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ANNUAL MEETING.

The annual meeting of the Hawaiian Sugar Planters' Association will be held at its rooms in Honolulu on Monday, October 22, 1900.

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THE SUGAR MARKET.—New York, Sept. 30.—The very light offerings of raw have been taken at quotations—5c for 96 test centrifugal; the quantity arriving is light. Refiners have been buying October beet sugars in Europe, due here in November, on the parity of 4.40@4.44c for 96 test centrifugals.

Last summary of the statistical position, as reported by Willett & Gray, shows stocks in the United States and Cuba together of 53,525 tons, against 67,716 tons the previous week, and 210,202 tons last year—a decrease of 156,677 tons under last year.

Stocks in Europe last week, 396,000 tons, against 532,000 tons the previous week, and 598,604 tons last year. Total stocks of Europe and America last week, 449,525 tons.

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By recent mails, we are in receipt of a number of documents, reporting investigations made by the U. S. Department of Agriculture relative to various industries. Some of these volumes possess information of value to persons engaged in the industries to which they refer. Among them are the monthly issues of Consular Reports, investigations of the Department of Agriculture, market reports on dairies, silkworms, fruits, vegetables, tobaccos and cigars, manufacturers, commerce, and almost every branch of industry. Among the pamphlets lately received is one on the School Gardens of Europe, giving a very interesting account of the progress made in these industrial institutions, and the practical methods by which the children are taught. The volume just at hand pertains to schools in Germany, France, Belgium and Switzerland, and the account in each country is illustrated with beautiful photograph plates, which afford a clear insight as to the modus operandi pursued in them. The pamphlet last received contains twelve of these plates. These volumes are placed on the shelves in the reading room of the Association, where they can be referred to.

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REPORT OF THE HAWAIIAN AGRICULTURAL STATION.

In this issue will be found, printed in full, the annual report of Dr. Walter Maxwell, the retiring director of the Hawaiian Experiment Station of the Sugar Planters' Association. It exhibits from beginning to end the same diligent study of the cane plant, the various soils, food, drink, care and nourishment required by it, that has characterized his previous reports, and attracted to them the special attention and commendation of others engaged in the same lines of investigation in other sugar countries. There can be no question that his study of the nature, habits, food and needs of this valuable food plant, as shown in his reports, during the past four years, have largely assisted in increasing the yield of sugar in Hawaii.

The doctor's investigations regarding the quantity of seed cane that should be planted, show that one good eye in every six inches of furrow will produce more cane than any larger number of seed eyes, even though double rows of seed cane are dropped for seed in the furrows. This will be a surprise to many. But if the one eye fails, a second should certainly be provided.

The experiments cover twenty varieties of cane, but most of the tests reported refer to thirteen, the names of which are given. Three Louisiana canes were tested, regarding which the report says: "The results furnished by the chief Louisiana canes are very remarkable. Even at the experiment stations of Louisiana the yields of those varieties have not exceeded 10,000 or 12,000 lbs., and yet when they are placed in the extremely different soil and climatic conditions of Hawaii they at once go up in production to well over 30,000 lbs. per acre, surpassing all other varieties that were native, and used to the tropics."

"The experiment station has introduced seven more new varieties which are being tested in competition with those established. Altogether, there are 20 varieties at the station, most of them being leading canes in the countries whence they were received. Varieties giving a reasonable promise at the experiment station will be sent out for plantation use. Varieties that have nothing to commend them and especially if their record in other countries is not strong, will be abandoned after due trial.

"The Louisiana varieties are all marked by the low contents of silica, and the extremely high amounts of potash and chlorine in the ash. These characteristics mark the Louisiana varieties in their native habitat, which is shown by analyses made in Dr. Stubb's laboratories. These varieties are voracious potash eaters; but time will show whether they cannot be bred out of this costly taste in some measure. The 'striped Singapore' and the 'Big Ribbon' very largely share the dominating marks of the Louisiana varieties."

Referring to the four "elements" which require to be added in fertilization, magnesia is referred to as a vital one, indispensable to the plant's growth. * * * In certain soils under consideration, magnesia as well as lime requires supplying. "It is also seen that a very notable proportion of the elements taken from the soil goes to the mill in the cane. What becomes of that proportion depends wholly upon the use that is made of the molasses, mud press cakes, and other wastes. Where the molasses are run out to sea, or into low lands, where they poison the air of the district, it requires no words to tell what happens. When it is fully comprehended, it will be called *madness*—what is taking place today in numerous localities:—the plantations paying 13 to 18 cents per lb. for nitrogen; 6 cents for potash, and 5 to 7 cents for phosphoric acid to bring those elements back to the soil!

"The 'Lahaina' maintains its reputation as a light feeder, the consumption of the four vital elements, per ton of sugar, being almost the same as last year. The Lahaina, however, is a heavy drinker; its demand for water, in irrigation, being very imperative. This reduces greatly its economy where water is scarce or costly, as upon locations of these islands. In respect of the average of qualities—yield per acre, consumption of soil elements, and consumption of water, the Louisiana varieties, 'Striped' and 'Tibboo Mird' have given the highest economic results. Of other introduced varieties, 'Demerara—95' and the 'Striped Singapore' deserve notice, and merit further trial, and also upon plantations."

Regarding the risk of introducing diseases with samples of cane intended for planting, the following extract will show that great care is needed in all cases: "At this place we urge the absolute necessity for all varieties introduced into this country being sent first to the station for trial. This is to guard against the introduction of disease. As an example, this year an excellent variety was brought from Fiji by Prof. Koebele, and sent to the station for trial. It came up and grew well, being full of promise. When seven months old, abnormal symptoms developed. Prof. Koebele was called in to inspect and found some symptoms of *Serch disease*, but not conclusive. Our personal comparison of the symptoms with the notes on the disease by the great authority, Dr. W. Krueger, made it evident to us that we had a case of the Sereh scourge. We dug up and burnt the whole plat, and sent out to two plantations, who had obtained a few sticks, asking them to also utterly destroy the same. The Association should seek to have it made imperative for all introduced varieties to go for trial at the experiment station; and it is advisable that the station shall in future withstand all solicitations for seed of new varieties until these have furnished a mature crop, and are eligible for a clean bill of health. The variety in question is the 'Malabar.' We believe it is originally a Java variety; the name following probably from the village or mountain of that name in Java."

The following items will interest all cane planters, as it refers to a situation of the canefield which often creates doubt regarding what course should be pursued: "We call attention to the apparent action of the fertilizers upon the cane last year at the season of tasseling (flowering). The plats which did not receive any fertilizer, and the plats which received potash and phosphoric acid, and either separately, or the elements together,—all these plats had cases of tasseling without exception. The plats which received nitrogen, either nitrogen alone or mixed with other elements, did not show one case of tasseling. Where no nitrogen was applied, tasseling occurred on every plat. Where nitrogen was applied no tasseling followed. The explanation of this action of nitrogen is to be looked for in the circumstance that nitrogen is the most vital element of protoplasmic activity, and of plant growth. The application of the element acts specifically upon the vegetative organs of the plant, keeping those in a continuously active state, and consequently keeps in abeyance the propagation organs. Thus, if by maintaining a rapid state of growth in the cane at the season of liability to flowering (producing seed) it may probably be pushed by, when the organs of propagation will remain quiet until the next season, twelve months hence, occurs."

"A reference to the 'monthly' applications of irrigation water enables us to see the increased volume applied with the increasing development of the crop. When the cane is planted, and while it is very small, the greater portion of water applied escapes by direct evaporation from the soil. As the cane increases in size, and its foliage begins to shade the ground, the crop gives off more water by transpiration, and the soil loses less. When the crop is in the fullest vigor of growth, and is attaining maximum development, its consumption of water is also at the maximum, which is indicated by the applications in June, July, August and September of the year 1899. The crop at this stage, however, practically shuts out the sun, and also the wind, so that the evaporation of water from the soil is reduced to a minimum.

"Concerning the sugar produced by the given volume of water, as shown in the stated results, it must be said that no plantation is using less than double the volume of water of irrigation used in these experiments. Some are using much more than double the volume, and with less than one-half the yield of sugar per acre (we have the records of the total number of acres on all irrigated plantations and the yield of sugar per acre over the whole). As it has already been said, many plantations now see that they have been using a great excess of water, and have reduced the amount by one-half, and one plantation by more than one-half. At this place it may be said that probably no other existing sugar-producing country could indulge in such extravagances and keep above water. The fact is that the increasing producing power of our soils (an increase of from 3 tons to 5 tons per acre), the abundance of labor up to recent date, and the happy fiscal relations of these islands with the United States—all these have made the situation luxurious, and have also made it unnecessary for the management of our estates to get down to the bed-rock lines of economy essentially practiced in other countries.

"In the case of rattoons, we invariably have found the crop to be too thick. It becomes grassy, and more canes come up than can ever find standing room. We have found it advisable to keep the water off for two or three or more weeks from such dense rattoon growths in order to *dry out* the weakest suckers. After this is done, the remaining, and strongest canes make more rapid growth, with a less immediate consumption of soil food and water."

"The analyses of the cane, as well as of the leaves and waste matters, put before us a statement of the enormous amount of soil material that is removed by the growing crop. These facts should sink into the mind, and abide in the daily consciousness of every one engaged in growing cane.

"The composition of the mineral matters in the 13 kinds of canes, whilst demonstrating the oneness of the family, indicate extreme variations of behavior of the canes as varieties. Remarkable is the scale of variation in the silica which moves between a minimum of 14.66% in the Louisiana 'Purple,' and 32.16% in the 'Moore's Purple.' "

The entire report is one of unusual interest and value to planters, and should be preserved for reference.

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OUR FORESTS. SHALL THEY BE DESTROYED OR PRESERVED?

Editor Planters' Monthly:—As a nation we seem to be awakening to the need of systematic forestry throughout the U. S., and it is to be hoped that the leaven will establish itself among us here in Hawaii. There is no other public utility that has been so neglected, ravaged, wasted and wantonly destroyed by civilized man as the great gift of our Creator—the forests.

The first great work in preparing a fitting place for man to work out his destiny, was to cover the earth with a mantle of vegetation, without which the whole plan of Creation along the lines of Genesis, would not have been possible. Yet today we see areas of the globe which have become almost uninhabitable by the wanton destruction of forest and verdure, through the vandalism and neglect of those whose duty, pleasure and *profit* it should have been to protect and guard it as a sacred inheritance. If such devastation should be extended over the whole globe, there could be no existence for any human being; yet we look supinely on at the destruction (limited so far as our observation may extend), without any apparent care or worry as to the results to follow, for the generations to come.

As sure as a stream cannot rise above its fountain head, a nation will not rise to a higher plane of thought and action than the sentiment of the people composing it, and if we would arrest the destruction that is going on with the forests and earth carpet of our nation, threatening the very existence of our agriculture—the foundation of all wealth, *we as individuals*, must shoulder the responsibility of our citizenship, and make it our personal affair to look after the well-being of so much of our country's forests as are within the limits of our influence; then and only then will there be maintained a healthy sentiment against the devastation of the people's inheritance, and proper steps taken for its conservation.

Within the limits of our county, the center of the highest agricultural development of Southern California, upwards of twenty thousand acres of forest have been destroyed by fire during the past two years. This area is mountain range from which the water supply for the valley is largely obtained; very little of this forest growth is "timber" in the sense that the lumberman or woodchopper use the term, but principally a dense growth of scrub-oak and other brush, protecting the soil of the mountain sides from the direct rays of the sun, and by their mass of roots and deposit of dead leaves retain the winter rains with sponge-like tenacity, until it soaks into the soil to become the fountainhead for numerous springs, and rivulets, which in time supply the valleys below with their life-giving energy.

The damage to this one county in dollars, can scarcely be estimated; yet such fires have been of periodical occurrence during the past twenty-five years, and abundant proof of the resultant diminution of the water supply is observable to all.

THE PASSING OF THE FORESTS OF HAWAII.—So far as I have observed and studied the situation on this island (Oahu) during my three years' residence here, have not been under the glare of great forest fires, but the more insiduous and various methods peculiar to local conditions; while a similarity of the process of destruction to that of California is apparent, yet the local conditions modify and prevent the sweeping of great fires over a very large area at one time, the frequent rains in the mountains preventing their continued burning for but short periods at a time.

The pastoral industry is charged with the destruction of the

Hawaiian forest. While perhaps in the past it has been true, and at present is a leading factor in the work of destruction, it is hard to bring the fact home and convince the average stockman, although at heart he is not more indifferent to the protection of the forest than many others, it is perhaps because he is generally not of an investigating turn of mind and draws his conclusions from present results, rather than from cause and effect. If he sees the dry trunk and decaying branches of the large forest tree, he will say "you need not tell me that cattle killed it, as it is impossible for an animal to injure such a tree," which is quite probable in the abstract, but are not they responsible for the conditions which have brought about the decine and final decay? Let us review the facts leading up to the conditions as we find them today. Mr. A. takes a long lease of several thousand acres of land extending from the beach up to the summit of the mountain range; the flat land near the shore, if on the lee side of island, is dotted with a growth of algeroba (Prosopis dulcis) which have established themselves here, owing to the friendly aid of some hand or animal scattering the seed, and congenial soil and climatic conditions: the sloping highlands back of this are covered with a growth of maniania grass, with clumps of kukui and other trees in the gulches, to a height of three to four hundred feet above sea level: above this grass belt, where the best grazing is found, the plain is more broken into ridges, covered with a coarse grass, and deep gulches with a greater variety and more dense growth of trees, shrubs, ferns, &c., finally merging into the mountain range, covered with a luxuriant growth of tropical forest and jungle, where the koa (acacia koa) lehua, ohia, kukui and other native forest trees find their most favorable conditions of growth. The marginal ridges projecting into the forest belt are covered with a coarse grass which during the rainy season is sour and not eaten by stock, and so long as the maniania grass sets sufficient moisture from passing showers to maintain a growth, they do not leave it to invade this section, or the forest materially, but with the advent of the dry season, the feed on the lower plain becomes scant, and Mr. A. must have more pasture. He has learned that by burning off the coarse grass and exposing the soil to the action of the sun's rays, it becomes areated and sweetened, and with the occasional showers of the higher altitude starts a new succulent growth, which tides his stock over, till the fall rains start the better grass on the lower plain. This work is delegated to the herdsmen, who choose a dry time that the grass may burn well; the fires are left to burn till a providential shower happens along; the grass is not only burned, but the brush and trees growing in the gulches are mostly destroyed, the flames sweep on and invade the adjacent forest, destroying the dense growth of fern and underbrush, all the smaller and younger forest trees, and many of the older growth; but if not an unusually dry spell, some of the larger trees will escape perhaps, with their branches singed, to prolong a miserable existence as a monument to the destructiveness of *civilized man*.

The cattle now seek the shade of the forest during the warm weather, browsing and trampling under foot the succulent shoots of the undergrowth as it strives in vain for an existence; the passing wind and the grazing cattle spread the seed of the rank-growing grasses from the open ground over the burned area, which find a congenial home, where before they could not get a foothold on account of the dense shade, and the luxuriance of the undergrowth. The new conditions, which are the opportunity for the tiny grass seedlings, are the death knell to the remnant of the stately forests which have survived the fire ordeal, Nature having provided abundant moisture, that was constantly maintained by the protecting undergrowth which kept the soil cool, and prevented too rapid evaporation. The roots of the forest trees run near the surface, not penetrating to the depth the same species would do if growing in the open country, and now that their covering has been destroyed, the sun beats down on their defenseless trunks and roots, scalding their sap and parching the soil, until it is only a question of time they succumb to the inevitable. Yet some will say, these trees were not killed by the cattle, and the destruction continues from year to year.

Not only this, but the unfavorable condition for reestablishing the forest by nature from seed, which has superceded the congenial one of former existence, must be considered. Even with the removal of the cattle, it is doubtful if the tiny seedling of most forest trees could establish itself in the heavy growth of grass which covers the soil, forming a dense clod, and superceding the forest. These annual burnings of the grass constantly destroy any young seedlings that do get a foothold, and the forestless area extends from year to year.

The utter impossibility of maintaining a pastoral industry and our forests on the same land should have been apparent years ago to all, and the few who have been wise enough to cease the attempt and undertake the conservation of their forests, are to be commended as benefactors. It is high time that every true friend of the Hawaiian Islands awakened to his duties as a citizen for the protection of our forests, and work for the extension of the area and the conservation of what we now have.

BYRON O. CLARK.

Wahiawa, Oahu, Sept. 25th, 1900.

WORK OF THE EXPERIMENT STATION AND LABORATORIES.

(Walter Maxwell, Director and Chief Chemist.)

To the Trustees and Members of the Hawaiian Sugar Planters' Association.

Gentlemen:—This report contains the results of experiments that have matured during the current year, and a statement of new work.

RESULTS OF PLANTING TESTS.

As it was explained in last year's report, these planting tests were begun in order to observe the results of planting seed bearing different numbers of eyes, and of planting different quantities of seed in the row, and to ascertain whether less seed can be used than is generally used on the plantations, without detriment to the stand and crop.

In last year's report, page 27, we gave the respective number of canes found at different stages of growth where the different quantities of seed had been used. The figures applied to two varieties of cane,—Lahaina and Rose Bamboo. In the following statement an average is given of the results of the two varieties, and for the following significant reason: The varieties were planted alternately, three rows of Lahaina, and by the side of these, three rows of Rose Bamboo. While the cane was young this alternation of the varieties had no apparent effect. As the cane became large, and especially when it approached to maturity, the utter inability of the Lahaina to hold its own against the enormous vitality and great size of the Bamboo led to results that we had not foreseen, or provided against. When it reached a given development the Bamboo began to lodge, but instead of going down, and remaining upon its area, it fell both ways, lodging upon the plats of Lahaina on each side. As time went on the Bamboo overgrew the Lahaina, the latter being thrust down into the furrows, where, for want of light, it began to die out. Consequently, when the time came to take off the crop, the Lahaina was unusually light, and the Rose Bamboo abnormally heavy. As a matter of fact, this behaviour of the two varieties, side by side, has robbed the tests of the conclusive results that were expected. In consequence, new series of tests were begun, and are now in growth, the varieties being carefully separated from each other. One great conclusion has been reached, however, and by most unmistakable data, viz: the supreme vitality of the Rose Bamboo, and the inability of the Lahaina cane to stand up against, and compete with it in equal conditions of soil, climate, and cultivation. For these reasons we give the average number of canes produced by the two varieties as the results of planting different quantities of seed.

No. of Tests.	Quantities of Seed Planted.	Canes per Row of 107½ feet.
2	Two continuous canes in row............	382
2	One continuous cane in row	313
2	One eye per 6 inches.	387
2	One eye per 12 inches....................	387
2	One eye per 18 inches....................	359

These figures show that the quantity of seed planted does not determine the number of canes that are produced. "One eye per 6 inches," and "per 12 inches" produces even more canes than "two continuous canes in the row." The lesser number of canes found where "one continuous row" was planted was due to the supreme action of the Rose Bamboo in crowding the Lahaina alongside of it. The number of dead canes found in the Lahaina of that test was greater than elsewhere. As many canes were produced, but they were smothered out. In the last test of "one eye per 18 inches" there were actually fewer canes produced, and the least number died out; so that in that case it is indicated that one eye per 18 inches is too wide to produce a full stand and crop. This observation will be confirmed or corrected by the new series of tests recently begun.

The number of canes produced per row or per acre from using different quantities of seed is a factor: It is not a conclusive factor, however, and in order to judge of the value of thin or thick planting we must also have the weight of cane produced; the quality of the cane juice, and, finally, the actual yield of sugar per acre.

WEIGHT OF CANE PER ACRE.

Tests.	Distances of Planting.	Pounds per Acre.
1	Two continuous canes in row.............	185,660
2	One continuous cane in row.............	193,180
3	One eye planted per 6 inches.	194,660
4	One eye planted per 12 inches............	195,940
5	One eye planted per 18 inches............	175,036

In the previous table, which gave the number of canes per row, it was seen that test No. 2 contained 69 canes per row of 107½ feet less than test No. 1. But test No. 2 gives a considerably greater weight of cane per acre than test No. 1, thus showing that the number of canes in the row does not necessarily indicate the weight per acre. In test No. 5 there were fewer canes per row, and there is a less weight per acre, thus indicating that the planting of only "one eye per 18 inches" cannot give a maximum crop.

QUALITY OF CANE PRODUCED.

Distances of Planting.	Density (Brix)	Sucrose in Juice.	Purity of Juice.
Two continuous canes in row.......	20.72	17.57	84.79
One continuous cane in row........	19.94	17.09	85.71
One eye planted per 6 inches........	19.99	16.95	84.79
One eye planted per 12 inches......	19.97	17.32	86.73
One eye planted per 18 inches	20.00	16.95	84.75

There is very little variation in density, richness, or purity of the juice in the canes grown from different quantities of seed planted. It is observable that the purity of the juices is generally rather low for Hawaiian conditions. This appears to be due to the fact that the cane did not generally tassel (flower). Samples were taken of tasseled and non-tasseled canes. This was done by taking a tasseled cane, and an untasseled cane from the same root and comparing them by analysis, when the results were as follows:

No. of Tests.	Cane.	Density (Brix.)	Sucrose in Juice.	Purity of Juice.
10	Tasseled cane	19.97	17.70	86.60
10	Un-tasseled cane. ..	18.48	15.80	85.40

The experiment station field lies but a few (some twenty) feet above sea level, and the low land cane does not tassel so regularly as the cane of somewhat higher elevations.

YIELD OF SUGAR PER ACRE.

Distances of Planting.	Cane per Acre.	Sucrose in Cane	Sugar per Acre.
Two continuous canes in row.	18 .660 lbs.	15.74 per cent	29,212 lbs.
One continuous cane in row..	193,180 "	15.31 "	29,575 "
One eye per 6 inches.........	194,660 "	15.18 "	29,549 "
One eye per 12 inches........	195,940 "	15.51 "	30,390 "
One eye per 18 inches.	175,036 "	15 18 "	26,570 "

These figures give the yield in English pounds, per English acre.

The results given are obtained from 10 tests with two varieties—Lahaina and Rose Bamboo, each one of the five lines of figures in the table giving the average results of the two varieties.

The tests were all made under uniform conditions of soil, cultivation, and fertilization, and the same exact volume of water was applied, by actual measurement, to the cane of each test. The most apparent first result of using the different quantities of seed is the comparative uniformity of the yield until the tests are reached where only "one eye per 18 inches" was planted, and there the yield of cane and sugar falls off. Test No. 4, where "one eye per 12 inches" was planted, gives the largest weight of cane; the highest quality of juice, and the greatest yield of sugar per acre.

The new series of tests, already spoken of, is now in progress. The planting was done on June 27th-29th, these being the dates of planting of the series just matured. The cane used for seed was 11 months old. Two feet at the bottom ends of the canes were cut off, and not used for seed. In the tests where continuous rows of cane were planted, the canes were cut into lengths bearing from five to ten eyes, according to the practice on plantations. In the other three orders of tests, single eyes (i. e. single joints) were planted, in all respects the same as was done in the previous series.

The single eyes came up four days ahead of the cane bearing several eyes, and in both the Lahaina and Rose Bamboo. The Rose Bamboo tests generally germinated, and were out of the ground, in one day less time than the Lahaina. Rose Bamboo single eyes began to come through the ground on the fourth day after planting. The Lahaina on the fifth day, which was phenomenally quick germination.

PLANTING TESTS (Second Series).

Variety Lahaina.	Mode of Planting.	Eyes that Planted.	Eyes that Grew.	Eyes that Died.
1	Two continuous canes in row...	2991	1179	1812
2	One continuous cane in row	1490	666	824
3	One eye per 6 inches	645	631	14
4	One eye per 12 inches	321	299	22
5	One eye per 18 inches	208	197	11
R. Bamboo				
1	Two continuous canes per row..	2925	1504	1331
2	One continuous cane per row...	1438	865	573
3	One eye per 6 inches...........	645	623	22
4	One eye per 12 inches..........	321	308	13
5	One eye per 18 inches...... ...	208	200	8

If the above figures are expressed as the relative quantities of seed used per acre, then the results are as follows:

Different Quantities of Cane Planted per Acre.	LAHAINA. Eyes Planted per Acre	ROSE BAMBOO. Eyes Planted per Acre
Two continuous canes in row.......	79,760	78,000
One continuous cane in row.	39,733	38,347
One eye per 6 inches..............	17,200	17,200
One eye per 12 inches........	8,560	8,560
One eye per 18 inches.......... ..	5,547	5,547

There is nothing more to be said of these tests at their present stage.

RESULTS FROM DIFFERENT VARIETIES OF CANE.

In last year's report, pages 29-30, account is given of the beginning of a comparative study of varieties. Thirteen different canes were planted including four varieties already upon the islands and nine other introduced canes. In the comparative tests of the thirteen varieties all were conducted in identical conditions of soil, cultivation and fertilization. The same volume of water was applied, by measurement, to each test. The canes used for seed of each variety were the same age, and the same amount of seed of each was used, and planted in the same way. Concerning the relative productiveness, in numbers of canes, of the varieties, the following data explain:

Varieties.	Age of Cane.	No. of Cane per Row of 107½ Feet
Lahaina	15 months	319 canes
Rose Bamboo	"	340 "
Yellow Caledonia	"	254 "
Yellow Bamboo	"	297 "
Moore's Purple (Fiji)	"	490 "
Demarara, No. 117	"	412 "
" No. 95	"	584 "
" No. 124	"	175 "
Louisiana, Tibboo Mird	"	441 "
" Striped	"	373 "
" Purple	"	411 "
Striped Singapore	"	353 "
Big Ribbon	"	307 "

It is seen that there is an extreme of variation in the number of canes produced per row or per acre by the different varieties. There was also a great divergence of behaviour in the matter of suckering. Several of the varieties, particularly the Demararas No. 117, and No. 95, and the Louisiana canes, suckered very freely; whilst the Yellow Caledonia, and Demarara No. 124 put forth very few suckers.

WEIGHT OF CANE PER ACRE OF THE VARIETIES.

Varieties.	Weight per Acre.
Lahaina	193,280 lbs.
Rose Bamboo	209,600 "
Yellow Caledonia	182,240 "
Yellow Bamboo	158,160 "
Moore's Purple (Fiji)	80,560 "
Demarara, No. 117	186,240 "
" No. 95	194,000 "
" No. 124	110,400 "
Louisiana, Tibboo Mird	241,360 "
" Striped	239,520 "
" Purple	153,360 "
Striped Singapore	165,040 "
Big Ribbon	232,161 "

The variation in production of cane of the several varieties is very great, varying all the way between a minimum of 80,560 lbs. of the Moore's Purple, and 241,360 lbs. per acre produced by the Louisiana variety, Tibboo Mird. It is seen that there is not necessarily any relation between the number of canes and the weights per acre. With some varieties, more particularly the Moore's Purple, and the Louisiana Purple, a great number of canes died out between the date of the last count and when the cane was harvested.

QUALITY OF THE JUICE OF THE VARIETIES.

Varieties.	Density (Brix.)	Sucrose in the Juice.	Purity of the Juice.
Lahaina	19.93	17.20	86.25
Rose Bamboo	18.72	16.15	85.35
Yellow Caledonia	17.87	14.00	78.15
Yellow Bamboo	18.45	15.05	81.58
Moore's Purple (Fiji)	17.75	14.05	79.15
Demarara, No. 117	18.35	13.85	75 58
" No. 95	20.17	17.45	87.24
" No. 124	16.68	13.30	79.73
Louisiana, Tibboo Mird	18.21	15 36	84.30
" Striped	18.54	15.95	85.82
" Purple	17.76	14.90	83.98
Striped Singapore	19.40	16.93	87.19
Big Ribbon	17.79	13.20	73.53

Extreme variations in the density, sugar content, and purity of the juices are observed amongst the varieties. Before commenting further we shall set forth the yields of sugar per acre of the varieties.

YIELD OF SUGAR PER ACRE OF THE VARIETIES.

Varieties.	Pounds of Cane Per Acre	Fibre in the Cane.	Sucrose in the Cane.	Pounds of Sugar Per Acre.
Lahaina	193,280	10 9 per cent.	15.32 per cent.	29,610
Rose Bamboo	209,600	9.9 "	14.54 "	30,475
Yellow Caledonia	182,240	11.7 "	12.36 "	22,524
Yellow Bamboo	158,160	12.8 "	13.12 "	20,750
Moore's Purple (Fiji)	80,560	10.3 "	12.60 "	10,150
Demarara, No. 117	186,240	10.1 "	12.45 "	23,186
" No. 95	194,000	11.7 "	15.40 "	29,876
" No. 124	110,400	9.3 "	12.06 "	13,314
Louisiana, Tibboo Mird	241,360	9.0 "	13 97 "	33,718
" Striped	239,520	9.9 "	14.36 "	34,395
" Purple	153,360	10.0 "	13.41 "	20,565
Striped Singapore	165,040	10.9 "	15.08 "	24,888
Big Ribbon	232,161	11.5 "	11.68 "	27,116

In the first place, may be noted the yields of the Lahaina and Rose Bamboo: The average of the two varieties is 30,042 lbs. of sugar per acre. The average of these two varieties in planting tests, given in a previous table, was 29,682 lbs. of sugar per acre. This comparison shows the exceeding uniformity of results of the tests and the consequent reliability of the same.

The economic results of the several varieties are extremely different. The yields of sugar per acre vary between a maximum of 34,395 lbs., and a minimum of 10,150 lbs. The actual yield or production of sugar is not the only factor in judging of a variety economically: The yield of sugar in the mill is controlled in a large measure by the purity of the juice; and it was seen in the previous table that the purity of the juice of the different varieties varied between a maximum of 87.19, and a minimum of 73.53. The worst example of combined bad properties is the Moore's Purple (Fiji), where the production per acre is only 10,150 pounds, and the purity of the juice is below 80.0. The Louisiana varieties, "Tibboo Mird," and more especially the "Striped" have given the highest economic results, considering the production, and the quality of the juice. Next in order is the Demarara No. 95; after which come the "Lahaina" and "Rose Bamboo."

The results furnished by the chief Louisiana canes are very remarkable. Even at the experiment stations of Louisiana the yields of those varieties have not exceeded 10,000 or 12,000 lbs., and yet when they are placed in the extremely different soil and climatic conditions of Hawaii they at once go up in production to well over 30,000 lbs. per acre, surpassing all other varieties that were native, and used to the tropics.

Demarara No. 95 is an extremely promising variety, and also is the Striped Singapore. All the varieties specially noted by us deserve careful and repeated testing on plantations.

The results of the several varieties given have been obtained under identical conditions of soil and treatment. Conditions are not identical over the islands, and upon the various plantations. For this reason the varieties will not be found to behave the same in all other localities. For example, the "Yellow Caledonia" and "Yellow Bamboo," although they have given yields at the experiment station far in advance of the yields of those varieties on plantations, they are far behind several other varieties in production. It is seen that whilst the weight of cane of the "Yellow Caledonia" is good, the sucrose content, and the purity of the juice are very low. But in Kau, Hawaii, where the variety was first developed by Manager Hewitt, of the Hutchinson Sugar Co., not only good yields of cane and sugar were obtained, but the purity of the juice went up to 86.0. These examples show that hasty conclusions must not be come to; but that all varieties that indicate any promise should be sent out and tried on the plantations.

Again, given varieties are more promising for different climatic conditions: A series of tests were made with the 13 varieties, *without irrigation*, all other conditions being the same. The seasons were excessively dry, only 26 inches of rain falling during the 17 months that the cane was in growth. No variety would have produced more than 1,000 lbs. of sugar per acre; but the Moore's Purple, the Yellow Bamboo, Lahaina, and Demarara No. 124 died out wholly and early in their career, the others surviving longer. Moore's Purple was all dead three months before any other. Rose Bamboo bore the drowth very well, but not so well, or so long, as the Louisiana canes, and the Demarara No. 95 and No. 117, and the Striped Singapore. This matter of the variety for the location is of peculiar importance upon these islands where the rainfall varies between 200 inches and 20 inches per annum.

The experiment station has introduced seven more new varieties which are being tested in competition with those established. Altogether, there are 20 varieties at the station, most of them being leading canes in the countries whence they were received.

Varieties giving a reasonable promise at the experiment station will be sent out for plantation use. Varieties that have nothing to commend them, and especially if the record in other countries is not strong, will be abandoned after due trial.

ELEMENTS REMOVED FROM THE SOIL BY THE RESPECTIVE VARIETIES.

In estimating the comparative economic values of canes it is not only necessary to know the yield of available sugar per acre, but also at what cost to the soil the production has been made. To ascertain this cost we have to know the composition of the cane, and the relative amounts of the soil elements that have been used.

COMPOSITION OF THE FRESH CANE.

Varieties.	Per cent Water.	Organic Matter.	Mineral Matter.	Total.
		Per cent.	Per cent.	Per cent.
Lahaina	71.34	27.89	0.77	100.00
Rose Bamboo	73.13	25.96	0.91	100.00
Yellow Caledonia	73.47	25.66	0.87	100.00
Yellow Bamboo	70.91	28.07	1.02	100.00
Moore's Purple	73.78	25.22	1.00	100.00
Demarara, No. 117	73.41	25 67	0.92	100.00
" No. 95	70.50	28.85	0.65	100.00
" No. 124	75.58	23.51	0.91	100.00
Louisiana, Tibboo Mird	74.43	24.56	1.01	100.00
" Striped	73.40	25.79	0.81	100.00
" Purple	74.02	25.17	0.81	100.00
Striped Singapore	72.76	26.48	0.76	100.00
Big Ribbon	72.76	26.35	0.89	100.00

The variation in the solid matters and water contents of the canes is very noteworthy, the significance of which will be more clearly seen in later paragraphs.

Not only are the water contents of canes of different varieties different, the water content of any one cane is a changing factor. Cane grown under dry conditions, or cane which has not received any water for a length of time, is "dried out," and a relatively low content of water and high amount of solid matters are found, and vice versa. In fact, it is known to persons who have made careful physiological and chemical studies of the sugar cane, and of the sugar beet, that the water content in the morning is greater than in the evening of the same day, and this is quite noticable on days of great heat and high winds. The same chemist, with the same polariscope, can find a difference of from 0.1% and 0.4%. This is very specially the case with the sugar beet, whose leaves in the early morning are erect, and in the evening are limp and flat on the ground, by reason of the fact that the beet has lost its moisture more rapidly through the leaves than it could take it up from the soil.

The water content then, being such an inconstant factor, it is necessary, in making final comparisons of the canes, to reduce all to the basis of the solid matters, or the so-called "water-free material."

SOLID MATTERS IN THE RESPECTIVE VARIETIES.

Varieties.	In the Cane. Solid Matter Produced per Acre.	In Tops, Leaves and Dead Canes. Solid Matter Produced per Acre.
Lahaina	55,394 lbs	60,560 lbs.
Rose Bamboo	56,319 "	64,560 "
Yellow Caledonia	48,348 "	45,760 "
Yellow Bamboo	46,008 "	50,720 "
Moore's Purple (Fiji)	21,122 "	63,680 "
Demarara, No. 117	49,521 "	46,560 "
" No. 95	57,230 "	69,760 "
" No. 124	26,959 "	51,760 "
Louisiana, Tibboo Mird	61,715 "	73,360 "
" Striped	63,712 "	66,480 "
" Purple	39,842 "	60,160 "
Striped Singapore	44,938 "	60,560 "
Big Ribbon	63,240 "	68,800 "

Under the head of "Tops, Leaves and Dead Canes" is embraced the total solid matter contained in the total waste products of the crop, less the roots, which remain in the ground.

The purpose of these tests was not a physiological one, dividing the cane organism into its three several parts—leaves, cane, and roots, but was simply planned and carried out in order to determine the economic value of each of the several varieties, which is ascertained by knowing the sugar produced per acre, and the draft made upon the soil, upon fertilizers, and upon irrigation water, in the production of the crop.

It is seen that, with the exception of the Yellow Caledonia, and the Demarara No. 117, the solid matter of the waste products (tops, leaves, dead cane) was greater than the solid matter in the canes. There is very great variation, however, and this is more chiefly due to the greater number of suckers which die young, and of canes which dry up after maturity, of some varieties more than others. Taking the "Moore's Purple" as example, that variety began its career with 1,052 canes per row of 107½ feet; when 15 months later it numbered 490 canes per row, which latter number was further greatly reduced before the crop was harvested; the final result being that only 21,122 lbs. of dry cane matter were harvested, but a mass of leaves, tops, and dead suckers and canes which amounted to nearly 64,000 lbs.

COMPOSITION OF THE SOLID MATTER OF THE CANE.

Varieties.	Organic Matter.		Mineral Matter.	
	Per Cent.	Pounds per Acre.	Per cent	Pounds per Acre.
Lahaina	97.30	53,899	2.70	1,495
Rose Bamboo	96.60	54,405	3.40	1,914
Yellow Caledonia	96.71	46,758	3.29	1,590
Yellow Bamboo	96.48	44,389	3.52	1,619
Moore's Purple (Fiji)	96.17	20,314	3.83	808
Demarara, No. 117	96.52	47,984	3.48	1,527
" No. 95	97.79	55,966	2.21	1.264
" No. 124	96.26	25,952	3.74	1.007
Louisiana, Tibboo Mird	96.04	58,272	3.96	2,443
" Striped	96.95	61,769	3.05	1,943
" Purple	96.85	38,588	3.15	1.254
Striped Singapore	97.19	43,676	2.81	1,262
Big Ribbon	96.73	61,173	3.27	2,067

The variations in the contents of mineral matter in the several varieties is very considerable. These variations do not, however, indicate the demands made upon the soil by the respective canes: it is further necessary to know the mineral matter in the waste matters of the crop to come at that.

COMPOSITION OF THE SOLID MATTER IN THE TOPS, LEAVES AND DEAD CANES.

Varieties.	Organic Matter.		Mineral Matter.	
	Per Cent.	Pounds per Acre.	Per Cent.	Pounds per Acre.
Lahaina	91.56	55,459	8.44	5,111
Rose Bamboo.	91.05	58,812	8 95	5,748
Yellow Caledonia	91.08	40,679	8.92	4,081
Yellow Bamboo	91.90	46,612	8.10	4,108
Moore's Purple.	90.22	57,453	9.78	6,227
Demarara, No. 117	89.54	41,690	10.46	4,870
" No. 95	90.01	62,917	9.81	6.843
" No. 124	87.94	45,718	12.06	6,242
Louisiana, Tibboo Mird	91.34	67,008	8 66	6,352
" Striped	90.05	59,866	9.95	6,614
" Purple	90.07	54,187	9.93	5,973
Striped Singapore	91.58	55,461	8.42	5,099
Big Ribbon	91.06	62,750	8.94	6,050

We can now come at the total amount of mineral matter used by each variety of cane, and the relative amounts of sugar produced.

MINERAL MATTER TAKEN OUT OF THE SOIL, AND THE SUGAR PRODUCED PER ACRE BY THE RESPECTIVE VARIETIES.

Varieties.	Sugar Produced per Acre.	Mineral Matter Used per Acre.	Sugar Produced per lb. of Mineral Matter Used.
Lahaina	29,610 lbs.	6,606 lbs.	4.48 lbs.
Rose Bamboo	30,475 "	7,662 "	3.97 "
Yellow Caledonia	22,524 "	5,671 "	3.97 "
Yellow Bamboo	20,750 "	5,727 "	3.79 "
Moore's Purple	10,150 "	7,035 "	1.44 "
Demarara, No. 117	23,186 "	6,397 "	3.62 "
" No. 95	29,876 "	8,107 "	3 68 "
" No. 124	13,314 "	7,249 "	1.83 "
Louisiana, Tibboo Mird.	33,718 "	8,795 "	3.83 "
" Striped	34,395 "	8,557 "	4.01 "
" Purple	20,565 "	7,227 "	2.84 "
Striped Singapore.	24,888 "	6,361 "	3.91 "
Big Ribbon	27,116 "	8,117 "	3.34 "

This table sums up very briefly the data and conclusions set forth in the preceding paragraphs. We see at a glance the amount of sugar that each variety has produced per acre, and at what cost to the mineral elements of the soil. This cost is very various, as the outer column in the table shows.

The Lahaina variety produces the largest amount of sugar per pound of mineral matter used. Next in order is the Louisiana "striped." The latter variety is strong in all its characteristics, and is quite easily the most economically advantageous cane according to the tests of this year. "Moore's Purple," and the Demarara No. 117, show as badly in this last table of comparisons as in previous ones. They do not give any promise as sugar producers.

It is now necessary to know of what the total mineral matter is composed which has been removed by the crop from the soil. This involves complete analyses of the mineral matter. But before giving the results of analyses that have been made we will speak of—

METHODS OF SAMPLING AND ANALYZING.

In the examination of vegetable organisms the first, and very important act is the preparing of exact samples of the material to be examined. This involves not only a strict representation of the material, but the material in a state free from all extraneous impurities.

Last year, in taking the samples of cane, and of cane leaves that were used in the analyses given in the report of 1899, the usual precautions were observed in order to have the material free from dust, soil material, etc. Our observations of this year have shown us that those "usual precautions" were not enough: we are now persuaded that each sample of cane, or cane leaves, that is intended for use in the determination of mineral matter, should be thoroughly washed in order to remove all adhering soil, and fine dust. We have actually noted canes, and also leaves, which were permeated with fine dust to an extent that was equal to from 10 per cent. to 40 per cent. of mineral matter present in the material. Unless this outside dust is first wholly removed it totally vitiates the analytical results. Our findings of "total mineral matter" this year are less than those of last year in the leaves and trash, and we are satisfied that it can be due to the washing of all the material this year before analysis. Our findings of mineral matter in the cane this year are higher than those of last year; but this is not due to the original sample, nor to the analysis, but to an error made in preparing the sample last year. By misunderstanding an instruction, the man who prepared the samples last year put the canes, that were to be analyzed, through the mill, expressing a large quantity of the juice, which juice, with all the mineral matter it contained, was thrown away and did not enter into the analyses. This was not known by us until too late to prevent the publication of the analyses. The samples of this year were all taken and prepared in the presence of the writer, and are correct in every possible detail. In taking samples for the determination of the ash, or mineral matter, nothing must be allowed to escape from the cane but its moisture. In preparing samples for the estimation of the fiber in the cane, the cane taken, after weighing, can have its juice expressed before the further acts are followed for the removal of everything but the fibre. In our estimations of fibre, instead of taking 10 grams of material, 500 or 1000 grams are taken; this weight being resolved into 20 portions or more, each portion being treated separately. The sum of the fiber found in all the portions is the actual fiber in the 1000 grams. This mode of coming at the fiber content has furnished better results than duplicates with samples of 10 grams each. * * * The error already explained in the determination of the ash in the cane last year, was due to the sample of cane, which was intended for the fiber estimation, having been taken by error for the determination of the ash; and as this sample had had part of its juice expressed, the ash content came out too low.

At this place we allude to the analyses of the "ash" in sugar juices made by mill chemists during the grinding season. The results of these are almost always too high, and for the reasons we have explained. The soil and fine dust covering the cane that has been grown in dry, dusty districts, or the soil adhering to the canes in wet districts, very largely goes into the juice at grinding, and especially if maceration is practiced. In proof of this we need only note the mineral matter that settles at the bottom of the cylinder used for the hydrometric readings. Sometimes this is very notable and large. This is all extraneous mineral matter, which enters into the sample taken for the estimation of the mineral matter in solution in the pure juice. In some cases the results can be even 25 per cent. to 40 per cent. too high.

Analyzing.—After obtaining an exact sample of the material to be examined, the next thing is a full and correct analysis.

In treating the mineral matter of cane ash, or of soils, or other materials, with strong hydrocloric acid, the insoluble residue is usually expressed in the statement of the analysis as "silica." In our analyses last year, as published in the report, 1899, this was done; but it was not correct, as we have this year taken the time and the care to demonstrate. Our analyses this year show that the insoluble residue, after treating with the strong hydrochloric acid, can contain all the way from 8% to 14% of bases, such as iron, lime, potash, soda, etc., and that it is not all silica, as is usually stated.

In the examinations this year, absolute analyses have been made. Each element has been fully estimated, and nothing assumed. The mineral matter of the leaves, etc., was treated with strong acid, and the elements brought into solution estimated; after which the insoluble residue was fused, and then totally analysed, the sum of the two furnishing the "absolute analysis." The mineral matter from the cane was directly fused, and the absolute analysis made direct; the alkalies being estimated in separate samples. The results, as set forth in the tables to be given, are the average of duplicate determinations. If in any particular the duplicates did not agree within allowable margins, the estimations were repeated. Having explained the errors found in the work of last year, we now state that the following results are drawn from the most minute and careful observance of all the essential factors involved in obtaining and preparing samples, and in making the analyses.

ANALYSIS OF THE MINERAL MATTER IN THE LEAVES, TOPS AND DEAD CANE.

1—LAHAINA.

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue	61.81	.....	.....	
Silica	.....	90.75	56.09	3,652 lbs.
Titanic Oxyd	0.71	0.69	1.14	75 "
Phosphoric Acid	1.11	0.63	1.50	99 "
Sulphuric Acid	5.34	.....	5.34	362 "
Chlorine	2.50	.....	2 50	165 "
Ferric Oxyd	4.81	2.68	6.47	427 "
Alumina	2.13	.....	2.13	141 "
Manganese Oxyd	0.27	.....	0.27	17 "
Lime	4.38	2.00	5 62	370 "
Magnesia	3.76	1.32	4.58	302 "
Soda	0.96	1.14	1.66	109 "
Potash	12.80	1.03	13.44	887 "
	100.58	100.24	100.74	6,606 lbs.

Note.—Those readers who do not wish to follow the analysis in detail will find a summary table further on. We wish to say, however, that the data in a report are like the figures in a financial statement—they are the "facts of the case," and consequently about the only items in a report that are of value.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

2—ROSE BAMBOO.

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue.....	62.66	...	.....	
Silica..................	.....	89.86	56.30	4,356 lbs.
Titanic Oxyd..........	0.60	0.30	0.79	60 "
Phosphoric Acid......	1.12	0 24	1.27	97 "
Sulphuric Acid	5.83	0.97	6.44	492 "
Chlorine........... ..	2.34	.....	2.34	189 "
Ferric Oxyd..........	3.49	0.66	3 90	298 "
Alumina...............	1.54	0.10	1.60	122 "
Manganese Oxyd.......	0.18	0.18	0.18	13 "
Lime.................	4.88	2.10	6.20	475 "
Magnesia..	3.77	0.66	4.21	322 "
Soda..	0.89	1.15	1.61	123 "
Potash................	12.43	3.40	14.56	1,115 "
	99.53	99.69	99.52	7,662 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

3—YELLOW CALEDONIA.

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue.. ..	58.14	....	....	
Silica..................	....	91.82	53.38	3,061 lbs.
Titanic Oxyd.........	0.43	0.45	0.69	39 "
Phosphoric Acid	1.13	0.25	1.28	73 "
Sulphuric Acid......	4.63	0.81	5.10	289 "
Chlorine.........	4.03	.....	4.03	229 "
Ferric Oxyd..........	3.60	0 76	4.04	231 "
Alumina......	1.81	.....	1.81	102 "
Manganese Oxyd......	0,10	.....	0.10	5 "
Lime.	5.09	1.60	6.02	341 "
Magnesia.	4.09	0.57	4.42	250 "
Soda..	0.90	0.80	1.37	77 "
Potash...............	15.56	2.67	17.11	974 "
	99 51	99.94	99.49	5,671 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

4—YELLOW BAMBOO.

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue	58.28	.....	.....	
Silica	.....	91.34	53.23	3,058 lbs.
Titanic Oxyd	0.58	0.41	0.77	44 "
Phosphoric Acid	1.45	0.16	1.55	88 "
Sulphuric Acid	7.10	0.79	7.57	432 "
Chlorine	2.19	.....	2.19	125 "
Ferric Oxyd	3.57	0.27	3.74	214 "
Alumina	1.76	.....	1.80	103 "
Manganese Oxyd	0.17	.....	0.17	9 "
Lime	3.71	1.18	4.40	251 "
Magnesia	3 43	0.69	3.83	219 "
Soda	0.81	1.39	1.62	92 "
Potash	16.73	3.72	18.90	1,092 "
	99.78	100.20	99.89	5 727 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

5—MOORE'S PURPLE.

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue	57.04	.....	.....	
Silica	.....	89.22	50.89	3,678 lbs.
Titanic Oxyd	0.47	0.31	0.65	45 "
Phosphoric Acid	1.29	0.28	1.45	101 "
Sulphuric Acid	6.34	0.86	6.83	480 "
Chlorine	3.40	.....	3.40	239 "
Ferric Oxyd	3.31	0.64	3.67	258 "
Alumina	1.99	0.19	2.10	147 "
Maganese Oxyd	0.22	.....	0.22	15 "
Lime	4.44	1.62	5.36	377 "
Magnesia	3.68	1.02	4.26	299 "
Soda	0.68	1 29	1.42	99 "
Potash	16.81	2.85	18.44	1,297 "
	99.67	98.36	98.94	7,035 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

6—DEMARARA, NO. 117.

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue...	58.86	.....	....	
Silica.	.	90.36	53.18	3,395 lbs.
Titanic Oxyd..	0.23	0 33	0.42	26 "
Phosphoric Acid	1.24	0.31	1.42	90 "
Sulphuric Acid........	7.68	1.14	8.35	533 "
Chlorine............	3.01	.....	3.01	192 "
Ferric Oxyd.... ..	3.38	1.28	4.13	263 "
Alumina...	2 77	0.11	2.83	180 "
Manganese Oxyd......	0.45	.	0 45	28 "
Lime................	5.32	2.16	6.59	420 "
Magnesia............	3.42	1.01	4.01	256 "
Soda.............	0.68	1.13	1.35	86 "
Potash..	13 05	2.50	14.52	928 "
	100 09	100.33	100.26	6,397 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

7—DEMARARA, NO. 95.

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue.....	57.28	.....	.....	
Silica.	.....	88.37	50.62	4,221 lbs.
Titanic Oxyd..........	0.30	0.44	0 55	44 "
Phosphoric Acid......	1.21	0.34	1.40	113 "
Sulphuric Acid........	6.57	1.81	7.60	616 "
Chlorine..............	3.23	.....	3.23	162 "
Ferric Oxyd..........	2.97	1.29	3.71	300 "
Alumina..............	3.03	0 45	3.29	266 "
Manganese Oxyd	0.30	0.78	0.75	60 "
Lime.	4.78	2.65	6.30	510 "
Magnesia....	3.61	1.04	4.20	340 "
Soda.................	1.08	0.54	1.38	111 "
Potash...............	15.41	2.48	16.83	1,364 "
	99.77	100.19	99.86	8,107 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

8—DEMARARA, NO. 124.

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue. ..	54.16	.....	. .	
Silica.	.....	90.15	48.85	3,590 lbs.
Titanic Oxyd..........	0.38	0.31	0.55	36 "
Phosphoric Acid......	1.31	0.35	1.50	108 "
Sulphuric Acid.......	7.52	1.39	8.25	598 "
Chlorine.............	4.12	.....	4.12	297 "
Ferric Oxyd..........	2.49	0.99	3.03	219 "
Alumina..............	1.13	.....	1.13	81 "
Manganese Oxyd......	0.58	0.66	0.93	67 "
Lime.................	4.22	1.82	5.21	376 "
Magnesia............	3.61	0.88	4.08	291 "
Soda.................	0.84	0.40	1.06	79 "
Potash...............	19.62	2.43	20.94	1,517 "
	99.98	99.38	99.65	7,249 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

9—TIBBOO MIRD, (LOUISIANA).

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue.....	60.48	....	. . .	
Silica................	.....	91.60	55.40	4,895 lbs.
Titanic Oxyd..........	0.54	0.48	0.83	75 "
Phosphoric Acid.......	1.15	0.34	1.36	119 "
Sulphuric Acid.	5.96	0.80	6.44	566 "
Chlorine	3.06	.....	3.06	269 "
Ferric Oxyd..........	2.44	0.50	2.74	240 "
Alumina	1.55	.....	1.55	135 "
Maganese Oxyd.......	0.07	0.15	0.16	13 "
Lime.................	4.96	1.91	6.12	538 "
Magnesia............	3.69	1.16	4.39	386 "
Soda................	1.65	0.80	2.13	187 "
Potash	13.72	3.12	15.61	1,372 "
	99.36	100.86	99.89	8,795 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

10—STRIPED, (LOUISIANA).

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue	53.80	.....	.....	
Silica	.....	90.18	53.03	4,473 lbs.
Titanic Oxyd.	0.31	0.68	0.71	59 "
Phosphoric Acid	1.07	0.46	1.34	113 "
Sulphuric Acid	7.23	1.01	7.82	671 "
Chlorine	3.40	.....	3.40	290 "
Ferric Oxyd	2.40	0.67	2.79	238 "
Alumina	1.94	.....	1.94	165 "
Maganese Oxyd.	0.08	0.14	0.17	14 "
Lime	4.23	2.23	5.66	484 "
Magnesia	3 61	1.29	4.27	365 "
Soda	0.76	2.11	2.00	171 "
Potash	15.88	3.12	17.71	1,514 "
	99.71	100.89	100.84	8,557 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

11—PURPLE, (LOUISIANA).

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue	61.23	.....	.....	
Silica	.....	89.72	54.94	3,920 lbs.
Titanic Oxyd.	0.38	0.59	0.74	53 "
Phosphoric Acid	1.10	0.46	1.38	99 "
Sulphuric Acid	6.23	0.94	6.81	491 "
Chlorine	3.34	.....	3.34	240 "
Ferric Oxyd	2.16	0.63	2.55	184 "
Alumina	0.84	.....	0.84	60 "
Manganese Oxyd	0.08	0.19	0.15	10 "
Lime	4.31	2.48	6.55	473 "
Magnesia	3.50	1.34	4.82	348 "
Soda	0.64	0.72	1.40	101 "
Potash	15.43	2.91	17.27	1,248 "
	99.24	99.98	99.84	7,227 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

12—STRIPED SINGAPORE.

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue	62.88	.....	.....	
Silica	.....	86.78	54.57	3,443 lbs.
Titanic Oxyd	0.52	0.23	0.73	40 "
Phosphoric Acid	1.08	0.24	1.23	77 "
Sulphuric Acid	6.20	1.34	7.04	447 "
Chlorine	3.10	.....	3.10	196 "
Ferric Oxyd	2.49	1.17	3.23	205 "
Alumina	1.71	.....	1.71	109 "
Manganese Oxyd	0.36	0.52	0.69	43 "
Lime	4.81	2.72	6.52	413 "
Magnesia	3.77	1.01	4.41	260 "
Soda	0.62	3.43	2.78	176 "
Potash	12.69	3.27	14.75	936 "
	100.23	100.73	100.76	6,351 lbs.

"MINERAL MATTER IN THE LEAVES, TOPS, AND DEAD CANES."

13—BIG RIBBON.

ELEMENTS.	Analysis of the Acid Extract.	Analysis of the Insoluble Residue	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
	Per cent.	Per cent.	Per cent.	
Insoluble Residue	60.37	. .	.....	
Silica	.....	89.41	53.98	4,401 lbs.
Titanic Oxyd	0.26	0.57	0.60	48 "
Phosphoric Acid	0.96	0.47	1.24	101 "
Sulphuric Acid	4.83	0.96	5.41	438 "
Chlorine	4.81	.....	4.81	389 "
Ferric Oxyd	1.87	0.78	2.34	189 "
Alumina	1.27	.....	1.27	103 "
Manganese Oxyd	0.08	0.12	0.15	12 "
Lime	4.96	2.64	6.55	531 "
Magnesia	4.05	1.27	4.82	391 "
Soda	1.13	0.44	1.40	113 "
Potash	15.58	2.80	17.27	1,401 "
	100.17	99.46	99.84	8,117 lbs.

The preceding thirteen tables have furnished us with a statement of the composition of the mineral matter in the "leaves, tops, and dead canes and suckers," or, in other words, in the waste matters of the crop. We will now, before making further comment, give a corresponding statement of the mineral matters found in the cane, and in that portion only which goes to the mill.

COMPOSITION OF THE SOLID MATTER IN THE CANE.

Varieties.	Organic Matter.		Mineral Matter.	
	Per cent.	Pounds per Acre.	Per cent.	Pounds per Acre.
Lahaina	97.30	53,898	2.70	1,496
Rose Bamboo.	96.60	54,404	3.40	1,915
Yellow Caledonia	96.71	46,757	3.29	1,591
Yellow Bamboo.	96.48	44,388	3.52	1,620
Moore's Purple	96.17	20,313	3.83	809
Demarara, No. 117	96.52	47,797	3 48	1,724
" No. 95	97.79	55,965	2.21	1,265
" No. 124	96.26	25,950	3.74	1,009
Louisiana, Tibboo Mird	96.04	59,271	3.96	2,444
" Striped	96.95	61,768	3.05	1,944
" Purple	96.85	38,586	3.15	1,256
Striped Singapore	97.19	43,675	2.81	1,263
Big Ribbon	96.73	61,172	3.27	2,068

These figures show us the relative amounts of organic and mineral matters composing the canes of the respective varieties. We will now record the composition of the mineral matters in the canes.

COMPOSITION OF THE MINERAL MATTER IN THE CANE OF THE SEVERAL VARIETIES.

Variety. 1—LAHAINA. Elements.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
Silica	18.09 per cent.	270 lbs.
Phosphoric Acid	9.12 "	136 "
Sulphuric Acid	5.64 "	84 "
Chlorine	5.45 "	81 "
Iron Oxyd	7.43 "	111 "
Alumina	12.21 "	182 "
Lime	3.85 "	56 "
Magnesia	6.06 "	90 "
Potash	28.99 "	436 "
Soda	3.40 "	50 "
	100.24 per cent.	1,496 lbs.

By "absolute analysis" is meant that the ash was fused and absolutely determined, the alkalies being estimated in separate samples.

In these analyses the manganese is not determined, nor the fraction of carbonic acid recorded. The small amount of titanic acid is given in with the alumina.

2—ROSE BAMBOO. Elements.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
Silica	20.23 per cent.	388 lbs.
Phosphoric Acid	5.89 "	112 "
Sulphuric Acid	2.61 "	49 "
Chlorine	9.92 "	189 "
Iron Oxyd	3.93 "	74 "
Alumina	14.04 "	268 "
Lime	3.06 "	58 "
Magnesia	3.45 "	66 "
Potash	33.41 "	631 "
Soda	4.20 "	80 "
	100.07 per cent.	1,915 lbs.

3—YELLOW CALEDONIA. Elements.	Absolute Analysis of the Ash.	Weight of Elements Removed per Acre.
Silica	28.69 per cent.	456 lbs.
Phosphoric Acid	7.46 "	118 "
Sulphuric Acid	4.15 "	66 "
Chlorine	8.76 "	138 "
Iron Oxyd	3 25 "	51 "
Alumina	3.65 "	58 "
Lime	4.08 "	65 "
Magnesia	5.91 "	93 "
Potash	32.26 "	503 "
Soda	2.70 "	43 "
	100.82 per cent.	1,591 lbs.

4—YELLOW BAMBOO. Elements.	Absolute Analysis of the Ash.	Elements Removed per Acre.
Silica	24 27 per cent.	393 lbs.
Phosphoric Acid	5.10 "	82 "
Sulphuric Acid	4.30 "	69 "
Chlorine	11.02 "	178 "
Iron Oxyd	3.69 "	59 "
Alumina	2.47 "	39 "
Lime	2.89 "	46 "
Magnesia	4.17 "	67 "
Potash	38.58 "	617 "
Soda	4 36 "	70 "
	100 85 per cent.	1,620 lbs.

5—MOORE'S PURPLE. Elements.	Absolute Analysis of the Ash.	Elements Removed per Acre.
Silica	32.16 per cent.	260 lbs.
Phosphoric Acid	10 49 "	84 "
Sulphuric Acid	4.23 "	33 "
Chlorine	6.88 "	55 "
Iron Oxyd	3.40 "	27 "
Alumina	2.13 "	17 "
Lime	3.51 "	28 "
Magnesia	4.89 "	39 "
Potash	29.80 "	245 "
Soda	2.64 "	21 "
	100 13 per cent.	809 lbs.

6—DEMARARA, 117. Elements.	Absolute Analysis of the Ash.	Elements Removed per Acre.
Silica	22.52 per cent.	388 lbs.
Phosphoric Acid	6.41 "	110 "
Sulphuric Acid	10.55 "	181 "
Chlorine	7.87 "	135 "
Iron Oxyd	5.15 "	87 "
Alumina	4.05 "	69 "
Lime	5.29 "	91 "
Magnesia	6.38 "	109 "
Potash	28.11 "	507 "
Soda	2.99 "	50 "
	99.32 per cent.	1,724 lbs.

7—DEMARARA, 95. Elements.	Absolute Analysis of the Ash.	Elements Removed per Acre.
Silica	29.08 per cent.	367 lbs.
Phosphoric Acid	7.99 "	101 "
Sulphuric Acid	7.43 "	93 "
Chlorine	4.43 "	55 "
Iron Oxyd	7.09 "	89 "
Alumina	4.69 "	59 "
Lime	3.71 "	46 "
Magnesia	4.65 "	58 "
Potash	28.75 "	371 "
Soda	2.13 "	26 "
	100.05 per cent.	1,265 lbs.

8—DEMARARA, 124. Elements.	Absolute Analysis of the Ash.	Elements Removed per Acre.
Silica	25.96 per cent.	262 lbs.
Phosphoric Acid	6·67 "	67 "
Sulphuric Acid	6.00 "	60 "
Chlorine	9.29 "	93 "
Iron Oxyd	4.32 "	43 "
Alumina	4.00 "	40 "
Lime	4.09 "	41 "
Magnesia	3.73 "	37 "
Potash	31.34 "	326 "
Soda	3.18 "	36 "
	98.58 per cent.	1,005 lbs.

9—LOUISIANA, TIBBOO MIRD. Elements.	Absolute Analysis of the Ash.	Elements Removed per Acre.
Silica	15.92 per cent	399 lbs.
Phosphoric Acid	7.08 "	171 "
Sulphuric Acid	5.31 "	129 "
Chlorine	14.37 "	350 "
Iron Oxyd	4.00 "	97 "
Alumina	3.54 "	86 "
Lime	3.37 "	82 "
Magnesia	3.34 "	80 "
Potash	39.50 "	988 "
Soda	2.57 "	62 "
	99.00 per cent.	2,444 lbs.

10—LOUISIANA, STRIPED. Elements.	Absolute Analysis of the Ash.	Elements Removed per Acre.
Silica	19.11 per cent.	371 lbs
Phosphoric Acid	7.30 "	142 "
Sulphuric Acid	5.49 "	106 "
Chlorine	10.27 "	199 "
Iron Oxyd	4.94 "	95 "
Alumina	4.37 "	84 "
Lime	2.82 "	54 "
Magnesia	2.34 "	45 "
Potash	40.08 "	797 "
Soda	2.65 "	51 "
	99.37 per cent.	1,944 lbs.

11—LOUISIANA, PURPLE. Elements.	Absolute Analysis of the Ash.	Elements Removed per Acre.
Silica	14.66 per cent.	183 lbs.
Phosphoric Acid	7.16 "	89 "
Sulphuric Acid	4.60 "	57 "
Chlorine	13.23 "	166 "
Iron Oxyd	4.17 "	52 "
Alumina	5.18 "	65 "
Lime	5.16 "	64 "
Magnesia	3.39 "	42 "
Potash	37.71 "	477 "
Soda	4.03 "	51 "
	99.29 per cent.	1,256 lbs.

12—STRIPED SINGAPORE. Elements.	Absolute Analysis of the Ash.	Elements Removed per Acre
Silica	21.85 per cent.	275 lbs.
Phosphoric Acid	7.46 "	94 "
Sulphuric Acid	5.00 "	63 "
Chlorine	9.24 "	116 "
Iron Oxyd	3.90 "	49 "
Alumina	6.61 "	83 "
Lime	3.27 "	41 "
Magnesia	3.42 "	43 "
Potash	35.57 "	461 "
Soda	3.02 "	38 "
	99.34 per cent.	1,263 lbs.

13—BIG RIBBON. Elements.	Absolute Analysis of the Ash.	Elements Removed per Acre.
Silica	19.95 per cent.	412 lbs.
Phosphoric Acid	6.52 "	135 "
Sulphuric Acid	5.90 "	122 "
Chlorine	11.27 "	233 "
Iron Oxyd	3.71 "	76 "
Alumina	6.17 "	127 "
Lime	3.98 "	82 "
Magnesia	5.44 "	112 "
Potash	34.45 "	727 "
Soda	2.07 "	42 "
	99.46 per cent.	2,068 lbs.

In the first place, we have to remark upon the higher content of mineral matter, and the great difference in its composition, as compared with the data stated in the report of last year. The cause of this difference has been fully explained in a previous paragraph.

The analyses of the cane, as well as of the leaves and waste matters, put before us a statement of the enormous amount of soil materials that is removed by the growing crop. These facts should sink into the mind, and abide in the daily consciousness of every one engaged in growing cane.

The composition of the mineral matters in the 13 kinds of canes, whilst demonstrating the oneness of the family, indicate extreme variations of behaviour of the canes as varieties. Remarkable is the scale of variation in the silica which moves between a minimum of 14.66% in the Louisiana "Purple," and 32.16% in the "Moore's Purple."

The Louisiana varieties are all marked by the low contents of silica, and the extremely high amounts of potash and chlorine in the ash. These characteristics mark the Louisiana varieties in their native habitat, which is shown by analyses made in Dr. Stubb's laboratories. These varieties are voracious potash eaters; but time will show whether they cannot be bred out of this costly taste in some measure. The "striped Singapore" and the "Big Ribbon" very largely share the dominating marks of the Louisiana varieties.

NITROGEN USED BY THE VARIETIES.

In the determinations of mineral matter in the cane, and in the waste matters, the nitrogen is necessarily omitted. This is due to the fact that when the material is burnt in order to come at, and get samples of ash, the nitrogen is all driven off. We have in previous reports shown that when the trash (leaves and waste matters) is "burnt off" in the field, the nitrogen, which is a part of the organic matter, is all driven off and lost. We have already dwelt upon the enormous loss which accrues from burning the trash, and sacrificing the most vital and costly element in plant nutrition.

NITROGEN CONTENT OF THE SEVERAL VARIETIES.

Varieties.	Nitrogen in the Leaves and Waste Matters.		Nitrogen in the Cane.	
	Per cent.	Removed per Acre.	Per cent.	Removed per Acre.
Lahaina	0.433	262 lbs.	0.207	114 lbs.
Rose Bamboo	0.546	352 "	0.481	270 "
Yellow Caledonia	0.531	242 "	0.402	194 "
Yellow Bamboo	0.494	250 "	0.344	160 "
Moore's Purple	0.599	381 "	0.477	101 "
Demarara, 117	0.549	255 "	0.530	242 "
" 95	0.476	331 "	0.378	216 "
" 124	0.542	280 "	0.270	72 "
Louisiana, Tibboo Mird	0.423	310 "	0 403	248 "
" Striped	0.538	357 "	0.349	222 "
" Purple	0.588	353 "	0.483	192 "
Striped Singapore	0.492	297 "	0.395	177 "
Big Ribbon	0.471	324 "	0.289	182 "
Means	0.521	307 lbs.	0.461	183 lbs.

Before doing more than calling attention to the enormous quantity of nitrogen that is taken from the soil, per acre, by the crop, we shall bring together in a brief table the amounts of the vital elements, and those which we furnish in fertilizers, that have been removed by the respective varieties.

NITROGEN, PHOSPHORIC ACID, POTASH, AND LIME REMOVED FROM THE SOIL BY THE VARIETIES.

Varieties.	Nitrogen Removed per Acre.	Phosphoric Acid Removed per Acre.	Potash Removed per Acre.	Lime Removed Per Acre.
Lahaina	376 lbs	235 lbs	1,323 lbs	426 lbs
Rose Bamboo	622 "	209 "	1,746 "	533 "
Yellow Caledonia	436 "	191 "	1,477 "	406 "
Yellow Bamboo	410 "	170 "	1,709 "	297 "
Moore's Purple	482 "	185 "	1,542 "	405 "
Demarara, 117	497 "	200 "	1,435 "	511 "
" 95	547 "	214 "	1,735 "	556 "
" 124	352 "	175 "	1,843 "	417 "
Louisiana, Tibboo Mird	558 "	290 "	2,360 "	620 "
" Striped	579 "	255 "	2,311 "	538 "
" Purple	545 "	138 "	1,725 "	537 "
Striped Singapore	474 "	171 "	1,397 "	457 "
Big Ribbon	506 "	236 "	2,128 "	613 "

It has already been said that these crops were grown upon land, and in conditions, absolutely identical and equal.

The land itself had been very carefully prepared by a long term (1¼ years) of fallowing and subsoiling. During the course of growth, liberal amounts of nitrogen, potash, and phosphoric acid were applied, which augmented the amounts of potash and phosphoric acid in the soils, which elements were in a high state of availability. Due to the fallowing, we estimate that not less than 2,000 lbs. of potash, and 300 lbs. of phosphoric acid were directly available per acre for the crop. The amounts of elements supplied to the soil for the crop were 120 lbs. of nitrogen, 150 lbs. of potash, and 80 lbs. of phosphoric acid per acre.

The nitrogen in the soil is low, being only about 0.15%, which is equal to about 6,000 lbs. per acre to a depth of 15 inches, which is the depth of tillable soil. Soils and subsoils, below the level of plant life and decay, do not contain nitrogen, this element coming wholly from the atmosphere. It is seen that the crop of certain varieties of cane removed from the soil about 600 lbs. of nitrogen per acre, which is one-tenth of the total nitrogen in the soil. We added 120 lbs. of nitrogen per acre to the soil during the growth of the crop, so that the crop was removing actually from the native amount of nitrogen in the soil, about 450 to 480 lbs. per acre. As we pointed out last year, it is not difficult to see what must happen if the whole of the leaves and waste matters of the crop are "burnt off," and the total nitrogen driven off into the air and lost!

Concerning the potash, and phosphoric acid and lime, these elements are contained in the subsoils, and original rocks, from which the soils were derived, and small portions of these are being liberated each year and added to the store in the soil. When the trash is "burnt off," however, as it is done in dry districts, it is largely blown away, as in the Hamakua district; whilst in the Hilo district, the terrific rains leach out the carbonate of potash, and the lime, and bear them right off to the sea. There is no escaping this ruinous loss of the vital elements where total "burning off" is practiced.

The elements termed "vital" by us are the four which we constantly require to add in fertilization. We have examined other kinds of soils, from other countries, where the *magnesia* has to be called a vital element. Magnesia is one of the several indispensable elements in plant growth. In the cane varieties under consideration it is seen that the amounts of magnesia in some cases about equals, and in few cases exceeds the lime contents. In certain soils under our consideration, magnesia as well as lime requires supplying.

It is also seen that a very notable proportion of the elements taken from the soil goes to the mill in the cane. What becomes of that proportion depends wholly upon the use that is made of the molasses, mud press cakes, and other wastes. Where the molasses are run out to sea, or into low lands, where they poison the air of the district, it requires no words to tell what happens. When it is fully comprehended, it will be called *madness* what is taking place today in numerous localities:—Trash totally burnt off the fields; molasses run to waste, and the plantations paying 13 to 18 cents per lb. for nitrogen; 6 cents for potash, and 5 to 7 cents for phosphoric acid to bring those elements back to the soil!

NITROGEN, PHOSPHORIC ACID, POTASH AND LIME USED PER TON OF SUGAR GROWN BY THE VARIETIES.

Varieties.	Nitrogen used per Ton of Sugar Grown.	Phosphoric Acid used per Ton of Sugar Grown.	Potash used per Ton of Sugar Grown.	Lime used per Ton of Sugar Grown.
Lahaina	25.4 lbs	16.0 lbs	89.5 lbs	28.7 lbs
Rose Bamboo	40.5 "	13.6 "	114.2 "	34.8 "
Yellow Caledonia	38.7 "	16.9 "	131.1 "	36.5 "
Yellow Bamboo	39.5 "	16.3 "	164.7 "	28.6 "
Moore's Purple	94.9 "	36.4 "	303.8 "	79.8 "
Demarara, 117	42.9 "	17.1 "	123.8 "	44.0 "
" 95	36.6 "	14.3 "	116.1 "	37.4 "
" 124	52.8 "	26.3 "	276.8 "	62.6 "
Louisiana, Tibboo Mird	33.0 "	17.2 "	139.9 "	36.8 "
" Striped	33.2 "	14.8 "	134.3 "	31.2 "
" Purple	53.3 "	18.2 "	167.7 "	52.2 "
Striped Singapore	38 0 "	13 7 "	112.2 "	36.8 "
Big Ribbon	37.3 "	17 4 "	156.2 "	45.2 "

The above table sets before us the strain put upon the soil by the respective varieties. It would have appeared impossible, without the demonstration of experiment, that such variations could occur. These data state the situation economically: Not only do given varieties yield small returns of sugar per acre, they make these small returns at an excessive cost to the vital elements of the soil.

The varieties which we have previously termed *economic failures,* maintain their reputation in the above table. "Moore's Purple" is shown to make quite ruinous drafts upon all the elements per ton of sugar grown; and Demarara No.

124 exhibits the same exhausting drain. The "Louisiana Purple" also does very poor work from the economic standpoint. It is this economic standpoint from which the varieties must be compared and finally judged: We require varieties that give large yields of sugar, but at the lowest cost to the soil.

The "Lahaina" maintains its reputation as a light feeder, the consumption of the four vital elements, per ton of sugar, being almost the same as last year. The Lahaina, however, is a heavy drinker; its demand for water, in irrigation, being very imperative. This reduces greatly its economy where water is scarce or costly, as upon locations of these islands. In respect of the average of qualities—yield per acre, consumption of soil elements, and consumption of water, the Louisiana varieties, "Striped" and "Tibboo Mird" have given the highest economic results.

Of other introduced varieties, "Demerara—95" and the "Striped Singapore" deserve notice, and merit further trial, and also upon plantations. We have already explained that the work done by a variety in the conditions of the experiment station does not fix the scale of its capabilities. We know already that the Yellow Caledonia has beaten other varieties on plantations in certain districts; yet it fell behind in these tests. The experiment station is sending out the varieties to plantations for testing. Of course, we are guided by the qualities that the varieties have exhibited: We do not send heavy water consumers to dry districts, where irrigation is not possible. The varieties that do not show any features of merit, such as Moore's Purple, and Demarara 124, we are ceasing to send out at all.

We have considered that it should be one of the first lines of work of the experiment station to introduce standard varieties from cane-growing countries with a view to selecting those showing the greatest economic promise in the conditions of these Islands. The economic results of these first competitive tests show the wide variations of value that the respective varieties possess. The intrinsic differences in the sugar-producing power of the varieties themselves can amount to more economically, than the sum of the means within our control to affect their productiveness.

Having sorted out the best standard varieties for the conditions of the country, resort may be had to the amelioration of the selected varieties themselves. This may embrace selection of individuals under chemical or other mode of control, and breeding from straight stock. Or it may include crossing of varieties as a course of production from seedlings. With these lines of work this station has not, so far, been engaged; being persuaded that more immediate and greater economic results would be reached from other sources.

At this place we urge the absolute necessity for all varieties introduced into this country being sent first to the station for trial. This is to guard against the introduction of disease. As an example, this year an excellent variety was brought from Fiji by Prof. Koebele, and sent to the station for trial. It came up and grew well, being full of promise. When seven months old, abnormal symptoms developed. Prof. Koebele was called in to inspect and found some symptoms of *Sereh disease,* but not conclusive. Our personal comparison of the symptoms with the notes on the disease by the great authority, Dr. W. Krueger, made it evident to us that we had a case of the Sereh scourge. We dug up and burnt the whole plat, and sent out to two plantations, who had obtained a few sticks, asking them to also utterly destroy the same. The Association should seek to have it made imperative for all introduced varieties to go for trial at the experiment station; and it is advisable that the station shall in future withstand all solicitations for seed of new varieties until these have furnished a mature crop, and are eligible for a clean bill of health. The variety in question is the "Malabar." We believe it is originally a Java variety, the name following probably from the village or mountain of that name in Java.

During the current year very considerable trouble was experienced by cane dying out. This was plant cane, of very heavy growth. When this cane was seven months old, a very heavy storm of wind and rain came suddenly on. On account of the very heavy growth, the cane went down suddenly, and very flat. Upon examination of the root system of those canes that were dying it was found that many, in some cases all, of the older roots had been broken off or fractured when the crop went down. Very careful examinations and comparisons were made of the root systems of canes not blown down and of the injured ones, which showed very apparently that the cause of the dying out was due to the injured roots, and that the cause of the injury was the sudden and violent storm described. (This destruction of the canes by the storm has taken away all value of keeping an account of the number of canes in the experiment.) Wishing to leave no room for question on the matter, Prof. Koebele was called in, when he made a thorough examination of the injured cane in question, and of the state of health of the crops at the station in general.

ENTOMOLOGIST'S REPORT.

HONOLULU, June 8th, 1900.

DR. WALTER MAXWELL.

SIR:—The sugar cane handed to me for examination and report thereon as well as the material taken from the experimental garden has been carefully examined as to the probable reason of the dying of tap roots, falling over of plants and subsequent decaying of tops.

As far as I am able to observe, no organic disease can be found either upon healthy or prostrate plants upon ground. The tap roots of the fallen plants plainly show that they have been severely interfered with; at various intervals the epidermis of the same is broken through the force of wind storm that blew the plants over, thereby interrupting the flow of sap and consequent the gradual decay. Indeed, it can be safely stated that not a trace of any disease is present upon the very healthy and vigorous plants at your experimental grounds.

The following insects were found present upon the partly decaying plants prostrate on ground and amongst the roots of such in considerable numbers yet not having any share whatever in the so-called disease they are the result of and not the effect in plants violently interfered with:

1. Ants.
2. Dipterous larvae.
3. Mealy bugs.
4. Acarides.
5. Nematode worms.

(1) Ants were not found in any large numbers and hence cannot be suspected in doing much damage to the roots, traces of their work however is evident.

On my first visit to the Fiji Islands some nine years since, a small field of cane was shown me at Nausori, the roots of which were in a very bad state, a large percentage death and some of the plants dying, several of those in various stages were taken up and examined; it was found that the ants, which were present in large numbers, had eaten numerous holes into the roots, usually about 2 m.m. in with and reach-ing to near the center of roots, which in consequence decayed. No insects or any other creature was found present which possibly could have done the destructive work. In doing this, the only object of the ants appears to be to care for their "milk cows," the mealy bugs which they constantly attent. Generally these insects obtain their food by inserting their long proboscis into the plants they live upon, which is a slow process; if once fastened and not interfered with they will remain for a long time on the same spot, often during the whole time of their existence, and keep up a continuous suction of the sap. It was noticed that during irrigation the ants would carry the scale bugs high up out of reach of the water. It seems more than likely, the holes are eaten into the roots for the sole object to keep up a continuous flow of sap and to enable the coccids to obtain their food without inserting their proboscis to any considerable depth, in case of any danger or inundation they can be taken at a moment's notice and carried out of danger; with the proboscis inserted it would take the insects a few minutes at least to free itself, too long for the ants to remain which have not the power of freeing the mealy bugs if once properly fastened.

(2) A small dipterous larva is present in considerable numbers in the decaying tops, upon which it feeds; a handsome little fly has been bred from the same which has all the characteristics of *Chlorops* or allied forms. This insect is not injurious to healthy sugar cane.

(3) The mealy bug mentioned as attented by ants is *Dactylopius calceolariae.* Mark, found over the South Sea Islands, New Zealand, Australia, etc., upon many other plants as well. Before the introduction of its most formidable enemy, the *Cryptolaemus* beetle, this coccid had been extremely numerous upon sugar cane on the Islands. At the present time while still found in limited numbers, it can hardly be called a serious enemy to the cane plants.

(4) Acarides or mites were found in large numbers and in several species, one, abundant in decaying tops; a second likewise feeding upon decaying roots and other parts of plant in such condition below ground; two or more species of very active forms very likely predations and feeding on larger insects present as also likely upon the nematode worms.

(5) Nematode worms were only observed in numbers amongst death and dying roots, upon which they feed in con-

junction with any other decaying vegetable matter, and cannot be called injurious to sugar cane. In one instance, intermixed with soil at the base of death cane a large mass of minute yellowish eggs were found representing many hundred and these all hatched out within twenty-four hours into minute active nematode worms, some of which reached maturity upon soil and decaying cane in about one week's time.

Yours respectfully,

A. KOEBELE,

Entomologist.

FERTILIZATION.

The tests with fertilizers are confined to the ratoon crop growing upon the fertilized plats, the results from the plant crop of which were given in the report of last year. The rattoons will not come off until the new year, 1901, the results of which will come into next year's report.

We call attention to the apparent action of the fertilizers upon the cane last year at the season of tasseling (flowering). The plats which did not receive any fertilizer, and the plats which received potash and phosphoric acid, and either separately, or the elements together,—all these plats had cases of tasseling without exception. The plats which received nitrogen, either nitrogen alone or mixed with other elements, did not show one case of tasseling. Where no nitrogen was applied tasseling occurred on every plat. Where nitrogen was applied no tasseling followed. The explanation of this action of nitrogen is to be looked for in the circumstances that nitrogen is the most vital element of protoplasmic activity, and of plant growth. The application of the element acts specifically upon the vegetative organs of the plant, keeping those in a continuously active state, and consequently keeps in abeyance the propagation organs. Thus, if by maintaining a rapid state of growth in the cane at the season of liability to flowering (producing seed) it may probably be pushed by, when the organs of propagation will remain quiet until the next season, twelve months hence, occurs. In consequence of these observations several plantations have appealed to us for advice in cases where the danger of strongly developed young cane tasseling is imminent. In these cases nitrate of soda is being used in order to keep the vegetative organs at high speed, and allow the cane no time to flower (breed). The results of our special studies of the action of nitrogen (nitrate of soda) upon plant transpiration, and plant growth were set forth in a previous report. This question is more fully treated by us in a report, now in the press of the United States Department of Agriculture, entitled "Factors in Economic Irrigation."

* * * * * * * * * * *

Concerning fertilization upon the plantations, results have shown, and are showing powerfully. The results that are following the methodical application of lime in locations where we strongly urged the use are highly satisfactory. Further, the analyses of soils by our Aspartic acid method, which caused us to very materially change the composition of fertilizers for given lands, in given districts, are leading to most desirable results. In the matter of potash, for example, where the sensitive Aspartic acid method showed most palpably the dearth of that element, we doubled the amount of potash in the advised fertilizer, and with strikingly evident gain. Amongst other plantations that have more closely followed our advices in the matter of lime and special fertilizers—based upon the demands of the soil, as shown by analysis—we refer to the Hilo Sugar Co.—Mr. J. Scott listened to the statements of specific soil analysis, and to the recommendations based upon them, several years ago, the result being that the outlook of that estate is most materially changed for the good, as compared with its condition five years ago. The Hilo Sugar Co. has put itself three years ahead of some others, in the matter of restoration of its lands, by taking the course it did, and when it did. Upon the matter of fertilization, the results that have been achieved show that enough has already been said and demonstrated to serve for our guidance. We repeat, however, and with express urgency, the fundamental need of plantations having their soils systematically examined, and by such a method as the one now in use, in order that fertilizers can be advised which the conditions of the soil and the climate call for. This is the first essential.

In the fertilization tests, now in course, upon the rattoon crop, special study is being given to the action of each applied element, and its influence in causing the cane to abstract more or less than normal of other elements from the soil. These observations are expected to lead to modes in fertilizer composition whereby greater economy of the vital elements may be reached. To illustrate—it is highly desirable that we shall be able to cause the cane to produce its present, or a greater yield of sugar, but with the consumption of a less proportion of potash. There are physiological grounds, and certain already achieved indications, which suggest tangible probabilities along these lines.

IRRIGATION.

Not only is irrigation practiced, every gallon of water used in our field tests is measured and recorded.

WATER USED IN PRODUCTION OF THE CROP.

Period of Application.	Monthly Rainfall.	Irrigation Water Applied Monthly.
1898—July	0.94 inches	4.0 inches
August	1.58 "	4.0 "
September	0.88 "	4.0 "
October	1.75 "	3.0 "
November	1.32 "	3.0 "
December	1.86 "	2.0 "
1899—January	1.00 "	4.0 "
February	3.73 "	1.0 "
March	3.98 "	3.0 "
April	0.85 "	4.0 "
May	2.01 "	4.0 "
June	0.88 "	7.0 "
July	0.17 "	7.0 "
August	1.90 "	9.0 "
September	0.75 "	8.0 "
October	2.92 "	6.0 "
November	0.47 "	3.0 "
	26.99 inches	76.0 inches

The rainfall during the seventeen months that the crop was in growth was extremely small, being almost the lowest on record. The following brief table compares the rainfall of the stated, and of the previous 17 months, with the irrigation water applied to the respective crops:

CROPS.	Rainfall of Growing Season.	Irrigation Applied.	Total Water Received by Crop.
1897—98	46.5 inches	47.0 inches	93.5 inches
1898—99	26.9 "	76.0 "	102.9 "

The rainfall of the former season of growth was nearly double the amount recorded in 1898-99, when it was at the rate of merely 18.9 inches per year. And it is not only the less rainfall, but the dry atmosphere, and drying winds, which prevailed during a greater number of days than in the previous season of growth. During 1898-99, the tests that were being made *without irrigation* collapsed totally, none coming to maturity.

A reference to the "monthly" applications of irrigation water enables us to see the increased volume applied with the increasing development of the crop. When the cane is planted, and while it is very small, the greater portion of water applied escapes by direct evaporation from the soil. As the cane increases in size, and its foliage begins to shade the ground, the crop gives off more water by transpiration, and the soil loses less. When the crop is in the fullest vigor of growth, and is attaining maximum development, its consumption of water is also at the maximum, which is indicated by the applications in June, July, August and September of the year 1899. The crop at this stage, however, practically shuts out the sun, and also the wind, so that the evaporation of water from the soil is reduced to a minimum. This is the reason why we do not need to apply a very much greater volume to the crop nearing its full growth: The cane gets the use of almost the total water applied, whereas when the cane is small, and the ground is bare, the winds and sun pick up the water straight from the soil. When the crop is twelve months' old, and in full vigor of growth, it consumes not less than ten times the volume which is actually used by cane when it is from one to two months old. As explained, we cannot, however, make a difference equal to 1 to 10 between the very young cane, and the crop in full size and vigor, and for the reason that the loss from the soil is great when the cane is small, and very little when the crop is large. In actual practice we have frequently found that one-half inch of water applied per week when the seed is planted, and until it is up, and to a height of 18 inches, is more effective than an inch per week. Filling the furrows with water when the seed is planted will delay its coming up for a whole week, when it will come out yellow and weakly. As the cane grows it comes to demand an inch per week, which amount, without rainfall, keeps it in full growth for three or four months after planting. Then 1½ inches per week are demanded, and finally, during the hottest months of the second summer of the crop, and when it is at the height of growth 3 inches are demanded in some weeks. We have never applied more than 3 inches in any week, and under the greatest strain of heat and wind. The whole matter in rational irrigation is to know the demands of the crop in its successive stages of development, which is determined by the character of the prevailing weather, the age and size of the cane, and the nature, and degree of exposure, of the soil.

In the case of rattoons, we invariably have found the crop to be too thick. It becomes grassy, and more canes come up than can ever find standing room. We have found it advisable to keep the water off for two or three or more weeks from such dense rattoon growths in order to *dry out* the weakest suckers. After this is done, the remaining, and strongest canes make more rapid growth, with a less immediate consumption of soil food and water. As a matter of fact, irrigation, or control of water supply, places the destiny of the crop almost wholly in the hands of the grower. If he understands the profound natural (physical and chemical) laws which underlie the relation of the crop to the soil, to water, and to its general environment, he can almost make his own terms in the way of present and permanent results. If these laws are not understood he may injure the growing crops, and work irreparable damage to the soil; and all this at a cost of water, and applied fertilizing elements that becomes ruinous. In one of the statements of the Secretary of Agriculture of the U. S. Government upon irrigation it is said "it has been turned into a curse instead of a blessing."

GALLONS OF WATER USED BY THE CROP PER ACRE.

CROPS.	Volume of Rainfall per Acre.	Volume of Irrigation per Acre	Total Water Received per Acre
1897—98	1,260,150 gals.	1,273,700 gals.	2,533,850 gals.
1898—99	728,990 "	2,059,600 "	2,788,590 "

As it has been already stated, these volumes of water were received during the season of growth, covering 17 months.

The water applied by irrigation in 1897-98 was equal to 32.5 inches of rain per year, whilst the application by irrigation to the crop of 1898-99 was equal to a rainfall of 53 inches per year.

TOTAL CONSUMPTION OF WATER PER POUND OF SUGAR PRODUCED.

CROPS.	Weight of Water used per Acre.	Weight of Sugar Produced per Acre.	Water used per Pound of Sugar.
1897—98	25,338,500 lbs	24,775 lbs	1,023 lbs
1898—99	27,885,900 "	29,059 "	959 "

These results are the mean of 20 tests in the crop of 1897-98, and of 13 tests in the crop of 1898-99.

The highest service rendered by the water is found by comparing the volume used with the largest yield of any given test, or variety of cane.

THE MAXIMUM SERVICE OF WATER.

CROPS.	Weight of Water used per Acre.	Sugar Produced per Acre (Maximum Result.)	Water used per Pound of Sugar Grown.
1897—98	25,338,500 lbs	29,189 lbs	868 lbs
1898—99	27,885,900 "	34,395 "	810 "

As the "weights of water used per acre" include the rainfall and the water applied by irrigation, the interesting question arises—How much is due to the natural rainfall, and how much is expressly due to the water of irrigation? This question is answered as follows:

RESULTS OF IRRIGATION AND NON-IRRIGATION.

CROPS.	No. of Tests.	Inches of Water (Rainfall.)	Inches of Water (Irrigation.)	Non-Irrigated Tests Sugar per Acre.	Irrigated Tests Sugar per Acre	Results of Irrigation per Acre.
1897—98	28	46.5	47.0	1,600 lbs	24.755 lbs	23.155 lbs
1898—99	21	26.9	76.0	....	29,059 "	29,059 "

The data in this table sum up the whole question of the economic results of irrigation of cane in the specified conditions. Without irrigation we cannot grow sugar in this locality.

Concerning the sugar produced by the given volume of water, as shown in the stated results, it must be said that no plantation is using less than double the volume of water of irrigation used in these experiments. Some are using much more than double the volume, and with less than one-half the yield of sugar per acre (we have the records of the total number of acres on all irrigated plantations and the yield of sugar per acre) over the whole. As it has already been said, many plantations now see that they have been using a great excess of water, and have reduced the amount by one-half, and one plantation by more than one-half. At this place it may be said that probably no other existing sugar-producing country could indulge in such extravagances and keep above water. The fact is that the increasing producing power of our soils (an increase of from 3 tons to 5 tons per acre), the abundance of labor up to recent date, and the happy fiscal relations of these islands with the United States—all these have made the situation luxurious, and have also made it unnecessary for the management of our estates to get down to the bed-rock lines of economy essentially practiced in other countries.

LABORATORY WORK.

The analytical work of the laboratory has continued in the hands of First Assistant Eckart and Assistant Thompson. Mr. Thompson has resigned from his position to accept one of greater responsibility. The work has embraced, as usual, soil examinations, fertilizer control, and examinations of waters, sugars, molasses, etc.

FERTILIZERS.

During the year not more than 75 fertilizers passed through the laboratory. In 1896, when the bulk of fertilizers used on the Islands was some 16,000 tons, not fewer than 200 samples were submitted for analysis. This year, with the bulk put upon the market having run up to over 30,000 tons, the samples inspected number less than 80. Last year we called attention to the degradation in the quality of the fertilizers that were put on the market under guarantee. This year, now closing, has been worse. We are not able to state exactly what the sum amounts to upon quantities found below the guarantee, but we are sure that that sum is not less than $12,000. Of course, with the settlement of these deficits this bureau has nothing to do. These facts, however, and other statements which have been sent to the "Committee on the Experiment Station," comprising F. M. Swanzy, H. P. Baldwin, G. H. Robertson, and the Director, force upon us the conviction that a rigid control of all fertilizers offered for sale is even more important today than previously. As already said, the bulk of fertilizer used is double in proportion today to what it was only five years ago. The value, or in other words, the fertilizer bill of these islands amounts now to not less than $1,250,000.00 per year. This bare fact should indicate to plantations, and to stockholders, the dire necessity for control of the whole business.

BARBADOES PLANTERS' JOURNAL ON DR. MAXWELL'S WORK.

In the course of his letter to a Louisiana paper, Dr. Maxwell says, in reference to his experiments, "before giving the figures I warn you that certain gentlemen in other countries when speaking of Hawaiian crops, have said, 'there is something wrong with the acres on Hawaii,' and thus wish to explain that in giving these results of yield I mean so many English pounds per English acre, which statements I know you will accept."

Now, Dr. Maxwell is a reliable witness. He is in charge of the Experiment Station in Hawaii; and towards the close of last year he was invited by the Queensland Government to visit that colony to report on the sugar industry and give expert advice with regard to the establishment of experiment stations, laboratories, etc., in connection with it. He is a man of standing.

When, therefore, Dr. Maxwell tells us he can certify to the production of 14.84 short tons (i.e. of 2,000 lbs.) per acre, even if from a field of exceptional fertility, being as good as his best at the experimental station, under special conditions—we are bound to ask whether there is not something wrong with our methods here, when if we get a beggarly two or three hogsheads to the acre we are thankful.

We would recall to our readers' minds a paper by Dr. Phipson of Jamaica, written some twenty odd years ago and republished a few years back as a bulletin from Dodds so well had it stood the test of time. In that paper the value of a sufficiency of lime was insisted on, and it was pointed out that samples of Barbadoes soil examined were poor in lime. The question of lime, says Dr. Maxwell, is like that of potash, of "crucial importance." Only three weeks ago one plantation sent down for examination soils from fields "that were giving out." The manager, at our request, sent samples also from virgin spots in the same fields, the places where the samples were taken having been selected by the manager and the writer one week previously. As a result of the analyses by our new method, it was shown that the cropped soils contained 40% less available lime, and 36% less available potash than the virgin soils from the same fields. As the manager states: "We know now what must be done." These elements that have been lost to the soil must be restored; or there can be only one end to the matter so far as large areas of land in given districts are concerned. The composition of the cane according to Dr. Maxwell, varies greatly in different countries and conditions. The standard of Hawaii will not be the standard for Barbadoes, but there is reason to hope that this new method may prove of great service to us also: and the question arises whether—of limestone formation though we are, and with all our calcareous gravel—the available amount of lime in some of our soils is sufficient.

To conclude. Those who read Dr. Maxwell's reports will probably feel as we do that his assurance of the future in store for the cane is well grounded.

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A GRAND OPENING FOR AMERICAN TRADE.

The Hon. James Wilson, the stirring Secretary of Agriculture in Washington, in a recent address says: "The Pacific Ocean is to become an American lake. Already our trade with the Asiatic shores exceeds $40,000,000 and within a short period it will be in the hundreds of millions. This trade is the great stake of the opening century, and already it is in our grasp. I have had an agent visiting China, Japan and the Orient generally with a view to looking up the chances for American trade in those products that affect the farmer, and I find that there is already an opening. For example, there is a good market for butter, flour and bread over there, but when the market has been found the fact stares us in the face that the farmers of the far West and of the coast are not yet ready to furnish the articles. The development of these industries on the Pacific coast must come. The door is open for such a trade. When the Eastern markets are opened up there will be a line of division running through this country from North to South. The produce of the farms will move to the East and to the West; from one side of the line the market will be in Europe, on the other side in Asia, and there will be an end of the harrowing competition between the farmers of the East and West. Each will have its own markets, and thus will the earth be divided between the farmers of America."

:o:

The Civil War was the means of raising the ideals of man in this great Nation by exterminating slavery, preserving the Union, and giving us the inspiration due to the noble acts and deeds of great leaders and their followers.—New York Christian Advocate.

THE EXPERIMENT STATION.

It is announced that Mr. R. E. Blouin has been named to fill the position of director of the Hawaiian Planters' Association's experiment station and laboratory in this city. Dr. Stubbs made the selection, and speaks very highly of him. He has been associated with the doctor for some ten years past, as his chief assistant, and is familiar with all the duties devolving on the incumbent of such a position. His work will be a continuation of the experiments of our central station. Dr. Maxwell expects to leave for Queensland in the steamer Alameda due here November 6. This experiment station work has unquestionably been of great service to our cane planting interest, and will no doubt continue to be so under the direction of one so well qualified to carry it on as the new incumbent. Dr. Maxwell goes to a larger and probably a much more difficult field to operate in, as the planters are more numerous, and probably not so intelligent a class as he has here had to deal with.

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LIGHT WITHOUT HEAT OR WASTE—A WONDERFUL SUBSTANCE DISCOVERED BY A WOMAN.

Professor Langley, of the Smithsonian Institution at Washington, D. C., is in receipt of a wonderful little piece of what the inventor has termed "radium," that has sent a thrill of wonder through every scientist in the land. The specimen was received incased in a small box made of lead, accompanied by instructions for the professor to open it in the dark. This was done. A number of the principal officers of the Institution repaired to the photograph "dark room" and the wonderful substance, no bigger than a silver dollar, was taken from its bed, and before those present could realize what had occurred the room was lit up as completely as though the full rays of the sun had penetrated the place. The substance emitted a clear greenish glow, and the features of every one were clearly outlined. There was a natural hesitancy on the part of those present to touch the thing, but investigation soon proved that the source of this wonderful light was cool and solid, and that it could be handled with ease.

What is this wonderful substance? It is a discovery made by a woman, Mme. Sklowdowska Currie, of the Municipal School of Physics in Paris, and if what is claimed for it be true it is the light of the future—the dream of alchemists—in short, a lamp that will burn forever, consume neither oil nor wick, is devoid of heat and requires no attention. Mme. Currie was awarded four thousand francs, and had her name enrolled on the books of the French Academy of Sciences for this discovery, which is regarded as one of the most stupendous of the age, upsetting as it does all hitherto accepted theories of heat, light, and physical energy, and opening up fields of knowledge heretofore regarded as beyond the scope of man. This light, it is claimed, will not only be very cheap when first installed, but after that there will be absolutely no expense in maintaining it, even though left to itself for centuries. Night after night for an indifinite period it will throw out its brilliant rays, and at the end of untold years the illumination will be as great as at first. No underground or overhead wires, no dynamos nor gas retorts, nothing but a little disk of greenish stone. Place this in the wall or in the ceiling and rooms will be lighted as long as the houses stand.

The origin of light as accepted by the layman is that it is merely the demonstration of energy produced by the destruction, combustion, or consumption of certain substances, like coal, oil, or gas. Heat is produced by the destruction of burning coal. This, transformed into motion by the steam engine and the dynamo, results in electricity for arc and incandescent lights. In short, no artificial light has ever been made for man's use that has not been the result of some material that was consumed in order to make it. A feeble light without heat is obtained from phosphorescence, but even this owes its origin to the slow consumption of the substance that produces it. To produce light without the expenditure of some sort of energy has been looked upon heretofore as an idle dream, but the discovery of the wonderful properties of the X-ray caused the scientist to put on his thinking cap. The X-ray discovery proved that there was more than one form of radiant energy, although all of them have the same qualities in certain directions, yet entirely different in others. Thus, while the powerful rays of the sun were unable to penetrate a thin piece of cardboard, the X-ray, which could hardly be seen, was able to go through wood and metal. This fact contradicted the universally accepted theory that the power of light was due in all cases to the material consumed. Experiments along this line soon convinced scientific students that uranium possessed remarkable qualities—that it had the power of absorbing light and emitting it afterward. It was then discovered on experimenting with salts of the metal that it would produce substances having properties similar to the X-rays, and that while they could not be seen by the human eye they yet had the power of "fogging" a photographic plate when brought in contact with it.

Different investigators produced different forms of these rays, but all failed of producing anything more than a laboratory experiment. There was energy, but unaccompanied by luminosity, and all the experiments were useless, so far as the commercial world was concerned. Then Mme. Currie began her work where the others left off. She reasoned that the wonderful properties manifested by different substances obtained from uranium were not due to any real power in the metal itself, but to some substance which is held in a state of non-activity. Working on this theory she began her work with a substance known as "pitch-blend," which is uranite, chemically considered, and which is simply the refuse from the factories where various uranium products are made. She first discovered a substance similar to bismuth, but several thousand times more powerful than the uranium salt from which it was obtained. The presence of this metal in combination with uranium was, up to this time, unsuspected, and the discovery was regarded as an important one. About three months ago the efforts of the talented lady scientist were crowned with success along the lines laid down by herself. By using different salts in combination with the bismuth she produced a substance with some of the properties of barium, which, after being heated, had the power of emitting visible rays of light. This is the substance which she has named "radium," and which promises to revolutionize the system of house lighting.

After she had obtained the long-sought-for substance, Mme. Currie set herself about measuring its power, and found that there was no need for the fine instruments which she had prepared for this purpose, as the light was strong enough to be measured by ordinary methods. A negative of ordinary density was placed in a frame in front of a fast photographic plate. She found, after repeated trials, that she was able to obtain a strong impression in about fifteen minutes—the slide produced was perfect—just as good as could be produced by day-light. A duplication of the plate showed that another could be produced in exactly the same time, which demonstrated that the power of the light was unchanged. At the end of two weeks, during which time the precious substance had been subjected to all sorts of conditions, still another test was made, with the same results, thus proving the stability of the power of the new light. The first piece of radium being produced, Mme. Currie argued that some accident might have been responsible for it, instead of scientific manipulation, but investigation proved conclusively that the results were sound—that radium could be produced at will. Tests were then made to show the exact nature of the material. Pieces were dropped into gun-powder, and, while a glow spread through the inflammable material, no explosion took place. There was no heat and no fire—merely light. Everything was tried that was at all likely to start combustion, but all failed.

The only thing that would destroy the luminosity of radium was boiling water, in which it must be kept for an hour. On taking it from the water it resembles green quartz—cold and dead. On heating it again, however, to the point of incandescence, it regained its luminosity with the same powers as before. It was then that several pieces of radium were manufactured and sent to scientists throughout the world, and this is how Professor Langley came to receive the queer little thing done up in a leaden box.

Recently Professor Bach of Berlin, a noted scientist, has made tests of the light, with a view of establishing its claims to permanency, and was unable to discover any waste of material whatever. He gave it as his opinion that it would require the lapse of one million years or more to destroy the luminosity of a piece of this radium no bigger than a quarter of an inch square. When it came to explaining the reason for the light's existence, however, he was dumb.

Even as the discovery stands today, it is one of the most useful on record, as small pieces may be used to illuminate dwellings, public buildings, and theaters, with the absolute certainty that there would result no flame from their extinguishment, as sometimes happens from the use of ordinary means of lighting, and that the expense of maintaining them would be absolutely nothing.

In its present stage of development there are many uses for this magic substance, yet without doubt it has been left to a talented member of the fair sex, whose work along this line exceeds all others, to benefit the world by one of the greatest discoveries of the age.—The Enquirer, Cincinnati, Ohio.

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There be some who see no appropriateness in Thanksgiving Day in a hard-times year. They are inclined to the gloomy view of things, and persistently refuse to look for the brighter side. For there truly is a brighter side. Scarce as money may be, lifeless as business is, hard as collections are, we have gone through worse times than these. Many business men find, from a careful comparison of records, that their actual condition is better than it has ever been before. Complaining is epidemic, and hosts of people have caught the infection who have no right at all to complain. They receive actually as much money as they have hitherto, and their expenses are actually less; yet they have not realized the facts. In many cases, alas, there has been, and is still, the real pinch of adversity; yet in the majority of these instances, the parties concerned have been in worse straits before now. And in the vast majority of cases, there is the greatest reason for gratitude in the preservation of health, in the enjoyment of home and friends, and other blessings whose very commonness leads us to forget them. There is not a man, no matter how straitened he may be, but can, like the negro parson—

"Kneel right down in all the muss,
And thank the Lord it ain't no wuss."

THE BAHAMAS.—These "islands of the blessed" are, we read, "rather neglected by Great Britain and the other colonies of the empire," and that as a consequence, "some of the whites have a hankering after annexation." Then "quite a profitable trade might be worked up from Canada in grain, hay, flour, cheese and manufactured lumber, which is now altogether controlled by the Americans." Again, it is a case of a northern clime and a tropical island. If any two communities are ever able to exchange their products to the profit of both, these two opposites should be; for each raises what the other cannot, and each sells what the other most desires to buy. Bermuda is very similarly situated, though more of it is known than of the Bahamas. The question of a possible trade development with these tropical British possessions has been discussed very freely in Canada, but little comparatively seems yet to have been done. They are plainly, however, in Canada's bailiwick. Canada should and could do all for them that the United States can for Porto Rico or Cuba. It will save much future bother to the Imperial Government if Canada does so, and will at the same time secure for her a profitable trade.—Commercial Advertiser.