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JAMAICA.

BOARD OF AGRICULTURE

A REPORT

ON

THE CULTIVATION OF

PINE APPLES

AND OTHER PRODUCTS OF FLORIDA.

BY ROBT. THOMSON.

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cultivation of Fruit and other products.)*

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Having recently visited Florida, on account of Messrs. Elder, Dempster & Co., for the purpose of acquiring information relative to the methods of pineapple cultivation so successfully pursued in that State, I have the pleasure to report accordingly.

In addition to Pineapples I embraced the opportunity of investigating other important cultures in Florida capable of being turned to good account in Jamaica.

The resourcefulness of the people there in developing new industries greatly impressed me throughout my trip. They have little beyond tropical sun and sand at their disposal. For success they depend upon their characteristic energy, industry and perseverance. With these traits they transform the barren resources of the soil.

Before leaving for Florida, I called at Washington, where I had the honour of an interview with the Honourable James Wilson, Secretary of Agriculture in the Cabinet of Mr. McKinley (with the Secretary I may mention I had recently been in communication relative to the cultivation of new products.) I was welcomed with the utmost consideration and introduced to the Chiefs of Bureaus of the Department, eminent Specialists, who most generously placed at my disposal every source of information. Professor Webber, the well-known expert on hybridization, prepared my itinerary with references to the leading cultivators in Florida, whom he thought might be most useful to me in my line of investigation. It is only necessary to say that the exceptional attention I received everywhere, placed me in a position to acquire valuable information. In this connection I wish to offer my sincere thanks to Professor B. T. Galloway, Chief of the Bureau of Plant Industry as well as to Professor Webber.

ORLANDO the first pineapple region I visited, is situated on the most northern latitude at which pineapples are grown in Florida.

Until about 12 years ago the pineapples were cultivated in the open without protection, but the recurrent frosts rendered the cultivation too precarious, for the slightest touch of frost ruined a year's crop.

My references from Washington included one to the pioneer of a new system of pineapple cultivation. Acres of sheds were constructed by this pioneer (Mr. Russell) and he commanded success. This system of cultivation is now exclusively adopted at Orlando, partly to afford protection from frost and partly to screen the pineries from the burning sun. Thus numerous pineries, ranging in size from one to twelve acres, are closely boarded all round 7 to 8 feet high. At regular distances posts are placed some 12ft. apart, on which are fixed connecting rods; on these are placed narrow rafters, between each of which a space similar in width is left for the admission of light. Through these spaces the light is admitted in glittering rays of sunshine, ample, it is abundantly proved, for the well-being of the plants. A still more remarkable feature of cultivation is demonstrated under these sheds, one that further exemplifies the constitutional flexibility of this plant. During several months of winter when frost is dreaded, when every hour of night is watched for possible disaster by all concerned, the whole of this shed structure is covered with canvas, sometimes even with laths fitted in the interstices of the fixed roof laths, with the result that all the plants in the interior are shrouded in comparative darkness for several months. Within this covered roof when the thermometer falls to about 40° in a two-acre pinery a hundred fires are lighted, sometimes stoves. The smoke from the fires combats the frost, though the plants frequently suffer from the smoke.

In one instance last winter one of the best growers risked his one and a half acre pinery throughout the winter without using canvas. He experienced many a sleepless night, but there was no frost, and he said he had stolen a march upon his neighbours from the fact that his plants looked much better than those that were covered. However the other pineries that were darkened, bore crops just as well as his. Thus the dark treatment does not affect the accommodating powers of the plant.

The cultivation under sheds is a remarkable success, it is not only perfect garden cultivation, but it rivals the most skilfully conducted greenhouse cultivation. Nine thousand are planted to the acre, every plant practically speaking flourishes. It is not uncommon to see a pinery with 95 per cent. bearing fruit. The average is 80 per cent. The soil is an important factor. It is nearly all sand containing as it does from 96 to 98 per cent. of silica. The growers furnish all the food by fertilizers which bring forth luxuriant crops. The fertilizers are manipulated and applied with scientific precision, just what is desired to ensure complete productiveness.

There are altogether about 200 acres of cultivation under sheds. Large extensions are made annually. At the time of my visit there was one application for 100,000 suckers. A one-acre or a two-acre shed (and there are many such) is considered a lucrative investment for a small capitalist. The larger cultivators have sheds occupying from 5 to 12 acres each.

The cost of erecting sheds per acre averages fully \$300 and for the canvas as much more. They last about 7 years. Suckers cost 10 cents each, 9,000 per acre (\$900). The fertilizers cost about \$100 per acre annually. Thus an acre costs fully \$2,000 on the first crop. The first crop in about 20 months covers all expenses. The range of prices obtained is from 20 to 75 cents each. This is for "fancy" fruit, practically all Smooth Cayenne. The net profit is stated to be about 40 per cent. The leading cultivators nett more than \$3 per crate averaging 16 fruits. Some of the growers replant, after reaping each crop, some after two crops.

Throughout the year, even during the cool season, the sun shines with tropical brilliancy. During most of the year the temperature approximates to that experienced in Jamaica. During my stay it was higher than it is in

Jamaica at any time. The average rainfall for 7 years has been 49 inches and it is evenly distributed.

The suckers are set in long beds usually with 7 in the cross rows 18 inches apart and from 22 to 24 inches between the rows. The sandy soil is kept perfectly free from weeds by means a scuffle hoe every fortnight, with which also the fertilizers are turned in two or three times a year. This hoe is worked from the passages on either side of the bed.

Notwithstanding the sandy character of the soil, forests of pine trees covered the land anterior to cultivation. Oak trees are also dispersed here and there. The inference to be drawn from the presence of these and other trees, is that there is more stamina in the soil than is apparent. However the trees penetrate to a considerable depth. Certain varieties of Peaches and Pears flourish in the open when fertilizers are applied. Maize is cultivated on selected spots and yields 15 bushels per acre. In most parts the sandy soil is very deep.

The fruiting season is affected by shed cultivation. Crops are obtained to some extent at the time desired by the cultivator according to the time of planting. The principal season is in August and September. A grower informed me that the "Smooth Cayenne has the great advantage of blooming at any time." The plants that bloom in the Summer here produce finer fruit than the ones that bloom in the cool Spring. The size of the crates used by the Florida Fancy Pineapple Association is 12 by 20 by 24 inches, number of fruit 10, 12, 14 and 16.

The growers claim that the fruit from the sheds is superior to that grown in the Azores under glass, where the same variety is cultivated. One grower had a fresh stock of suckers which he imported from the Azores for propagating purposes.

JENSEN on the Indian River is situated much further south, about 27° on the east coast. Here are vast fields, many miles of solid cultivation. Altogether there are several thousand acres cultivated on either side of the railway. Perhaps there is no such concentrated area of equal extent under sugar cane cultivation in Jamaica.

The pioneer pineapple cultivator here, indeed the pioneer cultivator on the Peninsula of Florida, Captain Richards, gave me an historical account of his initial experiments; how he 18 years ago (at that time the district was a wilderness) brought the first schooner load containing 40,000 suckers from the Key Islands, how they failed except a limited number, as he knew not how to treat them in the changed conditions of soil. He returned to the Keys for another schooner load. He persevered amidst the greatest difficulties. Mosquitoes were awful, heads and faces had to be shielded by a netted contrivance. His first shipment to New York attracted great attention. A son is now a large grower, shipping from 8,000 to 10,000 crates per year (average per crate 30). This veteran is at present experimenting with Pineapple wines, etc.

This is the greatest Pineapple region in the world; about 200,000 crates containing six million fruits are shipped to the northern cities annually, and plantations are constantly being extended. Practically all the plants cultivated are the Red Spanish variety. This variety is generally admitted to be inferior in quality to several others, but growers claim that "it is the hardiest, easiest to cultivate and best suited to varying conditions." The Jamaica Ripley is well known amongst growers and is considered the most luscious of fruits, but though repeatedly tried it has not been successfully cultivated. The Smooth Cayenne is cultivated in the open to a small extent but not quite satisfactorily.

For a long period of years frost was unknown here, but the calamitous

freeze of 1894-1895, destroyed all the plantations and ruined most of the planters. However most of the growers were determined to resist all obstacles,—the class of men that make a nation prosperous. They obtained from the Keys and the Bahamas fresh supplies of suckers and made new plantations. Another freeze two years ago, much less severe than the previous one, committed considerable destruction; suckers sprang up from the ground this time. Some pineries suffered more than others. From year to year the growers live in terror of the return of this disaster, though they look forward to comparative exemption from frost upon their devoted culture.

The soil here is practically the same as that at Orlando. The soil is a mystery, chemically and physically; it is not known how Pineapples can grow in soil which is practically devoid of plant food. "Just how it is that the Pineapple can thrive in such soil that seems to be exceedingly deficient in all the necessary qualifications of good land has not been explained. It will probably be necessary to institute careful physiological experiments with the plant itself before the matter shall be thoroughly understood." Again I quote from the Agricultural experiment station Report "we have here a plant that increases in size during the period of greatest drought, when there may be no rains for 6, 8, and at times 10 weeks, in a soil containing 99.44 per cent. of insoluble residue!"

The average area of each pinery is from 20 to 60 acres. I noticed that the smaller areas were under much better cultivation than the larger. This is what might be expected, when it is remembered that a 60 acres pinery contains some 700,000 plants. Throughout these thousands of acres of pineries weeds are conspicuous by their absence. They are carefully suppressed in the early stage of cultivation. The plants are set about 18 to 22 inches apart, some 12,000 to the acre, including passages. This extremely close planting is considered advantageous.

It is claimed that this dense mass not only supports the plants and fruit, but that it prevents the growth of weeds. The first crop is obtained in about 20 months, and at this stage the fields present a fine symmetrical appearance. For the second and subsequent crops, a couple of suckers are left to each plant; this aggregates into a dense mass of plants after the first crop is harvested, so much so that one wonders how the fruit is cropped. Each sucker yields a fruit, so that greatly augmented crops are obtained. From the period of planting the cultivation is kept up from 8 to 10 years. I noted that they passed their prime in 4 years, hence frequent replanting would be better, but a crop at least is lost by replanting, and when they are densely massed a touch of frost affects them less than it does those wider apart. The 12,000 plants per acre is estimated to yield from 8,000 to 9,000 fruit per acre. These with the additional suckers yield from 9,000 up to as many as 15,000 per acre. I have frequently counted 8 and 10 fruits on a square yard. One man reaped 600 crates per acre this year, though some growers got less than 200 crates per acre, and this may be put down as the general average.

The great bulk of the crop is harvested in June. Last June the growers were unfortunate in having heavy rains (17 inches) which affected the keeping quality of a considerable number of fruits. Not long before they experienced a drought, the fruit was smaller on this account. The fruit when packed is sent by rail to Jacksonville the great distributing centre of Florida,— one day for this. They are then transferred to other trains for the north,— 3 days more. When packed in the trains, a space is left between the crates for ventilation.

The standard size of the crate is 10½ by 12 by 36 inches, two divisions.

A crate holds 18 large fruits, next sizes 24, 30, 36, 42 and 48. Average size 30. The 48's are so small that they are hardly worth shipping. Before packing each fruit is wrapped with paper.

The average amount netted per acre is about \$400, "We have had from one acre of pines containing 10,000 plants 250 crates averaging 30 to the crate, or 7,500 pineapples, netting us over transportation, commission, &c. \$2 per crate or \$500 for the acre." Others state that 100 o/o profit is realized.

The importance of ammonia and potash are constantly discussed, and potash applied at the fruiting season is said to improve the keeping qualities of the fruit. The fertilizers are mixed by the grower to suit his own opinion as to the relative merits of each ingredient. Certain fertilizers are simply thrown over the tops of the plants, but wherever practicable between them. The cost of fertilizer ranges from about \$50 to \$100 per acre per annum.

Many vegetable forms here are purely tropical, including some of our West Indian species, intermingled with scrubby oaks, &c. Innumerable trees were completely destroyed by the great freeze that swept desolation over Florida. The cool winter season here, barring frost, is quite favourable to many tropical plants. This is accentuated by the cloudless sky. The rainfall averages about 60 inches. Amongst tropical fruits that flourish here may be mentioned the mango and the avocado pear. This indicates the nature of the climate. The characteristic vegetation is the spruce pine and the beautiful palmetto which is distributed in vast numbers. Thus the two great representatives of northern and southern latitudes appear in companionship.

Besides the open system of pineapple cultivation so extensively carried on here, the Orlando shed system has been inaugurated since the great freeze of 1895, and so successfully that there is already about the same area of sheds as at Orlando, about 200 acres, and they are in point of size much larger here. Dozens of acres are being extended at a cost of more than \$300 per acre. Peaches thrive in the sheds but not outside. The Jensen (Indian River) growers cultivate the red spanish pine under sheds in contra-distinction to the Orlando growers with their smooth cayenne. As already stated frosts are less frequent and less severe than at Orlando but the temperature falls to danger point under 40° from time to time, when the plants begin to suffer. No canvas covering or fires are used here. It is found that on a cold morning, the sheds conserve the temperature to the extent of a few degrees. This is important in itself, but other great advantages accrue by the adoption of this great plant growing contrivance. The Red Spanish plants grow far more luxuriantly therein, the fruit is one third larger and it is decidedly improved in flavour, and the plants are cultivated with considerably less fertilising ingredients. Fruit burning is also obviated. Careful observation of the open fields and of the shedded fields side by side, conclusively prove the far greater luxuriance and more perfect cultivation under the latter. The adoption of this system of cultivation is quite as important for the Red Spanish variety as it is for the Smooth Cayenne.

The shed method has thus brought to light new cultural possibilities of the pineapple. Darkness during several months of winter at Orlando does not interfere with the perfect cultivation of the plant. Interrupted sunshine throughout the year by means of sheds for both varieties, enhances the luxuriance, productiveness, size and flavour of the fruit, and the cost of fertilising is materially reduced thereby. One great grower to whom I was referred by the Department of Agriculture informed me in

the presence of another leading grower, that if he had from the first, confined his attention to 10 acres of sheds, he could have done better than by cultivating 60 acres in the open. Most of his cultivation is now under sheds. And the consensus of opinion is markedly in favour of shed culture. The same grower declared that more money is made out of the Red Spanish, than from the fancy fruit at Orlando, the demand for them being infinitely greater by reason of cheapness.

Oranges too, succeed perfectly in sheds, but the lofty structures requisite are very expensive. I have seen dozens of acres. Horticulturally the system ensures the most vigorous development of plants. At the great Hotels at Palm Beach, &c., ornamental plants are extensively cultivated in sheds. A notable instance of the importance of shed cultivation was expounded to me at Washington on my return from Florida. One of the experts at the Agricultural Department thus called my attention to the fact that in the vicinity of Tampa on the west coast the shed system for cultivating Tobacco is adopted with remarkable results, both as to quality and quantity "the crop is so valuable that the land is now covered with cheese cloth placed on wood framed 9 ft. high". In Jamaica, under sheds Tobacco may become an important industry. The quantity per acre would be greatly augmented as well as improved in quality, and it can be grown in places where it cannot be grown successfully without sheds.

The conclusions I arrived at with regard to the actual benefit conferred on plants by the adoption of shed cultivation are as follows:— It mitigates the fierce burning rays of a tropical sun upon plant life. It prevents continuons and excessive evaporation. It interrupts the force of winds which conduces to increased evaporation and aridity. Thus the whole mass of plants within creates atmospheric conditions of their own, conditions which are suffused throughout the shed.

Pineapples on the Keys.

From the port of Miami 25° 70' I proceeded in a schooner to Elliott Key, and Key Largo, the latter about 25° 20' to examine the methods of cultivation adopted there. Hundreds of acres are under cultivation on these islands since about 1860 when they were introduced. On the keys an absolutely different system of cultivation is carried on. The plants are grown among the coralline rocks, between the crevices, the crow bar being used to open the crevices for the plants. The vegetation on the rocks consists of small scrubby trees. This is cut down and burnt. An inch or two of decayed vegetable matter covers most of the rocks. About a year after clearing this soil is completely washed into the crevices so that on some plantations earth is invisible, the entire surface being rock difficult to walk over. In other places there are small collections of humus interspersed among the rocks. The suckers are actually planted to the extent of 1,500 dozens to the acre (18,000.) The cultivation of each pinery is kept up about 5 years. Fertilizers are not used. The cultivators have the great advantage of having their fruit a few weeks earlier in the market, than those cultivate on the mainland and consequently realise a higher price. There can be little doubt that the earlier crop, arises from the high temperature emanated by the rock.

Hybrid Pineapples.

During my interview with Professor Webber, the eminent Chief of Hybridization at Washington, on my way to Florida, I had the gratification of seeing the first hybrid pineapple fruit. The first product of a new type of Pineapple; the result of many years of devoted skill; a new departure in the history of this fruit. This precious specimen created intense interest.

On my return to Washington from Florida, I was informed by the Chief

of the Bureau of Plant Industry, by this time other hybrid fruits each distinctly different had been received from the Experiment Station in Florida; that the flavour of several of the types was extremely satisfactory.

At Miami I visited the Government Experiment Station where these fruits were grown, and saw the plant that gave the first fruit; there are about 300 hybrid plants altogether. Over a dozen had ripened fruit by the middle of July, and many more were coming to maturity. Each plant so far yields distinctly different forms, so that they will be numerous. Some of course will be superior to others. Those that have fruited are producing suckers for multiplication. It is also interesting to record the fact that many of these plants are smooth leaved, spineless, an important consideration from the grower's point of view, for it enables him to traverse his fields with great facility as compared with struggling through the spiny masses of leaves. It is further interesting to relate that the acquisition of smooth foliage was preconceived in the hybridizing operations, in view of its advantageous results. It was a source of pleasure to me to behold these precious achievements. In the near future we shall obtain specimens; for it may not be amiss to say, the Chief of the Bureau offered me most generously everything that can be spared by the Department. There can be no doubt that these important acquisitions are destined to advance the pineapple industry and extend its popularity everywhere.

I am glad to say I have received seeds from another source of rare varieties which I have sown and hope to grow for further experimental purposes.

At the station mentioned there are also many new types of hybridized Oranges the merits of which are as yet unknown, not having borne fruit. Guavas are also hybridized here and many other tropical plants are experimented upon.

Pineapples in Jamaica.

The number of fruits exported from Jamaica a *rerage* only about 65,000 a year. This is what Florida grows on 10 acres. Quite recently the cultivation has received increased attention and judging from the area planted at least 400,000 should be exported very soon. Even this number however is closely approximated by individual growers in Florida. It will remain an insignificant industry until we export millions annually.

Much of the cultivation is far from satisfactory. Small patches have been successfully cultivated but I suspect there is hardly any cultivator of an acre or two who has not been greatly disappointed. Probably we have had about 100 acres in cultivation for years, yet the export figures only show what is capable of being cultivated on 10 acres. The condition of the soil in Jamaica is the perplexing element. This is the secret of Florida's success. Intermediate between that barren sand and the ordinary soil of Jamaica, we have to strike the best possible medium. In other words to ensure success for this culture, the soil selected must be peculiarly sandy, gravelly or rocky even to the extent of impoverishment in the natural supply of plant food, which deficiency can be advantageously added according to the requirements of the soil.

As stated, in Florida soil is the all important factor and in order to make this cultivation successful in Jamaica on a large scale, soil is the important consideration.

There can be no doubt that the kinds best adapted to cultivation in Jamaica are the acclimatized varieties. The Smooth Cayenne, which by the way I introduced to Jamaica 30 years ago, is less successfully grown than the others. It seems to grow too luxuriantly, all into rank foliage. More sterile conditions of soil should remedy this.

Messrs. Elder Dempster & Co. have with a view to improve and establish this cultivation on a commercial scale decided to cultivate several acres on the Liguanea Plain under my supervision. My long experience in tropical agriculture, coupled with the advantages accruing from a careful study of this culture in Florida, where during my sojourn on the great pineapple fields I acquired much information, will enable me to turn to practical account improved methods of cultivation, the application to our most suitable land of the accumulated knowledge of Florida. I therefore hope to be able to instruct intending cultivators as to the most approved soils and methods applicable to Jamaica.

Pineapples are exposed in Jamaica to the burning sun throughout the year far more than is the case in Florida. I feel convinced that the inauguration of the shed system merits attention for the purpose of warding off the full blaze of the sun and for securing congenial atmospheric conditions. I therefore beg to suggest that I may be empowered to make an experimental trial of a one acre shed, 2 or 3 of the best varieties to be cultivated. On the dry Liguanea Plain, in places where the soil is extremely sandy, I am of opinion that these sheds will prove invaluable.

To cover an acre with laths costs about \$300 per acre in Florida. There timber is cheap. We have bamboo which doubtless will answer the purpose perfectly, and it is cheap. Of this material I purpose making my experimental shed. Possibly creepers trained on wires might be substituted for laths eventually. The remarkable improvement appertaining to the pineapples under sheds in Florida can probably be attained by cultivation under sheds here. Thus the Ripley, judging from Floridian experiences, will be considerably augmented in size and improved in quality (a little difference in the size of the fruit doubles its value) and the fruiting season is in some measure regulated by shed culture. In Florida, as already stated, no expense is spared to ensure these conditions. Such a valuable crop is worthy of any improvement of soil, &c.

With regard to this cultivation on the rocks of the keys, similar rocky land abounds in Jamaica,— extensive areas under rank bush and considered uncultivable, These wastes with sufficient rain can be converted into pineapple fields. Little capital is requisite beyond what is necessary for the purchase of suckers. One man can cultivate several acres. Were these hills in Florida hundreds of acres would be planted yearly. Besides we are practically exempt from the plague of mosquitoes that torment the lives of growers on the keys. Sheds are not used on the keys. The rainfall is about 60 inches. In Jamaica, too, as on the bare rocky lands of the keys, limes and tomatoes could be extensively cultivated, both for England and America. Tens of thousands of barrels and crates are exported from the keys, and large sums of money are amassed therefrom.

In addition to the methods of cultivation applicable to Jamaica, to which I have referred, I have the pleasure to recommend the initiation of another system, which I anticipate will prove most successful. Bearing in mind the peculiar conditions of soil under which the plant is cultivated on a great scale, viz., in the sandy soil of Florida, and on the rocks of the keys, I have arrived at the conclusion that we have in Jamaica another peculiarly favourable condition of soil on which it can be cultivated with the greatest success. Between Old Harbour and the foot of the Manchester Hills, and in other localities, there are thousands of acres of comparatively level limestone rock, on which there is a thin layer of earth about 9 inches deep. Only small trees grow on this land. The soil is too shallow for other cultures. The rainfall is about the same as on the keys.

Sand or rocks in Florida present the most perfect drainage conceiv-

able. The other type of soil which I recommend,— a thin film of earth resting on a bed rock, it is impossible to surpass from the drainage point of view. Being fertile it is more valuable than sand. The air permeates freely. These conditions assured, abundant rain, rain that would prove prejudicial without rock, will constantly invigorate the plants. Large areas are thus susceptible of cultivation based on the merits of the soil.

Oranges.

I visited according to arrangements made at Washington a great Orange nursery at Glen St. Mary, about 30 miles from Jacksonville. Many millions of plants have been propagated here. There are here about half a million plants comprising all the best varieties of Citrus fruits. The proprietor is a well known expert. Orange cultivation prior to the great freeze of 1895, was the greatest industry of Florida, it was the chief "wealth producer" extending over an immense area to the south of Jacksonville. Previous to that great disaster that ruined thousands of families, this region was extolled as the most congenial in Florida for Oranges for it is recognised by most leading growers that the further north even to "danger point" they grow the more luscious is the fruit. This tallies with our cultivation on the hills. Another frost 2 years ago destroyed the groves connected with this nursery, the trees being frozen to the ground. Thousands of groves were also destroyed by that morning's frost over hundreds of miles of land. Many of the growers are now planting further south in order to escape the frosts. Since last frozen the trees have sprung anew from the bases of the trunks and they now present a splendid appearance having attained a height of seven or eight feet. Several stems are allowed to grow from the base,—most luxuriant stems, branches and foliage. Next year innumerable trees are expected to yield considerable crops. Only a few severe freezes have occurred in about 60 years.

In this extensive nursery thousands of small plants budded two years ago yield from 20 to 40 fruits each. I suggested that many hundreds of small trees could be grown to the acre for early cropping. These precocious trees are budded on citrus trifoliata stock. Pears, peaches and plums are commonly cultivated side by side with the orange. Many of the groves in the great orange region of Orlando that were less severely injured by frost are now in a flourishing condition, far finer trees than any in Jamaica. This is another example of the capability of a sandy soil, in which they are made to flourish by constant care and fertilizers.

At this nursery I witnessed a new departure in orange cultivation. A considerable number of plants are under experimental treatment for the Department of Agriculture at Washington, plants that were hybridized a few years ago. There are at least 50 very distinct forms, distinguishable by foliage, etc. These are about 8 feet high, and some of them are likely to fruit next year for the first time. At Miami a few hundred miles further south I also saw duplicates of these new forms at the Government Experiment Station, but much smaller plants. Varieties that will endure more frost as well as superior in point of quality are anticipated from these hybridized types.

In the orange plantation connected with this nursery my attention was directed to great piles of logs between some of the wide rows of trees. I was surprised to learn that these piles are placed in summer in readiness for the winter frost. When the temperature falls seriously the huge piles of wood are set on fire to repel the frost by means of smoke; this in the open air. The result is usually satisfactory.

Orange groves I noted everywhere are peculiarly sensitive to bad cultivation, that is by allowing weeds to grow, by withholding fertilizers, by insufficient cultivation. Wherever neglected, they languish.

The ownership of a ten acre grove has been and is still looked forward to as ample to provide all the comforts of a well-to-do family. Each tree is highly prized, for on arriving at maturity it is valued at from \$15 to \$25 "In an Orange Grove 8 to 10 years old \$1,000 per acre has often been realized."

Ordinary manure is deprecated "the benefits of barn manure in an average grove are in serious question. The fruits produced by nitrogen from this source are, as above stated usually large, coarse, thick skinned, with abundant rag and of inferior flavour."

My attention was repeatedly called to the notorious manner in which oranges are packed in Jamaica. Frequently trained packers have been selected in Orlando, sent a few days journey to New York or Baltimore at great expense and besides paid \$2 a day to rehandle orange shipments from Jamaica, that is to size, pick and repack in boxes for distribution.

Orange growers and dealers freely express their surprise at this incredible example of Jamaican incompetency. For be it remembered that the splendid quality of the fruit itself is depreciated. "Fruit which is well known by a brand will often sell readily and quickly for 50 per cent more than other fruit equally as good, but not known to be so by the buyer."

Orange and Grape Fruit groves are being largely planted in the vicinity of Miami. Plants three years old budded on small lemon stock yield 100 fruit. The size and luxuriance of the foliage is remarkable. Several of the most successful growers informed me that they did not know 10 years ago the difference between an oak and an orange tree. With determined energy and enthusiasm they have become noted cultivators.

Before the 1895 freeze five million crates of oranges were shipped from Florida valued at about fifteen millions dollars. After the freeze the number of crates fell to 100,000. Last year it increased to 750,000 and next season double the latter number are expected. California produces six million crates.

In a conservatory at Washington the most famous of all orange trees was pointed out to me, the original plant of the navel variety from which by propagation about half of the orange crop of California has originated. Californians commonly salute this wonderful tree.

Since my return from Florida I have visited the parish of Manchester the chief centre of orange production in Jamaica, more than half of all that are shipped coming from here. One firm alone collects and ships about 100,000 barrels a year.

Great benefit has accrued to Jamaica by the naturalization of plants introduced hundreds of years ago. Thus Logwood and Oranges have spontaneously overrun hundreds of miles of the Island and the former has long been established as one of the staple products. The spontaneous diffusion of a species of plant affords abundant proof of the eligibility of the environments in which it grows. Innumerable orange trees are thus widely disseminated in Manchester. Intermingled with other forest trees they have been subjected to severe conditions of existence. Thus they present a dwarf stunted aspect. Practically the only attempt at cultivation has been to destroy the native trees by which they are surrounded with the result that small crops are obtainable. From these semi-wild trees thus reclaimed from the forest the average yield is less than half-a-barrel each. A little attention is sometimes bestowed upon groups of trees. For instance trees occur on the settlers' coffee fields which have to be regularly weeded. Here they occasionally yield several barrels each and they present a distinctly improved appearance. One of the settlers pointed out a considerable group

of trees he obtained on land he purchased. A few years ago his first crop was sold for 3/, the following year he had 6 barrels and in the two subsequent years 14 and 62 barrels respectively.

The trees are very unequally distributed; in many places from 20 to 60 may be counted on an acre—occupying but a small portion thereof. Commonly from 6 to 12 of these dwarf trees are crowded in a space equal to that allotted to a single tree in Florida.

The Manchester oranges are excellent in point of quality. They are sold at 2/ per barrel of about 400 fruits. If they were carefully handled, sized, etc., and packed in boxes the value would be greatly enhanced.

It is interesting to note that several gentlemen in this parish are initiating the cultivation of budded trees with very promising results. I strongly recommend medium-sized wild trees as the best stock for budding purposes. This can be done on a large scale.

The cultivation of Coffee in Manchester is a large industry among the small-settlers. The profit realizable can hardly exceed £2 per acre. If the same cultural attention were paid to the cultivation of oranges the returns would be surprising. Instead of an acre, containing irregular groups of desolate orange trees aggregating some 30 to 60, from which 20 barrels may be obtained, 150 of these small trees could be established per acre by the simple process of transplantation. By higher cultivation than that applied to Coffee 300 barrels of oranges would be assured per acre. On the lines I have propounded orange cultivation is capable of becoming one of the great industries of the Island.

There are numerous decayed or worn out trees that should be destroyed and replaced by healthy medium-sized trees. Better to cut the transplanted trees well back to induce new and vigorous growth.

In the delightful climate of the Port Royal Mountains this tree yields the very best possible fruit. Thousands of acres could be cultivated in lieu of thousands of trees as at present. The moderate application of fertilizers would ensure splendid returns where the soil is not sufficiently rich, this applies to all parts of the Island. All the conditions referred to emphasize our pre-eminent orange growing capabilities, capabilities such as throw into the shade all Florida that culminated with returns valued at 15 million dollars. Our illimitable resources await enterprising Englishmen to embark in orange growing.

Limes grow with perfect success, double the size of those that grow on the keys of Florida. On rocky land hundreds of thousands of lime trees could be established at a trifling cost.

Cassava Cultivation.

It is an interesting fact that Orlando (in Florida) the home of the pineapple shed system of cultivation, is indebted to Jamaica for an important industry. About three years ago an American tourist in Jamaica, Mr. Perkins, was struck with the value of cassava as a starch-yielding plant. On his return to Florida he organized a company and erected a great factory at Lake Mary, 18 miles from Orlando, for the manufacture of cassava starch. I visited the factory at the end of June and was kindly permitted to see through it, the managers taking a great interest in Jamaica. One thousand acres of cassava are cultivated in the vicinity, hundreds of acres of which by gentlemen connected with the factory. There are fields of one hundred acres each which I had the pleasure of inspecting. Within 60 miles of the factory the managers purchase the tubers delivered at railway stations at \$5 per ton, and the culture is extending rapidly. This factory crushes 40 to 50 tons of tubers daily during the cropping season of 4 months. The average crop per acre is 9 tons. This plant grows re-

markably well on the all present sandy soil. On the day of my visit to a 100 acres field fertilizers were applied to the field, to the value of \$500. I pointed out that larger returns would be obtainable from a better soil, in fact double the crop. The yield of starch from the tuber is from 17 to 20 per cent. It is also noteworthy that the manufacture of tapioca and dextrine from cassava are to be taken up with the least possible delay.

The coloured labourers employed in this cultivation are paid \$1 a day. From the planting to harvest seven months are requisite. On account of the winter-frosts the seed (stem cuttings) has to be buried in the sand for several months. Great piles of them are thus covered during winter. The cost of preparing the land for this cultivation is \$40 per acre. This is for digging up the Palmetto roots which cover the land.

I quote the following from a Savannah Newspaper of June 29th, 1901, relative to this cassava factory: "Brunswick's Board of Trade held an interesting meeting to-day to hear an informal address from President Perkins of the Florida Starch Factory, and for a lengthy session President Perkins entertained a large attendance. President Perkins is en route to the North, where he will study the needs of various cotton factories in their use of starch, and will still further adapt his factory to the manufacture of products suited to them. At present his firm has about \$100,000 invested in the development of the cassava industry and the enlargement of their plant is one of the near by plans."

During my sojourn in Florida, I collected other valuable information regarding cassava as an article of food for cattle, etc. Indeed Florida is determined to make cassava a leading staple product. The matter is discussed everywhere.

From the report of the Professor at the Florida Agricultural Experimental Station I make the following extracts "With all the facts procurable, and with the experience not only of myself, but many practical farmers to support the opinion, I have reached the conclusion that, all things considered, cassava comes nearer furnishing the Florida farmer with a more universally profitable crop than any other which he can grow on equally large areas. It can be utilized in more ways, can be sold in more different forms, can be more cheaply converted into staple and finished products and can be produced for a smaller part of its selling price than any other crop.

"It is unquestionably true that cassava, all things considered, comes nearer supplying a perfect ration for farm stock than any other concentrated food produced upon Florida farms.

"Every beef animal in Florida can be put in the condition of western stall-fed cattle by the simple use of cassava at a mere fraction of the cost to the corn feeders of the west.

"An acre yielding 40 bushels of corn would at this rate produce 1,187 pounds of starch, while an acre of cassava producing 6 tons would yield 2,400 pounds of starch.

"It thus appears that cassava is to-day the cheapest known source of starch, costing at present market values of raw material only about one-fourth as much as its nearest competitor.

"Not only therefore, does the high yield of starch in cassava place it prominently before manufacturers as a probable new material for the great glucose industry, at present practically dependent upon corn, but moreover cassava contains two other constituents worthy of consideration in this connection, namely, its 3 per cent. of sugar, against the 0.4 per cent. in corn and 1.68 per cent. of fibre, as compared with 2.20 per cent. of corn.

"Manufacturers are now considering the importance of these facts, and there is good reason for expecting the erection of at least two gluco factories in the near future, which will depend upon cassava for their raw material."

The same authority says in another report: "The actual profit on the feeding of the cassava steers was 48.42 per cent on the investment. The cotton seed steers returned a profit of 37.43 per cent., and the corn fed steers 14.98 per cent. The difference between lots 1 and 2 is decidedly apparent and shews cassava to be very materially the cheapest and best ration which can be used for fattening purposes. The most astonishing fact, however, is the very great difference demonstrated between the cost and the results of feeding corn and feeding cassava, the difference being almost two-thirds in favour of the latter.

"Cassava proves itself a most superior beef fattening food. The cost of live weight beef produced by feeding cassava is 1.1 cents per pound, and in 75 days a profit of 59.10 per cent was made by fattening beef upon cassava."

The Tampa Herald says "The one thing necessary to secure for Florida an immigration that will convert our pine woods into paying farms, is the discovery and fixed establishment of a money crop; a staple that can be produced on every farm in the state, and which will always bring cash to the farmer in profitable volume so that he can every year have some surplus money to put in the Bank; unless he should prefer to enlarge or improve his farm. Now the Herald believes that this crop can be established by the cultivation of Velvet Beans, and Cassava, and the conversion of them into beef and pork. After all is said and done, meat is the great backbone of the North West, where more good money is made than any where else. Let the farmers and owners of lands demonstrate this fact, and they can sell every acre of their holdings to men that will push the stock business. We will have as many people as the land can hold. We will have a village with churches and schools in every township. We will have a wealthy and powerful State. We can have it is our firm belief."

In addition to the importance of cassava from the foregoing points of view I have the pleasure to state that I directed the attention of the Secretary of State for India four years ago to the utilisation of new varieties of this plant, (the bitter and sweet varieties have been known in one or two localities of India for hundreds of years) among the inhabitants of famine stricken regions there. I pointed out that the cassava is peculiarly drought resisting, flourishing as it does in arid regions, as well as in humid regions. Thus about 14 inches of rainfall secures abundant crops, whereas for rice cultivation from 50 to 60 inches are requisite. I also pointed out that some of the varieties when cooked as Irish Potatoes, rival that edible in point of palatableness. My letters on this subject have been published in India.

A few months ago, I received instructions to furnish two Agricultural Departments in India with these special varieties for experimental cultivation. I have obtained these varieties from Colombia from sections of it, one thousand miles apart. During my residence in that Republic, many years ago, I detected the merits of some of these varieties. Thus co-incident with the intimation to hand of the great economic importance of one or two varieties of cassava in America, the acquisition of some 23 additional varieties is most opportune. Several of these are exceedingly rich in starch. And I have just despatched to Bombay and Punjaub all the varieties. I am forming a nursery of them here, so that vast numbers of

cuttings will be available soon. I purpose establishing a plot of each variety, with a view to determine their merits here.

I am also forwarding immediately to the Agricultural Department at Washington the entire collection, also of the bitter cassava which is much richer in starch than the one under cultivation in Florida. I am forwarding a supply for extensive propagation. Millions will soon be disseminated over Florida.

Two varieties the "Bitter" and the "Sweet" have been cultivated here from time immemorial; they are also spread throughout the West Indies.

Starch is made from the former for household purposes; from the latter cassava cakes are made and frequently the roots are cooked and eaten by the peasantry though the variety is inferior. Small patches are grown everywhere by the peasantry. The total aggregate may be 100 acres, consequently seed cuttings may be obtained for thousands of acres for immediate cultivation. Doubtless twenty thousand tons of roots could be produced within a year.

The cultivation is exceedingly simple; it thrives under the most diverse conditions of climate, on the Liguanea and other dry plains, on rocky hill sides, as well as on humid plains and hills wherever the soil is friable or gravelly. To obtain large crops it must be planted annually; it may be planted twice a year in Jamaica; the roots or tubers can be dried to keep for some time; thus the weight is greatly reduced for transport to be brought from distant parts to a factory. I have mentioned that the factory at Orlando is in operation only four months a year. In Jamaica a factory can be kept going most of the year. It is impossible to exaggerate the importance of a great cassava industry in Jamaica. As a matter of fact an acre of it is worth more than an acre of sugar cane. We have cheap labour compared with Florida. The land is sufficiently rich without artificial fertilizers,

A peasant can cultivate a few acres, each yielding at least ten tons at \$5 per ton; this is \$50 per acre. A factory here would confer immense benefit on the community.

Mangoes, &c.

Palm Beach is perhaps the most famous Winter Resort in the world. At one of Mr. Flagler's Hotels 400 rooms are added annually. The tropical aspect of the grounds is extremely grand; great avenues of palms miles in length and forests of palms. The coco-nut plays an important part; thousands of them commonly 30 feet high are transplanted to command effect. Many other tropical plants are displayed here. There are also hundreds of acres of pineapples and the shed system is strongly advocated. One of the finest plantations is that of Mr. Mattham, and he has several hybrid forms from Washington. Mango and Avocado trees abound here; Mango fruit is extremely popular; hundreds of thousands are eagerly bought at about \$7 per thousand. In the city of Key West the consumption is very large and its popularity is extending northwards, where in the near future it will doubtless become a staple fruit. My programme from Washington included a visit to a noted Mango grower, Professor Gale. He was delighted to show what he has done. Great Indian grafted trees as well as our no. 11 variety are propagated far more successfully than is the case in the West Indies,— by budding, grafting, and inarching.

It affords me great pleasure to report that I obtained from the Director of Botanical Gardens at Washington six plants of a new variety of Banana; it is described amongst bananas as "the best fruit of any." My attention will be directed to its propagation with the least possible delay.

Euphorbiaceous Plants.

The veteran Director of the Botanical Garden, Mr. Smith, whom I have known for 25 years, suggested to me on my way to Florida, to consider and form an opinion, on the practicability of cultivating Euphorbiaceous plants in this region. I therefore have the pleasure to submit a few remarks. In addition to the characteristic sandy soil of the east coast, another soil rich in humus abounds near Miami, vast areas of it, namely Everglade land. Heretofore nearly all experiments with tropical fruit cultivation have been conducted on the sandy soil, where sub-tropical fruits mingle with purely tropical fruits.

In this region frost is practically unknown, coco-nuts thirty years old flourish here, large mango trees, avocado pears with large trunks, some of which must be over twenty years old, rose apple, tamarind, guava, cotton tree, naseberry (sapodilla), ponciana regia, and many tropical palms. This affords substantial evidence of the capabilities of soil and climate. The widely dispersed pine forests cover great tracts; oaks are scrubby. In this region, therefore, many tropical as well as sub-tropical forms flourish, forms that withstand the reduced temperature of the cool season. At the same time the sub-tropical conditions are typical, for oranges, grape fruit trees, &c., grow with remarkable vigour.

I have had a wide experience in the cultivation of valuable economic plants at altitudes ranging from the sea level up to 10,000 feet in the tropics. In this connection, near the equator it is interesting to observe that at an elevation of 6,000 feet mangoes, avocado pears grow side by side with exceedingly fine oranges, just as they do in Florida. At this elevation in the Colombian Andes up to 8,000 feet one of the most important species of rubber is indigenous. I started the cultivation of a plantation of this tree in its native habitat. This plantation was abandoned at the time extensive Cinchona plantations were abandoned. The rubber tree grew with great rapidity, twenty feet high in three years. It is a very distinct form of *Sapium biglandulosum*. More than a year ago I had the pleasure to direct the attention of the Secretary of Agriculture to this important plant. I now beg to say that I have carefully considered at the suggestion of Mr. Smith of the Botanical Garden, the conditions at Miami compared with those on the Andes at 6,000 feet. In the forest at this elevation Oak trees abound; there are several species of coniferous trees. Close to Miami I found many indigenous species belonging to natural orders that grow at 6,000 and 8,000 feet in the Colombian Andes, for instance, many forms of Rubiaceae a characteristic order at this elevation (amongst Urticaceae I detected at Miami a congener of Ramie with a beautiful fibre). These analogous conditions coupled with the fact that Oranges, &c., flourish at the same elevation at which this rubber tree grows led me to the conclusion that the conditions presented near Miami on the beautiful lands of the Everglades distinctly point to the practicability of growing successfully this species of rubber thereat. Where this tree grows the rainfall is more than one hundred inches a year; it delights in water at the roots when thoroughly drained. Hence irrigation from the beautiful Miami River could be made subservient.

Halfway Tree,
August 27th, 1901.

