were seen, the larger of those figured on plate are quite large enough to satisfy the present trade requirements. Large limes are in fact, not in requisition and are even considered objectionable since they are liable to be mistaken for lemons. A small fruit is sufficient for the purposes to which they are usually put, and a larger would involve waste.

The demand for limes is constantly increasing and there is almost always room for more in the market. The lime endures shipment well if properly packed and as the quality of the Porto Rican product is good, it is perhaps the most eligible fruit with which to open a trade, ~~whenever commercial relations reach a satisfactory adjustment.~~

In the British island of Montserrat the production of limes for the extraction of lime juice has been made quite an industry. About 1400 acres are planted to limes, over 1200 belonging to a single estate. The annual total of income from the industry averages over \$30,000, and other Islands contribute large quantities.

As there is no duty on lime juice in bulk there is little to encourage the planting of estates in Porto Rico, except by those who are already in possession of market facilities. Strangely enough fresh limes are protected to the extent of a cent a pound. There is little or no direct importation of lime juice from the West Indies, most of it coming in bottled form from Scotland, where Leith is the center of the bottling industry. There is a duty of eighteen cents per dozen on bottles not containing

over three-quarters of a pint, but this would afford no adequate protection, since larger bulk importations of juice would doubtless be made if Puerto Rican competition should appear under present tariff conditions.

in the treatment of the limes

The machinery required is simple and comparatively inexpensive. The oil is secured by abrasion of the skin against the rough surface of a saucer-shaped copper vessel. Next the limes are cut in two, the juice which then flows out being kept separate and considered superior to that obtained by pressure between rollers. Another method is to tear the limes apart by means of wooden cylinders armed with gun-metal teeth, extraction being completed by bagging the pulp and subjecting to pressure. The juice if carefully strained and securely barreled to exclude the air can be shipped raw but if fuel is available it is generally boiled down to about one-eighth the original volume and then packed in casks for export.

In a favorable situations a tree is said to yield a barrel of limes, the equivalent of ten gallons of juice. Limes intended for shipment should be picked before they turn yellow, but when the juice is to be extracted they are allowed to fall to the ground, which greatly facilitates gathering, but if allowed to lie too long they deteriorate. In addition to the juice, the essential oil secured from the skins is exported in considerable quantity.

Limes might be much more extensively used ^{in this country} as ~~the~~ substitute for ~~a~~ lemon, if a method of curing could be contrived so that the fruit would keep as well as the lemon. The thin skin dries out rapidly and turns brown, and the flavor deteriorates.

In Montserrat trees are grown from the seed, and when about 1.8 inches high are transplanted into rows 20 feet apart and spaced 15 feet in the rows. Some advise keeping the ground clean while others believe it preferable to permit the growth of grass and use their lime orchard for pasturage. Bearing commences at three years and continues indefinitely. The lime appears to thrive excellently in Porto Rico both on the clay soils of the north side and the friable limestones of the south, but should not be planted in localities subject to long droughts, to which it is said to be more susceptible than other citrus fruits.

An investigation of the Montserrat industry is desirable but no stock should be imported from that island except under expert precautions to avoid the introduction of a so-called blight from which the trees are said to suffer in some localities.

The Lemon. The Porto Rico ^{an} lemon seems to be somewhat intermediate between the genuine lemon and the rough lemon of Florida and Jamaica. Externally it is uneven or irregularly raised into rounded prominences, the surface being rather ~~cottony~~ ^{coarsely} and deeply ^{pitted}. An unusually rough specimen is shown in figure ^{Figure} while ^{Plate} and figure represent more nearly the average. The vesicles of the flesh are rather large and decidedly looser than in the genuine lemon; there is also a large central cavity with a bundle of strands of delicate white tissue in the middle. Compared with the ordinary lemon there is very little "rag" and the segments separate readily. The taste is only moderately acid, with a pleasant, slightly bitter flavor, suggesting to some persons that of the grape-fruit. The skin, which is thick and cottony in the fresh fruit and has large oil glands, becomes quite thin when allowed to ripen. [¶] This fruit is rather different from any variety known to the Department's specialists. Commercially it cannot be expected to compete in the market with the ordinary lemon, but for eating, and possibly for the preparation of unsweetened lemonade it might become popular with those who are partial to acid fruits.

The rough lemon of Florida is the stock now always used for citrus fruits when planted in dry situations, where it has proved to be far superior to all others. For planting on the south side of Porto Rico this lemon may also have value and should not be neglected in the ^{stock} starting of nurseries.

The Citron. An example of this fruit was secured from a street vender at San Juan. He stated that considerable quantities are growing in the vicinity of Trujillo Alto but there was no opportunity of investigating that locality. Large amounts of citron-peel are imported into the United States from Mediterranean countries, notably from Corsica, and experiments in the culture of the trees are being made in Florida and California. The possibility of success in Porto Rico is worthy of investigation. Although none of the citrons now in commerce are growing in tropical countries there are said to be varieties of excellent quality in Hindoostan and the Malay Peninsula. The Porto Rican specimen was of medium size, but the skin was too thin, to ^{lose}lose in texture and apparently deficient in flavor. Some or all of these defects may, of course, be due to the absence of proper culture.

The Pith Shaddock. Along the road between Bayamon and Toa Baja was found a citrus fruit previously unknown to any of the Department's staff, and apparently not described in books of reference. It is of somewhat pyramidal or pyriform shape with a rather even, smooth exterior surface, having large scattered oil glands, some of which are depressed, while the majority are elevated. The sections show a firm, pithy rind occupying more than half the diameter, and with both radial and longitudinal fibers. The pulp is slight in

quantity, rather insipid and, somewhat bitter. There is a central pith column in which is imbedded a distinct fibre at the base of each dissepiment. The specimens were immature and the seeds still undeveloped. The fruit is of no commercial value but may be of interest to students of this group of fruits as representing an extreme degree of development of pithy rind. It may also throw some light upon the origin of such forms as that shown in Plate — figure — where the characters mentioned are all present to a limited extent in a fruit, which in other ^{respects} ~~extents~~ approximates a sweet orange and may be a hybrid with it.

In Porto Rico the name toronja is applied to these and similar fruits, and in dictionaries it is translated both as citron and as shaddock. It has a suspicious resemblance to "turuuj" a name used in India for numerous varieties of true citrons, and said also by some authors to be the Arabic word for citron, which would explain its existence in Spanish. In Grand Canary there is another little-known citrus fruit which may have some relationship to the present. It is from eight to ten inches long, ^{regularly} ~~rather~~ elliptical or melon-shaped with a rather smooth, hard, exterior nearly as firm as the rind of a watermelon. The rind is even thicker than in the Porto Rican fruit, ~~The~~ pulp cavity being very small, and has a not unpleasant flavor combining sweet and bitter. It is commonly eaten in the raw state and is supposed to be a variety of citron from the usual form of which it is certainly very distinct.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF BOTANY,
WASHINGTON, D. C.

SEED LABORATORY

In the Jour. Jamaica Ag.
Soc. 1:93, 1897,

Dr. D. Morris of Kew Gard.
his writes concerning grape-
fruits of "Fruits of Paradise"
as he calls them. He thinks
they are exceedingly fine.

He says that they command
sometimes exorbitant prices
in New York Market [$\$6$ per
bbl. or about $\$1.00$ apiece]
though, as he states, the price is
sure to fall, it might be worth
while to mention the demand ^{here}.

The Sweet Lemon. The sweet lemon (limon dulce) is a citrus type very little known and not likely to become popular with the American public, but quite generally cultivated and used in South European countries. No mature specimens of the fruit were seen, but the wingless petioles of the leaves, and the enormous spines of the vegetative branches shown in ^{figure} ~~Plate~~, renders the tree easily distinguishable.

Grape-Fruit. The flourishing grape fruit industry of Florida has been nearly destroyed by the frosts of recent winters. The grapefruit, while not so sensitive to frosts as the lemon or lime seems to require thoroughly tropical conditions for properly maturing the fruit and for this reason has never become popular in Southern Europe where it has long been grown in a small way for preserves and other minor uses.

If Porto Rico can produce grape-fruits of good quality and especially if they can be placed on our markets early in the season a remunerative industry could undoubtedly be built up. The trees are extremely productive and bear while still very young. Recently the grape-fruit has been found to succeed well in the Salt River valley of Arizona, but Porto Rico would be at no disadvantage in the ^{P.R.} East-ern market.

The popularity of this fruit is a recent development and is mostly confined to the United States. Dr. Daniel Morris, Director of the Royal Gardens at Kew, has, however, urged upon the planters of Jamaica the growing of grape fruit or Paradise fruit for the American market and his view of the matter will thus have especial interest for those interested in citrus culture in Porto Rico.

"The Grape Fruit is in such great demand in America chiefly because it has been so highly recommended by the medical faculty for its valuable dietetic and tonic qualities. It is also very refreshing, and is regarded as a specific for dyspepsia. The Americans are large fruit eaters, and seldom begin or end a meal without fruit of some kind. To supply them with bananas alone, there arrived from the West Indies during the year 1895 one hundred and eighty-five cargoes of this fruit, comprising nearly seventeen million bunches, of the value of over five million sterling. Jamaica furnished the larger share of this immense shipment of tropical fruit, and that Island is becoming quite prosperous in spite of the great depression that has overtaken all the sugar-producing countries in that part of the world. Hitherto Florida has supplied a good deal of the Grape Fruit for the American market, but since the disastrous effects of the 'freeze' of last year the Florida plantations have been almost destroyed. Much English capital invested in fruit-growing in that State has been lost, and many of our young countrymen settled there have suffered a severe reverse of fortune. Even where the groves are not quite destroyed, it will take years of toil and expenditure to bring them back to their former condition. For some time at least the chief supplies of Grape Fruit must, therefore, be drawn from the West Indies. The people in that part of the

world would do well to establish trees of the best varieties, and take advantage of the opportunity to participate in what promises to be a steady and remunerative industry. A leading authority in New York states: 'It will be long before there is an overproduction of the best sort of Grape Fruit, since the demand for it increases every year, and is constantly becoming more popular as a breakfast fruit.' A wealthy population numbering over sixty million supplies a splendid market for disposing of such an attractive commodity as this Grape Fruit. Some idea of the prices recently paid for especially choice fruits may be gathered from the fact that two barrels of Grape Fruit realised the extraordinary price of ~~six pounds~~ (£6) each in New York, and seven barrels of similar fruit sold in Philadelphia for £5 10s. each. Such fruit would retail at more than a dollar apiece. This is probably the highest price ever paid for any fruits of the Orange tribe for eating purposes. It clearly proves that a very active demand exists for Grape Fruit, and although prices must necessarily fall, the probability is that, with a careful selection of the best varieties, and a judicious management of the crop, the cultivation will be a profitable one for many years to come."











Australian Oranges.

From the London Globe.

What apple culture is in England that of the orange is in New South Wales, the Parramatta district, near Sydney, being to Australia what Kent, with its countless luxuriant orchards, is to the united kingdom. The scenery of the Parramatta river, remarks our Sydney correspondent, is not unlike that of the Thames above Richmond, only more romantic and beautiful, especially during springtime, when the wonderful profusion of wild flowers imparts an additional charm to the picture. Even the masses of rock, which in many places rise boldly from the edges of the stream, are decked with bright-colored clusters of Australian native flowers of the most lovely and varied description. The trees also claim a large share of admiration, not only from the lover of the beautiful in nature, but also from the utilitarian, for they include the orange, with its bright green foliage and dainty white flowers or rich golden fruit, both often being seen on the tree at one and the same time. The orange is not only a picturesque adjunct to the garden, but also more than repays the trouble and cost of cultivation. In the Parramatta district rich and luscious oranges are as plentiful as blackberries in an English country lane during the autumn time.

Orange.

Photos. # 13 & 14.

Specimen sectioned has three seeds. Slightly too much rag but flavor good. Color deep nearly as deep as California navels, dirty and stained, not making a good appearance. 3 for 2 cents. Not many oranges in the market.

11

Considerable quantities of oranges from Yauco and vicinity have been shipped from Ponce packed in boxes after the Florida manner. Shortly after the American occupation shipment of oranges from Porto Rico was attempted with the fruit in barrels with the result that most of it was lost.

70

(?) Parson Brown, Homosassa, Pineapple, Tangerina, Sanford,

_____, Ruby, King, Boone's Early, _____ Summer, Early Mountain.

Norton has about 300,000 seedlings.

Boyme and Marcelas grapefruit.

123



Orange seedlings in Nursery near Bayamon.
Sancti



Budded Oranges in Nursery near Bayamon.



Orange Trees near Rio Piedras, & as generally
grow in Porto Rico, without care.

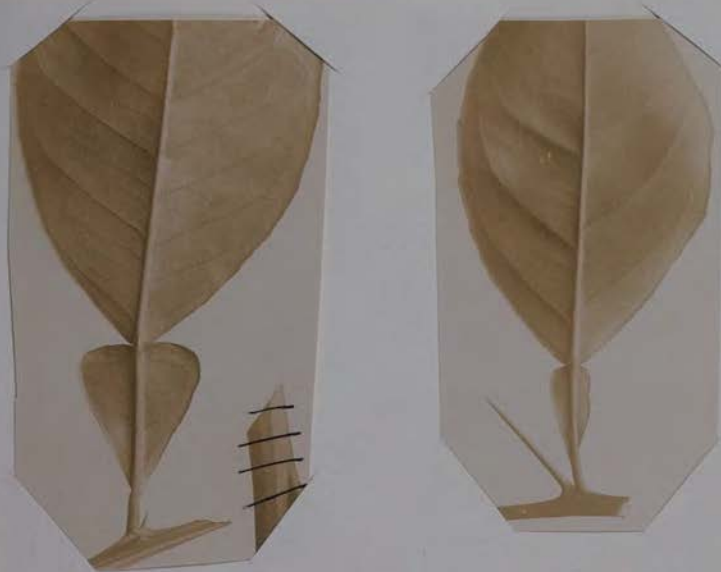


Fig. 1. Leaves from sucker branches of sour orange
(left) and sweet orange (right).
[Natural size.]

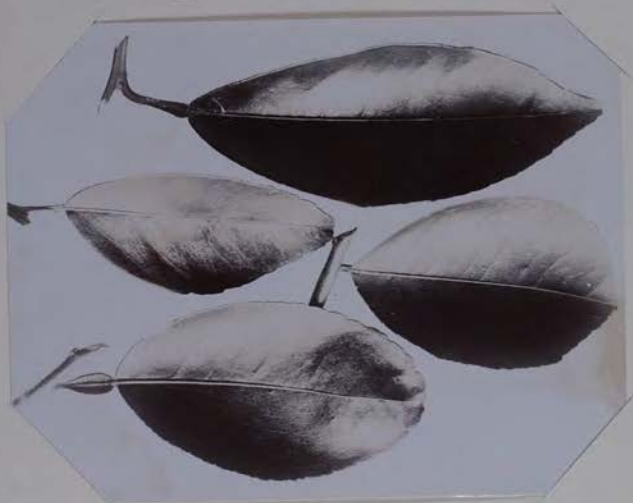


Fig. 2. Leaves from fruiting branches of the sweet orange
(above), sour orange (left), sweet lemon (right), and ~~to~~ lemon (below).
[Natural size.]



Fig. 1. Sweet orange of good size
and texture, but of inferior flavor. Pine market.
[Natural size]



Fig. 2. Inferior sweet orange. Pine market.
[Natural size]

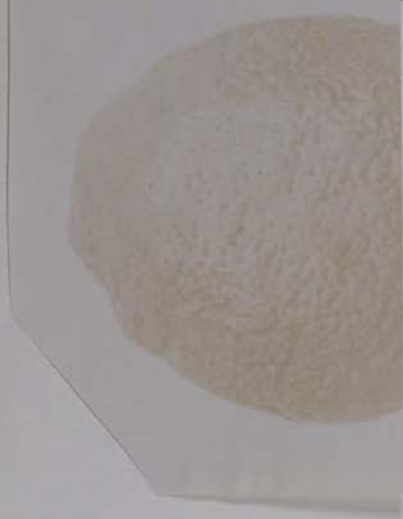


Sweet orange of good quality, San Juan.

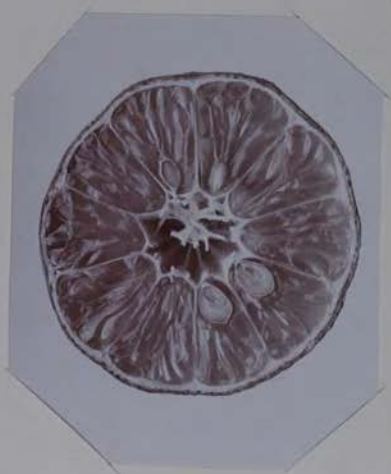
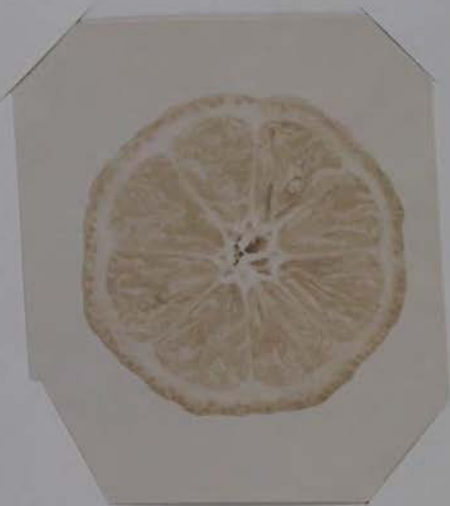
Hunt Institute for Botanical Documentation



Some orange (naranja), Catiaño.



Rough lemon (limon bobo) from San Juan ~~market~~
[Natural size]



Rough lemon before and after



Sweet lemon (*limon dulce*), from Cataño

[Natural size]

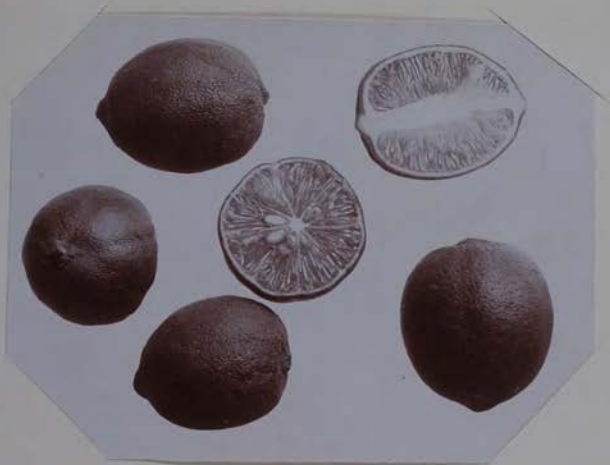


Fig. 1 Limes ^{from} Ponce market.
[natural size]



Fig. 2. Limes, San Juan market

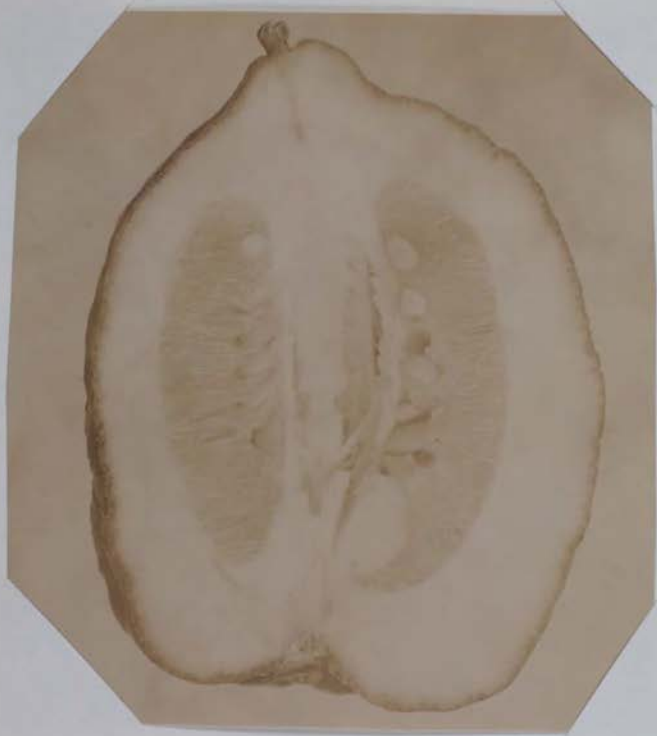


Citron, from Trujillo alto.
[Natural size.]



Citron from Pnce.

[Natural Size.]



Sections of Citron from Ponce.

[Natural size.]



Pith sheddock.

[natural size]



Pith Shaddock, longitudinal and transverse sections.

Citrus Trees

~~leaf-cutting or other ants sometimes attack~~

In some parts of the Tropics ~~budding~~ grafting or budding is rendered especially difficult by ~~the~~ attacks of leaf-cutting or other ants which attach ~~the~~ gnaw away the exposed tissues or the ~~new leaves~~ young leaves. It is claimed,

however, that ~~woolen strings or~~ if the ~~low~~ ants will not pass a ~~woolen~~ string saturated with castor oil adequate protection for ~~newly set~~ buds newly set young buds can be had by the simple expedient of tying the branch with ~~a~~ woolen strings saturated with castor oil - which is distasteful to the ants