THE

PLANTERS' MONTHLY.

PUBLISHED FOR THE

Planters' Labor and Supply Company,

OF THE HAWAIIAN ISLANDS.

VOL. VI.] HONOLULU, OCTOBER, 1887. [NO. 10

PLANTERS' LABOR AND SUPPLY COMPANY,

INCORPORATED MARCH, 1882.

OFFICE—HONOLULU, HAWAIIAN ISLANDS.

ANNUAL MEETING IN OCTOBER OF EACH YEAR.

EDITORIAL AND GENERAL.

Planting is being pushed forward with great vigor at Kapaa and Kealia.

———o———

The Hon. C. R. Bishop left Sept. 27th, by the *Australia* for the coast. He will be absent some eight or nine weeks.

———o———

The Hilo Sugar Company are all alive to their best interests and keep pace with the times. An eight-foot vacuum pan has just been put in.

———o———

It is said that the Hon. J. Maguire, of Kohala, Hawaii, is proposing to plant with trees, ten acres of the mountain land recently stripped.

———o———

Fair rains are reported from all the islands. In spite of the drought of a month or so back, the crops are coming well forward, and the outlook for the future is good.

———o———

The Carp in Mr. Henry Macfarlane's ponds are getting into fine condition. A specimen 12 inches long was exhibited in Hewitt's window, Merchant street, a fortnight or so ago.

———o———

Grinding will commence at the Lahaina plantation in November, and will then continue for about six months. The cane is looking well and there seems every promise of a good yield.

———o———

A rise in the sugar market makes the planter's heart rejoice. Unfortunately the rise comes just after the crop is in. Let us hope the upward tendency will continue throughout the year.

———o———

The resumption of Professor Van Slyke's articles on the chemistry of plants, has proved very welcome to many of our readers, another instalment appears in this issue of the Planter.

———o———

Mr. Foster, manager of the Pahala plantation, has returned from his trip to the coast, he is looking well and was soon *en route* for his regular stamping ground, he went up by the W. G. Hall, Sept. 27th.

———o———

It is reported that Coca leaves (*Erythroxylon Coca*) are becoming a recognized article of export from Peru, a demand having "sprung up for them for the manufacture of Cocoaine, now so much used in surgical operations for killing pain." The quantity exported from Mollindo during the year amounted to 705 quintals, valued at $17,625. Here is another thing that our planters might try. Keep a bright lookout for second strings to your bows.

—o—

Welcome to our friends from the other islands; it is good to see so many sturdy planters elbowing their way among the sallow city folk. The planter brings a pleasant memory of waving cane fields and busy mills along with him.

—o—

The local beef market must have been looking up lately. With the number of men-of-war in port, the consumption of beef must have increased at least five bullock a day, that would make one hundred and fifty in a month, not so bad if the demand would only last.

—o—

The Hon. S. G. Wilder has returned from his trip to Europe. He has visited, among other places, the celebrated Krupp Works in Germany, and has seen what few people are allowed to see. Mr. Wilder expects to go ahead with the Hilo railroad at an early date.

—o—

Chinese laborers are moving about. A large lot recently left Kohala, when wages had fallen, and went on to Maui, where they will pick up what they can till the Kohala planters are hard up for labor again, when the eagles will once more assemble to pick their toothsome bones.

—o—

Carp have been introduced into the ponds and patches of water in North Kohala. The fish are in fine condition but they are found to be destructive to banks, burrowing into them just as a hog roots, though, of course, on a smaller scale. Mr. Cornelius Bond has had to board in a number of his ponds.

—o—

Mr. Dillingham is still in London, looking after his colonization scheme. There seems every prospect of the affair becoming a success. If ever a man was supplied with an ample stock of facts and figures, friend Dillingham certainly was, and he has the ability to talk his information for days in succession.

—o—

A method of clarifying water has been devised by Professor Dobroslavine, of St. Petersburg. He uses first a solution of perchloride of iron, and follows that with a solution of carbonate of soda. The quantities are said to be three grains of the perchloride of iron, and four grains of the soda crystals per gallon of water.

—o—

A new vacuum pan has been put into the Kealia Mill. The new pan has a capacity of sixteen tons of dried sugar. The mill building has been raised sixty feet and the smoke-stack is now 115 feet from the level of the ground. Preparations are being made to receive the new diffusion plant which is expected to arrive early in November.

———o———

The articles upon the Samoan Islands, from the pen of Mr. Henry Poor, which were commenced last month are of great interest, especially at the present moment, when so much attention is being called to those islands. Mr. Poor acted as Secretary to the Hawaiian political mission to Samoa, and was resident long enough to make careful observations.

———o———

The black wattle, though a most excellent tree for our hillsides, and yielding a very valuable bark for tanning purposes, is short lived in some districts. The silver wattle has not the same objection. Observers on these islands should give their experience in such matters. The life of the black wattle is stated to be about ten years.

———o———

Some of the Eucalyptus trees on Dr. Bond's plantation, North Kohala, are doing remarkably well. Trees only four years old were upwards of thirty-five and forty feet high. Dr. Bond finds an advantage when planting out his trees on the hillsides, to clear the ground properly at first, it saves expense in the long run and the trees grow more quickly.

———o———

Mr. Lames, of the Paris *Revue Sud Americaine*, has published a most instructive book on the financial and economic status of Central and Southern America, from which many valuable statistics are taken. It appears that the Argentine Republic and Chile are exceptional from other South American countries in the character of their population, as shown by the following table:

POPULATION OF SOUTH AMERICAN STATES.

Countries.	*Caucassian.*	*Indian.*	*Hf-breeds.*
Brazil	3,500,000	3,500,000	4,500,000
Mexico	1,200,000	4,086,000	4,400,000
Argentine Republic	3,200,000	100,000	200,000
Chile	2,000,000	50,000	300,000
Venzuela	300,000	800,000	1,000,000

———o———

Artesian wells have been utilized with great success for fertilizing the African desert. Sir R. Lambert Playfair, in the course of a consular tour in Tunis, has visited the ground where the first well was sunk, and reports most favorably as to the success of the project. A space of 375 acres has been cleared, and sown with cereals and lucerne, a vegetable garden been made, and a nursery of young trees planted. Two other wells are being sunk, which on completion will irrigate 7,500 acres of land. The Bey of Tunis has conceded to the Artesian Wells Company 25,000 acres of land, which they can select themselves from districts which are at present of no value.

-o-

THE DESTRUCTION OF THE FORESTS.

From every part of the islands comes the same complaint relative to the destruction of the forests. Something is being done in a few isolated spots to remedy the evil; but more comprehensive work will have to be done in the future if our forests are to be saved. In Kohala, we are informed, that with the destruction of the forest land there has been a marked diminution in the quantity of water in the streams. Many which, in former years, gave an ample supply, now have barely a sickly thread which meanders down among the boulders, varied of course by a violent freshet, when millions of gallons dash headlong to the sea, and are there lost, instead of being stored in the former natural reservoirs in the hills. The Chinese seem to be great sinners in this respect, though the charge, perhaps, ought to be laid at the door of the land-owners, who allow so much wood to be cut on their estates. In woodcutting, as at present conducted on these islands, there is no discrimination used. A portion of forest land is leased, and the trees—young and old—are indiscriminately swept off, young saplings and half-grown trees are hewed down without any regard to the future.

There is plenty of forest land, judiciously used, to give an ample supply of wood for the needs of the present population of the Hawaiian group; but just as unreasoning and childish greed destroyed the sandalwood industry of this country, so will a like unreasoning and childish carelessness allow our hill sides to be completely denuded till our supplies of wood will have to be sought from more provident, if less favored, spots than these isles of the sea.

The Legislature of 1876 attempted to grapple with the question by passing an Act for forest preservation, and, under that Act, something has been done in a few isolated instances. But, like many of our laws, it has become somewhat of a dead letter; indeed, our statute-book has become very much like that celebrated path to an oft-talked of torrid spot that is said to be paved with good intentions; the laws are good enough, but they have been mighty seldom carried out.

To give our readers an opportunity of seeing for themselves how the legislators of 1876 attempted to meet the difficulty we reprint the Act in its entirety, saving only such clauses as referred to the pay, etc., of the Superintendent of Woods and Forests:

AN ACT FOR THE PROTECTION AND PRESERVATION OF WOODS AND FORESTS.

WHEREAS, It it is an established fact that the destruction of forests in any country tends to diminish the supply of water, therefore,

BE IT ENACTED by the King and the Legislative Assembly of the Hawaiian Islands, in the Legislature of the Kingdom assembled:

Section 1.—That the Minister of the Interior is hereby authorized to set apart and cause to be protected from damage by trespass of animals or otherwise, such woods and forest lands, the property of Government, as may in his opinion be best suited for the protection of water sources, and the supply of timber and fruit trees, cabinet woods and valuable shrubbery.

Section 2.—For the purposes contemplated in this Act, the Minister of the Interior is hereby authorized to appoint some competent person as superintendent of woods and forests, who shall, under the direction of the said Minister, enforce such rules and regulations as may be established to protect and preserve such reserved woods and forest lands from trespass. Said superintendent shall have charge of the construction of all fences and barriers required to protect the said woods and forest lands, and shall be responsible for their being kept in good condition. He shall, under the direction of the said Minister, be empowered to cause the arrest of any trespassers on such lands, and all constabulary or police of the districts in which such woods and lands may be situated, are hereby required to assist the said superintendent in carrying out the directions of the said Minister in the premises. And it is hereby made an offense punishable by a fine not to exceed one hundred dollars, or imprisonment at hard labor not to exceed one year, upon conviction before any police or district justice, of any person who shall violate any of the rules or regulations established as aforesaid tabuing such woods and forest lands.

Section 3.—The Minister of the Interior is hereby authorized to secure from the Commissioners of Crown Lands, by lease or otherwise, such woods and lands being the property of the Crown, as may be suitable for carrying out purposes set forth in this Act.

Section 4.—Whenever it shall be necessary to extinguish any private right or title in any woods or lands required to fully carry out the intention of this Act, the fair valuation of the same shall be determined by referees agreed upon by and between the parties interested therein and the Minister of the

Interior, and the valuation so adjudged and determined shall be the extreme limit of the price to be paid by the Government for such woods or lands, and upon making tender of such price so determined by the referees, it shall be lawful for the said Minister to take possession of such woods and lands for the purposes aforesaid.

Approved this 19th day of September, A. D. 1876.

KALAKAUA R.

We sincerely hope that this matter may come up before the Legislature at its April session. We have now men in the House who know how vital question this is, and whose own private interests are as much at stake as those of the public. The question is one which has agitated the minds of thinkers in every part of the globe, and every civilized Government has spent large sums of money, and devoted both the time and the talents of its most brilliant subjects to combating the destruction of its forests. With an intelligent set of men in our House and in the Government seats, we may expect to see like energy displayed here.

SEPTEMBER TWELFTH AND NOVEMBER THIRD.

The success of the elections exceeded the most sanguine hopes of those interested in the prosperity of the Islands. The planters have shown that if the city men and professional politicians can work, the tiller of the soil can go one better and sweep all before him. The question was a vital one for the planter. He had been robbed and insulted in the past; everything had been done to injure his prosperity, and daily and hourly the burden of taxation was being rolled up to lay on *his* back and to wring his unfortunate withers. The resolution of June 30th overthrew the goading and oppressive government of venality and fraud, and gave the planter once more a chance of making his voice heard, and his influence felt in the councils of the nation. But the mere overthrow of the Government without something to put in its place was nothing. A solid structure had to be raised, and the only solid foundation for such a structure was to be found at the polls. At the polls was ratified once for all the action of June 30th. The planter could not afford to be beaten, for a return to the former methods of government meant nothing but ruin to himself. And just here came in the strength of the Reform party. The white man did not stand alone. The native saw, too, the evils of former misgovernment. He had been bamboozled by frothy orators; he had been dazzled by promises which, like the proverbial piecrust, were made to be broken, and the scales had at last fallen from his eyes. Without the planter, with his energy and capital to develop the lands, to give employment, to consume the produce of the small cultivator, the native saw that a period of very great depression would set in. He took in the situation, and despite the most strenuous efforts on the part of the old Government party, saw where his true interest lay, and voted solid for Reform.

Of the members of the new Legislature, no less than seventeen are connected directly with the sugar-growing interests or with cattle-raising, while a large number of others are indirectly with either or both these industries. The greatest credit is due to the voters who staunchly stood by their true friends. A conclusive answer has been given to all those who have attempted to show that a class or a color line exists here. Once the matter has been conclusively put before all sorts and conditions of voters, it has been demonstrated that they can quickly "catch on" and see what is the best for the country and for themselves.

Another element which contributed directly to the victory of September 12th was the Portuguese. A great deal of nonsense was talked upon the subject of these people by those who know little or nothing about them. The event has proved that they, too, have common sense, and knowing who their friends are, have voted accordingly.

All the success obtained, however, would not have made unless there had been some solid work done. The work in Honolulu was easily appreciated: it had its chroniclers in the daily press of the city—it was kept prominently before the public, even that portion of the public which did not attend the ward meetings; but in the country there were those who had the time to chronicle the work done, that it had been done and well done was proved by the result; but few realize how hard the work was—what conscientious labor was performed by men who had to work hard enough during the day, and to whom night is a time not for amusement and relaxation, but a period for needed physical rest. Who thinks of the miles that had to be ridden, and the bad road traversed by those who were working up the Reform movement in the country. Another feature of the late election must also be borne in mind. It was, as far as the Reform party was concerned, a pure election. The use of oceans of bad gin, and the sight of reeling and drunken voters had no place in it. Wherever conducted, it was dignified and orderly: it was felt to be a test election, and the good sense of the community at large made itself thoroughly felt.

This House, so elected, will meet before another issue of the Planters' Monthly appears. There are many momentous questions with which it will have to deal, and chief among these at the present moment will be the financial one. To the political press we leave the discussion of such matters, but it does come in our province to urge upon the planters, mill-owners and stock-raisers who hold seats in the House, to deal broadly in such matters, to guard their own interests, but to regard the interests of all; to allow no narrowness of view to creep into their statements or demands, but to put all upon the broad platform of the greatest good for the greatest number, and above all things to support and strengthen the present Ministry. If the election was a test election, the next meeting of the Legislature will be a test session. The intelligence, wealth and brains of the country are really represented, let us hope that the good gifts which the members possess will be used for the best interests of the nation at large. One motto must not be forgotten—UNION IS STRENGTH! by union the country was enabled to obtain reform; let no petty jealousies allow it to lose the benefits of Reform; it is shoulder to shoulder—Hawaiian, Anglo-Saxon, Teuton and Portuguese—not for class interest, but for the whole. UNION IS STRENGTH!

———o———

THE SUGAR INDUSTRY OF THE FUTURE.

All over the world men engaged in sugar enterprises are doing the hardest kind of thinking. The price of sugar has fallen, and the industry is, in many cases, unremunerative. To meet this difficulty there can only be one solution, and that is to produce the article at a cheaper rate. A writer in the Mauritius *Revue Agricole* says upon the subject:

"For the solution of this problem there are two conditions to be fulfilled; reduce the expenditure, which has already been done, and increase the produce, which remains to be accomplished.

"The augmentation of production raises two problems of different orders. On one part the increase in the agricultural produce, which is a question of agronomy. On the other hand, the increase in quantity obtained in the manufacture, which divides itself again into two distinct sections, the extraction of the juice contained in the cane, which is a question in mechanics and physics, and the extraction of sugar from the juice which comes under the domain of chemistry.

"As to what concerns the agricultural production, we have before us this fact: that whilst the mean produce on well cultivated land does not exceed 4,000 lbs. an acre, it has frequently been established that in particular instances the production has been as much as 12,000, and even 15,000 lbs. an acre; from which it is evident that the average production hardly reaches to one-third of what it might be. In the face of such disproportion, it seems reasonable to assume that the mean production might be considerably increased by more judicious methods of cultivation and a more suitable use of fertilizing agents. In localities sufficiently watered by the rainfall, it is not difficult to increase production by a more liberal application of manure, and by more minute care in the cultivation; but such a mode of operation of necessity involves increase of expenditure, which goes directly against the object in view. The question is thus evaded, and to prevent useless outlay on manure, which increases the cost of production without any corresponding advantage, we have still to find out a certain soil being given, the relative proportions of the different fertilizers to be employed, so as to produce the greatest quantity of sugar at the lowest possible cost.

"This is a problem, for the solution of which the primary data are almost entirely wanting. We know as a general rule that we have to supply the plants with azote, phosphoric acid, lime and potash, but we are still ignorant of the nature of the action of these different elements on vegetation, or what the effect is, which each of them exercises on the sugar contained in the cane. Nor are we any better informed as to the form in which each is most advantageously presented to the plant, nor are opinions fixed even as to the best method of application. Is it better to place them on the surface, leaving the rain to cause them to penetrate into the soil? Or, is it preferable to incorporate them with the soil by a systematic digging, or ought we rather to concentrate them at the foot of each plant?

"Again, what are we to think as regards renovating the soil by means of cultivation more or less unproductive, such as peas, the embrevatte, etc., which cultivation improves the soil in a certain measure, but which has the disadvantage of leaving capital idle for a longer or shorter period on which interest has to be paid? May it be possible by the employment of manure to do without the rotation of unproductive crops?

"Such are the principal questions raised by the problem for increased production, questions which can only be solved by numerous and minute experiments, carried on methodically on establishments especially devoted to such researches. If we turn from cultivation to manufacture, we find before us questions fully as important and equally complex.

"The first point is the separation of the cane-juice from the woody fibre of the plant. Hitherto this operation has been effected by the crushing power of cylinders turned by machinery.

"But, although we seem to have attained the maximum crushing power, which is mechanically possible, this separation is accomplished in a very imperfect way, the best mills still leaving in the 'bagasse' or cane refuse from 20 to 25 per cent. of the total juice contained in the cane, which represents 25 to 33 per 100 of the juice obtained. Amongst the numerous methods which have been proposed for the purpose of reducing this loss to the minimum that which seems to present the best chances of success is "la diffusion," or extraction of the saccharine matter by boiling the cane. But the application of this method to the sugar-cane presents difficulties which do not appear to have been as yet overcome.

Besides the modifications of the apparatus used in the case of beet-root, in order to adapt it to the manipulation of sugar-cane, which modifications in some respects are at the present time subjects of experimental investigation, there are other difficulties of a grave nature which must be kept in mind. First, the increased quantity of fluid to be evaporated, increasing the quantity more or less considerable of coal which is rendered necessary.

"Secondly, the difficulty of drying the husk of the cane when removed from the boilers (diffuseurs) or digesters, so as to render it fit for fuel, as is now done with the bagasse (cane trash, or 'ampas' as it is called in Java).

"The idea has been suggested of abandoning the use of the refuse of the cane as fuel, and the opinion has been put forward that by digging it into the fields as manure it would represent a value equivalent to the cost of replacing it as fuel by coal, but this is an opinion that has not yet been confirmed by experience.

"The loss of sugar consequent on the incomplete extraction of juice from the cane is not the only results of the imperfection in our processes of manufacture; we must also bear in mind the quantity of sugar retained in the molasses, and which may be estimated as a tenth of the quantity of sugar contained in the cane juice. This is caused by the presence in the juice of glucose, mucilage and different salts, all of which substances have the effect of opposing the crystallization of the sugar.

"And this loss of quantity is not the only result of the presence of such molasses forming matter, we must remember that the loss in quality in the second, third and fourth boilings caused by the discoloring produced by these same matters may be calculated at from 3 to 10 per cent. of the value of the whole crop.

"Let us now add the sugar which remains in the skimmings that which is dispersed in evaporation in the triple effects, and lastly the unavoidable waste which takes place in some proportion, and we shall arrive at the conclusion that the loss incurred in manipulation of the juice is equal to that arising from its imperfect extraction from the cane, and that each of these losses represents fully 20 per cent. of the sugar produced.

There is thus a total loss of 43 per cent. resulting from imperfect manufacture.

"Thus it will be seen that there is a wide field open to the researches of scientific men, and it is greatly to be desired that agreeably to the request addressed to Government by the Chamber of Agriculture, substantial rewards should be offered for the discovery of the means of reducing this loss to a minimum.

"To sum up the result of the imperfection of our process of manipulation, as well as of our system of cultivation is, that our soil produces hardly the half of what it ought to yield, and that there is room for the hope that important improvements might be effected in these matters, if a plan of serious studies could be organized, systematically conducted and pursued with that perseverance which can alone lead to success."

HEMP.

In the last issue of the MONTHLY we drew the attention of our readers to the question of fibre-plants for the production of hemp, and quoted information upon the Sisal or Yucatan hemp and that obtained from Mauritius. Continuing the subject we take up this month Manila Hemp. This fibre is obtained from a member of the banana or plantain family, known locally as the abaca, (*musa textilis.*) From a report made in Manila by Consul Henry we learn that this plant thrives best in soils largely composed of decayed vegetable matter. Hence, freshly cleared forest land is essential. Hilly land, about 200 feet to 500 feet elevation, is considered more suitable than low-lying land, probably on account of drainage. The Manila hemp plantations are situated where there is a rich volcanic soil, and where the climate is hot and humid with a heavy rainfall The plants suffer severely during drought. Although seed is produced plantations are usually established by means of suckers put out when about three feet high, and about eight to nine feet apart. These form a root-stock, from which numerous stems are successively produced. The land is cleaned of weeds about twice a year. The first crop is reaped at the end of the second year after planting; a full crop is not obtained until the fourth year. The yield is then continued for fifteen to twenty years, after which the plantation is exhausted. The stems are fit to be treated for fibre just before they begin to flower. In stems that have been allowed to flower the fibre is said to be weaker and of less value. They are cut about a foot from the ground and the leaves removed. Each stem is then stripped or resolved into its component layers, and these are again divided into strips or ribbons about three inches wide. Usually each layer or leaf-sheath is divided into three strips. The outer layers contain a coarser and stronger fibre than the inner, while fibre from near the middle is of a fine silky texture, and capable of being utilized without spinning or weaving and made into articles of dress and ornament.

The method of preparing the fibre is very simple but effective. Each strip, in a fresh succulent condition, is taken up by hand and drawn deftly "between a blunt knife and a hard smooth board," which are attached to a light portable frame. This process, repeated several times if necessary, removes all the watery particles and pulp, and there remains in the hand of the operator a beautifully white and lustrous fibre. The fibre is thoroughly dried in the sun and afterwards packed in bales for shipment. Hemp not properly dried, or exposed to rain becomes discolored and loses strength. On the other hand, hemp from the outer layer of the stem is of a reddish color, but is quite sound. It is a characteristic of Manila hemp that it readily absorbs moisture, and in an ordinary dry condition it contains 12 per cent of water. In a damp climate it has been known to contain not less than 40 per cent of water.

Cordage, ropes, and indeed everything made from Manila hemp can be easily converted into paper of excellent quality.

The cost of establishing a Manila hemp plantation in the Philippines, including cutting down forest, cleaning and planting, is about £5 to £8 per acre. This does not include the cost of the land. After this the yearly expense of weeding and maintaining the plantation in full bearing is at the rate of 30s. to 35s. per acre. The yield during the fourth and subsequent years is at the rate of 400 to 700 pounds of dry hemp per acre. "A laborer working under pressure can clean nearly 20 pounds of hemp per diem; but as a rule the quantity cleaned by one man, working steadily, day by day, averages about 12 pounds." Usually two men work together, one cutting down the stems and splitting them while the other cleans the fibre. Several attempts have been made to introduce machinery, but so far nothing has been so successful as the primitive method above described. It is essential that any machinery introduced should be of a light and portable character, and that it should clean the fibre at a cheap rate, without breaking it.

In connection with Manila hemp some reference may be made to fibres produced by other species of the genus *Musa*. The late Director of the Botanical Department, Jamaica, discusses the subject as follows: "It would appear that the fibre of the ordinary plantain and of the banana is valued at about £12 or £15 per ton. This it will be noticed is only one-third the value of the best qualities of Manila hemp. There are in both the East Indies and West Indies numerous wild species of *Musa* which might yield good fibre, but so far none appears to have been found equal to the plant-yielding Manila hemp. The following facts have been elicited by recent experiments. A banana stem just after fruiting, cut as is usual with the country people, about two feet above ground, and denuded of its foliage weighed 108 pounds; this being divided into three lengths of two and a-half feet each and split longitudinally into several pieces, was prepared by beating and washing by hand, and yielded 25 ounces of clean marketable fibre, which is at the rate of 1.44 per cent of the gross weight. The fibre of the lower portion of the stem, as also the fibre in the petioles of the leaves was not extracted.

"A smaller banana, cut under similar circumstances, that is, two feet from the ground, and denuded of its foliage, weighed 41 pounds. This was divided into two lengths of 2½ feet each, and after being split longitudinally into several pieces was prepared by hand, and yielded 6¾ ounces of good clean fibre, or at the rate of 1.02 per cent on the gross weight.

"At the Hope plantation similar experiments were conducted with banana stems which yielded very much the same results. Two banana stems cut after fruiting, at two feet from the ground, and denuded of their leaves, weighed 147 pounds. These yielded 33 ounces of clean fibre, or at the rate of 1.44 per cent on the gross weight.

"From ordinary stems of banana, cut after fruiting, at about 1½ to two feet above ground, a settler might easily prepare about 1½ pounds of clear fibre, but if the stems are large, and if the whole length is used as well as the petioles of the leaves the amount of the fibre might be increased to 2½ pounds if not three pounds per stem.

"With plantain stems the results are more satisfactory than with the banana, both as regards the yield and the quality of the fibre.

"At the Castleton gardens, a plantain stem weighing, when cut and dressed, 25 pounds, was prepared in exactly the same manner as the banana stems above described, and yielded 7¼ ounces of clean fibre, or at the rate of 1.81 per cent on the gross weight. At the Hope plantation, a plantain stem weighing exactly the same, viz., 25 pounds, yielded 9 ounces of clean fibre, or at the rate of 2.25 per cent on the gross weight. The plantain fibre is whiter and finer than the banana fibre, and it approaches more nearly to the fine glossy character of the fibre of the Manila plantain.

"For purposes of comparison I had the fibre of a small stem of the Manila plantain, which, cut at 6 inches above ground and trimmed, weighed 10 pounds, prepared in the same manner as the banana and plantain fibre, and the result was three ounces of a beautifully fine and glossy fibre. This is at the rate of 1.87 per cent on the gross weight.

"In Jamaica another plantain is known as the Abyssinian plantain, *Musa ensete*, which is the largest species of this genus. It was discovered by the traveler Bruce, in Abyssinia, and is remarkable as being represented on ancient Egyptian sculptures. Specimens of this plantain growing at the Government Cinchona plantations at 5,000 feet, have often leaves 20 feet long, the stem is about eight feet in circumference at the base, rises to a height of 25 feet and weighs probably a quarter of a ton.

"Specimens of fibre prepared from this plantain are of excellent quality. Taking a portion of the central stem about four feet long and weighing 73 pounds, clean fibre, weighing 13 ounces, was obtained by beating and washing by hand. This is at the rate of 1.16 per cent on the gross weight.

"This plant might be grown extensively for its fibre, and it should prove valuable, but of course, not equal to *M. textilis* which is unapproachable as a fibre plant."

If we desire to succeed here, we must always keep our eyes open. The information here collected is certainly worth considering and we hope that some of our planters who have excellent opportunities, upon their estates, will enter upon some experiments. Two strings to your bow was considered a necessity in the days of Crecy and Poictiers, the Hawaiian agriculturist needs at least half a dozen.

CORRESPONDENCE AND SELECTIONS.

THE CHEMISTRY OF PLANTS AND SOME OF ITS APPLICATIONS.

BY PROFESSOR VAN SLYKE, OF OAHU COLLEGE.

VI. *Some General Properties of Soils.*

In the first number of this series of articles, it was stated that there are fourteen elements which are essential to the perfect growth and most complete development of every plant; that, of these fourteen elements, four are derived mainly from the air, while the remaining ten come exclusively from the soil. We have already studied the air-derived elements, as they exist in the atmosphere, in their relations to vegetation, and it now remains to consider the relations of the soil and its elements to plant life.

Attention has been called to a striking difference in respect to the proportions in which air-derived and soil-derived elements are found in plants—the former constituting at least ninety-five per cent. of the whole vegetable kingdom. However, to the agriculturist, that part of vegetation which is derived from the soil is of the utmost interest and importance;

for, while the atmosphere is entirely beyond his control, he can, through the medium of the soil, influence the amount of vegetable production.

It is here that the study of the chemistry of plants finds chance for practical application. However much we may know about the relations of the air to plant life, it is of little practical value so long as we cannot control the atmosphere, and directly obtain from it what we need. While, however, the atmosphere and all extra-terrestrial influences which affect the growth of vegetation are, in themselves, beyond our control, and cannot be modified in kind or amount, still their subserviency can be influenced through the medium of the soil by a right understanding of the latter's properties.

The general offices which the soil fulfills are of three kinds. First, the ashes of plants are furnished exclusively by the soil, so that the soil is thus directly concerned with the nutrition of plants. Second, the soil acts as a mechanical support for plants. The roots of plants penetrate the soil downwards and sideways, and brace the plant firmly to its upright position. Third, the soil contributes to the development of plants by modifying and storing the heat of the sun, by regulating supplies of food, and, in various ways, by securing those conditions which must be present and unite to produce the fully developed plant.

Soils consist of disintegrated rocks, mixed in greater or less proportion with organic matter called humus, formed by the decay of animal and vegetable substances. The principal part of the soil was once solid rock, and the first step toward the formation of soil was the pulverization of the rock. The conversion of rocks into soil has been effected through various agencies, such as changes of temperature, moving water and ice, chemical action of air and water, and the influence of vegetable and animal life.

There are few places outside of these islands better calculated to show the successive changes that take place in the formation of soil from solid rock. The agencies which have wrought, and are still causing these changes, are much the same as those already mentioned, but those which are especially active here are the following: The chemical action of air and water, the mechanical action of moving water, and the influence of animal and vegetable life. It is not my purpose to dwell upon the ways in which these agencies accomplish their purpose, but it may be interesting, in passing, to notice the manner in which the original mineral soil has become more or less impregnated with organic matter.

The lava is first seen flowing as red hot molten rock, often in masses of such depth and extent as to require months for cooling down to the ordinary temperature of the air. Sooner or later, low microscopic forms of vegetation find lodging and grow on its surface. Gradually the surface of the rock is disintegrated by the action of air and water and there appear spots of lichens. These lowest forms of plants, the lichens and mosses, are able to derive nourishment from the hardest rocks. By their decay these plants add to the film of soil from which they sprung. New generations grow more vigorously, and higher forms of vegetation follow; after many years, enough soil has accumulated to support herbaceous plants and dwarf-shrubs, which are followed by trees; and in a century, more or less, the hard, barren lava rock has formed a soil fit for many agricultural purposes.

On the Hilo flow of 1881, I saw many ferns growing luxuriantly five years after the flow took place. Through Puna one finds every conceivable stage and variety of the process of converting lava into soil. For obvious reasons, the disintegration goes on more swiftly on the windward side of the islands, and is more rapid in *a-a* lavas than in *pahoehoe.*

Soil is a mixture of sand, whether derived from quartz or feldspar, clay, carbonate of lime, and humus or organic matter; and on the predominance of one or more of these constituents are based the ordinary classifications of soils.

Soils are usually classified as *gravelly*, *sandy*, *clayey*, *loamy*, *calcareous*, *peaty*, *ochreous*, &c.

Gravelly soils are so called from the presence of numerous stones or pebbles in them. The name implies nothing as to the composition or real value of the soil.

Sandy soils consist of ninety per cent., or more of sand or small granular fragments of rock of any kind. The term is very indefinite, as it may include soil of almost any composition and of extreme fertility or great barrenness.

The term *Clayey* is applied to those soils in which clay or very fine matter preponderates. In general, clayey soils are very fine in texture, and have a great power of retaining water. When dried, they shrink and crack. A soil may be clayey and not contain much clay—that is, it may have the adhesiveness and impermeability of clay without having those chemical compounds which constitute clay.

Loamy soils partake of the character of sandy and clayey, consisting of mixtures of sand and clay, or of coarse with very fine matter. They do not possess the excessive tenacity of clay or the great porosity of sand. There are various gradations of loamy soils known as sandy or light loams, clayey loams, &c.

Calcareous or *Lime* soils are characterized by having corbonate of lime as a prominent constituent. They can be recognized by treating them with an acid, when they effervesce vigorously. Such soils are not common, but many soils contain or much lime as to be called calcareous sands, clays, or loams, according to their character.

Marls are mixtures of clay or clayey matters, and finely divided carbonate of lime in approximately equal proportions. They are used as fertilizers where they are found.

Peaty or *Mucky* soils are those which contain vegetable remains that have undergone partial decay under water. Peat, or swamp muck, is mostly humus—a substance which results from the decay of vegetable matter, and is common in bogs and marshes.

The term *Vegetable Mold* is applied to a soil containing much organic matter that has decayed without being submerged in water. It usually comes from the decaying of leaves, trees, roots of grasses, etc.

Ochery or *Ferruginous* soils are such as contain considerable iron as an oxide or silicate; they have a yellow, red or brown color.

There are current other general distinctions of soils, among which we may notice *surface soil* and *subsoil*. The former is the soil proper, or that portion which comes immediately under cultivation, which is moistened by rains and warmed by the sun, in which the plant sends out its roots, gathers its soil-food, and which, by the decay of vegetable matter in it, acquires more or less humus. The subsoil is generally lighter in color than the surface soil, as it contains little or no humus; it is apt to be tougher and more compact, and more largely mixed with stony debris. However, in many cases, such distinctions are entirely absent, the earth changing in appearance gradually or remaining uniform to a considerable depth.

Without stopping to speak further about its general qualities, we shall proceed to study the soil from two stand-points: First, with regard to its *physical properties*, those which externally affect the growth of the plant; and, second, with regard to its *chemical properties*, those which provide the plant with food.

———o———

HILO SUGAR COMPANY'S REPORT.

To the Editor of the Planters' Monthly:

I have noticed in your issue of August a criticism of the Hilo Sugar Company's May Report, published in the June number of your monthly, and I am much pleased that Mr. Martin has taken the trouble to go into the details so fully. It was only this past crop that I started the present system of accounting of the juice and sugars, and each month developed fuller particulars which helped to make my report larger in detail, and more comprehensive. Since the publication of the May report I have made a number of additions to subsequent reports, which will render them more clearly understood, and I since see that the May report without certain explanations can be very easily misinterpreted. For Mr. Martin's benefit, I will make some explanations of that report which will set him right, and, in order to do so, think it best to give the report in fuller detail :

SUGAR REPORT, MAY 31, 1887—TWENTY-SIX DAYS' WORK.

918 clarifiers, 504,900 gallons juice .. ..Brix, 20.2, Pol. 17.5.
Maceration mill juice (included in above), 49,850 gallons.... " 21.6, " 16.3.

EXTRACTION.

First mill, 64.5 per cent., 7,357,362 lbs. cane ground, or 3,678 1362-2000 tons.
Second " 9.8 " "

74.3 ....1,883,342 lbs. trash.

Possible pure sugar........957,883 lbs. ; possible pure sugar per clarifier, 1,043 lbs.
Returns " " ....897,177 " actual " " " " 977 "
" marketable sugar 934,266 " marketable " " " 1,017 "
2.4 per cent. loss marketable sugar in manufacture.
6.3 " " " pure " "
7.8 tons cane to 1 ton sugar manufactured.

72 9 per cent. No. 1=681,951 lbs. x Pol. 97.8=666,938 lbs. pure sugar.
22.8 " " No. 2=214,580 " x " 92.1=197,628 " " "
4.3 " " No. 3= 37,745 " x " 86.4= 32,611 " " "

100 934,266 897,177

In the first place you will observe that the *total juice* of the cane is represented in the first line as 504,900 gallons. The maceration mill juice given in the next line as follows, 49,850 gallons, *is not additional*, but is included in the above. This work of the maceration mill was given merely to show what work that mill was doing, and was, as I now see, misleading, not having any note appended to it in explanation. Again you will note that the weight of the cane ground was 7,357,362 lbs., or 3,678^{1362} tons, and the figures published before were either a printer's mistake or a clerical error in copying somewhere. There was an error in the calculation of the possible pure sugar in the juice which, as you show, should have been 957,883 lbs., or 478$\frac{1883}{2000}$ tons, which reduces the loss on marketable sugar to 2.4 per cent. With these explanations I think you will find my report explains itself.

Mr. Martin thinks our loss of less than 3 per cent. on marketable sugar a *marvellous result.* I have not had time since completing my crop a week ago to furnish the full result of the crop ; but if your space will permit, I would like to give you my sugar reports for the succeeding months of June and July, and am sure a comparison of the three will be of interest :

SUGAR REPORT, JUNE 30, 1887—TWENTY-FIVE DAYS' WORKING.

918 clarifiers, 504,900 gallons juice Brix 19.4 ; Pol. 18.36.
Maceration mill juice (included in above), 48,900 gallons Brix 22.3 ; Pol. 17.

EXTRACTION.

First mill, 64.2 per cent., 7,394,817 lbs., or 3,697^{817} tons.
Second " 9.6 " " cane ground.

73.8...................1,938,868 lbs. trash.

Possible pure sugar, 1,001,712 lbs.; possible pure sugar per clarifier, 1,091 lbs.
Returns " " 928,397 " returns " " " " 1,011 "
" marketable sugar, 962,570 " " marketable sugar per " 1,048 "
3.9 per cent. loss marketable sugar in manufacture.
7.3 " " " pure " "
7.6 tons cane ground to 1 ton sugar manufactured.
1.9 lb. marketable sugar per imperial gallon juice.
1.8 " pure " " " "

73	per cent. No. 1=702,855 lbs.	x Pol. 98.2=690,203	lbs. pure sugar.
22.4	" " No. 2=216,265 "	x " 92.4=199,828	" " "
4.6	" " No. 3= 43,450 "	x " 88.3= 38,366	" " "
100	962,570	928,397	

SUGAR REPORT, JULY 30, 1887—TWENTY-SIX DAYS' WORKING.

945 clarifiers, 519,600 gallons juice, Brix 18.9; Pol. 17.9.
Maceration mill juice (included in above), 48,850 gallons Brix 21.4; Pol. 16.5.

EXTRACTION.

First mill 64.2 per cent., 7,589,229 lbs., or 3,794^{1222} tons.
Second " 9.4 " "

73.6.................1,995,383 lbs. trash.

Possible pure sugar, 1,002,909 lbs; possible pure sugar per clarifier, 1,061 lbs.
Returns " " 927,787 " returns " " " " 981 "
" marketable sugar 966,692 " " marketable sugar " " 1,023 "
3.6 per cent. loss marketable sugar in manufacture.
7.4 " " " pure " "
7.8 tons cane ground to 1 ton sugar manufactured.
1.8 lb. marketable sugar per imperial gallon juice.
1.7 " " " " " " "

72.2	per cent. No. 1 sugar=698,200 lbs.	x Pol. 97.7=682,141	lbs. pure sugar.
23.3	" " No. 2 " =224,893 "	x " 91.8=206,451	" " "
3.5	" " No. 3 " = 43,599 "	x " 89.9= 39,195	" " "
100	966,692	927,787	

I would like a careful comparison of these reports so that you may observe how each one bears the other out. I would also like to state that the previous months of the year and the month following, which is August, also bear out these reports, but it would occupy too much of your space to give more.

The great uncertainty resting about all mill work in the past stirred me to try and get some better system to control the juices and sugars. The old plan of taking the mark on the outside of the clarifiers, 500 gallons, to represent the juices within when filled up was most inaccurate. My clarifiers, although marked 500 gallons on the outside, I fill up to a 550 measured gallon mark, and allow for the expansion of the juice when the steam is turned on, so I consider I have as nearly accurate a measurement as possible at present. A juice-meter has been proven unsatisfactory, as, the supply of juice from the mill being inconstant, the pump will at times have no juice to draw, so it sucks in air which it forces through the meter, which registers all the same. I have also discarded the Baume hydrometer for the Brix spindle, as the latter is much more delicate, and records more closely the density of the juice. I have a small sample of juice taken from each clarifier during the day before the steam is turned on, and the whole is tested with the Brix instrument at night. It will be necessary to put a little lime in the earlier samples to keep the whole from souring. I polarize the juice daily, and am thus enabled to find how much pure sugar there is in the juice. I also polarize the different grades of sugar each day, and so keep a check on the sugar-boiler, which is impossible for him to get around. If the returns of sugar packed daily are out of proportion to the possible pure sugar of the day before, his attention is called to it and an explanation required. It is such a system that, if attended to daily, gives a check on the mill-work that waste or poor polarization cannot go on more than a day or two unnoticed. I consider it would be of interest to give the headings of my monthly accounts, as it will explain how I have kept them and help better in understanding this letter:

Dr.

			Juice and Trash.									
Date.	Number of clarifiers.	Total juice from both mills, imperial gallons.	Brix.	Polarization.	Maceration mill juice, imperial gallons.	Brix.	Polarization.	Trash, lbs.	Total extraction	Maceration mill extraction.	Remarks.	Possible lbs. of pure sugar in juice.

Cr.

	Sugars.						
Date.	No. 1 Sugar, lbs.	Polarization.	No. 2 Sugar, lbs.	Polarization.	No. 3 Sugar, lbs.	Polarization.	Total returns.

I have also placed in position a Fairbanks scale for weighing the trash. The weight of the trash is handed in to the office, and a record of the extraction of the mill kept for each day. In this I have found a very decided advantage. The engineer sees each morning just what the extraction has been for the day before, and he knows exactly what he is doing, and it keeps him spurred up to the highest point of proficiency. These two checks first on the grinding of the mill, second on the returns of the sugar—are indispensible to the proper running of a mill, and I have no doubt will, in a very short time, be adopted by all. They have been of the very greatest benefit to me this crop. I have a system now that I know is a thorough and constant check on the whole mill-work, and I cannot speak too highly of the satisfactory results I have reaped from it, and heartily recommend it to all. No one who has not a check on their juice and sugars can appreciate what waste or loss is going on. I have to thank Mr. H. Morrison, of Spreckelsville, for many suggestions which enabled me to carry out my present system. While he has been in the Hilo district he has done very much to improve the old order of things by his practical knowled.

JOHN A. SCOTT,
Manager of the Hilo Sugar Company.

Wainaku, Hilo, September 15, 1887.

———o———

A NOVEL RAILROAD IN HAMAKUA.

EDITOR PLANTERS' MONTHLY:

At the Maulua Valley near Laupahoehoe may be seen an operation which we believe is novel in Hawaiian Sugar history, that is, the extensive hoisting of cane. Beyond the valley and from three to five miles from the Mill, there is quite an expanse of good sugar land which for a number of years has been unavailable owing to the impossibility of transporting cane across the intervening valley. This difficulty has now been met by fluming the cane into the bottom of the valley, hoisting up the side and then fluming again to the Mill.

The hoisting engines and machinery connected therewith were imported from New York, and are of excellent design and superior workmanship, and consist really of two complete hoists so arranged that they may be worked together or separately; so that one may wind on and the other wind off, or one may be kept as a spare. The boiler is horizontal of the locomotive type, steel and abundantly large to furnish plenty of steam.

The cane is flumed directly into large cars 15 ft. long and 5 ft. wide and properly distributed therein by swinging the movable end of the flume until the car is even full, when the flume is switched over to the other car, the rope is coupled on the electric button is touched which rings a bell in the engine room above, way over the brow of the hill, the engineer there answers the signal by his whistle and away we go. The vertical lift is 460 feet and the distance about 1200 feet, for the first few hundred feet the track has but a slight grade comparatively and we spin along at a good rate, but at the foot of the hill we come to a very steep little pitch—50°—where the car rises on end like a rearing horse until it seems as if it would go over backwards, the cane settles back to the lower end, the inch steel rope tightens like a fiddle string, the speed slows up, and it is needless to say that the inexperienced passenger holds his breath and mentally resolves that if he ever gets out of that car alive, he will never get into it again.

But as nothing happens he soon gains courage and perhaps diverts his attention from the supposed danger by admiring the landscape, which continually opens up like a panorama as he rises. Perhaps he has even so far recovered himself as to notice quite perceptibly that the air is growing cooler as he ascends. Again comes a very steep place, nearly 60°, and his heart is in his throat as he looks down and the horrible vision of what would happen if the rope were to break passes through his mind. But by this time we are over the crest, and the valley below is shut out from view, and a few seconds brings us to the end in fine style. We climb down and find that we have been something less than four minutes in making the trip—parts of it certainly seemed much longer than that. The dusky engineer catches some expression on our face that seems to amuse him for with a faint smile he says, "She ain't jest like a Pullman on a prairie, sir?"

Meanwhile one man knocks out the bars, three in number, which serve instead of a heavy side to the car, another hooks into the slings which pass under the cane. "Go ahead" is the signal and out comes the whole load alonside the flume which lies just below, where it is picked up and put into the flume by a band of Portuguese women and children, thence making its way to the mill a distance of nearly three miles.

By this time the cane is out and slings in again, and 'already' is the word, the engineer says, "You want to be lowered pretty fast don't you?" and before we can make up our minds whether we do or not, we are off, running along easily till we get to the brow of the hill, when the car suddenly tilts up on end and seems to hang in the air, or rather drop through the air, and we realize in an instant what 'lowering fast' means. The sensation is that of flying or of falling a long distance through the air, such as we have sometimes felt in dreams, not entirely unpleasant if it were not for the instinctive dread of the 'fetching up."

It seems as though the car had been turned loose down the slope and that destruction would be a question of only a few seconds, but the rope behind us is strained tight and the velocity does not increase, showing that the car is under control and in less than a minute we are down again onto the flat and under the flume for another load, having made the round trip in about ten minutes. And we can recommend this trip as a source of more rapid and varied experience than any way of spending ten minutes that we know of.

It is intended for the next crop to construct a double track so that the descending car will assist the ascending, thus relieving the engines of the weight of the car—over a ton—and reducing the time by that now occupied in lowering the car.

With this improvement it is confidently expected that there will be no difficulty in keeping the mill supplied with cane, even though it be five miles away. We commend the daring of the undertaking. OBSERVER.

---o---

THE DIFFUSION PROCESS.

REPORTED BY WILLIAM DEAKIN ITHELL FOR THE DEMERARA ARGOSY, AND CAREFULLY REVISED AND CORRECTED BY THE AUTHOR.

These slices fall on an endless band which runs in front of all the machines, and discharges on to another sloping carrier by which the slices are carried up to the floor above and discharged into a large wooden hopper. From this hopper they fall into a wooden truck which stands on a weighing machine and contains just one-half of the ordinary charge of a diffusion cell. As the diffusers hold 1,725 lbs., each wagon was loaded with chips of half that weight, and was then slid along a little wooden tramway and its contents shot into the diffuser that was being filled. The moment this was done, two coolies jumped into the diffuser and pressed the chips down with their feet. Two or three minutes afterwards, a second truck load arrived and was dealt with in a similar manner. The diffuser was then screwed up and instantly attached to the battery. Of the twelve cells only about nine were as a rule kept at work; and a cell was filled and diffused and emptied on an average every eight minutes throughout the week.

Mr. Minchin gave me a very interesting account of how very different his results were, when he first started diffusion twenty years ago. It appears that the Aska works were, in those days, in a rather bad way, and Mr. Minchin took advantage of sick leave to visit Europe, and endeavour to gain information of any suitable appliances for improving the financial condition of the works, of which he was then manager. He traversed Germany and France without seeing anything which he thought could adapt to his own factory; but in Austria he came across Mr. Julius Robert who had just invented diffusion and was struggling to convince the beetroot manufacturers of its suitability to their needs. We all know that it has since then proved itself to be the saviour of beet, and Mr. Minchin firmly believes that it is destined to be the saviour of cane also. So struck was he with what he saw in Austria that he went back to London, got the sanction of the consignees there, and instantly started for Aska, where he constructed a diffusion battery for himself consisting of vats very similar to what we use in our liquor lofts, only of somewhat smaller diameter. These vats contained about two tons of canes which, when exhausted, were discharged through a door in the side, the whole arrangement being so crude that in those days it took some twenty minutes to fill a diffuser, some twenty minutes to exhaust the chips, and twenty minutes to discharge them—processes which, as I have already said, are now completed in eight minutes.

It may, I think, interest you to have a statement of the temperatures and densities at which the Aska battery is worked. I took several notes of the condition of the various vessels during my stay there and will give you a few samples. I will ask you to bear in mind that in every case No 1 means the cell containing the fresh juice, from which therefore the liquid is being drawn for the clarifier loft; while Nos. 8 or 9 represent the cell containining the exhausted chips, and which, therefore, is about to be discharged. I must ask you further to remember that the Aska battery is discharged by what is known as as the "wet process;" that is to say, the bottom of the cell is taken away and the 1,725 lbs. of exhausted chips and 200 gallons of hot water are allowed to fall out as they please. The disadvantage of this process is that you waste 200 gallons of hot water every time you empty a diffuser. At *Nonpareil* we have the dry process; that is to say, we force the hot water from cell No. 9 into cell No. 8 by means of compressed air, and when that has been accomplished we take away the bottom of the diffuser and let the comparatively dry chips fall out.

Here then was the state of the battery when I arrived at Aska: No. 1, 124° F.; No. 2, 140; No. 3, 164; No. 4, 186; No. 5, 205; No. 6, 212; No. 7, 205; No. 8, 200; No. 9, 190. You will observe that No. 1 is the lowest in temperature, because the hot juice has just come into contact with the mass of cold chips, through which it has to pass to the clarifier loft. There is also a desire to let down the heat in the last two or three vessels, partly to avoid wasting heat, and partly because the chips, if at boiling point, would scald the bare feet of the coolies who have to handle them down below. Here again is a statement showing the density of the juice in the battery cells before drawing off the liquor:—

No.	deg. Balling.	No.	deg. Balling.
8	0.00	4	2.40
7	0.26	3	3.40
6	0.86	2	5.10
5	1.86	1	7.62

You will please note that the above densities are all corrected to a normal temperature of 63° F., and you may further note that whereas vessel No. 1 shows a density of 7.63 Balling, which is about equal to 4.2 Beaume, yet the liquor was discharged from that vessel into the clarifier at 11.75 Balling, or 6.5 Beaume, the reason for this being that, on the Aska battery at any rate, the apparatus for ascertaining the density of the juice requires you to draw your sample from the extreme top of the vessel where the density is lowest. Indeed, I found that the density of juice drawn from the top of any vessel really indicated the density of the juice at the bottom of the preceding vessel, and so on. Here is another statement giving the temperature and density of the battery just after the discharge of the 220 gallons of thick juice to the clarifier :—

Vessel No. 1—208°	Fahrenheit	........9.732	Balling.
do. " 2—212	do.	........5.55	do.
do. " 3—212	do.	........3.632	do.
do. " 4—206	do.	........2.629	do.
do. " 5—203	do.	........1.317	do.
do. " 6—187	do.	........0.364	do.
do. " 7—140	do.	........0.02	do.

Vessel No. 1 in this case discharged its juice into the clarifier at 11½ Balling. These three statements will, I think, enable you to form some idea of the normal temperature and density of the juice in the Aska Battery. I may mention, however, that we very rarely got the diffusion juice into the clarifier as high as 6° Beaume. As a rule it was about 5½°, the cane juice being 8½, which amounts to about 60 per cent. dilution as against the 30 per cent. which the Sangerhausen firm have guaranteed to me as a maximum. Mr. Kollman obtained about 87½ per cent. of the weight of the cane by diffusion, and he considered that he threw away only about 2½ per cent. of the juice in his water. This juice showed no acid reaction when tested by litmus paper. The cane slices however did show a slight reaction,—they coloured the paper about as much as one's finger discolours it when gently laid on a strip of litmus. Another point which must be mentioned in connection with diffusion is, that at Aska they always draw rather more than the entire contents of a vessel from the battery. For instance, at Aska, the vessels hold just 200 gallons of juice in addition to the 1,725 lbs. of cane. Mr. Kollman never drew less than 220 gallons, and when the juice got a trifle sweeter, he sometimes took as much as 235 gallons, experience having taught him if he failed to do that he might lose a small quantity of his sweets when he discharged his chips and water. He impressed upon me especially that if any accident brought me to a standstill with my battery, the temperature of the various vessels should be kept above 160° and below 200°; above 160, because at that temperature fermentation cannot take place; below 200° because he found that if the juice was kept stewing in the battery for any length of time at that high temperature, it always gave trouble in the pans and showed a falling off in the return of *massecuite*. I especially asked both Mr. Kollman and Mr. Minchin about the water question. They both laid stress on the desirability of having good water; but, added Mr. Minchin, "that is equally true of the water with which you supply your boilers. If I could afford it, I would filter all the water that went into my diffusion battery, and I would also treat the water which went to my boilers in the same way." He told me that two or three years ago, when they ran very short of water at Aska, he used all his condenser water—I mean not condensed water, but the water which was pumped through his condensers for diffusion, and found scarcely any appreciable dimunition of sugar as the result. I may further mention that, a few months ago, while they were trying diffusion in Australia in connection with a plant, erected by the *Fives-Lille* people, they ran short of water and actually used over and over again the liquid--I can hardly call it water—which they obtained by passing the exhausted chips through their mill. Of course, this must have been full of impurities, yet the proprietor of the estate was so pleased with the results which he obtained, even under such adverse circumstances, that he has, I understand, ordered a second battery from the *Fives-Lille* people. The water usually used at Aska is perfectly clear river water, and it goes from the battery in the sulphur boxes perfectly clear, resembling very fine hock in colour, and as different from the green liquid which we get from our mills as anything can possibly be. Mr. Minchin knows that the moment the smallest tendency to cloudiness, or an appearance of feathery streaks, occurs in his diffusion juice, that something is going wrong with his battery.

The diffusion juice is drawn from the battery into the measuring tank, passes through the sulphur boxes, where about 60 lbs. of sulphur are burnt in the 24 hours, and runs into the defecator, holding 450 gallons, where $1\frac{3}{4}$ gallons of lime water standing at 15 Beaume is added, and the liquid is brought up to boiling point. Very little skimming was necessary, and the scum was so small in quantity that the product of 450 gallons could all be taken away in a single galvanized bucket.

Mr. Kollman explained this absence of scum, by saying that the bulk of the mucilage and albumen was left in the chips. Albumen coagulates at 160° F., and as the battery there is worked above that temperature the bulk of the albuminous matter becomes fixed in the chips. "You won't know," said he to me, "what a good thing you've got in diffusion, until you come to deal with the juice." From the defecators the juice, standing at about $5\frac{1}{2}$ Beaume, was run through bag filters, 180 being kept at work for 24 hours, and purifying the product of about 140 tons of cane, I got some of these bags just as they were being changed, and we weighed the slush found in them. From 13 lbs. to 15 lbs. of wet mud were taken from each of them, and this when dried gave only 5 lbs. of hard dirt as the result of say one ton of diffusion juice. This shows, I think, that no very large amount of impurity could have been left in the juice; so the absence of scum cannot be explained in that way. The juice was then run from the concretor battery. It generally went on the battery at 5½° Beaume, and after remaining 7½ minutes in transitu came off at 11° Beaume. Two batteries easily performed the whole work. Indeed, on an average, 50 per cent. of the juice was evaporated by these trays. The juice went on clear, and came off clear, and was not appreciably darkened by the fierce heat of the trays, no change of colour having taken place other than that which necessarily occurred through the change in density.

As I was very desirous of finding out the fuel cost of returning the juice to its original density, Mr. Kollman made an experiment one week, carefully weighing every pound of fuel burnt under the concretor trays and taking his juice off at, as nearly as possible, the same density as the mill juice, viz.: at 8½ B. We found it took 12½ tons of wood to deal with the juice from 100 tons of canes; and as 100 tons of canes gave at least ten tons of sugar, it follows that less than a half a ton of coal per ton of sugar was burnt in undoing the very heavy dilution practiced at Aska, although that dilution is just double what the Sangerhausen firm guarantee me. To put the matter in another way: At Nonpariel, if we diluted the product of my daily task of 400 tons of canes, to the same extent as is done at Aska, I should require a triple effect a of 5,500 square feet of heating surface to take out the water which I had put in. If, on the other hand, I diluted only to the extent of 30 percent., I should require a triple effect with a total heating surface of 2,600 square feet to restore my juice to its original density.

While on the question of fuel I may as well sum up all I have to say on the matter. I have already said that six boilers are kept constantly fired at Aska, and I have given you a description of their make. The total fuel consumed in the Aska works apart from the foundry—that is to say, for the concretor furnaces, the boilers and the distillery—averages throughout the crop six tons of wood to ten tons of canes. Six tons of wood mean, I suppose, about two tons of coal, and ten tons of canes mean one ton of sugar; and that, in a factory where dilution is carried to its extreme extent, and no great desire is shown to save fuel or make the most out of the sweets. In addition to this, the chips were dried and burned, about one half of them during diffusion season and the other half after its close. I estimate the chips consumed during the diffusion season to be equal to about 25 tons of wood, not a very material item spread over 1,000 tons of sugar.

When the juice leaves the concretor trays stand, say at 11 Beaume, it is taken into the double effect, which evaporates as nearly as possible one-third of a gallon per square foot per hour, and is brought there to a density of about 25 or 26 Beaume. It is then struck, 400 gallons at a time, into a kind of eliminator, where it is brought to boiling point five and six times, much as we used sometimes to deal with our juice in the old-time clarifier days. The syrup is then left for about fifteen minutes, after which all except the extreme bottom is run to the syrup tank, whence it is drawn to the vacuum pan in the usual way. The *massecuite* is boiled up to 50 Beaume, and struck out into iron boxes. It is very good in appearance and has scarcely any molasses on its surface, In from 24 to 48 hours it is dug out with shovels, pugged, and run through the centrifugals. As white sugar is desired three-quarters of a gallon at least is used for each centrifugal, and the steam is turned on whenever needed. As a result they obtain from 41 to 44 per cent. of pure white sugar. The molasses is boiled up, and struck into the bamboo-lined boxes which I have described. In the event of a specially dry molasses sugar being required they sun their second product for five or six hours on the roof of their factory before they bag it. As a rule, however, the sugar is simply taken from the boxes and sent into consumption. From the sample on the table you will see that it is decidedly superior to the ordinary molasses sugar shipped from this colony. In default of a good local market, they simply store their sugar, and refine it as soon as their one-hundred days' diffusion season is over. When refined it yields 45 per cent. of pure white sugar, the molasses re-boiled gives a further 7 or 8 per cent. and the remaining 48 per cent. of the *massecuite* is sent to the distillery.

Owing to these various methods of dealing with the second sugar it was difficult to get an absolutely exact return of the second quality sugar resulting from the canes. All through there was perfectly plain sailing as far as the *massecuite* was concerned. This *massecuite* weighed 93½ lbs. to the cubic foot and 13 to 14 per cent. was obtained from the canes, the juice averaging 8½ B. This I take to be fully 20 to 25 per cent more than we get in this colony from similar canes.

Before I leave this part of the subject, I should like to impress upon you that the ordinary average Aska work produces one ton of sugar from four punts of canes, although the juice in their canes is slightly inferior to the average juice in this colony. To put this in other words; they average 1 ton of sugar from every 10 tons canes; and two-thirds of this sugar is pure white, the balance being good molasses sugar. Now, as to *Nonpareil*, I do not mean to go into any great detail on this subject. It will be sufficient for me to tell you that, owing to the faulty construction of our cutters, 108 tons of cane which ought to have been sliced in six hours occupied 48 hours in cutting, and the juice which ought to have been run through the battery in about an hour and a quarter, was kept stewing, sometime at over boiling point, for more than 24 hours, and when it was discharged into the clarifier loft, it had to remain for another long period before we got sufficient for the triple effect to deal with. Altogether, juice which ought to have been dealt with in six hours had to remain for 52 hours before we got it into the *massecuite.* No words of mine are necessary to tell you that a trial conducted under such circumstances is no trial at all. I should not have been surprised had we got very little sugar from our experiment. As a matter of fact, however, we obtained just 20 per cent. more *massecuite* than we got from a similar quantity of canes passed through our mill, the return of the *massecuite* in the one case being 14.63 per cent. on the weight of the canes, while the *massecuite* obtained from the same weight of canes by our mill was 12.14 per cent.

I am sorry to say that the Sangerhausen people omitted to put in a weighing apparatus, in spite of my having warned Mr. Schultz on the subject. The consequence was that we had to subject our canes to a great deal of handling, and to delay our process while this handling was going on. The result, both when we tried diffusion and when we tried milling, was very apparent, for the canes which, before we had pulled them about, transporting and weighing them, gave us a quotient of purity of 95, after being handled, gave us a quotient of purity of only 82, when we sliced them for diffusion, and 84 when we crushed them in the mill, the glucose having been increased by no less than 2½ per cent. Our trial was, I considered, so far satisfactory, that it showed us that in spite of very adverse conditions, diffusion gives us almost the exact increase over mill returns which I had calculated as probable from what I had seen at Aska. It showed us also that the battery could be manipulated by our own people without difficulty. And finally, it laid altogether one bugbear, which has been prominently brought forward by advocates of the mill. I refer to the disposal of the chips. This was really a serious matter, for at *Nonpareil* when in full work we should have to deal with two tons of chips every eight minutes, and Mr. Kollman warned me at Aska that this was by far the most serious difficulty with which I should have to contend. So much did I fear this that I sent out half a mile of wire tramway for the purpose of sunning and burning the chips, as I had seen done by human labour at Aska. To our great relief, however, we found that our mill, the trash turner of which had been slightly raised, took our chips readily, and re-delivered them to us containing only 55 per cent. moisture, and therefore in a state to form excellent fuel. They were thrown into our green megass furnaces, and as soon as these were got warm the chips burnt readily. Mr. Llewellyn Jones is of opinion that we may now safely count upon this difficulty having been overcome, though it is possible that some slight modification in the arrangement of the furnace bars, may be advisable.

I have only two points more to refer to, and will then conclude. In the first place, I was disappointed with the colour of our diffusion juice. We used bush water instead of the beautiful river water at Aska; but Mr. Kollmann had told me we should probably find this thoroughly filtered by passing through the diffusers, his idea being, that the chips would take up the impurities in the water. I do not know whether the long exposure to a high temperature injuriously affected the juice; probably it did; but when it got to our clarifier loft, it was not nearly as clear and bright as I hoped it would be. My second remark is with reference to the cutters. We found that the description of cutter furnished by the Sangerhausen people at first would not work at all; the cush cush being thrown to the edge of the disk accumulated there till it formed such a powerful brake that you could not pinch the machine round even with crowbars. Mr. Jones obviated this by cutting small openings at the edge of the machine and making a simple arrangement for throwing out the cush cush, thus preventing the machine from coming to an absolute standstill. At the same time, however, we were very much interfered with all through our trials by the accumulation of cush cush and of shreds of cane on the outer portion of the knives. Probably not less than from 15 to 20 per cent. of the cutting surface of the knives was rendered useless by this cause. Then we found that these horizontal cutters required to be fed with considerable force, or they would not take the canes at all. As a matter of fact these horizontal cutters, which were expected to slice 200 tons of canes each, in 24 hours, actually got through only one-eight or one-tenth of that quantity while they required six men to feed them, whereas the Aska machine easily sliced 60 tons in the 24 hours, and only needed one man at the hopper. By the the terms of my contract it is the business of the Sangerhausen people to supply me with proper cutters, and until they have done so, I shall of course resume my ordinary milling operations, merely using the interval to put on a hydraulic apparatus to our large mill so as to provide a safety valve in the event of a bolt or other hard material getting between the rollers, which, as they set nearly metal to metal, when the exhausted slices are passing between them, would be especially liable to a big smash in the event of any hard substance getting mixed up with the megass.

THE SAMOAN ISLANDS.

A Sketch by Henry F. Poor.

CURRENCY.

The currency of the country is a nondescript collection of all sorts of debased coins, consisting mainly of Chilian and Peruvian. It is impossible to accurately estimate the amount of this coin in circulation, as the estimates of the business men vary considerably, but the majority place it at about $300,000. The bulk of this was imported by the German firm at great profit, and by its means they have been enabled until lately to control trade and exchange, obliging smaller traders to sell produce to them in return for exchange necesary to remit for imports. At present the advent of English capital and enterprise has considerably curtailed their power. With these debased coins at par, English gold is worth 10 per cent. premium, and United States gold 15 per cent.; English exchange is worth 15 per cent., and American 20 per cent.

HARBORS AND ROADSTEADS.

These islands are more fortunate than their sister islands in the South Pacific in having some excellent harbors to facilitate their commerce. The greater portion of the islands is surrounded by barrier reefs from 30 feet to four miles from the shore, which forms a smooth lagoon in which innumerable boats and canoes travel back and forth. There are numerous outlets in these reefs to the ocean, the larger openings leading into bays and harbors, and the more numerous small ones giving entrance to small sloops, etc., which at high tide, can reach anchorage at nearly every village. The largest and best harbor is Pago Pago, on Tutuila, which was ceded to the United States by treaty. It is a large land-locked bay, and perfectly safe in any weather, and is considered the best harbor in all the Pacific islands. Leone bay, also on Tutuila, is also a good, small harbor. The second best harbor is Saluafata, on the north side of Upolu; it is a deep bay protected by reefs, the anchorage is good and roomy, and it would be possible to build wharves. Apia, ten miles from Saluafata, is the principal settlement in Samoa, and the headquarters of all its commerce. The bay, though small, is deep enough to hold vessels of the largest size, and except in a hurricane, is perfectly safe. There are no wharves, and they could be constructed only at great expense. The port is the resort of numerous shipping of all classes throughout the year. Other harbors on Upolu are Safata, Tataloa and Tagalii. Vessels of large size can find good anchorage, but landing can be effected only at high tide. The anchorage is safe in ordinary weather, but dangerous in severe weather. Savaii has three principal anchorages—Palauli bay, Matautu and Salailua; they are simply roadsteads, and vessels of large size go to them in fair weather. There are many other good landings for small craft of five tons or less all over the islands; there are also a number of good landings for craft of 50 tons or less.

FOREIGN COMMUNICATIONS.

A great number of craft of all kinds resort to Apia during the year. Five or six vessels with general cargo and lumber from San Francisco. An occasional vessel from England, and a great number of German vessels from Hamburg. There are also a great number of small craft trading to and from Sydney, Auckland, and the various islands of the Pacific. Naval vessels frequently resort here, and also vessels calling in for orders. There are two regular steam lines touching at Apia; one is a steamer of about 2,000 tons, belonging to the North German Lloyd Company, and under charter by the German Government to run once a month from Sydney to Tonga, Apia, and return. The other is a smaller steamer subsidized by the New Zealand Government to run once every six weeks from Auckland to Tonga, to Apia, Tahiti, to Rarotonga, and return. The steamers of the Oceanic S. S. Company, between San Francisco and Sydney touch off the west cape of Tutuila to deliver mails and passengers to a small cutter that awaits them there, but carry no freight. It would be a great boon to the merchants of Apia if these steamers would call at Apia to facilitate and promote the trade to San Francisco. The German firm contemplated running a line of steamers from San Francisco to Tahiti and Apia. The first steamer, the Raiatea, started from San Francisco, but was burned at sea. No more has yet been made to continue the service.

THE PEOPLE.

Physically, the Samoans are a fine-looking race of people. The women are of average height and development, but the men stand over six feet high on an average, with proportional muscular development. The majority have perfect proportions and symmetry, and are models of physical beauty, and would make splendid subjects for the sculptor or artist. This is especially so with the chiefs, who are easily distinguished by their erect, graceful, free and dignified carriage. The women are mostly inferior to the men, and pretty women are not numerous. The countenance of the people are rather prepossessing; the features are regular, almost Grecian in some, strongly Jewish in many, while the affinity to the Malay is strongly marked in the majority. They have small hands and feet, which points towards Asia as the place of origin; kindliness and good humor show forth in their mild eyes and expressive face; thick lips and broad noses are an exception; the hair is rather coarse and black, and they whiten it with lime about once a week to clense and protect the head, which also colors the hair a brick-red—their ambitious idea of beauty. They oil their bodies often with cocoanut oil, which is offensive while it is on; but they are generally clealy, for they bathe daily; they are rather a healthy people, there being comparatively little sickness or disease among them, though a great many are afflicted with a variety of cutaneous diseases, and a few have their limbs swollen into disgusting proportions with elephantiasis. The men are all tattooed from waist to knee, appearing as though they wore a neat-fitting trunk of dark-blue silk. Until a man is tattooed he is considered to be only a boy, has no right to speak with authority, cannot marry, can never be a warrior, nor become the head of a family, and is exposed to taunts and ridicule. Tattoing is usually done at the age of 16; the missionaries have tried to break down this custom, but without success. The natives wear no head-dress, and their only covering is a *lava-lava*—a piece of tapa or cloth wrapped around the waist and tucked in on the front, falling to the knee; the women usually wear also a *tiputa*, a couple of yards of cloth with a hole in the middle for the head, and the ends falling in front and back. They are good breeders, as is shown by the great number of healthy little children seen in every village. Darwinian theorists may find some argument in the following characteristics: They pick up things with their toes, squat when they meet to talk, and pick out lice from each other's head and eat them. In personal character they are beneath the Hawaiian, and lack many of the moral principles. Their greatest failing is petty thieving and deceit; love, affection, gratitude, morals and justice are but weakly developed in their organization, and they are excessively lazy, spending most of their time in sleep or play, as food is so abundant they have no need to work for it, and each village is a commune where idlers or travelers may eat or sleep from house to house; the live only in the present—the past and future concern them not—and, with their simple habits, are a happy and contented people. With civilization, education and law, with their social benefits, it is possible for them to develop a higher type of character and industry, and rival their more enlightened brethren in Hawaii.

POLITICAL DIVISIONS.

All Samoa is divided into nine distinct districts which regulate their affairs independently of each other. Each district has six to ten village communities who also have their own chiefs with rights and privileges distinct and independent. The villages of a district are united and have one village with traditional rights as the capital where the hold their *fonos* (public meetings) the orator of the head village having the opening speech, the others in turn according to an established etiquette, and they have unwritten forms and rules of political etiquette and precedence which are strictly followed. The head village has the right to elect a high chief who shall be governor of the district, and has also the right to declare war. The villages and their chiefs respect the authority of the Governor, but would soon call a *fono* and depose him should he transgress their wishes. These district and village *fonos* are composed of chiefs and *tulafales* with hereditary rights. The *tulafales* (orators) are a powerful and influential class, there being one or two in each village who hold their position by heriditary descent, and the title succeeds continuously in the family by descent or by election. They are the talking men of every public assemblage and argue and decide the questions involved, be it political or social. They also attend at marriage feasts and other ceremonies and rule the division of the presents. The districts are as follows: On Savaii three. *Faasaleleaga, Le Itu-o-tane, Le Itu-o-fafine.* On Upolu three, *Tuamasaga, Aana* and *Atua.* Manono and Apolima are one known as *Aiga. Tutuila* is one and *Manua* one.

HISTORY.

These islands were first noticed by the Dutch "Three ship expedition" in 1722. They were next visited by the French Circumnavigator Bougainville in 1768, who gave them the name of Navigators on account of their dexterity with their canoes. They were subsequently visited by La Perouse in 1787 and Cook in 1791. Two officers and ten men being massacred at Tutuila the islands were for a long time avoided and dreaded; but it is to be noted that the Frenchmen were decently buried in white tapas and the natives claimed they simply revenged an aggravation on the part of the visitors. The celebrated missionary arrived from Tahiti in 1830. He was kindly received and assisted on Savaii by Malietoa and in a few years he and his teachers overcame the mild form of heathenism existing and won a complete victory for christianity.

Though the Malietoas have ever been the leading and ruling family in Samoa, they have not always exercised absolute authority and each district has ruled itself independently, though until the Tupua family rose all acknowledged Malietoa though often engaged in tribal wars against each other. These wars have continued at frequent intervals and since the Tupuas rose up into rivalry with the Malietoas there have been frequent conflicts between the two families and their adherents.

These wars were very barbarous and cruel, creating distressing havoc, desolation and lamentations among the people, desolating whole villages and destroying vast numbers of cocoanuts, breadfruits and other food products. The first attempt to organize Samoa under one head was made in 1873. The record of events since that date may be found in reports previously sent to the Foreign Office.

LANGUAGE.

There are eight dialects in Eastern Polynesia which resemble each other and appear to be closely allied. These are the Hawaiian, Samoan, Rarotongan, Tongan, Austral, Tahitian, Marquesan and New Zealand. The Samoan has 14 letters in the alphabet and differs somewhat from the others. The letters are, a e i o u f g (sounded as ng in sing), l m n p s t v. Compared with the Hawaiin the Samoan is certainly richer and completer in expression and is softer and more mellifluous than all the others. The main difference from ours is in using t in place of k and t, or s in place of h. Latterly however, the k is coming into frequent use in place of t as the result of association with the numerous other islanders using the k who are living here among them. The language is prolific with words and phrases of compliment and politeness and among the chiefs it is both elegant and eloquent.

There are several words which I have noted particularly to show the superiority of the Samoan over the Hawaiian as a polite language. For thank you *faafetai* or superlative *faafetai lava*—No thank you, *soia faafetai*—Enough, or to desist, *soia*. *Alofa* is love as is our aloha, but the salutation is talofa and when parting *tofa* or complimentary *tofa soifua* (adieu, may you live.) *Manuia* is a universal drinking salutation. A lady is a *tamaitai*, a girl *teine* and a common woman *fafine*. There are also a large number of words and phrases used by and to the chiefs alone and their language of compliment is elegant and dignified. To come, *sau mai*, to a common person, *maliu* or *susu mai* to a chief, and *afio mai* to the King.

RELIGION AND EDUCATION.

The whole population of Samoa is christianized and there is hardly a household that do not have their regular *lotu* or evening prayers. An official almanac for 1887 published by the Catholics claims 5,140 converts to that religion. The Weslyans claim about 3,000 and the balance are under the teachings of the London missionary society. The influence of the Catholics is increasing, and they have some of the most influential chiefs and orators under their control. The London Missionary Society has its headquarters at Malua about 8 miles down the coast from Apia, where they own a handsome estate of 300 acres. A large building serving as church or school, two comfortable houses for the missionaries, and a series of small and commonly furnished houses ranged in rows about a large square form the institute. The buildings are all built of coral neatly plastered and whitewashed and the whole locality has an air of neatness, thrift and quietness becoming its character.

There is an attendance of about 100 young men preparing to be religous teachers. The course of study is four years. The students support themselves to a certain extent by cultivating small patches of land allotted to them. After becoming qualified they go back generally to their own villages and in due course become the village teacher and is supported by the villagers. There is not a village in Samoa that has not its church, and some have three or four. The church and property belongs to the village and is entirely independent of the parent society. These teachers have more or less influence, but their influence and services would be more efficient if the institute at Malua should alter the proportion of religious teaching and and practical education which is now about $\frac{7}{8}$ against $\frac{1}{8}$. Beside the institute at Malua there are other mission stations about the islands and I believe they are doing faithful and good work.

The great majority of the natives appear to be very religious and are habitual and constant in their attention at the *fale lotu* (church.) But after close observation I fear that genuine christian principals are not very deeply rooted in them as yet.

Previous to the conversion to christianity the heathenism of the Samoans was of a mild type, for they had neither temples, altars, nor sanguinary rites, and had no regular forms or systems of worship. They had a vague idea of a supreme being whom they called Tagaloa and their mythology has fragments and imitations of scripture history though mostly absurdly and obscenely distorted. They had their personal *etu* or gods in visible incanations, and either fish, fowl or insects are objects of adoration. There is now hardly any trace of their previous heathenish beliefs though some still have their gods and all sorts of harmless superstitions prevail.

Though well cared for spiritually, the facilities for ordinary education are poor and insufficient. Each teacher has a sort of school and undertakes to educate a few children, but with generally poor success. At the mission stations a little teaching is also done. These are the only attempts at schooling outside of Apia. In Apia there are two schools with foreign teachers but these are for children of foreigners. At the Catholic convert there is also an excellent English school for girls. The majority of Samoan children however go uneducated or simply learn to read and write. Good primary schools should be established in every district and a high school at Apia.

GOVERNMENT.

As stated before, the supreme authority has always vested Malietoas, though there has ever existed a state of chronic anarchy among the various districts who acted, and still act, as independent states. There has been various abortive attempts in recent years to establish central government. The last arrangement exists now, and is recognized by the foreign powers, but it is greatly disorganized and unsatisfactory, and German intrigue has created a petty rebellion which still further confuses affairs, and the attitude of the three great Powers of the United States, England and Germany having treaty relations with Samoa, is so unjust and unfair as to render a new arrangement desirable.

The Municipality of Apia, which was granted its privileges in 1879, still governs the district under the three Consuls; they have excellent regulations for preserving the peace and conducting the affairs of the municipality. and it is an orderly and well-governed place. The revenue is about $11,000 per annum, which is all judiciously expended. But the foreign residents are not satisfied with it, for the Consuls are rather arbitrary, and certainly often exceed the powers granted them by the Convention. It will be better that the town of Apia always remain under municipal control, but the Board should consist of an elected Board of property owners and tax-payers, and be subject to the general government.

The postal service is an independent organization, the postmaster holding commissions both from the municipal authorities and the King. The postmaster has no salary, but bears the expense of the service and pockets the profits from sales of stamps, of which he has a neatly designed set of seven. The service is conducted through the New Zealand Government.

———o———

SUGAR CANE.

BULLETIN FROM EXPERIMENTAL STATION, KENNER, LOUISIANA.

The sugar planter of Louisiana is both an agriculturist and a manufacturer. He grows the cane and then manufactures it into sugar and molasses. Therefore, to attain the most beneficial results, a Sugar Experiment Station should conduct experiments in the field, laboratory and sugar-house. Agriculture, chemistry and mechanics are the sciences which must contribute to the successful prosecution of the sugar industry.

Realizing this fact, this station, after a careful inauguration of a series of field experiments, and the establishment of a well appointed laboratory, proceeded to the equipment of a sugar-house. There was found on the station a small sugar-house, with a three-roller mill 24 x 14 inches, fed by hand, a boiler, an engine, a series of open kettles, wooden coolers, etc. The open kettles were rejected, together with the unnecessary coolers, etc. The engine, boiler, and mill were overhauled, repaired and used. A sulphur machine was erected; juice boxes, each large enough for a single experiment, were placed in proper positions, into which a juice-pump (*monte jus*) conveyed the juice from the sulphur box; an improved clarifier, capacity 70 gallons, with a settling tank of three compartments of 150 gallons each; two small brushing pans, with another settling tank of same size and form as one just mentioned, were the vessels used for clarification and preparing the juice for concentration. A Yaryan's vacuum distilling apparatus was used to concentrate the juices for the strike pan. This apparatus had the capacity of concentrating in vacuo 150 gallons per hour, from 7° B. to 30° B., and as far as we can judge from experiments made (nearly 100 in number) worked very successfully.

The concentrated syrup was then grained in a small vacuum pan, emptied into a mixer and purged in a small centrifugal. The Yaryan distilling apparatus was erected by and at the expense of the Yaryan Manufacturing Company, Toledo, Ohio. Mr. Day, the courteous agent of this company, sent to erect and instruct in the use of the machine, spent several weeks at the station, and rendered valuable assistance in the sugar-house.

The mixer and the settling tanks were generously donated by Messrs. Edwards & Haubtman, of New Orleans. The Whitney Iron Works contributed the shafting and pulleys required to run the mixer and the centrifugal.

The conversion of an open kettle sugar-house into the one just described was both expensive and tedious, demanding more than an ordinary knowledge of machinery and the requisites of a sugar-house. Fortunately the station had a volunteer assistant, whose rare mechanical genius, love of machinery, experience in a sugar-house, and persistent industry was fully equal to the occasion, and the subsequent working of the sugar house gave indisputable evidence of his fitness to adapt pieces of machinery, gathered from many quarters, to each other, and all to the sugar-house and the requirements of the station. To Mr. John P. Baldwin, Jr., Baldwin, La., this station is indebted not only for the above-mentioned work, but for other valuable assistance in the field and sugar-house.

The sugar-house was completed, and work begun in it, on October 21st, 1886.

ELEMENTARY CHEMISTRY OF THE SUGAR CANE.

Before proceeding with a description of the experiments in the sugar-house, a short presentation of the chemistry of the sugar-cane may not be inappropriate.

The composition of the sugar-cane varies. First, with varieties; second, with soils upon which they are grown; third, with different manures; fourth, with different climates and seasons; fifth, with different degrees of maturity; sixth, with different parts of the stalk of the same cane; and seventh, with plant and rattoons of different years.

1. It is well known to every planter that different varieties give very different amounts of sugar. The analyses of thirteen different kinds of cane grown upon "le champ d'experiences" the Agronomic Station of Reunion, and harvested at the end of twenty months, show that cane sugar varied between 13 and 21 per cent., and glucose between .07 and 1.48. Our own analyses of sixteen kinds grown last year on this station show similar results.

2. The soils upon which cane is grown have decided effects upon the content of sugar. To a Louisiana planter, it is well known that the black land produce sweeter cane than sandy.

3. Different manures effect materially the growth and maturity of canes, and therefore their sugar content. Large quantities of nitrogenous manures are always detrimental to large sugar yields.

4. Different climates, and in the same climate different seasons produces canes varying greatly in sugar content. In dry localities, and in dry seasons, canes are small, with much fibre and sugar. In damp climates and in wet seasons the canes are gorged with humidity, low in sugar and rich in glucose.

5. At different degrees of maturity the cane varies greatly in analyses.

The results determined at the Agronomic Station of Reunion upon the same variety of cane show this conclusively:

ANALYSES OF CANE AT DIFFERENT AGES.

Age.	Sucrose.	Glucose.
10 months	11.21 per cent.	3.01 per cent.
13 "	12.44 " "	2.55 " "
15 "	15.15 " "	1.05 " "
16 "	16.25 " "	0.36 " "
18 "	20.65 " "	0.22 " "
20 "	21.03 " "	0.07 " "

It is well known in Louisiana that cane ground in December is richer in sugar than that ground in October.

6. Sugar and the other elements in cane are very differently represented in the different parts of the same stalk. The middle and lower parts are the richest in sugar. The following analyses show this:

ANALYSES OF DIFFERENT PARTS OF THE CANE.

	White upper end.	Upper red part.	Middle.	Lower.
Sucrose	3.80	13.37	18.09	18.59
Glucose	1.33	0.81	0.16	0.14
Water	84.05	76.89	70.42	68.92
Fibre	9.96	9.51	10.71	11.55
Organic matter	0.38	0.35	.32	0.30
Salts	0.48	0.47	.30	0.50
	100.00	100.00	100.00	100.00
Degree Baume	3.70	9.30	11.60	2.00

This is convincing proof of the expediency in cutting cane for the mill, to "lower the knife" so as to avoid the upper immature joints which cannot increase, but may seriously decrease the sugar yield. To the above may be added the fact that the bark or rind of the cane—the nodes and the central pith—do not contain the same amount of sugar, hence the juice from the first mill, coming mainly from the pulp of the cane, is richer in sugar than that from the second mill, which is presumed to come by increased pressure from the outer rind.

7. Plant cane varies from stubble cane in its content of fibre and sugar, as is well known to all sugar planters.

With these announcements, it is not surprising to find so great a discrepancy in the many analyses of sugar-cane given to the public by distinguished chemists. Again, few realize how difficult it is to make a complete analysis of cane, especially of the numerous elements present in very small quantities, both on account of the absence of exact methods of analyses and of the rapid transformation which takes place as soon as the juices of the cane are removed from the influences of vitality.

ANALYSES OF CANE.

The following is the classical analyses of Payen, made upon stalks of Otaheite cane sent from Martinique, and chosen especially for the researches which they subsequently received. It is to be observed that this distinguished chemist, with others, found no uncrystallizable sugar present. But these are exceptions. All canes worked in the mill probably contain more or less of this substance. In Louisiana the percentage of glucose is between .5 and 2 per cent.

Water	71.04
Sucrose	18.02
Cellulose	9.56
Albumen and other nitrogenous matter	.55
Resinous, fatty and coloring matter	.35
Mineral salts (ash)	.48
	100,00

Many other standard analyses might be given, but the following will probably cover all that has been made, and will give an idea as to the general composition of all canes. The cane contains:

Water	from	73.38	to	69.54
Sucrose	"	10.00	"	20.00
Glucose	"	8.00	"	.00
Starch	"	....	"	....
Cellulose and lignose		7.03	"	9.50
Gum		....	"	....
Cerosin		....	"	....
Fatty and aromatic matter		....	"	....
Albuminoids		1.17	"	0.55
Coloring matter		....	"	....
Free acids				
Silicia				
Organic salts: Malates, Oxalates, Acetates, Citrates, etc.; Mineral salts: Sulphates, Phosphates, Chlorides, Silicates; of Potash, Soda, Lime, Magnesia, Alumina, Iron		0.42	to	0.35
		100.00	to	100.00

This table is not complete, and yet it represents what is known of the composition of sugar-cane.

The juice obtained by pressure usually contains nearly all the substances found in the cane, showing that the sucrose found in the cells of the cane is accompanied by a large number of soluble substances of a more or less variable nature, some useful, some indifferent, and others positively noxious to the product we wish to extract, by conversion into glucose, or by preventing its crystalization.

In the sugar-house these foreign bodies are far from being without influence upon our operations, and if we wish to succeed under all circumstances we should study the action of each in detail, as well as the influence of air, water, light and heat, upon our juices and syrups. A short examination of each may be beneficial.

HYDROCARBONS.

Starch has not been found in the canes of Louisiana, though reported in very small quantities in unripe canes of other countries. The chemical property of being transformed by acids at all temperature into dextrine, and then into glucose, makes it an undesirable element of cane-juice. Lime combines with it and partially precipitates it. Tannin completely precipitates it. It is insoluble in alcohol and cold water, and is not to be feared in the sugar-houses of this State.

Dextrine, produced easily from starch, is soluble in water and in dilute alcohol. Is not precipitated by any of the re-agents used in the sugar-house. It can be removed by an ammoniacal solution of acetate of lead. In the presence of albuminoids, ferments, fatty matter, etc., this substance causes a marked decomposition of the sugar, producing fermentation of the lactic butyric and viscous order.

Besides being the cause of this active fermentation, which is prevented by a careful removal of the other foreign substances, it is a source of constant annoyance to the sugar boiler. It is not crystalizable, and is not precipitated by lime, therefore we find it accompanying the sugar to the strike pan, augmenting the *massecuite* and restraining a portion of the sugar from crystalization. The station has not found dextrine in freshly-cut cane. In cane fermented either from exposure or in the wind-row it was invariably found; in the latter case only in small quantities. Dextrine, like sucrose, turns the polarized ray of light to the right.

Gum is analogous in its action to dextrine. It is insoluble in alcohol. It forms a soluble combination with lime, and like dextrine, it increases the molasses both by its weight and by the prevention of sugar from crystalization. The proportion of gummy matter in cane-juice is very small, a fortunate circumstance since there is no known way of removing it. A solution of gum turns the polarized ray of light to the left.

Glucose.—This name, retained throughout this bulletin, is improperly given to the uncrystalizable sugar found in cane-juice, though the latter is known to be a mixture of dextrose and levulose. It is found in the largest proportions in unripe cane. It is probably formed by the dehydration of starch or cellulose, and in graminiferous plants is re-converted in the grain into starch. In the sugar plants it is converted into sucrose, how, the following theories have been offered in explanation: 1. By simple dehydration. Glucose, $C^{12} H^{24} O^{12}$ minus water. $H^2 O$=Sucrose, $C^{12} H^{22} O^{11}$. This theory is somewhat sustained by the fact that the leaves and tender parts of the cane contain the larger proportions of glucose, and that the researches of Ville and Deherain show it to be quite plausible. 2. The carbonic acid of the air is absorbed by the leaves of the cane, and is reduced under the influence of sunlight, the oxygen set free, while the carbon enters into combination with hydrogen and oxygen of the water present, forming oxalic, acetic, citric, tartaric, etc., acids which disappear to make room for sucrose and other neutral substances.

An examination of a young stalk of cane shows always the presence of both sucrose and glucose. As the stalk grows and approaches maturity the sucrose increases and the glucose decreases even to the point sometimes of disappearing completely. If now the cane is not cut at maturity, it at once enters again in activity, and presents the opposite phenomenon of converting sucrose into glucose. Thus one may speak definitely of the causes producing glucose in the cane, viz.: A too active vegetation, the absence of sunlight, an abundance of rain, and a soil too rich or too wet. The formation of sucrose, on the contrary, is *en rapport* with maturity of plant, dryness of soil and air, and a great excess of solar light.

Again the slightest disturbance of the plant or its juice, either through fermentation from a wound, from heat, from action of acids; from immaturity, and a thousand other ways, causes the sucrose to be converted into glucose. There is no practical way of eliminating it, and it passes into the molasses, restraining therein from crystalization a quantity of sugar. This substance is the chief ingredient of molasses, and together with gum, dextrine, etc., oppose themselves by their viscosity to the separation of the crystals of sugar. The quantity of sugar thus restrained, but not transformed, is variously estimated from one-half to twice the weight of the total gummy matters. Again, a solution of pure sugar, or a solution of the mixture of glucose and sucrose can be concentrated without much coloration. But if glucose alone, or with sucrose, be heated with free or carbonated alkalies, the solution quickly assumes a brownish tint which deepens as the work progresses. This coloration is due to the formation from the glucose of melassic acid, and increases in proportion to the quantity formed. This coloration may be removed by bone-black; but, unless the alkalies be neutralized, which are the direct cause of this phenomenon, it will be reproduced after each decoloration, as soon as the work of concentration is renewed. Glucose is therefore the *bete noir* of the sugar-maker. It is formed at the expense of sucrose; it engages in the masse cuite, unaltered sucrose, and it is the most powerful cause of the coloration of the sugar products. In the present condition of sugar manufacture no way is known of eliminating the glucose already and always existing in the juice in Louisiana canes, and therefore the most judicious care should be exercised to preserve the sucrose present, and to avoid the causes which convert it into glucose. We are obliged to submit gracefully to the disastrous consequences of that is already in the juice.

The pectose group.—The process of pressure without heat as now practised in all our mills is believed to give us a juice free from pectic principles, especially when proper wire screens are interposed between the mill and the juice-box to remove the fragments of the bagasse, broken off by the rollers. The heat of boiling water is required to convert pectose into a soluble form, pectine, and if the fragments of bagasse are carefully removed before boiling, the juice should be entirely devoid of it. None has been found in any of the juices examined at this station. Both tannin and lime, however, remove all the pectose group likely to be found in juices by converting them into insoluble combinations.

Wax and resinous matters.—The "cerosin" first named and examined by Mr. Avequin, of New Orleans, the whitish wax found adherent to the bark of the cane and to the part sheathed by the leaves, is insoluble in water, and therefore is without action in the juice. The violet or purple canes contain the greatest amount, striped next, and the white canes very little. On the violet it is said to be found to the extent of 75 to 100 pounds per acre. Dumas gives it the following composition: $C^{48} H^{50} O^{2}$, while Lewy, later, makes it $C^{46} H^{46} O^{2}$.

Fatty matters and essential oils.—The former exert their influences most only when degeneracy of any kind occurs in the juice, as then it determines the formation of lactic butyric, mannitic or viscous products, forms of fermentation more destructive and objectionable than the regular and normal alcoholic kind. All fatty matters consist of fatty acids combined with glycerine. When lime is added it combines with the fatty acids and releases the glycerine which accompanies the sugar in the *massecuite*, remains in the molasses and restrains from crystalization a certain proportion of sugar. It is customary with some sugar-boilers to stop excessive foaming in the pan by the introduction of fat of some kind. This reprehensible custom might with propriety, and better results, be supplanted by the use of fatty acids alone, deprived of glycerine.

The essential oil, which gives that delicate perfume to the open kettle sugar-house, and the agreeable odor of *mel de canne* to brown sugar should rather be conserved than destroyed. Most of it, however, is eliminated by the different treatments to which the juice is subjected in concentration. Glycerine alone of these bodies is objectionable because of its increasing the quantity of molasses, both by its presence and its restraining power over sugar.

Albuminoids or nitrogenous bodies, such as albumen, legumine, fibrine and casein, are found in the cane. The latter when grown on a soil strongly manured with highly nitrogenous fertilizer, contain largely increased quantities of albuminoids. All planters are in accord on this point. Albumen and its congeners are the essential support of the ferment, which produces alteration of the sucrose. The ferment alone destroys a certain proportion of sucrose and dies; but, in the presence of albuminoids, a rapid multiplication of new and active globules takes place, which replace the effete ones, and which destroy in a short time large quantities of sugar. The planter has no more redoubtable enemy than these aulbuminoids, which, if not removed, show themselves in every phase of concentration. Therefore, to avoid their noxious influence, cane should be worked as soon as possible after being cut, and the albuminoids removed from the juice as soon as practicable after coming from the mill. But their removal presents some difficulty. Some of them are soluble, but coagulate by heat. Others soluble and not coagulable. Others insoluble but soluble by heat, and transformable after a while by the prolonged action of water and heat into gelatine. This action is hastened by the presence of free acids. Lime precipitates only a portion of the albuminoids, and when used in excess causes a re-solution of a part already precipitated. Therefore in the ordinary treatment, we find these albuminoids accompanying the juices from the mill to the *massecuite*, giving rise to the foaming which occurs in the concentration, augmenting the proportion of molasses, and engaging a part of the sugar by preventing its free crystalization. The employment of tannin, which unites with all or nearly all of them to form insoluble compounds, provided free lactic acid does not exist in the juice, followed by the usual treatment with lime, is said to be an excellent way of relieving the juices of these, the most powerful obstacle to the obtaining of large *rendments*.

Along with the albuminoids occur a living globular ferment ready to perform the work of destruction, of breaking up complex compounds into simpler ones, or even into elements, as soon as the plant is removed from the influence of vitality. This ferment is precipitable by lime and tannin, destroyed by acids and alkalies and its activity suspended by heat.

Vegetable acids, with the exception of tannic, acetic and carbonic, have the property of changing sucrose into glucose. Acetic acid, while exercising no direct action on the sugar, often by its presence favors ropy or viscous fermentation. Therefore, one can only hope to obtain a good treatment of sugar juice by perfect neutralization of all acids. If the juice be left, acid sugar will be inverted, albuminoids will be dissolved, etc. If alkaline, a part of the sugar will go in the molasses as sucrate of lime. The presence then of free acid in the clarified juice should not be tolerated.

Vegetable bases may be considered in the sugar industry of Louisiana as of little or no importance.

Mineral matter.—The influence of mineral matter upon the crystalization of sugar has been a subject of more controversy than any other connected with the sugar industry.

Alkalies, potash, and soda, and their carbonates.—Doctors have disagreed in the past as to the effect of these substances upon sugar juices. It is now however, pretty conclusively determined that they blacken the juices, by converting glucose into melassic acid and prevent an amount of sugar, according to best authorities, of about six times their own weight, from crystalization. They should therefore be neutralized with some inoffensive acid.

In a well defecated juice, potash and soda should be the only basic mineral elements of the cane present, since lime should precipitate the rest together with most of the acids, and any excess of lime used is precipitated by the proper reagent.

Mineral acids.—Most of these are removed by the lime, forming insoluble combinations, and giving no very serious results to the sugar maker. The chlorides, particularly of potassium and sodium, not removed by lime, are objectionable. They do not destroy the sugar but they form double salts with it, and thus restrain in the molasses a goodly quantity of sucrose, the former preventing 4,582 and the latter 5,852 times their weight from crystalization. According to best authorities, coloring matters are generally removed in great part by the usual methods of defecation. They are entirely suspended by the use of sulphur.

SUMMARY OF ABOVE.

The aim of every manufacturer of sugar is to extract the largest possible quantity of sucrose, and leave the smallest possible uncrystalizable residue. Therefore the question arises how can this double condition be methodically accomplished. We know that gum, dextrine and glucose, prevent the free crystalization of sugar. We have seen that the pectic principles, nitrogenized bodies and certain salts, accomplished the same end. It is evident that free acids, with three exceptions, convert sucrose into glucose, causing a double loss, that of the transformed sugar, and that restrained in the molasses by this sugar. The formation of glucose is believed to be the great cause of loss in Louisiana. The unavoidable causes of inversion are numerous. The natural acids of the cane, certain bases, the ferment, action of air, of water, and of heat, together, can alter so much sugar as to seriously decrease the yields. Add to that the free and indiscriminate use of sulphur, and the usual custom of leaving the juices quite acid, even after clarification, and the surprise is that so much sugar is made.

Work of the sugar house may be divided into

1st. Extraction of the juice.

2d. Purification of the juice usually termed clarification or defecation.

3d. Concentration.

4th. Cooking to grain.

5th. Purging the crystals.

Since all of this work is of a mechanical nature except the purification of the juice, this alone will be noticed here.

How long will a juice untreated remain without alteration, is a question often asked. It is best to answer by repeating that as soon as removed from the stalk, fermentation begins; the rapidity and violence depending upon temperature, condition of weather, etc. The natural ferment present is very active, and is aided more or less by the natural acidity of the juice, and the temperature of the sugar house. It is important then never to delay the purification of the juice. The fundamental principle involved in the clarification of juice, is either to remove or render inoffensive, all the foreign matters in the juice, and is practically performed in two ways by the addition of reagents. 1st. Which will produce insoluble compounds which are removed. 2nd. Which will neutralize all causes of alteration to the sucrose. These are chemical means, and are aided by mechanical and physical processes equally as essential.

The reagents used in Louisiana are sulphur, bi-sulphite of lime, lime, superphosphate of lime, superphosphate of alumina, tannin and bone black.

SULPHUR.

Sulphur is burnt and converted into sulphur dioxide, one part uniting with two parts of the oxygen of the air to form a gas which has an irritating odor, but with bleaching and antiseptic powers. Pure water dissolves under ordinary pressure 43.5 times its own volume of this gas. Cane juice under the same conditions absorbs 33. *A solution of this gas, exposed to the air absorbs oxygen, and is gradually converted into sdlphuric acid.*

In Louisiana this gas is forced by machinery into the cane juice as it comes from the mill. Laboratory experiments indicate that 1 ounce of sulphur suffices for the perfect clarification of 300 gallons of juice. Yet in daily practice this is greatly exceeded. Sulphured juices should be handled with great care and skill, since this gas is an acid, which in itself has the power of inverting sucrose, and further, is easily converted into sulphuric acid, a most energetic destroyer of sugar. Sulphured juices should therefore be worked as early as possible, and *never heated* before *being limed.* It is a good practice to run a small quantity of lime water into the juice at the mill before sulphuring, to unite with and render insoluble, any sulphuric acid formed in the combustion of sulphur, and which has escaped the wash water.

(*To be continued.*)