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PLANTERS' LABOR AND SUPPLY COMPANY,
OF THE HAWAIIAN ISLANDS.

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A good receipt for blight will be found on page 192.

It is stated that the crop of the Hawaiian Commercial and Sugar Company of Maui, will be about 10,000 tons of sugar, and that the grinding will be through by the end of April.

The exports of sugar from these islands during the first three months of this year have been 80,508,798 pounds, being 9,452,901 pounds less than for the corresponding period of 1892.

The price of sugar in New York has rapidly advanced during April, and was quoted at \$3.75 per hundred pounds on the 10th for Cuban centrifugals of 96 deg. test, with prospect of still further advance.

A fire occurred on the Makaweli (Kauai) plantation, April 4, originating from a spark from the locomotive, which burned 154 acres of ripe cane near the seashore. By extra efforts, running the works night and day, and with the help of the Eleele mill, the burnt cane was ground off with no material loss in the amount of sugar obtained. Had not the factory possessed such superior facilities, and also been assisted by the neighboring mill, the loss in sugar might have been considerable, as cane sours very quickly in this warm climate.

Mr. Geo. F. Renton, formerly of Hamakua, Hawaii, has been appointed Manager of the Kohala plantation, to fill the vacancy caused by the death of the late C. A. Chapin. Mr. Renton has had several years, experience on plantations, and is fully qualified for the position to which he has been appointed.

The publication of items now and then showing an extraordinary yield of six, seven, eight and even ten tons of sugar per acre from small tracts of land may serve to show what good cultivation can accomplish in exceptionally fine spots. It must be remembered, however, that the average yield of our cane fields has never exceeded four tons to the acre, and this may be taken as the only safe basis when calculating the profit attending investments in the sugar business, and to obtain it requires not only good field work, but the highest skill in every department of the mill.

A list of fruits grown in Jamaica is printed in this number, page 175, which will be interesting, as showing how many more they have than are found here, and valuable, as the botanical name of each is given by Mr. Fawcett, the director of the public gardens in that island. There are in the list some which would undoubtedly prove an acquisition were they introduced here. The Bureau of Agriculture has here provided for it an excellent list to examine and select from. It takes years to start the cultivation of even the commonest new fruits, introduced for the first time into any country, and for this reason prompt action should be taken.

The Provisional Government has taken steps to make operative the law passed by the Legislature of 1892, to establish a Bureau of Agriculture and Forestry, by appointing the following four members of the Bureau, who have named a Commissioner of Agriculture. They are William G. Irwin, John Ena, A. Herbert and A. Jaeger, and they have chosen Jos. Marsden to serve as Commissioner of Agriculture. Mr. Marsden has promptly issued a report on the situation, calling attention to the spread of insect pests, and the best method of treating them. Insecticide wash can be pro-

cured at the Government nursery, by an order from either E. O. Hall & Son or the Pacific Hardware Company. The fact that the blight is spreading and doing much damage to our best fruit trees should spur every one to prompt action in this matter. Mr. Marsden's report is printed on page 171.

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HAWAIIAN COMMERCIAL STATISTICS.

The trade of the Hawaiian Islands for 1892, as given in the Collector-General's annual report, shows a decline in exports over those of the previous year. There is also a considerable falling off in value, owing partly to shrinkage in the quotations. The total foreign and domestic exports exceed eight millions. The following table shows the domestic exports in detail :

ARTICLES.	Quantity.	Value.
Sugar	pounds 283,656,715	\$ 7,276,549 24
Rice	pounds 11,516,323	493,651 89
Hides	pounds 21,622	52,846 51
Bananas	bunches 105,375	104,945 00
Wool	pounds 288,969	32,185 23
Goat Skins	pieces 3,449	1,422 55
Sheep Skins	pieces 5,358	938 70
Tallow	pounds 792	45 00
Molasses	gallons 47,988	5,061 07
Betel Leaves	boxes 121	556 00
Coffee	pounds 13,568	3,238 00
Taro Flour	pounds 1,568	121 00
Guano	tons 61	2,132 00
Watermelons	pieces 179	180 00
Pineapples	pieces 19,471	10,139 00
do	boxes 900	
Plants and Seeds	packages 6	50 00
Sundry Fruits	boxes 333	609 00
Awa	pounds 8,179	776 00
Bones and Horns	pounds 40,315	475 00
Curios	packages 1	45 00
Sundries		3,971 86
Total		\$ 7,959,938 05

The exports of sugar and molasses for the past sixteen years are shown in the following table:

	Pounds Sugar.	Gallons Molasses.		Pounds Sugar.	Gallons Molasses.
1876	26,073,429	130,093	1885	171,350,314	57,931
1877	25,575,985	151,426	1886	216,223,615	113,147
1878	38,481,458	93,136	1887	212,761,647	71,222
1879	59,020,972	87,475	1888	235,688,346	47,065
1880	69,583,871	108,355	1889	242,165,835	54,638
1881	93,789,483	263,587	1890	259,798,462	8,661
1882	114,177,988	221,293	1891	274,989,580	55,845
1883	114,107,156	194,097	1892	263,656,715	47,988
1884	141,653,923	110,530			
Total Exports for 1892				\$ 8,060,087 00	
Total Imports for 1892				4,684,207 00	
Total Foreign Trade				\$12,744,294 00	
Exports Exceeded Imports by				\$ 3,375,880 00	

The following table shows with what countries the trade of Hawaii is connected :

COUNTRIES.	EXPORTS.			Imports.	Total Import and Export.	Per Cent.
	Domestic.	Foreign.	Total.			
U. S Pacific Ports.....	\$7,949,460 19	\$ 80,437 83	\$8,029,918 02	\$3,022,597 21	\$11,652,425 23	91.43
U. S. Atlantic Ports.....				215,852 70	215,852 70	1.69
Great Britain.....				380,079 89	380,079 89	2.98
Germany.....				99,113 87	99,113 87	.78
China.....	16 00	2,266 60	2,282 60	154,696 98	156,979 58	1.23
Japan.....	346 50	200 00	546 50	60,003 87	60,550 37	.48
Australia and N. Z.....	8,034 00	4,975 00	13,009 00	105,263 42	118,212 42	.93
British Columbia.....		615 00	615 00	25,159 00	25,774 00	.20
Whaleships.....		4,954 92	4,954 92	12,139 20	17,094 12	.13
Islands in the Pacific.....	2,061 36	6,999 81	8,761 17	4,608 85	13,570 03	.11
France.....				4,642 31	4,642 31	.04
Total.....	\$7,959,938 05	\$ 100,149 16	\$8,060,087 21	\$4,684,207 31	\$12,744,294 52	100.00

The United States received 91.40 per cent. of our exports, against 85.37 in 1891.

The following table shows the fluctuations in our foreign trade during the past ten years :

YEAR.	Imports.	Exports.	Excess Exports.	Excess Imports.
1883.....	\$ 5,624,240 09	\$ 8,021,843 88	\$ 2,397,603 79	
1884.....	4,637,514 22	8,195,182 63	3,557,668 41	
1885.....	3,880,544 58	9,069,318 01	5,238,773 43	
1886.....	4,877,738 73	10,457,285 58	5,579,546 85	
1887.....	4,943,840 72	9,529,447 33	4,585,606 61	
1888.....	4,540,887 46	11,707,593 76	7,166,711 30	
1889.....	5,488,790 63	13,874,341 40	8,485,550 77	
1890.....	6,982,201 13	13,142,829 48	6,160,628 35	
1891.....	7,439,482 65	10,258,788 27	2,819,305 62	
1892.....	4,684,207 31	8,060,087 21	3,375,879 90	
Total.....	\$ 52,979,447 52	\$ 102,316,722 55	\$ 49,337,275 03	

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CULTIVATING TEA PLANTS.

We have before referred to the experiment of raising tea that is now being made in Kona, Hawaii, and good reports continue to be received from it, showing that the plants thrive as well as in their native soil. One of our American exchanges refers to tea culture being successfully engaged in in various parts of the Southern United States, and to the fact that a small plot—say five by twenty yards in size—will furnish all that is required for a small family, and that many families there use none but what is grown by themselves. It is also stated that the gathering and curing of the leaves do not require any more care than that of tobacco, the work connected with which is easily learned, and is followed in

many sections of the United States. Tea seeds can readily be obtained from the Agricultural Department at Washington, and also in Ceylon. Japan tea costs here from sixty cents to one dollar per pound, making it quite an item in the family expenses. And a great deal of the article sold everywhere is vile stuff, adulterated or doctored with coloring substances, more or less injurious to health. The choicest tea is kept for those who are willing to pay the price demanded—from two to five and even ten dollars a pound. Now as it can be grown in every district on these islands, here is an industry which, with a little care, may be made productive of income, inasmuch as every pound raised and not required for home use, can be disposed of at a profit.

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THE AMERICAN BEET SUGAR CROP.

The production of the beet-sugar in 1892 in the United States was more than double that of 1891. Willett & Gray's "statistical" gives the following as the total production of beet factories during the season of 1892 :

	<i>Pounds.</i>
Norfolk Beet Sugar Co., Norfolk, Neb.....	1,698,400
Oxnard Beet Co., Grand Island, Neb.....	2,110,100
Utah Beet Sugar Co., Lehi, Utah.....	1,473,500
Chino Valley Beet Sugar Co., Chino, Cal.....	7,903,541
Alameda Beet Sugar Co., Alvarado, Cal.....	2,506,860
Western Beet Sugar Co., Watsonville, Cal.....	11,390,921
	<hr/>
Total for 1892.....	27,083,322
Previous season's production.....	12,004,838
	<hr/>
Increase of 1892 over 1891.....	15,078,484

The comparison of the two years, by localities, shows the greatest increase in production was in California :

	<i>1891.</i>		<i>1892.</i>
Utah.....	1,094,900	pounds.	1,473,500
California.....	8,175,438	"	21,801,322
Nebraska.....	2,734,500	"	3,808,500
	<hr/>		<hr/>
Tons of 2,240 lbs.....	5,359		12,091

LABOR ON HAWAIIAN PLANTATIONS.

Among the questions involved in the proposed change of the present Hawaiian Government by its absorption in the American Republic, and which has brought out much comment, is the labor system on our sugar and rice plantations. If we rightly understand the American law, no contract made abroad for any class of laborers is binding in the United States, and a penalty attaches for every attempt to evade this law, which is designed to prevent the importation of foreign laborers of any kind whatever, skilled or unskilled.

Laborers on Hawaiian plantations come here under a verbal promise or a written engagement to enter into a three-years' contract immediately on arrival. These contracts are generally favorable to the laborer, and in the case of the Japanese, where a portion of the wage is paid to the consul, many of them close their term of service with a handsome cash balance to their credit. In fact, they return comparatively independent to their homes in Japan, which they left as poor men three years before.

As some of the existing contracts contain penal provisions, these will, in the event of annexation, require to be changed. This might be done readily, if a small advance in wages were offered. It would seem, then, that our labor system, as thus modified, might be made to suit the new order of things, without injury to the planting interest.

The plantations employ about 20,000 laborers, of whom at the present time only 9,379 Japanese and Chinese are under contract, out of a total of over thirty thousand Asiatics residing in the Islands. Besides the above, many Hawaiians, Portuguese and others are employed under various forms of service, mostly as day or month laborers.

There is another system of service now being tried on several estates, which promises to work well, being based on the co-operative plan. A planter takes a tract of, say one hundred acres, more or less, and engages to plow, plant, cultivate and harvest for one-fifth of the sugar manufactured from it, less certain small charges. He is furnished by the plantation at cost with all the necessary tools, and agrees to provide all the labor that is required to work the tract as-

signed to him in the best manner possible. For each laborer in his employ, while the crop is growing, he receives from the plantation, say, ten dollars a month on account. When the cane is ground and the sugar delivered in Honolulu, he is credited with one-fifth, or whatever proportion may have been agreed on, of the sugar produced from his tract, which sum is equitably divided among all who have shared in the cultivation of the cane. This plan has been tried on several estates, and has worked well for all, though experience will doubtless show how it may be improved for the benefit of all interested. It is a system that can be readily adopted on any or all the plantations. The labor question will, therefore adjust itself to any changes that may be required whenever annexation may take place, and without much, if any, loss to the plantations, and in the end both employers and employees will be the gainers, for time will show that annexation will be a wise policy, not only for every industrial interest here, but equally so for the United States.

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A MISSTATEMENT CORRECTED.

“Sugar,” says the Inter State Grocer, “in both a literal and metaphorical sense, is at the bottom of the Hawaiian revolution. In a literal sense because with annexation the Sandwich Islands will be entitled to the sugar bounty. In a metaphorical sense because there is sugar in it for the professional politician, and most of all to the few American capitalists—Spreckels, et al—who own and work the sugar plantations.”

The above clipping is a sample of statements frequently made in American papers opposed to the annexation of Hawaii to the United States. The assertion that Col. Spreckles is one of the prime movers of the Hawaiian revolution is without the shadow of foundation. He had nothing to do with it whatever, and was greatly surprised when he heard of it. So also with planters residing in these islands,—not one of them anticipated revolution, or dreamed that it was among the possibilities until after the attempt of the Queen to abolish the Hawaiian constitution and replace it with one of her own making, which would have disfranchised every foreigner residing in these islands, excepting the few who are married to natives. No, sugar had nothing to do with the revolution, and had it not been for the treasonable act of the Queen, which no one knew of except a small coterie round her,

her government might still have been in power. Nor has the sugar bounty had a feather's weight in any act of the revolutionists who outnumber the planters here one hundred to one. The general belief here has been that the bounty will be repealed by Congress and a small duty replaced on all sugars imported into the United States—raws and refined alike. But as stated before, the sugar men have had no leading part in the events transpiring here during the past three months, nor have these events any connection with the sugar bounty.

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ELECTRICITY IN SUGAR MAKING.

The new discovery patented by Mr. James Greenwood, of the profitable production, on a commercial scale, of caustic soda, chlorine, etc., direct from brine by electrolysis, which is just announced, recalls the abortive results (not to mention swindles) which have hitherto attended the attempt to obtain refined sugar by the same means. We have not concealed our belief that it may be possible to discover a method of refining by electricity, nor shall we be surprised to hear of further attempts in this direction. But it may be safely assumed that the question of making such a process (when once discovered) commercially profitable, will be a very difficult one, the solution of which may be deferred for many years. As an instance of the partial employment of electricity in sugar making, may be quoted the fact that at the Hoym factory in Anhalt, there has been at work, since the middle of November, a process for purifying the diffusion juices by means of electricity. The proprietor, Herr Behm, is credited with the statement that the cost of setting up was already covered at the end of five or six days' working. The advantages are said to be—the small quantity of lime required; successful filtration of the scums, even where the beets were in very bad condition; easy boiling and evaporation; a dry-masse-cuite; a polarization always above 98°, with a yield of 71 per cent., or more, of the weight of masse-cuite. The sugar tests very high, because of the relatively small quantity of ash, varying between 0.36 and 0.40. The crystallization of the lower products was rapid, and high yields were obtained in all sugars. It is thought that the saline contents may be still further reduced by at least 0.10.—*The Sugar Cane.*

CORRESPONDENCE AND SELECTIONS.

THE TEA INDUSTRY OF CEYLON.

EDITOR HAWAIIAN PLANTERS' MONTHLY: The tea plant, a shrub indigenous to Assam, India, and China, and some other parts of Asia, and cultivated in Ceylon, Java, and, to a small extent, in the south of Africa, has' undoubtedly undergone more change in the mode of cultivation and manufacture during the last ten years than any other agricultural product grown in the tropics. Until recently tea planting was a Chinese monopoly, and no doubt the change from these celestials to the more enlightened ideas of their white brethren has produced the effect so visible in the tea industry of the present time. The custom-house returns of Great Britain give an idea of how the British grown teas stand in relation to that of the Chinese. In 1891, the following was imported to the U. K. from China—52,000,000 lbs., and in 1892, 34,000,000 lbs., a decrease of 18,000,000 lbs. in one year. From the same source do we find the following: Tea imported to U. K. from Ceylon in 1891 was 51,000,000 lbs., and in 1892 it increased to 72,000,000 lbs., or rather more than China decreased. India also exported to U. K. in 1891, 99,000,000 lbs., and in 1892, 109,000,000 lbs., which shows the progress of that country in the tea line.

The peculiar habits of the Chinese are widely known, if not so much appreciated as they might be, and with results as the above figures show, give little room for appreciation, even with what has been their main source of wealth for many years. A few facts regarding tea culture and manufacturing in China would be interesting enough, especially when you come to think of their highly flavored teas not being natural but scented by the using of different flowers, etc., a secret to the Chinese.

Further details than that the tea is mostly made by the hands are unnecessary, and the less said about it the better. Allow it to remain in its primitive state until it dies a natural death, which it will soon do at its present rate of decrease. The tea plant is a very hardy one and grows well at both

high and low elevations and in different latitudes; for instance, in Ceylon it grows from sea level up to 6,500 feet, and in India, as far north as 30 degrees, it grows up to 1,000 feet. At high elevations the growth is not so rapid and a less yield per acre, but a very rich flavor which makes up for deficiency of crops. In lower lying places the growth is more rapid, and plucking must be done every eight or ten days, the leaf being coarser and lacking flavor, but by a little extra rolling a good, strong, useful tea is procured.

In Ceylon the tea leaf, after plucking, is entirely plucked out on tatties (made of hessian or wire) to wither, and after being properly withered (which can be done artificially), is taken and put into a roller and rolled for one hour or more until a good twist is obtained and the leaf well broken up. The next thing is fermenting; when the leaf is taken out of the roller and spread out three or four inches deep and covered up until it has changed color from green to brown or copper color, and then taken and put through a drier at a temperature of 200 degrees, which gives the crispness and black color of made tea.

The tea at this stage is called bulk or unassorted, and for the purpose of grading is taken and sifted into different grades, through different sized sieves, into "Broken Orange Pekoe," "Orange Pekoe," "Pekoe Souchong," "Souchong" and broken tea, dust, etc. There are many more grades such as "Golden Tips," "Flowery Tips," "Orange Tips," etc., which go under the name of "fine teas" and are only obtained under very favorable circumstances. After the teas are thus classed they are again fired at about 200 degrees, called "final firing," and now being thoroughly desiccated are taken and packed hot into boxes of 50 and 100 lbs. for exportation.

Great care in every item of the preparation is most essential, as any one item not properly done results in the making of inferior tea. Careful plucking is the first consideration and nothing but the young tender shoots should be taken to make tea with, as the older leaves (called bangy) are hard, and will neither wither, roll nor ferment properly.

The withering of the leaf is also a precarious business, as an underwither breaks during rolling and turns out a green infusion with weak tea. On the other hand, an overwither

is just as bad, as it won't roll equally nor ferment equally and turns out a bad, unequal infusion. The proper stage to wither at can only be determined by the eye and feel of the hand after a certain amount of practical experience.

The rolling of the leaf must also be done systematically, as a long time of an equal heavy pressure causes a heat in the roll, which brings on premature fermentation and spoils a good after fermentation. Too light rolling does not break the leaf enough, but in cases where fancy teas are made, light rolling is adopted to give a fine twist. In ordinary cases the leaf should be subjected to both heavy and light rolling alternately, to start with a light pressure until the leaf gets on a little twist, after which extra pressure can be used for breaking up all the fibres of the leaves; the two points necessary are a good equal twist and the leaf thoroughly broken; unless the leaves are well broken a good fermentation cannot be obtained as an unbroken leaf wont ferment.

The next process after rolling is that of fermentation; and as fermentation goes on much quicker at a high than a low temperature, and as the proper stage can only be determined by appearance, it must be carefully watched and taken to be fired at the right time, as the color of the leaf when put into the drier turns out exactly the same color after infusion in the cup; hence an underfermentation turns on a green infusion, accompanied by a weak though rather pungent tasted tea (water). An overfermented leaf turns out a dark infusion with a soft, muggy tea, and lacking raspness or pungency.

Careful withering, rolling and fermenting can only produce a tea with a good appearance as made tea, a bright coppery colored infusion, and in the cup a well colored, strong and pungent taste. The processes of sifting and drying are attended with less risk, as certain rules are applicable to the different machines used for the purpose, the drier being kept at a temperature of about 200 degrees, and sifting machines and breakers regulated to sift and break the tea into different sizes or grades. The tea planting enterprise in Ceylon has been furthered by the Ceylon Government and District Societies, and though not an old established industry has attained a proficiency undisputed and unexcelled.

Yours truly,

Ceylon, January 25th, 1893.

J. A. HUNTER.

HANDLING SUGAR CANE.

[A paper was read by Mr. John Dymond before the Louisiana Sugar Planter's Association, March 9, 1893.]

(From *The Louisiana Planter.*)

In ante-bellum days the great difficulty attaching to the transportation of sugar cane was fully recognized, and it became a common practice on large plantations, where there was any considerable distance to haul cane, to construct additional sugar houses in preference to continuing the long haul. The great benefits to be derived from the occasional large crops, when successfully harvested, were frequently lost from the very fact that the larger crop so prolonged the grinding season that the rainy weather of January was reached, and with bad roads the sugar cane was frequently not worth the cost of its transportation. Even since the war, some sugar houses have been built, or re-built, in order to locate them near the cane fields to shorten the haul.

From this we can readily see the gravity of the case. Our old sugar planters were not dismayed by trifles, and yet they found from long experience that sugar cane was not worth cultivating if it had to be transported in the usual way over any considerable distance. The common conviction was that all sugar cane intended for any one sugar house should be cultivated within at least one mile of the house, and that cane located at a distance of greater than two miles could not be depended upon to ever reach the factory.

The development of central sugar factories in the tropics, and the construction of tramways there to bring cane considerable distances, has changed all this, and now we are beginning to find that the cost of sugar manufacture can only be made reasonably low by carrying it on in a very large way. In order to do this it becomes essential to transport sugar cane over long distances, and the work is now being carried on largely in this State by our public railways and by private tramways. In this way sugar canes are brought from distant points directly alongside the cane carriers of the various factories, and the labor at the factory is really reduced, as compared with the old method of handling there, and attention is now concentrated upon means of reducing the cost of handling the sugar cane at the various points where it is loaded into the factory cars.

In 1869 a German portable railway was introduced into America by Mr. Peteler, of Staten Island. It was then described in the *Scientific American*, and was utilized in transporting earth in the creation of Prospect Park, Brooklyn. Mr. John Dymond, of the Lower Coast, Louisiana, then in New York, investigated this railroad, and bought the right to use it on his plantation in Louisiana. This road was made of wood and had dumping cars, and was such as was used in the Black Forest, in Germany, for the transportation of wood from out the swamps. It seemed to have served its purpose very well there, but being cumbersome, and the average weight of cane per acre grown in Louisiana being much smaller than now, the use of this railway was abandoned as more expensive than the old method of handling cane in carts or wagons. At about the same time the emancipation of the slaves in Cuba and the increased scarcity of labor there, and the fact that the Peteler portable road had been used in Louisiana, led to its investigation by some Cuban planters and to their adoption of it for use in Cuba. It seems to have succeeded better there than in Louisiana, probably owing to the fact of their larger crops of cane on a given area of land.

It was, however, quickly improved, and John Fowler & Co., of Leeds, England, who were then selling steam plows in Cuba, took up a peculiar English patent for a corrugated crosstie, which, when made of sheet steel, permitted the construction of a very light portable railway. The late Hon. Duncan F. Kenner, visiting England about 1880, was led to investigate the merits of this railway, owing to its announced success in Cuba for the transportation of the sugar cane directly from the fields where cut to the factory where used, and he introduced it for use on his Ashland and Bowdon plantations, in the parish of Ascension. In this he was followed by Mr. John A. Morris, on the Ashton plantation, and a year later by Gov. H. C. Warmoth on his Magnolia plantation, and by Mr. Dymond again on his Belair plantation. This Fowler portable road really seems to have considerable merits, owing to its lightness. The rails being made of 10-pound steel and the ties of corrugated sheet steel, the very lightest practical form for a portable road be well taken care of, it can be kept in order for many years.

With it, it is practicable to take the canes directly from the field, where cut, and deliver them alongside the cane carrier at as low a cash cost as by ordinary means of cart or wagon transit, and at the same time requiring an extremely small mule force to transport the cane.

The chief difficulty with this road is its considerable cost and the large number of cars that is necessary to carry on the work economically. The gauge of this road that was and is used in Louisiana is 24 inches, the cars holding about one ton of cane each. Experience has shown that it is almost impossible with 100 cars to deliver over 150 car loads of cane per day from a distance of a mile and a half or more. As 100 cars cost \$3000, the large amount of capital so employed becomes a serious objection to their use.

There has been a considerable development of other kinds of portable railway, and especially the one made by the Pioneer Iron Works, of Brooklyn, N. Y., of which Messrs. Minnigerode & Co. are the agents in New Orleans, and of which there are numerous outfits now at work in this State.

Notwithstanding all this, the disposition of the sugar planters during recent years seems to have been toward the construction of permanent tramways, leading to remote cane fields where depots or dumping grounds were located, and the canes brought to these grounds or yards by cart or wagon and there loaded into the small cars of the tramways. This method of cane transportation at once suggested to our inventors the need of some means of taking the cane directly from the cars and dumping it into the cars without the cost of reloading it from the ground. This seems to have been successfully done with a number of inventions, which will be discussed here to-night, and my chief motive in this paper is to give an historic statement of the case and the needs of the industry which have led up to our present advanced position therein.

The various plans of cane transfer, whether by platform dumping or by derrick lifting, seem at present to give satisfaction and to have very largely cheapened the cost of the work, in fact sufficiently to warrant the production of sugar cane at points where it otherwise would not be carried on. The same devices applied to the smaller plantation tramways

are also applicable to our larger steam railways, which are now carrying sugar cane long distances, and it is to be hoped that the cost of all of this kind of work can be so cheapened as to quickly give every cane field, no matter how remote, easy access to first class sugar factories.

The sugar house is no longer built within a mile of its own cane field. The cane must now seek the sugar house, whether the distance be one mile or ten. The old problem of handling sugar cane was solved by the proximity of the sugar house, the new one by the modern railway and inexpensive transferring from carts to cars.

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SEEDLING CANES.

[Results obtained on the L'Etoile Parnasse Estate by Messrs. Littee Freres.]

(From The Manchester Sugar Cane)

We have on various occasions presented to our readers accounts of experiments in the reproduction of cane from seeds made by two of our most skilful cultivators, Messrs. Littee Freres, on their estate at Parnasse. We are now glad to be able to furnish particulars of extremely encouraging results obtained by these gentlemen.

Before entering on the scientifically accurate details which we find in the documents communicated to us, we will just remind our readers of the manner of procedure adopted by Messrs. Littee Freres.

The observations which we are considering refer to two categories of canes descended from seed; one being young plants sprung spontaneously in 1889, and found by the observers in consequence of indications given in this journal; the other having come from sowings made in 1890, and been carefully tended from the earliest stage of growth.

The parentage of some of these is unknown. Of others, the origin is partly known, the variety from which they proceeded having been noted. Messrs. Littee have not pursued a purely scientific object; they have not gone in for growing this or that kind of canes. On their estates are cultivated only the best kinds of cane, which have been recognized as such after a long course of successive selections. In common with those in our hemisphere who have discovered the semi-

nal fertility of the cane, and for six years have been devoting themselves to the study of this new science, they thought that the spontaneous products of the best kinds offered every chance of giving the best results, and have left to chance the care of fertilizing the flowers, trusting to their sagacity and their long practice to discover when the time had come, the finest specimens, and to separate them from the ordinary ones. At the same time they noted the variety from which the seeds sown by themselves had been obtained.

They have not been deceived in their calculations, and experience has shown that the same thing had happened elsewhere, and Messrs. Harrison and Jenman, in a very voluminous report on this subject published in 1891, express themselves as follows on the point :

“There is no proof that the chances are not equal, or even greater, of finding a new greatly improved cane by natural production left to the care of chance. Incomparably the most marked progress at present achieved has been realized by heterogeneous wild canes, of unknown paternity, gathered in the fields of Barbados.”

Having said this much we will allow the documents to speak which have been communicated to us. The first of these documents is a letter of Messrs. Littee to M. Rouf, accompanying samples of cane sent to that skilful chemist for analysis. This letter dated October 28, 1892, and runs as follows :

“This sample, and those which follow it, come from our sowings of seed commenced on the 12th November, 1890 ; the plants which have sprung from these seeds were turned out of the pots and planted in the ground in May and June, 1891, to the number of about 4000, on a superficies of one carre (1.29½ hectare=3¼ acres.) As you see, they were planted wide apart, They have been manured with farm yard manure, and had two months after, a dose of 60 grammes of your fertilizers S. P. R.

“It is therefore about twenty-three and one half months since these cane were sown, and seventeen months since they were planted out.

“At the time of the cyclone they had attained a certain amount of development, and were completely ruined, so that

we had doubts of being able to save them. Happily they had got through this first trial, and if it had not been for the worms and for what people have agreed to call the *cane sickness*—to whatever cause it may be due—by which they have been specially attacked, they would certainly have done better. Any way, the plot of land, on the whole, has produced a lot of canes, and now these have been cut, there remains on the stumps a large quantity of cuttings of all sizes, so that we have let them stand for another crop.

“We shall inform you of the final result, in litres of juice, of the whole plot, compared with what it habitually gives in canes planted in the usual manner.”

A letter of the 22d November gives the comparative yields promised in the preceding one. The same plot gave :

In 1892.....	43,103	litres of juice.
“ 1888.....	65,008	“ “ “
“ 1882.....	42,703	“ “ “
“ 1877.....	58,955	“ “ “

“While falling below the yields of 1888 and 1877, it slightly exceeded that of 1882, which might have been affected by various adverse circumstances, but certainly had not to suffer from the effects of a cyclone, nor yet at that time of any disease whatever.”

Such is the net result, and we may say with Messrs. Littee that “there is not very much to complain of,” especially when we consider that the general yield of the canes affected by the cyclone was inferior in 1892 by half.

But in the lot, as a whole, there were both splendid canes and abortions; and the task is to distinguish and pick out the former and destroy the latter. It is to this practical selection that Messrs. Littee are now devoting themselves, guided in their labors by the analysis of M. Rouf, and we may add that no one is more fitted to bring this delicate task to a good end.

From the 4000 canes planted on the one carre of ground, Messrs. Littee took a certain number of samples which seemed to them the most noteworthy. Six of these samples were analyzed by M. Rouf.

Four of these samples, Nos. 12, 13, 14, 15, came from seedlings; two are from shoots from canes found springing up spontaneously in 1889, from which a previous crop had been

taken. These are Nos. 7 and 10. On coming to classify these six samples in order of extractible sugar, we see that there are, per stool :

OF EXTRACTIBLE SUGAR.

No.	Kilos.	Pounds.
15 -----	19,473	42,838
10 -----	13,237	29,187
7 -----	11,104	24,484
12 -----	9,827	21,668
14 -----	7,027	17,258
13 -----	3,746	8,260

Nos. 15, 7 and 10 are, therefore, very remarkable varieties ; Nos. 12 and 14 are somewhat poorer, but they are superior to the canes which we are at present cultivating, for a carre, planted with canes such as No. 12, would give 39,308 kilos (86,674 pounds) of extractible sugar, and with canes of No. 7 (sic) quality. 28,108 kilos (61,978 pounds.)

Sample No. 13, the poorest, would still surpass our first-class cane, with a yield of 14,984 kilos (33,040 pounds) of extractible sugar per carre.

If we make similiar calculations for Nos. 15 and 10, we shall get formidable figures.

The cane No. 15 gave, per stool, a weight of 311 pounds of cane, and 43 pounds of extractible sugar ; with 4000 plants of cane to the carre, this would mean a production of 1244 pounds of cane and 192 pounds of extractible sugar. The cane No. 10 would yield 968 pounds of cane and 117 pounds of extractible sugar, and the cane No. 7, 894 pounds and 104 pounds respectively.

It is, of course, understood that we may have only drawn up these figures as a matter of curiosity, and that we do not for an instant cherish the hope of seeing such results verified in practice. We know what is the difference between a cane plant which has sprung up under all the most favorable circumstances, whether due to the care of man or to chance, and a field of canes exposed to the vicissitudes of actual vegetation. But as we have recorded the increditable retrogressions which have been met with in these experiments, and described a cane raised from seed hardly as big as a plant of guinea grass, so we now tell of exceptions in the contrary sense.

These extraordinary canes can be fixed as species by means of cuttings. This is what Messrs. Littee have done, and we may imagine the care that has been taken with these plants. If they only preserve even a portion of their original properties, the margin is so great that we may hope to see obtained from them a greatly improved cane, perhaps a means of salvation for the industry. However, that may be, we are fully warranted in characterizing the results obtained by Messrs. Littee as very remarkable and exceedingly encouraging, and congratulate them warmly on their success.

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CULTIVATION OF ARROW ROOT.

The best variety of arrow root, the *Maranta arundinacea*, which is grown so extensively in the Bermudas, thrives well in any warm country. It attains the height of two feet, and bears, at maturity, a small white flower somewhat resembling the potato blossom.

The mode of cultivation is as follows: The ground is plowed in ridges of about forty-six feet wide, and thoroughly harrowed and scarified. Nine rows are placed in this five feet apart, leaving six for the row in which the by-furrow comes. Shallow furrows, five inches deep, are run with the plow, then the smaller bulbs, about the size of a small apple, which are found growing at the bottom of the stems, are placed four feet six inches apart in the drill, and covered by turning a furrow from each side on to the top of the bulbs. Afterward, cultivation is carried on by keeping the ground clear of weeds by means of horse hoes or scufflers. When the plant reaches the height of about three feet, the space between the rows is turned up with a one horse plow, the soil thrown toward the plant, and a furrow left in the middle. It requires nothing further until it is dug up for the mill. When the tubers have come to maturity, which is generally in ten months or a year, the crop is ready. The stalks of the plant are then cut off as close as possible to the tubers with a cane knife or a strong reaping hook. The tubers are then raised with grubbing hoe or mattock. With all speed they are placed in carts and conveyed to the mill, for the color is seriously affected by being exposed to the sun or weather be-

fore grinding. Sometimes as much as fifty pounds of tubers are obtained from one plant.

The machinery consists of a six horse power engine, a root washer, grinding mill, cylinder sieves for separating the farina from the fiber and pulp, and a centrifugal for drying. The root washer is a trough ten feet long, three feet deep, and two feet in diameter. This has a half circular bottom, through which a stream of water is constantly running. A spindle, having pegs about four inches apart and of a sufficient length to reach within an inch of the bottom and sides, revolves in the trough. The pegs cleanse the bulbs of all dirt, and they gradually work down to one end of the trough. A wooden rake pushes the bulbs out into a continuous belt elevator, and thence they are conveyed to the hopper of the mill. This is a wooden drum two feet six inches on the face and two feet in diameter. It is covered with a sheet of galvanized iron, punched and placed on with the burr on the outside. The drum revolves at great speed, and a stream of water falls on it from tanks fixed above. Thus the bulbs are grated up, the bulbs and the water passing through the sieve No. 1, which is a cylinder eight feet long with the bottom half perforated with holes about the size of a No. 7 wire nail. Within this a beater revolves, forcing the water and farina through the holes, and being placed on a screw the pulp and fibre are forced out at the end. The farina and water pass into sieve No. 2, which is similar to No. 1, only with holes about the size of a large pin head in the bottom of copper. After this the liquid runs along a trough two feet wide, six inches deep and seventy feet long. The farina is deposited at the bottom of this, and the water passes off. The farina is now dug out and passed through sundry more sieves, washed by hand and in tubs, then finally left to subside. When pretty firm it is taken out and passed through a centrifugal machine. It is now placed on the drying frames. These are wooden frames about six feet six inches long, with marsupial netting and calico stretched upon them. They are placed away from any dust or smoke, and the wind passing underneath, as well as the sun above, aids in the drying process. But the sun and air are not alone trusted with the drying. A drying house has been erected, capable of accom-

modating 180 frames. This is heated by steam pipes to 140 degrees Fahr. The value and market price of arrow root depend so much on the color and quality, that the greatest care is necessary throughout its manufacture, and only very clear water is used in the washing.—*Australian Journal*.

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KAINIT IN THE STABLES.

The German kainit contains about 22 per cent. of sulphate of potash, with sulphate of magnesia, chloride of soda and chloride of magnesia. It is soluble in less than twice its weight of water, and can, therefore, be used readily either dissolved, and sprinkled over the stables, or spread by hand. It not only adds potash to the soil, but, according to the best chemical authority, such as Burner and Brimmer, "it unites with the ammonia in the manure," and it also has another valuable quality of gathering additional ammonia—most probably from the atmosphere. In researches on the action of kainit and other substances on manures, the German Experimental School during the past year found the following results: Portions of old manure were subjected for a year to the action of lime, plaster, sulphate of magnesia and kainit.

One per cent. of lime caused a loss of 9.78 per cent. of the nitrogen of the dung. One per cent. of plaster resulted in a loss of only 0.34 per cent. of the nitrogen. One per cent. of sulphate of magnesia saved all the nitrogen that was in the dung and attracted an addition of 5.06 per cent of ammonia. Lastly, one per cent. of kainit saved all the nitrogen, and added 7.97 per cent. to it. The editor has been careful to give a full account of this German experiment, so the full value of kainit may be known in retaining and adding to the value of manure. Farmers have for years, and do now, think that plaster is the great preserver of manure; but by these experiments, which may be fully accepted as true, one ton of kainit is worth over seven tons of plaster. Kainit can be purchased by the ton in our city to-day at \$9, plaster at \$7. This is less than half a cent per pound. One pound of kainit per day scattered in the stall is sufficient for each animal. A better way would be to dissolve it and apply it by means

of a watering can. Kainit has not only great preservative but also great purifying powers. It should be used freely in cow and horse stables, muck and compost heap, pig pens and chicken-houses, privy, sink and cesspools. It would not only keep down that offensive odor so common in most of these places, but it would greatly promote the health and comfort, and lessen the mortality both in the dwelling and stable.

It would be proper to say that kainit in itself is not a complete manure; that, though rich in hydrogen and potash, it is deficient in phosphoric acid. To make a complete and evenly-balanced manure, add to the manure, or compost heap treated with kainit, bone-dust in proportion of half a bushel to each cartload of manure.—*Baltimore American*.

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*SOME PHENOMENA OF THE ATMOSPHERE. — A
POPULAR EXPLANATION WITH REFER-
ENCE TO WEATHER CHANGES.*

[CORRESPONDENCE FLORIDA AGRICULTURIST.]

No subject is so much talked about and so little understood as the weather. Scarcely a day passes, perhaps, in the lives of any of us without some remark or discussion about the weather. How many of our actions for to-day—for the future—depend upon what the weather will be? The farmer sows his seed; the weather—the climate—brings his increase or blasts his hopes with hot, parching winds, drouths, excessive rains, frosts or extreme cold.

Men of excellent education in other respects are still occasionally found who connect change of weather with phases of the moon, and with all credulity consult their almanacs for predictions of rain or fair weather. Others, perhaps, consult the barometer, and may register its figures, but are so little acquainted with the exact meaning of its movements, with existing weather conditions bearing upon and causing weather changes, and with the governing laws of storms, that they are unable properly to interpret oscillations of this instrument, of such indispensable value to the more enlightened observer.

Another group of the unscientific weather-wise revel in statistics of rainfall, etc., forgetting that these only show the

general climate, and do not prognosticate the weather of any locality which is due to surrounding pressure and other atmospheric conditions.

To obtain a knowledge of these, it is necessary to search the daily weather charts of the weather bureau, and to pursue them to advantage the student must become acquainted with the exact meaning of "Isobars," "Isotherms," "Cyclones," "Anti-Cyclones," "Depressions," "Gradients," "Dew Point," and "Relative Humidity." It is the purpose of this paper to explain these.

Changes of weather are so closely related to changes of wind, and changes of wind to changes in the distribution of atmospheric pressure, that whether considered as the indices or the causes of coming changes of weather, no phenomenon is more important than the winds.

Upon the direction and force of the wind very great stress must be laid in every attempt at storm forecasting, and in order to determine these it is necessary to draw on a chart what are known as "Isobars," or lines of equal barometric pressure.

There are three important causes which contribute to the production of wind:

1. Unequal atmospheric pressure.
2. Unequal specific gravity of the air, resulting from (a) unequal temperature; (b) unequal humidity.
3. The rotation of the earth.

The measurements of atmospheric pressure are obtained by means of the barometer, an instrument with which it is necessary to assume the reader to be familiar. Unequal pressure tends to produce motion in the atmosphere. Conceive two vertical columns of air extending to the top of the atmosphere, and imagine them connected near the earth by a horizontal tube. If the weight of one column exceeds that of the other, the air must flow from the heavier to the lighter column, in the same manner as when water stands at unequal heights in two arms of a recurved tube. The wind must, therefore, blow from places where the pressure is greatest toward places where pressure is least; or, what is the same thing, from places where the barometer is highest toward places where the barometer is lowest or most depressed. As-

suming the lines of equal pressure or "Isobars," to be drawn on the chart, it is at once perceived that, in well understood accordance with the laws of mechanics, the atmosphere must be pushing from the regions of higher toward those of lower pressure. The resulting movements of the air, modified by the forces of inertia and friction, and by the rotation of the earth and local obstructions, are converted into local winds, whose directions are indicated by arrows on the charts, and whose velocities are given in miles per hour. These are called local winds, as distinguished from general winds of any section of the country and from the great currents of air.

The general winds appear to be primarily dependent upon the existence and position of the areas of high and low pressure. The great currents, spreading as they do over whole continents and encircling the earth, are largely influenced by, if not entirely dependent upon, the earth's axial rotation.

If the earth were not in rotation, the winds would uniformly blow in straight lines outward from the center of every area of high barometer toward the surrounding localities of lower barometer.

Observation, however, has long since clearly shown that in this hemisphere, within an area of high pressure, the winds will be found not only blowing away from the center outward, but also to be deflected toward the right hand as they move forward. It has also been shown with equal clearness, that in this hemisphere, within any area of low pressure, the winds will blow toward the center inward, and will also be deflected toward the right hand as they move forward. In other words, the prevalent direction under the given conditions would be like the hands of a clock. The contrary to this prevails south of the equator. It is a maritime proverb that a "backing wind never stands."

The daily weather charts of the weather bureau show the distribution at the same moment of time daily, throughout the United States and parts of Canada, of atmospheric pressure, temperature, wind, rain, clouds, and the various other phenomena. A glance at a number of these charts shows that there is always present either an area of low pressure, called a "Cyclone," usually having an approximately circular form, and as a rule, moving in an easterly or northeasterly direc-

tion ; or an area of high pressure, called an "Anti-Cyclone," also nearly circular in form, but almost stationary in position. The wind in all cases blows in a direction nearly parallel with the "Isobars," having the area of lowest pressure on the left hand. This has given rise to the following simple law for the northern hemisphere : "Stand with your back to the wind, and the barometer will be lower on your left hand than on your right." The intensity of the wind in all cases depends upon the closeness of the "Isobars," for the closer the "Isobars" the greater the difference in pressure in a given distance, i. e., the "Gradient," and consequently the stronger the wind.

Nearly all of our weather is of the "Cyclonic" or "Anti-Cyclonic" type, and is entirely dependent upon the form and distribution of the "Isobars." Generally an area of low and an area of high pressure, and often more than one of each falls within the boundaries of the United States.

We have thus far seen the results of general pressures. We will now examine a little into its causes.

When the atmosphere is in a state of equilibrium no movement of air can, of course, occur, but as soon as the equilibrium is disturbed, a current of air is generated, the air tending, as has been shown, to move from the district of the greater to the district of the lesser pressure ; or, in other words, the heavier air tending to drive out the lighter.

Absolute equilibrium is in nature rarely attained, the air being kept in almost perpetual agitation by atmospheric disturbances.

The prime cause of atmospheric disturbance is found in the unequal distribution of solar heat over the earth's surface ; in the changes, diurnal and seasonal, in the atmosphere, and in the unequal effects thus produced on the tension of the air itself, and of the vapor suspended in it.

The atmosphere is heated in three ways : By direct rays of the sun ; by the radiation and reflection of the heat from the earth ; by contact with the warmer earth, the latter two giving to it 75 per cent. of its heat. Thus it is seen that the atmosphere receives its heat chiefly at the bottom, and in consequence of radiation loses it most rapidly at the top. Hence, since the density of the air is diminished by the in-

crease of heat, the atmosphere is in a state of unstable equilibrium, and the lower strata tends continually to rise and take the place of the upper.

The constituents of atmospheric air are nitrogen, oxygen, a little carbonic acid gas, and a variable amount of vapor of water. The amount of moisture in the atmosphere sometimes forms four per cent. of its entire weight and sometimes less than one per cent., and as it is the lightest element of the atmosphere, it is easily seen that the greater the amount of vapor of water in the atmosphere, the lighter the latter will be. The air gets its water through evaporation of water from the earth's surface, evaporation being an effect of heat from the sun, and varying directly with it. Hence, the sun's heat not only produces unstable equilibrium in the atmosphere by heating, expanding and lightening it at the bottom, but also by putting into it at the bottom more of the vapor of water. The air thus lightened ascends, comes under diminished pressure, expands and cools.

The capacity of the air for holding vapor depends upon the temperature of the air—increasing or diminishing with it—and is a certain definite fixed amount for every temperature. Up to this amount the air will hold all the moisture evaporated into it from the earth's surface, but if any more moisture is attempted to be forced into it some of it will be condensed and fall as rain. That is, the atmosphere for every temperature has a saturation point, and beyond this, if the temperature remains the same, will hold no moisture. If, at any time, we find the temperature point to which the air would have to be cooled, before, with the moisture it contains, it would be entirely saturated, that temperature would be what is known as the "Dew Point" of the air at that time. The ratio of the amount of moisture in the air at that time to the amount it could hold, if saturated, is its "Relative Humidity."

Now the ascending air carries with it the vapor of the water it contains, and as it rises and cools, its temperature gradually approaches its dew point. The vapor is condensed, and after a while forms a cloud. First the "Cirrus" or high altitude thin clouds—the air not having yet much moisture must necessarily be carried to a great height before it will be sufficiently cooled to be saturated. By and by the "Cirrus"

becomes denser and forms the "Cirro-Stratas," then, as the air becomes more moist, condensation takes place lower down. "Cumulus" clouds are formed, then the "Stratas," and finally the rain cloud, or "Nimbus," is developed.

Thus, decreasing pressure, or low barometer, is associated with cloudy or rainy weather. The changes of the weather at all times must be closely related to changes of atmospheric pressure and the relative distribution of heat. Without a knowledge of these facts no accuracy whatever can be attained in estimating impending changes of weather.

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*REPORT OF THE HAWAIIAN COMMISSION OF
AGRICULTURE AND FORESTRY.*

To His Excellency, J. A. KING, ex officio President of the Bureau of Agriculture and Forestry:

SIR: Pursuant to instructions received from the Bureau of Agriculture and Forestry, at a meeting held on the 29th of March, 1893, directing your Commissioner to investigate the present condition of the forests and nurseries planted by and now being cared for by the Government, your Commissioner has examined the same, and begs to submit the following report:

The nursery on King street, comprising about three acres of land, was first visited by your Commissioner, and after a careful examination I am of the opinion that the nursery, as regards the quantity and quality of the land, is entirely inadequate to carry out the purposes of the Act under which the Bureau was formed. Owing to the ravages of the blight now so prevalent in Honolulu many of the valuable trees are in poor condition, and some have died, and no effort has been made up to the present time to rid the nursery of this destructive blight. Even the small plants growing in boxes are affected, and unless immediate action is taken much loss will ensue. A small amount of energy, properly applied, would have prevented much of the damage already done. The distribution of plants from the nursery to the different islands during the past five years has averaged a little over 5,000 plants per annum, the island of Oahu getting a little over one-

half the entire amount. The record kept by the gardener shows that the distribution of plants has not been fairly apportioned, some parties getting as many as from 200 to 300 plants at one time, and others as low as ten. This needs regulation, and the attention of the Bureau is called to this matter. While there is no doubt but that the distribution of 25,000 plants during the past five years has been of great benefit to the country, it is quite apparent that this usefulness can be greatly extended. The country is in great need of many small and diversified industries, and these can be greatly stimulated by the Government bringing within the reach of the poorer classes a variety of economic plants that can be cultivated with success on these islands. To accomplish this purpose new and more extensive facilities are required. The present nursery is entirely too small, the soil poor and the location unfavorable. In winter the garden is flooded, and some valuable trees have been lost from this cause. In summer the water supply is not sufficient to keep the nursery in good condition. The trees now in the nursery are generally unthrifty, and do not present the vigorous growth characteristic of trees grown in a rich soil. A new site for a Government nursery is urgently needed, and your Commissioner would ask to be allowed to make a careful survey of the Government land on the lower slope of Punchbowl, running towards the Lunalilo Home, and report on the same as to its suitability for a Government nursery.

THE MAKIKI FOREST.

The planting of this forest was commenced eleven years since, and a considerable area has been planted with different varieties of forest trees, principally eucalyptus, which is doing well. The Australian wattle is a tree which is apparently doing better than any other of the forest trees. The *keawe* tree is not doing well, being more at home on the lower plains. All the trees are planted very closely together, and the time is near at hand when the whole forest will need thinning. There is a good deal of undergrowth in the forest, and on the edges the lantana is growing vigorously. While I do not think it advisable that the whole forest should be cleared of undergrowth until such time as the work of thin-

ning should be undertaken, it is important that the lantana be cleared from the roadway and outskirts of the forest.

While it was, no doubt, a wise measure to clothe the bare slopes of the land with forest trees, and equally good policy to continue doing so, it is not good policy to plant the rich valleys with timber trees. They can be put to a much better use; they should be planted with the best varieties of citrus and other fruits, and with the various economic plants which add so much wealth to those countries that have a climate and soil similar to these islands. To this end I would strongly urge upon the Bureau to sanction the importation of several hundred suitable trees to be planted in the rich valleys situated below Tantalus, and from time to time, by further importations, increase the number of trees of the character mentioned. In a very few years these would prove an excellent source from which to procure cuttings from which to engraft seedlings, which could be started as soon as the necessary seeds can be procured. Among the citrus fruits there are but few stocks more hardy than our own native orange, but the fruit itself can be greatly improved. In a few years' time these valleys could be made to produce hundreds of thousands of valuable young trees for distribution to the different islands of the group, and particularly to the homesteaders and small landholders. It is a significant fact that California oranges and limes (probably Mexican) are being imported into this country. This should not be. I would call your attention to the fact that the *luna* in charge of the planting at Makiki forest is living several miles from the scene of operations in the only house under the control of the Commission, the same being situated close to the Makiki reservoir. Arrangements should be at once made for the erection of a suitable dwelling close to the present laborers quarters at the head of the forest. It is necessary, in order to get the best results from the force employed, that the *luna* live close to the work. In this respect I would call the attention of the Bureau to the fact that the present *luna* is not a trained forester, and that in order to obtain effective results it is advisable that a person trained in tree culture be employed to take charge of the tree planting at Makiki.

THE BLIGHT.

The attention of your Commissioner has been forcibly drawn to the blight which is devastating, and in many instances completely killing, the citrus fruit trees in and around the city of Honolulu. This blight is easily mistaken by many persons, especially when not closely examined, for the cottony cushion scale, and unlike that pest there is, unfortunately, no insect enemy known that will destroy it.

Energetic action is urgently needed to eradicate this blight, and to this end I would propose that your Commissioner be instructed to at once commence the manufacture of a solution that has already been tried with good results in killing this blight, and furnish the same at cost to those persons who wish to spray their trees. Also, that a number of spraying outfits be purchased, and men instructed in their use, and hired out at cost to any person wishing to have their trees cleared of blight, to render action against the blight effective. Legislative action is needed, allowing any person who goes to the trouble of clearing his own trees of blight to compel his neighbors on either side of the premises to have their trees cleared from blight, they in turn having the same power over their next neighbors. It is only by some such means that the blight can be got rid of, as one tree infected by blight will keep on infecting contiguous trees, no matter how often they are cleaned. Your Commissioner would respectfully recommend that the Bureau have a bill drafted, embracing the provisions mentioned, and request the Government to introduce the same to the Advisory Council for their consideration. Respectfully submitted,

JOSEPH MARSDEN,
Commissioner of Agriculture and Forestry.

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The decease is announced, at the ripe age of eighty-two, of Mr. Robert Andrew Macfie, of Dreghorn Castle, Midlothian, the founder of the well-known sugar refining firm at Liverpool. The family has been connected with sugar refining for more than a century, the business having been originally established at Greenock by Mr. Macfie's grandfather. Mr. Macfie was the father of R. A. Macfie, Jr., formerly Manager of the Kilauea Plantation, Kauai.

FRUITS OF JAMAICA.

REPORT BY CONSUL ESTES, OF KINGSTON.

Naseberry sapodilla.—The naseberry sapodilla (*Achras sapota*) is a native of the West Indies. The tree has dark green, shining leaves. The fruit is about the size of an ordinary quince, having a rough, brittle, dull-brown rind, the flesh being of a dirty, yellowish white color, very soft and deliciously sweet. The exports were only 14,026, valued at \$60, all to the United States.

Cashew.—The cashew (*Anacardium occidentale*) is a native of the West Indies. It is a tree 30 or 40 feet high, with simple leaves and small flowers. The fruit consists of a nut on the apex of a pear-shaped body formed of the enlarged top of the stalk. The nuts are commonly roasted, which improves their flavor. They yield by expression a light-yellow, bland, nutritious oil, superior to olive oil. The ripe, fleshy stalk is also used as a fruit, is about the size of an ordinary orange, and contains an acrid juice, from which a pleasant wine is made.

Pineapple.—The pineapple (*Ananassa sativa*) is a native of tropical America. It is an almost stemless plant with spiny leaves. The flowers are arranged many together in a dense head, the whole developing into a single fruit. It was so named from the resemblance of the fruit in shape and external appearance to the cone of the pine tree. The fruit is used fresh, stewed, or preserved. The juice is said to allay gastric irritability in fever. The export in 1889 was 8,292 dozens, valued at about \$5,000, of which 7,671 dozens went to the United States.

Cherimoya.—The cherimoya (*Anona cherimolia*) is a native of Jamaica and Central and South America. It is a tree with inconspicuous flowers and a large, smooth, green fruit. The fruit, being somewhat acid, is very agreeable.

Soursop.—The soursop (*Anona muricata*) is a native of the West Indies. It is a small tree, with large, green fruit covered with soft prickles, diuretic in its effects; closely allied to the custard-apple fruit of a large size.

Custard apple.—The custard apple (*Anona reticulata*) is a native of tropical America. It is a small tree; bark is an

astringent and tonic; leaves and young twigs used for tanning. The fruit, unripe, yields a black dye; ripe, it is said to be antidysenteric and vermifugal. It is the size of a tennis ball, of a brownish color, containing a yellowish eatable pulp of the consistency of custard.

Sweet-sop.—The sweet-sop (*Anona squamosa*) is a native of tropical America. It is a small tree. The fruit, when unripe, dry, powdered, and mixed with flour, is used to destroy vermin. The ripe fruit is agreeable and good for digestion.

Peanut.—The peanut (*Arachis hypogæa*) is not cultivated in Jamaica to any great extent.

Breadfruit.—The breadfruit (*Artocarpus incisa*) is a native of the East Indies. It is a tree with milky sap and large fruit, 5 to 7 inches in diameter. The trees bear prolifically. The fruit, when baked, somewhat resembles bread and is eaten as food; hence the name.

Jack fruit.—The jack fruit (*Artocarpus integrifolia*) is a native of the East Indies. It is a tree with milky sap and large, oblong fruit. The seeds, when roasted, taste like nuts.

Bilimbi tree.—The bilimbi tree (*Averrhoa bilimbi*) is cultivated in the East Indies. It is a small tree with reddish-purple flowers and cylindrical fruit, with five rounded lobes. The flowers are made into preserves, the fruit is used in curry and preserved in sugar, and the juice is made into a sirup and is used as a cooling drink in fevers and externally in cutaneous diseases.

Carambola.—The carambola (*Averrhoa carambola*) is cultivated in the East Indies. It is a small tree with yellowish-purple flowers; fruit acutely five angled. Unripe, it is astringent, and is used as an acid in dyeing, probably acting as a mordant; fruit, ripe, is an antiscorbutic. It is made into curries, pickles, and preserves. The juice removes iron stains from linen.

Annotto.—The annotto (*Bixa orellana*) is a native of the West Indies. It is a low tree, 10 feet high, with large, rose-colored flowers. The seed vessels are spiny and seeds covered with a colored pulp. J. J. Bamery, island chemist, has invented a method of obtaining annotto in powder, which is said to be of a superior kind. The exports in 1889 were 455,874 pounds; value, about \$19,000; to the United States, 410,585 pounds.

Lotus berry.—The lotus berry (*Byrsonima coriacea*) is native. It is a tree 20 to 30 feet high; leaves simple, flowers golden-yellow; fruit yellow, size of small cherry, and edible.

Divi-divi.—The divi-divi (*Cæsalpinia coriaria*) is native. It is a small, crooked tree; flowers white and fragrant; pod flat, incurved; grows in the hottest and driest places; pods rich in tannin. It is exported to a very small extent to the United Kingdom. If the seeds are not removed, the acid they contain induces fermentation. The powder of the pods is astringent and is used for antiperiodic tonic.

Papaw.—The papaw (*Carica papaya*) is a native of the West Indies and Central America. It is a tree 18 to 20 feet high, with milky juice, generally branchless; leaves large, lobed; flower small; fruit yellow, size of a small melon. The juice of unripe fruit is useful in dyspepsia as a vegetable substitute for pepsin. The unripe fruit is cooked as a vegetable, and the ripe fruit as dessert has the same effect and acts as a mild purgative. The digestive property of the juice and the fresh leaves is made use of to render meat tender and facilitate the the process of cooking.

Clove.—The clove (*Caryophyllus aromatica*) is cultivated in Jamaica. It is a small tree, of which the unopened flower buds form the cloves of commerce. The buds and stalks abound in an essential oil.

Star apple.—The star apple (*Chrysophyllum cainito*) is a native. It is a tree with leaves of a yellow hue beneath; flowers purplish inside; fruit size of an apple, green or purplish, and edible. It is so called because, when the fruit is cut across, the seeds present a starlike figure.

Cinnamon.—The cinnamon (*Cinnamomum zeylanicum*) is a native of the East Indies. It is a small tree. The cinnamon of commerce is obtained by stripping the bark from the shoots after they turn brown at the age of 18 months or 2 years. The leaves yield "clove oil."

Sweet orange.—The sweet orange (*Citrus aurantium*) is a native of northern India. It is a small tree. The orange is little cultivated in Jamaica. The Manchester orange used to have a distinct place in market quotations and be considered among the best, but, not having been cultivated for many years, it has deteriorated, and the Manchester orange of

to-day offered in the markets of the United States does not come from Jamaica at all; yet, if properly cultivated, there is no doubt but the oranges of Jamaica would occupy a place near the top of the list. Quite a large trade is still done in shipping oranges to the United States from Jamaica. They are nearly all shipped in barrels and repacked in New York. The exports in 1889 were 35,394,171; value, about \$25,500; to the United States, 34,354,621.

West India lime.—The West India lime (*Citrus aurantium*) is a smaller tree, with smaller leaves, flowers, and fruit than those of the orange. The fruit yields a juice which, like that from the lemon, is refrigerant and antiscorbutic, the latter property being due, according to Ganod, not to the citric acid, but to the potash salts contained in the juice. The export trade in limes and lemons is very limited, in 1889 being only 701 barrels, of which 690 went to the United States; total value, \$1,000.

Bitter or Seville orange.—The bitter or Seville orange (*Citrus aurantium*) is a small tree, the wing of the leaf-stalk broader than that in the sweet orange; fruit with bitter rind and pulp. The rind is used for marmalade.

Shaddock.—The shaddock (*Citrus decumana*) is said to be so called from Captain Shaddock, who first brought this fruit from the East Indies. It is a large species of orange. The export in 1889 was 33 barrels; value, \$80.

Citron.—The citron (*Citrus medica*) is a native of northern India. It is a small tree; leaves with short stalk and not winged; flowers pinkish, with purplish buds; fruit with transverse and longitudinal furrows; very thick, hard rind; pulp scanty, with acid juice. Like lemon rind, it yields an essential oil. The essence of cedrat is used for perfumery. The rind of the fruit is candied, and used for dessert and confectionery.

Lemon.—The lemon (*Citrus medica*, var. *limonum*) is a native of the northern India; fruit smooth and acid pulp. The outer rind is an aromatic stomachic. Oil or essence of lemon is obtained from the rind. The juice is used to prepare citric acid.

Seaside grape.—The seaside grape (*Coccoloba unifera*) is a native of the West Indies and tropical America. It is a tree with roundish, cordate leaves; flowers without petals, and

hanging bunches of dark-blue berries. In Jamaica this species remains small, whereas elsewhere it grows into a large tree, notably in Honduras. The fruit is so very astringent that caution has to be exercised in its use.

Cocoanut palm.—The cocoanut palm (*Cocos nucifera*) is a native of the tropics; a palm with pinnate leaves. "Toddy" is obtained from the flower spathe just before it opens by slicing off the top and collecting the sap in a vessel. It has a pleasant, sweetish taste, and in large doses is aperient; fermenting it is intoxicating. It can also be boiled down into a coarse sugar called "jaggery," which is refined or fermented, and distilled into spirits. The young cocoanut contains a sweet, refreshing water and jelly. The nut is generally harvested before it is perfectly mature. If the outer skin dries on the tree, the fiber of the husk becomes coarse and dark in color; if too young, it is weak. Cocoanut milk is made from gratings of the kernel. The shell is carved and used for many purposes. The dried kernel is known as "kopra," and is used for the preparation of oil by expression or boiling. The solid fat is employed in making candles and the oil for cooking, for lamps, as a substitute for codliver oil, etc. The cake which is left, or "ponac," is a good food for cattle, and is also used as a manure. The husk of the fruit yields coir fibre. Coir is remarkable for its durability, and is used for the manufacture of various textile fabrics, brushes, cordage for the rigging of ships, nets, matting, stuffing of cushions, pads and mattresses, scrubbing brushes, fishing nets, etc. The tender leaves are used for plaiting mats, boxes and other fancy articles. The mature leaves are plaited into matting, and also used as materials for fences, sails, buckets, books, fans, torches, and fuel. The ash yields an abundance of potash. The midribs of the leaflets are made use of as brooms, brushes, and skewers. The stalk of the spadix itself is in everyday use as a chunam brush to whitewash houses with. The reticulated web of the base of the leaf forms a coarse kind of cloth. The cottony hairs are used as a styptic. The soft parts within the stem of the cocoanut are cut out and pounded in a mortar; the resulting pulp is washed in water, and the farina is collected and used as a substitute for sago. Aged and unfruitful trees are cut down, and the wood is

turned to a variety of useful purposes. It is hard, handsome, and durable (known under the name of porcupine wood). It is used for veneering, and the hard stem is converted into drums, gutters, waste pipes, small boats, frames, furniture, rafters for houses, spear shafts, shingles, walking sticks, ladies' workboxes, etc. The root stem takes a high polish so as to resemble agate. A dye can be extracted from every part of the plant, producing a dirty brown color. The nuts are grown and exported in large quantities. In 1889 4,831,615 were exported, the United States taking 4,088,375.

Bissy, kola, or cola.—The bissy, kola, or cola (*Cola acuminata*) is a native of tropical west Africa. It is a tree of moderate height; leaves simple, 6 or 8 inches long; flowers with a pale yellow calyx, but without petals; seeds large, and used like chocolate. They are said to be of great dietetic value, and also to be useful in dyspepsia and nervous diseases. It has been said that the beverage made with cola paste is ten times more nutritious than chocolate made with cacao. The reputation of this substance in sustaining the system against fatigue is such that it is meeting with consideration from the military authorities of the world as an article to be given to soldiers during active service. Seeds have been sold lately in London at 50 cents, and even 75 cents, per pound.

Taro.—The taro (*Colocasia antiquorum*) is a native of the East Indies. It is an arum-like plant, with large, heart-shaped leaves and tuberous root stocks. The tubers (eddoes) often weigh several pounds and form a nutritious food when well cooked. Young leaves may be eaten like spinach.

Calabash.—The calabash (*Crescentia cujete*) is a native of the West Indies. It is a tree with narrow leaves; flowers two to three inches long, variegated in color; fruit pulpy, with a hard shell. The expressed juice of the pulp is a purgative, also a demulcent and pectoral. The shell of the fruit makes good drinking cups, vessels for carrying water, etc.

Wild cucumber.—The wild cucumber (*Cucumis anguria*) is a native of the West Indies and tropical America. It is a climbing plant with tendrils; leaves five lobed; flowers wild and small; fruit spiny. It is a wholesome vegetable; also used in pickles.

Akee.—The akee (*Cupania edulis*) is a native of tropical

West Africa, naturalized in Jamaica. It is a tree with pinnate leaves; flowers white; fruit red, splitting on the tree, displaying the black seeds half inclosed with a white covering. The white covering of the seeds is a wholesome vegetable.

Yam.—The yam (*Dioscorea alata*) is a large, esculent tuber, or root, of various climbing plants, growing in all tropical climates, and forming, when roasted or boiled, a wholesome, palatable, and nutritious food. The yam forms an important item of food for the natives of Jamaica, and a small export trade is done in them.

Yam bean.—The yam bean (*Dolichos tuberosus*) is a native of tropical Asia. It is a twining plant; leaves compound; flowers white; pod straight and compressed, with reddish hairs; seeds red; root formed of a number of fibers several feet long bearing tubers. The roots afford a plentiful supply of wholesome food. The produce of three plants is usually a bushel. The tubers may either be boiled plain, in which state they are a very good substitute for yams or other roots in common use, or they may be submitted to a process similar to arrowroot and a starch obtained. The starch is of a pure white, and is equal in every respect to arrowroot. To the taste it is very palatable, is easily digested, and is employed for custards and puddings. Even the trash left after obtaining the starch, which is lost in the preparation of arrowroot, may, when thoroughly dried, be formed into a palatable and wholesome flour. A very excellent flour may also be obtained by slicing the tubers, drying them in the sun, and then reducing to a powder. This plant is deserving of being more generally cultivated than it has been. It can be planted at any season of the year, and the roots are fit for digging in the course of four or five months. The return is infinitely greater than that from arrowroot, and the proportion of starch also is more abundant. The young pods may be used like French beans, but the ripe beans are poisonous.

Coca shrub.—The coca shrub (*Erythroxylon coca*) is a native of the Andes cultivated in Jamaica. It is a shrub with pale yellow flowers and red berries. The leaves dried form the coca of commerce. The chief constituents of coca are cocaine and hygrine.

Antidote cocoon.—The antidote cocoon (*Fevillea cordifolia*) is a climbing plant with tendrils; leaves roundish, three-fourths of an inch; flowers small, orange colored; fruit size of an apple, of a russet color, hard, full of large, flat, round seeds. The seeds abound in oil and are said to possess medicinal qualities.

Okra.—The okra (*Hibiscus esculentus*) is a large annual herb; flowers pale yellow, with a red base; fruit cylindrical, three to six inches long. The principal use of okra fruit is as a vegetable and to thicken soups, etc. The whole plant abounds in a viscid mucilage, and the seeds yield an oil similar to olive oil.

Indigo.—The indigo (*Indigofera tinctoria*) is raised but little in Jamaica. This is the indigo of commerce.

Mammee.—Mammee (*Mammea americana*) is a native. It is a spreading tree forty to sixty feet high; fruit larger than an orange, russet brown, of a sweetish, somewhat aromatic, taste, and of a peculiar odor.

Mango.—The mango (*Mangifera indica*) is a native of the East Indies. It was naturalized in tropical America and introduced into Jamaica about 100 years ago. It now grows spontaneously in the interior of the island up to 4,000 feet. The diameter is up to four feet; height, thirty feet; fruit of an oval, oblong shape, size of a medium apple. There are many varieties of mangoes in Jamaica, the famous "No. 11" being far superior to all others; but so little attention is paid to their care or cultivation that it is getting very hard to get the No. 11 unmixed with other varieties. Few people like mangoes at first, but soon acquire a taste for them. They are to be had almost the year round, but the months of May, June, July and August are their season. During this time the natives very nearly live on them, and it is harder to employ a native during this season of the year than any other, as the mango supplies nearly all his wants during the season. Thousands of bushels rot on the ground for want of a market; few are exported. In 1889, 170,980 mangoes were exported, 70,530 to the British West Indies and 95,250 to the United States. They are very perishable, but with fast steamers that could make the trip from north side ports to New York in 4 or 4½ days a profitable trade might be built up. The mangoes can be had almost for the gathering.

Cassava.—The cassava (*Manihot utilissima*) is a native, probably of Brazil. It is a half-shrubby perennial, with very large yellowish roots filled with a milky juice, which is poisonous; but by treatment with water, heat and pressure, the poisonous qualities are removed, and the root yields a starchy substance called cassava or cassava meal, much employed for food. Tapioca is purified cassava.

Genip.—The genip (*Melicocca bijuga*) is a native of Trinidad. It is a large tree, forty to fifty feet high; leaves pinnate; flowers very numerous, small, and fragrant; fruit green, size of a pigeon's egg. The pulp is edible and of a sweet, subacid, slightly astringent taste.

Arrowroot.—The arrowroot (*Maranta arundinacea*) is an herbaceous perennial. The root is used as food.

Plaintain.—The plaintain (*Musa paradisiaca*) has a growth much like the banana fruit. It requires cooking. Fried or boiled when ripe and roasted when green; it is an excellent vegetable of great value to the natives.

Banana.—The banana (*Musa sapientum*) has a soft, herbaceous stalk, with leaves of great length and breadth. The flowers grow in bunches covered with sheaths of purple color. The fruit is five or six inches long, and over one inch in diameter. It is eaten either raw when ripe or fried in slices. Bananas are third in rank in the list of Jamaica exports. In 1889, 2,881,313 bunches were exported, valued at \$1,226,917, of which the United States took 2,879,560 bunches. By cultivation the production could be greatly increased.

Nutmeg.—The nutmeg (*Myristica fragrans*) is nearly spherical, of the size of a medium-sized pear, of a yellowish color without and almost white within. It opens into two nearly equal longitudinal valves, inclosing the nut surrounded by the exterior covering, which is mace. The nut is oval and the shell dark brown. This immediately envelops the kernel, which is the nutmeg of commerce.

Rice.—The cultivation of rice (*Oryza sativa*) is just beginning to receive attention in Jamaica.

Mountain sweet cup.—The mountain sweet cup (*Passiflora edulis*) is a native of the Andes naturalized in the Blue Mountains. It is a passion flower with lobed leaves and whitish flowers; fruit egg shaped, purplish, with hard shell and edible pulp.

Water lemon.—The water lemon (*Passiflora laurifolia*) is a native of the West Indies and tropical America. It is a passion flower; leaves oval, entire; flowers white with red blotches; crown violet with white streaks; fruit egg shaped, of an orange yellow color, and soft rind; edible pulp.

Sweet cup.—The sweet cup (*Passiflora maliformis*) is a native of the West Indies and tropical America. It is a passion flower; leaves ovate, entire; flowers variegated; fruit globular, green with yellow tint; very hard shell, and edible pulp.

Granadilla.—The granadilla (*Passiflora quadrangularis*) is a native of the West Indies and tropical America. It is a passion flower with four-winged stem; leaves ovate, roundish; flowers large; petals rosy; crown violet; fruit five inches long, greenish yellow, with soft, thick rind; root large and fleshy. It is edible, like yam. The pulp is edible, and the rind is edible when cooked.

Wild clove.—The leaves of wild clove (*Pimenta acris*) yield oil of bay, one of the ingredients of bay rum.

Pimento or allspice.—The pimento or allspice (*Pimenta officinalis*) is a native. It is a tree thirty feet high, with very smooth, light gray bark. The wood is very hard. The young trees are used for walking sticks, in which a considerable export trade is done. The berries are collected of full size though unripe, and dried in the sun for export. There was \$232,825 worth of pimento exported, of which \$107,220 went to the United Kingdom, and \$123,558 to the United States.

Guava.—The guava (*Psidium guavy*) is a native. It is a low tree or bush. The fruit, stewed or made into jelly, is delicious.

Pomegranate.—The pomegranate (*Punica granatum*) is naturalized. It is a bush or small tree. The fruit is the size of a large orange, having hard rind, soft pulp, and numerous seeds. It is used as a dessert and may be eaten as a slightly astringent and refreshing refrigerant in some febrile affections, especially those of the bilious type.

Jamaica blackberry.—The Jamaica blackberry (*Rubus jamaicensis*) is a native of Jamaica. It is a bramble; fruit palatable. If infused in spirits with the bruised kernels of the prune tree and sweetened with sugar, a liqueur is obtained not inferior to, and not to be distinguished from, the Copenhagen cherry brandy.

Sugar cane.—The sugar cane (*Saccharum officinarum*) is a native of India and China. It is a large perennial grass, with thick rootstock and numerous stems. The ripe canes are cut down to the ground, stripped off their leaves, and subjected to pressure between two rollers, or in some other suitable way. The cane juice thus obtained is clarified by the combined use of lime and heat. The heat coagulates any albumen which may be present, and the lime neutralizes the free acid and combines with a peculiar albuminous body not coagulable by heat or acids and forms with it a coagulum, the separation of which is promoted by the heat. Part of it rises to the top as a scum, and the remainder subsides. The clarified juice is then drawn off into the boiler, evaporated, and skimmed. When it has acquired a proper tenacity and granular aspect, it is emptied into a cooler and allowed to crystallize or grain. The concrete sugar is then placed in casks perforated with holes in the bottom, and the sugar is left to drain for three or four weeks. It is then packed in hogshead, forming raw or muscovado sugar. The draining or uncrystallized portion of sugar constitutes molasses. Molasses is capable of fermentation, and then by distillation yields rum. The sugar and rum production has greatly fallen off in Jamaica since slavery was abolished, and more rapidly within a few years, consequent upon the development of the fruit trade. The sugar exports in 1889 were 32,323,826 pounds; value, \$1,189,217.45; of which the United States took 23,327,250 pounds, valued at \$858,226.66. The rum exports for same year were 1,374,931 gallons, valued at 669,110.12; of this the United Kingdom took 1,216,012 gallons and the United States 37,442 gallons. Thus the United States is Jamaica's best sugar market and the United Kingdom the best market for her rum.

Chocho.—The chocho (*Sechium edule*) is cultivated in the West Indies. It is a climbing plant, with tendrils; roots large and bushy; leaves large, simple; flowers yellow; fruit four or five inches long. The root can be used like the yam. The fruit is a most wholesome vegetable. It is also made into tarts with the addition of limes.

Tamarind.—The tamarind (*Tamarindus indica*) is cosmopolitan in the tropics. The trunk of the tree is lofty, large and

crown with spreading branches; it is much valued as a shade tree. The flowers are in simple clusters, terminating the short lateral branches. The fruit is prepared in the West Indies by removing the shell, placing alternate layers of fruit and sugar in a jar, and then pouring boiling sirup over them. In the East Indies the shell is removed and the fruit simply pressed together in a mass. Tamarind pulp is laxative and refrigerant, and is also used to prepare a gargle for sore throat.

Cacao or chocolate tree.—The cacao or chocolate tree (*Theobroma cacao*) is a native of tropical America. It grows to the height of twenty or thirty feet, with a brownish bark, and bears a pulpy fruit containing seeds of a flat, oblong shape, from which chocolate is made. The exports in 1889 were 524,896 pounds; value, \$51,496.42; of which 367,705 pounds went to the United Kingdom and 63,380 pounds to the United States.

Vanilla.—The vanilla (*Vanilla planifolia*) is a climbing orchid with pale yellowish-green flowers and a long two-valved pod. The pods forming vanilla are gathered before they are quite ripe and dried. Vanilla is used in perfumery and for flavoring chocolate, liqueurs, etc.

Wild grape or water-withe.—The wild grape or water-withe (*Vitis caribæa*) is a small fruit of the size of a currant, and has a rough acid taste, recommending it for tarts.

Grape vine.—The grape vine (*Vitis vinifera*) is a native of south Europe, scarcely cultivated in Jamaica. It could be profitably raised in some parts of the island.

Mountain plum.—The mountain plum (*Ximenia americana*) is a native of the tropic. It is a tree with simple leaves; flowers white, in clusters; fruit yellow, size of a plum; pulp of a pleasant subacid taste with a slight astringency.

Ginger.—The ginger (*Zinziber officinate*) is a native of tropical Asia. It is a perennial herb, with a rootstock consisting of many roundish joints. The rootstock dried forms the ginger commerce. The exports for 1889 were 895,227 pounds; value \$90,592.01; of which the United Kingdom took 564,069 pounds and the United States 299,630 pounds.

NOTE.—Consul Estes acknowledges his indebtedness to Mr. William Faucett Esq., director public gardens at Kingston, for valuable assistance in the preparation of this report.

THE PINE-APPLE.

(Queensland Horticulturist.)

In making a a pine-apple plantation it is of prime importance to select a suitable piece of ground to begin with, as, although the pines will grow almost anywhere, still to obtain the best results a careful selection of ground is necessary. First of all have your plantation, if possible, on a gentle elevation sloping to the south, east, or north. A north-east slope is the best, as the full benefit of the sunshine can here be obtained, while at the same time the plants will be sheltered in a measure from the cold westerly winds in winter. The soil should be of a porous nature and easily worked. Have nothing to do with clayey soils, because they retain too much moisture about the roots of pines in wet weather, and nothing has a more injurious effect on pine-apples than this. Having chosen your ground, if your operations are to be on a large scale the next thing to be done is to get a team of bullocks and have it ploughed, cross-ploughed and harrowed. If you can afford to have it done twice so much the better, but if not, once will do. This will cost from £4 to £5 per acre, and if you have still some money to spare you cannot do better than put a few drains in wherever the soil is likely to become sodden by retaining too much water.

Having got your land prepared you may get ready to go on with the planting of your suckers. In our opinion a great many people make the mistake of planting pines far too closely in order to make the most of the ground, but in planting on a large scale this ought to be avoided. Have your rows at least eight feet apart, or, better still, plant two rows at eight feet, then leave an alley of twelve feet, then two more row at eight feet, and so on. The advantage of this system will be apparent when the fruit has to be gathered, as, instead of having to carry all the pines to the ends of the rows, a dray can be taken down the twelve feet alleys and the fruit placed in it at once, thus effecting a very great saving of time and labor. Do not plant double rows as is often done; there is not the slightest need for it. The plants will soon be thick enough without that. No doubt it looks like a great waste of ground to plant in this way, but pine-apples

soon spread out, and in a very few years there will not be a bit too much room between the rows. If it goes too much against the grain to see too much ground lying idle then plant something else in the wider spaces for a year or two, taking care not to encroach too much on the pines. At least twelve inches ought to be allowed between the plants in the rows, and if you *must* plant something in the spaces between your rows, leave at the very least two feet clear on each side. Never plant in trenches as is sometimes done. This is a great mistake, and will soon result in your plants rotting off through too much wet, unless the soil is of a very porous nature indeed. It is much better in every way to plant on a slight elevation so that the water will not lodge about the roots, and, besides, it is much easier to keep them clean than if planted in trenches. Always select good strong healthy suckers, and do not mutilate them by cutting off the leaves. This is a senseless proceeding and of no earthly use, unless when the suckers have to be carried a long distance, when of course it is desirable to reduce the freight to as small a limit as possible, but if you can obtain suckers anywhere near at hand never cut the leaves off; merely pull off a few of the bottom leaves so that the young roots may meet with no obstruction when they begin to shoot forth.

Having got all planted and starting into growth, the soil must be kept loose by constant ploughing between the rows, and by the Dutch hoe where the plough cannot be used. The best method is to plough and scarify as close up to the rows as possible without injuring the roots of the plants, and then to go over each row with the hoe, removing all the weeds and stirring up the soil. If the soil be fairly good no manure will be required the first year, or perhaps for two years, but in poor soil manure must be applied from the beginning, if possible. If a supply of decomposed stable manure is obtainable, plough a good dressing of it into the ground before planting. If this cannot be done then you must use artificial manure. Bone-dust or blood and bones mixed are the best of the artificial manures for this purpose, but it is not of much use to apply them till the following spring after your suckers have been planted, because there will be hardly any roots before then, and the manure would be simply thrown

away. The easiest way to apply these manures is to run a furrow as close as possible to the rows, of course throwing the soil back; then put the manure in with the hand and turn the soil back again on top of it. Stable manure can be applied in the same way, but as it is less powerful so much care is not essential in dealing with it. A fresh dressing of manure ought to be given every year in the spring just before the roots begin to move. Pines may be planted at any time between September and February, but it is best to have them in as early as possible so that the young plants may have the benefit of all the warm weather, and thus be better able to stand the winter, as before the cold weather comes on they will have made a good many roots, besides being more robust and well established in the ground.

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CULTIVATION OF COCOA IN CUBA.

The French Consul at Santiago, in a report to his Government, says that the cultivation of cocoa is closely connected in Cuba with that of coffee, and is carried on at the same time and on the same properties. In fact, every coffee planter, if the nature of the soil permits him to do so, sows between the rows of young plants cocoa berries, which will produce trees that will continue to bear crops when the coffee plants have ceased to produce. It is impossible to discover the precise date at which the cultivation of cocoa was introduced into the island, but, as this plant was cultivated in Mexico and New Grenada before the Conquest, it cannot long have remained unknown to the Spanish colonists in Cuba, who kept up constant communication with the possessions of Spain on the American continent. It was not, however, until about 1830 that several planters made an effort to introduce cocoa into Cuba, and at this time plantations of a certain importance were formed at Figueroa and elsewhere. Unfortunately, for many years the cultivation of the cocoa remained unprofitable, in consequence of the small demand and the low selling price. The price slowly rose, however, the number of cocoa plantations increased, and by 1860 every coffee plantation in Cuba combined the cultivation of the cocoa, if the nature of the soil permitted it. The cocoa tree

lives longer than the coffee plant, but it is much slower in producing. It takes, in fact, five or six years before the newly planted cocoa begins to bear fruit; it is at its full bearing at the end of the seventh year, and begins to decline at the end of fifteen, but without ceasing to bear; on some old estates there exist cocoa trees of upwards of fifty years of age, which still produce. The cocoa is usually planted in the spring, by preference directly after rain; an interval of 10 to 12 feet is usually left between the plants. The kinds which are most used are those of Caracas, Guayaquil, and the Creole variety, which latter is said to come from Trinidad. The Caracas and Guayaquil varieties bear the finest fruit, but they are not so hardy and do not bear so well in Cuba as the Creole variety. The Caracas, however, fetches the best prices. The crop is gathered from the month of October to the month of August. During this period the trees are covered with blossom, and little bunches of ripe and half-ripe pods. The crop may therefore be gathered day by day, but as it is difficult to obtain the laborers necessary for the work, the owners generally prefer to harvest monthly or fortnightly. To prevent fraud as much as possible, the laborers are paid by piece-work, and receive wages calculated upon the number of measures of fruit which they pick. There is no harm done by leaving the pods on the bushes for one, two, or even four weeks, except in the spring, when, if possible, they should be picked at shorter intervals. The cultivation of cocoa, like that of coffee, is undertaken with the aid of colonists, who are hired by the day. The day is calculated from 6 A. M. to 4 P. M., for which time a man is paid about 2s. 6d., if food is not included, and about 6d. less if it is. The colonists are farmers to whom the proprietor of a coffee plantation has let a piece of ground, with the right to cultivate fruit or vegetables, but with the obligation of yielding the planter half or two-thirds of the cocoa gathered on the same piece of ground. Cocoa is weeded in the same way as coffee, but as the cocoa tree sometimes grows to a height of 15 or 20 feet, it is not so much troubled by coarse weeds as the coffee is. The spread of weeds is, moreover, checked in cocoa plantations by the continual fall of leaves, which soon cover the ground. The cocoa is pruned the same way as the coffee

tree, with a view to prevent each plant growing too high and mingling its branches with those of its neighbors. It is necessary always to take great care to remove the suckers which are continually being thrown up from the foot of the tree. As soon as the pods are ripe, they are picked and broken on the spot. The berries, which are full of a curious syrup, are measured and piled up in heaps, covered with leaves. These heaps are allowed to ferment for two or three days, the fermentation being regulated every morning by a rearrangement of the heaps. This process softens the bitterness of the berry, destroys the gum which surrounds it, and enables the cocoa to dry more rapidly. Moreover, the color of the berry depends on the proper conduct of the fermentation. Cocoa, like coffee, is then spread for two or three days on a sort of platform made of cemented stones, called a *secadero*, there to be exposed to the sun and dried. As soon as the cocoa is thoroughly dry, it is rubbed, cleaned of all the detritus which has gathered upon it, placed into bags, each containing about 105 lbs. of cocoa, and sent on the backs of mules to the market at Santiago. The conditions of transport are the same as in the case of coffee. Each mule carries two sacks, or 210 lbs. of cocoa, and travels ten leagues every day. Each group of twenty mules is led by a *capataz* and two watchmen, and travels by night to avoid the heat. The conductor, or *arriero*, is responsible for the arrival of the convoy, which is paid at the rate of 5d. per mile and per mule, or from 5s. 6d. per day's journey of ten leagues. Part of the cocoa grown in Cuba is consumed in the island, but the berries of the finest quality are sent abroad, and generally to Barcelona. France imports no Cuban cocoa whatever. The Cuban cocoa is, says the French Consul, exceedingly fine in quality, and it appears strange that there is no market for it in France. The price of cocoa in Cuba varies from 12 to 16 piastres the quintil, and sometimes, but rarely, rises to 18 piastres. The Caracas berries are sold one piastre dearer than the other varieties. The Consul says it would be difficult to foretell the future of cocoa cultivation in Cuba. Many cocoa plantations were destroyed during the civil war, but cocoa has suffered on the whole much less than coffee from the effects. In many of the largest plantations in the island,

the cultivation of coffee is now entirely abandoned, and the cocoa plants only are depended upon for a return. Many planters, moreover, prefer cocoa planting, because for small planting it is an industry which requires much less outlay than coffee.—*Journal of the Society of Arts.*

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LOOK OUT FOR INSECT PESTS.

During the past two years there has been an increase of insect pests, with the result seen almost any day that valuable fruit and shade trees are succumbing to their ravages. They first appear in small numbers, and can only be detected by close observation, the leaves commencing to turn yellow and soon drop off, depriving the tree of its natural lungs. The tree suddenly presents the appearance of having been through a fire, and dies.

Any one looking along the shore at Waikiki will see numerous coconut trees without leaves, which have been stripped off by the worms. These trees are dead, beyond any process of restoration to life. Hundreds of lime, citron and orange trees have also been killed by insect pests or every part of this island, and unless more and special efforts are made to combat and destroy these pests, their work of destruction will spread till our most valuable fruit and shade trees are killed. The following has been handed in for publication, by a gentleman from Southern California, who states that it has proved to be the most effectual remedy used in that state:—

RESIN WASH.

Caustic Soda (72 per cent).....	5 lbs.
Resin.....	20 lbs.
Fish Oil.....	3 pts.

In case the resin after cooking does not cut well, add a little more water.

Boil the Soda, Resin and Oil in 20 gallons of water for three or four hours. When done the mixture should dissolve readily, like milk, in water without being ropy. Add enough water to make 100 gallons. Boil for not less than three hours. The above wash is recommended for red scale, black, and soft brown scales. It is also an excellent summer wash for deciduous trees. Orange trees should not be sprayed with this wash when fruit is less than three months set. In case soda is 98 instead of 72 per cent., four, instead of five pounds must be used.

For dipping nursery stock add 4 pts. kerosene to the above formulæ. For mealy bugs, add the same.