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The latest quotation of sugar in New York, May 27, was 3 and 9-32, but fluctuating an eighth or sixteenth almost daily. The price will remain unsettled until the new tariff bill becomes a law.

The most ominous feature of the sugar situation is the large stock of European beet sugar, which shows no signs of reduction, while the prospects are that the plantings will equal if not exceed those of the last season.

The Los Angeles Herald states that a sample of sugar cane from Yuma recently sent to San Francisco yielded 13.7 per cent. sugar. Louisiana cane averages 12.32 per cent.; Hawaiian cane 15.79 per cent.; Java cane, 13.93 per cent.

A conservative estimate of the Florida pineapple crop for the present season, including the keys, is 150,000 barrel crates, 300,000 standard crates. The large output is placed on the market in a period of two or three months. The natural increase from year to year is 50 per cent.

Latest New York quotations are as follows: Lemons—Sicily, 300s, $2.25@3.75. Oranges—Sicily, $3.@4.00; California Navels, $4@6.00. Bananas—Per bunch, $1.40@1.50. Pine-

apples—Havana, per 100, $8@11.00; Florida, $3.25@4.25 per 100.

The bulk of the sugar crop of these Islands has been taken off, and is being shipped in about equal proportions to San Francisco and New York. As the shipments are now made from several ports on Hawaii and Maui, besides Honolulu, an accurate statement can not be made out till the close of the sugar year, September 30. It is believed that the crop will be about the same as last year, over 200,000 long tons.

An interesting article referring to the fertilization of coffee blossoms by bees in India will be found in this number of the Monthly. If the yield of a coffee plantation can be increased or made more certain by having a hive of bees located on it—then by all means procure the busy little bees. They can do no harm, and will repay in honey all the cost of introducing them; and better still, if they assist to fertilize the blossoms, and thus increase the yield of the coffee estate, it is well worth a trial.

The purchase of a half interest, or less, in the Watsonville Beet Sugar Factory by Mr. Jno. E. Searles on behalf of the American Sugar Trust, should excite no surprise, other than it is a very shrewd move on the Sugar Trust chess-board. The object has no doubt been to proclaim to all interested in beet sugar in the United States that the Trust is their friend, and intends to be friendly to every beet enterprise in the country—a very important and pleasant matter to beet growers. Col. Spreckels, the founder and owner of the Watsonville Beet Sugar Factory, which has proved such a successful venture, is understood to be a member of the Sugar Trust also, having some years since sold his Philadelphia Refinery to that corporation for eight million dollars' worth of Sugar Trust stock, which he is supposed still to own. We state these which we believe to be the facts, to show that the Trust will support the beet sugar industry, or any other industry that promises to bring grist to its mill, and the Colonel being in the Trust, everything works harmoniously. When these Islands become a part of American territory, as they will some day, the Sugar Trust may elect to purchase or control part or all of the sugar estates of Hawaii. And why not? They have the means to do it, twice over.

AMERICA'S POLITICAL RELATIONS WITH HAWAII.

We have never entertained doubts regarding the continuance, in some form, of the reciprocity treaty between the United States and Hawaii. It was established for the sole purpose of bringing the two countries into closer commercial and political union—a result which has been strengthening since the date of the treaty in 1876. It was designed for this purpose mainly, and as a compensation for certain concessions made, it was agreed that the duties on certain Hawaiian products named—among them sugar—should not be collected so long as the treaty remained in force. No money has ever been paid out from the United States Treasury to Hawaii on account of the treaty; but the United States agreed to collect no duties on certain products named—one of which is sugar. The amount thus relinquished to Hawaii has been increasing year by year, and is now deemed by many excessive in the United States. It may be so, and it may be thought best to reduce the amount on that item one-half. But to do this the treaty will require to be amended, as treaties usually specify, twelve months after notice of such change has been given. Hawaii will probably not object to this, nor to the reduction to one-half the present rate, or another and more acceptable amendment might be, the free entry into Hawaii of ALL AMERICAN PRODUCTS.

We have not entertained the remotest idea that the United States Government intend to terminate the treaty altogether, for it embraces valuable concessions which terminate with it. The extraordinary pre-eminence which the United States acquired and still maintains in this group as the suzerain power, holding the control of its destinies for the time, is not to be measured by dollars and cents. If terminated, and a rival European or Asiatic power acquired control of the group, it might soon become the Malta of the Pacific, and controlling in time of war the destinies of two hemispheres, or in time of peace might be a commercial entrepot for supplying the vast population of Oceanica.

At the time of the purchase of Alaska by Wm. H. Seward in 1867, there was a great popular howl against the expenditure of $7,200,000 for "that barren, rocky territory, fit only for

Indians to live in." The time will come when Alaska will prove to be among the richest mining territories of the Union, yielding annually ten millions of dollars worth of precious metals and ores, and prove of great political value. No Americaan would today listen to a proposition from England or Germany to buy Alaska for fifty millions of dollars, or even twice that sum. Such are the changes in value of strategic coveted points, and such the unwisdom of the people.

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HAWAIIAN LADS FOR COFFEE TREE PRUNERS.

An exceedingly interesting and instructive article will be found commencing on page 265, which has been condensed from the annual report of the Botanical Gardens of Jamaica. The first part relates to experiment stations in America. After which reference is made to the various botanical gardens for which Jamaica is famous. In the Hope Gardens is an industrial school, where thirty or more boys are trained in the care of trees, transplanting, pruning, etc. An institution of this kind is very much needed on Hawaii at the present time. In a communication to a local paper, a short time since, Mr. Alex. Cockburn called attention, to the necessity of training boys how to prune coffee trees, as there will soon be work in this line, with but few capable of doing it. His suggestions were appropriate and opportune, and the need of having persons ready to take hold when wanted will soon be felt.

The pruning of coffee trees has to be done in an expert and careful manner, and at the right time, usually twice a year. So also the topping of coffee trees requires good judgment and skill. The upward growth of the trees has to be checked and then kept to a uniform, height, which is usually about five feet. We have seen trees in Kau 36 feet in height, but it is impossible to gather all the berries from such trees. Then there is the "handling" or "searching," which relates to pruning the lateral branches, so that the tree will not have too much wood. The management of coffee trees at this period is an art, and the person engaged in handling them should be taught to do the work properly from the start, for on it depends, in a large measure, the yield. A novice may do more harm in one week than can be remedied in a year.

It seems to us that this art of pruning and handling coffee trees might be taught to the older boys in the Hilo Boarding School, and also at the Kamehameha School in this city. To carry out this plan would require a patch of a few acres of coffee trees near each institution, and a teacher familiar with this work. When once the student becomes accustomed to this work, and the care of coffee trees, he ought to find steady employment on a coffee plantation. It is true that pruning is not required all the year round, but one familiar with this branch will always find his services in demand on the plantation. Here, then, is a golden opportunity for bright Hawaiian lads who are soon to graduate, and are doubtful what to do. There are now at least 200 coffee plantations on these islands, and in the course of a few years the number may reach one thousand.

Under these circumstances, we urge teachers and others interested in the future of our young men to look into this matter, confident that no employment that they can engage in will offer better inducements than this. A good coffee pruner will, if he is industrious and trustworthy, become the best person to take charge of a coffee grove on shares or as manager, and then eventually, perhaps, secure one of his own.

Owners of coffee groves and plantations will very soon learn that the success or failure of their enterprises depends very much upon the manner in which their trees are pruned,—work which has to be done skilfully twice a year, and to watch this work requires a person who has had experience in it. If the trees once get a start unpruned, it is always difficult and laborious work to bring them into proper shape again. Hawaiian lads of 20 to 24 years of age can be taught to do this work as well as any imported persons, who will be sent for, if local pruners cannot be obtained. And they must be content with moderate wages, till time and experience have made their services more valuable.

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Thousands of honest people who would cut their hands off sooner than steal a penny do not hesitate to drop in and steal an hour of a busy man's time, which no money can replace. He who steals the time of a public servant trespasses on a nation's time.

IS CANE SUGAR "DOOMED"? IF SO, THEN WHY?

On page 271 of this issue will be found an article credited to an English paper, and headed "The Doom of Cane Sugar," which is little else than a pessimistic wail over the supremacy of beet sugar in its rivalry with cane. There can be no doubt that it is the firm purpose of the European beet sugar interests to continue, indefinitely perhaps, the drastic policy which they have adopted to corral the world's markets, by the aid of government bounties on exports, until a complete victory is assured, and cane sugar, as a chief factor in the world's supply, becomes a thing of the past. This policy, with its progressive taxes and bounties, will no doubt be continued from year to year and adhered to with increased tenacity, whenever the fact becomes demonstrated that the production of cane sugar is crushed out, in localities where it has hitherto flourished, and might continue to do so, with reasonable government aid, such as is given to beet sugar.

This apparently unequal and unfair struggle may be combatted on the part of governments interested in maintaining the production of cane sugar as a national industry, in two ways. One is to impose a countervailing duty on the importation of all bounty-fed beet sugar imported, equal to any bounty that it has received. There are but three leading nations in which such a protective policy may be adopted, viz.: England, the United States and Spain. England's established policy being free trade, and having no reserved special protective policy with her colonies, it is hardly probable that any change in her policy can at present be effected, and sooner than make a change in their favor, she may leave them to their fate, abandoning cane culture, to eat humble pie sweetened with beet sugar. So long as she adheres to her present free trade policy as regards sugar, she must remain the dumping ground of Europe's increasing surplus.

The United States, which is the largest consumer of sugar in the world, is able to protect the interests of her sugar growers, whether cane or beets, and will impose a protective tax equal to the bounty paid on beet sugar. This will serve to encourage her own beet and cane industries, which will develop so long as this policy is continued. The United States will always require,

and if it cannot be raised on her own territory, will always import, a certain amount of cane sugar required for domestic uses, and in the preservation of fruits of all kinds.

The second method of improving and perpetuating the cane industry lies wholly within the province of those engaged in it. It consists in selecting suitable localities, improving the soil, planting only the most profitable varieties of cane, and introducing the best methods in the mill and boiling house. Fruit growers, farmers and manufacturers are advancing in their methods from year to year, adopting every improvement that helps to increase the product. By so doing they secure larger and better returns from the same labor. Similar methods must be followed by the cane industry. Instead of this, however, it advances very slowly in most countries, and in some not at all. The total yield per acre or ton of cane remains, in too many instances, about the same that it was twenty years ago. Could returns be had from all the fields cropped in 1896 throughout the world, it would be found under two tons per acre, when it should be at least double that amount. In the article referred to in our opening paragraph, written by an experienced sugar man, appears the following statement:

"As for improved management or process in the West Indies, as I can testify, after visiting sugar estates in every island and colony where sugar is grown, every known system of management and process has been tried, and on the whole there is but little hope for general improvement. * * * For instance, in British Guiana, cane has been grown with excellent effect from the same stool many years in succession."

That any intelligent person, interested in the improvement and perpetuation of the sugar cane industry can assert with apparent approval that *sugar cane has been grown with excellent effect* from the same stool or hill for many years in succession, is past comprehension, and shows an ignorance of what is being done with improved methods and skillful preparation of the soil. It is only when sugar estates are managed on such lines of deterioration, both as regards the saccharine contents of the cane and the productive strength of the soil, that the "doom of the sugar cane" will surely follow. Modern science as well as the ex-

perience of every enlightened planter teaches that the soil, as well as the cane and the quality of its juice may be improved with proper stimulents and treatment, and the productiveness of the plant greatly increased by methods which are clearly laid down by those who have had ample opportunities to make the experiments and to test their value. If the cane industry in the West Indies or Demerara is carried on to any great extent, with the practice of "ratooning for many years," without allowing the land a rest or without a frequent renewal of the plants, the "doom of sugar cane" will justly be sealed for any country that follows such antiquated practices. Not only does the land require rest after the second or third crop is taken off, but the roots of the cane run so deep and spread so widely, as to cease in a measure to serve the functions they were designed for—to convey nourishment, to strengthen and invigorate the plant, by imparting the stimulus, energy and strength needed to produce a healthy stalk, with abundance of the richest sucrose, without which no plantation can prosper.

The same remark applies with even more force to the work in the sugar house. Ancient ideas and practices must give way to the new. "Going it blind," and trusting to luck for the results, will not do in these days, and will ruin the finest estates. Factory work must be kept under chemical control from the time the juice leaves the rollers till it is grained and centrifugalled, if profit is expected in the business. Those estates that are equipped so as to detect losses and leaks, and are able to correct them, are the only ones that can be relied on as profitable investments. The manager is the man whose keen eyes should be able to detect when the work is defective and is not what it should be, and it is right here where a chemist is needed to show the cause and the remedy of the waste and loss. Beet sugar making has become a fine art by adopting the most recent methods to produce the richest product in the largest quantity. Competition has forced cane planters to adopt similar methods, and enabled them in some places and in some respects to surpass their rivals. Generally the new ideas, adopted in one branch of the sugar industry are available in the other.

Another very important point, too often overlooked, is to

ascertain when plant and ratoon canes are ripe and should be cut. Formerly it was thought to be of little consequence, and this may be the case in some countries still. With cane that tassels, the juice is in the best condition from four to six months after tasseling is over. Again, at a certain period, varying according to latitude and altitude the juice rapidly deteriorates, if the cane is not cut at a certain time. To ascertain these periods requires the aid of the chemist, but much of the success of an estate depends on ascertaining the facts applying remedies and securing the largest outcome. A report of the Agricultural Society of Trinidad states that the canes harvested on that island "did not reach their maximum yield, until nearly the end of the crop season. It is curious to note that in colonies situated so near together as British Guiana and Trinidad, that the season of harvest should differ by several months. The crop is generally over in the former colony by the end of December, while that of Trinidad is not finished until the month of May or even later." This illustrates the variation in different localities and climates, if the cane had been cut only when the juice was in its best condition for the mill, the product would probably have been largely increased. The loss must surely have been large.

Another important item of economy is that of fuel, which formerly was an expensive part of the bill of costs. Now in all well administered sugar houses, the trash supplies all the steam needed, in crushing the cane as well as in the boiling house. But some varieties of cane furnish much better and more abundant fuel than others. Consequently a cane which will give rich juice, and supply ample fuel to run the mill and boiling house, will prove the most profitable in the long run. Such has been found to be the case here in Hawaii, and why not elsewhere.

In the face of strong rivalry from the beet industry, the successful manufacture of cane sugar can only be perpetuated by applying the same skill and economy in every branch of the industry as has been pointed out in these pages. It must commence with the preparation of the soil, the choice of the best seed for the locality, harvested at the right time, when the juice contains most sucrose, crushed with the most powerful machin-

ery, and the juice treated in the boiling house under competent chemical supervision. That this is not done, the evidence produced before the West India Royal Commission would seem to afford ample proof. In their report regarding Antigua, they state—"The defects of the present process of manufacturing are shown by the fact that in Antigua it takes 13½ tons of cane to make a ton of sugar, while in Demerara and Egypt only 10 tons, in Queensland only 9, and in Hawaii, only 7* to 8½ tons are required." These results are not obtained by accident, for the soil of Antigua, Jamaica and Egypt is as good or even better than that of Queensland or Hawaii. If the skill applied in the two latter countries were applied to the others, the word "Doomed" will never be written over their leading industry.

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CARBON ACID GAS IN THE AIR AT KOHALA.

EDITOR PLANTERS' MONTHLY:—During the past three years I have made a number of determinations of the amount of carbon dioxide (carbonic acid gas) in the air of Kohala, and as I have not heard of any such determinations having been made in the Islands, the figures may interest some of your readers. The determinations have been made at intervals, sometimes some distance apart, but have not been extended enough to cover all climatic conditions.

I have arranged the determinations in two series: (1) In the open air; (2) In growing cane. The samples in the open air were taken at a distance of five feet from the ground at a place removed from buildings and trees. The samples taken in growing cane were taken at a distance of two feet from the ground.

The method of sampling and analysis used was Pettenkoffers: "liquid equivalent" barium hydrate being used, and titrated against "liquid equivalent" hydrochloric acid with phenolphthalein as an indicator.

Determinations were made in duplicate, and when duplicates did not agree within 0.5 parts per 10,000 they were thrown out of the series.

Series I.—Carbon dioxide in the open air.

[*Note.—The best showing on one month's work at Ewa plantation has been 6.96-100 tons of cane to one ton of sugar.]

Set 1.—Four duplicates, half an hour apart. Heavy rain with no wind. Average, 2.81 part per 10,000.

Set 2.—Six duplicates, strong trade wind: bright. Average, 3.20 parts per 10,000.

Set 3.—Five duplicates, light trade wind: showery. Average, 3.78 parts per 10,000.

Set 4.—Four duplicates, light south wind: bright. Average, 3.13 parts per 10,000.

Average of all:—3.23 parts per 10,000.

Series II.—Carbon dioxide in the air in growing cane.

Set 1.—Four duplicates, trade wind: showery. In rattoon cane, 6ft high. Average, 3.83 parts per 10,000.

Set 2.—Six duplicates, light trade wind: bright. In plant cane one year old. Average, 3.50 parts per 10,000.

Set 3.—Four duplicates, strong trade wind: bright. In plant cane six months old. Average, 3.75 parts per 10,000.

Set 4.—Five duplicates. Conditions the same as in Set 3. Average, 3.96 parts per 10,000.

Average of all:—3.76 parts per 10,000.

All determinations made on the same day have been placed in one set; and where a set is composed of five duplicates, five duplicate samples have been taken in one day, etc.

EDMUND C. SHOREY.

Kohala, May 22, 1897.

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GREEN FERTILIZATION AT THE EXPERIMENT STATION.

The one-half of the land of the Experiment Station field which will come in for cane experimentation one year from now is being used this year for experiments in *fallowing* and *green fertilizing*, and it may be of value to some plantations to learn such results as have already been obtained.

The observations on fallowing will be stated at a later time, the following relating only to green crops.

In the second week of February, the following kinds of crops were planted:—White lupine, Windsor bean, winter vetch, hairy vetch, cow pea, alfalfa, red clover, crimson clover, rape, white mustard, black mustard, pearl millet, etc.

Of the above twelve kinds of crops planted, nine came to maturity and were dug into the ground. The white lupine, alfalfa, and red clover were attacked and destroyed by the army worm. The alfalfa crop on certain dairy farms on the Islands was eaten off completely by the same pest. It happens that the two crops (white lupine and alfalfa), most commonly successful, were failures at the Experiment Station this year, due to the cause stated.

The cow pea, which has usually failed on the Islands, we succeeded in maturing. This crop was allowed to stand until the earliest pods ripened, which were gathered. An enormous yield of seed was obtained from the small plat, which is of excellent quality. After reserving enough of this "home-grown" seed for the Station's use there are some thirty pounds left over, which plantations can have, in one pound amounts, if they wish to make small tests with this extremely valuable green fertilizer. We suggest these "small tests" because it is not advisable to plant large areas until it is further proven that the insect enemies of the cow pea have been sufficiently reduced (as is stated) to allow the crop to mature. The Station crop matured only after a hard struggle.

The winter vetch made a satisfactory growth, having a fine root development. It would have done better had it have been planted in November, as it is not only a temperate climate crop, but is planted in the autumn in cold countries.

The hairy vetch made an immense growth and appears to be admirably adapted to the conditions here. Although the vetches make a large green growth, it is not sure that they would produce good seed in this climate. The crimson clover is a "poor land" clover. It came up in the tests very strong, and grew rapidly, producing an immense root growth. Its behavior at the Station indicates that it is better adapted to our soils than the red clover, or even the alfalfa. The two latter clovers however, had no chance this year before the army worm. A point of great value was observed, viz: The army worm would have nothing to do with the crimson clover. The worms would crawl over to the crimson clover plat, but they crawled as quickly back after the first taste. This clover thrives with less moisture than some other plants.

The two *mustards* and the *rape* were grown with a double purpose in view. These crops are not only good green fertilizers, they also make excellent sheep feed; and as several plantations (specially in the Hamakua district of Hawaii) are aiming at running a flock of sheep, this was borne particularly in mind by the director. The mustards, and also the rape, made as vigorous a growth as I have seen upon the sheep farms in England, and there was a good mass of material to dig in.

The *pearl millet* which belongs to the same family of plants as the cane, was grown merely for comparison with the legumes and the crucifers (mustards and rape). It made an immense crop, which was very difficult to cover. Millet is specially useful to mix with vetches in order to keep the latter off the ground. It is difficult to bury the vetch when it lies close, the plow driving the mass before it. In England, wheat or rye is always mixed with either the winter or spring vetch. Lupines will answer the same purpose.

Other varieties have been planted at the Experiment Station, but there is nothing to say about them just now.

Some remark may be made upon the condition of the soil when the crops were planted. Great care had been taken to have as nearly as possible a uniformly good *seed-bed*, thus giving to all varieties of crop the same chance. Although the weather was extremely dry, all the varieties came up quickly and evenly, growing very rapidly; and without any irrigation until the growths were three to five inches high.

In the matter of preparing the land, and time of sowing green crops on plantations the better course will be as follows: Break up the land when the cane is off (better not later than July) and give it a fallowing, if possible, cross-plowing, and finally getting it down into a fine state. Sow the seed in November, at which time sufficient rain usually falls to bring them up and to secure a good growth. The fallowing of the land has an essential action on the mineral elements of the soil, and the green crop will furnish the organic matter, both of which conditions contribute to the state of fertility that is necessary for the cane crop. It is not necessary to call attention to where the seed of different varieties can be obtained. The agents in

the city are acquainted with these matters. The seeds used by the Station were procured mostly from Landreth & Sons, Philadelphia, and in part from the Cox Seed & Plant Co., San Francisco.

All the *fallowing* and *green-fertilizing* observations made at the Station are conducted with the strictest chemical control, the data relating to which will be fully given in the Experiment Station Department at a later time. Just to induce a belief, however, in the power we may possess to control certain of the physical properties of the soil, I will mention one instance, where the power to absorb and retain moisture has been raised 17 per cent. in one plat over another plat of the same soil by the side of it.

WALTER MAXWELL, Director.

Bureau of Experiment Station, Honolulu, May 31, 1897.

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HORNER'S WIRE CANE CARRIER.

The new method of transporting cane to the mill adopted by Mr. Horner of Kukaiau, has, after a great deal of practice, perseverance, and not a little ingenuity on the part of Mr. Albert Horner, proved an entire success. And I have no doubt that this method will soon be in use on other plantations of the Islands. Mr. Walker of Ookala, who has been inspecting it, is quite favorably impressed with its working, and will erect a similar line on the upper lands of the Ookala plantation.

There is no doubt but this method of transportation is well adapted for the higher lands, of most of the plantations where fluming cannot be done, and will eventually be resorted to by most of the managers. Its operation is very similar to fluming the cane. For instance, a strip of cane is cut up through the field, the same as for a flume, only in this instance, the strip cut is somewhat larger, or wider, so that sleds can be used to haul the cane to the wire rope. The cane is then tied in bundles, with ropes especially designed for the purpose, and which can be used very rapidly. It is then slipped on to the hook and the wheel sent on its journey to the mill.

These bundles of cane, I should say, vary in weight from 100

to 150 pounds, and are sent at the rate of two or three per minute. This amount of cane make from twenty to twenty-five clarifiers per day, and it is thought by Mr. Horner, that thirty clarifiers per day can be sent on one rope, when they have had more experience with its working. The wheels, hooks, ropes, etc., are taken back to the field by teams.

This line is very substatially made, and will stand almost any kind of useage, and though the wire rope is only a half inch in diameter, it will bear a weight of eleven tons with safety. It is also found that the grade determines the distance that the post or supports must be placed apart, and that this distance increases with the steepness of the grade. In practice, it is found that with six per cent. grade the posts must be placed not further than 100 feet apart, while with a nine per cent. grade the post may be 700 feet apart. It is also found that the fewer the number of posts, the slower will be the speed; and this is quite an object when the grade is very steep. It needs but a slight grade to give these loads of cane a great velocity, and if there is any trouble, it is in getting them to run slow, rather than fast. This new method of transportation is working very regularly, and satisfactory at the present time, and it is a great help in getting cane to the mill, as about two-fifths of the cane ground is brought by this new method. This enables the mill to grind nearly a third more cane than was formerly ground, when hauling from this distance in past times. O.

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WELL STATED.

In the inaugural address of the Governor of Florida, occur some paragraphs so appropriate to our own situation, that the sentiments expressed will be read with interest by our readers:

"With our climatic conditions, secured by geographical position; with our varied and fertile soils, admitting a range of production without a rival in our great sisterhood of states, and suited to both temperate and tropical climates; with our forests studded with natural contributions to commercial and manufacturing wealth; with thousands of miles of waterways, where myriads of food-producing fish cut with golden oar the silvery stream; with extensive herds grazing alone upon nature's

bounty; with remunerative and increasing manufacturing interests; with admirable transportation facilities, and unrivaled seaports; with a generous and law-abiding people, we can confidently invite immigration, and claim profitable remuneration for capital.

"Immigration and capital are two of the necessary factors to invigorate the growth of a state, and we should give our earnest and best efforts in securing those unrivaled motive powers of development. With them, will come transportation facilities to those sections still requiring it, and the development of our varied, vast and valuable resources.

"Recognizing that an intelligent suffrage is the best safeguard of constitutional liberty, we should fully sustain the paramount claim of public education; and not rest content with surpassing our neighboring sisters, but press forward to a still higher goal.

"Our commercial growth should be blocked by no improper impediments, while our enviable health record should be sustained by proper quarantine and municipal hygiene, to be enforced through the channels of our legally constituted health authorities, in accordance with the most advanced scientific thought.

"It is the exclusive prerogative of the state to redress wrong and to execute justice. An unrelenting opposition should be given to any effort to stain our fair name by the assumption of those duties by individuals."

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"The ravages of the rinderpest," said Mr. Howard, "are very imperfectly appreciated. It is difficult to form any conception of the extent to which this plague will affect South Africa. Khama, whom I saw on my way down from Buluwayo, told me that he and his people estimate their loss as 800,000 head of cattle, and they have now only 200,000 head, and there is no doubt that this is a much larger proportion than they have saved in Rhodesia. We estimate the loss of cattle in Matabeleland at 200,000 head, and there are not more than 20,000 left in the whole country. The rinderpest, we believe, was introduced into South Africa by some of the oxen brought by the Italians to Masowah. It touches neither horses, mules, elephants nor sheep, and the carnivora are, of course, exempt.

EXPERIMENT STATIONS IN THE UNITED STATES AND JAMAICA.

The last issue received of the Bulletin of the Botanical Department of Jamaica is taken up with a report by the Director, of what has been done in the Public Gardens and Plantations of that island during the year 1896. The report covers fifty octavo pages. The introduction quotes an interesting statement by Dr. A. C. True, Director of the Experiment Stations in the United States, which we insert, as this subject possesses much interest here just now:

"An agricultural experiment station is an institution in which scientific and practical investigations are made with a view to improving the methods of agriculture and introducing new crops or industries. The primary object of an experiment station is to apply scientific principles and methods to the problems of agriculture. It seeks to use for the benefit of agriculture the stores of knowledge regarding the operations of nature which science has accumulated, and to employ in the service of agriculture the trained brains and hands of scientists. Taking advantage of whatever has been discovered in any line of scientific research, the experiment stations should institute investigations to increase accurate information regarding the great principles which underlie the growth of plants and animals and to make new applications of well-known principles in the practical work of the farmer. It is very important that we should keep clearly before us the conception of the experiment station as primarily a scientific institution. This will enable us to understand its proper functions and prevent us from misjudging much of its work.

"The importance of scientific investigations as related to the arts has long been recognized in many industries. Hidden away in almost every factory may be found a chemist, microscopist or electrician, busily engaged in endeavors to solve the problems of the industrial arts. These men are working on the materials used in the arts, and have in view practical results, but they are using scientific methods and are employed solely because the manufacturers hope that rich rewards will result from the application of scientific principles to practical ends.

The wise employer leaves these men to work in their own way, he does not expect that the chemist will use the blacksmith's bellows, or the grocer's scales, or the carpenter's tools. He must have the appartus of the chemist and he must be free to follow the methods of the laboratory rather than those of the workshop. The factory chemist may have large wages, he may spoil much valuable material, and he may work for months without any result that will bring a single additional dollar into the manufacturer's treasury, but as long as there is a reasonable hope that something profitable will result, the chemist is kept at his task. One day he may find out something which will give the employer the advantage over his competitors and pay a thousand times over for all the expense which the chemist has caused. There is always the risk of total failure, but experience has shown that in the long run the arts have profited exceedingly by the labors of scientists.

"What manufacturers have been doing for themselves because they found it very profitable, the Government has undertaken to do for the farmers. Scientific investigations are necessarily expensive. Such investigations as are likely to be of advantage to agriculture must be conducted on so extensive a scale as to be beyond the means of the individual farmer. Agriculture is so fundamental to all other arts, and its success is so vital to all classes of people that it has been deemed expedient to extend governmental aid to this industry on consideration of the public welfare.

"The work of the agricultural experiment stations as organized in this country may be classified in a general way as follows: (1) they act as bureaus of information on many questions of practical interest to the farmers of their several localities; (2) they seek by practical tests to devise better methods of agriculture and to introduce new crops and live stock, or to establish new agricultural industries; (3) they aid the farmer in his contest with insects and with diseases of his crops and live stock; (4) they help to defend the farmer against fraud in the sale of fertilizers, seeds, and feeding stuffs; (5) they investigate the operations of nature in the air, water, soil, plants, and animals, in order to find out the principles which can be applied to the betterment of the processes and products of agriculture.

"The experiment stations are conducting a wide range of scientific research in the laboratory and plant house, and an equally large amount of practical experimenting in the field, the orchard, the stable and the dairy. Thirty stations are studying problems relating to meteorology and climatic conditions. Forty stations are at work upon the soil, investigating its geology, physics or chemistry, or conducting soil tests with fertilizers or in other ways. Fourteen stations are studying questions relating to irrigation. Thirty-nine stations are making analyses of commercial and home made fertilizers, or are conducting field experiments with fertilizers. At least fifteen stations either exercise a fertilizer control in their respective States, or make analyses on which the control is based. All the stations are studying the more important crops, either with regard to their composition, nutritive value, methods of manuring and cultivation, and the best varities adapted to individual localities, or with reference to systems of rotation. Thirty-five stations are investigating the composition of feeding stuffs, and in some instances making digestion experiments. Thirty-seven stations are conducting feeding experiments for milk, beef, mutton, or pork, or are studying different methods of feeding. Thirty-two stations are investigating subjects relating to dairying, including the chemistry and bacteria of milk, creaming, butter-making, or the construction and management of creameries. Forty-five stations are studying methods of analysis and doing other chemical work. Botanical studies occupy more or less of the attention of about thirty stations; these include investigations in systematic and physiological botany, with especial reference to the diseases of plants, testing of seeds with reference to their vitality and purity, classification of weeds, and methods for their eradication. Forty-three stations work to a greater or less extent in horticulture, testing varieties of vegetables and large and small fruits, and making studies in varietal improvement and synonymy. Several stations have begun operations in forestry. Thirty-one stations investigate injurious insects with a view to their restriction or destruction. Sixteen stations study and treat animal diseases or perform such operations as dehorning animals. At least seven stations are engaged in bee culture, and three in experiments with poultry.

"The service which the stations have rendered in promoting the education of our farmers is incalculable.

"Even if the station bulletins record only facts well known to scientists and advanced agriculturists, the influence of such a far-reaching system of popular education in agriculture must be very great. So vast a scheme of university extension has never been undertaken in any other line.

"The stations have also taught the farmer how to help himself."

Jamaica has four botanical gardens or experiment stations, viz: Hope, Castleton, Bath, and the public gardens in Kingston. The Hill Gardens are quite extensive, with an elevation of from 2500 to 6000 feet above the sea, and contain nurseries of many kinds of fruit and timber trees, with coffee, tea and various other valuable plants. Coffee is said to be successfully grown there at an elevation of 4100 feet above the sea. Also oranges, lemons, grape fruits, etc. Regarding the Saint Michael oranges, which are largely shipped to New York, 180,000 barrels having been shipped from Jamaica last year, the report says:

"This is a thin-skinned and well flavored orange. The tree bears young and is prolific, and has few thorns. Several thousands of grafted plants, and seedlings have been distributed for many years throughout the island from a tree in the Public Gardens originally imported from Messrs. Rivers, England. The fruit of one of these seedlings grown in the Port Royal Mountains has been submitted for an opinion to an experienced fruit buyer now purchasing oranges in the island for export: he states that it is one of the finest grades of the true St. Michael's orange, that this fruit would fetch the highest price in the New York market, and that there would always be a demand for these from Jamaica, as the St. Michael's grown in the island, and specially in the Port Royal Mountains, are much finer than any grown in either Florida or California."

At some seasons, the supply of water in Jamaica is very low. We may ask here, if the experiment of boring for artesian water has ever been tried there? If not, perhaps it, would be found available there as well as on Oahu. Most certainly it

would be a god send, if the experiment proved successful. Before it was sought for here, some of our wisest heads ridiculed the idea as preposterous.

In connection with the Hope Garden is an industrial school, with accommodations for thirty pupils, who are trained in the care of trees and plants, in connection with their other studies. They prove to be of much assistance, and the experience which they gain in this way, fits them for usefulness on plantations and as gardeners, when they leave the school. This suggests the idea that our reform school, if located on and conducted in connection with an experiment station, might prove a benefit as assisting in the labor, and obtaining practical knowledge which is not readily obtained elsewhere, except by a very few. The graduates, having thus early had their attention turned to cultivation and care of plants and trees, would naturally be inclined to seek such employment after leaving the station. Especially would this be the case, if instruction were given them regarding the care and cultivation of coffee and oranges.

Regarding sugar canes, the report says: Over fifty varieties are being tried to find which are best suited for growing on the hills. The canes grown from these are distributed free to settlers in the district, who will cultivate them.

The young canes have all been carefully attended to and have made very fine growths. Increased interest is taken in the numerous varities, and there is a large demand for tops. 3,360 tops have been distributed and some of the older varieties distributed from the Gardens are well spoken of. The trials of canes in different parts of the Island show that canes can be obtained to suit almost any district; the Salangore is highly spoken of by the people of the Brandon Hill district; Caladonian Queen is preferred by Colonel Kitchener for growth in Westmoreland; Lahaina by Mr. Mitchell of Amity Hall, Vere; Puaole is thought by Mr. Harry Cork of Burlington to be the best cane for his district in Portland,—it is largely grown at Worthy Park, and is spoken of as growing well and making a fine grade of sugar.

The following paragraphs give useful information to those engaged in transplanting trees, especially when the plants have to be conveyed a long distance.

The treatment of seeds and seedlings has been carefully looked after, difficulties have been overcome which were hitherto thought to be almost insurmountable in the way of raising large quantities of Eucalyptus, Casuarina, and many other trees, the seeds of which are so liable to be carried away by ants, cockroaches, etc.

When sown in beds, they can now be successfully dealt with, by immersing the seeds in kerosene before sowing them. The kerosene bath does not harm the seeds in the least, and entirely prevents the ravages of insects. Many other methods of preserving the seeds have been tried but with little success, watering the seed beds with Jeyes' fluid, carbolic acid, kerosene and water, but no method was an unqualified success except the immersion of the seeds in kerosene. It is not necessary for the seeds to be in the kerosene any longer than is needed for sufficient kerosene to adhere to the outside of the seed to render it distasteful to the insect attacking it.

We have also been very successful with the treatment of seedlings, oranges particularly having been grown to fine plants in a very short time. The method adopted with them is as follows:—When the seeds are to be sown, a bed is dug up thoroughly and the soil made nice and fine on the top; the seeds are spread evenly over the surface and then covered about half an inch thick with previously prepared soil sifted fine. The beds are never shaded, and never allowed to get dry, and the consequence is that the plants spring up as evenly as possible. They grow very fast, in six weeks from the time of sowing they have put out their first pair of true leaves and are ready to be transplanted into other beds. They are then planted in properly prepared beds, the end of the tap root being cut off at the time of transplanting. This is found to be advantageous in two ways, first by reducing the risk of the laborers' doubling up the long root when replanting the seedling, which would be very detrimental to the young plants, secondly by causing the plant to send out a larger quantity of small fibrous roots and lessening the danger in the second transplanting. Liberian coffee seeds treated in the same way produce good plants in twelve months.

The reports states that over 50,000 plants are disposed of annually from Hope Gardens alone.

In conclusion, we quote the following terse paragraph from the report of the Royal Finance Commissioners, as given in the pamphlet, which is as applicable to Hawaii as Jamaica: "In a purely agricultural country like Jamaica a well-organized department of gardens and plantations is invaluable, not only for introducing and propagating such plants as are most suitable to the climate and soil, but also for the dissemination of the knowledge requisite to cultivate the products of the island to the best advantage."

———:o:———

THE DOOM OF CANE SUGAR.—A COLONIAL PROBLEM.

(From the Fortnightly Review, by permission.)

The battle royal between beet and cane to supply the world with sugar happens to be also a battle royal between art and nature. Mr. Chamberlain is reported in The Times (of the 15th January) to have offered consolation to the Mauritius sugar planters in the words:—"I am fully aware of the gravity of the situation and sympathize with the hardships, which are not the result of natural causes, but of artificial interference."

Mr. Chamberlain has also given very practical consolation to the West Indian grower of cane-sugar, by the timely appointment of a peculiarly capable Commission of Inquiry.

There is no doubt about the gravity of the situation, and, as I have myself conducted official inquiries in the West Indies, and also had the whole of the problem in my mind and on my pen, for the past fifteen years, I should wish to do what I can to aid public opinion to come to a correct judgment.

It is no intention of mine to forestall the conclusion which may be reached by the new West Indian Commission. But, however necessary and useful, this inquiry does not by any means exhaust the subject, or suffice to establish in the public mind that full conception of the whole case, which is the indispensable antecedent to any effectual solution of the problem.

The issues involved extend far beyond the West Indies, and the Imperial Parliament and the Imperial Government will be powerless to act wisely until they possess full knowledge of all the elements of the question.

Let me first of all point out the relative position of this new Commission. Its scope is clearly defined: its instructions are to inquire in the British West Indian colonies and to proceed to New York to obtain information as to American trade with the West Indies. The time at its disposal may seem short. The actual traveling on the route sketched for them, from Southampton via the West Indies to New York, must occupy thirty days, leaving but ten or twelve weeks for visits to fourteen colonies and New York.

Happily the Commissioners will have at their disposal abundant material. There is the elaborate evidence (in five blue-books) on many of the very questions submitted to them, of the West Indies Finance Commission of 1882-84, and there is the voluminous correspondence on the several negotiations as to West Indian trade with the United States. All this the new Commission can have readily brought up to date.

That the evils are of old standing may be seen in the exact present application of what was written in the Fortnightly Review for November, 1884, page 638:—

"The West Indian Planters have put their case very strongly —pointing out the great value of the West Indian Sugar industry; its paramount importance to the prosperity, or indeed the very life of these colonies; the ruin and starvation which would follow on its destruction; and the responsibility which rests upon England, as the paramount power, to effectually act in defense of West Indian interests or bear the consequences and costs of inaction. In addition to this they point out that the production of beet sugar has, roughly speaking, trebled in amount, while that of cane sugar has done little more than hold its own; all or which they attribute directly to bounties."

The terms of reference for this 1896 Commission follows on precisely these lines and adopt almost identical terms.

The questions put to this Commission, whether sufficient remedy for the existing depression can be found in the removal of such causes as "mismanagement, imperfect processes, absentee ownership," will have to be answered in the negative.

Absentee ownership is altogether a false analogy. West Indian estates are commercial plantations, for profit and not for

residence. The proprietors of these plantations have no more need to live on their "property" than the proprietors who place their capital in ocean steamers, Johannesburg mines, Australian sheep stations, or Manchester cotton mills. Moreover, perhaps the most important duty of management consists in purchasing cheap "stores" in England, and securing the best prices for the sugar in that market. Even in the old days—before telegraphs and steamers, and when proprietors had perforce to reside on their tropical farms—the consignees in England became the masters of the situation.

As for improved management or process in the West Indies—as I can testify after visiting sugar estates in every island and colony where sugar is grown—every known system of management and process has been tried; and, on the whole, there is but little scope for general improvement. Taxpayers cannot be justly called upon to supply gratis brains or capital to their fellow citizens. Experts will, no doubt, see and suggest changes in minor matters, but men with lifelong experience in particular processes are slow to see good in expert advice. For instance, in British Guiana, cane has been grown with excellent effect from the same "stool" for many years in succession; but now, in Queensland, the Government expert is proclaiming the necessity, not only of making sugar an annual crop, but one in a scientific rotation of crops. Such technical and warmly-disputed points cannot with safety be entrusted to a political administration, although on this point I have presently a definite proposal to make.

Very similar is the case of neutralizing the bad effect of the extinction of sugar by the introduction of alternative industries. Dr. Morris has done signal service in discovering and disseminating the knowledge of a great variety of crops to suit such climates. The Commission is asked, "Are there other industries which could be promoted with success?" There can be no scientific reply to this, except that of actual commercial experience. It passes the wit of man to say what crop anywhere can be "cultivated with success." Experts may recommend, scientists may be confident, enthusiasts may try, confiding capitalists may invest—but it is experience alone which can assert

success, and experience rarely adopts new courses except under the stimulus of new information.

Certainly, at the moment, our British Colonies would appear to have good openings in filling the vacancies in the world's market caused by the breakdown of Cuba. In that luckless island the output of sugar has fallen this year from an old average of 1,000,000 tons to 150,000; and of tobacco from 500,000 bales to at most 75,000.

It is not, however, to be forgotten that neither sugar nor any other crop is, or has been, a permanent staple in the West Indies. Nowadays indigo is unknown in Jamaica, but one sees everywhere the ruinate indigo pits; Tobago knows not the cotton plant, but the island is fenced all over with the "breakwinds" set up during the American war, when cotton was a chief product of the island. British Guiana, at present given over altogether to sugar and gold, produced neither of these commodities in the older days. In 1880 one of the owners of the "cattle pens" in Jamaica was destroying self-sown orange trees, because the fruit choked the cattle. In 1895 the export of oranges reached a total value of £170,000.

The following table indicates the comparative value of the sugar crop among the West Indian exports:

	Exports (Value).		
	Sugar.	Other Products.	Total.
	£	£	£
Jamaica	195.000	1,680.000	1,875,000
British Guiana	1,060,000	720.000	1,780,000
Trinidad	650.000	1,403.000	2,080,000
Barbadoes	380,000	210.000	590,000
Windward Islands	60.000	320.000	380,000
Leeward Islands	215,000	75,000	290,000
Totals	2,560,000	4.435,000	6,995,000

In reference to both alternative crops and systems of management the proposal I have to make after prolonged personal experience and study on the spot, is that the Imperial Government should organize a department in connection with the admirable experimental collections at Kew, of information and advice to planters in all tropical portions of the Empire. I have seen the urgent need for this most practical step on the West Coast of Africa no less than in the West Indies. Strange diseases of sugar cane, coffee, and so forth; the best conditions for new products such as cocoa, rubber, cinchona, etc.; the important

question of manures, the commercial preparation fibres, tobacco, etc.; the discovery of new commercial plants, and, indeed, a lengthy program of appropriate experiments and knowledge, should be the charge of this special department. The culminating advantage would consist in the establishment of a travelling inspector of tropical products, who should, with a small staff, proceed on regular tour, at the right seasons, to our tropical colonies, to gather and to disseminate information of a thoroughly reliable character. I know that this suggested administrative advance has the cordial approval of our best experts and it will be pressed upon the attention of the authorities.

Another administrative step which could have been taken had special knowledge more political power, and which will be insisted on during the forthcoming session, is the completion of the Halifax-Bermuda-Jamaica cable. It is a recommendation of the 1884 Commission, and one that the commercial world has long been ready to carry out, but it has waited now fifteen years for the Administration to grasp the situation. Investment, trade, and industry in the British Indies are heavily handicapped by the absence of cheap telegraphic communication. It will surprise most men to hear that all telegraphic communications with our West Indian colonies, whether official or commercial, have to pass across revolting Cuba, and then by the American land lines before they reach even an Atlantic cable.

The new Commission is particularly to inquire as to the "probable result of a complete failure of the sugar industry on the condition of the laboring classes, both West Indian and East Indian." This labor question has been most thoroughly gone into on more than one occasion. The great fact of the abolition of slavery, sixty years ago, started the problem. The West Indian himself, as has been chiefly seen in Hayti and San Domingo, has an ineradicable tendency to revert to savagery. Thirty days' work spread over the twelve months suffices to feed a man and his family with yams and bananas, and it is generally known that, unless you can instill "wants" into his nature, backward the negro will go. In Jamaica and in Trinidad you have a very practical reply to the problem put to the Commission. The whole facts are well known. West Indians and East Indians were introduced to cultivate sugar. In both

cases sugar has long ceased to be the staple product; in either case the laboring population, both West and East Indian, has decidedly benefited by the change. But the change has been commercial and not political; better profits and not better rule has been the *causa motiva*. If you are to give the laboring classes a new prosperity, you will only do so by the preservation of natural freedom in industry, coupled with the supply of accurate and up-to-date information.

The Commission has neither time nor instructions to visit the foreign West Indian colonies. Spain and France could alike show the results of protection and preferential treatment—of the "Old Colonial System," in fact. Let me give an extract from the recent speech of the Governor of Guadaloupe:

"During the year (1895) the agriculture and commerce of Guadeloupe have been seriously shaken. The sugar and coffee crops have proved notable failures. The price of sugar was lower than ever known before. The Bank, which had made important advances to agriculturalists, could only obtain repayment of portions of the amount lent. The existence even of this financial establishment was menaced."

In reality the Commission investigates two separate questions—(*a*) the saving of the cane sugar industry; (*b*) the saving of the West India colonies. The first problem is an element in the second. For the accomplishment of both, among other things necessary, are the following:

1. Fiscal and administrative reform upon the lines laid down in 1884.

2 Securing at least most favored nation treatment for West India products in the United States markets.

3. Securing closer commercial relations with the great Canadian Dominion.

4. Cheapening telegraphic communication by completing the all-British cable.

5. Organizing a Department of an Inspector of Tropical Products, to collect and disseminate best scientific information.

These are practical administrative steps, not all of them within the terms of instructions of the new Commission, but all of them essential to the West Indian advance, most of which have long been advocated by those who know. The new Com-

mission will, however, do great good by bringing all information up to date, and once again forcing public attention on this important imperial task.

But in dealing with the problem, it is absolutely necessary to go further afield than the West Indies. The terms of reference ask whether "the present depression is due to . . . any other causes independently of the competition of sugar produced under the bounty system." In other words, this Commission is specifically precluded—and purposely—from touching that *quæstio vexata*—the bounties. As its inquiries are otherwise limited to our West Indian colonies, two other vital elements in the problem are also specifically excluded, viz., our other sugar colonies, and the use of sugar in the mother country.

Dealing with these three other elements in inverse order, in the mother country, it may be asked, why is the lucrative industry of growing beet for sugar not yet established in our midst? The enormous development of the beet industry on the Continent is one of the most striking of the industrial phenomena of the century. Sugar to the value of many millions sterling is annually produced where none was produced, say, thirty years ago.

Again, the low price of an article in such general consumption is a widespread advantage to the poorer classes and to the purchasing power of British wages. We see by the Board of Trade returns, that the "consumption of sugar per head of population" has been as follows: 1840, 15 lbs.; 1860, 33 lbs.; 1880, 64 lbs.; 1895, 81 lbs. We know that no individual habitually eats five times as much sugar now as was eaten fifty years ago. But we know that concomitantly with the fall in price of sugar there has been a steady increase in manufacturing industries using sugar. Among these may be mentioned distilling, brewing, and the making of biscuits, jams, chocolate, confectionary, varnish, blacking, and so forth.

It is to be remembered that the Continental bounties are only obtained on export, and practically on export to England, the only free market. The consequence is that the lowest price for sugar always exists in that English market. When the retail price of sugar is, for instance, in London less than one-half of

what it is in Paris, it is no wonder that industries using sugar as a raw material flourish better in London than in Paris. And the Paris and French taxpayers pay up the difference in price, and, indeed deserve a warm vote of thanks from all Londoners and residents in England. Thus the use of sugar in the mother country is an important element in the problem.

Another important element for Imperial consideration is that there are other colonies of the Empire which produce sugar besides the West Indies. The actual proportions and prospects of the two sources of supply may be judged from the following figures:

EXPORTS OF SUGAR (in Cwts.).

	1875.	1885.	1895.
From the West Indies	5,603 000	5,823,000	4,740,000
From other British Colonies	2,501,000	4,463,000	4,920,000

These other sugar colonies, which twenty years ago supplied half as much as now, supply actually more sugar than the West Indian colonies.

Markets outside the United Kingdom very largely absorb the sugar produced in these other colonies, and adequate consideration must be given to the interests of these producing and consuming colonies in any settlement of the question.

There remains the third element, viz., the bounty question. This is no occasion to enter on its details, which are complicated. The general results of the system may be summarized.

The bounty system:—

1. Is an artificial interference with the industry of sugar making, hampering production, exchange, and consumption.

2. Has caused gratuitous overproduction and glut, leading to an unnatural fall in prices.

3. Forces people to use that sugar which it costs most, to the exclusion of that which it costs least, to produce.

4. Causes a dead loss to aggregate wealth.

5. Impoverishes nations which give bounties:—

(*a*) By raising the price of refined sugar to the local consumer.

(*b*) By raising the price of raw sugar to the local manufacturer and lowering the price to his foreign rival.

(*c*) By forcing the taxpayer to contribute millions sterling a year to make up the losses, or at best increase the profits, of a small class.

(*d*) By forcing the taxpayer to make up by other taxes the deficit caused in the revenue derived from sugar.

There are two questions yet to be faced: (1) Can the bounties be put an end to? (2) Ought the bounties to be put an end to?

In regard to the first question, in the Fortnightly Review for November, 1884, I wrote of the two remedies then suggested: "A countervailing duty to be placed on all imported sugars that have received a bounty, and the absolute prohibition of all imports of sugar from countries where bounties are allowed. Neither of these penal clauses could be, or would be, accepted by England. I ask, need they be even so much as proposed at a Conference?"

At the Conference in 1886, so ably presided over by Baron Henry de Worms, both these clauses were discussed, and the latter was adopted. But Parliament promptly refused to accept it.

The bounty system *can* be suppressed if all the nations will agree to another Conference, at which only two resolutions are necessary:—

1. The bounty system is and remains abolished.

2. Any article obtaining a bounty on export is *ipso facto* excluded from most favored nation treatment.

The further question, "Ought the bounties to be abolished?" is hardly yet grasped by public opinion.

No doubt bounties are contrary to free trade, and should be put an end to by all free traders.

No doubt free trade forbids a government from fostering one industry at the expense of another—whether it be cane sugar growing at the expense of jam making, or jam making at the expense of cane growing.

No doubt free trade is against forcing people to consume that sugar which it costs most to produce.

No doubt free trade, to adopt Mr. Chamberlain's words, is against "artificial interference" and in favor of "natural causes."

But the practical question dominates all theories. We must

strike a balance-sheet. The Board of Trade once estimated the gain from the Bounties to the United Kingdom at £5,000,000 per annum in cheap food and cheap raw material. Assume any such figures, and what do the enemies of the Bounty system place on the other side of the account? The ruin of the West Indian sugar trade means no more machinery, plant, or stores from England or Scotland, lessened employment of West Indian shipping and postal and telegraph facilities, loss of capital invested in sugar, and the destruction of so powerful a competition would lead eventually to a rise in the price of sugar. In addition, there is diminution of general trade due to the pauperising effect of the system on the countries which give Bounties. There are other arguments, but for our present purpose it will suffice to add the further suggestion that whilst a fractional rise in the price of sugar which might follow the abolition of the system would be an inappreciable burden on the home industries using sugar, it would be a very appreciable, indeed crucial, advantage to the colonial industry of producing sugar.

My purpose now is merely to say enough to show that in any final settlement of the sugar question there are essential elements not covered by this important West Indian Commission, and which none the less demand prompt and full investigation and explanation. Fulness of exact information is needed in regard to our home industries, our other sugar colonies, beet growing, and the Bounty system. The doom of cane sugar has been pronounced by the unthinking and the uninformed. But cane sugar has inherent qualities, as, for instance, *for preservative purposes*, denied to beet sugar, and its natural cost of production is far lower than that of beet. This doom will not be ratified or realized when the public has secured authoritative and adequate information on all the elements of the problem. For then, but not till then, will the public be able to judge and act aright in this matter so closely connected with the general welfare. In this, as in other cases, a balance of good must result from the elimination of "artificial interference with natural causes," and the freeing of a great and important group of industries from the trammels of Protection.—The Sugar Cane.

GEORGE BADEN-POWELL.

THE FUTURE OF COFFEE PLANTING IN CEYLON.

Among the editorials in a late file of the Financial Times of Aug. 13th is one on "The Brazilian Outlook," giving an account of the failure of a well known and old established Rio firm with liabilities of over £600,000! And although our contemporary does not take a gloomy view of the future, it admits that "a mild commercial crisis" is not unlikely, and we know what a disturbing influence that must have on a great planting industry, and especially on the development and extension of planting—on which the continued prosperity of the Brazilian coffee enterprise so greatly depends. Here, then, we have a new and strong argument for faith in the future of "coffee" as a product not likely to be over-supplied from any quarter for a long period to come. We have already given our reasons for this faith in respect of the Eastern hemisphere, and if any check should be placed on the Brazil enterprise, the encouragement to try our old staple freely not only in Africa and Java, but in the Straits and once again in Ceylon would be very great indeed. * * * We commend the bold and enterprising few who have been of late replanting coffee in some parts of Ceylon, and we would ask if more cannot be done in this direction? Planters are not so much afraid of the fungus as of the coccus, bug-insect; and in this connection we have to introduce to special notice a letter from Mr. E. E. Green, as follows:

Bearsted, Maidstone, Kent, 17 May, 1896.

Dear Mr. Ferguson:—On back you will find extracts from letter from Mr. Koebele—*re* the importation of lady-bird beetles from Honolulu.

He seems to think we should get them direct from Australia. But here again is the difficulty that—unless very great care is exercised—the parasites of the beetles may be introduced as well; which would completely nullify the utility of the undertaking. It would require an experienced man to collect the beetles and keep them under observation for some time before liberating them. From the tenors of his letter I gather that Mr. Koebele himself might be willing to undertake this work—for a consideration.—Yours very truly, E. E. GREEN.

(Copy of letter from Mr. Albert Koebele to Mr. E. E. G.)

"Honolulu, 21st April,—'96.—It will be useless to attempt sending living specimens of Coccinellidae (Lady-bird beetles) to Ceylon from here. Of the many sent from here to California, none arrived safe. Why not get them at their home in Australia. Later I may be able to do the work for the Ceylon planters. Surely it would not cost them much if all help together. And I could guarantee that the work would be properly and successfully carried out without any mistake. All things look well here: the coffee trees are now practically clean."

The fact that the lady-beetles have cleared the coffee trees in Honolulu of bugs, is a great encouragement to planters in Ceylon and India and the Straits to take steps to introduce them into their plantations; but how is this to be done? We fully agree with Mr. Green that the wise plan would be to employ Mr. Koebele himself to do the work—as indeed he offers. On the other hand, there are so few proprietors now with any appreciable area under coffee in Ceylon, that the needful contribution might come rather heavy on their acreage in comparison with the prospective return. Why not, therefore, ask coffee estate proprietors in Coorg, the Straits and even Java to join in the mission? Mr. Koebele's mission might, possibly, mark a new era in the history of coffee in Ceylon—a marvellously chequered and romantic—full of ups and downs—as that history has been in the past.

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DO PLANTS ABSORB NITROGEN?

Although this query would demand a special article dealing completely with the absorption of nitrogen by plants, a short note may be of some service.

Briefly stated, plants have access to nitrogen in two conditions: (1) As free uncombined nitrogen in the air; (2) In a combined state (as salts of ammonium, nitrates and organic compounds in the soil). A very large number of carefully conducted experiments have shown that the absorption and assimilation of nitrogen in a free state is confined to the lower orders of plants—mainly bacteria—and to leguminous plants among higher green vegation. Wheat, rye, buckwheat, cruciferous

plants, and many others not belonging to the leguminosae, always die of nitrogen starvation when grown in soil containing very little or no nitrogen, although they may be exposed to the air. Moreover, leguminous plants die under these conditions unless their roots are possessed of fleshy "nodules," (well seen on the roots of ordinary broad beans). It is from the combined forms that an ordinary green plant—wheat for example—obtains all the nitrogen it possesses, and this it takes up by means of its roots-hairs from the ground.

In the soil the plant has access to nitrogen in (1) complex organic compounds, resulting from partial decay of vegetable or animal remains; (2) ammonium compounds (*e.g.*, ammonium carbonate), sulphate; and also (3) nitrates, chiefly of sodium, potassium, magnesium, and calcium. It was formerly supposed that the ammonium compounds supplied plants with all the nitrogen necessary for growth, but definite experiments have shown that, although many green plants can be nourished by both organic compounds and pure ammonium salts, the results are in every way inferior to those experiments where the plants are supplied with nitrates to their roots. These facts, coupled with the knowledge that both organic compounds and ammonium compounds soon give rise to nitrates in the soil, lead to the conclusion that the plants absorb or take up their nitrogen from nitrates, and seeing that nitrate of lime is most abundant in the soil it is concluded that this substance is the main source of nitrogen for plants.

"Student's" difficulty lies in the assumption, or statement, that nitrate of lime is taken into the plant as such—that is without any change. If this were true we should, as he remarks, expect to find the lime (neglecting the other bases, potash, soda, and magnesia), and nitrogen in something like the same chemically equivalent proportions as met with in nitrate of lime. This is found not to be the case. There is an excess of nitrogen and a deficiency of lime, as seen in the analysis quoted, and this has led "Student's" query and suggestion that the nitrogen must have been obtained from other sources than nitrates. The latter view has been amply refuted by most careful experiments, and the explanation of the apparent discrepancy is that the nitrate of lime is split up and decomposed at the very threshold of entry

into the plant—*i. e.*, in the root-hairs and in the roots which are not included in the analysis given, which soon dry up and remain in the soil. The lime is thus separated and practically left in the soil, while the nitrogen enters into new combination, and helps to build up various more or less complex organic compounds. The ratio of the lime and other bases to the nitrogen in different plants grown even upon the same soil, and thus having equal access to nitrates, varies much.

The details of the chemical changes which nitrogen undergoes after entering the plant and where these changes take place are practically unknown yet. The changes are slow, compared, for example, with those undergone by carbonic dioxide, and difficult to follow. Different kinds of plants, growing with equal access to nitrates in the soil, show very different results as regards their method of taking up and utilizing these compounds. In some cases the nitrates can be readily detected as such in all parts of the plant; in others only in the stem, or perhaps only in the root, or in no part at all.—Journal of Horticulture.

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BEES AND THE FERTILIZATION OF THE COFFEE BLOSSOM.

The subject of the fertilization of coffee blossom is, I trust, of sufficient importance to make it unnecessary for me to offer any apology for returning to a friendly discussion of the question with your original correspondent with a view to its more thorough elucidation.

With reference to the tree which I mentioned as being covered with honey-combs twice a year, I may state that I believe the bees were in the habit, as your correspondent suggests, of visiting it years before there was any coffee in the district; but one would have thought from the reasons he enumerates in your impression of the 9th ultimo for imagining a coffee estate to be about the last place to find bees in large numbers, viz.: that the coffee plant is in flower for a very short period, and with the exception of this tree there is very little that the bees can get honey from, the shade trees even not flowering more than once a year—one would fancy, I say, from

all this that the bees would have forsaken the place when the district was cleared and planted with coffee, for being converted into coffee estate there would be very little for the bees to get honey from, etc. If your correspondent had said that the lack of suitable quarters for the bees to hive in was against their occurring in large numbers on a coffee estate, it would have been very different, but it will be noticed that this was not given as a reason for "a coffee estate being about the last place to find bees in large numbers."

However all this is beside the main question as to how the coffee blossom is fertilized. In the opinion of your (original) correspondent it is for the most part self-fertilizing. He says:—"The flowers are in dense masses, so that the slightest puff of wind would blow the pollen from the antlers with the probability of this pollen catching on to one of the *adjoining stigmas.*" But let me point out before I proceed further—and this will make clear my reason for underscoring the words "adjoining stigmas" in the above quotation—that the pollen from the anthers of a flower *must reach the stigma of the same flower* before it can be said to be "self-fertilized," for if the pollen of one flower reached the stigma of another flower either contiguous to it or far removed—and it must be admitted that this is just as likely to happen in the case put by your correspondent as for pollen from the anthers of a flower to be transferred to the stigma of the same flower—it matters little by what agency the transfer is effected, it would be cross-fertilization.

But in works on Botany, "self-fertilization," it appears to me, has a more restricted meaning. It is restricted to flowers in which special arrangements exist to secure self-fertilization such as the cleistogamous or closed flowers, the interiors of which are utterly inaccessible to insects, and others in which the anthers bend over the stigmas and shed their pollen on them, etc. This only occurs in low degraded types of flowers such as Groundsel and Shepherd's purse, etc. (Grant Allen: Story of the Plants. Rev. Henslow: Origin of Floral Structures.) Now coffee cannot surely be classed amongst degraded types of this description for "we know" as Wallace says in his work "Darwinism," "that when petals cease to be required for

the attraction of insects, they rapidly diminish in size, lose their bright color or almost wholly disappear," and this has certainly not happened in the case of coffee.

But I had forgotten. Your correspondent does not hold that the coffee blossom is fertilized by any movement on the part of the anthers or stigmas or any special arrangement about the flower, but that it is effected for the most part by the agency of the wind. Now just let us examine for a moment the characteristics of wind-fertilized plants and see if we can find any good grounds for saying that coffee blossom must be largely fertilized by wind agency. Grant Allen says (and other authorities agree with him) "Bright colored petals and stores of honey will not serve to allure the unconscious breeze; such delicate adjustments of part to part as we saw in the case of bee and blossom will no longer be serviceable. What will most be needed now is quantities of pollen; and that pollen must hang out in such a way from the cup as to be easily dislodged by passing breezes. Hence wind-fertilized flowers differ from insect-fertilized in the following particulars. They have never brilliant corollas or calyxes. The stamens are usually very numerous; they hang out freely on long stalks or filaments; and they quiver in the wind with the slightest movement. On the other hand the stigmas are feathery and protude far from the flower, so as to catch every passing grain of pollen. More frequently than among the insect-fertilized section, the sexes are separated on different plants or isolated in distinct masses on neighboring branches. But numerous devices occur to prevent self-fertilization." Note that even in the case of flowers specialized for wind-fertilization, devices exist to prevent self-fertilization. Now the coffee blossom possesses none of the characteristics of wind-fertilized flowers; and I am convinced in my own mind that the pollen is not dry and powdery enough to be easily detached from the anthers and blown about by every passing puff of air.

To my mind the very fact that the coffee blossom is attractive looking, possesses a scent, secretes nectar, and above all is visited by bees and other insects directly it opens, is sufficient proof that it is entomophilous; for we read that the degraded types of wind and self-fertilized blossom are the result of the

neglect of insects to visit them, and they have lost all unnecessary parts; and as I said in my previous article, if the coffee blossom were capable of wind-fertilization, Natural Selection would have taken care that it had no useless appendages. The very fact that flowers are visited by bees is a sufficiently convincing proof that they are entomophilous to Grant Allen, who in speaking of willows says that one can easily satisfy one's self that they are insect-fertilized by standing under one in early spring when one will hear all the branches alive with the buzzing of bees: but I suppose Mr. Allen is not a sufficient practical authority for your correspondent. However he is accepted as one by Mr. A. R. Wallace, the Naturalist.

I will now state how I think the coffee blossom is fertilized. I think the pistil and stamens are so placed as to preclude self-fertilization. When the blossom opens the stamens fall away from the stigma which protrudes far out beyond the stamens. The stigma is two-lobed and shaped like a Y with the style. It appears to me that when the bee inserts its probosis into the nectary it gets covered with pollen, and when removing its head it knocks against the under sides of the lobes of the stigma which prevents self-fertilization, and when it visits another flower it knocks against the top surface of the stigma and thus cross-fertilizes it. I have watched a bee at work, and this is the idea I have formed of the way in which the blossom is fertilized.

Your correspondent makes a great point of coffee, as he says, coming up twice to seed. They do so to the superficial observer, but I think if plants grown in a nursery prepared exactly alike throughout were critically examined they would be found to differ slightly. Do not some seeds germinate sooner and some plants make better growth than others although equally nourished? There would appear to be no doubt that plants differ in constitution. This would seem to be the reason why there are so many failures as the plants are unsuited to the environment that suited their parents. If conditions could be so altered as to suit plants that differed from their parents, many differences would be apparent which are now not noted because all plants not suited to the old conditions usually die out. This accounts for the persistence of a species.

To come to your correspondent's quotation, I may say that

I think it refers to what is observed in garden and green house cultivation. Results are obtained in green houses by the manipulation of a camel's hair brush that are of much slower attainment in a state of nature. He seems to have missed the fact that the part underscored by him is advice to *hybridisers* and *raisers of seedlings*. The only way to prevent cross-fertilization is by excluding bees and this is easily done in a green house. I am not satisfied that close-fertilization is the same as self-fertilization, but even if it is, it may mean that under forced cultivation flowers lend themselves to close-fertilization and that the hybridiser should arm himself with a camel's hair brush and take advantage of this.—Corr. Planting Opinion.

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PREPARATION AND CULTIVATION OF OUR SUGAR LANDS.

[A paper by Dr. W. C. Stubbs, read before the Louisiana Sugar Planters' Association, March 11, 1897.]

Nearly all the land devoted to sugar cane in Louisiana is of alluvial origin. The soils of the Mississippi Valley and its outlying bayous are but the agglomerations of the materials brought down by water from over a score of States and deposited upon the blue clays of the Champlain or Port Hudson Group, through which the river has cut its channel. These materials have been assorted and deposited by running water, hence there are formed soils varying from fine sandy loams to stiff clays, often in the same field, showing the varying velocities of the current which transported and deposited them. In a rapidly moving current, soil particles of every size are mechanically carried. Check this current and the coarsest materials are deposited. In fact, as the velocity is decreased, particles of soil, decreasing in size, are deposited, until finally, when the waters are stilled, the finest silt and clay are gradually released. All sediment-bearing streams flowing through low plains build up banks in flood periods on either side by the deposition of material, due to the retardation of the velocity of the water along their edges. With each subsequent overflow the coarse material would increase near the stream, while across the flood plain,

extending from river to the swamps in the rear, would be spread particles decreasing in size till the swamps were reached, where, on account of the stagnation prevailing, the finest clay would be deposited. One should expect, then, the sandiest soils near the river and the stiffest in the swamps.

Strictly speaking, this is true; but the ever-changing banks of the Mississippi, due to caving and the numerous crevasses occurring since man began the system of leveeing, have so changed the relations of the stream to its banks, and so modified surface appearances, as to disguise this general fact and render it subordinate to local conditions.

Allusion has been made to the blue clays through which the Mississippi has cut its channel. Underneath these clays occurs a stratum of gravel and coarse sand. In times of flood, the rapidly moving current frequently washes away these deposits, and when the floods subside and the banks are no longer sustained by hydrostatic pressure, caving occurs, and with it a change in the location of the banks and direction of the river. Crevasses greatly modify surface soil; small ones have only local effects, while large ones like the Nita or Belmont superimpose many millions of cubic feet of sediment, and frequently change the tillable character of entire plantations. As a rule, too, the coarsest material will be found high up the stream, with silt and clay near its mouth. Hence, as we descend the Mississippi river the soils, generally speaking, become more and more clayey, until we reach the clay mud lumps of the delta proper.

Our soils, then, of the sugar belt lying along the Mississippi river and its numerous bayous, may be considered as varying from silty loams to very stiff clays.

There are also red and brown lands, varying from sandy loams to loamy clays of the Red river and its outlying bayous, the Teche, the Bœuf, the Cocodrie, and the Robert, which have been formed by a similar process by the Red river, though drawn from a much more restricted area of country.

The prairie lands west of Franklin, varying in character from black stiff clays to silty loams, are our bluff lands second-handed, which have been removed from the western bank of the Mississippi river and spread out over the marshes of southwest Lou-

isiana. These bluff lands occur *in situ* on the eastern bank, running continuously from Baton Rouge to Vicksburg, giving us several parishes in which sugar cane is grown. They are usually silty loams and are also of alluvial origin, though antedating the present Mississippi river. The bluff and prairie lands and the alluvial deposits of the Red and Mississippi rivers and their bayous, give the soils upon which the sugar cane of Louisiana is grown.

The question, then, of paramount importance to every planter is: How shall we prepare and cultivate these soils? A knowledge of the composition and characteristics of these soils will aid us in best applying the well established rules of preparation and cultivation to them.

Soils are only disintegrated rocks, mixed with vegetable debris and more or less charged with micro-organisms, through whose agency the food for plants is rendered available. It is not only necessary an abundance of plant food exhibited by chemical analysis be present, but it must be in an available form. The more finely divided the rock particles, the larger the quantity of the available food, the greater the surface areas of its particles, and therefore a large increase in surface tension, which gives an increased capacity for holding moisture. Therefore, the mechanical condition of a soil is frequently of more importance than a chemical analysis. Formerly a soil was regarded as being a mass of inert matter, whose ingredients were rendered soluble by the action of air, water, and chemicals. This view has given way to a knowledge recently gained by scientific investigations, that all fertile soils are swarming with microscopic organisms which are essential to the proper elaboration of the food materials in a soil for plant use.

Hence a thorough investigation of a soil involves a mechanical analysis, a mechanical separation of its particles, a study of its physical properties, and a microscopic research for its bacterial content.

A chemical analysis will give its contents of silica, iron, alumina, lime, magnesia, potash, soda, phosphoric, sulphuric and carbonic acids, chlorine, nitrogen, &c. The total quantities of each of the above solubles in the selected solvent are given, but no definite method has yet been devised by which a knowledge of

the immediate availability of these ingredients may be obtained. Chemical analysis has, however, a high value in the hands of a trained chemist.

The particles of soils vary greatly in size as well as in constitution, and a knowledge of the mechanical formation of a soil frequently throws a flood of light upon its relation to heat and moisture, as well as suggestions upon its cultivation. It has been conventionally agreed that all particles in a soil between 1 and 2 mm.* in diameter shall be called fine gravel; between .5 and 1 mm., coarse sand; between .25 and .5 mm., medium sand; between .1 and .25 mm., fine sand; between .05 and 1 mm., very fine sand; between .05 and .01 mm., silt; between .005 and .01 mm., fine silt; and between .0001 and .005 mm., clay. Such an analysis describes the texture of a soil and determines the crop which should be grown thereon, by comparing the water-carrying capacity of the soil with the water requirements of the crop. To illustrate, the more clayey the soil the greater its carrying capacity, and the nearer approach to pure sand the more droughty it becomes. Grasses, in which sugar cane may be placed as a gigantic specimen, require at least 25 per cent. of moisture continually in the soil for best results, a condition found frequently in clayey bottoms; while some vegetables, as melons, do best on soils carrying only 4 per cent. of water, and hence find congenial environments in our climate on very sandy soils.

Other crops grown in this latitude require intermediate quantities between these two extremes.

It may be remarked, on the other hand, that very large quantities of clay or sand are often equally objectionable, giving excesses of moisture or dryness, both being detrimental to the existence of bacteria, which are necessary to soil fertility.

The conditions necessary for bacteriological existence in our soils are the presence of air and water, a favorable temperature, an absence of light, the presence of proper chemicals, and inoculation with the bacteria desired.

The bacteria best known, and in which we are mostly interested, are those taking part in nitrification, and are of three distinct

*Note.—Mm., millimetre, equals .0395 of an inch.

types of genera: 1. Those parts which convert nitrogenous matter into ammonia. 2. Those which convert ammonia into nitrous acid. 3. Those which convert nitrous acid into nitric acid. Each are necessary to the complete transformation of nitrogenous matter in the soil to nitric acid, the form of nitrogen chiefly available as plant food. Since nitrogen is the most costly ingredient of our fertilizers, estimated at present to be worth 15 cents per pound, it is evident that the farmer or planter should endeavor to maintain such conditions in his fields most favorable to these ferments, and thus enhance his harvests by drawing upon his soils rather than upon purchased fertilizers.

With these preliminary remarks, let us examine several typical soils of each of the sections of the sugar belt. The following are given from hundreds of analyses made in the laboratories of the stations, and are selected because they represent typical soils, and have also been subjected to mechanical analyses which are given further on. These soils represent the alluvial soils of the upper and lower positions of the cane belt of the Mississippi river, the brown loam and whitish soils of the bluff formation and the sugar lands of the Red river deposits.

They are from Evan Hall plantation, Messrs. McCall Bros., McCall P., Ascension parish.

From Home Place, of J. H. Meeker & Bro., Rapids parish, from the State and Sugar Experiment Stations, Baton Rouge and New Orleans.

TABLE No. 1.—CHEMICAL ANALYSES OF SOIL.

L·CALITY.	Insoluble matter.	Potash.	Soda.	Lime.	Magnesia.	Iron Acid.	Phos. Acid.	Sulph. Acid.	Organic matters.	Nitrogen.
Evan Hall Plant. Cut 9 ...	88.720	.092	.158	.394	.087	1.12	.068	.028	2.96	.097
" " " " 26....	83.510	.170	.173	.272	.047	6.620	.137	.038	4.45	.118
" " " " 31 ...	80.800	.133	.143	.545	.044	5.041	.103	.038		...
" " " " 37 ..	83.680	.162	.142	.313	.025	6 33	.126	.046	4 10	.130
" " " " 44....	83.710	.125	.184	.182	.036	5.68	.075	.139	3 91	.120
" " " " 52....	79.210	.112	.111	.434	....	6 99	075	.037	3.51	.117
Home Place, Meeker Bro., soil from 2d front, 4 acres deep Rapides par	86 516	.233	081	1 494	.039	6 822	.098	.043	1.90	060
Do., 10 acres deep	86.420	.206	.122	2.376	.052	5 256	.092	.031	3.33	.084
Sugar Exp. Sta , dark soil ..	62.550	.747	.181	.910	1 361	13.444	.146	....	6.65	.085
" " " light soil ..	70.102	.414	.121	.787	.814	11.28	.161	.019	3 16	.112
State Experimant Station, Baton Rouge, bluff soil....	90.650	.100	.078	.170	.114	4 225	.064	.036	3 15	096
Subsoil of same	89.79	.164	.054	.163	.160	6.510	.128	.025	2.74	.074
Ditto, white soil	87.72	.120	.076	.060	.021	6 67	.112	.021	2 82	.080
Subsoil of same	83.00	.180	.123	.120	.085	8.80	.106	.016	4.21	.105

An inspection of the above and many other similar soils would lead to the conclusion that the contents of valuable ingredients in the average soils of the sugar belt would be about as follows: Lime .5, potash .4, phosphoric acid .1, and nitrogen .1 per cent. In an acre to the depth of 12 inches, estimated to weigh 5,000,000 pounds, there would be 25,000 pounds potash, and 5,000 pounds each of phosphoric acid and nitrogen. An average cane crop of 25 tons, including tops and fodder, will contain about the following: Lime, 40 pounds, potash 60 pounds, phosphoric acid 20 pounds, and nitrogen 65 pounds. Hence there is lime enough for 625 crops of cane, potash for 333, phosphoric acid for 230, and nitrogen for 75.

There is, therefore, no deficiency of plant food in our average sugar soil, and the aim of every planter should be to extract yearly the maximum amounts, which can be obtained only with proper drainage, supply of water (irrigation) in summer, and proper preparation and cultivation of the soil.

Table No. 2 gives the mechanical analyses of the soils whose chemical analyses have been given. Additional soils characteristic of many localities are also given.

TABLE No 2.—MECHANICAL ANALYSES OF SOILS.

LOCALITY	Fine Gravel 2-1 mm	Coarse Sand 1-5 mm.	Medium Sand .5-25 mm	Fine Sand .25-1 mm	Very fine Sand .1-05 mm	Silt .01 01 mm	Fine Silt .01 005 mm	Clay 005-0001 mm	Heated at 110.	Loss on ignition.
Evan Hall, cut No. 9	0 00	0 11	0.14	0 64	47 28	25 66	4 88	13.40	4.96	2 96
" " " No. 26	0 00	0.19	0 34	0 76	22 40	39 88	8 30	19.28	4.42	4.45
" " " No. 37	0 00	0.11	0 23	1 39	33.05	23 58	8 14	24.40	5.00	4.10
" " " No. 44.....	0.00	0.09	0.28	1.00	22.15	25 93	9.12	31 25	6.27	3 91
" " " No. 52.....	0 00	0 08	0 28	0 58	23 55	37 73	7.51	22 44	4.32	3.51
Audubon Park (dark soil)...	0 082	0 064	0 11	0.62	11 49	19 54	14 94	41.29	6.69	6.50
" " (light soil)...	0.00	0 055	0.11	0 71	26.22	34 99	6 95	22 28	4 00	4 64
" " plat VI A...	0 00	0 084	0 58	0 36	37.82	28 04	6 83	20.64	3 30	3 49
" " plat VIII D.	0.00	0.070	0 18	0.78	4 72	19 16	12.68	47.00	7.78	5 61
Home Place, Meeker Bros., (front)	0 00	0 06	0.07	0 22	61.43	26 37	2.08	6.65	1 56	1 90
Home Place, Meeker Bros., (back)	0 00	0 05	0 06	0 21	36 41	42 78	4.26	9.06	2 34	3 33
Cheneyville, Rapides par ..	0 00	0 00	0 05	0 21	27 69	47 16	5 51	11.65	2.85	3.19
Silty Prairie, Calcasieu	0 78	1.30	0 56	1 89	7.73	64.40	9 68	9 74	1 65	2 15
" " Eunice La	2 07	2.50	0 80	2 90	24 64	43.48	5 64	12 48	2.61	2 04
Black Prairie, Lafayette....	0 60	1 00	0 61	0 60	11 56	55.49	8.76	16 03	2 38	3 38
State Exp. Sta. (bluff soil)..	0 01	1 08	0 40	0.55	21 65	55.44	9.45	10 90	0 98	1 58
" " " (subsoil .. .	0.05	0 14	0 31	0 37	15.75	47.28	9 33	21 12	2 41	2 17
" " " (white soil).	0 00	0.09	0.50	0.71	19.99	55.52	8 78	9 74	1.38	2.29
" " " (subsoil) ...	0 31	0.26	0.31	0.43	17.82	48.69	9 50	17.21	2.58	2.62

From table No. 2 it will be seen that very few of these soils can properly be called sandy. They are loamy silts or silty clays. Their water capacity is great, requiring special attention

to drainage in order to reduce it to the amount most favorable to soil ferments. The clayey content of several suggests the propriety of breaking at exactly the right time—neither too wet nor too dry—throwing it into ridges to relieve it of excessive moisture and providing for escape of flood waters.

The Red river soils, particularly the front lands, are largely composed of very fine sand, with small portions of clay, while the bluffs and prairie soils are mainly silt.

Numerous experiments have been made at the Sugar Experiment Station during the past two years to determine the rate of nitrification on the different soils and at different depths, and on soils variously treated.

In every instance nitrification was most abundant at a depth of three to four inches, decreasing in depth until at two feet it was practically nought. In lands in good tilth, or manured with stable manure broadcast, or with good growth of cow peas, nitrification was rapid and copious. It was more abundant on the ridge of the rows than in the middles. Drainage could almost be measured by the rate of nitrification. In badly drained soils it was almost entirely absent, while high dry ridges gave abundant evidence of the activity of the microbes. An immersion of the soil for a few hours by a heavy down pour of rain suspended for two days the process of nitrification. It was more abundant in soils lightly stirred than in those cultivated with the plough.

Soils stirred daily gave increased quantities of nitrogen over those stirred weekly, and more in the latter than in those stirred bi-weekly.

In fact, good drainage and frequent surface cultivations were prime factors in rapid nitrification.

With this knowledge of our soils we can now proceed to apply the well-established principles of preparation and cultivation of all crops.

Since these soils are so strongly silty and clayey, and being level are without natural drainage, it is manifest that they should be placed in a condition of artificial drainage, to ensure warmth and necessary conditions of bacterial growth. Every operation should look to the maintenance of these conditions. Hence flat culture is unsuccessful. They should be broken

as deep as possible to admit air, to assist in drying out excessive water, and, most important, to give as large an area as possible for the foraging of the roots of the cane, since experiments have shown that in stiff lands but few roots pass beyond the broken soil. They should be broken as early in the fall as possible, thrown into high ridges, and the middles, quarter drains, ditches well cleaned out, for the quick removal of winter rains.

The spring should find each row in the condition of an ash bank, and the planter should endeavor to keep it so by proper cultivation throughout the season.

The tilth of our soils is greatly improved and the store of nitrogen largely enhanced by growing cow peas previously to occupying the land in cane. Cow peas perform many valuable functions. By their immense foliage and deep roots they pump up from great depths and evaporate large quantities of water, and thus placing the soil in a condition, relative to moisture, most favorable to nitrification. They intensely shade the ground, thus protecting the nitrogen ferments from the destructive influences of direct sunlight, and enabling them to work directly up to the surface. Their tap roots are pumping, along with water, soluble plant food from great depths.

But the chief virtue lies in its extraordinary power of utilizing the free nitrogen of the air. Among the leguminous crops it occupies the front rank as a rapid soil restorer, frequently accumulating in a few months over 100 pounds nitrogen per acre. An examination of the roots of the cow pea vine during rapid growth will reveal large quantities of wart-like tubercles, which, when crushed and a portion examined under the microscope, will reveal countless thousands of bacteria, peculiar to this plant, living in symbolic union with its host. No plant can supplant the cow-pea in the short rotation adopted by the sugar planter.

The plan usually pursued by our best sugar planters is as follows: Corn planted early and laid by early, and at lay-by sown in cow-peas, at the rate of one to three bushels per acre. The corn is gathered early and the vines turned under in August or September, with four to eight-mule plows. The lands are thrown into beds or rows from 5 ft. to 7 ft. wide, the middles are broken out with double mould-board plows, the quarter drains are cleaned to a depth of 6 in. below middles of the rows, the ditches are maintained at the proper depth. The rows are opened, the cane is planted and covered.

(To Be Continued.)