THE

PLANTERS' MONTHLY

PUBLISHED FOR THE

PLANTERS' LABOR AND SUPPLY COMPANY,

OF THE HAWAIIAN ISLANDS.

VOL. XII.] HONOLULU, FEBRUARY, 1893. [No. 2

The New York price of sugar polarizing 96 deg. is quoted at $3.44, by latest advices.

Owing to the hurricane in Mauritius, the crop of 1892 is much less than usual—not over 75,000 or 80,000 tons.

The New York Sugar Trust, known as the American Refinery Company, divided 9 per cent. dividend on common and 7 per cent. on preferred stock for the year 1892, carrying forward a surplus of $4,370,000.

San Francisco papers report the amount of beet sugar made in California in 1892, as 23,000,000 pounds, as against 8,000,000 for 1891. The price paid for beets ranged from four to five dollars per ton, the yield of beets per acre averaging twelve tons. The national bounty paid on last year's sugar manufactured in California amounted to over $400,000.

The temperature statistics published on page 8 of the January number, and the meteorological summary on page 56 of this issue, give information which will interest travelers. The average temperature for the three years named is 71—79—73, taken at morning, noon and night. The average rainfall for the same period was a fraction less than 37 inches. These data are from observations at Punahou College, two miles east of Honolulu Post Office.

Mr. J. N. S. Williams, of Honolulu, arrived in New Orleans last Monday, says the *Lousiana Planter* of January 28, and after spending a few hours in the city left for Mr. Daniel Thompson's Calumet plantation, on Bayou Teche. Mr. Williams is en route for Cuba, and after making a tour of observation among some of the large sugar establishments on that island, will go to Glasgow, Scotland, to assume control of the sugar machinery department of one of the largest foundries there.

We have received a copy of the catalogue of the Sherwood Hall Nursery Co. of Timothy Hopkins of San Francisco, issued for the year 1893. It is gotten up without regard to expense, with the most exquisite taste, and presents more illustrations than are usually seen in such catalogues, particularly of many of the new and rare flowers. Ladies wishing to secure the best seeds and plants, will do well to send for a copy of this catalogue, to be had at the seed store, No. 427 Sansome street, San Francisco.

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THE 17th OF JANUARY

—Will long be remembered as the anniversary of a bloodless revolution, which took place in this city, resulting in the overthrow of the Hawaiian Monarchy, and in the establishment of a Provisional Government. Whatever our future form of government may be, it is probable that some alliance with the United States will be made. One result of this union will be that all our industries will receive an impetus, and will secure the benefit of any protective duty or bonus given to American products. New industries will spring up, as by magic, affording to industrious Hawaiians—both male and female—new avenues for employment, with increased opportunities for bettering their domestic and social condition. A union of Hawaii with that great and prosperous nation will create a feeling of confidence in the bosom of every man and woman, and settle the long-disputed question that life is worth living, at least in our own favored and blissful isles—the Paradise of the Pacific.

HOMESTEADS FOR HAWAIIANS.

Among the questions brought into prominence by recent events is that of the disposition of the Royal Domain or Crown Lands, in which the agricultural interests of the Kingdom are deeply concerned. They comprise that portion of the land reserved by Kamehameha III. for himself when he relinquished the ownership of a portion, each to the government, the chiefs and the people. His interest in these lands descended to his successors on the throne, who enjoyed the income derived from them; and when from any cause the throne becomes vacant or is abolished, this royal domain must naturally become the property of the nation.

The crown lands comprise about one million acres, including some of the best tracts in the Kingdom. Many of them are under lease at merely nominal rentals, and as these leases expire, the demand for them will greatly increase their value and rental also. The income now is probably about $75,000 per annum, but they will ultimately yield a revenue of fully double that sum, and this within a very few years.

The present would seem to be a most opportune time to bestow on the native Hawaiian people a right royal benefaction by granting homesteads to all such as are destitute of land or homes. This may be done through the Crown Lands Commission awarding small tracts to such as need homesteads, under some uniform and equitable plan that may be adopted, as outlined below.

1. Give to each native Hawaiian head of a family—male or female—who is not already a landholder, and to every voter who is not a landholder, a tract of from five to twenty acres, to be designated a homestead or kuleana.

2. These homesteads to be located on unoccupied land, or on leased land, when the lessee is willing to have them located on it, as he might be, were the applicants already living on it.

3. This award to be given to the grantee, and his lawful heirs, on condition that it shall be inalienable by sale, gift or otherwise. Also, that it shall never be encumbered by debt of any kind.

4. Whenever the homestead shall cease to be occupied by

the grantee, or by his lawful heir or agent, it shall revert to the Government and become as before, a part of the public domain.

The chief object is to provide a home for every family of the aboriginal race, and for every industrious Hawaiian who is a voter, as a gift from the nation, that can never be encumbered, by debt or otherwise, or alienated in any manner whatever. The changes soon to take place here call for the adoption of some provision of this kind, and every friend of the native race will rejoice to see a provision of this kind that will secure to them and their posterity a home from which they can never be driven. It may be that some unworthy persons might secure homesteads in this distribution, but no matter if they do; it may serve as a means of reformation, if such descendants of a noble race are saved from want and thereby made industrious and happy. Another gain would be the better distribution of native families in the country districts, where labor is always wanted, whereas now the drift is towards the villages and settlements.

Many points will naturally be raised in connection with this proposition, for it is advanced chiefly with the view of calling attention to it and studying its merits and practicability. There are men among us who are capable of devising safeguards which will render these national homestead gifts a blessing to the recipients, by securing homes to them and their posterity.

If this plan can be carried out so as to provide to every household a home of its own, it would create a friendship between the native and the foreigner stronger than any that now exists. In the rush of adventurers which is likely to follow the present political crisis, justice demands that we should protect the aborigines by securing to them, as far as in our power, a perpetual franchise in the land of their own heritage, and while it assists to secure them health, comfort and happiness, it will be a perpetual token of the good will of those whose forethought secured it to them.

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The rainfall on these Islands for February has been unusually heavy, amounting in some places to over thirteen inches.

HAWAIIAN FRUITS.

A gentleman who made the circuit of Hawaii by land, has handed to us a list of twenty-seven fruits which he found growing during his trip. The list is inserted below, and our readers will notice that they are mostly common kinds, which are found ripe at any season of the year, in the localities where they thrive best. Strangers often complain that during their stay here they do not get all the fruits they would like. For instance, at the Volcano the *ohelo* berry and guavas are abundant at most seasons, wild strawberries and *ohias* at special seasons. Yet some travelers who go there say that they find no fruit of any kind, when a little effort might keep the table supplied. The following list by no means includes all the fruits growing on Hawaii:

Cherimoya	Cocoanut
Alligator Pear	Sweet Mango
Chutney Mango	Wild Strawberry
Lime	Orange
China Orange	Wild Guava
Red Guava	Yellow Guava (strawberry)
Fig	Mulberry, black and white.
Bread Fruit	Papaia
Ohia, red and white.	Banana, several kinds.
Water Lemon	Ohelo Berries
Pineapple	Rose Apple
Akala (raspberry)	Peach
Loquat	Spanish Plum
Grenadilla	

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SHIPPING AMERICAN ORANGES TO LONDON.

Last year the experiment of shipping oranges from Florida to London was made by Mr. E. L. Goodsell of New York, who sent over a cargo by the steamer Ethelwood. It was only an experiment, but it showed that the new opening is likely to prove successful, not only for Florida oranges but also for those grown in California. Mr. Goodsell is now in California. and was recently interviewed by a San Francisco *Bulletin* reporter to whom he said:

"You know this shipping of oranges to Europe is something I've been working on for five years, sending a fast steamer—the Ethelwood—from Fernandina to London. I had hard work to get the shippers—some thought I should go to the lunatic asylum for suggesting the idea—but I secured 10,000 boxes and they sold in London at figures that showed the experiment was a decided success. Of this shipment 5,700 boxes were in good condition on arrival, and these netted the growers from $1.50 to $2.50 a box, or an average figure far in excess of New York receipts. The voyage took fifteen days. I will try this again next season. The Florida people were delighted at the prices and at the advertising they received.

"My idea is that California oranges can also be sold abroad at good prices, shipments going via New York and the Cunard or White Star steamers. I hope to be able to get 3,000 or 4,000 boxes this season. The object of all this is to find outlets for our orange product now, instead of waiting until necessity forces it. I favor sending to Europe instead of making the great cities the dumping-ground for our surplus product. Orange-growers, as a rule, both in Florida and California, expect too great profit. It will be well when they realize that a profit on their investment of 10 per cent is a good thing, instead of expecting to net somewhere near 50 per cent."

If the Queensland orange growers can ship their surplus fruit to London as they are now doing, surely Hawaii cannot fail to find a market for all she can raise.

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INFORMATION WANTED.

At a meeting of Louisiana orange growers held at the experimental station in Audubon, a circular was prepared and sent out, soliciting information regarding the cultivation of oranges, and a list of questions propounded, to which answers were solicited. The object is to obtain the fullest information from growers regarding their mode of cultivation, from seed planting to harvesting. As the questions propounded are of equal interest here, we insert them (omitting two or three of no value here), that fruit-growers on these islands may keep a record of their practice for future reference. The system will apply, with a few changes, to coffee as well as to oranges and other fruit :

1. What class of soils (sandy, loamy or stiff) do you prefer for orange growing?
2. What preparation of soil do you give?
3. At what season do you prefer to plant?
4. Do you advocate deep or shallow planting of the trees?
5. Give best distances trees should be planted in the orchard.
6. Do you prefer seedlings or budded trees? Give reasons for preference.
7. Which stock do you prefer for budded trees: Sour orange? Bitter sweet orange? Sweet orange? Rough lemon or grape fruit? (shaddock.)
8. Give your experience with each?
9. At what season of the year that you prefer to bud?
10. Do you prefer budding in nursery or in the orchard?
11. What method of budding do you prefer?
12. What percentage of buds live?
13. Do you approve of pruning; if so, to what extent?
14. Do you fertilize your trees; if so, how?
15. Do you grow "green crops" in your orchards; if so, what kinds are preferred?
16. Do you cultivate your trees; if so, state your fertilizer, both for young and bearing trees?
17. Have you tried "Wind-breaks;" if so, with what success? State also character of wind-break.
18. What varieties do you grow? What varieties do you prefer? What varieties sell best in market?
19. What diseases have troubled your orchard?
20. Your method of gathering, packing and shipping?
21. Have you found orange growing profitable? If so, give approximate profits per acre.

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CONSUMPTION OF SUGAR IN THE UNITED STATES IN 1892.

In Willett & Gray's sugar circular we find the following synopsis of the consumption of sugar during 1892. The importations for 1891 were abnormally large, and beyond the actual consumption for that year, the reasons of which are as stated on the next page:

"Herewith we give the annual figures of the sugar trade of the United States for the past year, as well as for several preceding years. It will be interesting to note the countries from which our supplies of sugar have come, and particularly that notwithstanding the favorable out-turns of the several cane sugar crops we still required and have taken 149,482 tons from the European beet root crops. The figures of the consumption of sugar, both foreign and domestic, in the entire United States show a total of 1,837,626 tons, against 1,872,440 tons in 1891, a decrease of 34,727 tons, or 1.86 per cent. This difference is easily accounted for by the fact that at the beginning of 1891 every grocer and family in the whole country exhausted their carrying stock of refined sugar in anticipation of the taking off of the duty on April 1st, and it was afterwards replaced and remained in the carrying stock at the beginning of 1892. Also the year 1891 was much more favorable for canning and preserving than was 1892. Taken altogether the result is satisfactory, although not as much so as was anticipated at the beginning of the year, when it was thought that the consumption would equal 1891, and perhaps surpass it by 5 per cent.

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METEOROLOGICAL SUMMARY FOR 1892.

From Observations Made at Oahu College by Prof. A. B. Lyons.

	Temperature, Fah.				Barometer.			Relative Humidity.		Rain. (In.)	No. days of rain record.	Cloudiness.	No. days sky overcast.	No. days trade winds
	6 A. M.	12:30 M.	9:30 P. M	Av.	max.	min.	aver.	mid day	n'ht.					
Jan....	66.2	73.7	68.1	69.30	30.22	29.74	30.000	67.1	74.8	8.81	17	43	9	11
Feb	69.7	76.9	70.7	82.45	30.17	29 83	30.033	67.9	77.5	3.59	14	50	10	16
March..	69.4	76.1	70.3	71.93	30.22	29.94	30.098	61.8	68.8	1.09	11	52	8	24
April...	69.8	79.9	71.8	73.84	30.21	29.94	30.045	63.6	79.6	2.64	12	53	12	4
May....	71.5	80.7	73.2	75.09	30.16	29.89	30.053	60.1	75.7	5.75	7	47	10	13
June....	74.1	81.5	75.1	76.88	30.16	29.97	30.075	60 1	72.5	1.64	21	44	7	27
July....	74.2	81.4	75.6	77.05	30.22	29.99	30.090	60.	73.	1.62	16	44	5	31
August.	74.4	82.6	76.5	77.83	30.14	29.97	30.052	61.1	74.3	2.36	13	33	1	27
Sept....	75.5	83.4	77.0	78.63	30.07	30.00	30.034	57.8	68.4	0.98	8	34	3	28
Oct.....	72.7	81.1	75.1	76.28	30.13	29.83	30.015	63.2	72.1	2.40	9	42	5	24
Nov....	71.4	79.3	73.4	74.69	30.12	29.85	29.993	61.4	72.6	0.89	10	45	6	17
Dec....	67.8	76.2	70.2	71.41	30.15	29.77	29.971	62.4	75.6	3.90	14	45	9	14
										Tot'l				T'l
Avgs...	71.39	79.40	73.08	74.62	30.22	29.74	30.038	63.04	73.74	35.87	12.7	44.2	7.1	236
Av. 1890	71.37	78.84	73.04	74.42	30.20	29.69	30.016	67.07	79.38	49.77	13.5	43.8	6.2	251
Av. 1891	71.35	79.39	73.00	74.61	30.26	29.64	30.039	63.25	75.27	25.23	10.9	40.0	5.2	275

CORRESPONDENCE AND SELECTIONS.

LALAS, OR BRANCHES, AS CANE SEED.

EDITOR PLANTERS' MONTHLY:

In a former letter to the PLANTERS' MONTHLY (see September, 1892), the use of cane branches for seed was touched upon, and a comparison drawn between them and plants of a like age grown in the soil; it being assumed that the latter would constitute the larger and more desirable seed, and the argument in favor of them being based on the assumption that the branches were "converted into cuttings," as has been customary here, so far as I know.

The writer of the article copied from the Barbadoes Planters' Journal, in the same number, discusses the same subject and advocates a study of nature's method in that line, where the weight of the offshoots finally bears the parent cane to the ground where they proceed to take root, while still subsisting on the parent cane until they become firmly established for themselves.

It may surely be taken for granted that vegetation, seeking to propagate itself in nature's way, will sustain less of a draft on its vitality than when its forces have been called upon to recover from a severe shock imposed on it by interference from exterior contingencies. But does not this view of the subject present a new phase to the question of the use of the branches of cane for seed?

It will at once be apparent that the wound caused by the cutting or breaking of such a branch from its parent cane at the point of attachment, where it is the least in size and where indeed it is very small, and the texture very woody,—will be much smaller and of a less severe nature than that occasioned by the severing of a large cane through its body. May we not surmise then, that the use of the branches as *nursery plants*, with their terminals intact, and exposed above the ground when planted, and not as cuttings, may possibly serve as a partial solution to the problem of preserving the vitality and characteristics of any given variety of cane?

So much for argument in favor of the use of cane branches for seed; but now let us select two canes, either arrowed or topped, and prepared to send out their laterals; leave one to be provided for by nature's own method, but sever the other from its root and lay it, or a part of it if you choose, in the ground. The juices which supply its buds may not, after a few days, be quite as fresh and sweet as those that supply the buds on the standing cane, but at the end of four to six weeks these buds will have sent out roots of their own and be drawing sustenance direct from the earth.

Will not their growth thereafter, for I assume that it will be far in advance of the others, prove conclusively that they have had the superior advantages? And if so, who shall say that the vitality or character of the cane has obtained any injury from this interference with nature's process? As to the decrease in yield that has been noted by some observers, the tonnage of sugar per acre of land failing to keep pace with the increased extraction and yield per gallon of juice that has resulted from improvements in manufacturing apparatus, is there not too much of a tendency to overlook the natural decrease that should be expected to result from such a severe tax as has been levied on the soil by many, if not most, of the plantations in these islands?

Verily the wilyness that has been attributed to the Chinese of managing to have the last atom of fertility exhausted from the soil with timely reference to the expiration of his lease thereof could not have resulted more disastrously than had the method assiduously practiced by some plantation managers, whose aim has been to turn out each year the largest possible crop without regard even to the consequences in the immediate future.

The old Mosaic law that required the land to rest one year out of seven, may perhaps be satisfied in the disregard thereof by a liberal application of suitable fertilizers, but land that is cropped, burned off and replanted in three months, or even six months, will not respond with a satisfactory crop, and such a practice is not only suicidal, it is simply abusive.

E. C. BOND.

Kohala, Hawaii, December, 1892.

"AUTOMATIC MEGASS FIREMAN."

[CORRESPONDENCE OF DEMERARA ARGOSY.]

In Lancashire a maxim most throughly worked up to is, that "a man saved is one thousand pounds gained." In this colony we all recognize and appreciate the fact that labor saved is labor available for other work, particularly at this presént time of the efflux of men to the gold placers, and the ravages of influenza amongst our working population, at a time when every penny that can be saved must be saved.

To-day I am certain of your interest in what is herein described, because it is a labor-saving device so remarkably simple that it scarcely requires description.

The usual method of handling megass hitherto has been to drop it from an elevator, carrier, buckets or boxes, on to the megass platform, from there regulating and pushing it by labor, rolls, or gearing into the respective furnaces, this being laborious and requiring much attention.

With this brief account of the past condition of megass firing, to facilitate the description of my "automatic fireman," I will proceed to describe the invention.

My object is to reduce the labor on megass platforms, as now used, and at the same time to facilitate the combustion of the megass, by replacing human firemen by "automatic, mechanical ones."

The megass is carried the whole length of the platform by the usual rake carrier, this being connected with each furnace by "Enclosing Hoppers," down which the megass falls direct into the furnace until it is supplied, and the hopper is sufficiently full to cause the carrier megass to pass over that in the hopper; in other words a portion of the megass in its progress along the bottom of an ordinary carrier falls into the first fireman or enclosing hopper till it is full, then passes over the megass therein to the next, and so on, thus keeping a whole series of furnaces automatically supplied with megass, each taking its share to make up for that burnt in each furnace.

The surplus megass can be discharged at the carrier end, or stored between each furnace by opening intermediate doors that are under the easy control of the overlooker as shown. No human firemen whatever are required except in buildings, where and when the megass furnaces are not stopped with the mills; in which case, by simply opening the door at the bottom of each enclosing hopper, the furnaces can be fed by men in the usual way.

The man in charge simply regulates the damper to give the necessary steam, and the intermediate doors to prevent too much surplus megass accumulating at one place; he will also see by means of the peep-holes or slots in the hoppers or firemen, that each furnace is taking its own proper feed.

Marked advantages of the "Automatic Fireman:"—

1st. Saving labor.

2nd. No fireman whatever required, no matter how many boilers.

3rd. Less than half the usual number of backers or boxmen required.

4th. Pays for itself in one grinding season.

5th. No power and no gearing required.

6th. Absolutely "Automatic."

7th. Gives a constant regular feed which greatly facilitates perfect combustion.

8th. Prevents cold air entering the mouth.

Marked characteristics of the "Automatic Fireman:"—

1st. Hopper so arranged that when the furnace is sufficiently supplied with megass, the megass is automatically caused to pass on to the other furnaces, each taking automatically a quantity equal to that burnt.

2nd. A. B. C. simplicity.

Through the kindness of the Hon. W. Craigen, any one interested in megass firing can see the above stated facts borne out in practice on the first estate to adopt these automatic firemen.

There, Mr. Dawson tells me, two men now do the work that previously required fourteen; in other words the estate now has twelve able-bodied men at liberty for other work, besides a direct saving of at least $26 per week in labor. Two-thirds of this is saved entirely by the automatic firemen. The photograph will give a good idea of the apparatus in full work, and the blue prints will show the styles adopted for various carriers.

Many contrivances have been used, such as mechanical stokers, flaps, and other means by which megass and air can be supplied to the furnace of steam boilers for the purpose of obtaining good combustion, all of which have been found more or less imperfect.

By this statement I do not mean that any particular method of firing will produce any more heat from a pound of megass than nature put into it ;—just as good results may be obtained from careful hand-firing as from my automatic fireman. In the first instance, good men are expensive ; in the latter the very principle of the invention necessitates its fulfilling the two most important functions of preventing air entering at the furnace mouth, and giving the furnace a regular supply of megass in order that it may be dried before entering into combustion. I refrain from saying more on this now, but hope ere long to have the honor of laying before you some interesting observations on furnaces.

It is just as essential to good economy, that the boilers should have the very highest initial or furnace temperature, the highest possible steam pressure, and the lowest possible chimney temperature, as it is for the engine to be economical under similar conditions of high initial pressure and terminal temperature.

I do not care to use my privileges as a committee-man of this Society to advertise the apparatus I have recently invented and carried out with the assistance of Mr. Dawson, but I may state, that though simplicity itself, it is none the less effective, and that there is not a megass platform in the colony where this invention would not save from 50 per cent. to 90 per cent. of labor.

W. PRICE ABELL, W.S.
1883 Honours Medalist in Machine Design.

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SUGAR BOILING IN VACUO.

[FROM THE LOUISIANA PLANTER.]

To obtain high skill in the practice of pan boiling requires close observation and much experience, but the laws of crystallization on which the art is founded are simple and fully understood by chemists.

Most of us have watched troops exercising in extended order as skirmishers. Now, it is evident that if sufficient time be allowed the scattered men may be assembled in battalion squares; but it will take long, for many of the men will have far to run. Should a shorter time be allowed they can still form in small squares with faces accurately dressed, but should they be surprised by horsemen they will only be able to form small, irregular groups.

The first of these cases is analogous to the formation of large grained sugar, the second to small grained ditto and the third to what is known as "false grain." Each particle of sugar in solution will take its required place, but it must be allowed sufficient time, the rapidity of the evaporation being counteracted by drawing in fresh supplies of comparatively thin juice. False grain is not a crystal but an irregular assemblage of sugar particles, and the proper way to deal with it is disperse the particles and reform them in proper order. This is best done by keeping the masse cuite free, raising the temperature as high as necessary, and when the object has been gained gradually bringing down the thermometer again. Should a charge be run down with much false grain it simply won't dry, but should the quantity be small it will attach itself to the true grain and work without difficulty; the brilliancy, however, of the sugar will be destroyed. False grain is the principal dread of a young sugar boiler, and certainly if his pan be full and much bad grain in it no one can get him out of his scrape, but I have never seen matters so bad that the sugar could not be made workable and I have seen some bad messes.

With sugar as with all salts, when crystallization takes place from a weak solution the crystals form slowly, are large, sharp, hard and regular. When the solution is strong the crystals are small, numerous and (if the evaporation is very rapid) soft. Also, it may be noted that the particles of of sugar in solution prefer, if I may so express it, to attach themselves to crystals already formed rather than to originate new crystals. On these natural laws turn the whole art of the pan boiler.

The density of juice drawn into the pan is usually from 25 to 30 deg., but I have boiled at all densities, from 6 to 40 deg.

Beaume, and there is no difficulty in doing so. Did I, however, require an unusually large grain for exhibition, I should prefer the juice not higher than 30 deg.

The vacuum having risen to 15 deg., which it should do in a few seconds after starting the air pump, the charge cock should be opened and steam put on the coils as they become covered, and when the juice boils as high as the eye glass there is sufficient in the pan. Fresh juice should be taken in as the contents of the pan boil down, and when the juice has become strong enough to crystallize I prefer to have the coils all well covered. When my juice is of fair quality, and I desire a small grained sugar, I prefer to allow the grain to form in the charge, and when I have sufficient grain I open it out boldly and then set the charge cock so that it shall draw in juice about as fast as the pan evaporates it. This mode of working not only enables the sugar boiler to devote much of his time to the clarifiers, etc., but gives him an even, sharp and hard grain. I seldom have reason to boil hot in order to harden grain, and expect with peculiar qualities of juice I work with as high a vacuum as I can get. I have occasionally kept the charge cock open from the time that I struck the grain until the pan was full.

When a very large and even grain is required the best method is to begin with a moderate charge and to keep the pan at about granulation until considerably more than half full, at which time the grain should begin to appear. This, however, requires much care and attention, and the best sugar boilers frequently fail to get their crystals perfectly regular. Less skillful boilers obtain a very large grain by repeatedly cutting the pan, and I have even known the sugar to be dried, the smaller crystals sifted out, the remainder returned to the pan and the boiling continued with fresh juice. The result, however, was not satisfactory, the crystals being dark and defective in form and brilliancy.

In finishing a pan of sugar there is room for judgment. Fancy sugar of large grain should be run down quite free, but with commercial sugars there is a great advantage in boiling close. In all cases, however, the sugar should run freely from the pan and not drop slowly in lumps. It is of course safest to trust to the proof stick for the sticking point, but occasionally one may be deceived by a false proof. In the latter case the observant sugar boiler will notice a slight jar caused by the sugar ceasing to boil actively and falling on the coils. When this is felt, steam should immediately be shut off, the vacuum broken and the bottom valve opened. Should the sugar be too thick to come out freely it is best to warm it up by putting steam again on the coils, leaving the bottom valve open. This, however, should not be done if steam is supplied at higher pressure than ten pounds, as there would in that case be danger of burning the sugar. In every case when a pan is emptied it should be all steamed out for fifteen or twenty minutes.

It often happens that a sugar boiler finds his pan carrying a good vacuum and working slowly, and that the chief engineer declares that coils, steam traps, etc., are in perfect order. In such a case let him firmly maintain that if a coil is clean inside and outside, if the steam gets into it freely and the condensed water escapes, it must do the work due to its heating surface. When a pan works with exhaust steam the inside of the coils is liable to become coated with a layer of dirt derived from the tallow used in the cylinders. The best way to obviate this is to have attached to the coils cups similar to those on the slide valves of the engine, and occasionally to put in by this means a strong solution of caustic soda while the pan is working.

To remove scale the best way is periodically to cover the coils with water, add from ten to twenty pounds of caustic soda in solution, boil for fifteen minutes and discharge. Take in fresh water, add four or five gallons of hydrocholic acid and boil again, afterward washing out with fresh water. In no case, however, should chemicals be left in a pan over night, as galvanic action is thereby set up and the metal eaten away.—LESLIE C. BATTERSBY.

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HOW MANUFACTURE AFFECTS CULTIVATION.

[QUEENSLAND SUGAR JOURNAL.]

In our July number we referred at length to the necessity of shortening the crushing season in Queensland. We pointed out that so long as the milling power is more than able to cope with the cane fields, the work of crushing should be as far as possible compressed into those weeks when the cane is at its best. There follows this a second problem to be solved—what must we do when the supply of cane necessitates the mill being worked at least five or six months? If not to answer this, to at least point the direction of useful experiment and probable solution of the difficulty is the object of the present writing. Admitting what we said in July to be correct—that all cane should be treated when at its best—we have to consider whether we cannot by judicious cultivation bring our cane fields into such a state that they can supply canes containing the maximum of sucrose and the minimum of glucose during any given week in the six months allotted to harvesting. The thing seems feasible enough, and has, we know, proved successful in a limited degree. Careful manuring at the right time will force a cane to maturity as far as growth is concerned, while trashing will hasten ripening. By the choice of canes—short or long lived as may be required—there should be little difficulty in regulating our fields so that an approximate maturity may be arrived at in the cane at any given time during the crushing season. By attention to early cut canes it is not unreasonable to suppose that we can bring them to a state, best fitted for the mill, in, say June or July, and special treatment to each field it does not seem chimerical to think that the maturing of canes can be regulated to meet the requirements of the factories. That something in this direction is possible has been proved in countries affected by heavy frosts, where strict attention to the details we have named now enable crops to be grown and matured in eight months so as to avoid the severe cold. It is not too much to say that many thousands of tons of cane are lost annually in Queensland through their being harvested when unripe. Every mill-owner knows the difference between the results of his crushing in June and the results in October. In the first month his canes are unripe, and he takes up to two or more tons of cane to make a ton of sugar than if he were working on ripe canes. Assuming that we crush unripe canes for only two months during this season, the result is a loss of 40,000 tons of cane, or equal to at least 4,000 tons of sugar, an obvious money loss in all save bags and freight to port and a few very small items of £52,000—a serious amount indeed, which is unhappily likely to be much exceeded. To save this enormous sum is, we think, well worth a little trouble on the part of manufacturers, and we hope soon to learn that steps have been taken to sensibly reduce this loss. There is one difficulty in the way of what we suggest to many Queensland manufacturers. Their cane is cultivated by farmers, and these will have to be brought to recognize the desirableness of growing cane which, when delivered at the mills, will be ripe and return the best results to the purchaser. The difficulty is not insurmountable as the factory buying cane could insist upon the material it purchases being ready for its use at a certain date, and with the increasing knowledge of the chemistry of sugar it will soon be quite possible to establish a sliding scale of payments, based upon the quotient of purity of the cane, But we venture to think that once a fair start is made towards scientific cultivation with due consideration for the requirements of the factories the reform will spread apace, bringing increased capacities and consequently profits to the mills and enabling them to pay the cultivators a proportionately higher figure for the raw material, which will then be used instead of wasted, to the extent of 20 per cent., as at present.

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BROWN OR WHITE SUGAR.

A question that will certainly open up considerable discussion in the future in the manufacture of beet sugar in the United States is, to know if all processes for the manufacture of white crystallized sugar at the factory are to be abandoned in face of the well organized syndicate of the American Sugar Refining Company, which evidently has greater facility for the refining of sugar than would be possible in an ordinary beet-sugar factory.

Even in the present early stages of the industry opinions appear to be very much divided. Some of the factories make a white crystallized sugar testing 99 deg., while others prefer confining their efforts to raw sugar manufacture and to sell their product to refiners who are willing to contract in advance for all sugar made. From want of space, we are not able to enter into the question in detail. It is interesting, however, to call attention to a successful process of manufacturing white crystallized sugar at a low cost, and for which the machinery required costs but a few thousand dollars. A *cleare* is made with the sirup from multiple effect. This is concentrated to 36 deg. B. at a temperature of 104 deg. F. The cleare thus obtained is, in reality, a supersaturated sirup. The green sirup from *masse cuite* is swung out in centrifugals; 10 per cent. of the cleared, above described, is then added, during which time the outer surface of the centrifugal drum is heated with exhaust steam. The sirups running from centrifugals during this operation are subsequently mixed with sirups entering vacuum pan. Special steam injectors complete the sugar washing, and it is said that about 64 pounds white crystals, testing 99 deg., may be extracted from 100 pounds *masse cuite.*

It is interesting to compare this process with that of raw sugar extraction, considered on a basis of dollars and cents. For example, we may suppose that beets worked average 13 per cent. sugar. By American processes there may be extracted per ton of beets 150 pounds brown sugar, testing at least 88 deg., and worth 2.6 cents per pound, and 50 pounds of a second grade brown, which would have a ready market in New York at 2.3 cents per pound. The total value of these raw sugars would be about $5.05. On the other hand, by the process above described, from one ton of beets there could be extracted 129 pounds of high grade white crystallized sugar, testing 99 deg. At present market prices this would bring over 4 cents per pound, to which must be added 21 pounds of a lower grade sugar that would have a steady market at 2.3 cents per pound. In this case the total value would not be less than $5.60 per pound. Thus there remains a difference of 55 cents in favor of the process under consideration. For a campaign of 20,000 tons there would be a profit of $11,000. Just within what limits this figure is correct remains to the determined by practical experience. Whatever may be the results obtained, the experiment is worth trying. We shall be pleased to publish any practical data on this point that may be sent to us.

By adopting above method of manufacture there need be no cause for Northern sugar makers to envy Southern sugar manufacturers, who get a bounty upon sugar of 80 per cent. test and of quality that may enter into immediate consumption.—ED.—*Sugar Beet.*

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SUGAR PRODUCTION IN AMERICA.

The question of future sufficient production of sugar in the world to meet the constantly-increasing consumption, to which we have referred in previous issues, (says Willett & Gray's "Statistical,") is already occupying the attention of thoughtful men everywhere, as is evidenced by the English opinion we print to-day. Increased acreage of beets in Europe produce decreasing crops, and the figures we printed last week show that the increased consumption of the past three years has been met wholly by an increase of cane crops, and we may add that the only increased cane crop of any significance for four years has been that of Cuba, which has risen from 630,311 tons in 1888 to 965,000 tons in 1892. All other cane crops, in 1892, with few small exceptions, were were less than in 1888. It seems, therefore, that it must be to Cuba that the world, and especially the United States, must look for the increased production necessary for the constantly increasing consumption. If this is so, are we not entering on a period of high prices? Undoubtedly so, unless a new field for sugar production is opened up immediately.

When, in former years, the consumption of sugar in the world outgrew the cane production, and it became necessary, in order to prevent high prices, that new fields should be opened, the European governments did not hesitate to stimulate the production of beet sugar by the payment of bounties. The world is now confronted with the same question; consumption has outgrown both the cane and beet productions, and high prices must follow or new fields be opened. There are no such new fields to be found except in the United States.

Every nation has its special "eras." This nation has already had some, and is about to begin another. We are entering on a beet sugar agricultural era. This is not a political issue. It is a national matter in which every political party, and every consumer of sugar is interested. Upon its solution depends the question of higher prices for sugar, or a continuance of the present low prices. All the necessary experimental work has already been done by the Government, which has conclusively proved that abundance of land in many States is suitable for the cultivation of the sugar beet of as high or higher sugar content than those produced in any part of Europe.

Labor-saving machines are already invented, which do away with very much of the field labor required abroad. It is not to be expected, however, that we are any wiser or better able to do away with the means by which the beet sugar production of Europe was raised from nothing to 3,695,000 tons, or 60 per cent. of the world's production. To do this required the stimulus of a bounty, which, having accomplished its purpose, is now being gradually done away with. But suppose they had hesitated at the bounty at the outset, what would be the price of sugar to-day, dependent upon the cane countries producing only 40 per cent. of present consumption? Suppose the United States hesitates at bounty at this critical time in the establishment of beet sugar agriculture, what will be the price of sugar a few years hence, with a growing demand for consumption, which in the last two years has increased in the United States 421,206 tons, or 22 per cent. until we have now consumed 1,890,842 tons in one year, and produced but 218,725 tons, yet having at our disposal the climate, the soil, the farmers and the capital for the production of the remaining 1,600,000 tons, when once the industry shall have been placed on its feet by the same method as has been found indispensable to every other nation? The sugar question is a large one, and requires the broadest and highest statesmanship in its direction, if our 65,000,000 spoons are to continue to dip into our present, free and cheap sugar-bowls.

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SUGAR CANE INSECTS IN NEW SOUTH WALES.

[BY AL. KEOBELE, SPECIAL AGENT, IN INSECT LIFE.]

During the month of January, 1891, I had the pleasure of traveling with Mr. Rudolph Helms, chemist to the Colonial Sugar Company, through their sugar cane fields from Clarence to the Tweed river, and have had, through the generosity of this company, which kindly placed at my disposal steamers and other conveniences, a good opportunity of looking into the diseases of this plant.

The following insects are observed as being injurious to sugar cane: (1) The larva of a Noctuid, (2) Scarabiæid larvæ, (3) wire-worms or Diabrotica larvæ.

THE NOCTUID LARVA.

This ranks first in injuring or destroying many of the plants in all parts visited, and seems to be evenly distributed from the Clarence to the Tweed river, being somewhat more numerous in the first locality mentioned. This larva is most numerous on the outer rows, so much that in some places, as on the Clarence river, the entire plants were often destroyed, not bearing a single healthy or even living cane, while many fields, especially on the Richmond and Tweed, rarely showing any traces of the insect.

The abundance of the larva on the outskirts of the fields and places exposed to the wind may be readily explained. The moths which are on the wing at night and nearly always fly against the wind will often settle on the first plants reached, and there deposit their eggs. A second reason may be the usual strong winds during daytime not so readily allowing the minute flying enemies mentioned below to hunt up their hosts on the outer exposed parts of fields.

The eggs are, without doubt, deposited on the tops of plants and rarely in numbers, quite likely behind the young leaves, for very often but a single larva, or the work of such could be found upon a plant. The moth has a casual resemblance to our Arzama, which lays its eggs in clusters intermixed with the hairs of the bushy anal segments of the female. Although I have looked, I have never found a trace of such eggs. In this species the last segments are not provided with tufts, and the habits no doubt also differ. As the traces of young larva always indicated, they enter the tips of plants and work their way downward to the heart, which they destroy. If not forced to leave on account of decay, they will begin irregular tunnels several inches deeper, and, if full grown, pupate in one of them, providing first an opening lightly spun over for the moth to issue. The dry and dead top leaves always afford a favorite place in which to pupate. If the larva are compelled to leave the boring on top, they come lower down, and begin their destructive work behind the leaves, often girding the entire plant, and, if the entrance is found, usually on one of the eyes. The tunnels run very irregularly up and down, and sometimes the plant is nearly cut off, and this may be the case as low down as on the ground. It is uncertain where the larva will again enter a plant after leaving a burrow, but, in the first place, no doubt they look for shelter from their enemies, and perhaps sometimes enter the plant at or below the surface of the ground. Often plants six feet high were found uninjured down to the base, and here entirely cut up. Young shoots seem to be eagerly sought and entirely destroyed down to the roots, and one larva is able to destroy several such before becoming mature. In instances where several larva had been at work upon one plant, this was often destroyed completely; not a single healthy cane was left, and frequently four or five parallel tunnels could be found within one stalk. In rare cases, the whole inside of the cane is a complete mass of fibers.

During the time of my visit, the most of the larva were nearly full grown, although some were found measuring more than one-half inch in length. The chrysalis were not so numerous, and some of these had already hatched. From these meager observations alone, it cannot be said with any certainty how many broods there are annually, yet it is almost safe to say not more than two, allowing for irregularities in this warm climate. All the large larva found were no doubt of the first brood or larva that had hibernated and pupated, say, about October and November. The duration of the pupa state, judging from specimens bred in confinement, is extremely short, only from ten to twelve days, varying, however, with the temperature. During spring it may even take twice this length.

Two species of parasites were observed to prey upon this insect. The first is a species of Microgaster, which destroys fully one-half of the larva, and from 50 to 80 specimens were bred from single individual larva. No doubt these little parasites are in constant search for their hosts, and not only deposit their egg within such larva as have left their tunnels and are searching for new places, but also enter the open hole in the plant in search of them. All of the bred specimens were from grown or nearly grown larva. The larva of the parasites, as is well known, leave their host when full grown and spin a white silken cocoon on the outside and together, generally in the place prepared by the larva for pupation, and in four or five days, as repeatedly observed during January, the active little insects emerge to begin their useful work anew. This is certainly the most beneficial agent in keeping this serious pest to cane growers in check, and without which it would not be possible to grow this crop successfully. I might also prove its usefulness upon other and closely related species in distant countries if an opportunity were given.

We may safely say that the whole life cycle of this parasite, from egg to imago, will not take more than fifteen to eighteen days, during warm months, and that about twelve broods may be expected during the year to two of the moth. Thus it will be seen of what infinite value such minute insects are.

The second species is a Chalcidid, and parasitic upon the chrysalis of the moth. This also is a very interesting little insect. The chrysalis of the moth is stung by the parent parasite, and as many eggs are laid within as will entirely fill the shell with the larva as these become full grown. They then pupate, both within and without, making similar cocoons of the foregoing, and in due time the mature insects, which are half as large as the Microgaster, make their appearance. Very few holes for egress are made, and often all issue from a single one. A few hundred may be bred from the chrysalis of the cane borer moth, and as the life history, as far as is known, is of brief duration, this parasite is nearly if not wholly as valuable as the first in keeping the borers down. As may be inferred from analogy, this Chalcidid will not only be found preying upon this particular chrysalis, but on a great variety of Lepidopterous chrysalids, as is the case with related American forms.

In addition to those parasites, numerous small ants of two species were observed to form colonies in and around the burrows, and wherever these were present it was but very rarely that either larva of chrysalids could be found, and often dead larva or chrysalids and remains of such were found that were destroyed by them.

Numerous Curabid beetles were also present on the ground at the base of the plants and no doubt assist materially in reducing this pest.

SCARABÆID LARVÆ.

Various species of Scarabæid beetles are always present in cane fields and especially so in recently cleared ground. Of these a species of Anaplognathus, commonly called "Christmas Beetle," was most numerous, and is often plowed up both in the larva and imago state. Two other species of large Scarabæid larva were found behind the plow, as well as a species of Heteronyx, together with larva and pupa, no doubt of the same species.

The larva of the beetles are injurious by eating the roots of various plants, and as their transformation is very slow, they remain a long time in the ground, and in the absence of any other roots, they naturally attack those of the sugar cane. If numerous, they will become a serious pest, as insects of this sort often devastate whole fields.

As a remedy it is suggested in the first place that diligent search be instituted for the larva and beetles while plowing and harrowing. This could be done by children. The mature insects, which come out chiefly at night, may also be found in the daytime feeding on the leaves of the Eucalyptus trees which are often defoliated by them; by shaking the trees early in the morning, the beetles will drop to the ground and remain motionless for some time, when they can be gathered and destroyed. They are also readily attracted by lights and may be collected with traps consisting of a bright light placed over a tin or other vessel about a foot deep by two feet wide with perpendicular sides and with about two inches of water in the bottom. Many such simple traps could be placed over the fields in December and January, when the beetles are on the wing. Dark nights are the best for attracting insects. Without doubt, the presence of toads, if these were introduced, would have a remarkable effect in diminishing the numbers of these as well as many other injurious insects.

WIRE WORMS OR DIABROTICA LARVÆ

About Condong, on the Tweed river, in the early part of spring, a large number of young plants were destroyed to such an extent that in some of the fields, in a distance of 40 or 50 yards, all had to be replanted, often the second time. This had been done, it was claimed, by wire worms (Elaterid larva). During my visit, these larva had disappeared, and only in one instance, while digging up one of the plants, one of these, or a similar larva was found at the roots of a healthy plant adjoining one which had been destroyed. The burrow within the dead plant had been made, to all appearances, some months before.

The plant upon which this larva was found did not show any traces of having been injured in the slightest degree. This particular larva was, however, completely crushed in taking out the plant, and could not be recognized as an Elaterid.

Two of the larva found during the spring, within the narrow burrows below ground were promised to be forward to Sydney for a more careful examination.

Should these prove to be the larva of Diabrotica, as I am inclined to believe is the case, since hardly any Elaterid beetles were met with, it would be highly advisable to destroy the beetle with arsenical poison by spraying the tassels of corn. Paris green would act admirably, about one pound of this to two hundred gallons of water.

The larva of Diabrotica are destuctive to corn, and no doubt to cane as well, in America, and as maize is planted extensively in this locality these beetles will probably increase greatly from year to year if proper steps are not taken to destroy them. In the same district, during the same time of the year, it is claimed that the "blight" is destroying the corn. I do not hesitate in saying that the re-agent of this is not fungoid, as is claimed, but the larva of this Diabrotica boring in the plants below the surface. In this conclusion, I may be wrong, but investigation at the proper time would reveal the facts.

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Pasteur discovered that when milk was heated for a short time at 172 deg. and then suddenly cooled, it kept sweet much longer than the unheated milk.

A TREE FOR BEE-KEEPERS.

[JAMAICA BOTANICAL BULLETIN.]

"I send you herewith some sprigs of a shrub or dwarf tree which seems to me to be botanically interesting and economically useful.

"My son keeps many hives of bees here, and does very well with them. He has, as his crop this spring, shipped 27 barrels of honey of 30 gallons each, and about 1½ cwt. of wax, although he uses much of his wax in making "foundation comb" for his comb frames. My attention was first called to the plant I am noticing by the way all sorts of bees, wasps, flies and ants, swarm upon it when in flower. It is a night blossomer, opening at about an hour before dusk and closing about the same time after sunrise, but in that short space of time, especially in the evening, it is simply alive with hymenoptera, so that it is difficult to pick a flower without being stung.

"When it is in flower it is one sheet of white-looking flowers, I say white-looking, because it is the stamens only that are white, but I have picked as many as 152 of these out of one flower set in a bed within the calyx, and surrounding the single pistil. The stamens are about two inches long and are filamentous and therefore do not stand out in any star-like form, and the bees and wasps just cut them down by the dozen to get at the two or three drops of nectar, secreting from the thalamus. The calyx is small and four-fold. The corolla is also four-fold; when it opens it folds back over the calyx, but it remains without still quite green and within also of a silky sheeny green, and might, to me, easily be taken for an inner foliation of the calyx.

"These green petals of the corolla soon drop, or are just gnawed out by the bees and wasps, and the calyx-leaves, or sepals, also soon after drop, and the stamens by that time have all disappeared also, leaving just the bed and the pistil.

"Hitherto the flower has been upright, and when in bloom its perfume is fine and delicate, not so strong as the jasmine, and a little like coffee; but when the flower has dropped, the end of the pistil begins to swell and the stock of it to elongate, until as shown in the samples sent the pistil turns into a bean-pod, six, eight or even ten inches long!

"I have seen two or three of these pods; they are not ripe yet, ten inches long. I do not pluck them as I want them for seed and when ripe I will send you some of them, if you care to have them. The plants grow here naturally in the lowlands, and stand drought well. The wood is small but knotty and close-grained.

"The swelling of the pistil and turning itself at the extreme end into a bean pod seems to me remarkable. The Leguminosæ seems within their papilionaceous flowers to develop the seed-pod.

"I have sent you specimens by which you can see this gradual transformation when in flower. The head of the pistil is quite blunt, even to a pocket magnifying glass, and seems just as fragile and as likely to dry and fall off as the staminal filaments.

"Wasps and ants at least feed upon the reddish fruity matter that lines the inside of the open pod."

"In the above notes, the Rev. H. Scotland has pointed out the economic value of this tree to bee-keepers, and especially to those who live in dry situations, subject to droughts.

The root tastes like horse-radish, and Dr. Macfadyen states that it has been recommended as a specific in dropsy.

This plant is commonly known as the Bottle-cod Root. Its botanical name is *Cappris cynophallophora.* It belongs to the Caper family *(Capparideæ.)* Mr. Scotland has very well pointed out a characteristic of the family,—the peculiar fruit with a long stalk. Another species, a shrub native in the Mediterranean region, *(Capparis spinosa,)* yields commercial capers, which are the flower-buds preserved in salt and vinegar. The Garlic-Pear Tree, common in the Liguanea Plains, *(Cratæva gynandra,)* belongs to the same family. The bark applied externally is said to produce vesication.

The only other member of this family growing in Jamaica which is of economic value is the Five-leaved Bastard Mustard *(Gynand ropsis pentaphylla.)* It is an herbaceous plant, about two feet high, found in dry places ; petals white with a slight tinge of purple ; stamens six, united below ; leaflets generally five, sometimes three.

Macfadyen states : "This plant has a warm bitter taste. It is said to be a very wholesome green, and to be a preventative against belly-ache; but to render it palatable, it requires a long boiling, and the water to be frequently changed. The juice either plain, or mixed with sweet oil is a certain remedy for the ear-ache. It ought to be warmed previous to being used. A preparation may be made by beating up the young branches of the plant with sweet oil, in a mortar."

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THE BANANA INDUSTRY IN CENTRAL AMERICA AND FLORIDA.

CORRESPONDENCE OF THE FLORIDA AGRICULTURIST.

Our last article on this subject, which appeared months ago, was devoted to showing how the banana business was managed in Central America. This one, in turn, will follow, to some extent, in the same groove, and yet be widely different in detail. While information on this subject of banana culture, may not be of much utility in the northern and central counties of the State, there are still far south of those counties, a large number of agriculturists who read this paper, to whom the ensuing facts may be of interest and profit.

In the Central American republics the cultivation of the banana is, chiefly, by the following methods: In preparing a plantation the trees and bushes are cut down and allowed to lie where they fall until dry enough to burn; fire is then started, burning the leaves, twigs and branches. Then the sprouts or suckers of the banana are set in shallow holes. If placed at the uniform distance of fifteen feet apart, there will be 225 plants per acre. Nearly all of these will, in eight or ten months after planting, mature a bunch of fruit worth from 37½ to 75 cents each. Meantime, a number of young suckers will have sprung up from the parent stalk. As they appear they are cut down until about the third month after planting; then one of these young plants is allowed to live, and three months later another, and so on. Thus, at intervals of three months new plants are suffered to live to take the place of those that have borne fruit and have been cut down. Managed in this way, there are always, after the first three months, four growing stalks in each "stool," or rather from each plant. These new roots or suckers grow on, year after year. There are many fields of bananas which have borne for hundreds of years without replanting. This

PROLIFIC GROWTH

does not attain to anything like the same degree in even the most fertile section of Florida most favorable to their growth. It is a matter of soil and climate.

The steady growth of the demand for bananas in the United States has caused keen competition among buyers; and, as the increase in production has not kept pace with the growth of consumption, prices have advanced enormously, and it does not look as if the market could be surfeited, if at all, within the next dozen years.

In San Salvador the cost and product of a mansana—or about two acres—that is 100 yards square—is as follows:

Cost of clearing and planting the land	$20 00
Cost of 700 sprouts or suckers	7 50
Cultivating until first crop is harvested	15 00
Interest on investment one year	4 25
Total	$46 75

The plantation the first year, or probably in ten months, after planting the suckers. will yield 750 bunches of bananas, which at the prices then existing, of 75 cents each, gave $562, or a net profit of $515.75, on an investment with interest added of $46.75, which gave a net profit of $234.43 per acre.

IN COSTA RICA.

The outlay and income of a plantation of 250 mansanas, or 525 acres, in Costa Rico is as follows:

Outlay first year—

Clearing land and setting 100,000 plants	$ 7,500
90,000 cacao trees and setting same	2,700
Houses, stable, wharf and roads	2,500
Wagons, boats, cooking and farm utensils	3,000
Five houses at $60	300
Cultivating two times in twelve months at $8 per acre	4,000
Total investment	$20,000

Second year—

Wages, 40 men one year at $300	12,000
Wages and keep of foreman	1,500
Feeding five horses	500
Sundries	500
Total expenses	$14,500

The annual expenses after the second year will be as last above shown. The income for the second year is given at $30,000 for 75,000 bunches at 45 cents, and for each of the three years thereafter at $40,000 from 100,000 bunches per annum, making a total of 375,000 bunches for $150,000. Deducting $34,500 outlay, of which $30,000 went into permanent plant, we have $115,500, to which was added the value of 70,000 cacao trees four years old, $70,000 and 20,000 young cacao trees worth $2,000, making a total of $187,500. This equals an annual profit of $37,500 on an investment of $20,-000 or $71.43 per acre per annum.

From this and other data the ensuing facts are evolved:

A man of moderate means going for instance to the Perry land grant in Honduras, can achieve the ensuing results with a working capital of from $300 to $500. By paying down to begin with:

Twenty per cent of price of land	$100 to $200
Pair good woolen blankets	4 to 6
Cooking utensils	5 to 10
Four machettes	4 to 6
Axes	2 to 4
Grindstones and whetstones	3 to 5
Clearing and planting ten acres	150 to 150
Living for one year	100 to 200
House	25 to 50
Totals	$393 to $531

During the year the planter can prepare and set banana sprouts on ten to twenty acres of land in addition to that planted by his hired laborers. He will also plant a few acres of corn, beans, sweet potatoes, cacao and yams. An acre of any of these roots will, in a few weeks, supply more starchy food than a large family can use. The rivers, sounds and forests furnish an unlimited quantity of fish, turtle and game.

At the end of a year the first ten acres will yield say 2,000 bunches worth $1,000 or $470 to $600 more than his cash outlay for land, fares, house, camp and outfit and tools. Within a few months after the first crop, the ten or twenty acres cleared and planted by the owner himself, will yield $1,000 to $2,000, making a total of $2,000 to $3,000 per year. Deduct the price of land and interest on same, and on the above outlay, and there remains a net gain of $1,034 to $1,172.

WHAT UNCLE SAM SAYS.

A slightly altered, and in some places an abbreviated statement, is herewith given of what the Agricultural Department at Washington has to say about the cultivation of the banana in this country:

Probably no one of the fruits classed as tropical is cultivated over a greater extent of territory in the Gulf States than the banana. The reason for this is apparent. The plant is of easy culture, and if killed to the ground by a severe freeze, new and strong suckers soon appear from the roots, and in some cases will fruit the same year. It is found cultivated, therefore, in many places where fruit is not expected oftener than once every four or five years. Then, too, the plants will produce a moderate crop of fruit often, even when they have been deprived of every leaf by frost during the previous winter. Most banana plants that are in a strong, healthy condition will stand a cold as low as 25 degrees for a few hours without any further injury than the loss of leaves, and if the stalks are nearly full grown, a shortage on the head of bananas produced' will afterward result.

Indeed, the culture of the banana, as is well known, is universal throughout the

TROPICAL WORLD,

and in many places extends far outside of the tropics, as in the United States and Southern Europe.

In the Gulf States the banana is met with from Southern Texas to South Carolina, being cultivated only for its grandeur as an ornamental plant. In Florida its culture for profit is carried on in a large section of the State, with greater or less success.

Extensive banana growing, once carried on as far north as Palatka in Putnam county, has within the past three or four years ceased to be cultivated to any considerable extent for profit as far down as Orange county. This is on account of the increasing severity of the cold in winter, caused by the destruction of large forests in the Mississippi valley. Below latitude 27½ and 28 attention is largely given it on the score of commercial profit, as stated in a previous article. * * * The banana flourishes best in very

MOIST, RICH SOIL,

but will not endure standing water about the roots. Bananas may be cultivated, however, on high, dry land of almost any description, with more or less success (generally less). In this State the best possible location for a banana patch is on the banks sloping down to a lake, pond or "bay head." The springy nature of the soil in such a location agrees perfectly with the roots of the banana, provided they are not planted far enough down to be in standing water.

Methods of cultivation are as diverse as in the case of the orange tree, some being in favor of a deep and continuous mulching; others with cultivation like corn; still others set the banana plant in a hole two feet deep when doing the original planting. Location and soil, however, account in a great degree for these differences in mode of cultivation, different soils requiring different treatment. The banana growers of the lower Keys produce fine results with no cultivation whatever, except an occasional piling of weeds around the plants. Excellent results usually follow heavy and often renewed mulching.

[We know of several parties who have invested in the banana business in Honduras and the West Indies, but they do not report any such profits as Mr. James figures out. It is easy enough to count so many bunches so much money, but to sell and get the money is something else.—ED. FLA. AG.]

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A watermelon weighing 178 pounds, and measuring 3 feet 4 inches in length, is on exhibition in Los Angeles. It will be preserved in alcohol and sent to Boston.

ARTESIAN BORES AS AFFECTING CLIMATE.

Mr. W. G. Cox, C. E., writes to the *Courier* as follows:—In a very interesting letter recently Dr. Bancroft alluded to the possible action of the water from the numerous artesian bores which are being made in the interior inducing moisture sufficient to coalesce with the rainy atmosphere of the coast, and thus determine rainfall in the interior.

As an hydraulic engineer and one of the oldest well-borers in Australia, I wish to endorse this idea as being a very feasible one, and one which has often occurred to me in my practice, which has been in the very driest parts of the interior. In all lake districts, with their accumulation of inland surface water, the rainfall is greater than in the adjacent waterless country. This I found to be the case during a recent visit to the chain of reservoirs which supply the city of Manchester, England, where with a very heavy periodical yearly rainfall it was found that during spells of dry weather in the country generally, rain fell more or less over the line of the reservoirs. It is the custom of mining engineers to make models of the coal properties in their charge showing the various seams of coal. The top of the model being lifted the seam of coal with the workings and characteristics of inclination, faults, etc., is exposed to view. If a model were made of, say, the Barcaldine artesian water district—which may be taken as a representative one of proved large artesian supplies—and the top of it were lifted to the impervious water-tight rocks on which the water lies or travels, or both, a huge system of underground water would be exposed to view; great underground natural reservoirs, channels, and rivers of running water from the surcharged reservoirs and channels which are great natural depressions left by former volcanic disruptive agencies. To simplify the matter and state it in a manner that everyone interested (and who is not?) may easily grasp it: An enormous quantity of water has fallen in the shape of rain over the interior of this country. The comparatively small number of rivers have carried but a small portion of that water to the ocean, as the large river systems have done in other countries. Evaporation by the sun's heat has also been a small factor—some 15 per cent.

per annum—in taking that water from us. Owing to the peculiar nature of the ground, the greater portion of the rain water has sunk into the ground through porous strata, and has, after filling up the depressions on the top of the water-tight rocks, in some cases far below, found its way may be for hundreds, or even thousands, of miles; and finally emptied itself into the lowest level attainable—the bed of the ocean—unseen and unrecorded. It requires no great imaginative impulse to grasp this. If the accumulated rainfall of bygone times had not so found its way to the ocean—that receptacle of the huge surface rivers of other countries—the flat, rolling downs of the interior of this country would have become long ago an inland swamp or sea. Another point upon which there is a good deal of misapprehension in non-professional circles is as to the permanence of supply from these artesian wells. Upon a map of Queensland may be marked the line of country which has already been proved by artesian boring to be water-bearing—namely, from Hungerford to the Culgoa River on the New South Wales border; thence to Charleville and Muckadilla; thence to Tambo, Blackall, Barcaldine, Aramac, Muttaburra, and Hughenden; thence down the Flinders to west of Manfred Downs, and as far south as M'Kinlay; in other words the existence of underground water has been established over this long stretch of country, some 900 miles. If we take into consideration the enormous quantity of water which is undoubtedly stored in the ground in porous strata, lying on non-porous rocks, the surplus or overflow of which water is regularly traveling on its way to the bed of the ocean, it is easy to conceive that it will take an immense number of artesian bores of a minimum diameter of discharge of 6in. to exhaust to all the constant yearly supply of rain. Particulars could be given of the regular and undiminished outflow from artesian wells both in Europe and America, in the former during centuries in districts where the wells are not only great in number but of a large diameter. We know what a bore of 6in. diameter of discharge has accomplished—the bore at Tambo to wit:—in rendering the vicinity of the outflow more like a garden than its normal condition of a desert during the summer. During the last fifteen years I have persistently urged boring for artesian water, and have always expressed the opinion that the time will come, and that, considering the paucity of surface water in Australia, it must come when the outflow of underground artesian water—although, as Dr. Bancroft terms it, in "patches"—will from the great multiplicity of the bores render the atmospheric humidity of the inland country sufficient to induce a greater rainfall, and thus palliate the effects of the greatest natural drawback the country has to contend with—periodical droughts.—*Queenslander.*

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"THE WAGE WHICH THE SUGAR INDUSTRY IN QUEENSLAND CAN AFFORD TO GIVE TO THE UNSKILLED LABORER.

[J. E. DAVIDSON IN QUEENSLAND SUGAR JOURNAL.]

The object of this paper is not so much to make an estimate of the probable results of forming and carrying on a sugar plantation of a certain size in Queensland, as it is by working backwards from the value of the sugar produced, and from what is absolutely known as to the capital required to establish a plantation, the skilled labor necessary, the number of unskilled laborers required, the known cost of their rations, the known cost of the supplies, to arrive at what sum is available for distribution amongst the ordinary hands, after allowing a fair interest on the capital employed, and also allowing for wear and tear, accidents and depreciation.

It is obvious that certain assumptions must be made to start with, and certain figures fixed, which can all be more or less disputed, as the cost of everything varies with the locality, and also with different positions in the same locality.

I will start with a few comprehensive statements.

1. *The capital* required to purchase the necessary land, clear, grub, fence, purchase working stock and agricultural implements, and put up machinery and buildings equal to taking off an annual crop of, say, 2000 tons of sugar, is £40 per ton, or £80,000, of which one-fourth, or £20,000, will have to be expended on machinery alone.

2. *The labor* required to work such an estate, counting all hands, is equal to one man for every five tons, or, for a 2,000

ton estate, 400 men, of whom 80 would be skilled workmen and 320 unskilled, proportion of one to four.

3. *Rations* cost, on an average of all hands employed, including cooking, fuel, and other requisites, 5s. 6d. per week, or a little over £14 per head per annum.

4. The expenditure on *supplies* of all sorts, including wear and tear, amounts to between £4 and £4 10s. per ton, and covers fuel, chemicals, bags, cartage, wharfage, stock, horse-feed, harness, manure, ironmongery, timber, insurance, rates, and office outlay.

5. *The value* of the sugar produced, assuming the best possible sugar to be made, may be taken at present prices at £14 per ton all round net to the plantation.

It will be obvious to most of my hearers, that there must be a good deal of latitude allowed in the matter of supplies, as such items as fuel, and carriage of produce, will be very different in amount in different parts of this one district, let alone in others, but the broad results I wish to bring before you will not be much affected by these matters, the principle of compensation being largely applicable, as where carriage is long, fuel is cheap, and vice versa.

Starting with the five premises laid down, I will, following the idea I began with, work backwards from the value of the sugar produce.

This is 2000 tons at £14 per ton—£28,000. Against this I have to put for items, which are absolutely known, with a small margin for accidents and unforeseen expenses, viz :

1.	*Interest* on £80,000 at 5 per cent	£4,000	
2.	*Wages* of 80 skilled workmen averaging 25s. per week	£5,200	
3.	*Rations* for 400 men at £14 per annum	£5,600	
4.	*Supplies* as per list at £4 per ton	£8,000	
	Margin for accident and extra men and rations at busy time	£ 720	£23,520
			£ 4,480

It will thus be seen that including 5 per cent. interest on the capital (which is very little, considering all the risks that are incurred of seasons, of manufacture, and commercial), the absolutely necessary outlay absorbs £23,520, leaving £4,-

480 available for the 320 unskilled laborers, or £14 per annum, or 5s. 6d. per week each. The bare cost of rations to the colored races is a little less than to white workmen and comes to about £12 per annum, so that the outside wages, *including everything*, which the sugar industry can at present afford to pay to unskilled labor is £26 per head per annum or 10s. per week.

When the cost of importation of kanakas ran up to over £30 per head, the annual cost of such labor, including everything, wages, rations, clothing, medical attendance and passage both ways from and to the Island came to £40 per annum, an amount which the sugar industry at the prevailing price of sugar could not profitably afford to pay, and hence the necessity of closing so many sugar estates throughout Queensland.

The result, as worked out in this paper, that £26 per annum including everything, is the outside value which the sugar industry can profitably give to unskilled labor, and survive, should put an end to those crude ideas that sugar can be profitably grown by white labor employed on plantations, for who would dream of offering 5s. 6d. per week and rations; who would dream of accepting such wages? But there is an opening for white men as employers of colored labor providing cane for central mills.

Yet, these are the highest wages the industry can afford to give and live, and we must stick to sound commercial principles, *i.e.* the article produced, must, at current market rates, pay the cost of production and the interest on the capital necessary; if it fails to do this, it must die.

If capital is to be invested in this or any other sugar growing district, it must be shown that interest can be obtained for the investment, and to show this the cost of the unskilled labor is a main factor, and that cost, as I have endeavored to show to-night, cannot, at the present price of sugar, exceed 10s. a week including everything; the sugar industry cannot afford to pay more.

This 10s. a week is equal to 1s. 8d. per working day, and it is interesting to compare this with the wages of other sugar producing countries, with which we have at present to compete in the open market, for until we get undiluted seperation, we shall not be able to enter into reciprocity arrangements with other Southern colonies and exchange our sugar free for their flour free.

In Mauritius the ordinary rates out of which the laborers provide their own rations are 15s. per month, or 6d. a day; in Natal 8d. a day; the Java and Phillipine Islands, 4d. per day; Fiji gives half our minimum wages, £3 per annum, and their cost of importation is £12, or less than half of our's. It will then be seen that even 10s. a week, or 1s. 8d. per day, is more than double what is at present paid by our actively competing neighbors. We must therefore exert all energies towards cheapening the cost of introduction and return (where the chief expense lies) of our unskilled labor, so that we may be placed more upon a commercial equality with our competitors.

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USE OF PINEAPPLES.

[FLORIDA DISPATCH.]

This is a unique and peculiar fruit, and it will pay one who is not conversant with its peculiarities to refer to a reference book where many interesting things will be learned. Just now there are quantities of them in the market, and at very reasonable prices.

Like other good things, its delicacy depends upon its preparation, whether for dessert or canning. The ordinary cook will invariably handle one in such a manner as to waste the very best part of it, and it is seldom served to the best advantage of either fruit or eater.

The outside should be cut off with a very sharp knife, deep enough to remove the traces of the green line which runs around the "eyes," but cut no deeper than this, for close to these "eyes" lies the best of the pine, as the delicious juice decreases in very perceptible quantities toward the stem, or core. After stripping the outside a smaller, sharp-pointed knife should be used to remove the eyes. Then instead of slicing it across the core and having the round slices that are usually seen, cut very thin pieces up to the core, working around it in cutting. The result is a dish of dainty slices, which can be easily cut once or twice with the spoon, if necessary, when it is eaten.

A liberal quantity of sugar should be put with it as soon as it is cut, and then it should be allowed to stand from three to six hours before serving, as it then becomes more tender and thoroughly seasoned.

Besides its palatable qualities as a dessert, it is said to possess wonderful digestive properties. The Medical Record states that its "proteid-digesting power is quite remarkable in its intensity; three ounces of the juice will dissolve ten or fifteen grains of dried albumen in four hours. A well known meat powder is said to be prepared with the help of pineapple juice."

There is no other fruit that passes through the canning process so little injured by the heating as this. They may be prepared the same as for dessert, allowing about a pint of granulated sugar to one good-sized pineapple, and after it has stood long enough for the sugar to melt, allow it to come to a scalding heat and then fill the cans; or, if preferred, it may be put in the cans first and then heated.

When preserved in this manner it looks so much more tempting than the "hashed" and "minced" product of the canning factories, where it is always chopped—core and all!

If the juice is extracted, scalded and put up in sealed bottles, it will keep and may be used for ices and flavoring purposes.

If some pineapple is left over from dessert it may be utilized by making it into pudding. Add nearly as much sugar as there is fruit and cream together, say for half a pint, a tablespoonful of butter and four eggs, and add half a cup of milk. Line a deep dish with puff paste and bake in a "slow" oven.

Pineapple marmalade is a delicious preparation of the fruit. Nice ripe ones should be selected and pared, then grated and an equal weight of sugar added. Set it over a moderate fire and boil about an hour, skimming it thoroughly before removing it from the fire.

If one can secure good cream and has a quick freezer, first-class ice cream may be made in little time and without much trouble. To flavor with pineapple, take a ripe one and cut it into very thin, small pieces and cover it with a pound of sugar, then set it on ice for three hours at least. Beat one quart of cream, add a small pinch of salt, and then drain off the syrup and beat into the cream. When the cream is partly frozen some of the slices may be added if desired—*Country Gentleman.*

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LIME JUICE.

In a recent report the United States consul at Kingston gives the following description of the manufacture of lime juice in Jamaica:

The juice in its crude state is obtained either by running the limes through an ordinary cane mill, when the same is convenient and the fruit to be had in sufficient quantities, or by placing them in a squeezer especially adapted to the purpose, which seems to be the simpler and more usual plan.

To clarify the same requires straining and filtration, when some foreign substance is added to prevent decomposition of the vegetable matter, in which shape most of the juice is shipped from the island.

In order to concentrate, it is strained from the seed and pulp and placed in a copper battery and boiled on the same principle as sugar, care being taken not to scorch or burn it, as that destroys the acid. The more densely the juice is concentrated, the more valuable it is; but it is not advisable to go too far, as it burns easily without forming a crust on the copper. No iron vessel must be used, as the iron turns the acid black. From the latest data (the year ended 31st March, 1891) the amount exported, which was doubtless about all that was made, was 53,884 gallons, of which 44,492 gallons went to the United Kingdom, 110 to Canada, and 9,282 to the United States.

The average valuation in the export list is 20 cents per gallon, but the price for the raw juice ranges from 18 to 30 cents, according to the supply and the demand, while the concentrated juice sells according to the percentage of citric acid is contains.

Substantially the same process is adopted in the manufacture of sour orange juice, which, when concentrated, I notice to be invoiced at from 45 to 50 cents per gallon; and 1,102 gallons, the entire amount manufactured during the period above stated, was exported to the United States.—*Scientific American.*

THE SUGAR INDUSTRY OF FLORIDA.

[FLORIDA AGRICULTURIST.]

In speaking of the sugar industry of Florida we may almost entirely confine ourselves to that which has been done, and all that will be done, on muck or reclaimed lands; for, in looking over the bounty applications, we find that but few farmers of this State produce sufficient sugar to go to the trouble of even making an application for the bounty of $1\frac{3}{4}$ cents, which all outside of the St. Cloud plantation would get, for most or all of the sugar producers of Florida use very primitive methods, namely: a horse mill and open evaporators, where the syrup is boiled down very low, to what is known in Louisiana as "cuite" and left to grain of its own accord. Yet there is no particular reason why many hundreds of Florida's best pine and hammock lands should not yield an immense revenue from sugar, for it is a staple product and can be sold at all times of the year, and generally at a very profitable figure, and there is no risk to be run in its transportation and it may be easily kept for a year.

It has been observed that cane grown on pine lands or lands containing much silicous matter is impervious to the cold, owing to the fact that the stalk contains more fibre and has a better constitution. Muck contains little silica and the stalk is consequently very soft and tender, and where there is a good water protection muck land cane will stand through the most severe weather we have yet seen in Florida.

As the St. Cloud plantation is the only place where cane is grown on muck we may confine our remarks entirely to what it has done and what it will probably do.

This place has produced some of the best yields of sugar ever made in this country, and yet there are lands far superior to this which surround the Okeechobee and better for two obvious reasons; it is very reasonable to suppose that the muck land of this region is older, for it was necessary for that land to form first, in order that the water level might be raised to form the lands higher up. It was the growth of all kinds of aquatic plants in shallow water, which yearly decayed, that formed our immense marshes; then if this land is older it is more decayed; the organic matter being better decayed it is a better soil, and consequently more suited to a luxuriant growth of cane, and able to sustain such a growth after it has once fairly started.

The muck of this region is underlaid with lime stone and phosphates; the alkali of which has been of incalculable benefit in the decay and in neutralization of organic acids.

Second, the immense body of water renders the country almost as free from frost as is Cuba, so one might manufacture sugar as is done in the tropics, leaving the cane to go to perfect maturity.

Much of this land has already been drained, and still the operation goes on; it is necessary to reduce the water level very little, say three or four feet to render this country secure from inundations, for there are sufficient outlets to carry off all the water before it can reach a high stage. One can imagine how long and how much water would be necessary to cause much rise over a thousand square miles, which is Okeechobee's extent. These lands are practically unlimited, at present there are 200,000 acres available for cultivation, and from the roof of a steamer one can see nothing for miles and miles but this immense body of land and not even a tree in sight.

Besides its natural abilities, this country is beautiful beyond description; it is nature's hot house, where luxuriate the most magnificent palms, ferns and tropical flowers and plants of all description.

It is only a matter of time when the tropical cane will have taken the place of rank "saw grass" (the natural growth), and the land which once laid buried in a watery grave will yield to the industrious strokes and ingenuity of man the richest harvest he has ever yet gathered.

The results from cane in this State have not been very encouraging this year, for the season was extremely severe, there being not one drop of rain for about four months; this was, of course, a very exceptional year and one may confidently expect its return in the far future, yet those interested in sugar around here, still push this industry on with relentless vigor; the area has been extended ever since the first stalk of cane was planted on the reclaimed land, till now St. Cloud comprehends about 2,000 acres and with its magnificent factory can easily handle this acreage.

The sugar possibilities of Florida are so great and sugar so important an article to our country that the United States Department of Agriculture has established an experimental station on the shore of East Lake, opposite St. Cloud, to thoroughly investigate the subject. There has been introduced from all parts of the world eighty varieties of cane and their relative merit and adaptability will be thoroughly tested, and every method of cultivation will be applied and the subject most thoroughly treated in every way and the results handed to the people. In order to fully carry out this work a most splendid experimental factory has been built, so that no pains will be spared to make the investigations complete.

Thus far the State of Florida has neglected this matter and it is to be hoped that she will soon awaken to her duty and do as much for herself as our government is doing and will do.

D. C. SUTTON,
U. S. Assistant Chemist and director in charge of station.

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BOTANICAL GARDENS IN JAVA.

[JAMAICA BOTANICAL BULLETIN NO. 33.]

The following account of these gardens is taken from one by Dr. Treub, the present director; it appeared originally in the "Revue Deux Mondes," and later, as a translation, in the "Chautauquan."

"The number of botanical gardens situated within the tropical zone is much greater than is generally supposed. It is necessary to say however, that not all are botanical gardens, in the proper sense of the word, but rather limited agricultural stations or gardens of acclimatization. Some among them merit the name of great scientific establishments, and, holding the first rank in this list, are the gardens of Calcutta, and those on the Islands of Ceylon and Java. We propose briefly to trace the history of the last of these three, and to show by a study of its organization, how a new era is beginning for such institutions and that they are destined to play a steadily increasing part in the evolution of vegetable life.

The Institution comprises three distinct departments. First there is the botanical garden, properly so called, in the centre of the town, occupying an area of about eighty acres. It is crossed by a large and beautiful walk called the Walk of the Kanaries, after the native name of the trees which border it, beautiful specimens of the *Canarium commune*, frequently reaching a height of ninety feet. Over this walk which runs along by the side of an artifical lake containing a little island, pass daily numberless carriages and pedestrians. Leading out from it in every direction, numerous paths penetrate to all parts of the grounds. Plants of the same family are found grouped together, or occupying one of the entire divisions marked out by the paths. At one corner of each such plot is to be found a notice of the species which it incloses; and each species is represented by two plants, one of which bears a label giving its scientific name, its common name and usually its special characteristics. His attention being attracted to the great number of climbing plants in the tropical regions, Teysmann conceived the happy idea of giving them a special place in the garden, where each might be surrounded with its natural conditions; and this department now offers a vast fields for interesting observations. The total number of herbaceous plants comprised is about nine thousand.

In the middle of the garden is found a series of nurseries where young plants are cultivated partly under shelter which protects them from the heat of the sun and from injury by the heavy rains. Some plants demand particular care, notably certain species of ferns and of the *Araceæ* and of the orchid family. These are placed in buildings, resembling the hot houses of Europe, but with this difference that here they serve to keep the plants cool, instead of procuring for them a higher temperature. The garden has its own carpenters for executing such constructions—a little detail, which, however, will serve to give an idea of the scale upon which it is organized.

The native *personnel* is composed of a hundred individuals, among whom are three possessed of a special botanical knowledge, much more profound than one would expect to find among the Malays. This force works under the supervision of the Gardener-in-Chief and his Assistant.

The agricultural garden, the second department comprised in the Institution, situated about a mile from the centre of Buitenzorg, occupies more than one hundred and fifty acres. The local arrangement and the distribution of the plants at once indicate an object exclusively practical. All is laid out in regular order here; the roads and the paths cross each other at right angles, the plots which they set off are nearly all of the same size, the plants in each plot are of the same species and of the same age. While in the scientific garden each species had only two representatives, it has here on an average one hundred. But here the limitations are placed on the kinds of plants, which must be such as are or may become useful to agriculture or to colonial industries. There are to be found the different species and varieties of the coffee tree, of the tea plant, sugar cane, caoutchouc and gutta-percha trees, the *Erythroxlon Coca,* which furnishes cocaine, the trees which produce tannin and oils, plants used for fodder, etc. A special part of the garden is reserved for medicinal plants. A chief gardner conducts the work which is carried on by a force of seventy native workers.

The third garden is located at quite a distance from Buitenzorg, upon the slope of the neighboring volcano, Gedeh. With an area of seventy acres, situated at an altitude of 5,000 feet, it possesses a climate which is marvelously adapted to the cultivation of the flora indigenous to mountains as well as to that of Australia and Japan. A force of a dozen natives works here under the direction of a European gardener. These tree gardens which together constitute the State Botanical Garden, occupy an area of more than three hundred acres.

The museum built opposite the first garden described, is a building about one hundred fifty feet long and comprises a large central hall and two wings. On the lower floor the hall contains cupboards running all along its walls and glass cases through the centre, in which are kept the botanical collections. Some of the specimens are dried and some are preserved in alcohol. A gallery running the whole length of the upper hall is exclusively occupied by the herbarium. The pressed plants are not kept in portfolios as in Europe but in tin boxes in order the better to protect them against insects and mould, the great enemies of such collections in tropical countries. The number of such boxes exceeds twelve hundred and each box contains one hundred specimens. One of the wings of the building is used as a museum, and the other for a library which contains five thousand volumes.

There are three laboratories connected with the gardens to which a fourth is soon to be added, for the *personnel* is to be increased by the addition of two new officers, a botanist and a chemist, to whom will fall the special task of furnishing by long and patient researches, scientific information to those asking it, regarding the useful plants of the tropics. Behind the museum in a special building is the medical laboratory where a pharmacist makes researches into the nature of alkaloids and other curious and useful substances found in tropical plants. Of the other two laboratories, placed behind the nurseries, one is reserved for the use of scholars who come from beyond the seas to study in this place. The room is lighted by five windows in each of which is a large work-table. Cupboards against the wall contain all the necessary implements. There is in it, besides a small collection of the books which are needed, always at hand, in order to save the trouble of going to consult them in the regular library. It is now proposed also, in order to facilitate the work of the visitor, to place here an herbarium composed entirely of the plants cultivated in the garden, in order that a rapid identification can be made in any doubtful case without being obliged to have recourse to the general herbarium. The arrangement of this building is simple, and presents the two great advantages of plenty of light and plenty of room. The last point is a very essential one in a warm country where one can endure no crowding, especially in work requiring close research. The third laboratory is devoted to the use of the Director of the Garden. Close to these buildings are the offices and a photographic and lithographic gallery. All of these well equipped buildings show the interest taken in the enterprise both by the Netherlandish Indies and by the mother country.

It is interesting to compare what is said of these gardens by Dr. Trimen, Director of Botanic Gardens in Ceylon. He visited them in 1891, and in his report he states his experience as follows :

"The Dutch botanical establishment at Buitenzorg is maintained entirely on a scientific basis.

"The director has the control of all the six departments into which the institution is divided, as follows :—1, the Herbarium, Library and Museum ; 2, the Botanical Laboratory ; 3, the Experimental Garden and Laboratory for Agricultural Chemistry ; 4, the Pharmacological Laboratory ; 5, the Botanic Gardens ; 6, the Photographic Institution. Each of these departments is under the immediate management of a highly trained scientific or technical chief from Holland, and most of these have also an assistant. There is thus a very large staff of Europeans. The laboratories, library, etc., are completely stocked, and kept fully up to the time, and everything is provided for close investigation and original research in all branches of botanical study. Many students are thus attracted from Europe, and the laboratories afford accommodation for a considerable number of workers. A valuable serial publication, the "Annales du Jardin Buitenzorg," is issued at intervals, devoted to scientific botany, and another one, "Teijsmannia," occupied with economic and garden subjects.

"The botanic gardens themselves at Buitenzorg occupy between 60 and 70 acres, at an elevation of about 800 feet, with a fine soil and abundant water, and are well protected by a high iron railing and a barbed wire fence. Nearly the whole is occupied by a classified arboretum, each natural order being isolated by a road or path. The collection is extremely rich, and every species is elaborately labelled with upright labels made of the very hard wood of *Eusideroxylon*, which is never attacked by termites. The whole is now much too crowded, and cannot be said to be of much beauty but is of course extremely convenient for scientific study. Connected with Buitenzorg is a small hill-garden at Tijbodas, 4,700 feet, also under a European superintendent, where is also a house for the director and a laboratory and accommodation for four students.

"The experimental garden is about two miles from the main garden, and is 200 acres, in extent, but is not all at present occupied. It is laid out in square plots, each devoted to one product; large labels at each corner give the name, date of sowing, or planting, and other information. Here are very many plants of great interest. Though a large distribution of seeds and plants is made to planters and others, no charge is made for anything.

"On the whole, I was filled with surprise and admiration at the completeness of Buitenzorg as a centre for botanical work; the only weak side seemed to be the herbarium, which is by no means kept up on a par with the rest of the means of study."