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The exports of sugar from the Hawaiian Islands for the first six months of 1890 have been 180,257,029 pounds, against 195,-651,835 pounds for the same period in 1890. The invoice valuation of the sugar exported for six months is given at $9,482,845.81.

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Among the changes made in the new tariff bill now pending in Congress are these: The duty on cleaned rice is reduced from 2 cents to 1½ cents, uncleaned from 1¼ cents to 1 cent, paddy unchanged at ¾ cent, broken rice from ½ cent to ¼ cent. The duties on oranges, lemons and limes are changed as follows: In packages of 1¼ cubic feet or less 13 cents per package, exceeding 1¼ and not exceeding 2½ 25 cents, exceeding 2½ and not exceeding 5, 50 cents, above 2 for every additional cubic foot 10 cents, in bulk $1.50 a thousand.

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The sale of the one-half interest in the Waikapu, (Maui), plantation is reported to have been recently made by Geo. W. Macfarlane, Esq., to Col. Claus Spreckels, who some time previous purchased the other half from the Cornwell estate. It is probable that this plantation will now be consolidated with the Hawaiian Commercial Company's large estate which adjoins it, and both be carried on under one management, which can readily be done, and at much less expense than when managed separately.

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A gentleman familiar with the treatment of the cottony cushion scale pest, which is now spreading so rapidly in this city, is expected to arrive in the steamer Australia. Whether he will bring a colony of the lady bugs is not certain, but he will, if they are obtainable in California. Another colony of these bugs is also expected from Australia by return of the steamer Alameda, Aug. 23. Persons from Southern California inform us that it does no good to cut down infested trees, and that nothing but the lady bug will exterminate these pests.

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The re-opening of the American Sugar Refinery which had been closed for several months by order of the receiver appointed by a subordinate judge, was an act of simple justice to the owners of the refinery. The fact that a large portion of Hawaiian sugars were sold to it under contract, made the case one of special interest to our planters, though we are not aware that they sustained any loss by the temporary suspension of the refinery work. It was one of those instances where even a court of justice perpetuates a wrong, for reasons best known to the judge issuing the order.

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The latest telegrams from Washington leave it still uncertain whether the sugar tariff bill will pass Congress at this session. The administration is very reluctant to give up sixty millions of duties now obtained from sugar without securing some reasonable free trade compensation from sugar producing countries. The justice of this proposition is so apparent and so reasonable that it gathers strength wherever it is discussed and understood. So far as Hawaii is concerned, we think that public sentiment here favors absolute and unrestricted free trade with the United States. And this, as we understand the question, is part of the new policy of the American Government.

SUGAR PROTECTION.

It may be justly said that no other industry has received as much protection on the continent of Europe as the growth and manufacture of sugar. No other industry, says the *American Economist*, is to-day receiving as much attention in Europe as this. The regulations governing its manufacture and growth are the subject of negotiations between the different countries, absorbing more attention than all other matters not involving vital issues of peace or war. The sugar bounty question has been the subject of an important bill in the Parliament, the motive of which was to induce European countries to abolish or so change their bounties on sugar exports as to protect English sugar refiners. Duties are levied as follows on sugars imported into European beet sugar countries, which, having gained control of the sugar trade in England, through her short sighted abolition of sugar duty, now clamour for abolition of sugar duties in the United States for the same purpose :—

	Cents per lb.
FRANCE.—On brown sugar, 98 degrees and under	4.38.
On brown above 98 degrees, and on refined	5.47.
GERMANY.—On all raw sugars	2.59.
On all refined sugars	3.25.
AUSTRIA, ETC.—On all sugar under 19 D. S.	3.27.
On 19 D. S. and over and on refined	4.36.
ITALY.—On all sugars No. 20 D. S. or less	4.65.
On all sugars above No. 20 D. S.	5.81.
NETHERLANDS.—On raw sugar 99 degrees, and on refined	4.91.
On melada and on grape sugar	3.27.
BELGIUM.—On class 4, under No. 7 D. S.	3.00.
On class 3, Nos. 7 to 10 D. S., exclusive	3.59.
On class 2, Nos. 10 to 15 D. S., exclusive	3.95.
On class 1, Nos. 15 to 18 D. S., inclusive	4.22.
On refined over No. 10, and loaves	4.49.
On refined crystallized	4.80.
SPAIN.—On sugar	5.20.
DENMARK.—On all sugar	3.89.

Duties are levied on sugar in all sugar-producing countries, ranging from 2 cents to 7 cents per pound.

It has been shown that in Austria these bounties average 1s. 8d. per cwt., in Germany 1s. per cwt., in Holland nearly 2s. per cwt., in France 4s. 10d. per cwt. All such bounties are estimated to result chiefly in protection to the home industry. Their effect, combined with the operation of other forms of encouragement, has augmented the production of beet sugar from a gross amount of 200,000 tons in 1853 to nearly 3,600,000 in 1889, of which over 1,000,000 has been produced in Germany. —*Sugar Cane.*

WITH OUR READERS.

Every planter should thoroughly acquaint himself with the wants of his soil. Soils vary very much in different localities. About twenty-five years ago, some leading planters visited Kualoa, on the other island, at the request of the owner, to examine the soil as to its suitableness for cane planting. It was unanimously decided that it would be a good site for a sugar plantation, and one was at once started. A few years' trial demonstrated that the advice given was not sound, for though two or three good crops were obtained, the enterprise proved a failure, with heavy loss to its projectors. The trouble was found to be that the soil was too shallow, and underlaid with pure sea sand.

So when Waimanalo was started as a plantation, some predicted it would result in the same way. But on the contrary, it has turned out to be one of the most profitable sugar estates in the Kingdom, because it possesses a good depth of virgin soil from the mountains back of it. Still this, like all other sugar, banana or rice plantations, will require fertilizers to insure paying crops.

On page 305 is a paper by Prof. Ross of Louisiana on fertilizers, which will impart valuable information on this subject. There are various kinds of fertilizers used on our plantations, some better adapted to certain soils than to others. Trial alone can furnish a reliable test of the value of each, and in the testing of them full data should be obtained, as generally the wants of the soil vary in different localities and elevations, even in the same district. In this number four different kinds are advertised, each suited, no doubt, to some soils.

Two years ago we published the story of the origin and growth of Captain Baker's banana enterprise in Jamaica, which, from a small beginning of 2000 bunches per month, shipped to Boston in schooners, has increased to give business to a line of large steamers, carrying 200,000 bunches monthly to Boston and New York. On page 316 will be found some information regarding the kind of fruit which he has found to be the best for the American trade. It is called the "Jamaica banana," a very sweet variety, which we do not recognize, and yet it may be growing here. It would be well if some one interested in the trade would introduce a few barrels of the roots of the "Jamaica," and give it a fair trial. The only variety raised here for export is the "Chinese," which may be the best we have, and yet be far inferior to what the Eastern appetite calls for. The size and weight of the bunches are given on page 318, first class bunches having 142 bananas, second class 121, and third class 102. The number of bananas on each is large, but we think the weight of some of our bunches exceeds that given above. However, the account is instructive, and gives some new points.

Every planter should read the article on page 321 on the diseases of sugar canes, for sooner or later we shall have to contend with them. Everybody has noticed the white *Aphis*, which is often found in our fields, some seasons worse than others. So far no great harm has been done by it, but in case it should increase, or develope into something worse, it will become necessary to attack it, and the experience in other countries with these pests will prove of service.

Who does not love coffee, and who does not wish to see an impetus given to the growth of it here? We are glad to learn from various sources that there is less blight now than formerly, and that the trees in Kona and other sections are looking well and bearing well. On page 327 will be found an article which contains some information relating to the Liberian coffee, which is said to be proof against the pest and blights which have destroyed so many trees and fond hopes. Has the real Liberian coffee been tried here? If it has, will any of our readers who know of the trial give us the result. Hawaii, and especially Kona, possesses just the soil, climate and moisture for growing it, and along the sea-shore just the sun and air to dry it and impart to it the rich aroma possessed by the genuine "Mocha," which it resembles so closely that connoisseurs can hardly decide which is the best. Let us make another effort to establish a coffee plantation, assisted by government subsidy, and give the enterprise a fair trial. If successful, there "are millions in it," for coffee is scarce and wanted, even at 20 cents a pound.

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STEADY STEAMING.

There are few things in which steadiness is a most desirable quality. In the engine, regularity of motion is for nearly every purpose an absolute requirement, but what is a most amazing feature of modern engineering is that people who will haggle about the regulation of their engine down to a quarter of one per cent of a revolution, will make or put in boilers which are as spasmodic in their steam supply as an intermittent spring, and as violent and local in their circulation as a geyser.

Where a boiler will take almost any kind of water, and about anything in the way of fuel to be changed every few minutes, as in such places as umbrella handle and cane manufactories, where they must burn the waste as fast as made, when, under these circumstances, it will keep right on, quarter of an hour after quarter of an hour, furnishing just about the same amount and kind of steam, that is a good boiler to tie to in many respects. The boiler that blows for part of the time and slows up the whole establishment at others, deranges the economy of nearly every concern in which it is placed; while the one which will show no signs of distress if steam is suddenly desired for such a "steam chewer" as a power hammer is a good thing to have about.

Some boilers will be steady so long as they have competent firemen, and then if they get a man who is not an expert will behave as badly as a spoiled child. As good firemen are very much more rare than poor ones, it is a bad feature in a boiler to have to require a professor of chemistry and a meteorologist, an athlete and a diplomat, all rolled into one, to run it.

There is in some boilers a reservoir of heat which can be drawn upon to keep up steam when the combustion is low. In some the "brick arch" over the gate serves to gasify the fuel just thrown in, and to ignite the products of combustion at such a high temperature as to make their combustion more thorough and economical. In some the walls themselves have a mass of masonry which absorbs heat from the products of combustion as long as they are above a certain temperature and volume, and as soon as they cease to receive heat, at once give it out to the shell and its contents. Every boiler has its own peculiarities, and we must remember that a good one is that of steady steaming.—*Power and Transmission.*

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THE SUGAR TARIFF AND THE BOUNTY QUESTION.

A late issue of the San Francisco *Bulletin* contains the following, which is the most sensible statement of the sugar question that we have seen :

"The latest information from Washington is that the tariff bill is not likely to come to a vote in the Senate for some weeks, possibly months. It is also furthermore stated that the President is not satisfied with some of its features, especially that of free sugar in the way proposed. It is alleged that he would rather get some things from foreign sugar raising countries in the way of reciprocity for the remission of duties on sugar.

"Whether the President has expressed any views on this subject is immaterial. The suggestion of getting something for what we relinquish is worthy of consideration. The Ways and Means Committee has argued that its proposition of free sugar means a saving of $64,000,000 per annum to the American people, equal to $1 per capita. The committee assumes, first, that the duty would be taken off from the price of sugar to the consumer, and second, that the removal of such duty would cause a corresponding reduction in the price of domestic sugars, and that these two sums are equal to the saving above reported. As an offset, the committee think the bounty proposed would amount to about $7,000,000 per annum. These are the theoretical phases of the question. Unless all precedents be set aside it is safe to say that the duty which the bill removes from sugar, amounting to $55,000,000 per annum, more or less, instead of being retained in the pockets of consumers by giving them sugar at that amount of reduction in price, would be transferred in the pockets of foreign planters, who would practically exact the same price for free sugar delivered at the Atlantic seaboard ports as is now given for duty paid sugar. That is the logic of history.

"The committee, on the other hand, says the bounty system of 2c per pound would cost only $7,000,000 per anum. This, of course, is based on the assumption that the United States would not or could not produce over 350,000,000 pounds of sugar annually, whereas, without such bounty, it is doing better than that now. If the bounty system can be considered to have any effect on the production of sugar in this country, instead of a yield of 350,000,000 pounds per annum, we may be able to produce 3,000,000,000 pounds per annum, the bounty on which would be $60,000,000. That is certainly a possibility under the bounty system. It is worth while to look the matter in the face long enough to ask and answer the question of where the money is coming from to pay the bill. We fancy that this bounty feature is not in accord with the ideas of the average American citizen. It is evident that if we go into the bounty system on sugar, producers of other articles will not be satisfied to be taxed for such an object, while the articles which they produce are not provided for in the same way. Then there is no power to make a bounty system on any article perpetual, and the idea of a sugar bounty might as well be abandoned first at last.

"Before adopting the free sugar feature of the tariff as it passed the House, it will be well for the Senate, if convinced that the people of the United States really desire the removal of the tax on sugar, to see what arrangements can be made with Cuba and other cane-growing countries on the line of reciprocity. If our Government is to relinquish a source of revenue, amounting to over $50,000,000 per annum, it is certainly wise to see what compensating advantages can be secured in the way of admitting free of duty American manufactures and produce into the sugar countries. We ought to have thought of that when removing the tax on tea and coffee. By that act we gave away a franchise worth many million dollars without getting a single dime in return. The reciprocity between this country and the Hawaiian Islands shows what can be done along this line on a larger scale. The act has resulted in stimulating the production of sugar at the Islands, and called into the field a larger population than could have possibly existed without such stimulus, and as a result we have found an enlarged market for American products at the Islands. Besides, American capital has found an avenue of investment and use at the Islands not before possible."

CORRESPONDENCE AND SELECTIONS.

THE UTILITY OF FORESTS.

Forestry preservation is a subject the interest in which is general rather than special in character, and which, therefore, stands in no danger of being pressed too persistently upon public attention. The danger, in fact, lies in the other direction; because of the lack of any urgent special interest in the subject it is more likely than not to be neglected. The matter is one also in reference to which knowledge of an accurate or scientific character is less widely diffused in the United States than it is in other countries, for while there are competent students of the science of forestry in the United States, the results of their researches have not been popularized to the extent that is desirable. Under the circumstances it may serve a useful purpose to give publicity to some of the main points of such a paper, for example, as that read before the London Society of Arts by Dr. W. Schlich, who after a competent education in the science of forestry spent upwards of twenty years in the Forest Department of India, where he rose to be Inspector-General of Forests, and afterwards became Professor of Forestry in the Royal Engineering College at Cooper's Hill, in England, and lately published the first volume of a scientific treatise on forestry.

Forests, Dr. Schlich pointed out, are of value both directly and indirectly, and the advantages arising indirectly from them are of high importance. Among the direct benefits arising from forests must be mentioned the many products which find their way into manufacture and trade, such as timber, firewood, bark for tanning, turpentine, resin, caoutchuc, gutta percha, catechu, numerous dye stuffs, flowers, fruits, fibers, grass, moss, peat, bamboos, canes, shellac, honey, wax, etc. Among the indirect advantages arising from the existence of forests may be noticed the influence which they exert on the climate, the regulation of moisture, the stability of the soil and the healthiness of a country, not to mention the improvement of scenery. The crowns of the trees which interrupt the rays of the sun and the falling rain obstruct the movement of air currents and reduce the radiation of heat during the night. The fallen leaves, flowers and fruits, together with mosses which grow in the half shade of trees, form a layer of mold or humus which protects the soil against changes of temperature and influences the movements of water and air in the soil. The roots of the trees give stability to the soil by penetrating into the soil and binding it together.

Forestry, in so far as it may be regarded as a science, is distinctly a modern one, the most important and valuable contributions to it having been made in Germany, France and Switzerland. As might be expected, there are a number of points in reference to the effects produced on soil and climate by the existence of forests upon which there is some difference of opinion, and in reference to which final conclusions are not possible. In the existing state of forestry knowledge, however, according to Dr. Schlich, the following may be set down among the advantages arising from forests, in addition to the products referred to above and the industries depending on them for their raw material:

(*a*) Forests reduce the temperature of the air and soil to a moderate extent, and render the climate more equable.

(*b*) They increase the relative humidity of the air and reduce evaporation to a considerable extent.

(*c*) They tend to increase the rainfall.

(*d*) They help to regulate the water supply, insure a more sustained feeding of springs, tend to reduce violent floods, and render the flow of water in rivers more continuous.

(*e*) They assist in preventing land slips, avalanches, the silting up of rivers and low lands, and arrest moving sands.

(*f*) They reduce the velocity of air currents, protect adjoining fields against cold or dry winds, and afford shelter to cattle, game and useful birds, and

(*g*) They assist in the production of oxygen and ozone.

These considerations should convince all reflecting men, and particularly the agricultural classes, of the importance of preventing the destruction of our forest wealth which has been proceeding at such a ruinous rate of late years. The destruction of forests is, in fact, not alone a direct destruction of one kind of wealth, but it is also an annihilation, not only of moderating influences which exert a direct effect upon the production and conservation of other kinds of wealth, but of positive safeguards against disaster, the want of which has been often felt in the past, and may be felt more seriously in the future unless the present tendency is checked.—*Bradstreets'*

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RAISINS.

Doubtless the pioneer raisin grower lived and died thousands of years ago in Asia. In ancient times the vineyards climbed the hill-tops, and were often surrounded by walls or by hedges, in order to keep out the wild beasts, such as jackals, wild boars and foxes. If allowed to enter, these animals would tread down the vines and eat and destroy the grapes. It was also customary for the vine-dresser to live within the vineyard, in a stone tower. The vintage season was the occasion of general festivity, and the towns were sometimes nearly deserted in order that the people might go to the vineyards, where, with shouts of joy, the precious grapes were being gathered in.

Probably grapes were often dried into raisins as now, in order to longer preserve them, while the greater portion of the grapes went into the wine-press. The raisins of commerce at the present time are mostly grown in countries near the Mediterranean Sea. In France, the vine is seen by the traveler more and more abundantly as he goes toward the south. Upon the mountain tops the peasants have climbed like wild goats, and have set out their vineyards, and built their huts against the rocks, and there they live in their mountain homes, surrounded by green vines and happy children.

When grapes are quite ripe they are picked from the vines in bunches, and for making raisins are placed in the sun to dry. In Malaga, grapes are said to be dumped into the sand and dust for drying—the Spaniards considering this method the best for preserving the "bloom" of the raisin. In some countries beds about 12x40 feet are prepared on the ground, on which the ripe grapes are spread to dry. Sometimes bunches are strung upon lines in the air while they dry, while other growers merely cut the bunches partially off the vine and there they shrivel up.

The best raisins are usually imported from Malaga, Spain. That the fruit may become large and of a good quality, the vines are annually pruned back, so that sometimes but two or three pounds of grapes are grown on each vine. When thoroughly dry the raisins are strictly graded, so that there are eight distinct brands. When raisins are partially dry they are dipped into a lye of wood ashes, or into soda and water, slightly salted, and mixed with a little oil. Then they are drained and again dried. The sweeter kinds of grapes are usually used for raisins, such as the sweet muscatel, sultana, etc. Many growers are mistaken in thinking that the quantity of grapes grown is of more importance than the quality. The vine, with proper care, will increase its yield from year to year, for twenty or more years, and it is of great importance that the raisin grape should have a good reputation so that it may stand high in the market and bring a good price. As in all kinds of business, knowledge and skill are needed in raisin production. The value of imported raisins amounts to millions of dollars yearly, although California has of late years begun to do its share of work toward making the import less. In 1888 there was realized, according to statistics, $100,000 from raisins in this State. These raisins are growing better yearly, and are being recognized as of good quality, and are an honor to the grower, while wine growing and making are but detrimental, and the cause of much evil, from the days of Noah until the present time.

In portions of California vineyards are abundant, and in their season the vines are loaded with ripening clusters of white and purple grapes. Many vineyards are upon side hills, and the red, mountainous, volcanic soil is said to yield a good quality of grape. Other vineyards are planted upon level ground, the owner perhaps, finding, like the Dutchman, that "de top of de hill is harder to find dan de bottom," and that it is much easier to plow in the valley than upon a hill-side. In small vineyards, where the rows are from eight to twelve feet wide, there is no difficulty in plowing between the rows, and there is sufficient room for placing the trays in which the grapes are sun-dried.

Upon a hill-side, with a southern exposure, the trays, which are usually two by three feet, and made of wood, may easily incline toward the sun. The trays each hold from twenty to twenty-five pounds of fruit, and when thus dried often make sweeter raisins than those which are artificially dried. But the latter mode of drying is a great aid in large vineyards, and excellent raisins are made from both modes. The artificial method has the advantage of having no grit or sand mixed with the raisins, as is often the case with sun-dried.

A water-tight cloth or other covering is usually necessary in foggy weather, or to cover the trays during a shower to protect the raisins from damage. When about half dried, an empty tray is brought and the full tray turned into it in such a manner as to expose the raisins upon the other side to the sun. When cured the raisins are placed in sweat-boxes, and thick paper placed between each twenty-five pounds, and they are stored for about two weeks so that the moisture left may be equalized, afterward they are packed for the market.

The artificial drier is said to be a California invention. It varies in size from that of a capacity of two or three tons to seventy-five tons or more. The drier is often used in a long drying house, one end of which is occupied by a brick furnace and the other end by a fan-wheel. The temperature is about 110 degrees, or perhaps 115 degrees. By keeping the fan-wheel in motion a current of air serves to equally distribute the heat throughout the driers. In from three to six days the fruit is properly cured. A pound of raisins is generally produced from three or four pounds of grapes.

There are many vineyards in the State of from thirty to 320 acres, and some of the owners are practical raisin growers. One grower owning 600 acres in vines, is reported as saying he expects to pack 100,000 boxes of raisins this season, and probably 260,000 boxes will be ready for the market from this State during the present year.

The raisin industry is increasing from year to year, and bids fair, if nothing prevents, to become of great value to the country. In the course of time there may be no more need of importing rasins from Mediterranean countries, because they can be produced at home.

About August or September the grape picking commences. Some vineyards employ Chinamen for this purpose. Others advertise for boys and girls when this season arrives, and many young people are glad to leave the cities to spend a few weeks in the country, with a chance of earning a little money of their own to spend as they please when they return home. If all of the grapes thus picked were made into raisins, or were used for table grapes, this business, if conducted right, might not be an injury to the young people of the State. But when they are employed to pick grapes for making wine, the moral influence is injurious to temperance principles, and parents should not allow it.—*Independent.*

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CULTIVATION OF THE OTAHEITE CANE IN GUADALOUPE.

The Guadaloupe Chamber of Agriculture has drawn up the following report, to be forwarded to the Chamber of Agriculture at St. Denis (Reunion), which had asked for information respecting the methods of planting and cultivation in use in the West Indian Islands.

The Otaheiti cane is one of the most generally cultivated in Guadaloupe, and has always been preferred. For some years, however, a sort of degeneration has been noticed in this cane, undoubtedly arising from the careless manner in which the plants have been chosen. In fact, those plants which were destined for the fresh plantations made during the time when cutting was suspended, viz., October, November and December, were almost always taken from the worst plots. Worn out, diseased and improperly cultivated canes can certainly be nothing but bad reproducers, and we should not have had to wait long before total ruin set in, had we not found a remedy for the evil.

For the last five years we have set ourselves to work to regenerate the good Otaheite cane by proper selection of plants, and are in a position to affirm that the minute attention which we had paid to this subject has already been largely rewarded. The head-shoots and cuttings bud with a strength and luxuriance which delight our planters, and give them cause to hope that before long the Otaheite cane will be completely regenerated.

The following is our mode of proceeding for these two kinds of planting. We make use of head-shoots and of shoots with two divisions of cane attached, after the leading shoot has been cut off. We confine ourselves to the two divisions, having noticed that the third produced defective buds, undoubtedly because it is less rich in sap than the two first.

The plants are always chosen from the best canes, *i.e.*, the first and second growths of planted canes. In order not to strip the plots, these are chosen from the outside of the plots, in the first row. The canes there are better developed, they stand thick on the stools, and supply plants infinitely superior to those growing inside; this fact is explained by the action of the sun and the air, and also by the larger space which these first rows have for the growth. We choose the best out of the eighteen or twenty canes of which the stools are generally composed, taking about half; we commence by cutting off the heads of the plants, and five or six days after this operation the time for putting them in the ground is indicated by the sap flowing to the eyes and causing them to swell. The first plant is cut with a length of fourteen to sixteen inches, the next two cuttings (also of the same length), when the eyes have in their turn become swollen, the rest of the cane being cut down to the ground, taking care not to injure the other canes of the stool which are intended to be retained. The portions cut down are chopped small, and form a substantial fodder much appreciated by mules. The head-plants and likewise the cuttings are put into the ground at an angle of fifteen to eighteen degrees, during the season, viz., October, November and December. It should be added that we only make use of the cuttings during this season. In January, February and March we only make use of the head-shoots, choosing them from the best canes, and being careful to leave for each shoot four or five joints previously deprived of their leaves, and the heads having also been cut off at a time when the eyes were not naturally swollen by the sap. During the dry season the eyes should not be allowed to become too large. At this time we plant *a la pince*, vertically, taking care to press the soil round the plants sufficiently close to intercept the action of the air, the plants not being less than sixteen inches long. If the ground has a clay sub-soil, as is the case with almost all the land in the Grande Terre, planting can be carried on during the greatest drouth, for the plants almost always succeed. The lower part, which is in the clay, throws out roots which cause the eyes to germinate and keep up a certain amount of vegetation up to the time of rain. Undoubtedly, however, if the drouth lasted too long (which is rarely the case,) the plants would finally succumb. We have spoken of plantings made as late as March. We have now no fear with regard to these plantings, which arrive at maturity in a good and healthy condition. The regular use of instruments for breaking up the ground, the free circulation of air permitted to the canes, the good manures supplied at the right time, the possibility of always getting the plants (which are to be obtained at this season in profusion and of the best type) to throw out shoots, are so many guarantees for. obtaining excellent results. We have on many occasions observed that the canes of January, February and March were the most healthy at the time of cutting, whilst those planted in October, November and December were considerably deficient in quantity because of the number that were spoiled. It is to be feared that many of those sent to the works are already diseased or beginning to rot; this is not perceived because the outside appears healthy. In our opinion, the best manner of proceeding is to divide the plantings as follows:—As little as possible in October, somewhat more in November, and still more in December, January and February, but little in March. We have said that a careful choice of plants is an essential condition for the improvement of the species, but we must add that a careful and intelligent cultivation contributes enormously to this improvement, more especially the use of good animal manure, and of artificial manures of the best description. But amongst the causes of the improvement which has taken place must be placed first of all the employment of cultivators, which was introduced on a large scale five years ago by our eminent compatriot, Mr. E. Souques, to whom is owing the great advances made, and the present prosperity of Guadaloupe.

The plantings being made at a distance of about five feet in every direction, these valuable implements keep the soil in a constant state of looseness, and hinder the weeds from growing in the spaces.

The cultivated lots must have drains about every six or seven yards, especially on clay soils, where the filtration of the water cannot take place naturally in the sub-soil.

Last year we made a trial of plantings, in rows, which gave very good results. We shall continue these this year in larger proportions. The width of the furrows is about two yards, the head-shoots and the cuttings are planted at a distance of three-quarters of a yard. The Haies form quickly, One of the great advantages of this mode of planting is that it allows the canes to remain in better condition.—*Sugar.*

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FERTILIZERS—SOURCES AND METHODS OF UTILIZATION.

[READ BY PROF. B. B. ROSS OF BATON ROUGE BEFORE THE LOUISIANA STATE AGRICULTURAL SOCIETY, JAN. 1890.]

Mr. President and Gentlemen of the Convention :—Two years since at Shreveport, upon the occasion of the second annual meeting of this Society, it was my pleasure to read a paper before your body upon the general subject of commercial fertilizers. The treatment of that subject at that time, however, was restricted to the limits of the term commercial fertilizers as defined in the law regulating their sale within the state of Louisiana. It is my purpose on this occasion to treat, in a more comprehensive manner, the subject of fertilizers, and to include in this discussion not only commercial manures, but also the various other compositions, mixtures and crude fertilizing materials entering into the manurial economy of the farm, but which, by the terms of the fertilizer law, are exempt from taxation. It was stated in the paper referred to that of fifteen elements entering into plant structure and contributing to plant growth all, except three, exist in comparative abundance in most soils. It is the chief desideratum, then, in the improvement of our soils by the application of manures, to furnish appropriate quantities of any or all of these three essential elements, phosphorus, potassium and nitrogen, to supply deficiencies existing in the soils in question.

Before the coming of the agricultural chemist, the farmer was dependent solely upon practical experiments, rudely and irrationally conducted, for information with regard to the adaptability of manures to soils and crops, while fertilizing materials of almost inestimable value were even left untouched and unutilized through want of knowledge of their constitution and valuable properties.

With the advent of Liebig's advanced principles of agricultural chemistry, followed by the experimental researches of Lawes & Gilbert, Boussingault, Ville and others the investigations of the composition and properties of soils and the manurial requirements of plants, have grown apace, and with the great army of experiment station workers in this country and Europe now engaged in the study of problems relating to this department of agricultural economy, the fundamental facts and principles thereof are daily becoming more patent and more widely diffused.

Indeed, scientific experimentation has progressed so far that not only can the essential elements for almost any soil or crop be prescribed, but also the form in which it can be most advantageously supplied, and under what conditions, both as regards time and mode of application. Although the practice of applying crude manures to the soil is almost as old as the cultivation of crops itself, it is only within the last few decades that an intelligent utilization of the various stores and sources of fertilizing materials has been brought about.

Of the three essential constituents of fertilizers before mentioned, phosphorus in the form of phosphoric acid is in demand in the greatest quantities. The chief sources of supply of this valuable fertilizing ingredient are at present bones, Charleston phosphate rock, natural phosphates from Navassa, Swan Island and other islands in the Caribbean sea, while the basic process for the manufacture of steel from phosphorus is annually furnishing many thousands of tons of slag, rich in phosphorus, to the European agriculturist.

In most of these substances the phosphoric acid exists to a very large extent in the form of insoluble or bone phosphate of lime, a state of combination almost entirely beyond the reach of the assimilative properties of the plant. The Charleston phosphate pulverized by the "Duc Atomizer" till its particles, crushed to impalpability, readily float in the air, is found to more readily yield its phosphoric acid to the plant than the less finely divided phosphate, and bones, when ground to a meal of moderate division of particles, are still extensively used as a source of phosphoric acid where immediate and rapid action is not deemed essential. But to place these locked up stores of nutritive wealth within easy reach of vegetable life, this state of insolubility must be changed by the intervention of chemical agencies to one of solubility, and consequent availability. This insoluble phosphate of lime, when acted upon by sulphuric acid, is converted into superphosphate of lime, which is easily soluble in water, and readily assimilable as plant food. Superphosphate of lime, acid phosphate or dissolved bone, as this product is variously termed, is chiefly manufactured at present from Charleston phosphate, raw bones, bone ash and spent bone black, and its relative consumption, as compared with that of other classes of manure, shows a large annual increase.

When in its manufacture a quantity of acid, insufficient to completely dissolve the crude phosphate, is used, the resulting superphosphate is found to contain a small proportion of insoluble phosphate of lime along with a small percentage of reduced or reverted phosphate. This reduced or reverted form of phosphoric acid is insoluble in pure water, but dissolves in solution of certain chemical salts, such as citrate of ammonia, and it is hence chemically designated as "citrate soluble" phosphoric acid. Together with soluble phosphoric acid, it constitutes what is termed by many chemists "available" phosphoric acid, though the appropriateness of the term is much questioned. While the reverted phosphoric acid may be gradually, and perhaps at length completely, utilized by the plant, it lacks the initiative diffusive properties and ready assimilability of the soluble form. It occurs along with the insoluble form in phosphate rock, natural guanos, in phosphoretic slags, in bones, in fish scraps, in cotton seed hull ashes, and various manurial waste products, and is formed in considerable proportions when a soluble phosphate is placed in a soil containing an excess of lime or oxide of iron.

In the schedule of valuations of the essential constituents of fertilizers in some of the states, no value whatever is assigned to the insoluble form of phosphoric acid, though there is no doubt but that it is of some manurial utility, especially if sufficient time is allowed for its action.

The Charleston rock, used in the manufacture of superphosphates, contains from 24 to 28 per cent of phosphoric acid, while a slightly less proportion is found in raw bones, and, as might be reasonably expected, a much larger proportion occurs in bone ash. In addition to the large proportion of phosphoric acid contained in raw bones, there is also from $3\frac{1}{2}$ to 5 per cent of nitrogen derived from the goodly quantity of organic matter present, and this nitrogen is retained in raw bone superphosphates. Of course, upon the addition of sulphuric acid to these substances, with the increase in bulk and weight of the mixture thereby occasioned, a corresponding decrease in the relative (but not absolute) quantity of phosphoric acid is noticed, and comparatively few superphosphates upon the market contain more than fifteen per cent. of available phosphoric acid.

The form of potassium most utilized by Southern farmers is Kainite, a crude product of the German salt mines, consisting chiefly of the sulphates of potash and magnesia, and the chlorides of magnesium and sodium. It is chiefly employed, either as an ingredient of the so-called manipulated fertilizers, or in composting, it being frequently applied for the latter purpose in the form of a solution in water, and where it is desired to furnish potash to the crop in a more concentrated form, the muriate sulphate, nitrate and sometimes (though rarely) the carbonate are used, the commercial muriate containing on an average an equivalent of at least 50 per cent. of potash, while the high grade sulphate contains upwards of 45 per cent. of potash.

Cotton seed hull ashes, thirty pounds of which are obtained from a ton of cotton seed, contain from 15 to 30 per cent potash and from 6 to 11 per cent phosphoric acid in addition. They are much prized at the North, being used chiefly as a tobacco fertilizer, though employed sometimes as a constituent of complete manures, in which case a loss of ammonia is almost invariably the result of their introduction into the mixture.

Potash, in ashes of various kinds, exists to a large extent as the carbonate, and on account of its easy solubility is readily leached out therefrom. The sulphate and muriate of potash come almost exclusively from the salt mines of Germany, while the nitrate, which is mostly esteemed for its large proportion of nitrogen, is derived chiefly from the nitre beds of India.

Nitrogen, while so widely diffused and universally distributed, is the most costly of the constituents of plant food. It constitutes nearly four-fifths of the air we breathe, and while all vegetable life is surrounded by this element in such prodigal profusion, like the fabled Tantalus it is unable to drink in and appropriate the rich supply of nutrition almost within its grasp. Experiments, conducted by the French agriculturist, Ville, substantiated by Dumas and others, were originally claimed to point conclusively to the assimilation of free nitrogen by the plant, and at a comparatively recent date in this country, the Storr's experiment station in Connecticut, Dr. W. O. Atwater, Director, publishes a bulletin, giving the results of a series of investigations as to the capacity of certain leguminous plants to take up and appropriate free nitrogen from the air, the conclusions drawn being favorable to the original theory of Ville. The comprehensive and continuous experiments of Lawes, Gilbert, Pugh, Bouissingault and others, however, refute the free nitrogen theory of Ville, but concede the absorbtion of this element in a combined state.

Nitrogen in artificial manures is furnished to plants in the form of ammonia in a state of combination, nitric acid, combined, in nitrates, and organic nitrogen in multitudinous forms. The ammonia salts used to the greatest extent are the sulphate and muriate, both of which are largely obtained by the treatment of the ammoniacal liquors of gas works with sulphuric and hydrochloric acids respectively, and subsequent evaporation.

The nitrates of potash and soda are both extensively used in compounding complete manures, either for the general market or for special crops. The nitrate of soda, or Chilian saltpetre, is frequently employed as a top dressing for certain cereals, and for this purpose has long been in great request in England. As both ammonia salts and nitrates are distinguished for their extreme solubility, and are easily leached from the soils by rains, they must, as a consequence, be used with great caution on soils through which the rain water percolates with little difficulty.

The sources of organic nitrogen for fertilizers are almost innumerable, and quite variable in character. The chief supply for the Southern farmer is derived from the cotton seed, crude or in the form of meal, and it affords nitrogen in its cheapest and most easily obtainable form.

In addition to the average content of 7 per cent of nitrogen, occurring in the first class meal, there is about 3 per cent. of phosphoric acid and 2 per cent. of potash, both of which are readily available as plant food.

Assigning to the potash and phosphoric acid the values given those ingredients in the fertilizer valuation schedules of the Southern states, we find the nitrogen costs only about 10 cents per pound, while the nitrogen of nitrates and ammonia salts is quoted at from 15 to 17 cents per pound in the New York market. While nitrogen, in its principal organic forms, is not as quickly available as in the more soluble forms just mentioned, nevertheless these nitrogenous organic matters, on decomposition and oxidation, yield both compounds of ammonia and of nitrate acid. Indeed, during the season when our crops are making their most rapid growth, the process of nitrification, or the conversion of nitrogen in its various forms into nitrates, is going on most actively in the soil. The same changes are produced in nitre beds, rudely constructed, by mixing waste nitrogenous organic matter with a small proportion of a weak alkali, or ashes of lime, together with a quantity of porous earth, free access of air and the presence of a little moisture being allowed. The temperature of the bed soon rises, the nitric ferment becomes active, and the nitrogen is oxidized to nitric acid, which combines with the alkali and forms a nitrate, and by leaching this mass, and evaporating the solution, nitrate is obtained as a solid residue.

A source of organic nitrogen much in demand in the North is dried blood, obtained by drying, by means of superheated steam, the blood from slaughter houses. It contained from 10 to 15 per cent nitrogen, with a very small fraction of phosphoric acid and potash, and in the soil its nitrogen becomes readily available to the needs of the plant.

Fish scrap or dry ground fish is obtained by drying and pulverizing the residue left from the extraction of oil from fish, and contains in addition to nitrogen a goodly proportion of phosphoric acid.

Tankage consists chiefly of offal from slaughter houses, and is a mixture of particles of partly cooked bone and meat deposited in tanks, in which the refuse from the butcher is treated to separate the grease. It contains good percentages of both nitrogen and phosphoric acid, the proportions of each in general varying inversely as the quantity of the other. Azotin and ammonite, prepared from slaughter house wastes, are also in some demand as sources of organic nitrogen, as well as castor pomace, the ground residue or cake resulting from the extraction of oil from the castor beam.

The availability and utility of these nitrogenous materials is largely dependent upon their mechanical condition, a fine division of their particles rendering much easier the conversion of their nitrogen into forms readily appropriated by the plant.

As before stated, none of these nitrogenous manures compare with cotton seed meal in cheapness and accessibility to the Southern planter.

An opinion has prevailed to some extent among farmers that in the extraction of oil from the seed some of the fertilizing properties of the latter are lost, and as a consequence they are somewhat prejudiced against the use of the meal. The very composition of the oil, however, shows that it has no fertilizing ingredients of value, the hulls contain little of plant food other than potash, while the true manurial constituents are concentrated in the meal, of which an average of 700 pounds is obtained from each ton of seed.

Where great distances separate the farmer from the oil mills, of course, it is frequently impracticable to transport the seed to the mill and bring back the meal, under which conditions the cotton seed itself should be returned to the soil. Every bushel of corn, oats, wheat or cotton seed, each ton of forage of whatever kind grown upon the farm exported, each animal raised upon pastures or upon forage products and sent to market all take away a certain proportion of valuable manurial ingredients from the farm, and unless an equivalent is given back in some other form, a gradual deterioration of the soil takes place, which rotation of crops and green manures may ameliorate, but cannot permanently remedy. The manure of farm animals returned to the soil compensates to a great extent for the valuable plant ingredients consumed by them and utilized by crops, but it cannot restore the quantities abstracted therefrom, and hence the necessity of importing fertilizers from external sources to fill up deficits.

It is well known that the character of the food consumed by farm animals influences the quantity of manure produced, a very large proportion of the mineral and a good proportion of the nitrogenous constituents being found in the manure itself. At the Tennessee experiment station recently some experiments were made to ascertain the relative value of manures obtained from mixed feeds, and also from a feed of cotton seed meal and hulls alone.

The value of the air-dried samples analyzed, computed from the fertilizer scale of valuations, was $11.28 and $8.02 per ton respectively, for the manure from the cotton seed meal and from the mixed feed, a difference of $3.26 in favor of the former, or an increase of more than forty per cent over the latter. Of course, the fresh samples would have only about one-fourth of the value per ton as when dry.

The material with which stalls are bedded or littered, too, exercises an appreciable effect upon the composition of stable manures, the composition of the litter itself and its power of absorption of liquid drainings being the chief factors involved. Ordinary dry straw of various kinds has about one-half to three-fourths of one per cent of nitrogen, but if placed by itself in the soil, it would yield up this element slowly. In the presence of decomposing and fermenting organic matter, however, it soon breaks up and its particles become distributed throughout the whole mass of the mixture.

The preservation of stable manures, too, is a subject to which too much importance cannot be attached, and their value is frequently much diminished from careless handling. At the Cornell University Experiment Station, quite recently, some tests were made to ascertain losses occasioned by the reckless exposure of loose piles of stable manures to wind and weather. At the end of six months' time, it was found that a ton of the material had, through decrease in bulk and loss of valuable constituents, deteriorated in value 42 per cent, this valuation being determined as before according to the schedule of fertilizer valuations. A sample of average farm yard manure, containing about one-third of its weight of dry matter, has an average content of about one-half per cent. nitrogen, one-quarter to three per cent. of phosphoric acid, and one-half per cent potash. A more thoroughly dried manure would, of course, however, exhibit larger percentages of these constituents.

Throughout the South, at present, stable manure is extensively used as an ingredient of compost, together with cotton seed, acid phosphate, Kainite and other substances, which are used chiefly to furnish potash and phosphoric acid to the mixture. A compost prepared for cotton according to the formula of Dr. Stubbs consists of 100 bushels of stable manure, 100 bushels of cotton seed and a ton of first class acid phosphate, arranged in alternate layers, and the heap covered with rich earth. The cotton seed is moistened thoroughly, and in case Kainite is added, it is supplied in the form of a solution in water. Decomposing organic matter in the form of leaves, pine straw, etc., are frequently added, and sometimes the heap is moistened with stable drainings. The heap is protected from rains by a shelter, and fermentation, soon setting in, renders more readily available constituents which would otherwise be slowly appropriated as plant food.

For corn a compost containing double the quantities of cotton seed meal and stable manure used in the compost for cotton is recommended, as the former needs larger supplies of nitrogen nearer the surface. In the place of acid phosphate in composts, phosphatic marls and green sands have been utilized in some sections of the country, contiguous deposits of the latter substance, in which case the heap is left undisturbed for a much greater length of time than usual.

Marls consist chiefly of carbonate of lime, together with sand, clay and varying small proportions of phosphate of lime. They are of comparatively abundant occurrence in some sections, and are utilized chiefly for the lime they contain, though they afford minute quantities of potash and phosphoric acid.

Lime itself is an essential constituent in soils, but, being present in sufficient quantities in most soils, it is rarely applied artificially. It is what is termed a stimulant manure, in contradistinction to nutritive manures, such as nitric, potassic and phosphatic manures. It serves to correct the acidity of so-called "sour" soils, to decompose and break up compounds in the soil, liberating elements essential to plant life, otherwise unavailable; aiding the transformation of vegetable matter into humus, and the retention of the homus formed, and improving the physical condition of the soil. It is also believed to check the "running to weed" of plants and to increase the fruiting tendency. Soils containing less than one per cent. are considered by Dr. Hilgard deficient in this ingredient, and, of course, this deficiency must be supplied artificially. Ville classes lime along with nitrogen, potash and phosphorus among the absolutely essential constituents of fertilizers, but the addition of lime to soils already containing a superabundance of this substance is an unnecessary expenditure of time and labor.

Sulphate of lime, or gypsum, commonly known as land plaster, is in some demand in certain portions of the country as a fertilizer for clover, some other forage plants and some of the cereals, being utilized chiefly as a top dressing. It is sometimes applied as a covering for compost and manure heaps, fixing certain volatile ammonia compounds which would otherwise escape. Certain soils are quite strongly impregnated with gypsum, and quite appreciable quantities of it are found in the soils of the Red River valley. Commercial plaster rarely contains more than 75 or 80 per cent of pure sulphate of lime, the Nova Scotia plaster being the most highly esteemed. Superphosphates invariably possess a large proportion of gypsum, this substance being produced in considerable quantities as the result of the action of the sulphuric acid upon the bone phosphate.

On farms adjacent to swamps or low marshy bottoms where a dense vegetable growth has prevailed, mucks form a desirable portion of the manurial supply, and in some countries of Europe they are even an article of commerce.

Mucks owe their value chiefly to the quantity of vegetable matter they contain, and the character of vegetable growth from which they are derived influences appreciably their composition, which is not at all constant, the per cent of nitrogen varying from one-half in low grade mucks to four per cent. in mucks of extreme richness.

There are, in addition, small quantities of mineral constituents of value, though of small importance as compared with the organic matter which is a ready source of humus.

The thoroughly air dried muck is either composted with lime, stable manure, or superphosphate, or is used as a bedding in stables, it being especially adapted to this purpose on account of its great absorbent powers, readily taking up and retaining liquid manures without loss of ammonia. In addition to all of the manures heretofore enumerated, in many localities incidental manurial supplies are met with, sometimes of great importance to the agricultural economy of the neighborhood.

For instant, in some sections of Louisiana we frequently find in the attics or lofts of long unused buildings considerable deposits of bat manures of high fertilizing value. Several years since, several tons of this substance were removed from a building on the grounds of the State University at Baton Rouge, a sample of which, when analyzed, showed a calculated commercial value of $40.78 per ton. Used as a top dressing for clovers, grasses, etc., most excellent results followed its application.

Did I not fear transgressing the limits of my time and subject, I might dwell for a moment upon the advantages of green manures, whose chief province is to furnish humus to the soil, and to yield up to the subsequent crop stores of nitrogen and other plant food, gathered by roots reaching far beneath the surface, and conserved by the whole plant. Prof. Hutchinson, now of the Mississippi Agricultural College, at the Shreveport meeting gave the results of experiments showing that a crop of peas turned under furnished the same amount of valuable fertilizing ingredients to the soil, per acre, as 920 pounds of cotton seed meal and 770 pounds of Kainite.

While the consumption of commercial fertilizers is constantly increasing, the annual demand in this country having reached a million of tons, and while this increased consumption has been marked by the recuperation of exhausted soils, and larger yields of the staple crop per acre, still the natural manurial resources of the farm must not be neglected and set at naught, but all waste and refuse material must be utilized and their fertilizing properties developed.

In all enterprises and industries to-day, all waste and incidental products must be advantageously disposed of in order to best insure the success of the industry itself. The cotton-seed oil mill keeps its ponderous machinery in motion by burning the formerly worthless hulls in its furnaces; the rice mills use the chaff, heretofore blown before the winds, to raise steam in their boilers, and in the sugar house the costly coal has been to a great extent supplanted as fuel by the waste bagasse, while the filter press sends to the evaporator large quantities of rich saccharine matter which formerly found its way to the scum ditches; indeed, diffusion itself has even seemed to halt, pending the satisfactory combustion of the exhausted cane chips. So the successful farmer must utilize in the manure bed and compost heap waste materials and refuse by-products, so to speak, which are often disregarded.

These crude materials, whether marl or muck, manure from the stable or pen, or other waste organic substances, animal or vegetable, if employed intelligently in conjunction with commercial fertilizers, will give results more than commensurate with the expenditure of time, labor and money.

In conclusion, if the rational system of agriculture, inaugurated and encouraged by the experiment stations of the state, under the supervision of their able director, be followed by the farmers of Louisiana, the coming years will find her rich soils even more fertile, and her teeming harvests even more bounteous.—*Proceedings of the Louisiana State Ag. Society.*

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THE JAMAICA BANANA.

When Capt. Baker, of the Boston Fruit Company, visited Demerara, in February last, he described the character of the banana grown in Jamaica for export, laying special stress on its adaptability for shipping, owing to the peculiarity which it possessed over other varieties, of the fruit lying quite in a line with the stalk, which feature saved it from injury in careful handling. Capt. Baker further said that he saw no banana here that possessed this feature in the same complete degree. As we possess several varieties of banana, in which the character described by Capt. Baker is more or less marked, I asked him to be good enough on his return to Jamaica to send down half a dozen bunches of the Jamaica variety, so that we might determine with certainty whether that kind was amongst those cultivated here or not. By last mail these bunches arrived, and have since been on view at the Museum and Exchange Rooms. These show that we have got the same banana, introduced too, apparently from Jamaica, as it is known by the name of "Jamaica banana" but it is not common, and the fruit is not so much appreciated as is that of the commoner kinds. There is no other kind of banana, however, known to me in which the fruit is so completely reflexed, lying back quite in a line and parallel with the stalk. As a consequence of this horizontal direction, when a bunch is laid down, the bananas which touch the surface, rest almost their full length upon it, and have consequently no strain upon any part, which would tend to cause them to break, as have other kinds which do not so completely possess this character. As every observer knows, the fruit of the banana reverses its direction in growth, for when first formed it is turned down the line of the axis or stalk upon which it is borne. It is barely formed, however, and the flower has hardly withered, before it begins to turn outward from the axis, gradually going on till it reaches the angle at which it is to remain. In certain varieties this position is at a right angle with the stalk, thus completing a quarter circle in the range. But the majority curve more or less decidedly backward, covering more than a quarter circle, and in most of the varieties some degree of curve is maintained by the individual fruits to the end. The Jamaica banana, however, as I have before said, goes beyond this degree of curve, lies quite back against the stalk, making the entire half circle of range, and is straight, thus reversing completely the direction it was born in.

The individaul bananas of this kind are larger than those of the majority of kinds, and in external appearance resemble more a maiden plantain of medium size than a banana. They are, as I have said, straight, or only curved at the inner end, where attached to the stalk, markedly angular, the ribs conspicuous and more ar less sharp, four to five in number, making the surface quadragonal or pentagonal, the sides being nearly flat. The outer end is rather suddenly narrowed, with a larger scar where the flower has dropped, than is usual in other kinds. In weight they vary from three to four and one-half or five ounces each, in length from six to seven inches, and in girth from four to five inches. The color, when ripe, is that of a plantain—yellow, with a slightly green tinge in it. The flesh is short, moderately firm, but melting, sugar-yellow, and exceedingly sweet—too sweet in fact, to please a fastidious taste. It seems to be a good keeping kind. One bunch ripened on the twelfth day, two on the fifteenth and sixteenth, at which time the other three still remained green, and seemed to promise to keep three or four days longer. But they were all evidently cut before they were quite "full." Of the three bunches exhibited in the Museum, which were selected by Capt. Baker as of average market size, Mr. Quelch has kindly taken the following details for me:

	Class I.		Class II.		Class III.
Weight of bunch......	39 lbs. 12 oz.		34 lbs. 14 oz.		26 lbs. 8 oz.
No hands on bunch.......	9		8		7
No bananas on bunch.....	142		121		102
1st hand had..............	18	1st hand had..	18	1st hand had..	16
2d "	18	2d " ..	16	2d " ..	16
3d "	16	3d " ..	15	3d " ..	14
4th "	16	4th " ..	16	4th " ..	14
5th "	15	5th " ..	15	5th " ..	14
6th "	14	6th " ..	14	6th " ..	15
7th "	14	7th " ..	13	7th " ..	13
8th "	15	8th " ..	14		
9th "	16				

Sweetness is an essential quality of a good fruit, but it does not constitute all that is required, the palate demands a distinctive flavor as well. This some of our local bananas afford in a mild form, and one or two of them very decidedly, and in this I regard these kinds as superior in quality to that in question. But, as Mr. Barr pointed out at the last meeting of the Banana Commission, in trade one must supply what the market requires, not what one's personal predelictions or taste might lead one to think best. It is therefore to our interest, in view of an export fruit trade becoming established, to grow the Jamaica banana for the purpose. As the plant is known here under the name of "Jamaica banana," and is likely to continue to be called by that name, I may as well here give its synonym as far as this is known to me. In Jamaica it is known under the names "Martinique banana," and "Lady's finger." The banana in Trinidad known as "Gros Michel" is supposed to be the same, but I am not sure that the name is applied with certainty, probably not, as large quantities of suckers of the undoubted kind were, a year ago, imported by the Trinidad Government, from Jamaica. With the six bunches of fruit mentioned, Capt. Baker sent down thirty barrels of banana suckers, twenty of which Capt. White, his agent here, gave to the Banana Commission. The barrels contained an average of forty-four suckers each, which are being propagated for future distribution.

The question of establishing an export fruit trade has, however, at present reached a critical stage. When discussing the question of a contract, on his visit here in February, Capt. Baker mentioned a simple business precaution that the Company which he represented would require, namely, that if they guaranteed to bring steamers here for fruit at fixed intervals, they should have an assurance from us that sufficient land would be placed under banana cultivation to produce the quantity of fruit required to load their steamers with due expedition on arrival. This being a vital point, the Banana Commission decided, at its last meeting, to ascertain officially, by public advertisement, what quantity of land cultivators were prepared to devote, under assurance, for a period of five years—the proposed duration of the contract—to banana cultivation. As a result the Commission has received three offers, two of ten acres each, and one of five acres—twenty-five acres in all out of the minimum of 3,000 required. Whether this holding back on the part of cultivators is due to apathy and indifference on the subject, or only to indecision as to whether the business will pay or not, I can't say, but at any rate it is unfortunate, for it is the point on which the matter at present hinges. If we fail to show the Boston, or any other Fruit Company that may come in, that the fruit will be forthcoming when required, it is not likely to take up the contract; but even if any Company were so willing, the Government is not likely to commit the folly of giving away a subsidy of $25,000 per year to carry fruit with the obvious fact before its eyes that there will be no fruit to carry. It therefore rests now with cultivators whether the matter shall proceed further or not.—*Demerara Argosy.*

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PROPOSED BEET SUGAR EXPERIMENT IN LOUISIANA.

At the June meeting of the Louisiana Sugar Planters' Association, Prof. B. B. Ross read a paper on the cultivation of sugar beets in the United States and the manufacture of sugar therefrom, prepared by Prof Von Tresckow. The paper treated fully of the subject and the following are but extracts from it.:

What great advantage it would be for Louisiana planters through acclimatization of the sugar beet, besides the cane, to work two crops every year in their sugar-houses.

According to Dr. Stubbs there would be too many obstacles in the way to the realization of this idea, but such should not discourage any one from further experimenting in order to fully demonstrate and prove the success or failure of this important industry in our midst. In Europe it has taken many years to bring the beet industry to its present great importance, and that only through science and perseverance which must surely be well known to all present.

Perhaps one reason for failure in Louisiana so far, lies in the fact that it may take several years to properly acclimatize the sugar beets, or to find out the most suitable season for growing them here. In these I do not hesitate to state that former experiments in Louisiana and some other States did not receive the proper attention, nor were the experimenters familiar enough with their subject.

The soil in Louisiana, according to many analyses from various districts made by me during the last two years, I find very suitable for sugar beets. The experiment of growing sugar beets, which I made last year at Cinclare, carried out under the most unfavorable circumstances and on unfertilized soil, cannot be considered a failure in the least degree. The beets reached a maximum of 13½ per cent of sucrose. Afterward, in consequence of receiving no attention, during my absence in Europe, and coming to maturity by throwing new leaves and growing into seed, their sucrose contents quickly fell off. Special attention must be paid to the beets during the maturing period, which, however, is easily known by the leaves becoming yellow and flappy. Whenever this occurs the beets must at once be removed from the soil.

Spain, a country which, till within a few years, was considered unsuitable for growing beets, is making rapid strides with great success, and that in the same localities where they grow cane.

In 1889 there were in Spain three beet factories in operation and this year eight more factories are being erected.

In Europe the expenses of cultivating sugar beets are about $50 per acre, and the revenue from an acre $73, leaving a net profit of $23 per acre to the farmer, but if he has an interest in the sugar factory, as is usually the case, his profits are considerably increased.

In the United States the profits have a better show, according to the reports from Watsonville, in California, where from the sale of the beets it amounted to from $35 to $43 per acre.

Beet culture has a decided advantage over cane in so far as capital is concerned. The beet seed costs only $2.50 per acre; the total crop is sold every year. A flood can only ruin one crop, and even then there may be made some other crop in such a year, still leaving the land ready for a full crop of beets the following year.

The pulp from the beet sugar factory amounts to from thirty to forty per cent of the weight of the beets treated in the factory; the leaves and heads left in the field come to one-fifth or one-quarter of the total weight of the beets. These articles are not included in my figures of earnings, but are of great value to the grower as "cattle food."

The climate most suitable for beet culture was formerly believed to lie between the forty-seventh and fifty-fourth degrees north latitude, but in recent years it has been found that both lines may be streched, as proved by the success in Sweden, Spain and Italy. The average temperature for the beet growing is about sixty-five degrees Fahrenheit. The most suitable weather, as found during many years of careful observation, is for the first period warm and moist, in order to produce quick germination of the seed, thereafter rainy weather to produce size; and during the ripening period warm and dry, in order to increase the sucrose content.—*Sugar Bowl, Jan. 21.*

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*MITES AND DISEASES OF SUGAR CANE.**

Specimens of mites affecting sugar canes at Barbados were forwarded to Kew by Mr. John R. Bovell, Superintendent of Dodd's Botanical Station. The Mites were found to affect specimen canes under experimental trial at the station, as well as on two neighboring estates. It was estimated by Mr. Bovell that canes affected with mites would yield only about one ton of sugar per acre, as against three tons per acre from unaffected canes growing on the same estates under identical conditions in regard to soil, manure and tillage. The mites

*As a contribution to our knowledge of the pests affecting the sugar cane, I reprint this article from the *Kew Bulletin* for April. Mr. Bovell sent me a specimen of Acari two months ago, but I did not recognize it as a local pest. Whether it is or not, after reading this article planters will now be able to determine.—ED. ARGOSY.

are very minute, and usually live under the leaf-sheaths of the canes. They are doubtless present in many other sugar-producing countries, but have escaped notice. The specimens received from Barbados have been very exhaustively examined by Mr. A. D. Michael, F.L.S., who has kindly prepared the following valuable report on the subject:—

Mr. Bovell's excellently packed box reached me with the various creatures alive, and apparently uninjured. I found upon the canes five sorts of Acari, viz:—

1. *Histiostoma rostro-serratus.*—This is a small opaque white mite often found in great numbers. It may be disregarded, as it is a follower, not a causer, of decay. It is only useful to mention it, in order that it may not be mistaken for the real enemy. The best drawing of it I know is in a paper by Megnin, "Memoire anatomique et zoologique sur un Nouvel Acarien de la famile des Sarcopsides, etc.," in Robin's *Journal de l'Anatomie et de la Physiologie*, 1876, p. 369.

2. Numerous forms of immature *Gamasidæ.*—These are friends, being predatory creatures, doubtless present to feed upon the real destroyers. The *Gamasidæ* vary greatly, but drawings of type species may be found in any book on *Acari.*

3. The *Damæus* or *Notaspis*, originally sent by Mr. Bovell.—This I found in all stages, and from the position in which it was found and the parts it was feeding on, I am decidedly of opinion, as Mr. Bovell supposes, they were doing damage. But in the canes sent the numbers of these *Acari* are small—certainly not sufficient to account for the extensive damage spoken of by Mr. Bovell; and, looking at the analogy of the allied species, I am still of opinion that this species is probably not the principal cause of the evil.

4. Two species of *Tarsonymus.*—Acari of this genus are almost invariably great destroyers of vegetable life. They are extremely minute and almost transparent, and, therefore, are likely to escape the notice of any one except a practised microscopist, or a person specially looking for them and provided with sufficient microscopical instruments. These *Tarsonymi* were absolutely swarming upon every sample of the cane sent, they were in all stages. They were chiefly found in the axils of the leaves. The larger species is certainly identical with the *Acarus* which Dr. Bancroft found doing such serious damage to

the growing sugar-cane in Queensland, and which is unnamed, but ought fairly to be called *Tarsonymus Bancrofti.* Dr. Bancroft evidently had not sufficient knowledge of the *Acarina* to know what family his mite belonged to, but he appended drawings to his report, which are good, and render the nature of the creature quite unmistakable. (2nd Annual Report of the Board Appointed to Inquire into the Causes of Diseases Affecting Live Stock and Plants, Queensland, 1877.) I believe this *Tarsonymus* to be the principal destroyer. There are present in the canes (in addition to the *Acari*) a large number of *Anguillulæ.* It should not be forgotten that although these are probably as a rule followers of decay, yet they are often causers of it.

All the specimens of cane sent were in a tolerably advanced state of the disease, and consequently of decay. It would be well worth Mr. Bovell's while to examine specimens in which the disease was only just commencing, and even the neighboring canes which still appeared healthy, so as to ascertain, if possible, which creature commences the evil. If he has not the means of doing this, I should be happy to assist him.

With regard to the important questions of how to cure the evil the same means would probably be applicable to the *Damæus* and the *Tarsonymus.* The latter would be more easy to destroy than the former, as the hard cuticle of the adult *Damæus* is practically impervious to chemicals. Boiling water and dessication are at once destructive of life in both species. These means, however, of course cannot be employed on the canes, but might sometimes be useful with infected material to be used as dressings, etc. The means employed by Dr. Bancroft were steeping the canes before planting in carbolic acid and water for 24 hours. The strength he was trying was 1 pound of acid to 100 gallons of water; he also tried prolonged immersion in lime dip (milk of lime). These means are probably as good as any that can be adopted, but a mixture of powdered sulphur in soap and water is also a very good destroyer of this class of life. Whatever chemicals be employed I would suggest that it would be desirable, where possible, instead of applying the remedy once only, to do so two or three times at intervals of, say, a fortnight, because the eggs of *Acari* have a shell which, as a rule, is quite impenetrable to chemicals, and therefore, although the larvæ and adults may be destroyed, the eggs survive; and to really clear the plant it is necessary to catch the larvæ when they emerge from these eggs. Of course, infected *debris* should be burned.

As Mr. Michael's very complete investigation also incidentally clears up what was doubtful in the long mysterious "Red Rust" of the Queensland canes, it will be convenient to reprint here, from the Kew reports for 1877 and 1878, the account therein given of its investigation.

ABSTRACT FROM THE REPORT ON THE CONDITIONS AND PROGRESS OF THE ROYAL GARDENS, KEW, DURING THE YEAR 1877, PP. 37–38.

The disease which I mentioned in my last report as having inflicted great injury on the sugar cane in Queensland, (where it is known as "rust") has engaged a good deal of our attention. The examination of the numerous documents, both printed and written, which have come into my hands, as well as the specimens of diseased cane, unfortunately far from satisfactory, which have been transmitted to us from the Colony, have led to the following conclusions, which have already been communicated to the Queensland Government:—

1. It appears not improbable that the disease is identical with one which had been noticed in the Malayan Archipelago, and in Mauritius (*Journal Royal Horticultural Society*, New Series, vol. ii., pp. 131–132), in the Society Islands according to Professor Liversedge, and in Bahia (*Journal Royal Horticultural Society*, New Series, vol. iii., pp. 14–17).

2. It is recognized by the appearance on the leaves of red spots known as "rust," which increase in number till the whole leaf withers, and ultimately dies. When the leaf is stripped off, there is usually found inside the sheath and upon the stem a patch of dark brown or reddish incrustation.

Professor Liversedge of the University of Sydney has studied the disease, and attributed it to defective conditions of cultivation. He considers that the marks on the leaves, and the red incrustations on the stem, are caused by a fungus of the family *Æcidiacei*, but that its attacks are the effect and not the cause of the disease. Professor Liversedge also noted the presence of acari, which he believed fed on the fungi.

3. Dr. Bancroft, in a paper presented to the Queensland Par-

liament in 1876, distinguished between the disease as affecting the leaf and stem. He found that the red spots on the leaves eventually produced a fungus with black spores, and he attributed the spots to its attacks. The red incrustation on the stem he also believed to be fungoid, but was unable to throw any further light upon its cause; he detected mites *(acari)* at the injured spots.

4. In a subsequent paper *(Sugar Cane,* 1877, pp. 476–480), Dr. Bancroft has shown, I think, most conclusively that the red incrustation is the result of the attack of an *acarus* which infests the young shoots of the diseased sugar cane in immense numbers.

5. The specimens sent to this country had been carefully examined before Dr. Bancroft's paper appeared here in print. The Rev. M. J. Berkeley and Mr. Broome, two well-known crytogamists, satisfied themselves that the red incrustation was in no way due to a fungus, and were disposed to attribute it to the attack of a coccus.

6. Specimens were then submitted to Mr. McLachlan, F.R.S., by whom they were sent to M. Signoret, the best living authority on the *Coccidæ.* He arrived at the opinion that the red incrustation was not the work of a *coccus*, a view in which Mr. McLachlan concurred. On a further examination of some of the specimens Mr. McLachlan stated in a letter (September 14th, 1877) that he had found "myriads of what may be collapsed *acari.*"

7. This was independent of, and so far confirmatory of, the observations made by Dr. Bancroft. I think, therefore, that it is probable that the true cause of the so-called "rust" has now been detected. The sugar cane being grown from joints, the acarus would easily be communicated from one crop to another. Dr. Bancroft finds that steeping the joints in milk of lime destroys the acarus, and probably a mixture of two to four ounces of fluid carbolic acid to a gallon of water would be still more effective.

8. The black spored fungus eventually produced by the red spots on the leaves is regarded by Mr. Berkeley as a new species, to which he has given the name of *Dupazea sacchari;* he does not consider that it plays any part in the disease, but simply takes possession of the already moribund tissues.

EXTRACT FROM THE REPORT ON THE PROGRESS AND CONDITION OF THE ROYAL GARDENS, KEW, DURING THE YEAR 1878, PP. 48–49.

In the Kew Report for 1877 the history of the various insect pests which had proven so injurious to the sugar cane in Queensland was given in some detail.

During the past year a further correspondence has taken place upon the subject between this establishment and the Colonial office, and a large series of specimens, carefully selected and sent over to this country in various preservative fluids by Mr. J. Staiger, F.L.S., Government Analytical Chemist, has received for examination.

It appears now to be placed beyond question that the "rust" is due to the puncture of a minute acarus which exists upon the diseased cane in myriads. The exact scientific determination of this parasite would be, as I am informed by Mr. McLachlan, F.R.S., who has again most obligingly assisted us in this matter, a point requiring research of some difficulty. Mr. McLachlan states, however, that the "creature looks very like a *Tyroglyphus,* but the habits do not altogether accord with those of that genus."

I am to state that the treatment with lime suggested by Dr. Bancroft, and that with carbolic acid recommended in the Kew Report for 1877 (p. 38), promises to be quite effectual in keeping this pest under control. Mr. MacKay reports to the Legislative Council of Queensland the results of experiments upon diseased canes subjected to the following treatment directed by Dr. Bancroft, which I quote here as likely to be efficacious in other colonies:—

"Clean the joints entirely from all trash as carefully as possible. 2. Immerse for 24 hours in water and carbolic acid at a temperature to bear the hand—1 pound of acid to 50 gallons of water. 3. Make milk of lime—2 pounds of lime to 1 gallon of water; immerse the plants in this for a few minutes. 4. Lift out and spread in the sun, turning them over to dry for one day before planting.

"Out of 24 different varieties of cane so treated I am glad to say that all except two have come up sound and healthy, and the two are but slightly touched with the disease, a few spots only showing on the outer ends of the leaves, while the heart of the cane is quite green and healthy. The old stools or roots from which were taken the plants so treated have all come up diseased, some of them died out, so that there can be no doubt that the mixture had its effect."—*Demerara Argosy, May 10.*

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THE COFFEE PLANT.

Coffee has long been a favorite subject for experiments in tropical agriculture, and it would appear from an announcement just made that its successful growth in the New Hebrides is now an accomplished fact. The beans sent by the authorities of Kew Gardens to the Colonial Institute are, it is true, rather small, but from their general appearance, and the character of the soil, great expectations are formed by experts regarding the latest of the many localities into which the famous Arabian plant has been introduced. Hurricanes aside, and these tropical storms are serious factors in the planter's calculations—there can be no reason for doubting the soundness of the estimate. Bananas, sugar, arrowroot, oranges and other products of the sun-lands have already proved quite suitable for the climate; and as tropical islands, especially if a little damp, are considered the best spots for coffee-growing, the New Hebrides need not be considered an exception to the rule. We fear, however, that if this oft-coveted group becomes attractive to planters, the question of its independence will once more come to the front. The species imported into the islands is, we presume, the Liberian coffee. Indeed, to experiment with any other would be to risk discouragement, since, apart from its merits as a crop, the West African coffee has, as yet, alone resisted the disease which has ruined so many plantations of the Arabian species.

Ceylon, not many years ago, attracted a large amount of British capital, and for a long time it appeared as if this rich Indian island was to be the greatest of all the coffee-growing regions of the world. But before long the woes of the planter began. The Golunda rat gnawed the trees, and the coffee bug played havoc with the beans. Then came the worst of all its pests, in the shape of the leaf fungi, which all but completed the destruction of what the others had spared. The result is that tea, instead of coffee, is now the staple of the Singalese planters, and, happily, for the present the Chinese herb bids fair to more than compensate for the loss sustained by the Arabian tree.

The Liberian coffee-plant is, curiously enough, free from the parasite attacks, possibly because, being more recently reclaimed from a state of nature, its constitution is less enfeebled than the old variety, which has been cultivated for at least a thousand years, though in Arabia it does not date further back than the early part of the fifteenth century. The Liberian plant has, in addition, the advantage of being very prolific in highly aromatic beans, and as it loves low lands, it can be grown at altitudes unsuitable for the Arabian coffee, the native country of which is the uplands of Abyssinia. But something more than climate is necessary to a profitable coffee plantation. It requires a well-watered mountain slope not much over 25 degrees from the equator, and between 1000 feet and 4000 feet above the sea, where the mean temperature is not less than 55 degrees. Then the soil must be friable and well drained, and enriched by the fresh loam which is being constantly washed down the hill-slope by the tropical rains. In Quito and Peru, no doubt, there are plantations at a height of 6000 feet on the Andes. But even at this elevation in such a climate frost is unknown. Moisture is especially necessary, and if the rainfall be deficient the ground must at intervals be carefully irrigated.

For at least three years after the seedlings are set out no return can be expected, while the labor of the cultivator in weeding, cleaning, pruning, draining and "handling" the plants generally has to be unremitting, if his hopes are not to be doomed to disappointment. In the third year the little shrubs begin to yield a remunerative crop. Yet, even at the best of times, the ordinary Arabian variety cannot be reckoned upon to bear more than from one and a half to two pounds of berries in a season, though much depends upon the climate, soil and situation. The Liberian species is said to sometimes bear as much as sixteen pounds of marketable beans during the eight months it continues to flower. Three gatherings are usually made every year, since the berries, owing to the circumstances mentioned, may at any period be of unequal ripeness. These operations naturally require great care, judgment and experience, for the value of coffee depends entirely upon its flavor, and such a seeming trifle as not cutting off the irrigating streams at the proper time will injure the aroma of the berries, while a deficiency in the water supply or the presence of weeds between the rows is equally apt to reduce their dimensions. The latter point is vital, for the shape, size and color of the beans are among the principal elements which determine the value of a crop, and are affected by very trivial circumstances. Then the shape seems related to the particular part of the plant upon which the berry grows, the size and succulence on the nature of the locality, while the color has, according to the investigations of Mr. Hiern, reference to the degree of maturity which the fruit has attained at the time of gathering. The nicety with which the beans are sun-dried and passed between rollers, in order to remove the external pulp and the membrane enclosing them, has also an influence on the esteem in which they are held.

Thus we have the matchless Mocha coffee from Arabia, easily distinguished by its small greenish-grey beans; Java and East India, with large yellow ones; Jamaica, with beans rather smaller and greener; Bourbon, distinguished by its pale yellow and almost whitish beans; and Surinam coffee, in which the beans are larger than in any other kind. But in these and a score of other varieties there are various grades of quality—"fine," "middling," "ordinary," "low," and "triage," the last being broken seeds. The New Hebrides have, therefore, a good many preliminary obstacles to overcome before they can manage to find a recognized place among the coffee-growing countries of the world. We are, indeed, doubtful whether the mere circumstance that the islands, or any of them, may be able to harvest a salable crop of the bean is anything more than an interesting scientific fact, unless the crop can be put on the market at a smaller expense than that of Brazil or Arabia, or is of a much finer quality. For there is plenty of coffee for sale, and much more would be available did it pay to produce. Up to nearly the close of the seventeenth century Europe depended for its coffee upon Arabia alone. But in 1670, Mynheer van Wieser, the Burgomaster of Amsterdam, introduced it into Batavia, and since that period the original home of the plant forms a comparatively insignificant source of supply.

Brazil and Central America grow enormous quantities. So do Venezuela, Guiana, Peru and Bolivia in the southern half of the new world. Java is one great coffee plantation, and Ceylon, in spite of her troubles, still harvests an appreciable quantity. In southern India the cultivation of coffee is an important and ever-growing branch of rural industry; in Sumatra, Reunion, Mauritius and along the west coast of Africa it finds employment—and occasionally wealth—to a great many people; while if Mr. Stanley's somewhat sanguine dreams take a substantial shape, Central Africa and the Upper Congo are soon to rank among the lands which are to compete with the great coffee-growing regions. It is therefore, clear that quality and low prices, which depend on cheap labor, cheap land, suitability of soil and climate, freedom from animal and vegetable plagues, and easy access to markets, are of paramount importance. All these may be found in the New Hebrides, though for the present it would be safer to moderate our expectations, until a few crops have been disposed of profitably. The mere fact of any locality yielding a particular product is only one point gained. Coffee often ripens in the conservatories at Kew, though we fancy this incident would scarcely be considered an argument for ranking *Coffea Arabica* among the future saviors of British agriculture. What the practical botanist ought now to consider is how best he can produce a hardy variety of the plant proof against disease and capable of yielding a large supply of berries. With the results of hybridisation before us, this, one might venture to think, ought to be within the power of science. There are some fifty or sixty species known in a wild condition, if the American forms are to be referred to the same genus as the Asiatic and African ones. Surely, when pedigree wheats have been selected from "sports" in ordinary crops, and other agricultural plants made to yield fourfold what they do in a wild condition, a little care in "breeding" ought to produce a much improved coffee plant.—*London Standard.*

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It is reported that about 2,500 acres have been planted with beets in Watsonville and the adjoining valleys—sufficient, it is estimated to produce 4,000 tons of sugar.

MANUFACTURE OF GLUCOSE.

The Boston *Herald* says that the process of making glucose "will be best understood by following the corn from which it is made from the time it enters the factory until it runs out of the spigot, a clear, odorless liquid. The shell-corn is first soaked for several days in water to soften the hull and prepare it for the cracking process. The softened corn is conveyed by elevators to one of the highest stories of the factory, and shoveled into large hoppers, that merely crack the grains without reducing them at once to a fine meal. The cracked grain is then conducted to a large tank filled with rinsing water. The hulls of the corn float at the top of the water, the germs sink to the bottom, and the portions of the grain, becoming gradually reduced to flour by friction, are held in solution in the water. By an ingenous process both the hulls and the germs are removed, and the flour part now held in solution contains nothing but starch and gluten. This liquid is then made to flow over a series of tables, representing several acres in area, and the difference in the specific gravity of the two substances causes the gluten and the starch to separate without the use of chemicals. The gluten is of a golden yellow color, and the starch snow white. By the time the gluten has been completely eliminated the starch assumes a plastic form, and is collected from the separating tables by wheelbarrowfulls, and taken to a drying room, where it is prepared as the starch of commerce, or is placed in a chemical apparatus to be converted into glucose. The conversion is effected by submitting the starch to the action of a minute percentage of diluted sulphuric acid, which, without becoming a constituent part of the compound, produces by its presence merely a miraculous change. This change from starch to glucose is a gradual process, and has four or five well defined stages. On the addition of the acid the first change results in the production of what is known to chemists as dextrine. If at this stage the acid is neutralized by the addition of lime water the process is choked, and dextrine is the permanent product. If the process is allowed to go on, the acid, however, works a second change, and maltose is the result. Here also the process can, if necessary, be interrupted by neutralizing the acid by means of lime water, and for some processes in the art of brewing this is sometimes done. The third and important change wrought by the action results in the production of glucose, and just here is where the greatest skill of the chemist is required. The product must show by tests that it responds to the chemical formula, $C6, H12, O6$. By comparing the formula with that of starch, which is $C6, H10, O5$—that is, 6 parts of carbon to 10 of hydrogen and 5 of oxygen—it will be seen that the sulphuric acid has not added to the starch, but has taken up two parts of hydrogen, and the only gain in the starch is one part of oxygen.

"The lime water introduced to neutralize the acid forms with it a product called gypsum—sulphate of lime—which can be removed from the glucose without leaving any appreciable trace. The fourth stage in the chemical process results in crystalizing the liquid, and then the product is called grape sugar. There is a fifth stage, in which caramel, or burnt sugar, could be produced were it of any commercial value. The gypsum, or sulphate of lime, formed by the neutralizing lime water and sulphuric acid, sinks by gravitation to the bottom of the vessel, and the supernatant saccharine liquid is drawn off from the top. This is almost pure chemical glucose, but it is still subject to a filtering process through boneblack, and refined in the same way as cane sugar is refined. The bone-black has anything but the appearance of a purifying agent, but possesses the peculiar property of attracting to itself all coloring matter. The glucose, passing through a labyrinthine system of filtering, is drawn off through spigots in the lower part of the building, and is ready to be shipped away in barrels. To give the glucose the appearance of cane syrup, as well as to impart some of the characteristic taste, a small amount of that syrup is added to suit the fancy of buyers. To make grape sugar the glucose is dried in rapidly revolving vessels, from which much of the moisture escapes by virtue of the centrifugal force. Neither the glucose nor the grape sugar is used for domestic purposes, although either one is about two-thirds as sweet as the sweetest cane sugar. Glucose is largely used by makers of cheap candies, but chiefly for fermenting purposes, and of late years has become valuable to the brewer in making beer and pale ales. It is also largely used in mixtures with cane syrups and molasses, and is esteemed by those who are best capable of forming an opinion on the subject as being more wholesome than the cane product, which is, at least, only a side product or residue in the manufacture of sugar."

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FRENCH FORESTRY DEPARTMENT.

The *Engineering and Building Record* says that "at the Paris Exposition the exhibition of the department of 'Eaux et Forets' was made in a special building of its own. The exterior was covered with slabs showing the bark in such a way as to resemble tree trunks, and has rustic decoration. This appropriateness of style is a minor illustration of the æsthetic taste which characterizes the French exhibition. Different portions of the interior of the Forestry Building were assigned each to a single kind of tree, and for each kind there is exhibited the surface with the bark on, sections transverse, radial and tangential, and the goods into which it is manufactured, as, for instance, one kind is made into wooden shoes, another into boxes, a third into bottle stoppers, etc. This simplicity by which facts are made as clear as possible, even to untrained minds, is also very characteristic of the French exhibition; further illustration of it will be found in what I am going to speak of. Another portion of the forestry exhibition shows the work of the department in the mountain regions, the French Alps and Pyrenees, in protecting the steeply-sloping territory. Where a mountain-side is liable to landslides or avalanches of rock, a series of retaining walls is built, and loose bowlders are supported, and the growth of vegetation is started to hold the soil. In valleys which torrents of water have occasionally devastated some very extensive improvements are made. The injury by flood is not only the washing out of the upper valley, but the overwhelming of arable land in the flatter portion below with the detritus, destroying its fertility, and the cutting off of communication over government roads, which, near the frontier, are important from the military point of view. The cure for these evils is of the nature of substituting for the inclined bed of the stream a series of steps, so that, instead of acquiring such destructive velocity, the water may fall nearly dead from one pool to another. More practically speaking, the fundamental work of protection consists of building dams at short intervals on all the steep parts of the channels. These dams, however, are of several classes. In the upper and smaller channels they are merely little rough stone walls of the simplest character, while on the lower and larger portions of the stream some are fine masonry structures with waste ways, comparable with the best that are built here for water power. It is not uncommon to put a hundred or more dams on a single stream. Besides the beds of the stream are improved by removing their irregularities and establishing a smooth and approximately uniform cross section, so as to facilitate steadiness of flow. The banks, which may have been denuded, are replanted with whatever is suitable to grow. This work of caring for the whole length of the channels has cost in the aggregate millions of francs, and to an American who is accustomed to seeing mountain streams left in a state of nature, it is very striking, and suggests that in this country it is high time that more general interest were awakened in the preservation of existing forests at least. The most conspicuous part of the exhibition consists of three handsome paintings, such as are called dioramas, giving very natural representations of three of the works as they would look to an actual spectator from a well chosen point of view. They show mountain summit and landscape, and possess merit as works of art. In one of the scenes the spectator seems to be looking out of a smithy; in another out of an engineers shanty fitted up in realistic style. In alcoves adjoining are collected maps on a large scale of the areas drained by the streams, photographs for comparison taken from nearly the same standpoints before and after the execution of the works, and monographs describing the work in detail and giving its cost, also plans and sections, pictures of scenery and full information."

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POLARIZATION OF BEETS AND SUGAR.

I have read, with much interest, your editorial on beet sugar in Nebraska in the *Prairie Farmer* of April 5.

I am sure you will permit me to call attention to an error you have made in your comments, found in this article, in regard to the yield of sugar per ton of beets. I think it rather unjust to the beet sugar industry that you should make comparisons with the experiments made a few years ago at Chatsworth, and which resulted so disastrously from a financial point of view. You state that eight per cent of sugar is better than the average outcome in Europe from beets polarizing fourteen and eighteen per cent. I need only call your attention to the fact that the mean yield of sugar from beets in Germany is now fully 13 per cent or 260 pounds per ton; and if the beets should polarize 18 per cent. the yield would be fully 16 per cent., or 320 pounds per ton.

In point of fact, the average polarization of beets in Germany is between fourteen and fifteen per cent., and with the latest improved methods of work and extracting the sugar from molasses, a yield of thirteen per cent. has been secured.

There is every reason to believe that if beets averaging 14 per cent. can be produced in Nebraska or other parts of the country, it will not be difficult to secure a yield of 12 per cent. of sugar, or 240 pounds per ton. Of course this is of more interest to the manufacturer than the farmer, but the profit which the farmer will receive will eventually be gauged by that which the manufacturer can make. In other words, it is quite plain that if the manufacturer can get 240 pounds of sugar per ton he can afford to pay a great deal more for beets than if he could get 150 or 160 pounds per ton.

H. M. Wiley.

Mr. Wiley, the Chemist of the Department of Agriculture, should be authority on this subject, and we accept his statement. What we called particular attention to was that if 80 per cent. of manufactured sugar was to determine the price paid for the beets, there would be no profit to the grower.

As to the Chatsworth factory, we had no other data upon which to base an assumption, though we are aware that in Europe through late improved processes in manufacture, and the absence of nitrates in the beets, the product is larger than formerly; and we are glad to have the fact stated that 13 per cent of sugar is the average product in Germany.

The soil of Nebraska should be most excellent for beets, and we truly hope the present experiment may be alike profitable for both grower and manufacturer.—*Prairie Farmer.*

FRENCH SUGAR INDUSTRY.

Some alarm is being felt by the French sugar manufacturers and beet cultivators, in face of the great probability of a further change in the fiscal legislation affecting the article. We long ago pointed out the almost certainty that the French government could not continue to suffer the heavy drain caused by the existing arrangements, which in themselves are a modification in favor of the treasury, of the high protective law of 1884. It now appears certain that the calculations of the French minister for the budget of 1891 indicate a deficit of about 27,000,000 francs (£1,080,000) on the head of sugar, and there can be no doubt that the manufacturers will have to submit to fresh charges and a reduction of the excessive bounty which they have been enjoying. Many people think that an industry which requires such sacrifices on the part of the nation is, to say the least, a dear bargain.—*Sugar Cane.*

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A LESSON IN ECONOMY.

We now sport a rich milch cow. How did we get her? Bought her. Paid $40 for her, the whole amount being ten cents a day saved since March 6, 1886. On that day a friend of ours insisted on treating us to a smoke, as it was our birthday, but we refused the kindness, informing him courteously that we never smoked a cigar, to which he replied that he averaged from one to three per day, at a cost of five to twenty cents each day, and that he never missed the small change. We told him then that from that day on we would lay away ten cents per day as long as we were able to do so, and see how much it would amount to each year. We have kept it up to date, and as a consequence, we have a fine Durham cow and calf, bought with 400 ten-cent pieces.—*Texas Paper.*

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The United States consul at Manila says that the principal products of the Philippines are hemp, coffee, rice, tobacco, corn and fruits. The cultivation of hemp is a very simple operation, and as it yields a large revenue it is not surprising that it is a popular occupation among the people.