THE

PLANTERS' MONTHLY.

PUBLISHED FOR THE

Planters' Labor and Supply Company,

OF THE HAWAIIAN ISLANDS.

VOL. VIII.] HONOLULU, MARCH, 1889. [NO. 3

The price of sugar in New York has advanced to $5\frac{3}{4}$ for Cuban centrifugals of 96 deg. This is on account of the short Cuban and beet crops. There is every prospect that the price will again advance, for the same cause, to six cents and over.

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Governor Warmoth obtained by the diffusion process 236 pounds of sugar per ton of cane, the largest outcome yet reported. It is thought that Lahaina cane will yield a much larger return, by the same process.

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Mr. Quintin Hogg, of London, owner of several sugar estates in Demarara, has given instructions to the manufacturers, to furnish two diffusion plants for two of his Demarara estates, having become satisfied that cane sugar can be manufactured by this process as readily as beets.

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European advices state that there has been a large falling off in the beet sugar crop from the estimates made by Licht, which appear to have been placed too high. The Cuban crop is also fully one hundred thousand tons less than the crop estimates, chiefly the result of the hurricanes in July and August last.

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We are indebted to Mr. J. B. Wilkinson Jr., assistant editor of the New Orleans *City Item*, for a copy of a pamphlet of fifty-seven pages devoted to the discussion of the diffusion process. In this issue, on page 135, will be found an article from it describing Col. Cunningham's plantation in Texas. The whole of Mr. W.'s pamphlet is devoted to the diffusion process.

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The subject of width between the rows in cane planting is being discussed in Louisiana, with considerable difference of opinion among the planters, some of whom favor planting five, six, seven, and even seven and a-half feet apart. As both the wide and narrow systems have been fully tested here, we would invite our planters to express their views on the subject, confident that their experience in planting will be found valuable.

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LOUISIANA SUGAR CROP.—As the manufacturing season was exceptionally fine, and the cane matured pretty thoroughly toward the end of the season, causing a fine sugar yield even from a light stand of cane, it now appears certain that Louisiana's total sugar crop of 1888 will be about 225,000 hogsheads. This, although considerably short of last season's yield, will net our planters nearly as much money, since sugar making expenses were so light and improved price of sugar goes far toward overcoming the shortage of the crop,—*Sugar Bowl.*

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This is the flowering season of the vanilla plant. In answer to inquiries, as to how the flowers should be treated to insure fertilization, we quote the following from a circular issued by the Jamaica Botanical Gardens:

"In the flower is a central white column, at the summit of which is a detachable cap or anther, which if touched on the lower front edge with a sharpened pencil or knife blade will adhere to the implement. The pollen masses contained in the anther must then be made to lightly touch the viscous (sticky) disk situated on the front of the column. Each flower must be so treated at or about noon of the day on which it opens."

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WITH OUR READERS.

The present issue of the Monthly is filled with interesting topics on the subjects to which it is devoted. Mr. Paton's article, taken from *Sugar*, is full of hints to mill-men, and shows how the business is carried on in other countries.

A capital criticism on the Barbados seedlings, by an experienced botanist in Demarara, will repay perusal; and as he puts it, what is now wanted is proof that the new plants are seedlings.

"Orange and lemon culture in Sicily," is an instructive statement of how these fruits are cared for in that island. As oranges are a failure here, lemons or limes might prove a profitable business. Many people are not aware it is so valuable branch of horticulture. Limes grow everywhere here, and are probably as good as lemons for trade.

On page 141, are extracts from Dr. Stubbs' last report on the progress of sugar manufacture in Louisiana, particularly as relates to diffusion, on which he is enthusiastic, and believes it will supersede roller mill work.

A new cane disease in Java is treated of on page 143, which is doing much injury there. Fortunately our canes are, so far, free from disease of any kind; but it is well to be on guard against the introduction of any foreign diseases affecting them.

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LABORERS AND SUGARCANE AREA PLANTED IN HAWAII.

From the report of the Inspector-General of Immigrants, Charles N. Spencer Esq., who has visited every plantation during the past three or four months, we learn that the total number of acres of cane under cultivation in the group is as follows:

	Plant Cane.	*Ratoons.*
Hawaii	21,960	13,912
Maui	8,097	3,320
Kauai	5,744	4,009
Oahu	2,072	1,523
Molokai	75	75
Total	37,948	22,839

As the cane matures here in from fifteen to twenty-four months, it is not easy to ascertain or estimate the annual yield per acre, except from the figures actually obtained at the close of each grinding season. The crop now harvesting for the year 1889 will be fully 120,000 tons, perhaps a little over, the product of about 40,000 acres of plant and ratoon cane, averaging three tons to the acre.

The number of laborers employed on the sugar plantations is 16,375, as ascertained by the Inspector-General, who reports that their health is generally good, with the exception of two or three plantations, on which there is considerable sickness, attributed chiefly to the drinking water. Of the Japanese immigrants, he says: "Those who arrived here since December, 1887, came from the agricultural districts of Japan, and have proved a very desirable class of laborers." It is a fact, not generally known that the 6,000 Japanese laborers on these islands have, on deposit, to their credit, about $500,000, in United States gold coin, the Japanese Government requiring that a certain percentage of their earnings shall be set aside as a deposit for their benefit, to be returned to them when their term of service expires, or when they return to Japan.

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GRASSES AS FERTILIZERS.

We notice in our American exchanges that growing attention is being paid to the cultivation of certain plants as fertilizers. Among these is are the *cowpea*, which is a favorite in the Southern States, as a fertilizer for various crops, such as cotton, cane, sorghum, etc. Another is lucern, a grass of the clover species, which is being cultivated as a fertilizer. One writer, speaking of its value for this purpose, says: "The inquiry is often made, how can plants increase the fertility of the soil? We reply, that there are two ways—one by adding to it that part of themselves which they obtain from the air, and the other by searching many feet into the ground with their roots and bringing to the surface the chemicals and fertilizing material stored there and filtered from the surface for ages."

Now, there may be plants growing on these islands which are quite as valuable for this purpose as cowpea or lucern. Hilo grass, manienie and honohono, and perhaps other plants, although considered as troublesome pests in cane fields, possess the requisites of good fertilizers; and the experience of some who have raised cane on fields that have been overgrown with these grasses will support the assertion that large crops have been secured. Either of these grasses sends its roots very deep into the soil, loosening it, and preparing the subsoil for the crop which follows. The question then, which planters should test is this—will it not be wise to turn fields which have been cropped with cane for several years, into fallow, planting them with grass, and allowing the grass to take full possession for two or three years—whichever grass may be most available and is likely to cover the ground quickest and heaviest. Either will send its roots down ten to fifteen feet in that time.

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COLONEL CUNNINGHAM'S SUGAR PLANTATION IN TEXAS.

The *American Grocer* publishes the following data regarding "Sugarland," now becoming somewhat noted from the fact that its proprietor has risked everything on diffusion in the manufacture of sugar from cane, and has abandoned his roller mills: "This plantation is situated twenty-five miles from Houston, Texas. Something over 1,500 acres were planted with cane in 1888, to say nothing of corn, oats, etc. Some 225 laborers are employed, forty or fifty wagons, as well as a little narrow-gauge railroad. It requires as much labor on one acre of cane as on twenty of corn. Col. Cunningham, with great pluck and energy, departed from the old ways of the sugar plantation. The diffusion process was in use in Kansas and also on a small scale in Louisiana. The colonel made up his mind to change his system, and in spite of warnings of failure, has succeeded. This year he has for sale between 4,000,000 5,000,000 pounds of sugar, with about 5,000 barrels of molasses. This is forty per cent more than any one plantation in Louisiana. The Houston *Post* gives a very interesting account of the buildings, machinery and diffusion batteries which we reluctantly omit. In conclusion, Col. Cunningham is quoted as saying that he would rather sell his mill, and, if necessary, go into debt for a diffusion apparatus than to continue with the old mill process."

On page 135 will be found an interesting account of the above diffusion mill, copied from J. B. Wilkinson's pamphlet on diffusion. Sugar men should not fail to read the article, and some no doubt would be glad to possess Mr. W.'s pamphlet.

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THE WATSONVILLE BEET SUGAR ENTERPRISE.

We have watched with considerable interest the growth of this new industry, and have inserted all the reliable information regarding it that has come to hand, for we desire to see it become a permanent success, not only in Santa Cruz County, but in every part of California, where it may be undertaken. For this reason we regret to learn from the Watsonville *Pajaronian* that the farmers of that place have not as yet consented to contract for a sufficient acreage of beets to insure full work for the factory for the required five months. That paper says:

"Claus Spreckels, on his return from Washington, visited Watsonville. He is disappointed at the limited acreage contracted for the coming season, and says that if the company cannot secure an acreage in this vicinity sufficient to run the factory five months in each year he will be compelled to seek a location elsewhere. This is the conclusion of Mr. Spreckels and associates. At Alvarado the beet sugar factory has applications for more acreage this season than it wants. The Western Beet Sugar Co. has been offered a large tract of land in the upper part of the State at reasonable figures and is considering the proposition to hereafter construct factories only where it owns the land that is to produce the beets. There is a strong prospect, unless an increased acreage is obtained, that the factory will not run after 1889. It stands our farmers and merchants to take united action to further the interests of the beet factory."

The trouble lies chiefly in the labor question, as was anticipated by us in an article published in the PLANTERS' MONTHLY for November, 1887, (page 392) in which we stated that

"Among the obstacles which those interested in this new enterprise will have to encounter, are high-priced labor, finding the localities best adapted to the growth of the sugar-beet, transportation of the crop to the factories, and the instruction of the farmers in the best way to plant, cultivate and harvest the beets. To an outsider these may appear as trivial matters, but it has taken France, Germany and Austria a half century to instruct the farmers how to grow beets to profit. The labor question is the most important one in California, where labor is high and none can be obtained for less than thirty dollars a month and found. While in Germany beets are grown mostly by small farmers on their small holdings of five to twenty ares, which are cultivated by the women and children, with very little outside hired labor.

"Transportation of the crops to the factory must be provided, probably by tramways. This will necessitate charges, which must fall on the producers, and take off considerable from the four dollars per ton which are offered for beets delivered at the factory. As beets must be delivered fresh daily, from every direction and distance, it will be seen at once that some system must be established to regulate the delivery from a hundred sources. All this will take time, and if Col. Spreckels succeeds in getting his army of farmers into line, working in harmony with the daily demands of his central factories by the end of five years, he will accomplish what few have done in Germany in the same time."

The whole trouble lies in this, that the labor required to cultivate beets costs more than was anticipated by the farmers. With Chinese labor the work may be done, so as to sell beets at four dollars per ton, but it is a doubtful question whether this can be done with white labor, which compels the farmers to demand five dollars per ton for their beets, while the factory will pay but four. It is not for us to say whether the factory can afford to pay five dollars, but that figure would probably bring all the beets wanted. It is one of those questions that can only be settled by mutual concessions, as is often the case with new enterprises. A first crop also costs much more than the following, and each subsequent crop generally pays better than did the previous. We desire to see the beet sugar industry prosper in California, and it surely will, if the spirit of compromise prevails in its management, and a fair division of the cost of labor is made.

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PACKING SEED CANE FOR TRANSPORTATION.

Mr. John H. Paty, Consul for the Netherlands, has placed in our hands correspondence received by him relative to cases of sugarcane procured by him and sent to Java on the Netherland frigate, Zilverin Kruis, which visited this port last year. There were nine packages sent, each packed in a different manner. The report received from Batavia regarding them is inserted herewith, and will interest those who have occasion to send or order seeds for transportation across the ocean :

According to Mr. Joekes' report, dated Yokohama, the 4th of July, 1888, the canes were put into nine cases after leaving the roads of Honolulu, consequently six to seven days after the canes had been cut in the fields, The lot arrived at Pecalougau on the 1st of August, and was unpacked in the sugar estates Tirto and Klidang, on the following day, an interval between the cutting and unpacking of nearly seventy days.

Five cases, Nos. 1, 2, 4, 5 and 9, were brought to the estate Tirto, and four cases, Nos. 3, 6, 7 and 8, to the estate Klidang. The manager of the estate Tirto gives the following particulars:

"The packing of all cases looked splendid and had undoubtedly been affected with the utmost care. The results were, however, less favorable than might have been expected.

"Case No. 1 contained 60 canes of nearly 1½ yards in length, packed in dry sugar leaves, which looked very fresh, but the eyes (budding parts) were dried out. After having been put into the nursery-beds six eyes have budded out, which after having been planted, are growing well.

"Case No. 2 contained 42 canes dipped in wax, packed in dry charcoal, which looked as fresh as if they had been cut the day before, but the eyes were all dead and did not germinate.

"About the contents of cases Nos. 4 and 5, must be said the same as about those of case No. 2.

"Case No. 9 contained top-cuts of canes packed in wet sand. On opening the case everything seemed totally rotten. Every piece of cane was carefully taken out and cleaned in pure water, after which ten top ends were found germinating, which were immediately planted, and in pots, but of which only eight have been kept growing by the utmost possible care.

"From these results may be surmised that dipping in wax is injurious to the eyes or budding parts of the cane. The use of wet sand for packing has given better results, but is perhaps not to be recommended, on account of its bulkiness and of its augmenting the expenses of transport. The use of dried leaves for packing seems, after all, to be the most practicable way. Consequently only fourteen pieces of cane could be planted out from the five cases."

The manager of the estate Klidang reports:

"The cases Nos. 3, 6, 7 and 8, were all in good condition and very carefully packed. The cases 6, 7 and 8 contained soldered tins with pieces of sugar cane, those from the cases 6 and 7 were dipped altogether in wax, whilst the cane from case No. 8 was only dipped in wax at the extremities. The wax having been carefully removed, the canes looked fresh and healthy, the eyes had maintained their color, but were sunken; it was therefore supposed that the power of budding had not been lost. The canes from case No. 3, dipped in wax and packed in rather large pieces of charcoal, did not look so favorable as those from the tins, but notwithstanding this, a few of them had budded out in the case.

"All pieces of cane were thoroughly and carefully cleaned and planted out immediately; a careful treatment of the soil in which they were planted has given, however, no better results than the germinating in three parts each of two pieces of cane from case No. 3. Those six plants are growing well, and promise to develop into fine plants.

"From these results I conclude that the total seclusion from air is very injurious to the power of germination, and dipping in wax altogether, should be avoided. The germination of the two pieces of cane from case No. 3 is, according to my opinion, an instance of luck; the eyes or budding parts were probably swollen or budding before applying the wax, and not having been covered by it, the cane has been germinating in the case.

"I consider the best way of maintaining the power of germination is to dip the extremities of the cane in wax, directly after its having been cut, in order to prevent putrifying; not to rip off its leaves; but to leave them as a protection for the eyes or budding parts; to put the canes, having been cut at an equal length, in a case with airing holes, having inside the same length as the canes, in order to prevent their being damaged by the shaking of the cases when being handled. The quickest despatch is, of course, desirable."

As a general conclusion from these reports it may be mentioned that a despatch of canes in soldered tins is not to be recommended; that the use of cases allowing the air to enter is preferable; that the canes should only be dipped in wax at the extremities and that above all, the best way should be to despatch the canes in bundles, if it is possible to secure them an airy place on board, with liberal admittance of air between the bundles. (Signed,) S. Evarts.

Pecalougau, September 29th, 1888.

[Remarks.—Mr. Charles N. Spencer, of this city, who has had considerable experience in packing canes for shipment abroad, informs us that the following method has proved very successful: Take half-barrel sugar kegs for containers, cut the canes of the proper length to fit in tight: dip both ends of each stock in common *mucilage*, and cover the ends with paper, which will adhere closely and exclude the air. This should be done immediately after cutting the stalks. Pack the stalks in the keg with *sawdust*, which has been thoroughly dried in the sun or oven. This drying is very important. Bore augur holes in the top or head of the kegs, and see that the packages are put on board in a dry but airy part of the ship. In one shipment to Australia and another to the United States, packed in this way every eye turned out good and sprouted. He adds: That should the eyes appear dead or withered, soak the cane in water for twenty-four hours, and often they will recover the power of vegetation. A portion of the leaves (a few inches of each) should be left on the stalks.—Editor Planters' Monthly.

CORRESPONDENCE AND SELECTIONS.

GENERAL NOTES ON SUGAR MACHINERY.

BY JOHN M. C. PATON, MEM. INST. ME.

Makers of Machinery or Plant for the manufacture of sugar are frequently requested to prepare and supply estimates, and it is sometimes quite impossible to give the requisite information on account of the want of sufficient data to form a basis for calculation.

The following are exact copies of letters received quite recently in the ordinary course of business:

"We have an enquiry for sugar machinery, and should be glad if you would send us, *per return*, drawings and prices."

"Please quote us for a sugar mill, state weight for shipment."

"Please send us your price lists of sugar machinery, and give us net and gross weight of each package, to enable us to calculate freight."

"Some friends of ours are enquiring for a sugar refinery, if this is in your way, please send us full particulars, and say how soon the machinery could be ready."

"Please send me estimates and sketches, to send to the West Indies of sugar machinery on vacuum pan and also bucket system for hydraulic power. We have no further particulars."

"It is my intention to erect a sugar plant to work off cane which I am now planting; please oblige me with estimates, and give all possible details, sending a plan showing proposed arrangement of the machinery."

Nothing is said of the quantity of sugar it is intended to manufacture, it may be one ton per hour, or one ton per day; it may be that only brown sugar is wanted, or on the other hand the finest white sugar may be the article required. When the enquirer finds he gets no definite reply, but is asked questions as to the amount of cane to be dealt with, method of working most likely to suit his requirements, and precise quality of sugar he wishes to produce, etc., he is apt to think that the makers of machinery to whom he has applied are not properly posted in their business.

To ask the "price of a sugar mill" without giving some indication of size, is much like asking the price of a house, without saying whether it is to have two rooms or twenty; or asking the price of a "steamer" without giving any indication of size or type; whether fifty tons or 500 tons is the capacity required.

For a "sugar mill" alone, the price varies from £5 to £5,000. This is for the crushing machinery only. The mill at £5 is a very small mill, to be turned by an ox, and the one at £5,000, is a large steam-driven apparatus. The £5 mill may make two or three tons of sugar in a season, while the £5,000 one will make the quantity in about an hour. The £5 mill can be carried by two men; the £5,000 one weighs over two hundred tons.

A "complete sugar plant" may cost from £10 up to any amount almost without limit. Machinery to make one ton of sugar per hour is usually expected to cost from £10,000 to £12,-000, but this average may be considerably reduced or increased to meet the special requirements of the purchaser.

An intimate knowledge of local circumstances is frequently necessary to enable engineers to arrange a plant of machinery to give the best possible results; and with the object of obtaining this special information, several of the most celebrated makers have their own engineers resident in the more important sugar growing countries, and in this way the maker is brought directly into contact with the planter, and all details can be discussed and explained and arrangements successfully carried out. In new countries, however, the planter frequently has no resident engineer to confer with, but he has to send home his enquiries. And it is with the object of calling attention to some of the points on which information should be given, and at the same time to give a few general hints to those intending purchasers of sugar machinery who may not yet be fully posted in the business, that these notes are written.

Enquiries frequently specify a certain number of tons of cane to be crushed, or of sugar to be produced in a day. One of the first points, is the length of the day, which may be ten, twelve, or any number of hours up to twenty-four. When the planter is not certain about the length to which it may become desirable to extend the working day, it is best to take the quantity of work per hour as a basis. It is, at the same time, always useful to know whether the factory will work by day only, or day and night, as machinery has sometimes slightly to be modified to suit continuous or intermittent work. Most sugar growing countries have a "season," and, in many districts, this is very exactly determined by the monsoons, or rains, or other climatic causes which render it necessary to have ample power for taking off the whole crop within a given time, as all the canes standing over may be absolutely lost. Other countries work, more or less, all the year round; and, in this case, a want of power may mean only slow working, with the resulting inconvenience, but not actual loss of produce. The number of working days in the season should always be stated; and it is sometimes useful to know the times of the year at which the season commences and closes.

The quantity and quality of canes to be dealt with will determine the size and strength of the crushing machinery. Plant canes are easier to crush than "ratoons," consequently a mill crushing plant canes will crush a greater quantity of canes per hour than when dealing with "ratoons," although in the latter case, the juice is usually denser and richer in sugar, and the quantity of the product may not fall far short of that from plant canes. Most sugar mills are now made strong enough to crush the heaviest canes, but if it is known what variety will be constantly dealt with, certain modifications may sometimes be introduced.

The four motors employed to turn the rollers of a sugar mill are, animal power, wind, water and steam. Animal power is only employed when working on the smallest possible scale. The great advantage of wind is its cheapness, but it is not reliable in duration or quantity, and consequently, its use is almost obsolete as a motor. Water is still employed in many districts where suitable streams are plentiful, the water-wheel being frequently made on the spot. Where steam is not used for evaporating or any other purpose, the water-wheel is an economical motor, and may be made to do very good work. Except in new countries, where sugar making is only an experiment, conducted on the lowest possible outlay, or where the quantity made is very small indeed, the steam engine is decidedly the best motor, and is now almost universally employed. The steam from the boilers, after driving the mill, passes off from the engine as low pressure steam, still containing a very large proportion of the heat imparted to it when at a higher pressure, and capable of doing a large amount of work in the evaporating apparatus later on.

The general practice is to raise high pressure steam in the boilers, while most of the evaporating apparatus is usually arranged to work with steam at a low pressure, thus necessitating the use of a reducing valve to regulate the steam pressure, but where steam engines are employed they also act as reducing valves, first using the steam to give out power, and then passing it on as low pressure for boiling and evaporation.

Although beam engines and vertical engines are occasionally employed for driving cane mills, they have now given way almost entirely to the horizontal engine, which, when properly designed, is equally satisfactory, and much lower in first cost.

The proper speed for the surface of the rolls, is a subject frequently discussed, but an average of about sixteen feet per minute appears to meet most requirements. Speeds as low as eight feet per minute have been tried with great success as far as the extraction of a large percentage of juice is concerned, but the slow rate at which the cane passes through the mill necessitates the use of very much larger crushing machinery than is usually employed, and the expense of this frequently stands in the way of its adoption. On the other hand, if the speed of the rolls is too great, the cane has not sufficient time to part with its juice, and a very low percentage is the result. Where an estate has to be cleared within certain limits of time, it becomes necessary to pass the cane through the mill within that time, even if a loss in efficiency results. An average of seventy per cent of juice on the weight of the cane, taken over the whole season, may be looked upon as a very good result from an ordinary three-roller mill, and it becomes a question even with the heaviest mills of modern construction, if it is wise to strain the machinery and run some risk of breakdown, for the sake of a slight increase in the percentage of juice. Although mills with more than three rollers are sometimes made, yet the ordinary three-roller mill, when of good design, is still holding its own, and may be looked upon as the standard. Sometimes two sets of three-roll machinery are employed, the second set crushing the megass from the first mill and extracting a further quantity of juice. On its way to the second mill the megass may be treated with water or steam. It is stated that the juice from the second mill is frequently of distinctly worse quality than that from the first set of rolls, owing to the extraction of certain impurities by the greater pressure.

With regard to the dimensions of the rolls, a very usual and convenient proportion is to make the length of the roll twice its diameter. Where very efficient crushing is desired, it may be wise to reduce the length of the roll and increase the diameter. Two principal points to be borne in mind with regard to mills are, that large diameters crush more efficiently than small ones; and that with short rolls the pressure is more concentrated, and consequently the cane is very severely crushed. Most makers have adopted lengths which have been found to do good work in the districts to which they are in the habit of sending machinery; but the planter will do well not to insist upon having patterns altered for the sake of an inch or two in length. A difference in the length of roll influences the cost of a mill very slightly, but a very small difference in the diameter alters the price very considerably.

Before leaving the subject of the extraction of juice from the cane, the writer may mention that he has visited the Aska Sugar Works, the property of Mr. Minchin, situated in the Madras Presidency, where the diffusion system is employed with excellent results.

The power required to slice the cane is less than half that required to crush it in a mill, and as several sets of cutters are employed, the risk of a breakdown is less than when all depends upon a single mill. The diffusion juice is, of course, less dense than the original juice in the cane, but the amount of impurities it contains is very much less than is usually found in juice extracted by pressure in the roller mill. The diffusion juice is usually equivalent to about eighty per cent of the juice in the cane, but this is diluted with water, which brings the weight of the juice from the diffusion up to practically the same weight as the cane. With the object of comparing some of the relative merits of the two systems, suppose that ten per cent of the original juice in the cane may be taken out in the form of sugar, then a mill extracting seventy per cent will give seven tons of sugar from 100 tons of cane; while with diffusion, eight tons of sugar is produced from the same quantity of cane, showing a clear increase of one-seventh, or nearly fifteen per cent in favor of diffusion. On the other hand, from the mill juice it would be necessary to evaporate sixty-three tons of water, while from the diffusion juice ninety-two tons of water would have to be driven off. Thus for an increased production of one ton of sugar nearly thirty tons of water must be evaporated in addition to that dealt with in the ordinary way. This increase in the amount of water driven off, entails a corresponding increase in the first cost of the evaporating machinery; but against this there is the large increase in the return of sugar, and greater ease in the manufacture owing to the very small amount of impurity found in the diffusion juice. Where fuel is expensive the diffusion process will not recommend itself so strongly as it will where coal or wood are cheap. When considering the adoption of the diffusion process for a factory already possessing a mill, it must be remembered that with the same evaporating plant less cane will be worked per day, and the length of the crushing season consequently prolonged if the crop of cane remains the same. Diffusion has been a grand success in the beet-root sugar industry, and it is probably destined to play an important part in the future of cane sugar.

Where the buildings are situated on the side of a slope, or where the mill foundations are carried to some height above the ground level, it may be possible to run the juice direct from the spout of the mill bed to the defecators or clarifiers, or whatever other apparatus it is intended to use; but the more common practice is to employ a pump or montejus. The latter is intermittent in its action, is not automatic, and the condensation of the steam, with consequent dilution of the juice, is a further disadvantage. A pump is very frequently objected to on account of the "churning" action of the plunger, or bucket, which is said to produce a bad effect; but where care is taken to have the pump properly proportioned, and arranged so that air cannot be sucked in and churned with the juice, there appears to be little objection to its use. Immediately after extraction, the juice is in some cases brought into contact with sulphurous acid gas, which acts as a bleaching agent, and consequently helps to produce a lighter colored sugar. The juice after leaving the mill must, as soon as possible, be heated to coagulate the albuminous impurities, treated with lime to neutralize the acids, and then evaporated to a density of from 20 deg. to 30 deg. Baume, at which stage it is frequently spoken of as liquor or syrup. It is most important that this density should be reached without loss of time, and it should be carefully borne in mind, not only that high temperatures are very hurtful, but also that long exposure to low temperatures is at least equally injurious. In all matters connected with the manufacture of sugar, rapidity of working cannot be too much insisted upon. The old system of hemispherical battery pans or "coppers wall" combined in itself the elements of the modern arrangement of defecators, clarifiers and evaporators. The first pan corresponded to the defecator, where most of the lime was added, the middle pans took the place of clarifiers or eliminators, while the last pans were purely evaporators. Although the use of such apparatus is opposed to all scientific work, yet, under favorable circumstances, very good results were obtained, although at great cost for fuel, and at a considerable sacrifice of sugar.

The usual course in a modern sugar factory, is to heat the juice as soon as possible after it leaves the mill, by means of a juice-heater, of tubular or other type, generally arranged to form practically a part of the delivery pipe from the juice-pump; and from this heater, the juice passes on to the defecators. There are several varieties of defecators, but those usually employed are rectangular, with a swing coil, or circular with hemispherical double bottom. A circular defecator with a serpentine or coil is also occasionally employed. The advantages of large defecators are (1) that they require less frequent attention (2) that it is probable the juice will be more equally limed than when smaller vessels are used. The best results are produced when the vessels are of moderate size, as there is less time occupied in filling, and consequently less chance of fermentation. Some planters allow the juice to settle in the defecators, but it is in most cases, desirable to use separate tanks for it, fitted with decanting cocks; or otherwise to use filters. Where clarifiers or eliminators are employed the juice may be run to them direct from the defecators.

It is well known to sugar boilers that no matter how much care has been bestowed on the defecation or clarification of the juice it will throw up scum at each stage of boiling. There appear to be certain impurities in cane juice which only coagulate or come to the surface in the form of scum at temperatures higher than that at which juice of ordinary density boils under ordinary atmospheric pressure. Continued boiling increases the density and consequently the boiling point is raised. As the temperature is increased, scum is thrown up from what was previously, to all appearance clear juice; and constant skimming or brushing is required. To avoid this difficulty, a form of continuous heater has recently been devised, so arranged that while the juice passes through it in a continuous stream, the temperature is raised by means of high pressure steam to a point that could not possibly be attained in open air under ordinary atmospheric pressure. The object is to submit the juice to the action of heat as great as that due to the increased density at which boiling usually takes place later on in the process of manufacture. Lime is afterwards added in any simple form of clarifier and the results are in many cases most satisfactory. Careful experiments show that considerable advantage results from giving the juice a sharp boil for a short time, and no consequent injury can be detected.

Clarifiers may be either double-bottomed or fitted with steam coils. Very efficient clarifiers are now made with heating surface arranged in the form of a multitubular steam drum, and the same apparatus may be used as an evaporator.

After clarification the juice is frequently allowed to settle in tanks, or is filtered through either bag-filters or filter-presses. Bag-filters, as usually made, are exceedingly clumsy and dirty arrangements, and a vast amount of work is necessary for removing the dirty bags and fixing the clean ones. The bag-filter is sometimes called a Taylor filter; it is a well known apparatus—simple, but costly in working.

The filter-press is an improvement on the bag-filter, and is replacing it in many instances. In the bag-filter the dirty juice passes slowly through the cloth under pressure due to a head of a few inches of juice only, while in the press the filtration goes under high pressure, through a cloth supported on perforated plates or gauze. If a bag in a bag-filter bursts the whole apparatus must be stopped; but the press is divided into compartments, each of which can be shut off by means of a small cock if cloudy juice or liquor is seen to issue from it, while the remaining chambers go on filtering, without reference to the one shut off. Pressure may be obtained either by means of a pump or a montejus. If the pump is preferred, care must be taken to select a type which is not easily choked. The montejus is very frequently employed, and if worked by steam the pressure obtainable is limited by the pressure in the boiler, and disappointment has not infrequently arisen from this, when filter-presses have been placed in an existing factory where the boiler pressure was too low to enable the work to be done efficiently.

By adopting the use of compressed air instead of steam, any required pressure may be easily obtained, as the steam cylinder of the compressor may be made of a size to suit the steam pressure. Even where a high steam pressure is used, compressed air possesses the advantage of not condensing and diluting the juice.

In a previous paragraph it was stated that after clarification, or cleaning, the juice should as quickly as possible be brought to a density of from 20 to 30 degs. Baumè. At this density the liquor is not so liable to fermentation, and where filters are not employed it is not unusual to keep it in this state from twelve to twenty-four hours, during which time no bad effects are noticed; mechanical impurities are deposited in the tanks, and the sugar is frequently said to have a finer bloom in consequence of this treatment.

To concentrate the juice a considerables variety of machinery is in the market. The oldest plan is to use the round battery-pans, which are wasteful of fuel, injurious to the color, and require a considerable amount of manual labor. A steam coil is sometimes fitted into the pans, and a montejus or "liquor-passer" can be employed to pass the juice from one pan to the other. The shallow flat-bottomed pans are a step in advance of the large, deep pans. Then come varieties of steam-heated pans, all claiming some distinct advantage over other forms; one of the best being the arrangement of a circular pan with an internal multitubular steam drum, which is a modification of the well known "Aspinall" pan. All these evaporators which allow the steam to pass off into the air, or which make no use of its latent heat, are more or less wasteful of fuel, and evaporation is, of course, carried on at a temperature due to the density of the liquor under the ordinary pressure of the atmosphere.

Fryer's concretor is frequently used for evaporating the juice, and the writer has had considerable experience with it, and can testify to many good qualities. With this apparatus the juice is kept at boiling point on very shallow trays for a period of about ten minutes only, and the evaporation is afterwards carried on at a very low temperature by employing hot air, which causes rapid evaporation from the surface, at the same time cooling the liquor and not injuring the color. This air is heated by means of the waste products of combustion, and consequently a saving in fuel is effected. The concretor can be frequently introduced into existing factories with great advantage.

Except where planting on a small scale is contemplated, most new factories are adopting double or triple effects, which evaporate at low temperatures, and bring about a very considerable saving in fuel.

The triple effect consists of a series of three vacuum pans, the first of which is heated by means of the exhaust steam collected from the various engines, sometimes supplemented by steam from the boilers direct; a low degree of vacuum is maintained in this vessel, and the vapor or steam driven off passes over to heat the second pan; the vacuum in the second pan is more perfect than that in the first, consequently the boiling point is lower, and the difference in temperature between vapor from the first pan and the boiling point in the second, is sufficient to cause rapid evaporation. The vapor from the boiling liquor in the second pan passes on to heat the third. This last vessel is in communication with a condenser and air-pump, and as the best possible degree of vacuum is maintained, with a correspondingly low boiling point, the vapor from the second pan has consequently heat enough to produce evaporation.

When this system is adopted, special care should be taken to thoroughly clean the juice before commencing to concentrate, as the evaporation is carried on entirely in vacuo, and consequently it is impossible to remove any scum which may form. Valves, etc., should always be fitted to enable any one pan of the system to be put out of action, either for cleaning or repairs, and the others to be worked on a double effect. Most triple effects are arranged to fill and empty intermittently, but more work can be got out of them when planned to fill and discharge continuously. Much depends on the arrangement for the perfect circulation of the juice, and the best results can only be obtained when this point has been carefully attended to. It must be remembered that the double or triple effect requires a considerable amount of water for condensing the vapor, and where water is scarce, the planter has frequently to adopt open air evaporation even at a considerable sacrifice of fuel.

The proportions of condensers have to be varied to suit different climates, and when the maker of the machinery knows the temperature of the water, it is easy to proportion the condenser and other parts of the apparatus to suit any special case. It has sometimes happened that the condenser and its appendages have been made too small, or, on the other hand, much larger and more expensive than necessary, simply for want of information with regard to the water to be used for condensing.

The liquor after leaving the triple effect may be considered ready for the vacuum pan, or it may be again clarified, settled, or filtered. In some countries, it is usual to have a sufficient supply of storage tanks to contain all the liquor made during a day's work, and, as already mentioned, it is sometimes stated that this storing of the liquor for a day improves the appearance of the sugar. On the other hand, many planters are of opinion that the liquor should be passed on to the vacuum pan with as little delay as possible.

To boil the syrup to "grain," there are several different kinds of apparatus in use. The most ancient and the most wasteful is the round battery-pan, which is now seldom employed in new undertakings; but on a small scale its low first cost recommends it to the beginner or small planter. Its use should, however, be avoided as much as possible, especially at this stage of the process. It is wasteful in fuel and converts a large quantity of good sugar into molasses.

The next step in advance, is the steam evaporator, in which the liquor is boiled by means of steam coils, or tubes, fixed in a drum, or other suitable arrangement of heating surface, and in any case the vessel may have a double bottom in addition. In these steam evaporators although the boiling point is as high as in the pans heated by fire, still the heat is under perfect control, and there is less danger of burning, and consequently less chance of serious injury.

Various attempts have been made to produce a pan or evaporator to work at a low temperature in the open air; perhaps the best known apparatus of this class is the "Wetzel" pan, consisting of a reel of steam-heated pipes revolving in a shallow pan of syrup. The lower tubes dip into the liquid while the upper portion of the reel is exposed to the air. The "Wetzel" pan, when properly constructed, is a fairly efficient machine, but the mechanical details are frequently arranged in a most wretched manner. It evaporates at a comparatively low temperature, and is, consequently, a great advance on the ordinary fire or steam-heated pans. Its use is, however, principally confined to small estates, and in the majority of cases, it has been replaced by the vacuum pan.

Whatever may have been the various methods employed in the extraction of the juice, its clarification, and its preliminary evaporation, there is not the slightest doubt that the vacuum pan is now looked upon as the only satisfactory means of boiling to grain. The vacuum pan is really only an ordinary steam-heated evaporating vessel covered in and connected to a condenser and air pump. The air pump removes the pressure of the atmosphere, and evaporation consequently goes on at a very low temperature. Occasionally, the want of condensing water may prevent its adoption, but even where water is scarce it is frequently possible to arrange cooling apparatus and to work with the same water over and over again. When this is done, after once collecting a supply, it is only necessary to add from day to day, sufficient water to make up for the loss of the portion which unavoidably passes off as vapor into the air. This loss is only a few hundred gallons per ton of sugar, and is seldom sufficient to make the adoption of the vacuum pan impracticable. The original form of the vacuum pan was spherical (that being the form theoretically best able to resist the pressure of the air), and the material of which it was constructed was copper. The lower half of the pan had an iron jacket, thus forming a steam-heated double bottom, and later on steam-heated coils were introduced in addition. A double bottom is now becoming uncommon, and the form of pan has changed from the shallow spherical shape to that of a comparatively deep vertical cylinder. The forms and proportions of the vacuum pan are modified to suit different qualities of sugar, and to produce various sizes of grain, but for ordinary purposes on sugar plantations, the most approved type is the vertical cylindrical pan, constructed of cast or wrought iron, with copper heating coils and with a single bottom. Although the vacuum pan is a very simple apparatus, some stupid blunders have been made by makers not acquainted with the arrangement and proportions of its various parts, and consequent disappointment has been the result.

The condenser may be either of the "jet" or "surface" type. In the jet condenser the vapor mixes with the water, while in the surface condenser the vapor is condensed by contact with cold surfaces only. When a surface condenser is used it is easy to detect loss of sugar caused by the contents of pan boiling over.

The most efficient type of air pump to work in connection with the vacuum pan is a frequent subject of discussion. It was formerly usual to give the preference to some variety of vertical pump, sometimes driven by a beam engine, but during the last few years very considerable improvements have been made in horizontal pumps, and the horizontal double-acting pump, when properly constructed, is now generally recognized as combining the highest degree of efficiency with the lowest first cost.

The sugar leaves the vacuum pan in the form of "massecuite," or green sugar mixed with molasses, and may be either placed in cooling or crystalizing tanks, or passed at once to the centrifugal machines. When the green sugar is treated hot in the centrifugal machines, the proportionate amount of drainage sent back to be re-boiled is greater than when coolers are used, and some days elapse between boiling and draining. The proportions of second and third sugars will depend very much on the quality of the canes and care taken in the course of manufacture. but it is usually considered wise to provide ample tank or cooling capacity for the low sugars.

The old practice was to "clay" the green sugar, but the centrifugal machine has practically superseded this process. The "Suspended" centrifugal machine has now come into fashion, as it requires very little foundation, and can be run at a high speed; but care should be taken to select a type not liable to accident.

It should be noted that the number of crystalizing tanks or coolers for low sugars may frequently be considerably reduced by the addition of one or two centrifugal machines.

The drainage from the first and second sugars is frequently sent back to the vacuum pan to be re-boiled without further treatment; but it is now becoming usual, when arranging new plants, to provide "blow-ups," or heaters, in which to clarify the molasses before re-boiling.

The treatment of skimmings, settlings, etc., is frequently considered of little importance, and in new districts it is not unusual to see the scum from the clarifiers, etc., run off to the drains. On the other hand, experienced planters are paying great attention to the proper treatment of the skimmings and settlings ; and when it is remembered that these usually form at least ten per cent of the quantity of juice, it is scarcely necessary to point out the importance of recovering as much as possible. The usual practice is to blow up the contents of the dirt tank by injecting steam through a perforated pipe, and at the same time adding a little lime. The clear juice may then be recovered by settling and decanting, or by means of bag-filters or filter-presses. Many factories are supplied with filter-presses for filtering scum, etc., only, while the juice is treated by some other method.

In cases where a distillery is worked in connection with the manufacture of sugar, less attention is paid to the separation of clear juice from scum, and frequently the whole of the scum, etc., is sent to the fermenting vats. Where a distillery is at work, it is usual to ferment the lower qualities of drainage or molasses from the "massecuite," or green sugar, instead of re-boiling again and again, with the object of recovering as much sugar as possible. It follows that in such cases the quantity of crystallizing tanks for low sugars may be considerably reduced or entirely abolished, and also that the manufacture of the sugar is not complicated by treatment of scums, settlings, etc., Whether it is better to distil or not, will depend almost entirely on the value of spirit as compared with sugar, the Excise laws, and other points which require consideration in each individual case.

The efficiency of the steam boiler is an important item in the working of a sugar factory. Very ample power should be allowed, as shortness of steam means considerable loss of economy, and is a constant source of annoyance. Many types of boilers are in use on sugar estates; but the larger portion are of the multitubular type, frequently arranged with tubes easily removable for cleaning. The boiler with its fittings is usually very similar to those for burning coal, but the arrangement of the flues, furnaces, etc., have to be suited for burning crushed cane, wood, etc. Many attempts have been made to burn megass direct from the mill, and several furnaces are now made which do this fairly well, provided the crushing of the cane is well done. Care should be taken to select a boiler of simple construction and of the best material and workmanship, otherwise constant trouble and repairs may result.

The hot condensed water from the boiling pans should be collected and returned to the boiler. It was formerly the rule to have boiler feed pumps on each of the steam engines in a factory; but it has now become usual to fix an independent donkey feed pump. Injectors are also employed on some estates; but when a boiler is fed with hot water, a pump is necessary.

The chimney may be of stone or brick, but iron chimneys are very frequently sent out, either rivetted up into lengths, or sent in plates ready for rivetting. An iron chimney is less durable than a brick one, but the former is frequently preferred on account of convenience and quickness of erection.

An over-head water-tank should be fixed in every factory, having pipes or a hose for washing down, or for use in case of fire.

As the whole of the exhaust steam in a sugar factory is generally used for heating and evaporating, it is not usual to supply the engines with expansion valves or any special fittings to reduce the consumption of steam. If the engines give out less exhaust steam than is required, it becomes necessary to use more steam direct from the boiler, usually through a reducing valve. In some modern factories the evaporating apparatus is so well arranged and so efficient that the exhaust steam from the engines is more than is required; in such cases the surplus should be used as far as possible for heating the boiler feed-water, and one or two of the engines fitted with expansion valves.

Whether animal charcoal is to be used or not for filtering will depend entirely on the class of sugar it is desired to produce. If refined sugar is required it is necessary to employ charcoal; but sugar refining carried on on a small scale can scarcely expect to compete with the home refineries furnished with the best appliances and employing an amount of skilled labor which it is usually impossible to obtain in the tropics. For reburning the char, simple pipe kilns are still in vogue on sugar estates; but more perfect, although at the same time more complicated apparatus is sometimes used in refineries.

The cost of labor is an important factor when arranging a plant for the manufacture of sugar. The greater the cost of labor the more desirable it becomes to have as much of the work as possible done by machinery; but where the use of machinery means greater risk of stoppage or breakdown, it may sometimes in the long run be more economical to employ hand labor, rather than very complicated machinery.

The difference between the amount of sugar shown by analysis to exist in the sugarcane, and the amount of dry marketable sugar as usually obtained, although constantly being slightly reduced, is still great enough to provide a large field for individual skill and experiment.

The slowness with which sugar planters take to new apparatus is not easy to understand until we fully appreciate the magnitude of the interests at stake, and the enormous loss usually resulting from failure. A modern plant to produce a little more than one ton of sugar per hour may cost from £15,000 to £20,000, whilst the value of the crop, most of which would be absolutely lost if the machinery failed, would probably be from £30,000 to £40,000. Planters are consequently very slow to adopt new and untried schemes, and it is curious to note that each new sugar growing country has in almost every instance, begun at the beginning and gained most of its knowledge by the light of experience, instead of at once adopting the latest and most approved methods found to work satisfactorily in the other and older countries.—"*Sugar,*" *January, 1, 1889.*

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THE BARBADOS SEEDLING SUGARCANES.

[Under the above heading we find in the *Demarara Argosy* of January 19th the following interesting comments on the claim of Prof. Harrison to the discovery of seedlings from the sugarcanes growing in his nursery in Barbados. While we do not discredit his statement, we join with the writer, whom we conclude to be a professional florist, in calling for proof in the shape of seeds, for these can alone furnish satisfactory evidence. As he rightly says, if his sugarcanes do bear seeds, they can be gathered from the arrow or tassel, as the seeds of other grasses are gathered:—Editor *Planters' Monthly.*]

"The proof we want in regard to sugarcane seeding is the actual seed gathered from the arrow of the cane. If it does bear, the seed can be gathered from the arrow, as the seeds of other grasses are gathered from the spikes or panicles they bear before the seed falls to the ground. Here there would be no possibility of doubt, and no liability to error regarding the seedlings produced, providing, of course, that the plant producing the seed had beforehand been certainly identified as the sugarcane. This identification of the cane, dealing with some observers, would be an essential precaution—as is instanced by sorghum seed having been sent to Kew by a Fiji planter, in all confidence as he believed, as *Saccharum* seed. I may give another instance, the strongest to point, of many within my knowledge of how the seed or flower of one plant is often mistakenly associated with another by persons insufficiently informed to detect the error. The common bamboo—*Bambusa vulgaris*—does not often flower; and, while residing in the West Indies, being anxious to see the flower, for which I had watched for years in vain in my peregrinations over the country, I asked a gentleman (whose occupation kept him almost constantly in the saddle, riding among the hills of the island in question where the bamboo was hardly ever out of his sight) if he had ever seen a plant in flower? 'Oh, yes,' he said, 'quite often.' But when questioned closely on the subject, and he had explained what he had seen, I found he referred to a very common small-flowered convolvulus, an *Ipomœa*, that twines up other plants, reaching many feet high and then flowering.

"With regard to finding seedlings of sugarcane on ground at present, or in the immediate past, occupied by canes, I will show how, unless to well-informed observers on the subject, there might well be error made. When cane roots are dug up and thrown aside, especially when soil is thrown over them they send up, more or less, a number of often very weak shoots from the roots. If the roots are in a position to lack moisture, being raised above the general surface of the ground, these shoots subsequently perish; but if observed when first they come up, they look very like seedling plants, and might be regarded as such by one not acquainted with the circumstances of the particular case or the history of the subject. Many of these shoots are so small as not to be much stronger than seedling wheat or oat plants. The stocks from which they have sprung are buried in the ground, where they remain as a rule if these slender growths are pulled up by hands, no particle coming up attached to the shoot, the latter then appearing to be most certainly a seedling plant. I do not mention this merely in the way of cold criticism, or to throw doubt on the reported discovery of seedling canes in Barbados, but only to suggest necessary caution, and to show how easily error might arise. Many persons who have been associated with agriculture for years do not observe at a glance the difference between a true seedling growth and a shoot that is an off-set or sucker from some other plant, as it is seen springing from the ground; nor do they as the trained observer would intuitively consider, without conscious mental action or intention, the probabilities from surrounding circumstances and conditions of whether it is likely to be one or the other.

"I notice that Professor Harrison, in reporting to Kew the discovery of the seedling canes in Barbados, says: 'We found these to be growing in a rather narrow belt of the field one side of the plots, and in a little below it, following the direction of the wind.' This would seem to indicate that the spot was some little distance, at least, from the standing canes that were supposed to have shed the seed. How far off was it? This is an important question. As no one has ever seen cane seeds we cannot say how light they are, nor, consequently, how far the prevailing wind mentioned by Professor Harrison, and inferred to affect the case in question, would be likely to to carry them. But if carried by the wind—an improbable supposition—however light they might be, unless still adhering to portions of the arrow, some would certainly have fallen (more than elsewhere, necessarily, one would suppose) on the intervening ground, and would, if the conditions were equally favorable, have sprung up there. But none is mentioned to have done so. If distributed by the agency of birds, the absence of which the cane arrows I have always regarded as evidence of the absence of seed, they could not necessarily have been only on the spot where found. But further, of the 64 or 65 plants gathered, Professor Harrison says: 'We carefully examined three or four so as to ascertain as far as we could the absence of any particles of old cane in them.' Surely this was a very small percentage to examine to determine so vital, and, from all we know of the cane, so very probable, conditions of such growths.

"Again he does not say whether the ground upon which they were found was carefully dug over at the time, and as carefully examined to see if there were any portions of old canes or cane roots buried in it. This was an equally essential precaution to have taken, as the examination of the roots of, not the three or four which were examined but, at least for the satisfaction of others who would have only such evidence to judge from, of all the seedlings. Further, seedlings, unless in their very earliest infancy, having nothing to derive nourishment from after the seed was exhausted, would have a good many roots, and could easily catch or establish in the soil when transplanted, while weakly shoots springing from concealed stumps, from which they drew their nourishment, would have very few; and would, having no roots reared to feed with, languish on removal and not readily catch the soil, perishing quite if exposed to the sun before they could develop the necessary roots. But instead of the former, this latter is what Professor Harrison says they had to contend with in rearing their plants. I have said enough to show that much caution was necessary, in the face of the great improbabilities against it, to determine certainly that the plants were what they were supposed to be—true seedlings; yet apparently, judging only from Professor Harrison's letter all the evidence we have before us at present, only the barest semblance of precaution against error seems to have been taken. There is still one kind of indirect proof possible. Should the plants vary in type from the kinds of cane growing on the ground near by, or that were grown on it the year before they were discovered, the probability of their seed origin will be greatly supported thereby; for though hybridity might not have occurred in the production of the seed, and without it no very striking or wide variation would be likely to occur, nor could be expected in one generation, yet its presence would be strong and almost certain evidence, that the plants had been derived by seminal generation. If on the other hand they are identifiable with any of the plants grown on the ground, or that have been thrown away upon it, during the past two years, though the fact would not disprove their seed origin, it would militate much against its probability."

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DIRECTORY OF OFFICERS EMPLOYED ON SUGAR PLANTATIONS IN THESE ISLANDS.

The following data are compiled from the Report of the Inspector-General of Immigrants, made to the Minister of the Interior, Feb. 21, 1889.

ISLAND OF HAWAII.

Waiakea: C. C. Kennedy, Manager; T. H. Davies & Co., Agents; H. Deacon, Bookkeeper; William Chalmers, Head Overseer; T. Forbes, Engineer; A. B. Lobenstein, Sugar Boiler. Laborers, 307.

Hilo Sugar Co.: J. A. Scott, Manager; W. G. Irwin & Co., Agents; W. Scott, Bookkeper; Robert Sadler, Engineer; H. C. Austin, Sugar Boiler; Geo. Chalmers, Head Overseer at Wainaku; J. Fiddes, Head Overseer at Amaulu. Laborers, 426.

Papaikou: Wm. W. Goodale, Manager; Castle & Cooke, Agents; G. E. Whitaker, Bookkeeper; C. M. Walton, Head Overseer; John Dickson, Engineer; W. Weight, Sugar Boiler. Laborers, 294.

Onomea: Wm. W. Goodale, Manager; C. Brewer & Co., Agents; Geo. Weight, Head Overseer. Cane ground at the Papaikou mill. Laborers, 311.

Paukaa: Wm. W. Goodale, Manager; C. Brewer & Co., Agents. Cane ground at Papaikou mill. Laborers, 90.

Pepeekeo: Chun Lung, Manager; C. Afong Agent; D. Wylie, Assistant Manager: H. T. Walker, Engineer; John Robinson, Sugar Boiler. Laborers, 242.

Honomu: Wm. Kinney, Manager; C. Brewer & Co., Agents; H. Scholtzy, Bookkeeper; M. McCann, Engineer; J. Reinhardt, Sugar Boiler. Laborers, 173.

Hakalau: Chas. Lehmann, Manager; W. G. Irwin & Co., Agents; J. H. Wodehouse, Bookkeper; J. Chalmers, Head Overseer; C. Horswill, Engineer; H. Wilgeroth and F. H. Kaapa, Sugar Boilers. Laborers, 414.

Laupahoehoe and Kaiwilahilahi Plantation: C. M'Clellan, Manager; T. H. Davies & Co., Agents; A. C. Palfrey, Bookkeeper; ——— ———, Head Overseer; S. Taylor, Engineer; E. W. Barnard and J. Reinhardt, Sugar Boilers. Laborers, 356.

Waipunalei: Thomas Hind, Manager; T. H. Davies, & Co., Agents. Cane ground at Laupahoehoe mill. Laborers, 66.

Ookala: J. N. Wright, Manager; W. G. Irwin & Co., Agents; G. Theker, Head Overseer; J. B. Hopkins, Bookkeeper; H. Kruger, Sugar Boiler; J. Cushingham, Engineer; J. Thompson, Blacksmith. Laborers, 176.

Kukaiau: J. M. Horner, Manager; H. Hackfeld & Co., Agents; A. Horner, Head Overseer; Miss Annie Horner, Bookkeeper. Cane ground by the Kukaiau mill. Laborers, 199.

Kukaiau Mill Co.: G. F. Renton, Manager; T. H. Davies & Co., Agents; J. S. Muirhead, Engineer; E. Madden, Sugar Boiler. Laborers, 48.

Hamakua Plantation Co.: A. Lydgate, Manager; T. H. Davies & Co., Agents. Cane ground at the Hamakua mill. Laborers, 203.

Hamakua Mill Co.: J. R. Renton, Manager; T. H. Davies, & Co., Agents; J. F. McEntee, Engineer; Thomas Hughes, Sugar Boiler. Laborers, 41.

Paauhau: Andrew Moore, Manager; W. G. Irwin & Co., Agents; J. Watt, Head Overseer; C. Bragg, Bookkeeper; W. Brede, Engineer; W. Peterson, Sugar Boiler. Laborers, 306.

Honokaa: Wm. H. Rickard, Manager; F. Schaefer & Co., Agents; H. T. Broderick, Bookkeeper; H. S. Rickard, Head Overseer; A. Kidd, Engineer; A. de Breteville, Sugar Boiler. Laborers, 222.

Honokaa: R. T. Rickard, Planter. Cane ground at the Honokaa mill. Laborers, 52.

Honakaa: R. M. Overend, Planter; H. Hackfeld & Co., Agents. Cane ground at the Honokaa mill. Laborers, 74.

Honokaa: J. Marsden, Planter; F. A. Schaefer & Co., Agents. Cane ground at Honokaa mill. Laborers, 18.

Kukuihaele: W. H Purvis & Co., Planters; F. A. Schaefer & Co., Agents; C. D. Miller, Bookkeeper; J. Melanphy, Head Overseer. Cane ground at the Pacific Sugar Mill. Laborers, 205.

Kukuihaele; J. M. Horner & Sons, Planters; William Horner, Manager; F. A. Schaefer & Co., Agents. Cane ground at the Pacific Sugar Mill. Laborers, 205.

Kukuihaele: Pacific Sugar Mill; C. von Mengersen, Manager; F. A. Schaefer & Co., Agents; S. Jatho, Engineer; H. Schultz, Sugar Boiler. Laborers, 50.

Hawi: John Hinds, Manager; T. H. Davies & Co. Agents; Wm. McKim, Head Overseer; Chas. Kempster, Bookkeeper; Robert Talentine, Engineer. Laborers, 180.

Beecroft Plantation Company: H. R. Bryant, Manager. Cane ground at the Hawi mill. Laborers, 78.

Union Mill: James Renton, Manager; T. H. Davies & Co., Agents; H. H. Renton, Assistant Manager and Bookkeeper. Laborers, 78.

Puehuehu Plantation Company: Kynnersley Brothers Planters; Robert Wallace, Manager; T. H. Davies & Co., Agents. Cane ground at the Union mill. Laborers, 98.

Star Mill: J. Hind, Manager; W. G. Irwin & Co., Agents; G. H. Williams, Assistant Manager; E. C. Bond, Bookkeeper; J. Leech, Engineer; Moses Kennedy, Sugar Boiler. Laborers, 106.

Wong Kawa, Planter: Cane ground at Union mill. Laborers, 40.

Kohala: C. A. Chapin, Manager; Castle & Cooke, Agents; A. R. Laws, Bookkeeper; W. P. McDougall, Head Overseer; J. F. Colay, Assistant Overseer; J. N. Blaisdell, Sugar Boiler; C. F. Phelps, Engineer. Laborers, 388.

Halawa Sugar Company: C. B. Wells, Manager; C. Brewer & Co., Agents; C. J. Falk, Bookkeeper; H. Streubeck, Engineer; H. M. Alexander, Sugar Boiler. Laborers, 132.

Makapala: R. Hall, Manager; M. S. Grinbaum & Co., Agents. Laborers, 24.

Akina & Aseu, Planters: Cane ground at the Niulii mill. Laborers, 88.

Niulii: Robert Hall, Manager; T. H. Davies & Co., Agents; Emil Bader, Head Overseer; T. R. Mossman, Bookkeeper; Peter Born, Engineer; G. E. Bryant, Sugar Boiler. Laborers, 144.

Hilea Sugar Co.: H. Center, Manager; W. G. Irwin & Co., Agents; E. E. Robbins, Head Overseer; I. H. Patten, Bookkeeper; J. Turnbull, Sugar Boiler; Frank Richards, Engineer. Laborers, 195.

Naalehu and Honuapo Plantations: H. Center, Manager; W. G. Irwin & Co., Agents; J. Dow, Head Overseer; G. C. Hewett, Engineer; Sam. Center, Sugar Boiler; Charles Binning, Bookkeeper. Laborers, 497.

Pahala: D. Foster, Manager; C. Brewer & Co., Agents; E. W. Fuller, Head Overseer; R. Zeigler, Bookkeeper; J. G. Myhrer, Engineer; E. McDade, Sugar Boiler. Laborers, 320.

ISLAND OF MAUI.

Waikapu: W. H. Cornwell, Manager; W. G. Irwin & Co., Agents; E. B. Friel, Bookkeeper; E. A. Morris, Sugar Boiler; Joe Crockett, Head Overseer. Laborers, 165.

Wailuku: R. D. Walbridge, Manager; C. Brewer & Co., Agents; H. H. Plemer, Head Overseer; H. B. Wentworth, Engineer; A. Barnes, Bookkeeper; W. A. Bailey, Sugar Boiler. Laborers, 213.

Hamakuapoko: H. P. Baldwin, Manager; Castle & Cooke, Agents; A. Lenden, Head Overseer; Warren Goodale, Bookkeeper; J. Cowan, Engineer; R. T. Wilbur, Sugar Boiler; G. Gillius, Clerk. Laborers, 456.

East Maui, (Kaluanui): W. von Graevermeyer, Overseer. Cane ground at the Hamakuapoko mill. Laborers, 52, Paia: J. W. Colville, Manager; Castle & Cooke, Agents; L. F. Carleton, Head Overseer; H. Laws, Bookkeeper; F. S. Armstrong, Sugar Boiler; Thomas Campbell, Engineer. Laborers, 483.

Spreckelsville: H. Morrison, Manager; W. G. Irwin & Co., Agents; W. G. Walker, Head Overseer; Phil. Mondt, Cashier; Geo. Ross, Bookkeeper; J. H. Stelling, Assistant Bookkeeper; F. Moore, Engineer; H. Antonsen, Sugar Boiler. Laborers, 1,298.

Grove Ranch: W. J. Lowrie, Manager; J. A. Palmer, Bookkeeper and Overseer.

Waihee: P. Norton Makee, Manager; C. Brewer & Co., Agents; Geo. C. Potter, Head Overseer and Bookkeeper. Laborers, 189.

Huelo: Wm. Turner, Manager; W. G. Irwin & Co., Agents; Wm. P. Fennell, Bookkeeper; J. K. Smith, Engineer; J. A. Rodney, Sugar Boiler. Laborers, 221.

Oluwalu: Aug. Haneberg, Manager; W. G. Irwin & Co., Agents; W. Fecola, Head Overseer; F. Earnest Hartman, Bookkeeper; W. Heine, Engineer and Sugar Boiler. Laborers, 155.

W. Y. Horner &. Sons, Planters: H. Hackfeld & Co., Agents; W. Y. Horner, Manager; C. F. Horner, Head Overseer; W. Y. Horner Jr., Bookkeeper. Cane ground at the Pioneer mill Laborers, 280.

Pioneer Mill: F. S. Dunn, Manager; W. Ebeling, Sugar Boiler; C. Rosse, Bookkeeper. Laborers, 66.

Hana: David Center, Manager; M. S. Grinbaum & Co., Agents; P. McLane, Head Overseer; J. F. McKenzie, Bookkeeper; John Neal, Engineer; J. M. Davidson, Sugar Boiler. Laborers, 348.

Reciprocity: P. M. Rooney, Manager; W. G. Irwin & Co., Agents; Dan Quill, Head Overseer; A. Irvine, Bookkeeper; C. Ahm, Sugar Boiler; Thomas P. Lowther, Engineer. Laborers, 271.

Muulea: P. M. Rooney, Manager. Cane ground at the Reciprocity mill. Laborers, 27.

Kipahulu: Oscar Unna, Manager; H. Hackfeld & Co., Agents; W. von Uffel, Bookkeeper; A. Gunning, Head Overseer; E. Baskerville, Engineer; J. M. Davidson, Sugar Boiler. There are no laborers under contract on this plantation. Laborers, 174.

ISLAND OF OAHU.

Waianae: A. Ahrens, Manager; H. A. Wedemann, Agents; Wm. Arnemann, Head Overseer; Carl Arnemann, Sugar Boiler; A. K. Hapai, Bookkeeper; John Wright, Engineer. Laborers, 302.

Laie: William King, Manager; J. T. Waterhouse, Agent. There are no contract laborers on this plantation. Laborers, 80.

Waialua: R. Halstead, Manager; Castle & Cooke, Agents; E. Halstead, Head Overseer; F. Halstead, Sugar Boiler; A. Hastings, Engineer. Laborers, 202.

Makaha: A. Ahrens, Manager. Cane ground at the Waianae mill. Laborers, 40.

Kaneohe: M. Rose, Manager. Cane ground at the Heeia mill. Laborers, 84.

Waimanalo: John A. Cummins, Manager; C. Bolte, Agent; James Merseberg, Bookkeeper; W. H. Pond, Engineer; J. O. Dowda, Sugar Boiler; Moses Hiram, Engine Driver. There are no laborers under contract on this plantation. Laborers, 458.

Heeia: Geo. R. Ewart, Manager; M. S. Grinbaum & Co., Agents; G. W. Williams, Head Overseer; H. C. Ovenden, Bookkeeper; W. McGowan, Sugar Boiler; F. Scott, Engineer. Laborers, 191.

ISLAND OF KAUAI.

Kekaha: Otto Isenberg, Manager; H. Hackfeld & Co., Agents; F. W. Glade, Head Overseer and Bookkeeper; C. Bosse, Engineer. Laborers, 150.

Kekaha: Meyer & Kruse, Planters. Cane ground at the Kekaha mill. Laborers, 206.

Mana: H. P. Faye & Co., Planters; H. Hackfeld & Co., Agents. Cane ground at the Kekaha mill. Laborers, 74.

Princeville: C. Koelling, Manager; C. Brewer & Co., Agents; J. C. Long, Head Overseer; C. Tuch, Sugar Boile r; M. Hopfe, Engineer. Laborers, 145.

Waimea: W. D. Schmidt, Manager; H. Hackfeld & Co.. Agents; John Fassoth, Engineer; J. Rahe, Sugar Boiler. Laborers, 112.

Eleele: A. Dreier, Manager; F. A. Schaefer & Co., Agents; H. Dortmund, Head Overseer; J. Thompson, Engineer; H. Weber, Sugar Boiler; R. Poppe, Bookkeeper. Laborers, 195.

Koloa: Anton Crop, Manager; H. Hackfeld & Co., Agents; Louis Kahlbaum, Head Overseer; M. Richter, Bookkeeper; G. Goodacre, Sugar Boiler; F. Loeba, Engineer. Laborers, 416.

Grove Farm: George N. Wilcox, Owner; Louis Ahlborn, Manager. Cane ground at the Lihue mill. Employs no contract laborers. Laborers, 86.

Lihue; Carl Isenberg, Manager; H. Hackleld & Co., Agents; C. H. Bishop and W. Grote, Sugar Boilers; J. Wilcox and H. Kellner, Engineers; C. Wolters, Bookkeeper; P. R. Isenberg, Overseer. Laborers, 412.

Hanamaulu: A. S, Wilcox, Manager; H. Hackfeld & Co., Agents; R. W. H. Purvis, Bookkeeper. Laborers, 221.

Kealea: Z. S. Spalding, Manager and President; C. Brewer & Co., Agents; William Blaisdell, Assistant Manager; C. N. Arnold, Manager at Kapaa; Wm. Eassie, Engineer; F. Reidel, Sugar Boiler; W. G. Smith, Timekeeper; R. C. Spalding, Bookkeeper and Cashier. Laborers, 1,005.

Kilauea: R. A. Macfie Jr., Manager; W. G. Irwin & Co., Agents; R. L. Auerback, Bookkeeper; Ed. Macfie, Engineer; E. Muller, Sugar Boiler. Laborers, 335.

Swift, Garstens & Co., Planters. Cane ground at Kilauea mill. Laborers, 98.

A. H. Smith & Co., Planters: Jared K. Smith, Manager; Castle & Cooke, Agents. Cane ground at the Koloa mill. Laborers, 56.

Kaluahonu Co., Planters: E. E. Conant, Manager; H. Hackfeld & Co., Agents. Cane ground at the Koloa mill. Laborers, 14.

Makaweli: Gay & Robinson, Planters: J. T. Waterhouse, Agent; F. Gay and Aubrey Robinson, Managers. Cane ground at the Waimea mill. Laborers, 130.

ISLAND OF MOLOKAI.

Kamalo: J. McColgan & Co.: D. McCorriston, Manager; George Temple, Sugar Boiler. Laborers, 55.

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ORANGE AND LEMON CULTURE IN SICILY.

WALLACE S. JONES, U. S. CONSUL, MESSINA.

The Sicily lemon culture is thirty per cent more profitable than orange culture. Lemon trees are more prolific than orange trees, and the prices for lemons are always higher than for oranges. The province of Palermo is the great orange district of Sicily. Throughout the province of Messina the orange was exterminated in 1865–75 by the "gum," and the lemon, budded on the wild orange has taken its place. To defy the ravages of the "gum" the bud must be put in the wild orange stock at least three feet from the ground.

THE ORANGE.

The bulk of the oranges shipped from Messina comes from the province of Reggio, on the mainland. In Calabria they begin gathering the orange in October. This fruit is hard and sour and of a whitish appearance, and is shipped to England. Shipments of oranges to the United States begin in December. They begin gathering oranges in Sicily in November—if we except small shipments to London of unripe and undersized oranges from Milazzo, thirty miles to the northwest of Messina. This poor fruit is quoted at about seventy cents a box in October; deducting twenty cents for cost of box, leaves fifty cents for the fruit and handling. These oranges are bought by confectioners. The climate of Southern Italy being warmer in summer than that of Sicily (Sicily, surrounded by the deep waters of the Mediterranean, is cooler in summer and warmer in winter than the province of Reggio), and the oranges being generally grown on a light, sandy soil, accounts for this maturing earlier in Calabria. As just stated, the first gathering of oranges in Sicily occurs in November, but most of the crop is gathered in December and January. The Sicilian grower prefers running the risk of damage by frost (but two crops have been injured by cold during the last twenty years) to gathering his fruit (oranges) when it is still too immature. Sicily oranges, which are, of course not fully ripe when gathered, keep well for forty days. Frequently the fruit when gathered, is allowed to sweat in the groves from two to three days—piled on the ground and covered over with tarpaulins. It is then wrapped in tissue paper, boxed up and sent to the city. Fruit is also sent directly from the grove, in bulk, as it is gathered. All fruit, upon reaching the exporters' warehouses, is carefully inspected and selected, wrapped in fresh tissue paper and repacked. Exporters ship their oranges as soon as packed.

COST OF PACKING—SHIPMENT.

During the shipping season large firms in Messina employ as many as 300 women and girls, paying them from twenty to twenty-five cents a day, nine hours work. The women select and wrap up the fruit. Men are employed to pack the fruit and handle the boxes. They get from forty to fifty cents a day. The stevedores handle the fruit with great care. The steamers give all possible ventilation to the fruit during the voyage. Fruit possessing the greatest keeping qualities is sent in sailing vessels to the United States. The duties paid on oranges and lemons entering the United States, are: On oranges, per box, twenty-five cents; on lemons, per box, thirty-five cents.

Exporters frequently buy the fruit on the trees. Below is given the cost of preparing and shipping a box of oranges or lemons:

Cutting, selecting and packing in grove	$ .15
Box, paper, nails, hooping	.30
Transportation to Messina (average)	.20
Freight per box by steamer to New York	.30
Repacking, shipping charges, rent, brokerage	.14
Total	$1.09

A few firms export fruit to the United States on joint account. Fruit is generally shipped on consignment. Consignee's commissions and auction fees are six per cent.

Years ago oranges were preserved in sand for from four to five months, merely for family use. This practice no longer prevails; it would not pay on a large scale, such enormous warehouses would be required, and so great would be the expense of handling the fruit. Preserving oranges in bran has been tried; it proved too heating. I have heard of a successful shipment of oranges packed in beech sawdust. The vessel carrying the cargo left Messina in December and reached St. Petersburg in May. Spanish grapes packed in cork-tree saw-dust keep from September to March. Preserving oranges by the fumes of sulphur has never been attempted here, lest the fumes might cause the fruit to dry up.

The maturing of oranges and lemons is affected by the altitude, latitude, excessive heat in certain localities, irregular rainfall and the nature of the soil.

Sicily is mountainous in character and is agronomically divided into three zones—(1) Marine zone, in which fruit ripens earliest; (2) Middle zone, extending from 1,500 to 3,000 feet above sea level; (3) Mountain zone, where the temperature is too low and the climate too damp for citrus culture.

The soil has a great influence upon the maturing and keeping qualities of the citri. The fruit ripens earlier on light, sandy soil than on clay soil. Fruit grown on light, sandy soil cannot be left long on the trees without deteriorating in quality,—becoming dry and spongy,—whereas on stiff clay it can remain with impunity until the end of April. The latest fruit to ripen is that produced on the upper limit of the middle zone (the trees growing on stiff clay soil), which can remain on the trees until the end of June, without drying up or its skin becoming hard and spongy. It must, however, be gathered in July, for should it be left longer on the trees it would injure the new crop.

Fruit grown on a light, sandy soil is small and of a pale yellow, and is comparatively short keeping. That grown on a clay soil is larger and keeps well, and is of a reddish brown. Trees on a clay soil resist drouth much better than those on sandy soil. The groves to the southwest of the Palermo district produce much more highly prized fruit than those on the northwest, the sole difference between them being their clay and sandy soils. As in the neighborhood of Palermo, so in other districts of the province, even where the climatic differences are great.

Fruit in Sicily is known as "mountain" fruit and "sea-coast" fruit. Merchants further classify the fruit according to the soil on which it grows. Fruit grown on clay soil brings thirty per cent more than fruit produced on a sandy soil. Mountain fruit is firmer and keeps better. Its superiority is attributed to the nature of the soil and not to the nature of the climate. Fruit produced in the plain of Portobello, the soil of which is clay, brings the same price as that grown on the heights of Moureale.

The fine, large oranges that bring a high price in Palermo in summer, are allowed to remain on the trees until the end of May when they are stored in subterranean grottoes. They are produced on clay soil abounding in alkalis and well decomposed organic matter. In the sides of the mountains, near Palermo, are many grottoes that are cool and well ventilated, in which oranges keep nicely during the summer. They are spread two layers deep upon large mats placed at convenient distances one above the other. Every day or two the fruit is turned over and all the defective oranges are removed. This fruit finds a home market.

The principal orange and lemon groves are on the northern and eastern coasts. The mountains along these shores rise in bold headlands from the sea, leaving but a narrow strip of land —the marine zone, of sandy character—at their base. The soil of the hillsides—the middle zone—is generally clayey. For lack of water for irrigation, oranges and lemons are not grown to any extent on the southern and western shores.

THE LEMON.

The well known variety of lemon called the "Lunare,"—lunar,—or everbearing, produces blossoms and fruit every month in the year. When, however, during the Indian summer, rainy days are succeeded by dry, clear weather, lemon trees of different varieties immediately put on bloom, and if, owing to the mildness of the season, the fruit sets at the beginning of winter, it will come to maturity in midsummer.

Lemons are divided into two classes—the true lemon and the bastard lemon.

The true lemon is produced by the April and May blooms. The bastard by the irregular blooms of February, March, June and July, which depend upon the rainfall and regular irrigation, and the intensity of the heat during the summer and winter season.

The true lemon requires nine months to reach maturity,—from the bloom in May to the mature fruit in January. There are but three harvests of the true lemon. The November cut, when the lemon is green in appearance and not fully ripe; lemons of this cut are the most highly prized, they possess remarkable keeping qualities, and are admirably preserved in boxes in warehouses from November until March, and sometimes as late as May, and then shipped. The second cut occurs in December and January. Lemons of the January cut must be shipped three weeks after gathering. At this date the lemon on the trees has acquired a yellow appearance. The third cut occurs in March and April. This fruit is shipped as soon as gathered, spring prices being always high. The uniformity in size of lemons, as we meet them in the trade, is due to the monthly harvestings from October to March. No sizer is used or even known here.

Bastard lemons present well characterized peculiarities in shape and appearance. Their inner skin is fine and adheres tenaciously to the meat. These bastards are hard, rich in acid and seedless. The bastard lemon, produced from the bloom of June 1st, is still green the following April, and ripens only towards the end of July; it remains on the tree over a year, and sells well in summer. Besides the March and June bastards there are yet others that remain on the trees from twelve to eighteen months. The true lemon can be left on the tree until the end of May or first week in June, but it interferes with the new crop, drops off from over-maturity and is liable to be attacked by insects. The bastards, on the contrary, withstand bad weather and parasites; they mature from June to October. It is estimated that four times as many oranges are lost in the groves and warehouses as lemons.

ESSENCES.

The method employed in Sicily for extracting essence (essential oil) from the peel of the lemon, the sweet and sour orange and the bergamot, is as follows:

With three strokes of his sharp knife the cutter peels the lemon lengthwise and lets the peel fall into a tub under the chopping block. He then cuts the lemon in two and throws it from his knife into a basket. He works with wonderful rapidity and fills from ten to twelve tubs with peel a day and is paid five cents a tub, weighing seventy-seven pounds. His left hand and right index are protected with osnaburgs or leather. Decayed fruit is not peeled, as its oil cells, being atrophied, yield no essence. Fresh peel is soaked in water fifteen minutes before the essence is extracted. Peel that has stood a day or two should remain in soak thirty to forty minutes, that it may swell and offer a greater resistance when pressed against the sponge. The operative holds a small sponge in his left hand against which he presses each piece of peel two or three times, simple pressure followed by rotary pressure. The women employed in this work, run a piece of cane through their sponges to enable them to hold them more firmly. The outside of the peel is pressed against the sponge, as the oil glands are in the epi-carp. The crushing of the oil cells liberates the essence therein contained. The sponge, when saturated with the essence, is squeezed into an earthenware vessel the operative holds in his lap. He is expected to press the peel so thoroughly as not to overlook a single cell. This is ascertained by holding the pressed peel to the flame of a candle; should it neither crackle nor diminish the brilliancy of the flame, the cells are empty. This process yields, besides the essence, a small quantity of juice and feccia (dregs). The separation of the essence, juice and feccia soon takes place if the vessels are not disturbed; the oil floats on the juice and the dregs fall to the bottom. These three products derived from the peel have no affinity with each other. As the essence rises to the surface it is skimmed off, bottled and left to settle for a few days. It is then drawn off with a glass siphon, into copper cans which are hermetically sealed. After the essence has been expressed a small quantity of juice is pressed from the peels, which are then either fed to oxen and goats or thrown on the manure pile and well rotted, or they would make too heating a fertilizer.

The yield of essence is very variable. This industry is carried on five months of the year. Immature fruit contains the most oil. From November to April, in the province of Messina, 1,000 lemons yield about fourteen ounces of essence and seventeen gallons of juice. An operative expresses three baskets of lemon peel (weighing 190 pounds) a day and is paid twenty cents a basket. The essence is so valuable the operatives are closely watched; they are most ingenious in secreting it about their persons. Six men work up 8,000 lemons a day (two cut off the peel while four extract the essence and juice) and obtain to 136 gallons of lemon juice, seven pounds of essence.

In the extraction of essence defective fruit, thorn-pricked, fruit blown down by the wind or attacked by rust is used. This fruit is sold by the "thousand," equivalent to 119 kilos or 260 pounds and thus classified:

1. Mixed lemons as they come from the groves December and January, of good quality, but not always marketable, often from top branches.
2. Lemons from March bloom.
3. Lemons rejected at the packing-houses.
4. Dropped fruit.
5. Shrivelled or deformed fruit.

Prices do not depend exclusively upon the classification of the fruit, the locality where it was grown is taken into consideration as well. Lemons grown on clay soil yield more essence and juice than those grown on sandy or rocky soil.

Dealers sometimes adulterate their essences with fixed oils, alcohol or turpentine. Adulteration by fixed oils is detected by pouring a few drops of essence on a sheet of paper and heating it; upon the evaporation of the essence a greasy spot will remain. Alcohol is detected by pouring a few drops of the esence into a glass tube in which a small quantity of chloride of lime has been dissolved; the tube is then heated and well shaken, and its contents being allowed to settle, the essence will float on the denser liquid. To detect turpentine, pour a few drops of essence on writing paper, and a strong smell of turpentine will remain after the essence has evaporated. The essence of sour orange mixed with the essence of lemon produces an aroma similar to that of bergamot. The latter is much used by confectioners in flavoring ice creams, etc.

Equal parts of lemon essence and spirits of turpentine well mixed (mixture known as *essenza vestimentale*) removes stains from linen and silk fabrics.

In a bergamot essence establishment at Reggio, on the mainland, is to be seen in operation a hand machine for extracting essential oil. The skin of the unpeeled bergamot is punctured by a system of revolving knives, and then gently pressed. (The machine resembles the Little Giant Corn and Cob Crusher). It should be borne in mind that the bergamot is spherical in shape; this machine could not be used on the lemon, on account of its (the lemon's) shape. A thermo-pneumatic essence-extractor, worked by steam power, has also been invented, but the old system is still in general use in Sicily, on account of abundant and cheap labor. The method employed for the extraction of essential oil from the lemon (as given above) applies as well to the sweet and sour orange, to the bergamot and the Mandarin. But a very small quantity of essence of Mandarin is made, and but slight attention is paid to the extracting of essence from the orange flowers. The essence extracted from the flower of the bergamot is called *neroli*, and is worth $35 per pound.—*Florida Agriculturist.*

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PACIFIC COLD STORAGE AND ICE COMPANY.

The cold storage and consequent preservation of perishable articles of consumption, says the *Rural Press*, has for some considerable time held the serious attention of those most interested, and in the Eastern States, as in Europe, many large establishments have been erected with a view to so desirable an end. The want of such an undertaking in San Francisco has now been adequately filled by the enterprise of the Pacific Cold Storage and Ice Co., which has fitted up a portion of the old California Sugar Refinery and is now prepared to receive a thousand tons or more of produce or merchandise.

A few remarks on the system adopted by the company and a few hints to intending patrons may prove useful to our numerous readers.

To reduce the temperature, to keep it when reduced always the same, and to keep it withal dry, are the three secrets of successful cold storage, and to attain these results the greatest care and experience are necessary.

A Linde compressor ice-making machine produces the temperature necessary to refrigerate the storehouse, which is done by means of coils of one-inch iron pipes placed in the ceilings of the various rooms. The brine, which has been cooled by anhydrous ammonia, passes through three miles of piping, and is deposited into a tank at a temperature of eight deg. to ten deg. above zero.

The insulation of these pipes is so perfect that the variation in any room will never exceed two degrees. Having reduced the temperature and insured its immutability, the next thing is to preclude as far as practicable the accumulation of moisture. Perfect ventilation is obtained by means of a steam fan and blower, which can be used in any of the eleven rooms. Any moisture that may arise from improperly packed articles, is taken up in the shape of frost on the coils of pipe, leaving the packages as dry as if exposed to the sun.

With all the care taken that is possible, cold storage works no miracle. If the packing is carelessly performed, or the articles too ripe, they are not fit for cold storage. As they go in, so they come out, if they are in good condition at entry; but if the work of decay or disintegration has commenced, the dissolution will be only temporarily arrested by cold storage and will be hastened materially when articles in such a condition are withdrawn. The greatest possible care should be taken in the packing. When the market is overstocked and fruit, vegetables, poultry and game may be purchased at very low prices, they should be sent to the Storage Co. and kept until a changed state of the market brings the fortunate speculator much higher prices.

An impression exists in the minds of many persons that freezing, which is also undertaken by this company, injures the flavor of meat or poultry. This is quite an error, for beef, mutton, poultry and all kinds of game are, on the contrary, improved both in sweetness and flavor by this process. When the freezing is done at a low temperature, the flesh loses none of its color when thawed, preparatory to being used, and cannot be distinguished from fresh meat.

Fruit growers, especially those who grow small fruit for market, says a writer in *Farm and Vineyard*, would doubtless realize great benefit from any method that would infallibly preserve their fruit in a sound condition for several days after becoming ripe and marketable.

During the berry season fair fruit is not unfrequently hawked about the streets of large cities at ruinously small sums, and yet perhaps in less than three days the same kind and quality of berries cannot be had by cousumers for much larger sums, if at all. Consumers cannot take advantage of the brief periods of abundance and cheapness to any extent, except for canning. Therefore, fresh fruit for daily table use, by the largely predominating class of people, is quite unattainable; and yet such use—regular daily consumption—is really the only one from which the highly desirable sanitary benefits can be fully realized, and to supply which, if once established, would probably require many times the amounts of such fruits now marketed. Fortunately there is a sure means of preserving ripe perishable fruits in a sound and fresh condition for days, and even weeks. It has been demonstrated that cold storage will accomplish this.

How to secure the conveniences for cold storage is an important question. It is easy enough to say that all that is required is to place the fruit in an apartment in which the temperature is kept invariably as near the freezing point as possible, yet not quite reach it—about 34 deg, to 35 deg. Fahrenheit. But how best to secure an apartment adapted to such use is less easily answered, for the reason that "circumstances alter cases," and what would be best for one might be beyond the reach of others. Those able to erect structures for themselves can proceed at once to provide cold storage apartments.

Even a wooden cold storage building is somewhat expensive. It should be large enough to accommodate all the fruit, in marketable packages, desired to be kept over at any one time, and also for an entry or packing-room, of intermediate temperature, in which the fruit can be cooled gradually before putting it into the cooling room and modified before taking out to ship, to prevent too sudden extremes of temperature. A cellar under this room for storing boxes might be of advantage.

A tested and approved form of structure is that of an efficient two-story ice-house, its outer walls having two spaces for filling with sawdust (or other suitable material), the outer one ten inches wide and the inner eight, with also an inner filled space. The upper story is the real ice-house—or at least there must be sufficient room in the upper story to hold enough ice to keep the room beneath cold, if not for the season's supply. The ground floor and walls of the cold room must be impervious to the passage of air, and the floor above slightly descend to a drainage gutter in the center. Of course, this floor must be well supported to sustain the weight of ice, but the less impervious to air it is, without letting the melted ice through, the better. As cold air settles down the warmer air is brought in contact with the upper floor, and the ice upon it keeps the entire cold room beneath at near the freezing point. People in any city may unite and co-operate in erecting a cold storage structure that would accommodate all interested in it; or they may unite their influence to induce some capitalist to provide cold storage facilities, and make a reasonable charge for storage to remunerate him. Probably the nearer the place of shipment the storage-room can conveniently be, the better for the fruit. A party who stores and deals in ice might reasonably be expected to furnish cold storage-room to good advantage.—*S. F. Merchant.*

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Henry Clews, the New York banker, tells the following: I know of a sugar refinery bought by a friend of mine for $60,000. It laid idle for a time, but he was asked his figure for it. He said $120,000. The money was paid and the property transferred, and, do you know, that property was put into the Trust as $750,000.—*Louisiana Sugar Bowl.*

DIFFUSION IN TEXAS.

SUGAR LAND PLANTATION.

Col. E. H. Cunningham owns the finest sugar estate in Texas and one of the finest in the world. Sugar Land Plantation comprises 8,000 acres of land, located in the fertile Brazos Valley, twenty-five miles west of Houston. Last year 3,000 acres of land were in cultivation: 1,550 in cane, 700 in sorghum and the remainder in corn. Two sugar-houses, about one mile apart are on the place. The main factory is on the railroad, and was equipped with a large double mill, clarifiers, steam train, vacuum pan, centrifugals, etc. The other house contained a double mill only, from which the juice was pumped to the main factory.

The splendid success of the Parkinson factory at Fort Scott, Kansas, in making sugar out of sorghum, attracted the attention and excited the interest of the Colonel. His land is eminently adapted to sorghum culture, and he believed that if he could keep his sugar-house busy with sorghum from June to the middle of October, and with cane from the middle of October to the end of January, he would find sugar making much more profitable than it is. He thought also that if the manufacture of sorghum sugar could be introduced into Texas it would develop a great industry in the State.

In order to ascertain facts for himself the Colonel visited Fort Scott, and found that that the reports had not been exaggerated. Satisfied with the effect of diffusion on sorghum, he visited Magnolia, two or three months later, during the government experiments, to witness the result of the process when applied to cane. He was still further convinced of the success of diffusion, and immediately resolved to adopt the new method. He sent to foundries in New Orleans and at the north for estimates, and to the lowest bidders, Edwards & Haubtman, was awarded the contract for building the diffusion battery. Mr. Leon Haubtman showed a very commendable spirit of enterprise in taking this contract, as he was given only two or three months in which to execute it.

Colonel Cunningham had the good fortune to secure the services of Prof. M. Swenson to design and build the cutting apparatus, and to give a personal supervision to the diffusion work.

After making his arrangements for the apparatus the Colonel tore down and sold the double mill in the main factory. As the steam train would not do to boil diluted juice he procured from Edwards & Haubtman a mammoth double effect, with a daily capacity of 100,000 gallons of juice. He also purchased from the same firm a low-pressure vacuum pan, of a capacity of 20,000 pounds of sugar at a strike, and put low-pressure coils in a similar pan that he had already. He engaged Mr. W. W.

Sutcliffe to build a furnace to burn the chips, and did all that was possible to put the sugar-house in order for the change of methods.

But, owing to unavoidable delays in erecting the machinery, the apparatus was not completed before the beginning of August. Then, when a trial was made, the bottoms of the battery proved of insufficient strength. New bottoms had to be cast, and it was weeks before they were finished and up in place. In the meantime the sorghum crop of 700 acres ripened and deteriorated past the point of its availability for sugar. The crop did not prove to be a total loss, as the seed-heads, it is stated, gathered for forage, about paid for the cost of cultivation.

The machinery was finally got in order, and the work of diffusing cane began on November 7. The mill in the auxiliary sugar-house had been in operation about two weeks, but after this date the battery was continuous in its work, and the mill was used only at rare intervals, when the field force delivered more cane than the battery could use.

DESCRIPTION OF THE APPARATUS.

The sugar-house is a large brick building without wings, and is of ample size to accommodate under the one roof the enormous amount of machinery necessary to manufacture into sugar even a larger crop that of Sugar Land.

Cane is fed to an ordinary carrier from cars on either side, as at any mill sugar-house where cars are used. But the carrier travels 44 feet to the minute, or about twice as fast as the usual rate of speed. The carrier elevates the cane to a chute through which it falls into a Ross ensilage cutter. This is a horizontal cylinder, 3 feet long and 15 inches in diameter, with eight knives set diagonally on the surface. Here the cane is cut into bits about one inch long. These are conveyed by a drag to a chute, through which they fall into the macerators. The macerators are horizontal cylinders, made out of gun metal, 3 feet long and 15 inches in diameter. There are nine adjustable knives running from end to end of the cylinder and setting at an angle of 45 degrees. The blades project about three-sixteenths of an inch, but can be raised or lowered as desired. A dead knife is so arranged that it will hold the chips against the knives, but will revolve and release any bit of iron or other obstruction that may get in the feed. The advantages of the dead knife were experienced several times during the season. On one of my visits an iron fork with a wooden handle, used for carrying off trash, was thrown on the carrier with the cane. The ensilage cutter and the macerator left only about enough of the fork for its identification, but no damage was done other than gapping the knives. The gaps were ground out, but even had the knives been ruined it would not have been a serious matter, as they cost only $3 each.

Two macerators in the same frame do the work. The present rate of speed is about 1,000 revolutions a minute, but they were designed for 1,500. This macerator is one of the many valuable inventions of Professor Swenson, who is a practical machinist. He served six years in a machine shop before he went to the University of Wisconsin, of which he became the professor of chemistry after graduating at the head of his class.

When I first saw the cutting apparatus I could hardly believe that it would do the work intended. Observation, however, has convinced me that it is a perfect success. It is beyond comparison superior to the German cutter used at Magnolia, and will doubtless be erected wherever diffusion may be adopted, in this country at least. No pieces of cane too large to diffuse come out of the macerators. The chips range in size from coarse sawdust up to bits of the diameter of a slate pencil, and diffuse equally as well as those cut with the grooved knife at Magnolia. And the first named would, no doubt, be taken better by a mill, when a mill is used to prepare the chips for fuel.

As well as I could judge by the number of cells filled during one of my visits the macerators were cutting not less than fifteen tons of cane an hour. There is no delay in sharpening knives, as there are extra cylinders with knives already sharpened, and a change of cylinders is made every twenty-four hours.

The chips are elevated by a carrier to another drag, which runs in a horizontal trough, above the double-line diffusion battery. A hole cut in the bottom of the trough, on a line with each pair of cells, and two light iron spouts, that can be slided from one end of the line to the other, constitute the simple means of filling the cells. When one cell is full a sliding gate covers the hole in the trough, and the spout is removed to another cell. This filling arrangement works very well, except that there is some labor in sweeping up chips spilled by the drag. This defect can and should be remedied.

The diffusion battery consists of 16 cells, set in a double line. Each cell is a cylinder, 13 feet long and 4 feet inside diameter, made of $\frac{1}{4}$ inch steel, with cast-iron heads and bottoms. The method of opening and closing the doors or bottoms of the cells is much superior to that in use at Magnolia. The opening and closing is attended to from above by the man who operates the battery. The movement is controlled by hydraulic pressure, a column of water 75 feet high furnishing a pressure of 300 pounds to the square inch. Valves connected with the hydraulic machine regulate the speed of the opening and closing of the door. The door swings on a hinge, and when it is shut and secured a hydraulic joint makes it as tight as a bottle. Each cell, without packing, holds by actual weight two tons of chips. The record of the battery man shows 35 cells in 6 hours—about 280 tons of cane a day.

The cane at Sugar Land was not weighed. The chips contained in a cell were weighed from time to time, and the weight found every time to be about two tons. While this might be sufficient information for practical working, it would hardly give a satisfactory basis in estimating the yield per ton, or for other data that might be expected in this pamphlet. But even had the cane been weighed it would be impossible to make any reliable statement of its yield by diffusion, as the auxiliary mill on the adjoining place was run from time to time, and the juice pumped into the clarifiers with the diffusion juice.

But there is one salient fact that stands out without the need of cane weights and chemical analysis. The crop this year, although not yet finished, with less than 5 per cent. increase in acreage, has turned out 25 per cent. more sugar than last year's crop did. It is this fact that enables Colonel Cunningham to delare without any qualification, as he did to me: "Diffusion is a grand success."

The delay in harvesting the crop was due to the exceptionally bad weather that has prevailed in Texas this winter, rendering the fields boggy and the roads impassable. A large portion of the crop would have been lost but for seven miles of portable railway and 300 cars, which the Colonel has. The acreage ground will be about 1,400 acres. The sugar product on Feb. 4 amounted to over 4,000,000 pounds weighed out, besides third sugars in the hot-room and 100 acres of cane in the field. Harvest is now about over, but it will be impossible to give the exact figures of the crop until the wagon sugars are all dried out.

While I do not propose to consider in this pamphlet that branch of the sugar industry, it is well to add that Colonel Cunningham intends to plant a large sorghum crop this spring, and the diffusion of sorghum next summer will be of exceeding interest. Sorghum diffusion in Kansas paved the way for cane diffusion in Lousiana. It is hoped that these kindred industries, forming already a natural alliance between the West and South, may, under the leadership of the enterprising and gifted Colonel Cunningham, be happily united at Sugar Land plantation.—*J. B. Wilkinson's "Diffusion in Louisiana and Texas."*

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The Sugar Trust is attracting attention abroad. Extracts from American papers are printed, and editorial comments on them. The *Barbados Agricultural Gazette*, in the course of a long article, says: "We hope the short-sighted Americans will not put their heads into the yoke."

BERMUDA GRASS.

The following extract from an address delivered before the Mississippi A. and M. College, by B. W. Stone, will be of interest to many of our readers:

"While Bermuda is now considered by most men a blessing to the country, it was formerly a great curse. In some instances now it may be considered a curse, for when it gets a footing upon a farm, the owner has to exert himself to no little extent to raise a respectable crop where it is growing. Formerly the opinion of most of our farmers was, that when a piece of land had a sod of Bermuda on it, it was utterly impossible to cultivate a crop, therefore they considered it to be of but little value.

"Bermuda grass, when planted on good land, and when the proper attention is paid to it, yields as great a quantity of hay as one could expect of any grass. Although it will not grow tall enough for hay on poor land, it will grow tall enough to serve for good pasturage. On common meadow it yields from three to four tons of hay to the acre. Mr. J. C. Rand, a gentleman who has a hay farm but a few miles from this place, has a Bermuda meadow from which he cut last season seven and one-half tons per acre. By the aid of a little nitrate of soda, Dr. Ravenel, on a meadow of his, obtained as high as ten tons per acre.

"After we see that this grass is so valuable, we next want to find out something of its propagation. Some men who have given this subject considerable investigation say that it has no seed; but others who have given it more attention, and who have investigated it more closely, say it has seed. Bermuda seed is very small, and is very scarce, and to attempt to find one would be like seeking 'a needle in a hay-stack.' So we see it would be entirely too expensive to obtain a Bermuda meadow from the seed. Hence we have no means within our country of propagating it, except from cuttings of the under stems, and from the superficial runners. These may be prepared by taking up the sod of any convenient size with a spade or some convenient tool, cutting the sod into pieces about two inches square; after which the pieces should be placed about two feet apart each way on prepared land. With a few plowings the land will soon be occupied with the grass. Another method of distributing the roots or runners is to wash them, and place them in a cutting box. The pieces are then scattered over the land and plowed in. In either case, after planting, passing a roller over the ground will benefit it.

"Often a farmer wants to cultivate a certain piece of ground which is thoroughly set with Bermuda grass. It is then that the methods of destroying are in demand. The following methods are the best:—1. Keep stock from it, and leave it alone; weeds, broom-grass and briers in a few years will destroy it. 2. Turn the sod upside down during the dryest days of midsummer; after a few days' drying, run a harrow over it in every direction, most of the dirt will be shaken from the roots, and they can be easily collected in piles and burned or hauled away to set out other lands if such is desired. The third method is to turn up the sod with two inches of earth in winter. The freezes will kill most of the roots; then in the spring the land can be bedded for cotton. Lespedeza will also kill it, if stock is kept from it.

"When a person wishes to get rid of Bermuda, and does not undertake it with the proper method, he will find it quite expensive; but a farmer to deal with it by one of the methods just described, and then plant the land in some small grain, so as to shade the land as much as possible, he will succeed in getting rid of it, for Bermuda grass will not grow enough to do any harm when shaded.

"Next to be considered is its qualities. By chemical examination it is found to contain more nutritive matter than blue grass. Now we all know that blue grass is considered by all to be one of the finest grasses; hence, since it yields so bountifully, and contains so much nutriment, it is very valuable for hay, grass, pasturage and other purposes. When this grass is used as lawn grass, it does not grow tall, is not coarse, rough grass, grows uniform, and is very beautiful.

"These are its summer qualities, while in the winter its roots are so numerous that it will serve as a walk or carpet all winter without allowing your feet to become soiled.

"For holding sandy lands and ditch banks, and for filling up gullies, this grass has no equal. And there is not a levee on the banks of the Mississippi which could resist for an hour the pressure of the fearful flood but for this grass.

"As a permanent pasture grass there is no other that is as valuable as this. To get the best results from a Bermuda pasture, it is important to graze enough stock on it so as to keep it tender for cattle, horses, sheep, etc. In the summer time the roots of this grass become very sweet, and it also makes a splendid pasture for hogs.

"As a fertilizer it is one of the best. Being always moist, and when the growth is vigorous, studded with dew-drops underneath throughout the dryest, hottest days; even its densely tangled and packed masses seem to keep the carpeted earth cool and moist in hot weather. Hence the continuous absorption, condensation and storage of plant food from the atmosphere in the roots and subjacent soil will make any of our worn-out Southern fields again productive."—*Florida Agriculturist.*

PROGRESS OF SUGAR MANUFACTURE IN LOUISIANA.

[Extracts from a Report of Dr. W. C. Stubbs.]

The experiments in sugarcane have been of a three-fold character—field, laboratory, and sugar-house. In the field the following have engaged our attention: Germination questions, physiological questions, varieties of cane, and manurial requirements. Full results of all of these experiments are now ready for the printer, and will soon appear as Bulletin No. 20.

Through the kind offices of Commissioner Colman, aided by the generous co-operation of Hon. Thos. F. Bayard, Secretary of State, this station has received about seventy-five varieties of foreign sugarcane. Of these, forty-eight have been successfully propagated, and are now growing upon the station.

In the laboratory and sugar-house much of our best energies have been spent. Through the liberality of our State Bureau of Agriculture and of Commissioner Norman J. Colman, we were enabled to erect a complete diffusion plant with a vertical double effect. By means of this plant, extensive investigations were made as to the requisite of good extraction, time, temperature and fineness of chips, the economical dilution of juice, the agents and methods of clarification, and the quality and quantity of sugar per ton.

Calcic clarification in the cells, performed at the right temperature, gives a juice which can easily be worked into the purest sugars. By drawing from the third cell from the last, the heat was found there sufficiently high to produce the desired clarification. The simplicity, the freedom from loss and inversion and the economy of this process are its great attractions, and force the prediction that it will be the universal process of clarification in the future.

From 200 to 251 lbs. of sugar to the ton of cane have been made daily since October 1st, working upon canes containing from 11.5 to 14 per cent. sugar. The quantity of water left in the chips and the amount removed by single and double passage through a three-roller mill has been several times determined, as well as this practical question of burning them after passage through the mill. The application of diffusion to standing frosted cane, matelas cane, and to windrowed cane was satisfactorily tested with most favorable results. Early in December, about four tons of cane were cut up in the Ross cutter and carefully ensilaged, using every effort to secure perfect exclusion of air. It was taken out on January 18th, and, to our great disappointment, was so badly acetified as to preclude the possibility of making sugar of it. The chips were white and sound in appearance, and only by appealing to the senses of smell and taste could the acetous fermentation be detected. They were diffused, but the juice was found nearly devoid of sugar, and very viscous and cloudy. It had to be thrown away. The importance of this question to the future central factory can hardly be estimated, and this one experiment must not be taken as a final decision.

The results of our experiments, the past season, suggests the central factory of the future, located everywhere throughout Louisiana, fed by cane and sorghum, cut and loaded by machinery in the field, topped and cleaned in the sugar-house, diffused and clarified in the cell, concentrated in a multiple effect, and granulated in a vacuum pan by exhaust steam. The dried leaves and tops, together with the upper white joints, can be burned with the expressed chips in an improved Godellot furnace, and perhaps supply all the needed fuel. Such a factory combines the maximum of economy with the minimum of loss, the largest results at the least cost.

The year just closed is believed to mark an epoch in the cane sugar industry of this State. Never before in our history has such an intense interest been awakened in the economy of sugar-making. The success of the diffusion process in extracting the juice from the cane, the excellent work accomplished by evaporation in vacuo, the saving of the scums and settlings hitherto thrown away by the filter presses; yea more, the presence of scientific aid in the sugar-house, discovering losses hitherto unsuspected, point unmistakably to 200 to 250 lbs. of sugar to the ton of cane as the future yield of Louisiana. To reasonably doubt this is no longer permitted us, the inexorable logic of facts having convinced our most obdurate skeptics. The open kettle must go; the clarifier and settling tanks must be dispensed with; the open evaporators must be supplanted by double, triple and multiple effects, and the ponderous five-roller mills be made to squeeze the water from the diffused chips, rather than the juice from the cane.

Of old things all are over old;
Of good things none are good enough,
We'll show that we can help to frame
A world of other stuff.

The central factory, with all these foreshadowed improvements, is surely coming, and the prophetic finger of the history of this checkered industry points to it as the climax of its achievements. When that day comes—when the sugar industry shall be over all its present obstacles, victorious; when the shrill blast of the central factory, starting at Lake Charles, shall roll across the Southwestern prairies, reverberate along the banks of our lower bayous, echo and re-echo on both sides of the Father of Waters, and with majestic swell ascend the Red, the Tensas, the Black and the Ouachita, and ring out in clear, crispy tones upon the frosty air of the valleys and hills of North Louisiana, calling all Louisiana on watch, then will be realized the dream, the mad ambition, the alluring hopes of the present Director of the Sugar Experiment Station.—*Sugar Bowl.*

NEW CANE DISEASE.

The manager of the Colonial Sugar Company, Sydney, having learnt from Dr. Kottman, who has just returned from a trip to Java, that a new disease called "sereh" is devastating the cane-fields in that island, and the company being advised by Dr. Kottmann to do all in their power to prevent the importation of Java cane to Australia on account of the disease being infectious, have entered into correspondence with their representative in Brisbane with a view to preventing any more of this cane being imported. The Colonial Sugar Company consider the danger so great that they have destroyed a number of cuttings which they had recently obtained at some expense. These cuttings were a new variety which was introduced into Java from Borneo in 1887, and planted in a district free from disease. The manager of the company has wired to Mackay to stop any possible importation to that district, as he had heard that Mackay planters were thinking of getting canes from Java. The matter having been brought under the notice of the Minister for Lands, he issued instructions to the Department of Agriculture to communicate with the members of the Planters' Association in Maryborough, Bundaberg, and Mackay desiring their opinion on this matter, and asking whether they recommended that all importations from Java be stopped for the present. The Under-Secretary for Agriculture has already done so, but has not yet received any reply.

Dr. Kottman says the cane disease called "sereh" is considered infectious by a large majority of men in Java competent to form an opinion on the subject. It was first discovered some ten years ago in the Cheribon variety (Java), and canes in that colony—chiefly in the Western sugar-growing district; then it spread to the neighboring districts of Tegal and Pekalonjan, and it has ravaged the districts of Solo and Djeoja, in Middle Java. Eastern Java is as yet free from the scourge, but it is impossible to tell where there also the plantations are not already infected with germs of this disease. Some mills have lost half their crops by it, and the crops in the districts of Solo and Djeoja were last season reduced by about 30 per cent. all round. These figures are extremely high in a country where formerly good crops were invariably obtained. The nature of the disease is not known yet, and great differences of opinion prevail regarding it. The cane plant, when attacked, grows more leaves than cane, and what stalks there are have many roots and side shoots, while the cane rapidly becomes over-ripe, and the ratoon crops suffer greatly in consequence. To remedy the evil the planters in the infested districts procure plants from the unaffected districts or from Borneo, and the owners of some mills capable of turning out

3,000 tons of sugar in a season now spend £3,000 or £4,000 yearly in obtaining fresh plants, and no charge is made for the transport of these plants on the Government railways.

The following is an extract from Dr. Kottman's letter to the Colonial Sugar Company on the subject of the new disease in sugarcane:—"I have sent you from Thursday Island the following telegram, under date 3d November, 1888: 'Strongly advisable to destroy cane plants received from Krause, Batavia, as sereh disease is probably infectious. Am going to Goondi.' Although Mr. Krause has prudently procured the plants from the mill Kalibagar, situated in a district which is yet totally free from sereh, I had to consider it my duty to warn against planting them. In the districts which suffer from sereh this disease is believed to be infectious, and after what I have heard and seen I am very much inclined to be of the same opinion. Dr. Kruger, of the trial station, Kagok, says that he and Dr. Soltwedel have never been in doubt about this point, and an instance how practical men dread this disease may be the following: Mr. Van Soest is the only owner of the above mill, Kalibagor, which he took partly over when sugar-mills were set down at a higher figure than nowadays. This mill, however, producing the highest quantity of sugar in Java per acre, namely, 5¾ tons on an average, makes enormous profits, which this year for a production of 4,000 tons high-class sugar, will be about £18,000 or £4 10s. per ton sugar when not calculating the interest on the value of the mill and on the working capital. Mr. Van Soest, when speaking frankly on his situation, said that he now needed only one or two years more of similar success and his position would be fully secured and independent. I replied that, considering the wonderful results of the last year, there was scarcely any reason to fear the contrary. He then replied that the sereh might yet get into his cane. Thus a sugar-grower far off all infected districts, who has yet the soundest cane, and who in fact is visited from all parts of Java for the renown his successes in the cultivation have gained in this island, even he does not feel himself quite secure against the sereh. My opinion on the position of Australia as regards this matter is in short this—that with the view of securing the colonies against the disease, prohibitory measures should be taken by the various Governments against the importation from Java of any cane-stalks or plants or other matter to which the disease might cling, until such time as the disease has either disappeared or is proved not to be infectious. The advantage of having cane from Java tried when comparing varieties from different sugar-growing countries is, I think, very small, as compared with the risk which, under the present circumstances, is possibly connected with the importation of cane from Java."—*Queenslander.*