THE HAWAIIAN

PLANTERS' MONTHLY

PUBLISHED FOR THE

PLANTERS' LABOR AND SUPPLY COMPANY

OF THE HAWAIIAN ISLANDS.

Vol. XV.] HONOLULU, MAY, 1896. [No. 5.

The latest quotation of sugar in New York, April 30, for Cuban centrifugals of 96 deg. test was 4¼ cents. Information from principal sources of sugar supply points to less than average crops of both beet and cane sugars, while Cuba almost entirely drops out of estimates for 1896–97. These conditions indicate high prices for a year or more to come.

The Sunday liquor law, which went into operation in New York city on the first day of April, has been strictly enforced, and very few saloon keepers undertook to do business, contrary to the law. These few had their licenses promptly cancelled. For the first time in many years it was found impossible to procure spirits or beer for beverage, and the number of arrests on Sundays has decreased beyond the most sanguine expectations of the friends of the reform.

The manufacture of alcohol from sugar beets is said to be nearing a solution. A still erected in Nebraska, has been successfully operated, the product possessing a high spirit test. It is thought that a good grade of alcohol can be made from beets, and if so, this will create an increased demand for them.

THE exact reason or cause of the formation of molasses remains still an open question. The new theory now is that there are other causes than those due to organic and inorganic salts. On the other hand, it is maintained that molasses is the outcome of the combination of sugar with potassic organic salts.

IN 1894, California sent to market about 275 carloads of prunes. In 1895 her entire stock did not amount to 100 carloads. The reason for the shortage is the fact that about 175 carloads were shipped to England, Germany and France. The culture of prunes is proving to be one of the surest and most profitable of the various fruit industries of that State.

DR. MAXWELL'S article on sulphurous acids, etc., in the April number of this monthly should have been credited as having been read before the "*Louisiana Planters' Association,*" and *not* the Hawaiian Association. It was reprinted from the "Bulletin of the Sugar Experiment Station" at Audubon Park, La., to which credit should have been given.

CHINO, CAL.—The *Chino Valley Champion* gives details of the sale by Mr. Richard Gird, of the Chino Ranch property to an English syndicate for $1,600,000. The acreage transferred aggregates, 40,000. It includes the centre North Chino water system, the Chino Valley railway, Mr. Richard Gird's home place, the Chino dairy, the race track, cattle, horses, implements, etc. The new owners propose to operate it as a limited liability company, capitalized at $2,500,000.—*Willett & Gray's Statistical.*

THE cost of cultivating an acre of beets, yielding fifteen tons, for Watsonville, is about as follows: Plowing and preparing soil, $3.00; beet seed, $1.00; thinning and hoeing, $5.00; cultivating between rows, $1.00; topping and loading into wagon, at 50 cents per ton, $7.50; plowing and hauling to depot, $7.50; freight to Watsonville from Salinas Valley,

$7.50; total cost, $32.50, leaving a net profit of $27,50, supposing that the roots are purchased for $4.00 net per ton which is the contract price at that place.—*Sugar Beet.*

"THE total yield of raw sugar in Germany," reports U. S. Consul Murth, of Magdeburg, "was 1,844,586 tons, against 1,381,603 in 1894, an increase of 33.50 per cent. The export increased to 1,073,590 tons, from 748,447 tons in 1894 The home consumption increased but slightly. The tax on sugar, less export bounty, yielded to the Government 85,714,000 marks, (a mark equals 23.8 cents), against 82,231,000 marks in 1894, and was 1.65 marks per head of population. The average consumption per head of population was 10.70 kilos (kilo equals 2.2 pounds), against 10.10 in 1894. The total raw sugar production of Europe in 1895 was 4,792,530 tons, against 3,889,845 tons in 1894."

THE American ship Roanoke sailed from Honolulu for New York, on the 27th of April, with a cargo of 5370 tons of sugar. She is the largest vessel that has ever loaded here, and drew 27 feet 8 inches of water in leaving. But the fact that she went out as readily as she entered, without stirring the mud in the harbor or channel, shows that any vessel of her size or or even larger can safely load at Honolulu. The entrance now has thirty feet depth at mean tide, and at high tide a vessel with that draft of water can enter or leave this port with safety.

Garden and Forest says:—While most of the pineapples sold within the United States have, within recent years, come from Cuba, the cultivation of this fruit in Florida has rapidly increased, and last season 50,C00 crates were shipped from that State. A crop of 250,000 crates is counted on for 1896. The Bahamas formerly furnished the main supply, which was carried in small sailing vessels taking four or five days to reach New York. The grade known to wholesale merchants as Havana XX, (thirty-five pineapples required to fill a barrel), now commands $9.00 a barrel, and this is also the importers' price to wholesale buyers in New York for barrels holding from forty-five to ninety of the fruits.

It is stated that in Cuba, in an area of fifty square miles, there are growing ever two million banana trees. Formerly, before the rebellion, there were over 3,000 persons engaged in the cultivation and handling of this fruit, and over twenty steamers were employed in conveying it to the American market. In the Hilo district, above the cane belt, there is a stretch of land suited to the cultivation of bananas, where one million bunches might be annually harvested, and a dozen steamers kept constantly engaged in transporting them direct to ports on the Pacific Coast, from San Diego to Victoria. The demand for bananas was never greater in the United States than it now is, and this demand continues throughout the year.

A Valuable Handbook.—We have received from the publishers a copy of "The Sugar Factory Manager's Handbook," which comprises notes, rules, tables and data for managers, engineers, chemists, overseers, pan-boilers and others engaged in the manufacture of cane sugar. The author is B. R. Body, and the book is published at the office of the *Sugar Cane*, Manchester, England. It is just such a book as every engineer or sugar-house man needs to refer to almost daily. The care, strength and capacity of boilers, filte presses, fuel, rollers, pumps, steam, gravity, pipes, triple effects, polariscope, and in short, almost every question arising in a sugar mill, in readily solved by reference to this handbook. It consists of 76 pages, and can be ordered through either of our bookstores. Price is three shillings.

Lantana in New South Wales.—The following is extracted from the report of J. H. Maiden, government botanist in the colony of New South Wales, as published in the Agricultural Gazette for September, 1895: "Lantana is a terrible pest at Laurieton, overrunning the place. Considerable expense has been incurred in eradicating it at one time, but it came up thicker than ever in a year or two. I advised eradicating it in the summer instead of the winter, as disturbance of a plant is more likely to be fatal at that season than at any other. When the ground is soft, after rain, would be time naturally chosen. No method of eradication can be final without careful watching and much labor to continue to eradicate it as fresh plants appear. But it would be an insult to the intelligence and enterprise of a go-ahead little township like Laurieton to assume that, by concerted effort, the pest cannot be exterminated from within the boundaries of a township, and from its immediate neighborhood."

THE NEW DISK PLOW.—In the issue of this Monthly for October, 1895, and again in that for January, 1896, page 14, we described a new plow manufactured by the John Deere Plow Co., of Moline, Illinois. On Wednesday, May 6, a trial of this new implement was had on the field opposite the tramway stables in the eastern part of the city. A number of gentlemen interested in agricultural matters were invited by Mr. Jas. G. Spencer, of the Pacific Hardware Co., to witness its work. With a team of three horses, and in moderately stiff land, the plow did very good work, turning up the dirt and pulverizing it to a uniform depth and width of furrow of say twelve inches. The work is done by a circular revolving steel disk of about twenty inches diameter, which serves not only to cut the sward, but also to break up or pulverize it. The use of this new plowing machine will demonstrate that it is susceptible of improvement, in the strengthening of some of the weaker parts, so that the strain may be more evenly divided. In a previous notice of it in the January issue, we suggested that short teeth under the rear end of the subsoil iron will be an improvement. The exhibition was under the supervision of Mr. Legler, a representative of the above Plow Company, and was very satisfactory.

---:o:---

COMMERCE OF THE REPUBLIC OF HAWAII FOR 1895.

WE are indebted to the Minister of Finance for a copy of his annual report to the President of the Republic, from which we learn that the receipts of the national treasury for the year 1895, including a balance of $302,676.27 from the previous year, amounted to $2,353,405.68. The expenditures for the same period were $2,284,179.92.

The Hawaiian public debt amounted at the same date to $3,574,030.16, of which about one million dollars are held in England.

Accompanying the above is the report of the Collector-General of Customs, Mr. James B. Castle, which covers the same period. The receipts from customs during the year 1895, amounted to $535,892.92, being a small gain over those of the previous year.

The exports show a decrease as compared with those of 1894, both in quantity and value. Sugar, to the amount of 294,784,819 pounds was exported against 306,684,993 pounds in 1895. A similar falling off is shown in rice and other staples. The total exports amounted in value to $8,474,-138.15, and the imports for the year to $5,339,785.00. The combined foreign trade is stated in the report to have been $14,188,155.69. Ninety per cent. of the export and import trade of the year has been with the United States, and eighty-seven per cent. of the freighting business has been done in American and Hawaiian vessels.

The number of clearances of vessels engaged in the foreign trade during the year has been 318, with a gross tonnage of 339,970 tons.

Of passengers, the arrivals number 8,090, and the departures 4,636, showing an addition of 3,454 to the resident population of the group, which is believed to be not less than 112,000 at this date.

———:o:———

A QUESTION THAT PUZZLES MILLMEN.

EDITOR PLANTERS' MONTHLY :—Entrainment! Entrainment!!—in the effects is the bug-bear that has been troubling engineers and sugar manufacturers for a long time. And the loss of sugar from this source has been variously stated to be from 100 to 400 pounds per day. Quite a number of experiments have been made to discover the actual loss, but with such various results that we are still kept in doubt to the importance of the subject. Therefore, the experiment just made at the Hamakua sugar mill will be of interest and value to every one interested in this subject.

The first thing to consider in making this experiment is what is the best way to obtain a sample of the vapor, after it passes the save-alls, and on its course to the condenser? If you arrange a pipe in the *U* or *elbow* of the vapor pipe, just before it enters the pipe on its downward course to the condenser, and attach this to a container, and have another pipe attached to or near the condenser so as to keep the vacuum about the same in the container as in the vapor pipe, and having the container immersed in water; or better still have coils before entering the container. Having condensed all the vapor passing through this container, then you having the time and quantity caught with the ratio's existing between the two pipes, and either the Brix or Polarization, you can easily see what loss there is in your effect, which will, no doubt, astonish every one on the Islands handling such apparatus.

To prevent this loss quite a number of experiments have been made, but none of them give entire satisfaction. Now having discovered the loss, the question arises, how to prevent it? Since most of the effects on the Islands are of the "Standard" kind, and the distance between the top of drum and "Goose Neck" is so limited, and the save-all capacity and arrangement deficient that there is a very short distance for the vapor to pass into the condenser, hence when once the vapor gets into the Goose Neck the velocity is so great that in spite of all you may do by putting in "Baffle" plates in vapor pipe and in save-all, a large quantity of sugar will pass off. Now in order to stop the sugar completely from passing over, it must be caught before it assumes its great velocity, and this must be done within the effect.

A new device has just been tried at the Hamakua mill which seems to be a perfect success, and is undoubtedly the best thing ever used to stop entrainment. The apparatus is placed within the effect, and so arranged as to give free passage to all vapors, but nevertheless preventing any loss of sugar, the apparatus so arranged as not to prevent or inconvenience in cleaning the effect.

Mr. Wm. W. McQuaid, the chemist at this mill, devised the apparatus and conducted quite a number of experiments before and after the use of the apparatus, and has shown that there is no loss of sugar from this source.

From what I have seen this device is far ahead of anything that we have ever used, and they are in fact as I have said before, a complete success in stopping entrainment.

We find from these experiments that the loss through entrainment is greater than we had supposed, and we are glad to learn that it can be prevented.

These plates are now put in both the Kukaiau and Hamakua mills. I remain, yours truly, G. O.

Kukaiau, Hawaii, April 15, 1896.

:o:

ANALYSIS MADE AT THE LABORATORY OF THE HAWAIIAN EXPERIMENT STATION.

No. 1.—A PRECIPITATE FROM SETTLINGS OF MOLASSES BLOW-UP TANKS.

A sample of a precipitate, which was found in very large amounts in blow-up tank settlings, was sent in to the experiment station laboratory for examination from Heeia Plantation. This precipitate, if it has occurred before, has never been observed in such great abundance as this year in the grinding of certain fields of cane, and the Manager, Mr. Bull, was of opinion that it might be a result of unusual conditions of the weather during several months previous to grinding.

An analysis of the precipitate gave as follows:

Water	9.08%
Mineral matter	39.78 "
Organic matter	51.14 "

The composition of the mineral matter was—

Lime (Ca O)	57.23%
Magnesia (Mg O)	5.90 "
Iron ($Fe_2 O_3$)	trace
Alumina ($Al_2 O_3$)	3.92 "
Hydrochloric acid (Hcl)	0.24 "
Sulphuric acid (So_3)	4.37 "
Carbonic acid (Co_2)	25.30 "
Undetermined	3.04 "
	100.00 "

A qualitative examination of the organic matter showed a large amount of sucrose with glucose admixed, and mucilaginous bodies, which were found to be in chemical combination with sulphate of lime, a compound which has been found in Louisiana juices, and the juices of the sorghum cane, and which is broken up by use of oxalate of ammonia, the oxalic acid taking up the lime and leaving the mucilages and gums free.

Very noteworthy is the large amount of carbonic acid (Co_2) found in the mineral matter. This indicates that the lime used had probably been stale, or badly burnt, as fresh and perfectly burnt lime should contain but little re-carbonated lime. Now, lime carbonate put into the clarifiers is not of value in clarification, and is just so much mineral matter that must cause trouble, and some loss of sugar, at some stage of working, which is shown by the large amount of sucrose present in the precipitate.

March 20, 1896.—Laboratories of the Hawaiian Experiment Station.

Note.—The Director suggests that Plantations, having doubt of the quality of the lime being used, shall send small samples to the Experiment Station for examination.

No. 2.—Analysis of Lime made from Waianae Plantation Limestone.

Lime (Ca O)	78.23 %
Magnesia (Mg O)	0.56 "
Carbonic acid (CO_2)	21.20 "
	99.99

The large amount of carbonic acid (CO_2) present in the lime shows that it was very imperfectly burnt, about one-half of it being still lime carbonate of limestone. The analyst (C. F. Eckart) found extremely small quantities of basic impurities. It was also observed that the common salt contained in the limestone was volatilized completely, no trace of chlorine remaining in the imperfectly burnt lime.

If this is an average sample of what can be made at Waianae, it appears that a lime can be made at home more pure than much that is imported.

March 20.—Laboratories of the Hawaiian Experiment Station.

CHEMICAL CONTROL OF THE SUGAR HOUSE.

DR. W. MAXWELL: Dear Sir:—There appears to be a growing desire among managers of our sugar plantations, to provide scientific control in the manufacture of sugar, as has been done on some few estates here.

In view of this, I wish to inquire what, in your opinion, would be the qualifications of persons competent to conduct such control? Some of our planters will, no doubt, be glad to have an expression of your views on this subject.

Respectfully yours,
H. M. WHITNEY,
Editor "Planters' Monthly."

MR. H. M. WHITNEY,
Editor "Planters' Monthly."

Dear Sir:—I beg to acknowledge your letter referring to the movement in the direction of a more scientific control in Sugar Manufacture, and asking my opinion as to the qualifications of men that it may be desirable to have in charge?

In attempting to answer you, I think it well, in the first place, to clear away from the main subject all the diverting, and detailed considerations which recent scientific additions have tended to envelope us in, and to ask again "what are the primary and essential acts of which Sugar Manufacture consists?" These acts are, in simple language, *the production of cane with a good content of Sugar, and of a Machine that will effectively take it out.*

In some countries the effort is being made to distinctly separate the growing of the cane from the manufacture, but as there are pre-eminent natural and economic reasons why this separation does not, and is not likely to, obtain on these islands, I shall not let myself be led off into that question.

Your questions, however, are intended to bear chiefly on the manufacturing part of sugar production, so I shall confine a few observations to the "machine," by which the sugar is to be gotten out of the cane, and to the mode of handling the machine.

Of course, by the "machine" is meant the mill, including every part of it, from the rollers to the centrifugals.

To commence with the mill proper: The mill is made and set up by an engineer. It is the engineer's device and construction for getting the juice out of the cane. If the mill breaks a roller, or otherwise goes wrong, the engineer must put it in order again. More than that, it is the engineer's interest and duty to study and see that his device (machine) is the right one for getting the very best results. It may be said that it requires chemistry to tell what the rollers are doing. So it does, but no more than the engineer should know in order to test the working of his machine. Moreover, if there is a chemist who tests the extractive and shows that the work is not good, he cannot, (unless he is more than a chemist), and the engineer must, step in and adjust the rollers or, as a last resource, put new ones in their place.

Passing from the rollers and on to the effects, the same possibilities recur. The "effect" is a device of the engineer for the rapid and safe contenting of the juice. It is the business of the engineer to see that his instrument is the best construction of its kind, and in the best working order. One question in relation to its working that may occur is. Is any loss of sugar going on during the operation?" It is undoubtedly the engineer's interest to know this, because he is the only man who can carry out the mechanical work to stop the leak, if loss is taking place. Again it may be stated that a chemical test is necessary to determine the fact and amount of the loss: So it is; but the test is so extremely simple an act in comparison with the work of altering or supplementing the "effect" to prevent the loss, that the engineer should perform it as merely incidental to his work.

Now sir, I think what has been said in relation to the rollers and the effects applies to every mechanical appliance in the sugar house; and it shows us that the sugar house is a huge mechanical application for the recovery of the sugar from the cane, and that the engineer, in the first degree, is the person to see that the "appliance" is what it should be, and is kept in working order.

In the clarifying or cleaning of the juices the engineer's skill should predominate. The processes of separation and filtration are more mechanical than chemical problems and only elementary chemistry is necessary to test what is being done. I have probably made the most exhaustive chemical examination of cane juice that has been done, and yet I am persuaded that the results of the examination, which are of a physiological chemical nature, have more bearing upon the fertilization and culture of the cane than upon the technical processes of getting the sugar from it.

As for the sugar boiler's art, a young and very intelligent sugar boiler on Hawaii said to me two weeks ago, "I see that if I can't do anything more than watch the pan and make a strike, I shall soon be nowhere." This young man asked me what else he should learn with his sugar boiling, and "where should he go to learn it?" A large part of the actual work at the pan is now done, under direction, by Japanese and Chinamen.

"Under direction" naturally suggests "who shall direct?" I am of opinion, Mr. Editor, that the person upon whom the burthen of direction and control of a sugar house should devolve should, in the first place, be scientifically and practically competent in mechanical engineering. In addition, he must be able to put into use, in his tests, the measure of chemical knowledge that all trained engineers are being required to know to-day: In other words he requires to be, what the French term such an expert, a "chemical engineer," with an application of his technical skill in the line of sugar making.

The best sugar colleges are educating experts on the lines I have defined. The Audubon Park, (Louisiana) sugar school, last year, "plucked" its candidates, because they were weak in mechanics and practical engineering.

What I have said, of course, bears chiefly on young men who are looking to their chances in the future. We, however, have to make the best of the present. Experts are not forthcoming who can cover all the ground that has been defined. Moreover, the effort should be made to help the practical sugar house men to continue in their work rather than to advocate radical changes. I therefore. have advised many young sugar boilers to take practice in the use of the polari cope and in making other tests, and I have offered to give them some instruction along these lines, if they are unable to go to institutions where these things are being taught.

Although chemistry is absolutely indispensable in rational sugar house control, I am impressed that too much weight has been given to the chemist as our individual in sugar house work. A man who knows no more, and can do nothing more than make chemical tests has, and can have, only a subordinate value in the sugar house. Unless he can also boil sugar or direct others in doing it, then a practical sugar boiler is a more valuable man than the chemist; in fact the sugar boiler is indispensable. These remarks only bear on our conditions as they are found, and do not in any way affect what I consider are the qualifications of the sugar house expert or "chemical engineer."

The fundamental value of a training in engineering, especially on these islands, in the ultimate position of the Manager of a Plantation, does not require to be dwelt upon, yet it could be with advantage.

I am Mr. Editor,

Yours very truly,

WALTER MAXWELL,

Director, Hawaiian Experiment Station.

———:o:———

FILTER PRESS

EDITOR PLANTERS' MONTHLY:—There are but few people, that fully realize the large amount of sugar lost in the mud, of the filter press cakes, and it would, perhaps, surprise them to learn, that this amount sometimes exceeds a thousand of pounds of sugar per day. For instance, the sugar left in the mud really amounts to less than ten per cent. of the weight of mud, and as the quantity varies from 4,000 to 10,000 pounds per day, it is easily seen that this loss is considerable. And to be exact the loss in the first instance is 400, and in the second 1,000 pounds sugar per day.

The usual method of reducing this loss is to add plenty of water to the skimmings. Others again claim that lime will make a dryer cake, and therefore reduces the loss. But the most successful method seems to be to well saturate the cakes with water after they have been pressed, *and press them again.*

This last method is practiced in Fiji, and reduces this loss to three per cent. It however must, after all, be a rather slow method, and requires a number of extra presses. Quite a number of persons are now fully alive to this unfortunate state of things, and they are trying various means of stopping it. The most successful effort made in this line comes from America.

In Lousiana, it is stated, a new style of filter press has been constructed, which reduces this loss from ten to a little over one per cent., while with the old style press, even after the cakes of mud have been saturated with water, and again passed through the filter press, they still contained three per cent. sugar. The advantage of the new style is found to be, so it is stated, in having three inlets, instead of one, and it is supposed that this allows the water to distribute more thoroughly all over the press, and consequently to lower the density of the juice. Another advantage of this machine is, that notwithstanding it does the work more thoroughly, it still does its work more rapidly than in the old apparatus, and in consequence saves not only the cost of presses, but what soon costs as much, filter press cloth as well. If this machine will do this, great progress has certainly been made towards solving this difficulty, and it will probably soon be adopted here. O.

Kukaiau, Hawaii.

:o:

CANE JUICE CLARIFICATION IN LOUISIANA.

EDITOR PLANTERS' MONTHLY:—The following is a translation of an article, which appeared in No. 81 of the Chemiker Zeitung by W. P. Kirchhoff and F. C. Thiele. It refers to the cleaning of sugar cane juice in Louisiana, and may at this time, be read with profit and interest by the sugar manufacturers of this country. The remarks of the above-named gentlemen are about as follows:

"The experiments made in Europe to establish scientific methods of juice cleaning remain, as far as the benefits to be derived therefrom are concerned, among the Louisana planters, a dead letter. They have made no progress in their old practice, which consists in pumping the raw juice into wooden containers, arranged in steps from which the juice flows in a succession of falls, while sulphurous acid gas is injected by a steam jet. Thus prepared the juice runs into a large receiver, where the main portion of lime, in the form of milk of lime, is added, at the same time heating the juice. From this receiver it is decanted into square clarifiers, heated with steam, and a further dose of lime is added. The lime is generally added in an empirical manner, the sugar boiler, who next to the engineer is the superintendent in almost all the factories, is quite satisfied with the so-called 'eye-test,' that is, if the juice becomes as yellow as honey and the precipitate falls quickly, the lime is considered sufficient. In case the desired color does not appear, he will determine empirically, whether too much or too little lime has been used, and accordingly more or less 'buckets' of milk of lime are added or left out, as the case may be.

"It is hardly necessary to say how irrational such a procedure is, but as scarcely one-quarter of the 600 factories in Louisiana employ a chemist, the question of chemical control is yet in a rudimentary condition.

"Seven years ago a sugar school was started in New Orleans, with the object of preparing young men as 'experts' in sugar manufacture. The director of this school gives his attention among other subjects to the cleaning of juice, and recommended, according to his own trials made in the sugar house of the institution, the following method:

"Lime is added in the clarifier to the sulphured juice until it shows a deep reddish color and gives a strongly alkaline reaction with litmus paper. It is then heated to ebulition, and after a short time is allowed to precipitate, is run into another set of clarifiers, where it is treated with diluted phosphoric acid, known under the local name of 'Clariphos,' until the alkaline reaction gives place to a slightly acid one. After precipitation, the clear juice is sent to the effects for concentration.

"The author of this process gives as an explanation of the chemical theory involved, that the preexisting glucose of the raw cane juice is transposed into glucic acid, which becoming volatile in the course of the boiling process, is subsequently eliminated, and therefore gives no further deleterious action on the crystallization of the cane sugar.

"We know cases in which the 'experts' of this school have applied this method on plantations, (for example—'Cedar Grove,') and have occasioned thereby considerable loss to the planters; at all events a very doubtful recommendation of the 'Stubbs method.'

"During last season's campaign two plantations, 'Baton Rouge Refinery' and 'Palo Alto Plantation' have experimented with another new process, viz: that of heating the juice under pressure. The limed raw juice is pumped under a pressure of fifty pounds per square inch through an apparatus similar in make to a 'Yaryan,' and subjected to a constant temperature of 260 degrees F. The juice, it is claimed, gives up its impurities after this treatment very rapidly, so that continuous settling tanks can be used. These tanks are large and tapered at the lower part, which is connected with a filter press, while the upper part has an outlet pipe for the clear juice. From time to time the precipitate which collects at the bottom is pumped through the filter press. So far no explanation of the chemical action connected with this process has been put forward. The results unfortunately have not been very encouraging, as the Baton Rouge Refinery has thrown the apparatus out of doors, but the Palo Alto Plantation will try this process yet another season.

"The planters are not favorably impressed with the carbonatation process. They consider it renders the juice more difficult to crystalize, and the resulting sugar is deficient in quality.* Several years ago some trials were made with this process, by unexperienced hands it is true, and were found unsatisfactory, consequently opinions already formed, unfavorably to the process, could not be easily overcome. But although the backward condition of the Louisiana folks regarding juice cleaning is manifest, more intelligent and progressive methods of manufacturing sugar are regarded as indispensible, seeing the abolition of the bounty has reduced their margin of profit to a loss."

Makaweli Plantation, April 24th, 1896.

AUG. FRIES, Chemist.

* Mr. Otto Isenberg of Kekaha, Kauai, introduced the cleaning of cane juice with carbonic acid gas some seasons ago into his mill, with very marked success. The juice formerly so difficult to evaporate now works freely and the grade of sugar manufactured is much improved.

BAGASSE AS FUEL.

[A PAPER BY PROF. R. T. BURWELL, READ BEFORE THE LOUISIANA SUGAR PLANTER'S ASSOCIATION, MARCH 12, 1896.]

The term bagasse is generally understood to mean that portion of the cane left after extracting the juice, and as the methods of securing this extraction give results varying all the way from 40 per cent. to 80 per cent., it is seen that it includes substances differing greatly in composition. We shall not limit the application of the term in this paper, but use it in the broad sense, usually taken as meaning the refuse discharged from the cane mill or diffusion process, whether it come from a mill giving 40 per cent. extraction and contain 70 per cent. of moisture, or whether it be the air-dried bagasse of the tropics with only 10 per cent. moisture.

The first question that shall engage our attention is the thermal or heat value of bagasse. During the last season four samples were submitted for test to Dr. Atwater with the results as shown in table No. 1.

The first column shows the moisture in the samples; the second the number of heat units in each pound of the sample as received. For instance, one pound of No. 1 is capable of developing 779 B. T. U's; but 90.36 per cent. of this is water, so that the 779 heat units are due to 9.64 per cent. dry matter; a pound of dry matter should, therefore, give $\frac{779}{0964}$=8288 B. T. U's. Similar calculations have been made in the other cases, and are given in column III, the average of which is 8319—practically the same as that of the

TABLE NO. 1—RESULTS OF CALORIMETE (BOMB) TESTS UPON BAGASSE BY DR. W. O. ATWATER.

	Per cent. moisture in sample.	Heat units per pound as received B. T. U.	Heat units per pound dry matter from column II, B. T. U.	Heat units per pound dry matter by actual test B. T. U.
(1) Purple cane exhaust chips direct from diffusion battery.	90.36	799	8288	8320
(2) Striped cane, exhaust chips direct from diffusion battery	90.54	873	9229	8289
(3) Purple cane exhaust chips passed through laboratory mill	73.34	1966	7373	8309
(4) Striped cane exhaust chips passed through laboratory mill	69.62	2547	8384	8384
Average			8319	8325

fourth column. This last column, however, gives results of tests made directly upon dry matter, and these are the figures that we shall base our calculation upon. It may be argued that the amount of water present in the sample might have had an effect to change the calorific power from its true value, but an inspection of the above table will show that this is hardly probable; the increase in heat developed follows neither the increase nor the decrease in percentage of moisture.

We shall, therefore, take the average of column IV (8325 B. T. U's per pound) as representing the calorific power of the fibre contained in the cane. To determine the amount of heat that a pound of bagasse resulting from the diffusion process will develop it is only necessary then to multiply the percentage of dry matter by 8325; to determine the heat available for generating steam, however, we must deduct from this product the amount of heat necessary to raise the water present into steam at atmospheric pressure, and at the temperature of the gases leaving the boiler. Let us take for example diffusion bagasse after it has been passed through a mill and containing 50 per cent. moisture; in every pound we have only .5 pound dry matter, which has a heat value of .5x8325=4162 B. T. U's and this must first do the work of evaporating the other .5 pound water. If the bagasse have an average temperature of 80 degrees Fahrenheit, and the temperature of the gases as they leave the boiler be 420 degrees Fahrenheit, there will be required for every pound of water in the fuel 1198 B. T. U's; hence the .5 pound water acquires 599 B. T. U's, leaving only 3363 B. T. U's as available heat. To express this in terms of coal we must decide upon the heat value of a pound of coal; this varies quite a good deal in different coals, and a universal value cannot be fixed upon. As a large portion of the coal consumed in this State comes from Pennsylvania, we shall take this as our standard of reference. An average of ten tests recently conducted by Professor Carpenter, of Cornell University, upon Pennsylvania bituminous coals gives 14026 B. T. U's as the value of coal we have $\frac{14026}{3363}$=3.93 pounds diffusion bagasse of 50 per cent. moisture, equivalent to one pound coal. Results calculated for such bagasse of various water contents are embraced in the following table:

TABLE NO. 2.—FUEL VALUES OF ONE POUND DIFFUSION BAGASSE AT VARIOUS DEGREES OF MOISTURE.

Moisture in bagasse per cent.	Heat units developed per lb. bagasse, B. T. U.	Heat units available per lb. bagasse, B. T. U.	No. lbs. bagasse equivalent for lb. coal.	Estimated temperature of the fibre; Fahr. Deg.
0	8325	8325	1.68	2465
20	6660	6420	2.18	2294
30	5827	5468	2.56	2186
40	4995	4516	3.10	2049
50	4162	3563	3.93	1870
60	3330	2611	5.41	1627
70	2497	1658	8.44	1281
75	2081	1183	11.90	1045

The coal ratio is best represented by a curve, as shown in diagram, the horizontal distances representing moisture percentage, while the vertical give the corresponding coal ratios.

Let us now consider mill bagasse. This variety greatly in composition according to the degree of extraction. The only method as yet available to us in estimating the fuel value for the different extractions is that based upon the assumption that bagasse consists of two substances—fibre and juice—and that this juice has the same composition as that extracted; we do know that this is not actually the case, but the error arising from such an assumption is undoubtedly very small. We have already adopted a fuel value for fibre, but to obtain one for juice we shall have to make a further subdivision into sugar and molasses. To illustrate this, let us take as an average cane one of 10 per cent. fibre and containing juice of 12 per cent. sucrose, 2 per cent. glucose and 1 per cent. solids not sugar, making the total solids amount to 15 per cent.

It is considered impracticable to reduce the percentage of sucrose in the molasses below that of glucose; in other words, 10, and not 12 per cent., represents, as a rule, the *available* sugar, the other 2 per cent. going with the glucose and solids not sugar to form molasses. Thus, $\frac{10}{15}=\frac{2}{3}$ of the total solids will be taken as sugar and the remaining $\frac{1}{3}$ as the dry matter of molasses. One hundred pounds of such cane passed through a mill giving an extraction of 75 per cent. upon the weight of the cane will furnish 25 pounds juice, of which 2.25 pounds will be total solids and 12.75 pounds will be water; but $\frac{2}{3}$ of the total solids, or 1.5 pounds, is to be reckoned as sugar.

Thus we have—

25 lbs. bagasse consisting of—
- 12.75 lbs. water.
- 10. " fibre.
- 1.5 " sugar.
- .75 " molasses (dry matter only)

or expressed in percentages we should say that such bagasse consists of water, 51 per cent., fibre, 40 per cent., sugar, 6 per cent., and (dry) molasses 3 per cent.

The average of calorimetic made tests by Dr. Atwater upon mill and diffusion molasses give 6956 B. T. U's per pound of dry matter, and according to the same authority sugar has a calorific power of 7223 B. T. U's per pound. Thus one pound of the above bagasse has a full value$=.40\times8325+.6\times7223+.3\times6956=3972$ B. T. U's, but from this we must subtract $1198\times.51=61$ B. T. U's necessary to drive off the water present. This leaves us available heat for generating steam, 3361 B. gives 4.17 as the coal ratio. Now, let us see how much fuel a ton of cane should yield under these conditions: the 75 per cent. extraction leaves us 500 pounds bagasse, which should be equivalent to $\frac{500}{4.17}=120$ pounds coal.

Table No. 3 gives similar results calculated for a number of extractions.

TABLE No. 3—VALUE ONE POUND MILL BAGASSE AT DIFFERENT EXTRACTIONS, UPON CANE OF 10 PER CENT. FIBRE AND JUICE OF 15 PER CENT. TOTAL SOLIDS.

Per cent. Extraction on weight of cane.	Per cent. Moisture in Bagasse.	Fibre.		Sugar.		Molasses.		Total heat developed. B. T. U.	Heat required to evaporate the water present. B. T. U.	Heat available. B. T. U.	Pounds bagasse required to equal 1 lb. coal 14000 B. T. U. Calorific power.	Coal equivalent per ton cane. Pounds.	Temperature of fibre. Fahr.
		Per cent. in Bagasse.	Fuel value. B. T. U.	Per cent in Bagasse.	Fuel value. B. T. U.	Per cent. in Bagasse.	Fuel value. B. T. U.						
90	0.00	100.00	8325	....	....	....	....	8325	....	8325	1.68	119	2465
85	28.33	66.67	5550	3.33	240	1.67	116	5900	339	5561	2.52	119	2236
80	42.50	50.00	4162	5.00	361	2.50	174	4697	509	4188	3.34	120	2023
75	51.00	40.00	3330	6.00	433	3.00	209	3972	611	3361	4.17	120	1862
70	56.67	33.33	2775	6.67	482	3.33	232	3489	679	2810	4.98	120	1732
65	60.71	28.57	2378	7.15	516	3.57	248	3142	727	2415	5.80	121	1612
60	63.75	25.00	2081	7.50	541	3.75	261	2883	764	2119	6.61	121	1513
55	66.12	22.22	1850	7.78	562	3.88	270	2682	792	1890	7.40	121	1427
50	68.00	20.00	1665	8.00	578	4.00	278	2521	815	1706	8.21	122	1350
45	69.55	18.18	1513	8.18	591	4.09	284	2388	833	1555	9.00	122	1284
40	70.83	16.67	1388	8.33	601	4.17	290	2279	849	1430	9.79	123	1222
25	73.67	13.33	1110	8.67	626	4.33	301	2037	883	1154	12.13	124	1077
15	75.00	11.77	980	8.82	637	4.41	307	1924	8[illegible]9	1025	13.66	124	1002
0	76.50	10.00	832	9.00	650	4.50	313	1795	916	879	15.93	126	906

From the table we see that the fuel value of bagasse from a ton of cane, according to our methods of calculation, remains practically the same for all extractions, the slight increase that we find being due to the greater amount of the total solids of the juice left at the lower extractions, which evidently more than compensates for the heat necessary to evaporate the water from the bagasse. To make this more clear, suppose that we burn 2500 pounds *dry* diffusion bagasse beneath a boiler supplied with water at a temperature of 80 deg. F.; if all the heat of the bagasse, which is 8325×2500= 20,812,500 B. T. U's, be taken up by the boiler it would be sufficient to evaporate 19,000 pounds of water atmospheric pressure, and even the very low boiler efficiency of 50 per cent. would give us 9500 pounds of water evaporated. Now take the same amount (2500 pounds) of *dry* bagasse and add to it 7500 pounds of water, and we obtain a material closely resembling bagasse from a 15 per cent. mill extraction, which we all know will positively refuse to burn unless subjected to some drying process or mixed with large quantities of dry fuel. Thus, by simply changing the method by which we present water to the action of the fuel, we obtain results differing very widely. In the first case not only will the fuel burn with readiness, but under poor economy it is capable of evaporating *four* times its weight in water; and yet in the second case, with only three times its weight of water, we are unable to make it burn.

We are, therefore, led to the conclusion that the practical value of fuels containing varying percentages of moisture cannot be adequately expressed in terms of another by simply comparing their calorific power.

The trouble lies in the fact that any increase in moisture decreases the temperature of the fire and this decrease finally reaches a point at which the gases leaving the fuel refuse to ignite. Complete combustion analyses of bagasse are not at hand to enable us to make authentic calculations of the temperatures of combustion; in the case of bagasse we shall take it identical with the softer woods used for fuel and having about the same heat value—any slight discrepancies that may exist between the analyses of the two materials could not appreciably affect our results. For molasses we shall have to make an approximation, the exact amounts of carbon and hydrogen not being known ; but while it will not enable to give to our calculations the extreme exactness demanded by the physicist, still it furnishes figures as near correct as technical practice would demand.

It is found that temperatures obtained by experiment fall short of those deduced by calculation on account of the cooling effect of the sides of the furnace and other causes ; one result must not, therefore, be taken as representing the true temperature to be expected. The calculated temperatures are obtainable only on condition that the gases shall combine instantaneously throughout their whole mass. This condition is practically impossible ; the gases formed at the beginning of an explosion dilute the remaining combustible gases and tend to retard or check their combustion. They do, however, represent the maximum temperatures obtainable in each case, and in the absence of more reliable figures, they furnish a fair method of comparison. The theoretical amount of air necessary for the combustion 1 pound of dry fibre is $6\frac{1}{3}$ pounds, for 1 pound sugar it is $4\frac{7}{8}$ pounds, while for 1 pound of dry matter in molasses there is required $4\frac{2}{3}$ pounds air. In practice we find that it is necessary to furnish a greater amount of air than theory indicates ; this is due to the dilute condition of the oxygen found in the air and the difficulty of producing a quick and thorough intermixture of it with the gases of combustion. Forced draught is an aid only from the fact that it hastens and facilitates this mixture ; the small jets of swiftly-moving air act as so many stirring rods to the gases and insure a more rapid combustion. On this account it is found that a smaller weight of air is necessary for high draughts than for low , for a pound of coal, for instance, with ordinary draught about 24 pounds of air are necessary for good combustion, while with properly regulated forced draught only 18 pounds are required. The amount of air necessary in any case will therefore depend upon the intensity of the draught and the facilities that are offered for the thorough mixture of the fuel with the air.

Practice points to the fact that fuels burned under average conditions require about twice the theoretical amount of air necessary ; this would give for a pound of dry bagasse $12\frac{2}{3}$

pounds air, for a pound of sugar $9\frac{3}{4}$ pounds, and for molasses $9\frac{1}{3}$ pounds air per pound of dry matter. We have adopted these figures in our estimation of the temperatures of combustion and the results are given in tables 2 and 3. Thus with dry bagasse the highest attainable temperature under these conditions would be 2465 deg. Fahr., while that given by a mill extraction of 75 per cent. a temperature of only 1862 deg. Fahr. is possible, and as the extraction decreases the temperature falls off very rapidly. Just how far the temperatures attained in actual practice differ from these, it is impossible to say; the greater the amount of moisture present, the more difficult it is to obtain a prompt and thorough admixture of the air and gases of combustion, and this calls for a higher air ratio, which is very effective in reducing the temperature of the fire. A great drawback is undoubtedly the latent heat of the water. So long as the moisture remains in the state of a liquid it can never go beyond 212 deg., and in passing into the state of vapor it takes up 88 per cent. of the total heat necessary to drive it off. As there is a wide difference between its temperature of 212 deg. and that necessary for combustion, it has the power of rapidly absorbing a great quantity of heat and very materially reducing the temperature of the fire.

The temperature 2465 deg. Fahr., given for *dry* bagasse, corresponds very closely to that acquired in practice with other fuels, and for the higher extractions the temperatures given in the tables will doubtless be not far from those actually attained; but for the lower extractions they are evidently much too high.

One authority states that carbon monoxide gas will not burn until it reaches 1472 deg. Fahr., and the hydrocarbons require 1292 deg. Fahr. If this be true, it would appear that the burning of bagasse below 45 per cent. extraction is attended with very incomplete combustion. This is, of course, speaking in a general way; the conditions under which the fuel is burnt may have the effect of driving off much of the moisture before it comes in touch with the incandescent fuel, and the temperature of the fire thus raised; while under other conditions the fresh bagasse may be delivered in such a way as to smother the fire and reduce the temperature far below that necessary for combustion.

We have plodded through a long series of calculations and explanations and yet the main point at issue has not been settled. The burning question to the planter is: "With a given mill extraction how many pounds of coal can I estimate the bagasse from a ton of cane to be worth ?"

We have shown that based merely upon a comparison of calorific powers the coal equivalent per ton of cane actually increases with a decreasing extraction, and while a comparison of the temperature of combustion is valuable in pointing out the trouble encountered they offered no tangible solution to the question. We can therefore, only answer in another general way: absolutely dry bagasse from a ton of cane has a coal value of 120 pounds, and at the higher extractions where it burns with ease and the temperature of the fire is not abnormally lowered we should expect the same figure to hold good. It should be remembered, however, that his figure is based upon the assumption that the coal referred to has a fuel value of 14,000 B. T. U's.; this is undoubtedly high for much of the coal sold in this State. The lowest value for the bituminous coals of which this is an average is 10,506 B. T. U's., and compared with such fuels bagasse from a ton of cane should be worth 160 pounds. An average of fifty-four tests upon Wyoming coals give 11,308 B. T. U's., per pound and expressed interms of this a ton of cane should yield the equivalent of 155 pounds. Which of these figures to select would of course depend upon the quality of the coal with which we are comparing it; we should therefore know something about our coal to begin with.

These estimates are also upon the basis of 10 per cent. fibre in the cane; with an 8 per cent. fibre, bagasse from a ton of cane would be worth approximately .8, the above values, or 96, 124 or 128 according to the coal taken as standard, while a 12 per cent. fibre would give 144, 186 or 192 pounds. Taking the average fibre content of the tropical canes to be 12 per cent., we see that they have an advantage over us of 24 to 32 pounds coal per ton of cane.

Let us now consider briefly how this fuel should be burned. We have shown that even the cane itself as it comes into the mill has sufficient heat power to evaporate the amount of moisture contained in it, if only this moisture be presented to it in the proper way. It would seem therefore that were it possible to subject bagasse to an efficient drying process before it reaches the fire, we should obtain an increased economy. Suppose, for instance, that it were practicable to drop the cane in at the top of the chimney and that by the time it reached the bottom it is deprived of all of its moisture by the action of the hot gases leaving the boiler, we should have from a ton of such cane, as we adopted in our tables, 570 pounds dry matter, which would be equivalent to about 250 pounds coal. This could be burnt at a high temperature and good economy; first, giving up a great portion of its heat to the boiler and then passing its heated products of combustion to the chimney to dry the incoming fresh fuel; by such an arrangement we should be able to obtain good results with the *cane itself.* But there are many drawbacks to the adoption of such a system in practice. The evaporation of the moisture would not take place as rapidly as the fuel is burned, and an arrangement that permitted any fresh air to mingle with the chimney gases would be worse than beneficial. It would appear to be a difficult and expensive undertaking to completely dry the bagasse by such a method; we do not, therefore, offer it even as a suggestion, but simply as an illustration of the conditions surrounding the burning of such a fuel. Just how far such a method, however, could be rendered practicable we shall not attempt to prophesy; experience alone can determine such a question. The drying of the bagasse could be carried on, to a large extent, in the furnace itself, by delivering the fresh fuel in such a way that it receive the heat of radiation from the incandescent fuel and not that of conduction—the vapor of water leaving this will, of course, absorb more heat; but it would acquire this by mixing with the products of combustion after they have been more thoroughly consumed. A fire brick arch thrown over the fire would, by a counter-radiation, promote the quick absorption of heat by the water, and materially facilitate its evaporation. There is another consideration that should lead us to favor the use of this arch, due to the nature of the dry fuel itself. The ingredients of this kind of fuel can be thus classified:

(*a*) Fixed or free carbon.
(*b*) Combustible gases.
(*c*) Water of constitution.
(*d*) Ash.

Fixed carbon is that which is commonly known as the charcoal, and together with the ash, is what is left after the volatile ingredients have been distilled away. By water of constitution we shall mean the amount of hydrogen and oxygen existing in combination with the other constituents in the proportion to form water; these gases combine in the bed of the fuel the moment decomposition sets in, under the action of the heat, and do not require either a supply of air or room to combine. This can be demonstrated by subjecting a closed test tube containing *dry* bagasse to the action of a blast lamp and conducting the gases evolved through a glass tube; the moisture, or water of constitution, will be seen to condense on the cool sides of the tube. Tests made upon a sample of dry bagasse gave:

Volatile matter......................	81.37	per cent.
Fixed carbon.........................	14.26	"
Ash..................................	4.6	"

The water of constitution was not determined, but if we suppose it to be the same as that of wood, it represents about 50 per cent., leaving as combustible gases 31.37 per cent. This portion of the volatile matter does require aid and it also requires to be kept at the temperature necessary for combustion until the combination with the oxygen of the air is complete; on account of the dilute condition of this oxygen complete combination is not instantaneous and in the meantime the gases are expanding. If they be exposed directly to the cooling action of the boilers, their temperature is rapidly lowered and soon reaches a point at which combustion ceases.

Mr. J. H. Coadley found in a series of tests upon a horizontal tubular boiler burning coal directly beneath the boiler, that with a fire temperature of 2426 deg. Fahr. the temperature at the bridge wall was only 1341 deg. Fahr., and we have already shown that carbon monoxide must be at a temperature of about 1472 deg. Fahr. to burn.

In the case of wood fuel burned in fire-box boilers, the condensation of the wood gases on the plates of the furnace and in the tubes causes a rapid deterioration and wasting of the plates, and we should expect that a kindred fuel like bagasse might have a similar effect. These troubles are eliminated in the extension furnace, for by the time the gases strike the comparatively cool boiler, the combustion is nearly perfect, and the corrosive substances distilled from the wood have been completely burned.

A great loss in a majority of cases undoubtedly lies in the improper facilities to distribute the fuel over the grate properly; every fireman knows the telling effect that a bare place on his grates will produce, and he knows, also, that there is a limit to which he can carry the thickness of his fire. And yet the writer, by watching the fire through the bagasse hopper, has seen bare spaces of fully six inches in diameter, while at another point the fuel was piled too high to penetrate it. The introduction of this excess of air is nearly as objectionable as an insufficient supply, for it has to be heated at the expense of the fuel, and the intensity of temperature of combustion is proportionally reduced. A calculation based upon a draught produced by an eighty-foot chimney, shows that merely to heat the air passing through a bare place of six inches diameter will require twenty pounds of coal per hour, without considering the loss incurred by the incomplete combustion of the adjacent fuel. Where a higher chimney or forced draught is used this figure will of course be much larger. It may be contended that this state of affairs does not exist continuously, but only for a few moments at a time. A single break does not exist very long in any fire; but a careless fireman that would allow one to form will allow another on different portions of the place to take its place almost as soon as the first has disappeared. In a fire where the fuel is allowed to drop upon the grate without either hand or mechanical stoking, such as in many—in fact, in a majority—of our bagasse burners, the above state of affairs exist to a much more exaggerated extent.

The bagasse falls upon the grate or bed of the furnace in practically one spot, forming a pyramid, down the sides of which fresh fuel falls; there is not a continuous and equal distribution on all sides of this pyramid and portions of the grate or tuyers are left uncovered. In addition to this the depth of the fuel at the centre is generally too thick for good combustion.

The lack of proper stoking or the distribution of fuel over the grate is, in the writer's opinion, a very serious defect in our present methods of burning bagasse.

Another great source of waste is the improper proportioning of the heating to grate surface, giving either a too high or too low stack temperature. Mr. Barrus places the proper stack temperature for anthracite coal at 375 deg. F. and for bituminous 415 deg. F., and cited two instances where reductions of 101 deg. and 107 deg. F., gave increased percentages 6 per cent. and 7 per cent. respectively in the evaporation per pound of coal. Low red heat indicates about 1000 F. and the color of the base of some of the iron stacks would indicate a great loss in efficiency. It is impossible in the scope of this paper to discuss the best form of boiler adapted to the sugar house, but in passing let us call attention to one fact.

If we burn a given weight of fuel completely and pass it out at the stack at a definite temperature, then a certain amount of heat has been absorbed, and this can only generate a certain amount of steam. It would appear that it would make no difference then what type of boiler we interpose, if it had the proper proportion of heating surface to grate surface, and does not throttle the gases and render the combustion incomplete. This assertion may seem a little bold to some, but it is actually borne out in practice. I quote the following from "Boiler Tests," by Mr. George H. Barrus, the well known American authority: "The conclusions to be drawn from all these comparisons is that the economy with which different types of boilers operate depends much more upon their proportions and conditions under which they work than upon their type; and moreover, that when these proportions are suitably carried out, and when the conditions are favorable, the various types of boilers give substantially the same economic results." These conclusions are drawn from the results of 134 boiler tests, made by the author upon various types. Careful experiments made in Alsace and Belgium also confirm this statement, and still more recent and reliable experiments by Prof. Kennedy and Mr. Bryan Donkin show that the type of boiler has not the excessive importance that is sometimes attached to it.

We must not forget that the result obtained from a boiler varies according to the quality of fuel and the experience and the capacity of the fireman. Expressing the relative economy of boilers by the evaporation per pound of combustible in the coal is not an accurate method of comparing the work of two boilers; for this takes no account of the fact that the combustible contained in the coal varies in different coals. Prof. Carpenter cites two instances where the amount of combustible in one coal was 8.6 per cent. more than the other and should give 8.6 per cent. more evaporation.

We find poor efficiency from the cylindrical and flue boilers on account of their improper ratio of heating to grate surface. To give the ordinary two-flue boilers, in such common use in this State, the proper ratio found best for burning bituminous coal we should have to make them twice as long, which is impracticable. But the tubular boiler can be given the proper proportions without any trouble and can be made to do as efficient work as any type; there may be other considerations that prompt the selection of other types, but let us accord to this type its just deserts.

In closing let me enter a plea for better data upon which to work; laboratory experiments may accomplish much, but the engineer looks more to the results of tests made upon machinery in actual operation for data to guide him. It is a very useful gauge of efficiency of any house to put in so many barrels of coal per 1000 pounds of sugar—it represents not only the combined work of all the machinery, but what is also an extremely important factor—the personnel of the force in charge. It shows us nothing definite, however, regarding the operation of the various machines. Let us have the value of our bagasse not in rough cane estimates but in the actual amount of steam generated per ton of cane; let us have the amount of the draught and the analyses and temperatures at the base of the stack; let us have in every case the ratio of heating to grate surface and the amount of fuel burned per square foot of grate. In other words, let us have that data that engineering experience has proven necessary for a rational study of such questions.—*Louisiana Planter.*

:o:

EARLY CANE MANURE

As the season for planting sugar cane is now on us, and few planters seem to hold any very definite opinions as to the wisdom or unwisdom of using early cane manures, we propose giving a few cf the reasons why we think the practice one to be commended under our special conditions. The cane plant, like every other living organism, needs a full supply of proper food at every stage of growth, and particularly at the start, for then it is least able to bear the strain of starvation, or of improper feeding. The quantity required is, it is true, small, but however little is required, depend upon it the absence of any normal constituents from the supply obtainable will produce most injurious results, so will a disproportionate amount of any constituent. It seems to be widely believed that retarding the growth of the young cane by semi-starvation is beneficial, yet the same persons who advocate this treatment of the plant in the majority of cases admit, that if an animal, say a young calf, is stunted by want of food it never becomes as fine an animal as if it had been kept growing until it reached the adult stage. Why then, one asks, do you believe in checking the growth of the cane at an early stage? At once the planter answers, as a practical man, because experience teaches us that if we allow canes to be rushed forward by artificial manures at this stage. they suffer terribly during the dry season, which in the West Indies is most felt when the young canes are only a few months old. The planter is right so far as he goes, but unfortunately he does not go far enough. He takes for granted that there are but two alternatives before him (1) to starve the plant, let it rough it as best it can in a poor soil with very little food, or (2) to use stimulating artificial manures and rush it forward. We do not wonder at his thinking there is no escape from one or other of these alternatives because almost everywhere the use of superphosphates or dissolved phosphates (chiefly phosphate rock rendered quickly soluble by the action of sulphuric acid, "soaked in sulphuric acid," as Professor Jamieson calls it) is highly recommended by chemists, and all the early cane manures this planter has tried, having been of this kind, he prefers as a practical man to use nothing sooner than those manures. But it has been made abundantly clear to West Indians during the last two years that there is a way out of the difficulty which avoids both evils; the use of moral true plant food prepared without the use of acid, and containing all the varied constituents needed by the plant in the proper proportions. Further, not only has this plant food been prepared by most eminent authority in plant-feeding, but it has been tested in the West Indies in all classes of soils, with exceptionally gratifying results to experienced planters. The cane plant, therefore, can be fed naturally without being stimulated and rushed forward. and such a plant possessing neither the weakness due to deranged functions or incipient disease is better able to withstand the trying effects of the dry season. The first reason, therefore, why early cane manures should be used by sugar planters, who make sugar their sole industry and hence depend on purchased food for their crops, is because unless the plant is well fed and grown normally from the start, it cannot successfully pass through the dry season. Secondly, of two plants, one fed and the other half-starved in early life, both of which are supplied with abundance of food, as soon as the wet season sets in, say in June, that one which has all along been well fed will be far more capable of utilizing its food supply during the wet season than the one which has very little vigor, and feeble powers of digestion and assimilation. Thirdly, we all know now that the best, indeed the only protection against disease is health (although this truism when first stated was denied in Barbados), and health which is that state wherein all the functions of the organism are performed in all their normal and due proportions, depends on a normal diet, the due amount of food in kind, quantity, quality and proportion. The plant, therefore, which has been fed normally from the beginning stands a far superior chance of resisting disease than one that has been first starved and then fed bountifully, or fed with an unnatural abnormal diet, and thus has had its functions deranged; for deranged function is the precusor of all diseases, and it will take years of normal feeding to enable the Bourbon to regain perfect health, just as it took years of improper feeding to break its health down. Further, unless the normal diet for the sugar-cane is discovered any substitute for the Bourbon will also succumb to disease, and thus the laudable efforts to produce a substitute richer in sucrose will be rendered futile. Fourthly, the productive powers of every organism, plant, or animal, depend on its health—even a machine must be in perfect condition, with all its parts in perfect order, if it is to turn out the maximum of work—so the cane plant must be in perfect health if it is to yield us the maximum results. We utilize its transforming powers, and any cause which interferes adversely with its life processes interferes with the amount of sugar we will obtain. Hence our first consideration should be health of the plant, and this necessitates regarding as what it is—a living organism, not what we are often urged to regard as a being, viz., a machine.

The feeding of plants is one of the most difficult problems with which the human mind has to deal, far more difficult than the feeding of animals or of man; how to feed plants for health first and produce second, how to feed plants, lower animals and men, as living organisms, all of them with rights we are bound to respect on the principle that to obtain the best results we must maintain the productive forces in the highest state of efficiency being assuredly dependent on the perfect health of the organism, is an idea that is entirely new to the vast majority of the race. To sum up for the present on this interesting subject we advise the use of early cane manure of the proper kind, because

1. The well-fed plant is better able to stand the dry season.

2. The well-fed plant can better utilize the large food supply at hand during the wet season.

3. The normally fed plant preserves better health, and hence better resists disease.

4. Productive power depending on health, the produce will be greater, the amount of food transformed into sugar, and we may add,

5. Because the farm manure applied early once dried out is of no more use than so much wood, until a good soaking rain falls, and this cannot be expected until the rainy season sets in. Meanwhile, as at present applied, it is an ideal breeding ground for fungus, and is largely made up of litter from sporeladen fields.

6. Because the expense is less if one applies half the quantity he proposes using for the year as early cane, and half as special, than he applies all as special in June, the former being several dollars cheaper per ton, hence it is not to the pecuniary interest of the manufacturer, but of the planter to do this, viz., cut the June supply in half and apply half early cane and half June special. We consider the proper kind to be a non-acidulated non-stimulating plant food whose basis should be pure bone (non-putrified) because this had given the best results so far.—*Planters' Gazette, Barbadoes.*

———:o:———

THE SUGAR INDUSTRY IN HAWAII.

[It will be remembered that in December last, a ministerial delegation, including the premier and two others of the Queensland government, visited these islands, and after a trip to Hawaii, returned in February to Queensland. On their arrival there, they were interviewed by the editor of the Brisbane Courier, who published the following statement of their views, which in the main are quite correct, barring a few inaccuracies, referred to in foot notes.—Editor Planters' Monthly.]

The high average yield of sugar reported by the Ministers to be obtained on Hawaiian plantations is attracting attention, the produce per acre there being twice as great as here. The 10-ton yields, Mr. Nelson states, are a fact, but they are not found on the plantations, but on small spots subjected by individuals to intense cultivation.* In these spots the growth of cane is little short of marvellous in its luxuriance. And in comparing Queensland yields with those of the islands allowance must be made for the Hawaiian practice

* All the heavy yields reported in Hawaii, are part of the plantation crops, and not patches planted by individuals. These fields vary in size from ten to fifty acres.—Editor Planters' Monthly.

of counting the "short hundreds," which exaggerates the quantity by about 10 per cent. Then while our planters do not allow cane more than eighteen months to mature, it is the practice at Hawaii to allow a portion of the crop as much as thirty months' growth before cutting.* Still, after making due allowances on these grounds, it is certain that the Hawaiian average yield per acre is far above ours, but our Ministers do not seem convinced that the enlarged productiveness of the island soil is due to its peculiar richness, or to climatic advantages. The rainfall is no doubt on the whole heavier there than here, but the records show at least equal capriciousness. For the year ending the 1st October last the range had been from 13.30 at a station on one of the smaller islands to 200.86 at the wettest season on Hawaii. At six out of twenty-three stations in the group the register for the year exceeded 119 in.; at eight others it exceeded 50 in.; and at the remaining nine less than 46 in. Generally speaking the rainfall, owing probably to the deposition caused by its lofty mountains, is much heavier at Hawaii than the other islands of the group. Indeed, the records show that there is a much less range of rainfall in Queensland coastal districts than at Hawaii, where the excessive wet in certain seasons is injurious to the cane and washes the nutriment out of the soil. The resort to irrigation at the islands shows the distribution of rainfall is of greater importance than quantity. It is imperative that cane, like other vegetable products, shall get water at certain periods of its growth. In tropical countries, in which alone cane is grown to perfection, water at such periods can only be insured by artificial means. The experience at Hawaii, as elsewhere, proves that the cost of irrigation is far more than reimbursed by the heavier crop it insures; and that by giving the earth liquid nourishment at the proper times the abundance of its produce may be greatly stimulated. A similar effect results from the judicious use of fertilizers. But fertilizers in excess or otherwise improperly used are as injurious to the plant as excessive moisture.

All this has of course been known for many years past, and will be read like a repetition of truism. But the three

* Plant cane mature in eighteen months from the planting. Rattoon crops mature in from twelve to fifteen months from the cutting.—EDITOR PLANTERS' MONTHLY.

Queensland Ministers have nevertheless been greatly impressed by the confirmatory evidence which lately met their eyes at Hawaii. And it is remarkable that the island planters who have for many years past been using fertilizers have lately discovered that they have not always been using them with intelligence. A fertilizer applied in certain proportions to the land of one planter has sometimes given poor results, while a precisely similar application by his neighbor on different soil has been most successful. There is less occasion for skill and judgment in the practice of irrigation ; but it is now an accepted fact that fertilizers cannot be economically used without the systematic analysis of the soil treated. The process is comparatively expensive, and if nitrogen be applied where it is abundant in the soil, or which is wanting in phosphates or lime, more harm than good will be done. The same rule applies to all fertilizers. The "food" supplied must be precisely the food wanted, or the hunger of the plant will not be allayed. For many years the Hawaiian planters used their fertilizers by the rule of thumb, but eventually they discovered the importance of the rule of three. That is, they found chemistry imperative to the treatment of soils. They therefore resolved upon the establishment in their midst of a chemical laboratory, in charge of experienced men, and that resolve has been carried into effect during the past year, a chemist named Dr. Maxwell, with assistants, having been brought from America for the purpose. And to the laboratory will be added an experimental station as soon as the necessary arrangements can be perfected.

The December number of a well-printed magazine, "The Planters' Monthly," contains an interesting account of the annual meeting of the Hawaiian Planters' Association. At that meeting were presented a report from the secretary reviewing the proceedings of the year, and a number of reports from sectional committees—namely, from the Labor Committee detailing the measures taken to procure suitable laborers for the planters' requirements, and discussing the labor question generally; from the Committee on Cultivation giving information as to the work of the year, and hints for the guidance of planters; from the Committee on Machinery, showing the improvements made during the year, and offering advice; from the Committee on Manufacture, narrating the experience gained at the various mills, and making suggestions for getting better results; and from the Committee on Forestry, calling attention to the deplorable effect upon the rainfall of the destruction of forests, and recommending the systematic planting of useful trees. These committee reports were followed by three papers from the director of the laboratory, on soils, on fertilization, and on fermentation of sugars. The magazine forms a most valuable contribution to the literature of sugar production. It is impossible with the space at command to more than touch upon a few of the topics of discussion, but they prove that the Hawaiian planters are thoroughly alive to the necessity of adopting every possible device to improve the yield of cane, to extract every fraction of sugar, and to avail themselves of the most economical methods of production and manufacture.

It may be a surprise to the Queensland reader to learn that notwithstanding the small import duty of 10 per cent., the whole of the sugar manufacturing machinery used at Hawaii is made on the spot. "There is considerable rivalry among the millmen, " says the editor of the magazine, "to put their works in the condition for extracting the largest percentage of sugar;" and one of the planters' reports closes with these words:—"The indications are that the Hawaiian planters are making a long reach after some of the 20 per cent. of sugar now lost to most of them through weak and imperfect machinery. And if only 5 per cent. of that heretofore lost is saved, it will go a long way, year by year, towards equipping our sugar houses to gain a stray cent here and there."

As to labor, the committee estimate the total increase during the year at 3918 adult males, and the total number in the group in November last at 43,608. Of these 22,864, or more than one-half, were Japanese, 15,702 Chinese, and 5042 Portuguese. But only 20,484 laborers were engaged on the plantations, and of these 1193 were women and 1606 Hawaiians. The planters complain of a scarcity of labor for the "coming campaign," and we note that the Portuguese laborers lately introduced cost about £20 per head. The wages paid are said to be considerably higher than in Queensland. As to quality there appear to be good and bad of each race, but some of the Japs are inclined to desertion, and some of the Portuguese are not well spoken of. The majority of the planters prefer their men to be of mixed race. The unemployed, that is those who dislike work, are addicted to gambling, and, like the unemployed Kanakas here, become a source of trouble.

Of the total quantity of sugar produced at Hawaii last year—about 200,000* tons—149,627 tons were exported to San Francisco. The reciprocity treaty with the United States gives Hawaiian sugar imported to that country an advantage of 40 per cent. through the remission of duty. In the year 1894, the New York sugar market was so depressed that the Hawaiian planters had to accept a considerably less price than was obtained in Australia by our planters, but last year, owing to the disturbances in Cuba, the American price gave the island growers a great advantage, which they are likely to retain for the current year at least. The large profits made are fostering production by the planting of increased areas of cane, as well as by enlarging the acreage yield. Fortunately there is a boundless market for sugar in America, or we might apprehend early competition from Hawaii in the Australian markets. The progressiveness displayed by our island neighbors, however, should stimulate Queensland growers and manufacturers to fresh efforts in the same direction.—*Brisbane Courier.*

———:o:———

THE NATIVE HOME OF COFFEE.

When we are enjoying a fragrant cup of coffee. It is pleasant to reflect that there is one country, though one only, where the coffee plant grows and flourishes without cultivation. This country—according to an Italian traveller—is Kaffa, in Abyssinia, from which town, it is surmised, the plant took its name. At the present day, he says, there is not a house in Kaffa which does not possess a piece of ground planted with coffee, and he himself, during his two years' stay in the place, had about three thousand plants in the

* Hawaii's sugar crop for the year 1895, as shown by official figures published in the March number of this Monthly amounted to 153,419½ short tons. The exports for the same year, as shown by the customs returns were 144,969 short tons.—EDITOR PLANTERS' MONTHLY.

ground, but that which grows spontaneously in the wood, producing without artificial means, was always esteemed the best. And, in fact, rich people, in order to have good and fresh coffee every morning, keep a piece of ground apart in their farms planted thickly with the forest trees, beneath which the plant thrives and bears better and more aromatic fruit than when in the open. Here the berries are gathered daily for the family consumption. Another advantage mentioned with regard to forest-grown coffee is that it is never subject to any malady, whereas the other suffers from a variety of diseases. Again, the wild plant germinates in a fortnight, while the domestic one does so after several months only.

It is usually believed that there are various species of the coffee plant. Our informant is of the opinion that there exists but one plant, which, nevertheless, according to the different methods of cultivation, undergoes a certain change. As, for example, in the wild and domestic plant; and, again, in that which is favored by climate and soil, and that which is not. Much also depends upon the cultivator. The same species growing wild produces small berries, which become double the size when cultivated. It is also impossible, we are reminded, that one harvest can produce nothing but fine full berries; consequently the bad and the good are mixed together for sale, or sold separately at different prices by the coffee merchants. The small unripe grains have neither taste, nor smell, nor form. An apparent variety in coffee is likewise produced, according to the time employed in and the manner of gathering the grains at harvest time. Coffee requires several months to come to maturity; in Kaffa ripe berries begin to appear in September, and are fit for gathering in November. Any small or unripe berries remaining are equally gathered and given to the servants or sent away for sale. The Arabians are reported to be the best coffee cultivators, because they know how to gather the grains at the most favorable moment, and take great care in sifting and cleansing them to send them in good condition to the market. Consequently, our traveller maintains that the good reputation that Moka coffee has maintained is due solely to the care referred to, inasmuch as the products of this country do not differ in the least from that which is sown and cultivated in other parts.

What a pity it seems, then, that in a country where coffee comes to perfection in a wild state there should be neither roads nor means of transport for converting it into an article of commerce. These necessary aids to business are, however, wanting in Kaffa, it is said. Neither do they exist even for the interior of the African towns, or for the regions of the Oriental coast. Consequently the production is a source of little or no profit to the country, whereas it might be one of great gain to the inhabitants. The only purpose for which it is utilized is for domestic use, as everyone is accustomed to this beverage. If by chance the provision should not suffice for one family, it is easily made up by a neighbor, in return for a measure of corn. The great ivory, musk, and slave merchants purchase a certain quantity, but only sufficient for their journey, or for presents to their hosts *en route*, or to obtain a free passage over one of the frontiers, never for selling. Less important vendors, who pass through the country selling wax, coriander, and other small wares, buy it for selling again, but in such limited quantities that no one in Kaffa cultivates and gathers in the berries in the hope of gaining anything by such transactions. And if, in time of war, even these small itinerant merchants fail to pass, the cultivators, not knowing what to do with so much coffee in the house, do not trouble to gather the grains when ripe.

Another authority on this subject, M. Massaja, confirms the above statements, and, basing his opinion on the traditions of the Kaffas and the Arabs of Moka and Jemen, says that this plant, which the greater part of botanists assert to be a native of Arabia, comes instead from Kaffa, whence it takes its name. "And this," he continues, "appears to be probable, as Kaffa and the adjacent territory are, as far as I know, the only places where the coffee grows so spontaneously, and with such force of vegetation in the woods. And the plants which vegetate under the shade of the great forests are, according to the natives, of excellent quality, and not subject to any of the diseases which generally attack those which grow in the open country." How far the assertion of the Kaffas is true, says this writer, I cannot venture to say; it is a fact, however, that rich proprietors, in cultivating this shrub near their dwellings, always select the most shady spot; and if trees are scarce, they have them planted in a manner so as to form small forests.

There is not a house in Kaffa which is not surrounded by coffee woods or plantations, the products of which always surpass the quantity necessary for the family's consumption. When the coffee is fresh, the natives eat it fried with salt and butter, or make an infusion of it, as we do. The plant is propagated in two ways in Kaffa—by transplanting and sowing. In the former case, they generally wait for the rainy season. Then proceeding to the forest, such plants as have taken growth in others half fallen to the ground, vegetating to the detriment of the larger shrub by robbing it of its nourishment, are taken up. Care is however taken not to loosen the earth adhering to the young roots, which are replanted in a free spot, in holes about twelve inches deep, so that not more than nine inches of the plant remain above ground, and in a slightly slanting position. The sowing of of coffee takes place, as soon as the ripe fruit is harvested, in ground freshly ploughed and well manured. After one or two years, the young plants are transported to a spot where they will remain till the time of production is finished. A little while after the transplanting or sowing, the Arabs take care to exterminate all weeds and useless growths. The Kaffas, however, do not trouble themselves about any weeds, except for the plants near their habitations, the result being that the weeds and parasites, increasing with all the force belonging to intertropical vegetation, often finish by suffocating the whole plantation. In Kaffa, as we are told, the coffee shrub reaches a height of from three to five yards. It begins to bear fruit, as in Arabia, about a year or two after transplanting, and three or four weeks after sowing. In the fifth or sixth year it attains to the maximum of production, and becomes sterile in the sixteenth or seventeenth year. In the Antilles or in Venezuela the plant bears fruit till the thirtieth or fortieth year. It is probable, however, says our informant, that if the plants are pruned at the base they would bear fruit in Kaffa for another five or six years. Contrary to the former authority, already quoted, Mons. Massaja says that the berries of the wild plant are somewhat larger than those of the cultivated ones; sometimes the pod contains but one grain, which being free to develop itself at pleasure, takes a form almost round, and is called Moka by the coast merchants from the resemblance it bears to the coffee of Jemen. In Kaffa and the adjacent country the coffee selected for the consumption of the great dignitaries and the Court is preserved for two or three years in a dry place, because the older it is the more coffee develops its aroma and strength. That which is destined for commerce is sold before it is quite dry.—*London Standard.*

———:o:———

CULTIVATION OF CANAIGRE.

A few sections of Florida have engaged in the cultivation of canaigre this season. The planting, of course, is experimental this season, but the acreage is considerable especially in Orange county. Our people will be at a disadvantage this year in the matter of cultivation, but if their efforts prove satisfactory, and the product can be marketed at a fair profit, canaigre culture will be quite an industry here in the future. The following article on the cultivation of the plant we reproduce from the columns of the American Agriculturist:

In the rainless regions of the Southwest, the Aztecs, Zunis, Pueblos, and later the Mexicans, have for centuries been tanning hides with the roots of a sour dock or wild rhubarb, Rumex hymenosepalus, called by the early missionaries sour cane, "Cana agria," which was finally pronounced cah-na-gre and spelled canaigre. With the advent of the Anglo Saxon and the railway, the plant was utilized in the local tanneries, and recently stock companies were organized to gather, slice, and sundry large quantities of the roots of the wild plant, and many carloads have been prepared and shipped to American and European tanneries. A canaigre tanning extract is also made, which is very similar to the gambier tanning extract, derived from the leaves and young twigs of an East Indian tree. The United States imports gambier to the extent of $1,500,000 annually, and also sends abroad for hemlock bark and other tanning materials to the value of $1,000,000 more. The world's yearly crop of gambier is valued at $10,000,000, and nearly all of it is shipped from India to Great Britain, and is thence exported to the other European nations, and to America, being wholesaled at from 4 to 5 cents per pound. Canaigre finds its strongest competitor in gambier, as the tanning properties of the two substances are very similar.

Leather acquires from canaigre a clearer, brighter orange color than from any other tanning material. The use of even a small quantity gives a brighter yellow tint to the leather, and it is the very best material for retanning poorly-tanned hides. The great value of canaigre lies in the fact that it tans quickly, colors deeply, and seems to give strength to the soft, durable, impervious leather which is very tough and pliable. It is especially adapted to the tanning of fancy leather, uppers, saddlery, and the finer kinds of sole leather, as the product is of a pleasing color, and neither shrinks nor swells. As it is the first to act on the hide, a small amount of canaigre, used with pine or other barks, causes the latter to tan the leather more rapidly and uniformly. Hence there is already an increasing demand for this new American tanning material. Canaigre is a dock-like plant or narrow-leaved rhubarb, growing during the moist weather of the Southwestern fall and winter, and throwing up a seed stalk three feet high, bearing pink flowers, which change to purple. The valuable part is the tuberous roots which resemble a cluster of sweet potatoes. These tubers are the permanent part of the plant, making their growth before the hot, dry summer, which kills all the plant above ground. The roots continue to grow and increase in tannin for many years. The tannic acid in the green root increases from 4 per cent. in the young root to 10 per cent. in the old. The tannin in the air-dried root varies from 15 per cent. in the young root to 35 per cent. in the old. The leaves and stems contain 1 per cent. of tannin when green and 4 per cent. when dry. One-year-old tubers, when air-dried, are about one-fourth tannin.

A moist, sandy soil is preferred by the canaigre, but it also grows on the mesas and other high land. So many of the wild roots have already been gathered that the supply of canaigre within a profitable distance of the railways is already limited. The plant, however, bears cultivation well, and the experiment stations at Tucson, Arizona, and at Las Cruces, New Mexico, have tested various methods of its culture and irrigation. The soil is prepared as it would be for potatoes or other root crops, being mellowed as deeply as possible. As the crop does not grow during the summer, it is best planted in the fall, though a complete season's growth is not gained thereby, as the spring-planted canaigre will make some growth before becoming dormant for the summer. The plant produces as little mature seed as the common potato does, and the delicate seedlings are much more tender than rhubarb seedlings. Hence canaigre is propagated from tubers, as the common potato is, with this advantage, that the seed tuber for the canaigre crop does not decay or die, but increases its content of the valuable tannin, so that the ton of whole tubers needed to plant an acre is of itself a safe and profitable investment. Though the roots may be cut up very small for seed, there is thus little advantage in such treatment. Canaigre is so tenacious of life that the tubers in the ground will not die from neglect or drouth, but its yield increases in proportion to the amount of rainfall moisture, or irrigation, the weeding, and the cultivation it receives during the fall and spring. The treatment and cost per acre is about the same as for potatoes, though it should have an extra fall irrigation, which the potatoes do not, of course, receive.

The canaigre crop may be harvested at any time, though the largest yield is obtained when dormant in summer, and the greatest amount of tannin just after it begins to sprout in the fall. The cultivated roots are dug with any plow or machine that will harvest potatoes. As large heaps or carloads of the green roots will heat and spoil from the fermentation, the roots are spread out in a thin layer, to dry in the air and sunshine, or when thus spread are covered with earth, to keep them. The tubers withstand drouth and desert conditions so long that it is almost necessary to slice them in order to air-dry them thoroughly. The roots will keep best as they grow in the ground, and should remain there until the crop is to be marketed and the field replanted, As the bunch of cultivated tubers makes nearly all its growth the first year, the crop needs no attention during the succeeding years if left undug, while the precious tannic acid increases from 25 per cent. in the dried one-year-old roots, to 30 per cent. in the two-year-olds, and the third year may even reach 35 per cent.; and the valuable coloring matter increases even faster with age. The cultivation of canaigre is at present much hampered by the necessary cost of railway transportation to the distant tanneries, but it seems probable that by a diffusion process similar to that used with the sugar beet, an extract will soon be profitably obtained from either fresh or dried roots, to contain from two-thirds to three-fourths of pure tannic acid, thus saving at least one-third of the freight. Dried canaigre root commands $65 per ton in the Austrian tanneries, and its intrinsic merits for tanning are only beginning to be appreciated. The culture of canaigre for tanning is certainly worthy of cautious trial by the farmers throughout the southwestern United States, and it may prove a very useful crop for the warm, semi-arid regions of the Great Plains, including a large area in western Texas.

———:o:———

CANE VS. BEET SUGAR.

It is somewhat surprising to find in these enlightened days what a deal of ignorance exists in the public mind as to the relative merits of cane and beet sugars, and what is the essential difference between the two kinds. Some persons seem to think that both descriptions are equally good, and that one is neither better nor worse than the other; whereas, when their respective qualities and characteristics are fully known, they are found to be as widely distinct from each other as substitutes generally are from genuine articles they represent. Thanks to the operation of the bounties bestowed by foreign governments on refined sugar exported, the English market within the last quarter of a century has been so swamped and deluged with supplies of beet sugar from all parts of the continent, to the greater exclusion of grocery raw sugars derived from the cane, that the taste for sugar of pure saccharine sweetness has become corrupted, even if it has not been entirely lost; whenever it happens that people outside the ordinary run of consumers want cane sugars and nothing else, they experience a difficulty in obtaining them.

And more—when they see each class of sugar side by side, they can hardly distinguish one from the other by their own unguided judgment, and must ask some person to explain and point out to them which is which, before they can make sure of selecting the right sort.

We have frequently been called upon to express an opinion as to which is the superior kind of sugar for table use, cane or beet; and have as often replied on the same subject in our columns for "Notes and Queries," with hints as to how cane sugar may be distinguished from that which is manufactured from beet root or mangel-wurzel; always giving a decided preference to the first named production. Still there are many inquirers and purchasers who are but ill-informed on the matter, and have a very hazy idea as to what are real and what are imitation yellow crystalized sugars. This is clearly proved by the correspondence which is going on in the pages of a daily contemporary during the past week, where such remarks as the following have been published: "Tell the British public to buy the splendid sugars made from the sugar cane in our West Indian colonies as being so vastly superior to the wretched stuff manufactured from the beet root in Germany, which has been flooding this country for years, to the great detriment of our colonies. Cane sugar is the merest trifle dearer than that made out of beet root, but is decidedly cheaper in the end. It possesses far greater sweetening powers, and is infinitely more wholesome. If people when they purchase sugar, would only ask for cane sugar—such as the 'Demerara'—and see that they get it, they would very soon appreciate its fine qualities and economical value."

Again—"The flavor and sweetening properties are so infinitely superior as to be well-nigh incredible to those accustomed to beet sugar. The public buy the sticky moist sugar, not knowing that the moistness is left in to cheapen it, and reject the genuine dry cane sugar which has been properly treated in the centrifugal machine and has had all the molasses thrown out. There are varieties of good looking dry sugars made in this country from a mixture of cane and beet, but there is nothing so wholesome or so good as the genuine sugar."—*London Grocer.*

———:o:———

BROAD VERSUS NARROW TIRES.

[SOUTH AUSTRALIAN PAPER.]

"Here a 'Width of Tires Act' has been in force since the sixties, and consequently our roads are far and away superior to those of New South Wales and Victoria and cost far less to maintain.

"I was living for some years in the New England district of New South Wales, and there the average load taken in the narrow-tired (2½ in.) wagons is from four to five tons, drawn by 10 to 12 medium draught horses, or barley half a ton per horse. Here, by way of contrast, and on steeper grades too, the average is one ton per horse.

"Showing that the roads in the Mount lofty hill are much steeper than most are in New England, it is quite common to see two brakes on a wagon here, while I never saw more than one there.

"My brother frequently sends five tons of fire wood over these hills with six bullocks without at all distressing them. The main road from Glenn Innes railway station to Inverell in New England, some 44 miles long and metalled, is kept in a chronic state of deep ruts by the narrow-tired wagons. It is misery to drive over this road in a buggy even by daylight, and positively dangerous to attempt it at night. Many thousands of pounds are spent annually on this individual road in the vain attempt to keep it in decent repair.

"It seems incomprehensible why any Government should allow this state of roads to exist when they have such an easy remedy at hand as the 'Width of Tires Act.' The working of this Act costs nothing, and does not even require local government to administer it. The maintenance men on each road can be sworn in as special constables, with the power to compel any carrier to weigh his load, and where he is carrying an access the magistrate should have no option but to fine him. I can tell you the colonies which enjoy the real luxury of good roads kept in repair at a comparatively small expense, and they are South Australia, New Zealand and Tasmania, because they have a 'Width of Tires Act' in operation."

In the days of turnpikes in England not only were less tolls charged for broad wheels than narrow ones, but much smaller loads were allowed to be carried on the narrow-tired wheel.—*Barbadoes Planters' Journal.*

———:o:———

TO PRESERVE PINEAPPLES.

The piles of lucious-looking pineapples displayed on the fruit stalls at present may tempt many young house-keepers to try their skill with that most delicious of all conserves, a preserve of pineapples. The sugar loaf, is one of the sweetest and best pineapples for preserving. The season for this pineapple is at its height about the Fourth of July, when these delicious "pines" may often be purchased at $1 a dozen. The best sugar-loaf pineapples come from Havana. The choice Ripley and the Queen Anne pineapples come from Jamaica. They are both favorite varieties. They are exceedingly rich in flavor and sweet. These fancy pines are quite small and never very cheap, selling on an average at 30 cents apiece. Housewives consider them superior to any other variety for the table because of their rich flavor.

The most delicious way of preserving a pineapple is in its own juice, without using one drop of water to make the syrup. Peel carefully the requisite number of pineapples, weigh them after they are peeled, and allow three-quarters of a pound of sugar to every pound of pineapple. Put the pineapples in a huge yellow earthen bowl or in a stone crock and scatter the sugar thickly over them till it is all used. Cover them and let them stand in the sugar for twenty-four hours; a clear juice will nearly cover them then. Now take each pineapple and tear the pulp off the core, using a silver fork. Drain off all the juice and sugar in the dish in which the pineapples were put to soak in sugar; put all this juice into a preserving kettle, Let it come to the boiling point and boil for five minutes, then skim it and strain it through a gravy strainer over the pineapple pulp. Let the pulp boil up in the syrup once, then can it immediately, as longer boiling darkens the preserves. If you wish, the syrup can be clarified.

The most delicious way of serving a pineapple on the table is to peel it, cover it thickly with sugar, and set it away in a cool place in as pretty a glass fruit dish as you possess for at least two hours. When you are ready to serve it tear the fruit from the core with a silver fork. Housekeepers need to be reminded that preserved pineapple is especially delicious served with whipped cream. A pineapple Bavarian cream is one of the best desserts we have, and there is no better water-ice or sherbet, as our New England cousins prefer to call it, than one of pineapple. There is, however, very little satisfaction to be obtained from coarse-grained, flavorless fruit of any kind, and no fruit depends more on culture and stock for its quality than a pineapple.

———:o:———

THE COFFEE TRADE.—Everyone knows that high prices have stimulated production and that new plantations are every year coming into bearing in Mexico, Central America, United States of Colombia, Africa and other points. If production outside of Brazil should show a like increase as in that country we would have a much greater supply. It certainly looks as if the trade would soon be face to face with the largest crop ever harvested, promising, as Crossman & Bro. say, a surplus of 2,500,000 bags in excess of requirements. And this points unmistakably to lower prices.

We compile from the *Coffee Exchange* statistics the following table showing the position of coffee during the last crop year: If in 1896-97 the world needs 11.250,000 bags of coffee, and all countries outside of Brazil may be counted upon for 45 per cent. of the total production, or 5,062,500 bags, it follows that we need from Brazil 6,187,500 bags. If the crop turns out as estimated—8,500,000 bags for export—there is an excess over the world's requirements of 2,312,500 bags, exclusive of the carry-over, which will probably bring the total to over 3,000,000 bags beyond any year's consumption on record. When supply exceeds demand, prices always go down. The outlook is for an era of cheap coffee, and thus this article will come into harmony with wheat, corn, cotton, iron, tea and other great staples, contributing further toward making the present a consumer's millennium.—*Am. Grocer.*