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Errata: Through an oversight there was omitted in printing Mr. Hartmann's paper in the June number, on pages 246 and 247, the headings of Tables III and V, and to correct our error we herewith reproduce the two tables with the proper headings as they appear in the M.S.:—

TABLE III.

Extraction Per cent Sucr. in Cane	Sucr. in Bag. Per cent Cane	Bagasse Lbs.	Bagasse Sucr. Per cent	Bagasse Fiber Per cent	Diffusion—Water For Total Increase	Diffusion—Water For Last 1 Per cent in Extraction
93	.98	236	4.13	50.8		
94	.84	234	3.60	51.3	15.8	15.8
95	.70	232	3.02	51.8	39.5	23.7
96	.56	230	2.44	52.4	74.0	34.5
97	.42	228	1.80	53.2	137.2	63.2

From Tables II and IV follows:—

TABLE V.

Increase in Extraction	Maceration Water Required Simple Mac.	Maceration Water Required Double Mac.	Lbs. Sucr. Obtained	@ c.	Value c.
93—94	35.1	21.9	1.19	2.75	3.27
94—95	55.1	34.4	1.15	"	3.15
95—96	86.2	53.9	1.10	"	3.02
96—97	175.6	109.0	1.04	"	2 86

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PLANTERS' ASSOCIATION COMMITTEES.

The following is a list of the Committees which have been appointed for the year ending November, 1903.

LABOR:—W. M. Giffard, Chairman; E. D. Tenney, E. F. Bishop, J. P. Cooke, E. E. Paxton.

CULTIVATION:—Geo. F. Renton, Chairman; H. Deacon, W. A. Baldwin, D. Forbes, L. Barkhausen, H. P. Faye.

FERTILIZATION:—C. F. Eckart, Chairman; Fred Meyer, C. B. Wells, J. T. Crawley, J. F. C. Hagens, C. McLennan.

IRRIGATION:—H. P. Baldwin, Chairman; W. W. Goodale, L. Barkhausen, J. A. Low, Geo. C. Hewitt.

HANDLING AND TRANSPORTATION OF CANE:—C. C. Kennedy, Chairman; A. Horner, F. B. McStocker, John Sherman, H. A. Baldwin, F. Weber.

MANUFACTURE:—John A. Scott, Chairman; E. E. Olding, Wm. Pullar, Andrew Adams, A. Moore, H. P. Baldwin.

MACHINERY:—W. Stodart, Chairman; C. Hedemann, J. A. Low, Jas. Scott, J. T. Moir, Geo. Ross.

UTILIZATION OF BY-PRODUCTS:—W. W. Goodale, Chairman; Jas. Gibb, Jas. Renton, W. G. Walker, Andrew Adams, G. H. Fairchild.

DISEASES OF CANE:—R. C. L. Perkins, Chairman; A. Lidgate, D. C. Lindsay, K. S. Gjerdrum, G. F. Renton, A. Ahrens.

FORESTRY:—L. A. Thurston, Chairman; H. A. Baldwin, G. N. Wilcox, T. S. Kay, G. C. Chalmers.

EXPERIMENT STATION:—F. M. Swanzy, Chairman; F. A. Schaefer, H. A. Isenberg, G. H. Robertson, J. P. Cooke.

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A STUDY IN COMPARATIVE EXTRACTION.

The question of relative extraction is as much alive today as it was in 1898–1899, when the diffusion process was being looked upon by some as possibly being the most efficient method of extracting high percentages of sugar from cane.

Experience (more or less bitter) has shown that while the diffusion process stands even now in advance of any other method of securing the greatest quantity of cane or beet sugar per unit of raw material, the cost of getting this increase of sugar was at that time, and in many places, greater than the value of the sugar so obtained, and consequently the process fell into disrepute.

For several years past in the Australian Colonies multiple crushing with unusually heavy maceration has been practiced, the amount of water of maceration added to the cane during the process of crushing reaching from 60 per cent to 100 per cent; that is for every 100 gallons of original juice, additional water to the amount of from 60 to 100 gallons is applied to the cane during crushing.

The extraction claimed by the engineers and chemists of the Colonial Sugar Refinery Co. varies from 95.5 per cent to 97 per cent of the total sugar in the cane, and there is no reason to doubt the accuracy of their figures. As this method of extraction has been in use for some time, it is fair to conclude that the C. S. R. Co. finds that it pays, but as coal costs them but $2.00 per ton delivered to the furnace mouths at most of their mills, it is easily understood how an enormous maceration can be used in that country with a resulting profit, which could not be attempted with prospects of success in this country.

Before attempting to show how much sugar is extracted, it is well to know how much sugar there is in the cane that has been crushed; and the united opinion of nearly all practical sugar house men is that the *sugar in the cane* equals *sugar in the extracted juice + sugar in the bagasse.* Some will object to this, saying that it is impossible to obtain accurately the weight of the juice coming into a boiling house from a crushing plant; others may object that the analysis of the bagasse does not give very accurate results. In answer to these objections it may at once be conceded that neither cane weights, nor juice weights, nor bagasse analysis are absolutely accurate in any one case; but the margin of error in a well conducted plant is small, and varies on the plus as well as on the minus side, so that for comparative purposes from day to day, and crop to crop, the figures obtained by reasonably accurate weights and measures, such as are used commercially, are sufficiently correct, that is, until more reliable means of obtaining weights shall come on the market.

The following figures are taken from the daily reports of two of the largest sugar houses in this country and are exactly as reported:

	No. 1.	No. 2.
Cane ground	1,133 tons	1,434.64 tons
Fibre in cane	12.1 per cent	11.3 per cent
Polarization normal juice	18.94 "	18.72 "
Polarization mixed juice	16 9 "	13.22 "
Brix mixed juice	19.6 "	15.05 "
Weight of mixed juice into house	2,103,385 lbs.	3,272,287 lbs.
Sugar in bagasse	4.25 per cent	2.83 per cent
Soluble solids not sugar in bagasse	1.07 "	1.63 "
Moisture in bagasee	42.9 "	44.58 "
Fibre in bagasse	51.78 "	50.92 "
Weight of bagasse per 100 cane	23.368 lbs.	22.19 lbs.

From above data to determine "Sugar in Cane," "Extraction per 100 of Sugar in Cane," and "True Dilution." All figures for weights expressed in pounds per ton of cane:—

No. 1.

Fibre in cane per ton 12.1 × 20	=	242	lbs.
Then original juice = 2,000 − 242	=	1,758	"
Juice into house per ton of cane	=	1,856.5	"
Wt. of bagasse per ton of cane 23.368 × 20	=	467.36	"
Juice in bagasse = 467.36 − 242 lbs. fibre	=	225.36	"
The original juice in cane plus added water of maceration equals juice taken into house plus juice going off in bagasse and is 1,856.5 + 225.36 = 1,758 + added water of maceration which is equal to	=	323.86	"

And the true dilution = $\frac{323.86 \times 100}{1758}$	=	18.42	%
Sugar in mixed juice per ton of cane $\frac{1856.5 \times 16.9}{100}$	=	313.75	lbs.
Sugar in the bagasse per ton of cane $\frac{467.3 \times 4.25}{100}$	=	19.86	"
Sugar in cane per ton of cane 313.75 + 19.86	=	333.61	"
Per cent of extraction of Sugar $\frac{313.75 \times 100}{333.61}$ ..	=	94.05	%

No. 2.

Fibre in cane per ton 11.3 × 20............	=	226	lbs.
Then original juice = 2,000 — 226.........	=	1,774	"
Juice into house per ton of cane............	=	2,279.3	"
Wt. bagasse per ton of cane 22.19 × 20.....	=	443.8	"
Juice in bagasse 443.8 — 226 lbs. fibre......	=	217.8	"
Original juice in cane plus added water of maceration equals juice taken into house plus juice going off in bagasse and is 2,279.3 + 217.8 = 1,774 + added water of maceration which is equal to........		723.1	"
True dilution = $\frac{723.1 \times 100}{1774}$	=	40.76	%
Sugar in mixed juice per ton of cane $\frac{2279.3 \times 13.22}{100}$	=	301.32	lbs.
Sugar in bagasse per ton of cane $\frac{443.8 \times 2.83}{100}$ ..	=	12.56	"
Total sugar in cane per ton of cane 301.32 + 12.56	=	313.88	"
Per cent extraction of sugar $\frac{301.32 \times 100}{313.88}$	=	95.99	%

The foregoing figures can be drawn down to a short statement of the figures of value as follows:—

	No. 1.	No. 2.
Wt. of original juice per ton	1,758 lbs.	1,774 lbs.
Polarization normal juice..	18.94 per cent	18.72 per cent
Fibre in cane	12.1 "	11.3 "
Total sugar in cane.......	333.61 lbs. per ton	313.88 lbs per ton
Total sugar extracted....	313.75 " "	301.32 " "
Per cent of extraction.....	94.05 per cent	95.99 per cent
Per cent true dilution.....	18.42 "	40.76 "

Now since the amount of sugar originally present in the cane has been determined, and also the amount of original juice per ton of cane, the true sugar value of the normal juice is to be had:— By calculating the true polarization of the normal juice from the figures found as above, and comparing with the normal juice found by polarizing the samples taken throughout the day, a figure full of interest to the investigator is obtained.

Thus the true polarization of the normal juice for—

No. 1 is $\frac{333.61 \times 100}{1758}$ = wt. of original juice = 18.97 per cent

No. 2 is $\frac{313.88 \times 100}{1774}$ = wt. of original juice = 17.69 "

This shows that at No. 1 mill the normal juice analysis as taken by the samplers represented practically the true constitution of the original juice in the cane, there being a + difference of .03, a very small figure and easily accounted for.

At mill No. 2 (as there is no reason to suppose that the figures as given in the daily report are not correct), it is evident that the analysis of normal juice as taken by the samplers does not represent the true normal juice by quite a large figure, being a minus difference of 1.03.

It is a matter of observation that normal juices vary in every district, and probably in every field, in this peculiarity, namely, that the analysis of normal juice as taken from the first mill may or may not be a true index of the real normal juice; consequently the analysis of the normal juice is not a safe figure to adopt for any calculations of importance.

J. N. S. WILLIAMS.

Puunene Mill, June 15, 1903

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HIGH NARROW VACUUM PANS, vs. THE BROAD SHALLOW TYPE.

Puunene, Maui, June 15th 1903.

Editor of the "Planters' Monthly:"

Some Plantations, during the last few years, have installed in their factories vacuum pans of the high narrow type. I have yet to meet a practical sugar boiler that would recommend them.

Three of the principal factors on which the success of a vacuum pan depends, are:—I, An adequate heating surface; II, A free circulation; III, An extended surface of the massecuite for the disengagement of vapor.

In the high narrow pan, the first of these factors of efficiency is amply covered, the second is almost entirely wanting, owing partly to the circulation channels being too small, partly to the large number and poor arrangement of small coils employed in them, they being fitted with return bends in the centre, the tails of the coils carrying off the condensed steam laying next to the hottest part of the coils, absorbing heat from them and allaying circulation of the mass, and partly to the height of the massecuite above the heating surfaces, which raises the temperature abnormally high in the lower part of the pan, restricts evaporation and makes ebulition of the mass very difficult.

The third factor the makers of this type of pan, have reduced in proportion as they have increased the heighth. The result is a slow working pan, great waste of steam, slow discharge on completion of strike accompanied by a certain loss of sucrose, through inversion, due to long continued boiling at an abnormally high temperature.

On the other hand, the broad shallow pan with the same amount of heating surface per Cubic Foot of capacity, as the high narrow type, has wider circulating channels, with very little weight of liquid above the heating surfaces, to raise temperatures and restrict evaporation, and greater surface area for the disengagement of vapors, ensuring rapid boiling at a much lower temperature, and a freer discharge at a higher density, with a consequent greater recovery of sugar, on completion of the strike.

From operating two pans, one each of the different types side by side boiling identically the same goods, I have found the efficiency of the broad shallow pan to be more than 50 per cent. greater than the high narrow variety.

Wm. Searby.

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REPORT OF THE COMMISSIONER OF LABOR ON HAWAII.

We are in receipt of the Report of the United States Commissioner of Labor upon the commercial, industrial, social, educational and sanitary condition of the laboring classes of the Territory of Hawaii, for 1902.

This is the second annual report of the Commissioner, and we have seldom read a report upon any matter connected with Hawaii which has impressed us as being so fair, temperate and impartial in its view of the situation.

The labor conditions existing and which have heretofore existed in the islands, have so often been the subject of attack by agitators and so-called reformers, that we read this report of an unbiased, disinterested official with great pleasure, and if space permitted would be glad to publish it in full, as an answer to some of the carping criticisms and violent attacks which have been directed at the Government and the sugar planters of the Islands.

The report opens with a chapter on the general conditions of labor and industry, describing the group, the climate, general conditions and trade possibilities. It is stated herein that the productiveness of the soil is far greater than that of ordinary lands in other countries, and that therefore, the Islands may in time support by agriculture alone a large population—possibly a million people. Even then they would be less than half as densely populated as Porto Rico, and Porto Rico is stated to be considerably smaller than the island of Hawaii.

The report then deals with the history of the Penal Labor contract existing, by virtue of law, up to the time of the annexation of these Islands by the United States, and says: "The early importance of the whaling industry to Hawaii has already been mentioned. The natives are natural seamen and were frequently sought as recruits by the whaling captains. Soon irregularities and abuses crept into the system of enlistment, and the native kings, who, with the advice and assistance of the missionaries, were trying to create a body of modern law for their kingdom, borrowed from the United States our seamen's shipping act. This thus became the most practically familiar piece of civilized legislation to the average Hawaiian workingman. * * When the early sugar plantations were started the seamen's shipping act had thus become by usage the master-and-servant law of the kingdom. This seamen's or penal contract had 20 years to become established on land before the whaling industry ceased, and during this time its operation was confined practically to natives. * * It is significant that from 1868 to 1872 a vigorous campaign was conducted in the islands for the modification of the contract system. This was headed by Americans and white Hawaiians, and resulted in the control of the legislature in the latter year by the reforming party and in a series of amendments to the existing master and servant law intended to restrict the authority of the employers. So the seamen's shipping act of the United States, as adopted practically without change in Hawaii, had been modified in what was considered a humanitarian direction before there was extensive employment of Asiatic labor on the plantations."

After following the history of the system and quoting the form of contract used, the covenants on both sides, and showing that the tendency of legislation and court rulings were for a more complete protection of the laborer and a humane administration of the law, the report says:

"As to what the system was as a concrete fact, apart from the statute books, opinion and testimony in the Islands differ. The planting interests have long constituted a sort of industrial oligarchy in Hawaii, and even their passive influence has counted for much, both in legislature and hall of justice. But it does not necessarily follow that this influence was detrimental to public or private welfare, or exercised as a rule for selfish or short-sighted ends. It doubtless tended to preserve internal peace and order under the monarchy, hastened the material development of the country, and was otherwise potent in evolving modern civilization in the Islands. But the commercial spirit has not dominated alone. The missionaries brought into Hawaii a temper of New England altruism so practical and progressive that it has always constituted an efficient force in shaping public policy and private practice in matters of civil right. Local public sentiment was strong enough to correct evils that were arising in 1870, and there is little doubt that such sentiment would have led ultimately to a termination of penal contracts even had no such emergency as annexation arisen. * * * Physical ill-treatment of contract laborers was the exception. * * In considering these methods of discipline employed by planters during the contract system, it must be remembered that the free or day laborers were nearly as numerous as those under contract; that both classes were working side by side in the field, and that the same manner of handling must be used with both to a large extent. Furthermore, the cost of importing new men was very heavy, and consequently every far-sighted manager was studying to maintain such conditions among his employees as would make his day laborers remain and lead as many as possible of his contract men to 'reship' with him when their period of service was over. More than 45 per cent. of the 23,000 field hands on Hawaiian plantations in 1897, the year before annexation, were day men, and the policy of managers in relation with their laborers could hardly fail to be guided by this fact.

"There seems no ground, therefore, for believing that the former contract system in Hawaii was a system of quasi-servitude for laborers after the reforms of 1872, or that it was marked by extreme injustice or brutality. Europeans who have worked under it seem to regard it with no special antipathy. A man who had himself arisen from the position of a field cultivator to the highest ranks of plantation administration, stated that he had seen more abuse of men in a single watch upon an American sailing vessel than in 21 years of life in the Hawaiian cane fields. It was not a system that an American would care to work under, or one that it would be practical to revive, but it ought not to go down in history burdened with any particular odium. It was simply an adaptation of a United States statute to a particular situation—to an end no less exigent for the country in which it was enforced than is the end which justifies in the opinion of our Supreme Court the existence of our seamen's shipping act, in spite of our constitutional provision against involuntary servitude."

The report then deals with the present plantation labor supply and with the measures taken to recruit labor for the Islands during the last half century, and speaks of the importation of Chinese, Japanese, South Sea Islanders, Portuguese, Germans and Norwegians under contract. More Asiatics were brought, not because they were better laborers, but the cost was a very great deal less. "The field of labor supply was well covered by the island government. Hardly a locality in the world exists where there is a surplus of unskilled labor that has not been visited and investigated by Hawaiian labor agents. Attempts to recruit field labor have been made in many European countries, in various parts of the United States, in the East Indies, the islands of the Pacific and in Asia, but nowhere was a people found combining the civic capacity to build up a state with the humility of ambition necessary for a contract laborer.

"The present plantation labor of Hawaii, exclusive of skilled labor and superintendence, is composed of a few Europeans and Portuguese from the Azores, Hawaiians, American Negroes, Porto Ricans, Chinese and Japanese. The Europeans include a few Italians who have come into the country from Louisiana (where they work for the same wages upon the sugar plantations and live in the same quarters with the Negroes), Galicians and Slavs from East Austria, and a few Germans. The latter are almost entirely upon one or two plantations on the windward side of Kauai, the northernmost island of the group, where the climate and general conditions are favorable to outdoor work by Europeans. The owners and managers are also Germans, and the men are allowed the use of a garden and of sufficient land to keep a cow—in addition to the fuel and quarters that are regularly furnished field hands. Aside from the Portuguese, however, the number of Europeans employed in actual field labor is very small. In the autumn of 1902 it was but 39 in a total force of 18,536 men.

"The Portuguese are largely employed in the semi-skilled occupations of the plantation, though 1,183 of the 2,663 on the pay rolls are listed as field laborers. These people are an exceedingly hopeful element of the population. They are both industrious and frugal, and their vices are not of a sort to injure their efficiency as workers. They make good citizens, and though those of the first generation are usually illiterate and averse to sending their children to the public schools, they rapidly become Americanized. In fact the town Portuguese one meets in Honolulu or Hilo differ in no essential respect from intelligent foreign-born citizens of the United States. Their education has been acquired in the public schools, if they are of the younger generation, under a system identical with that of the mainland, and they have acquired the habits of thought and action that distinguish an American from a European. They take an active part in local politics and are prominent in both commercial and public life. The country people become homesteaders, cultivate small crops and fruits or coffee, and raise enormous families of bright, sturdy children—the most desirable crop of all in a country like Hawaii. It is rather significant, however, that they are not classed with 'white men' on the plantations. They form a class apart, somewhere between Asiatics and the other Caucasians. This is probably because the 'whiteman' has always been a sort of aristocrat in the islands, and a large body of immigrants who lived in ordinary plantation quarters and worked with hoes could hardly aspire to that rank in popular estimation. Portuguese or Hawaiians are usually employed as teamsters, plowmen, or cultivators where animals are used It is rather interesting that the Portuguese, like the Italians in Louisiana to-day, were formerly considered inferior for this sort of work.

But they have acquired the knack of handling mules and oxen, and in this branch of plantation labor are excelled only, if at all, by the Hawaiians. The Portuguese is more individualistic—he has less of the communal instinct than either the Chinese or the Japanese. Therefore he is less successful in co-operative and company contract work than are the Orientals. He is not inclined to strike, and is quite as apt to disagree with his fellow workmen as with his employer. But he can not be counted upon to remain upon a plantation after he has saved enough to become his own master. The ambition of most of the Portuguese laborers interviewed was to get a little homestead back in the mountains and to come down to the plantation occasionally to work at odd jobs for ready money.

"There are 1,369 Hawaiians employed on sugar plantations in all capacities. This is without considering those whites who may have a strain of Hawaiian blood in their veins, who are to be found among plantation owners and in the highest administrative positions. The natives, as intimated above, are usually preferred for handling animals. On account of their superior strength they also make excellent wharf men and porters. They are frequently found occupying positions as locomotive drivers and stokers and in the mechanical employments. Comparatively few are field hands, those so engaged numbering but 392, or 28.6 per cent. of the total number employed in the autumn of 1902. The Hawaiians are reported to be good men when they work, but they lack industrial discipline. They are indisposed to regular labor day after day in any occupation of a monotonous character. It is for this reason that they give best satisfaction in positions that afford varied or irregular employment, such as that of the wharf laborers just mentioned.

"There are a few American Negroes in Hawaii, a majority of whom have arrived since annexation. About a dozen were brought into the Kohala district of Hawaii in the spring of 1901, and some 100 men and their families were imported from Louisiana and Alabama by Maui planters under a contract by which they were to be paid from $18 to $24 a month, with a bonus of $72 at the end of 3 years of continuous service. Their passage to the islands was also paid by the planters. Of the latter expedition only a few men remained in the fall of 1902, practically none serving as field hands. Those who remained were earning salaries varying from a minimum of $26 a month and board as hospital nurses to $70 a month as policemen. There were 5 Negro field hands earning $22 a month and qaurters in the Kohala district. In a word, the experiment of importing black labor from the South was a failure. After the variety and excitement of a long trip across the continent and the Pacific, ending with an entirely new environment and change of climate, the Southern Negroes found it impossible to settle down to plantation routine. The men drifted into the towns, found employment there or on ships, and scattered to the four points of the compass. The more industrious and ambitious did not find the same opportunities for acquiring small holdings or making economic progress in other ways that they possessed in the South, and their civil and social status was little improved by the change. The minimum wages of field labor in Texas and Louisiana cane fields is $18 a month and quarters, and the cost of living far less than in Hawaii. Under these conditions there is no inducement for the Negro to migrate to the islands. Furthermore, a prejudice has always existed in Hawaii against the importation of black labor, which has found voice on at least one occasion in a special resolution of the legislature opposing such immigration. There are social reasons that make the Negro an especially undesirable settler in the islands. The color line is very loosely drawn between the Hawaiians and Caucasians. The former have hitherto included the rulers, the nobility, and many of the largest landowners of the country. Schools, churches, and society are opened to them, and they have intermarried with leading American and European residents. The Hawaiians are not racially allied with the Negro. For all these reasons, political and social, Hawaiian public sentiment considers it undesirable that an element be added to the population that would be certain in time to disturb the existing happy conditions and to create or emphasize unnecessary prejudices.

"The Porto Ricans, when they arrived, gave the least promise, either as citizens or laborers, of any immigrants that ever disembarked at Honolulu. The men had been carelessly recruited at a time when the laboring population of Porto Rico was in a condition of acute distress. It is probable that few of them were in a physical condition to make a long voyage when they went on shipboard. They were mostly people from the coffee country of their own island, who had been starved out of the mountains when that region was devastated by the hurricane of 1899. This was followed by a year of idleness, semi dependence, and mendicancy in the coast country before they left for Hawaii. They were half starved, anaemic, and, in some cases, diseased. A considerable number of petty criminals, wharf rats, and prostitutes from Ponce and other coast towns accompanied them. They were not so much representatives of the people of Porto Rico as of famine and misery in the abstract when they arrived in Honolulu. Numbers of men afflicted with hydrocele and other diseases, and who were manifestly incapable of working, found their way among the immigrants. But this was hardly the fault of the Hawaiian planters, who spent nearly $565,000 to get these men, or more than $192 passage money and recruiting expenses for every adult male arriving, and who were practically interested in their physical well-being.

"The Porto Ricans appear to have been well treated during their passage from Porto Rico to Hawaii, and to have been provided with as many comforts as are usually enjoyed by voluntary immigrants from Europe to the United States. But their food, while wholesome and abundant, was not always the kind to which they were accustomed, and they had been made ravenous by long starvation. The first three expeditions passed through San Francisco in the winter, and, although they were brought across the country by the southern route, the lightly clad members were subjected to the inclemencies of what was to them almost an arctic climate. But there were few deaths among them while en route. The hardships of traveling merely prevented any recuperation from the deplorable physical condition in which they had left their homes. When they reached the plantations where they were to be employed, many—especially of the first expeditions, which arrived in the worst condition—were taken directly to the hospitals, which some of them never left alive. Those who were not actually ill were in no condition to work and had to be fed with specially prepared food for some weeks before they could do a full day's labor in the fields. They did not care for themselves. They had to be taught how to live in their new surroundings. They were morally upset by their long travels and changed environment, and many could not acquire the new habits of life necessary to their new condition. So a considerable number became strollers and vagabonds, and, wherever possible, flocked into the towns.

"The social regimen of the islands is strict. There is no extreme poverty, and begging is unknown. Any industriuos and able-bodied man can always find employment in the country, and planters act upon the theory that a man who doesn't work is bound to steal. So a person without visible means of support is not allowed to remain on a plantation, and as the plantations cover nearly all the settled portion of the islands, it is exceedingly difficult for a man to follow a life of vagrancy with comfort. A certain number of Asiatics contrive to do so, but they live a sort of parasite existence upon their fellows, visiting from plantation to plantation among their more industrious brothers, and do not sink to the social rank or follow the methods of tramps or public beggars. Therefore Porto Ricans so disposed did not find conditions favorable to the *dolce far niente* existence so common among their own country population. They were confronted with the necessity of constant labor, and this was a new situation to most of them. A fair number are meeting the emergency with credit, and are acquiring habits of persistent industry that they might never have gained in their own country. But a certain proportion have failed to adapt themselves to any sort of an industrious life, and these have drifted from the plantations into the towns of their immediate vicinity and form a class of malcontents and petty criminals.

"So far as a personal visit to every plantation in the islands save one (and that a place where no Porto Ricans were or had been employed) was able to show, the planters appear to have fully kept their side of the agreement. In most cases, however, the men have left the plantations originally employing them and wandered from place to place, taking such positions as their fancy or necessity dictated, like other free agricultural laborers. On nearly every plantation they are given in addition to the wages agreed upon in the 'contract' a bonus of 50 cents a week for every week in which they work six full days. They receive special consideration in many ways that is not shown laborers of other nationalities. One plantation employs a physician for Porto Ricans exclusively, others that do not run plantation stores buy rice and similar supplies at wholesale which they sell at cost to these employees; a planter on the island of Hawaii gives his Porto Ricans a sack of flour in addition to their weekly bonus whenever they work a full month of 26 days, and at another place, where there are nearly 100 employed, they are served with a free luncheon of hard tack and coffee in the field. Among about 100 Porto Ricans interviewed, there was not a single man who complained that he had not received full compensation for his services.

"Of the 55 plantations in Hawaii, 34 had Porto Ricans on their pay rolls in the autumn of 1902. One thousand seven hundred men, or slightly more than 58 per cent. of the whole number of men imported, were then employed, and were earning an average monthly wage, without bonus, of $17.52. Including the weekly bonus of 50 cents paid to a very large majority of them for regular work, their possible wages were nearly $2 a month more than this, and their real monthly earnings probably averaged between $18 and $19. On one plantation, where the actual wages paid 54 Porto Rican employees were averaged for the month of August, 1902, it was found that they earned $18.85 each, or 51 cents a month more than the Japanese. There were also 127 Porto Rican women employed at an average wage of $11.13 a month, and 164 minors, whose average wages were $10.20. The occupations of the men were distributed as follows: Four held clerical positions, paying an average of $35.32 a month; 11 were overseers, receiving $30.29 a month; 18 mechanics and mechanics' helpers received $21.57; 29 teamsters received, $20.61; 15 wharf men received $19.77; 15 railway laborers received $20; 9 mill hands received $18.20; and 1,734 field hands and common laborers received, without including the bonus, an average of $16.13 a month. The average wages of the Porto Ricans employed on the plantations are therefore higher than those promised them when they left Porto Rico. But slightly more than half of those imported still remain in plantation work. Of these 539 are accounted for by the school children, 166 had been committed to Oahu Prison, and the remaining 2,300 represent minors too young to attend school, those employed off the plantations, and the vagrant and vagabond population that has collected in Honolulu. Some also have died and a few have left for the Coast. Twenty-three Porto Ricans are also engaged in cultivating on contracts, and are earning about $26 a month besides quarters, fuel, and medical attendance. These are not included among the plantation wage earners enumerated above.

"From the planters' point of view an important result of the Porto Rican immigration was the moral effect that their arrival had upon the Japanese. The latter had begun to fancy that with the enforcement of the Federal Chinese exclusion and contract laws after the annexation they were complete masters of the labor situation in Hawaii. They formed temporary combinations for the purpose of striking at critical periods of the planting and grinding season, and in this way had succeded in forcing up wages. This is sufficiently shown by the rise in the average wage of field hands from 60 to 75 cents a day, or an increase of over 25 per cent., during the year ending June 30, 1901—the first 12 months following annexation. The regular arrival of monthly expeditions of Porto Rican laboring people throughout an entire year largely disabused them of this sense of monopoly and made them much more reasonable in their relations with their employers.

"The ultimate effect of the Porto Rican immigration upon the islands will probably be unimportant. Those who remain will doubtless amalgamate more or less with the Portuguese during their transition into Hawaiian Americans. They and their descendants will in all probability be vastly better off than they had any prospect of being in their own country. They have brought with them a criminal element which it may take time to eliminate, but which will find the islands a decidedly discouraging field for operations, and they have faults and weaknesses which it may require a generation or two fully to correct. They are somewhat given to drinking, gambling, and carrying concealed weapons, and are more quarrelsome and vindictive than the other inhabitants. Difficulties sometimes arise between them and the Japanese. The latter are seldom the aggressors and rather fear the Porto Ricans in individual disagreements, but on one or two occasions, when their blood was up, it required prompt and energetic police interference to prevent a sudden extermination of the local Porto Rican population. The customs of the two people are so different that trouble is apt to result if they are placed in neighboring quarters. The Japanese, for instance, have a naive disregard for proprieties of costume and occasionally walk about their camps in an absence of attire that Americans or Europeans tolerate only in works of art. Porto Ricans object to this in case of adults, and one or two small riots have occurred as a consequence. His careless disregard for cleanliness renders the Porto Rican a less pleasant neighbor or employee in many respects than an Oriental. But to an outside observer it would seem that despite all his faults he is more desirable as a permanent settler. He possesses the heredity of the Caucasian, and with the discipline of regular work and the encouragement of the social and political environment he finds in Hawaii, he ought to turn out in the course of time a fairly intelligent and industrious citizen.

"The Chinese have long constituted an important—most of the time the most important—element of Hawaii's working population, and they possessed influence and privileges and received a degree of consideration in the old island kingdom that they never enjoyed in the United States. The first connection of Hawaii with China was through the sandal-wood traffic, when the Celestial Empire was looked upon as the great source of royal revenue and of ready money for the people. The cooley appeared in 1852 with the dignity of this tradition behind him. His number increased slowly at first; he accumulated property in those days of early abundance, intermarried with the natives, learned their language, gained their confidence and trade, and with his shrewd commercial instincts established himself strongly in the mercantile life of the Kingdom. In the marshy coast regions and fertile mountain valleys he opened profitable rice plantations, redeeming valueless waste lands, and adding greatly to the wealth of the country, the income of the native proprietors, and the revenues of the Government. His competition was not felt as much as his services were appreciated, and he was treated accordingly. Visitors from California speak of his superiority to the Chinamen of the coast as if he came from a different quarter of the globe, but he is simply the cousin or brother of the latter developed under a different environment.

"But the number of Chinese immigrants ultimately caused disquietude, especially in view of the constantly decreasing native population and the small contingent of permanent white residents, and from 1883 a growing opposition to their continued importation existed. Shortly afterwards plantation labor began to flock in from Japan, and a Chinese-restriction act was passed in 1887, with amendments in 1888, which virtually excluded laboring people of that nationality from the islands for a time. Chinese women and children having relatives in Hawaii, clergymen, merchants and teachers formerly residing in the country were allowed to land. Under a special permit from the minister of the interior merchants and travelers were allowed to remain in the country 6 months under bond. A limited number of field hands and domestic servants were also permitted to enter the country each year. These were allowed to engage in no occupations but the two stated, and had to keep their residence registered with the authorities, while their employers were required, under penalty of a fine, to deposit a certain portion of their wages each month with the Government for the payment of their return passage when the contracts under which they were permitted to enter had expired. Despite these restrictions, however, the number of Chinese plantation laborers increased relatively to the number of Japanese from 1894 to 1896, inclusive, though the latter always remained a large majority. The constitution of 1887 prohibited Chinese from voting for members of the legislature.

"The planting interests have usually, though not unanimously, been in favor of Chinese labor. An ideal situation in the eyes of most managers would be to have a force of unskilled employees divided about equally between the two Oriental nationalities. If confined to either one of the two, probably a majority would prefer the Chinese, partly because they still retain a lively recollection of their difficulties with the Japanese at the time of annexation. The two peoples, in spite of their kinship, have marked dissimilarities. The Chinaman is unsually the more steady and reliable but the less energetic laborer of the two, and is preferred for irrigation and cane cutting. The Japanese has greater physical strength, and is the better man for loading or for general roustabout work in the mill. He is more frequently seen with a team than is the Chinaman. He is more cleanly about his person and tidy about his surroundings, and adopts much more readily all the superficial tokens of Caucasian civilization. He wears European clothing, carries a watch, and seeks most eagerly for variety in life. He is constantly visiting new places and trying his hand at new trades. He represents the radical, the Chinaman the conservative, side of Oriental character. His white employers consider him mercurial, superficial, and untrustworthy in business matters. His vices are more occidental than those of the Chinese. He does not fall a victim to opium or the unnatural practices of the latter, but is fond of intoxicants. Partly on account of his religion he is usually kind to animals and largely vegetarian in his diet. When the Japanese first began to arrive in the country one of the difficulties employers experienced was to persuade them to eat enough wholesome and strength-sustaining food to do a fair day's work. The Chinaman is said by planters to spend half again as much for his provisions as a Japanese. He eats meat and not unusually is to be seen tramping home to his quarters with a canvas-wrapped ham on his shoulder. In matters of business honor, the Chinaman is considered vastly more reliable. He seldom deserts a contract, even though he lose heavily, while a Japanese will walk off and leave a manager in the lurch if he fails to get what he considers a profitable bargain. A prominent business man of Honolulu, who had dealt with the Chinese for 31 years, buying rice from them and advancing them money on crop loans and mortgages, stated that he had never lost a cent through their dishonesty or had one of them fail to keep his side of an agreement fairly entered into or attempt to evade a business promise. They are also said to be constant in their domestic relations and to bring up their families with a strict regard for their own ethical ideas. They have less national sentiment than the Japanese, and a number of them have settled and made permanent homes in the islands, where their children, either pure Chinese or mixed Chinese and Hawaiian, form a small but constantly growing element of the population. The descendants from Chinese-Hawaiian marriages are esteemed the best mixed race in the territory.

"The Japanese make more demands upon a plantation manager in the way of quarters and general conveniences for living than do the Chinese. Many of them have families and require individual apartments. They will not sleep in "double deckers," and tear them out of any apartments to which they are assigned. They prefer to board in small companies, upon a cottage system, while the Chinese like to herd together in large barracks—usually roomy, barn-like structures—with little suggestion of domesticity about them. It is difficult to keep Japanese employees upon a plantation unless they are provided with plenty of water—preferably hot water—for their daily bath. No provision for privacy need accompany these bathing arrangements. One big tub satisfies all ordinary requirements.

The patriotism and national aggressiveness of the Japanese are factors of the sociological influence in the islands. On the one hand these qualities have, up to the present time, prevented their becoming permanent settlers like some of the Chinese. They have not acquired large property holdings in Hawaii, though they conduct many business enterprises of importance among their own people. Japanese financial institutions and steamship companies handle the savings of the laborers and carry the latter to and from the islands, while the Government of Japan closely supervises and regulates every detail of their immigration. Most of those migrating to Hawaii do so at the instance and under the control of immigration companies, which are institutions authorized by the home Government for conducting this business. It is stated that at times only a fixed quota of laborers is permitted to leave each province, the number being adjusted to local requirements and to the rate of wages prevailing in the foreign labor market. Each immigrant pays or becomes indebted to the immigration company for his passage, and a fixed fee or commission, which ranges from $10 to $20, in consideration of which the company is bound to transport the laborer to his destination, and to provide for his care or else return him to his own country in case illness or accident incapacitates him for work. As a Japanese can save as much from his wages in a year in Hawaii as in the better part of a lifetime in some of the rural distrcts of his own country, and as the cost of passage to Honolulu—under $40—is by no means prohibitive, the voluntary labor supply from Japan has naturally filled the Hawaiian market, though always under the strict control of the Government. It is even rumored that when the plantation hands become numerous and wages begin to decline, or when the pressure for employment becomes great at home, the local agents of the Government intervene to encourage a return to Japan of those laborers having the largest deposits in the Japanese bank. Whether this is true or not, it is certain that Japan never lets go of its citizens, and does not intend they shall form permanent ties in another country. This fact has so far distinguished Japanese immigration into Hawaii from European immigration into the United States. The Japanese, with his inherited reverence for the authority of the Government, is not a free agent in the social or industrial world and does not sever himself from the influence of his native rulers when he passes beyond the sphere of their political control.

"It is in part this national sentiment which gives a certain aggressiveness to the religious policy of the Japanese. A majority of the laborers are Buddhists, and this religion is conducting a quiet but persistent propaganda against Christianity among its own people. Outside of Honolulu there are perhaps a score of Buddhist temples recently erected upon the different plantations, and Japanese schools are conducted in connection with a number of them. The national trait of assimilating readily the exterior forms of Western civilization reproduces itself peculiarly in their religion. Partly as a matter of convenience the Buddhists observe Sunday in the islands, conduct Sunday school and meetings on that day, and to some extent imitate church observances. Buddhist priests have adopted the title of "Reverend." There is no opposition to this religion on the part of managers and plantation authorities, in fact they rather encourage the building of temples and the observance of forms of worship among their Asiatic employees. The moral and social influence of the priests among the laborers is thought to be good. But cases are reported where Buddhist committees have been at work using their moral influence, and even, it is said, using a form of boycott, to force Christian Japanese to send their children to Buddhist schools and to renounce their adopted form of worship. Aside from their religion, patriotism alone is a potent influence in keeping the Japanese loyal to their own national institutions. They co-operate and make considerable sacrifices to maintain schools where their children can be taught in their mother tongue and in accordance with the customs and beliefs of Japan.

"'Despite the transient character of Asiatic settlement in Hawaii, the labor question there has certain permanent social and racial aspects that it does not possess in other portions of the country. These turn upon the probability of a final orientalization of that Territory. At present Hawaii is as characteristically American as any place on the mainland. This may be due in part to an aggressiveness in Hawaiian Americanism that was born of its struggle to survive and to dominate the country. Something of the cohesiveness that Macaulay mentions as characterizing the Englishry of Ireland in the sixteenth and seventeenth centuries has united the white population. The public school system has been a powerful instrument for unifying the ideals and establishing a solidarity in the civilization of the islands. European immigrants are assimilated into this American life as readily as in any other part of the Union. Up to the present time the Asiatic has had only an economic value in the social equation. So far as the institutions, laws, customs, and language of the permanent population go, his presence is no more felt than is that of the cattle upon the mountain ranges. He lives apart, his society forms an *imperium in imperio* that is not assimilated, and does not even coalesce with the social organism of the dominant race.

"The question whether this is a permanent condition and whether two societies can continue thus to exist side by side without reacting the one upon the other, is an interesting one, because it is certain to become more important and to have many new applications in the future. In Hawaii there seems to be an appreciable tendency to extend Western at the expense of Eastern civilization and customs. This is not so significant in case of the Japanese, for they are ready imitators, if not assimilators, of Western ideals. But a breaking down of Chinese conservatism means much more, and when these people decide to make their permanent homes in the islands it is evidently with a view to becoming Occidentals. They send their children to the public schools and encourage them to acquire American accomplishments and habits. In one school visited where there were about 70 pupils, but 13 wore cues. Ten years ago, the principal said, the proportion was about reversed. And a group of Chinese boys without cues, talking very fair English, dressed as American boys would be under similar circumstances, and starting out for a football game—as these boys were the morning the school was visited —present very few Oriental characteristics. Each one of these young men and women who steps over the line that separates the East from the West makes it easier for more to follow.

"The Americanized Chinaman contributes a not unimportant element to the Hawaiian people, and there are indications that he will stand on a certain social parity with the Caucasians. Young Chinese are occasionally seen in evening dress at balls and receptions where whites predominate. When they adopt an American manner of life they soon cease to be a depressing factor in the labor market. Those best qualified to speak of the Hawaiian Chinese state that they are rapidly acquiring the habits and tastes of American working people and demand the same standards of living. Many of those who make but a temporary sojourn in the islands, carry back with them to China packing cases full of American lamps, clocks, tools and implements, sewing machines, and other novelties and conveniences of various kinds, a knowledge of which they often introduce for the first time to the remoter parts of their own country. Some of them return to build and furnish homes, like those of the Americans, in their native villages. The circulation of Oriental labor through Hawaii has been a potent but little-heeded influence in extending familiarity with Western civilization and a demand for Western products throughout the two great Oriental nations.

"On the other hand, the presence of a transient population of Asiatics in Hawaii checks Caucasian immigration, limits the market for white labor, and thus tends to hinder the building up of a strong, self-governing American community in the mid-Pacific. Were Hawaii virgin and unoccupied territory it might be questioned whether American interests would permit a single Mongolian upon its shores. But now there are established industries and interests urging their claims. The sugar industry has been built upon Asiatic labor; that labor cannot be withdrawn at once without ruining the industry, and with it the economic prosperity of the islands for many years to come. Causes already sufficiently described limit the industrial possibilities, and no community, white or yellow, can obviate these limitations. Certain other conditions, sociological rather than material, still further restrict the sphere of industrial effort in the islands. That labor policy is evidently the wisest which, while recognizing existing conditions and the natural limitations to productive enterprises already mentioned, strives to maintain the economic prosperity of the Territory with the least possible sacrifice of the interests of Caucasian workingmen.

"Assuming the production of sugar to retain its present ascendancy, it is pertinent to inquire to what extent white men can be profitably employed in that industry. It is generally conceded that all the higher occupations, such as those involving superintendence or mechanical skill, might remain in their control. But the men employed in these pursuits are only a small fraction of the whole plantation force. Unskilled laborers constituted, in round numbers, over 38,000 of the 42,000 men employed on Hawaiian plantations in the fall of 1892, or about 90 per cent. of the whole plantation force. It is among the remaining 10 per cent. that there would theoretically be the greatest field for white employment.

"The preliminary explanation should be made that, irrespective of the general question whether white men can work satisfactorily in the cane fields, there is, it is said, no supply of the kind of labor needed in the States. Italy furnishes a large share of the field hands employed in Louisiana, and Japanese cultivate the beet sugar fields of California. The latter State furnishes a ready market for all the agricultural labor that up to the present date has ever reached its borders, at higher wages than the cane industry can afford to pay. American farm hands can not be employed, and small farmers from the States will not occupy and till with their own hands cane lands in Hawaii, until some economic revolution is accomplished by which workers are made to move freely from a higher to a lower market and from more profitable to less profitable fields of production.

"White men are sometimes said to be physically incapable of working continuously in the cane fields of a country having the climate of Hawaii. This may be true of some spots., like the Mana end of Kekaha plantation, where the highlands cut off the ocean breezes and the sun porus its untempered rays into a little pocket in the foothills, but as a general statement it has been disproved by the use of the Portuguese in Hawaii, and, it might be added, of the Gallego in Cuba. The Italians, while they have the recuperative effects of the frost season, work for months of the busiest time of the year in Louisiana in temperatures higher than are common in Hawaii. North Europeans have been and are still employed in field labor in the islands. The committee of labor of the Hawaiian Planters' Association said in its report for 1882:

" 'The employment of Europeans has not as a rule proved desirable, although in some cases Germans from the farming classes have proved valuable laborers, especially when the employers were Germans.'

"There is one field operation, however, in which white men can rarely be prevailed upon to engage. That is 'stripping' the cane, or tearing off the leaves so as to admit the sugar-building sunlight to the stalks. This is an especially disagreeable operation in many parts of Hawaii—on some plantations they do not strip at all—because the cane grows heavier on the irrigated lands than in any other place in the world. Forty tons of cane to an acre is a big crop in Cuba or other sugar countries, while 120 tons is sometimes raised in Hawaii. When this occurs the stalks attain an extraordinary length, sometimes 28 feet, and intertwine and taage so as to produce a nearly impenetrable jungle. A writer thus describes this operation of thrashing the cane in Australia, where the growth is far less luxuriant than in some portions of the Hawaiian Islands:

"'Picture to yourself a 50 or 60 acre field of well-grown cane. It stands from 8 to 10 feet high, in serried rows some 6 feet apart with half that distance between the stools, which number 6 to 12 stalks each. Much of the cane has been blown down, and lies in a tangled mass under foot. Every single stalk is clothed with a casing of dead leaves from the ground to the green crown. This is the so-called "trash," which has to be removed in order to allow the sun and air to act directly upon ahe cane. Enter this field and a few feet from the outside edge you find it difficult to force your way farther. Overhead is the pitiless, blazing sun of the Tropics. Should there be any breeze at all not a breath of it can find its way more than a few yeards into the thickly growing cane. The thermometer stands well above 100 in the sun, and added to that there is a deadly, muggy dampness everywhere, which renders the heat more oppressive. The trash is easily detached from the cane stalk—a child can pull a dead leaf off with his finger and thumb. All that the laborer has to do is to throw himself upon a stool of cane, plunge both hands into the accumulated trash, drag it clear of the cane and deposit it between the rows. But fine dust rises from the crackling leaves in clouds, which gets into the laborer's eyes and nostrils, covers his whole perspiring body with streaming dirt, and closes up his bronchial tubes as badly as if he were working a cotton gin in a closed room. In addition to this annoyance there is the still greater one arising from the hairs fringing each cane joint. These become detached in the process of thrashing and stick into the skin, like the fine hairs of a certain caterpillar or the fine spicules of the prickly pear, and cause intense irritation. The skin burns and itches, and there is no possible escape or relief until knock-off time.'

"Several serious attempts have been made by Hawaiian planters to introduce a system of colonies or small farming into the sugar industry, and thus to dispense to some extent with the uncertainties of labor supply that faced them as large individual employers. These experiments appear to have been made in good faith and to have demonstrated that this particular method of cane culture is not practicable in Hawaii. Certainly no new system of this sort could survive in competition with the one already established.

As early as 1870 one of the pioneer sugar raisers, Captain James McKee, brought 18 white settlers to Ulupakalu plantation, on Maui. They built a little hamlet called Lincolnsville, and received advances of supplies and living expenses and the use of land, with an understanding that they should be paid for their crop according to the number of tons produced. Only one of the members remained until the crop matured. A still more elaborate experiment was recently tried at Ewa plantation, which is described in detail in the two letters below. Fifteen farmers were brought from California, their expenses were paid in full and they were placed under exceptional conditions for succeeding as cane cultivators upon one of the best-paying plantations in the islands; but for various reasons they became dissatisfied and gave up the undertaking. Americans and many Europeans will not engage in an occupation that is stigmatized by cooley traditions, even though it prove profitable and not excessively laborious. They have a certain pride or vanity of race that is as difficult as any economic obstacle to overcome.

"LETTER FROM MR. W. J. LOWRIE, THE MANAGER UNDER WHOM THE EXPERIMENT WAS INAUGURATED OF INTRODUCING A COLONY OF AMERICAN FARMERS AS CULTIVATORS UPON EWA PLANTATION IN 1898–99.

"DEAR SIR: The question of employing white labor for the cultivation of sugar cane has received considerable and careful consideration by the Ewa Plantation Company. In the early part of 1897, Mr. W. N. Armstrong told of interviews he had had with Mr. E. L. Fitzgerald, labor commissioner of the State of California, and he was invited to a meeting of the directors of the Ewa Plantation Company, at which meeting, I, as manager, was present; the results of which meeting may best be told by quoting the following resolution unanimously passed:

" '*Resolved*, That the Ewa Plantation Company, through Mr. W. N. Armstrong, extend to Mr. Fitzgerald, labor commissioner of the State of California, an invitation to visit Honolulu and the Ewa Plantation, to look into the labor conditions existing here, with the view of introducing desirable white laborers upon the plantation.'

"Mr. Fitzgerald accepted the invitation of the company, arriving here in the islands shortly afterwards. He was furnished with every opportunity for the purpose of obtaining all the information possible on the subject, not only from a practical point of view, but also in the line of statistics, and before his return to California was able to express the opinion that it was his belief that white labor could be introduced for the cultivation of sugar cane on our plantation. After the return of Mr. Fitzgerald to California considerable correspondence was conducted with him on the subject, and, acting on the results of his visit to the islands and such correspondence, in July, 1898, I was authorized to visit California for the purpose of securing white families of the farming class to enter upon the cultivation of sugar cane at Ewa Plantation, according to the general terms of a form of contract that I had drawn up, with such modifications as might be considered necessary.

"Accordingly I went to San Francisco, going into the agricultural districts of the State in the interior, particularly to Modesto, Stanislaus County. On reaching Modesto, in order to thoroughly lay before the people the conditions as they existed pertaining to the cultivation of sugar cane, I engaged a hall, inviting the people from around the neighboring districts to come together in meetings, where I addressed them, offering them all the information possible on the subject. I found these people very anxious and willing to accept the propositions offered them to come to Hawaii; in fact, they had been suffering quite severely the past two or three years with their crops there, owing to drought. These people, while honest and hard-working farming people, were actually without any money whatever, owing to the losses sustained undoubtedly by them owing to the drought. In order to assist them in getting to the islands, we offered and did pay their fares to San Francisco, even going so far as to settle up some indebtedness owing by some of them in Modesto. They were all furnished with transportation from San. Francisco to Honolulu, and thence to the plantation, free of charge to themselves.

"As the result of my visit I succeeded in selecting personally 15 farmers, 10 of whom were single men and 5 married. They arrived here in the islands during September of that same year, being engaged under the general following conditions:

"They were to cultivate and take care of the cane from the time it received its first watering up to maturity, and were to receive therefor one-sixth of the actual net price realized on the sale of sugar. During the time previous to settlement with them after the harvesting of each crop they were allowed an advance of $18 per month. Further, they were furnished, free of charge to themselves, houses, fuel, and water, and medical services; they were also allowed to have a small piece of ground surrounding their houses, on which to cultivate and grow for themselves vegetables and other articles for their own use, with the water necessary to irrigate the same.

Having resigned the management of the Ewa Plantation in November of that same year, for further information as to the results obtained with these farmers I will have to refer you to the present management, but I believe that all have left the plantation, with rather unsatisfactory results to the Ewa Plantation Company.

"One can see from the foregoing that the Ewa Plantation Company made an honest and earnest effort to introduce white labor, especially white farmers, for the purpose of cultivating sugar cane on their plantation, with the hope that the same would prove successful, and that in the future we could get large numbers of American farmers into this country, and we could not help but admit that the whole thing was a complete failure. It may be of interest to note that the Ewa Plantation Company did not send a paid agent who went to the cities of the mainland to try this experiment, securing their labor from the cities; on the contrary, they sent me as manager, and I did go to the agricultural districts and did get the farmers.

"It also may be of interest in this connection to state that at the time this experiment was undertaken the joint commission sent here by Congress to report upon our conditions (consisting of Senators Cullom and Morgan and Representative Hitt) were very much interested in the effort, and, together with the directors of the Ewa Plantation Company, were in hopes that it would tend to solve the labor question for these islands.

Yours, truly, W. J. LOWRIE."

"LETTER FROM MR. GEORGE F. RENTON, THE MANAGER UNDER WHOM THE EXPERIMENT WAS CONCLUDED.

"DEAR SIR: I have now to reply to your request for information concerning the experiment with American labor in the cane fields on the estate.

The profit-sharing company on the Ewa plantation, known as the California Farmers' Colony, consisted at the outset of 15 men, 5 of whom were married. These farmers arrived at Ewa in October and November of 1898.

"For their transportation from San Francisco $1,110.81 had been advanced to them; for their free accommodation 9 houses, each containing four rooms, 13 by 12 feet, exclusive of kitchen and pantry, with 24 by 6 feet verandas front and back, had been erected; for their convenience water was piped to each building, gardens were alloted to each household, and a fenced pasture of 17 acres immediately adjoining the house lots was set aside for common use. Each married man had a separate house; of the single men, 6 occupied 2 rooms each, while the remaining 4 had separate apartments. This was at the inception of the experiment.

"After a few months had elapsed, owing to departures, each single man had two rooms, and before eight months had passed each farmer, whether married or otherwise, occupied an entire house. Thus, of the original 9, there remained 4 houses empty and to spare.

"This was at the middle of the experiment.

"They were, therefore, housed with ample accommodations and sufficient comfort; fuel, water, and medical attendance were supplied, without charge, a field of deep rich soil already planted with seed cane and 'first watered' was allotted to them for their cultivation; one of their number was selected as their suboverseer in the distribution of irrigation water, and they commenced work.

"The following is a record of the time each man stayed on the estate, and the reasons given by each for dissolving his connection with the plantation:

Number of men.	Time worked (months).	Reason for leaving.
1.......	1	Wife dissatisfied.
2.......	7	Dissatisfied and quarrelled with the rest.
1.......	7	Dissatisfied with the work.
2.......	8	Dissatisfied with the work.
1.......	8	Dissatisfied with the work. Returned to California.
1.......	9	Wife died at Portland, Oreg.
1.......	12	Illness.
1.......	12	Ill and dissatisfied with the work.
5.......	16	Dissatisfied with the work, but stayed until crop was mature to fulfill agreement.

General average of time at the plantation, 10.9 months.

"From the first there was dissension among themselves; complaints of one another, both trivial and otherwise, were of frequent occurrence; extra men were always needed to keep their field in order; one by one they departed, until finally the California Farmers' Colony dwindled, as per record, to but 5 out of an original 15. They remained, but they remained dissatisfied. They stayed to the completion of maturity of the crop, but they stayed to demonstrate that they would not work longer at the cultivation of cane. They had done fairly well financially; they each had received over $40 per month of labor cash, clear of rent, firewood, water rates, and medical attendance; they had received, in fact, more than the plantation could afford to pay for profitable cultivation, and yet these 5 men refused point-blank and without hesitation to entertain a similar proposition for continuance of cane-field work. This was the end of the experiment.

"The work was distasteful to them in this warm climate; the irrigation, being light, was least disagreeable; the task of stripping, with the necessary bending and stooping, was unfit for the taller Anglo-Saxon, they said, and should be relegated to Japanese; whereupon they flatly refused to perform the work; of assisting at the cutting and loading of canes during harvest they would have none.

"To sum up, the plantation cleared, plowed, furrowed, ditched, surveyed for irrigation, planted, and 'first watered' the field for the California farmers and turned it over to them. At the proper time for fertilizing the plantation had to apply fertilizer with extra labor, stripped (what was stripped) with extra labor, and had the labor of cutting and loading the canes done by extra labor.

"The farmers performed, merely, the lightest portion of the work, viz, the hoeing and the irrigation, which consists in the removal by hoe of weeds from the furrows and the turning in of water from the various water courses into the furrows. This, too, was not performed without daily assistance of extra labor supplied by the plantation.

"I do not think that any of these men have complained that the plantation did not fulfill its agreement with them. One farmer returned to San Francisco shortly after his arrival at a loss of $112.76 for transportation to the plantation; the one whose wife died in Oregon was given a liberal estimate of his share when he went; in fact, was given all he asked for; the two, both past middle age, who stayed 12 months received their shares of profit for the time they worked and the amount due them was given them. Of the remainder who left, the profits from 3 of the shares were turned over to the 5 who remained until the cane had matured.

"And yet the experiment was a failure and the men were not satisfied to remain.

"Mark this further. Not one of these 15 farmers was intemperate. They quarreled, they were dissatisfied, the work was menial, was laborious, was distasteful, but, while a few were not as industrious as they might have been, they were all respectable, law abiding, temperate men. If they had been otherwise, vice and intemperance might have contributed to the failure of the colony of these farmers. But it was not so. And I am forced to the conclusion that American farmers will not work in the cultivation of Hawaiian cane fields.

"Here was an experiment entered into by the largest and most fertile plantation in the Hawaiian Islands, under a directorate composed entirely of Americans, and its terms carried out in the field under the management of Americans.

"It was the aim of the Ewa Plantation Company, if the scheme had proved successful, to establish further colonies of American farmers, and thus obtain a source of labor in the United States from which to draw, which labor would be reliable, would be American in spirit, and thus do away with the necessity of looking entirely to the Orient.

"It was a praiseworthy effort, but it was utterly fruitless and entirely disappointing.

"It was unfortunate to have to say that the experiment, toward which the whole country looked with so much interest, was a flat failure. Nevertheless the fact remains and I so record it; for, looking back over the whole situation of labor in Hawaii, comprising both this experiment with the California farmers and my personal experience of 24 years on sugar plantations with white men, I have come to this settled conclusion:

"That Anglo-Saxons can perform the actual labor of cultivation on sugar plantations in Hawaii only when forced by necessity to do so, but that now they will not.

"The principal objection seems to be to perform the laborious work required in the cane field when there is any other possible opening in any easier occupation in other industries. Another objection is to the sort of pioneer life which obtains on a plantation when compared to that to which the laborer is accustomed on the mainland. It is probable, also, that a great drawback to the success of any scheme for American farm labor here in Hawaii lies in the great distance this Territory is from the mainland, and the difficulty and expense this distance necessitates in getting to or away from Hawaii.

"The geographical drawback mentioned in a natural one. The objections above stated are also natural ones. But they will as surely kill any attempts to introduce American farmers here as labor for cane fields as they have already killed the Ewa plantation experiment.

"Yours, very truly, GEO. F. RENTON, Manager.

"As our contract labor and immigration laws prevent the direct importation of laborers, and there is no voluntary immigration of moment except from Japan, the question of whom he shall employ is taken entirely out of the hands of the planter at present. Oriental labor is forced upon him, especially since the partial failure of the Porto Rican experiment. He is not entirely averse to this situation, perhaps, but it has its difficulties from the point of view of the sugar raiser.

"The objections which have been made by planters to the present labor conditions are these:

"1. He is entirely dependent upon a supply of unskilled workers that may at any moment be cut off or withdrawn. During and immediately after the first war between Japan and China 20 per cent. of the plantation laborers of the former nationality withdrew from the silands. Another war diplomatic difficulties with the United States, or even a domestic crisis in Japan might prostrate industries in Hawaii and cause losses from which it would be difficult to recuperate, simply by checking the immigration or increasing the emigration of Japanese laborers.

"2. The present condition has created a large, homogeneous Asiatic population of the same nationality, which is, so to speak, industrially autonomous. These people trade among themselves, carry on their own local industries, and are practically independent of the white population commercially. These activities absorb the energies of a large population into which the plantation laborer frequently retreats, but from which he seldom emerges. The proportion of the whole number of Japanese in the islands employed on the plantations continues to grow smaller. The interests of the outsiders are often opposed to those of the planters. Some act as shyster employment agents, who make their gains by shifting men as often as possible from one place to another. Others purvey to the vices of the hands and disorganize plantation discipline. All live, in one way or another, off the common laborer, who is the only primary producer among them, and their presence, considered as a whole, constitutes a sort of parasitic growth upon the body of the working people that cripples their effectiveness and disturbs their relations with their employers. It is claimed that if there were more diversity of nationality among the laborers, this evil would be greatly reduced.

"3. The predominance of one nationality among the field hands increases the liability to strikes and similar disturbances, such as occurred at the time of annexation.

"4. The actual supply of labor from Japan is inadequate, and does not increase to meet new demands.

"These are the arguments which the planters present against field labor of a single nationality, as gathered from numerous conversations in the islands. Actual records show that strikes and combinations to force up wages occur as rarely in Hawaii as in most countries where there are business enterprises employing a large force of unskilled labor. Plantation wages are falling after the abnormal rise of 1901, without having occasioned up to the present any crisis in the relations of employers and their men. The embarrassments resulting from a large secondary population of Japanese, living upon and exploiting the laborers in various ways, are such as are encountered everywhere and are hardly to be remedied in a free country.

"The complaint of an existing shortage of labor in the autumn of 1902 could be verified by an inspection of the fields on some of the plantations. It was hard to judge just how far this might be due to exceptional conditions prevailing in certain localities. A severe drought afflicted portions of the island of Hawaii in 1901, affecting especially the Kohala district and part of the Hamakua coast. The crop was so short that plantations were obliged to discharge many laborers and several contracting cultivating companies failed. It was in this country that the labor shortage was most apparent in 1902. Some fields of young plant and rattoon cane were entirely lost through lack of hands to cultivate them, while others were badly damaged because of late or inadequate attention. Managers who had studied to economize labor in previous years, and were equipped to utilize animal cultivation to the largest extent, met this difficulty more easily than others. The shortage on other islands, while a source of constant complaint, had not resulted in such obvious damage to the fields as in Hawaii. At the opening of the grinding season for 1902-03 the entire labor deficiency for all the islands was reported by the Planters' Association to be 5,450 men, or about 12 per cent. of the whole force employed. The distribution of this shortage was as follows: Kauai, 375 men, or 4 per cent. of thetotal force; Oahu, 990 men, or slightly over 10 per cent. of the total force! Oahu, 990 men, or slightly over 10 per cent. of whole force, and Hawaii, 3,075 men, or practically 20 per cent. of all the plantation workmen employed in the islands.

"The immigration statistics since annexation account in large part for this condition. They are more fully discussed in a later paragraph of this report, but they show that while the Oriental population has remained nearly stationary since annexation, so far as additions from Asia are concerned, there is a rapid substitution of females for males taking place, which promises to continue until an equilibrium of the sexes is established among the Hawaiian Japanese. Allowing for this fact, and taking into account those who have migrated to the California coast, there has been a decrease of 3,088 in the immigrant population of male Asiatics from the date of annexation to the time the above statistics relating to the labor deficiency were gathered. The number of Oriental laborers in Hawaii had constantly decreased during the two years of industrial expansion. There had been an increase of 65,000 tons in the sugar crop and an increase of nearly 3,000 employees upon the plantation rolls during this period. The present stringency would therefore be easily accounted for, even if there were no movement, such as is actually taking place, of Oriental laborers toward the towns. Without the 2,000 Porto Ricans who remain upon the plantations, the situation would have been even more critical.

"A deficiency of laborers is not a new or unusual thing in Hawaii, but it is a source of more financial loss and more administrative embrarrassment in sugar production than in most other industries. Cane can neither be cut nor planted at random seasons, even where the climate is as equable as it is in the Hawaiian Islands. Delays in planting or grinding due to an inadequate force of laborers mean financial losses by which a plantation in a single season may eat up two or three years' profits. Insufficient cultivation may produce almost equally bad results. Ordinary expenses for irrigation, manufacture, or land rentals, which are very high in portions of Hawaii, remain virtually the same, irrespective of the size of the crop. A single plantation on the island of Hawaii, which produced slightly under 8,000 tons of sugar in 1901-02, spends upon an average $80,000 a year for fertilizers. Through lack of cultivators the present year, a considerable fraction of this investment was exhausted in producing weeds instead of cane. In a word, no matter how men may come and men may go, the processes of nature go on upon a plantation without interruption. The planter has to keep up with them. He is not like the manufacturer or the miner, who can employ idle periods to repair a plant or sell surplus stock, or can recoup temporary losses by higher prices in the future. He can not dictate to the processes of production. The manufacturing side of his business obeys the agricultural. Like the small farmer, he is subservient to wind and weather, but, unlike him, he is at the head of a vast enterprise, combining with its agricultural features the characteristics of a manufacturing industry and a commercial establishment. His dependence upon satisfactory labor condition is therfore unique. It is not primarily a question of wages, but certainty and assurance of an abundant supply of workers that interests him.

"In the organic act for Hawaii Congress made three provisions relating directly to labor—it abolished the penal contract, and extended the Federal immigration and contract-labor laws and the Chinese-exclusion act to the Territory. People in the islands generally agree that the old form of labor contract ought not to be revived. While the system was misrepresented and was quite different from what it was popularly supposed to be in the United States, it was contrary to the best sentiment of the islands and would form a legal anomaly, even if it could exist at all, under our Constitution. But it is urged by the planters, inasmuch as conditions are quite different from those in the States, that the Territory is justified in asking for special treatment in regard to the other two series of enactments thus suddenly imposed upon her, and especially in case of the law prohibiting the importation of contract labor.

"Hawaii, it is argued, is a country that invites very little voluntary immigration of Caucasians. There are no large tracts of public lands where agriculture can be profitably pursued by people unfamiliar with local conditions; the islands are isolated and expensive to reach, and the extent of territory is not great enough to attract attention or to give occasion for an immigration boom in any European country. Without some artificial stimulus the influx of white settlers promises to be exceedingly small. And yet permanent prosperity and the solution of the gravest political and social problems that confront Hawaii depend upon just this sort of immigration. When white families have once settled in the islands and have become acclimated, they find opportunities, especially in the field of agriculture, to acquire lands and homes and to attain economic independence. The only method of securing such settlers that has ever been effective in the past or is likely to prove successful in the future is to permit of their importation under contract from Europe. The planter and the other business interests of the Territory are in accord in urging this point.

(To be continued.)

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THE COST OF PRODUCTION OF BEETROOT SUGAR IN GERMANY.

In the paper read before the Royal Statistical Society on the 18th April, 1899, I gave some calculations of the cost of production of beetroot sugar in Germany. It may be interesting to give later statistics on the same point; the more so, now that with the abolition of bounties the cost of production will be the main factor governing production and price.

The yield of sugar from the roots varies, in different countries and seasons, between 12 and 14 per cent. These are equivalent to the following quantity of roots per cwt. of sugar:—

12%=8·33	cwts. of roots	per 1 cwt.	of sugar.
13%=7·692	"	"	"
14%=7·143	"	"	"

The Paris Journal des Fabricants de Sucre of the 8th April, 1903, quotes figures given by Herr Ernst Glantz of the results of 33 German factories in the year 1901–2, from which it appears that the average cost of manufacture for these 33 factories can be calculated as follows:—

	Pfennigs.		Per Cwt. of Roots d.
Average price of roots.............	88	=	10·56
Average cost of manufacture........	38·7	=	4.644

The average yield in Germany now varies between 13 and 14 per cent.

If we take an average yield of 13 per cent. of sugar from the roots (= 7·7 cwt. of roots per cwt. of sugar) we get:—

		d.		s.	d.	
7·7	×	10·56	=	6	9¼	per cwt. of sugar.
7·7	×	4·64	=	2	11¾	" "
Total cost of 1 cwt. sugar in the factory....................				9	9	

If we take the higher average yield, an exceptional one, of 14 per cent., the calculation comes out:—

	d.		s.	d.	
7·14 ×	10·56	=	6	3½	per cwt. of sugar.
7·14 ×	4·64	=	2	9	" "
Total cost of 1 cwt. sugar in the factory..............			9	0½	

The figures for the last five seasons are given as follows:—

	Cost of Roots per Cwt. Pfennigs.		d.	Cost of Manufacture per Cwt. of Roots Pfennigs.		d.
1897–8	89	=	10·68	40	=	4·8
1898–9	96·5	=	11·58	42 3	=	5·076
1899–00....	96·45	=	11·57	45·3	=	5·436
1900–1	101·4	=	12·16	42·3	=	5·076
1901–2	88	=	10·56	38·7	=	4·644
Average........			11·31	Average..		5·006

Taking this average we get, on the basis of a yield of 13 per cent.:—

	d.		s.	d.	
7·7 ×	11·3	=	7	3	per cwt. of sugar.
7·7 ×	5	=	3	2½	" "
Total cost..			10	5½	

or, on the basis of an exceptional yield of 14 per cent.:—

	d.		s.	d.	
7·14 ×	11·3	=	6	8¾	per cwt. of sugar.
7·14 ×	5	=	2	11¾	" "
Total cost...			9	8½	

An examination of how the cost varies in different factories may also be interesting. Thus, of the 33 factories, the one which paid the highest price for roots paid 106 pfennigs per cwt., while the lowest price paid was 69 pfennigs. The highest cost of manufacture was 68 pfennigs, and the lowest 28 pfennigs per cwt. of roots.

The factory which had the highest cost of working of 68 pfennigs per cwt. of roots, worked 42 000 tons of roots. There were ten factories which worked smaller quantities, but their average cost of manufacture came to only 42 pfennigs, so that this particular factory must be an exceptional case and should be disregarded. The factory with the lowest cost of manufacture was capable of working and actually worked 139,000 tons of roots. But two factories with a still larger capacity had a cost of manufacture of 30 and 32 pfennigs.

In fact, a careful examination of the figures for the 33 factories shows that size of factory is not by any means an invariable measure of the cost of manufacture. Thus we can find several small factories which worked below the average cost of 38 pfennigs, and an equal number of large ones that worked at as high and even a much higher figure. Here are five of each kind:—

Tons of roots worked.	Cost of manufacture per cwt. of roots. Pfennigs.	Tons of roots worked.	Cost of manufacture per cwt. of roots. Pfennigs.
40,137	30	96,891	38
33,950	34	61,253	41
26,360	35	52,900	43
26,000	35	69,500	47
26,720	36	46,810	49

It is clear that the cost of production of beetroot sugar varies within very wide limits even in Germany, where it has been reduced to its present minimum. The fluctuations in the cost of roots, cost of manufacture, and yield of sugar are considerable, and therefore if the above figures be correct it is impossible to put the average German cost of production of beetroot sugar at less than from 9s. to 10s. per cwt., to which has to be added the freight from the factory to Hamburg, warehousing charges, and expenses of putting f. o. b.

That the cost of production in France, Austria and Russia is considerably higher is, I think, generally admitted. But those countries, having room for improvement, will no doubt continue to progress, and two of them will probably succeed in reaching the perfection arrived at in Germany.

GEORGE MARTINEAU.

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ON THE "RIND" DISEASE OF THE SUGAR CANE IN THE WEST INDIES.

BY ALBERT HOWARD, M.A., F.L.S.

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During the years 1899–1902 I had occasion to study some of the diseases of economic plants in the West Indies, including that known as the "rind" disease of the sugar cane. A technical account with illustrations, of this malady, embodying the results of my investigations, is to be found in the "Annals of Botany" of March, 1903. In the same memoir, the common root disease of the sugar cane in the West Indies is discussed, and a list of the more important papers relating to these diseases is given.

In the present paper it is proposed to deal with the cause of the "rind" disease, and especially with the possible remedial and preventive measures to check the damage done thereby. In a second paper it is hoped to consider this root disease of the cane in a similar manner.

CHARACTERS OF THE DISEASE.

Canes attacked by the "rind" disease have a very characteristic appearance. The disease appears about four or five months before the canes are cut, generally at the beginning of the ripening period. It makes its appearance earlier in first crop canes than in ratoons, and attacks sweet canes like the Bourbon to a much greater extent than some of the seedlings. These latter, however, are by no means immune, and in no case was a seedling cane found which was entirely free from the disease. The White Transparent, a variety much cultivated in Barbados at the present time, is often affected. The first outward symptom of the malady is the drying up of the leaves, which commences at the margins of the older ones, and gradually spreads to the centre of the tuft in from four to six weeks. When this drying of the leaves is well marked, the stem of the cane shows a brown discoloration in one or more places, after which the rind shrivels up, and the discoloration rapidly extends in all directions. On splitting such canes in half, the tissues are seen to be of a reddish colour, in which darker red areas can be seen. Very frequently these darker regions contain definite white centres, elliptical in vertical section. The appearance coincides exactly with that originally figured by Went in his writings on the "Red Smut" disease of the cane in Java, and later by Barber in the case of the same disease in Madras.

Infection seems to take place in many cases at the tunnels made by boring insects, such as the moth borer (*diatraea saccharalis*, Fabr.), but in a good many instances it appears to have started at the old leaf basis.

Two fungi are very common on such diseased canes—the *Melconium*, described and figured by Massee as a phase of his *Trichosphaeria Sacchari*, and a second form which is not very often seen in the earlier stages. The former fungus appears to the naked eye as black, hair-like filaments, bursting through the rind of the cane. These filaments are composed of an immense number of spores, loosely cemented together. The latter form occurs as minute, black, velvety, star-shaped patches on the outside of the cane, generally just below the leaf-base, or on the sleeping roots above the node. These bodies are spore patches bearing dark hairs, near the base of which crescent-shaped spores are formed. The reddish-coloured tissue in the interior of the cane contains colourless mycelium, in which the contents appear as a row of circular oily drops. In the older portion of the affected tissue, dark-brown resting spores are to be seen in the hyphae. All these appearances agree with the fungus causing the "Red Smut" disease of the sugar cane in Java, described by Went.

Canes attacked by this disease give rise to considerable trouble in the factory. Not only is the sucrose content of the juice of these canes extremely low, but impurities are present in such amount as to render the presence of such canes very undesirable.

They are thus useless in themselves, and also contaminate and lower the quality of the juice of the sound canes of the sample. Those diseased canes which are greatly discoloured and partly drying up are known locally as "rotten" canes, and are thrown aside, and thus escape crushing with the rest. When the disease is not so advanced, and can only be discovered by splitting the cane in two, the workman is unable to detect it. Consequently, such canes are crushed with the rest, and thus lower the purity of the juice.

In reaping the experimental plots in Barbados it is customary to weigh the obviously diseased canes separately and return them as "rotten cane." The proportion of these diseased canes is supposed to be an index of the disease resisting power of the variety. As will be shown below, this idea is hardly in accordance with the facts of the case.

CAUSE OF THE DISEASE.

In the first instance an extended study of the *Melanconium* fungus so common on these diseased canes was undertaken with a view of determining its possible relationship with other forms sometimes met with on such canes, and also whether it behaves as a parasite towards the sugar cane and thus causes the "rind" disease. The final results of this study were negative, and are to be found in a previous paper. They need not be given in detail here. Briefly stated, it was found that this fungus is not a parasite, and is not the cause of the "rind" disease. Further, no connexion between this form and the other fungi met with on the sugar cane was obtained by the methods of pure culture. An opportunity of repeating these experiments in England lately presented itself. Thanks to the kindness of Professor Marshall Ward, I was able to study this fungus at Cambridge, and to carry out inoculation experiments on mature sugar cane in the Lily House at the Botanical Gardens there. The results, under these conditions, were identical with those obtained in Barbados. *Melanconium* did not behave as a parasite towards the cane, neither was any connexion between it and other sugar cane fungi obtained in pure cultures of this form.

An examination of the other fungus referred to above found on canes attacked by the "rind" disease gave decisive results. A detailed study of the behaviour of this form, when grown in pure culture, was first undertaken. A beginning was made with a spore obtained from one of the star-shaped spore patches.

Germination takes place in a few hours especially when the food material was composed of:—

Cane Extract........................	100 c.c.
Gelatine	15 grams
Tartaric Acid........................	.2 gram
Peptone	.5 gram

Under these circumstances the subsequent development of the fungus is also very rapid.

Spores are formed in great numbers from the mycelium by a process of budding about the third day. These spores are smaller ($25 \times 2 \cdot 5u$) than those formed at the spore-patches on the exterior of the cane, and are identical with those produced in large numbers when a piece of fresh cane attacked by the "rind" disease is split open and placed in a moist chamber.

When five days old, dark brown resting spores similar to those noted in the older portion of the cane when attacked by this disease, were found. Lastly spore patches, similar to those seen on the outside of the cane, were noted when the cultures were six days old. These gave rise to crescent-shaped spores similar to that started with.

In addition to these small hanging-drop cultures, in which the development of the fungus could be studied under the microscope from one spore, many large cultures were also made and the growth of the fungus observed. Similar results to those described above were in all cases obtained. The development of the fungus on the cane and in artificial media was therefore identical.

A large number of inoculation experiments with pure cultures of this fungus was then made on healthy sugar canes. The following account of this part of the work is taken from my previous paper on this subject:—

1. On December 4, six healthy canes in the same stool were inoculated at wounds made in internodes about the middle of the stem, and also at upper leaf-bases, with spores from a pure culture of the fungus. Precautions to prevent the entry of other spores were taken, and six other canes were used as controls. On December 10, one of the inoculated canes showed that infection was taking p ace at the wound, but no result was observed at the leaf-base. On December 16, a second cane was examined, when distinct infection was observed in the tissues of the internode where the wound was made, and also at the upper-leaf base. On December 26, two more canes were examined. No infection was detected at the leaf-bases, but at the wounds very definite indications of the "rind" disease were noted. The leaves were beginning to dry in the characteristic manner, and on splitting open the canes infection was apparent in four of the internodes, where the red blotches, with white centres, were evident. The invading mycelium was characterized by its branching and oil-drops, and agreed exactly with that seen in canes attacked by "rind" disease. The remaining two canes were also drying at the top and were obviously infected at the wounds. They were used tor the experiments with *Melanconium*, described below. In this experiment one of the controls became infected with the fungus; the other five gave negative results.

2. On December 10, six canes were inoculated in a similar manner to those in the above experiment, and six others were used as controls. On December 28, one of the inoculated canes showed infection at the wound, but not at the leaf-base. On January 22, two of the inoculated canes showed that at the wounds

the fungus had invaded two of the internodes, and had produced the characteristic red blotches with white centres. In one case infection had also taken place at a leaf-base. The other three canes, in which infection at the wounds was very evident, were used for the experiments with *Melanconium*, described below. The control canes gave negative results.

3. On December 19, four canes were doubly inoculated at wounds made in an upper and a lower internode, with mycelium from a pure culture of the fungus. As before, controls, were employed, and precautions taken to introduce only one fungus. The object of this experiment was to determine the comparative effect of the fungus on those portions of the cane which are very rich and very poor in sugar. On January 22, a cane was examined, when it was found that the fungus had invaded 16 inches of the upper part, which showed the characteristic markings, but had not spread beyond the internode at the lower wound. The remainder of the canes were examined five days later. In all cases infection had taken place to about the same extent, the length of cane affested varying from 18 to 24 inches. The characteristic red blotches with white centres were abundant.

4. On December 31, four canes were inoculated with spores from a pure culture of the fungus as follows: In two cases the canes were doubly inoculated at upper and lower leaf-bases, and in the other cases at wounds in upper and lower internodes. Two control canes were also used. On January 22, the canes which had been inoculated at leaf-bases showed that infection had taken place at both the upper nodes and at one of the lower nodes. At the upper part of both canes the star-shaped spore patches of the fungus were abundant on the affected rind at the nodes above and below the point of inoculation. In each case about 9 inches of the cane were infected, and the red blotches were abundant. A similar result was observed in the case of the cane where the fungus had also infected at a lowor node, but no spore patches were evident on the rind. On January 23, the canes inoculated at wounds showed that in all cases inoculation had taken place, and spore patches had formed on the outside at the upper affected regions. From 12 to 18 inches of the cane were invaded at each wound. The controls gave negative results.

The above inoculation experiments were carried out with canes during the ripening periok, and after active growth in size had ceased. The results obtained, while indicating that the fnngus is a wound parasite, nevertheless do not conclusively show that it is capable of overcoming tissues still capable of growth and development. Accordingly, further experiments were made on first-crop canes, about six months old, which were in a vigorous state of growth. In all cases inoculation was performed in developing internodes, which were then not more than 1 inch in length. The experiments were as follows:—

5. On June 20, three young canes were inoculated by placing seven days old, actively-growing mycelium, from a pure culture

in the sugar-cane extract medium, into wounds made in the centre of a lower internode, then about three-quarters of an inch in length. Care was taken to introduce only one fungus, and to shut off the apertures from the air by means of sterilized wax tape. Three similar canes were used as controls. Two months afterwards the canes were examined. In the first case, the affected internode had grown to $2\frac{1}{2}$ inches in length, and on splitting open the cane this and the internode below were found to be generally reddish in colour with the elliptical white areas, characteristic of the "rind" disease, well represented. About 4 inches of the cane were invaked by mycelium, which agreed with that of the fungus which had been introkuced. A closely similar result was obtained in the other two inoculated canes, but the controls showed no infection.

6. On June 23, the above experiment was repeated on two similar canes. Two months afterwards two internodes were, in each case, found to be completely invaded by the fungus, which had produced all the characters of the "rind" disease.

7. On June 27, four canes about six months old, growing in tubs, were inoculated wi h pure cultures of the fungus, three at wounds in the internodes, the other at a leaf-base. On August 19, one of the canes inoculated at a wound exhibited the characteristics of the "rind" disease in the infected internode, but the other three and the controls gave negative results.

8. On June 23, three vigorous canes about six months old, growing in the field, were inoculated at leaf-bases, from which the adhering green leaves had been torn, with six days' old mycelium from a pure culture. Afterwards the nodes were covered with sterile waxed tape. On August 19, one of the canes gave a negative result, but the other two showed distinct iniecti n. In one case, 5 inches of the cane were invaded, in the other about $2\frac{1}{2}$ inches.

These experiments show conclusively that the fungus is capable of more than mere wound parasitism. It is able to overcome tissues capable of active growth. At the same time it can thrive readily as a saprophyte in artificial media and pass through its whole development thereon. It occurs in the West Indies every ripening season as a parasite. It would seem to be, therefore, intermediate between a hemi-saprophyte and a hemi-parasite, and not to belong strictly to either of these classes.

Further, it is clear that this fungus, and not *Melanconium*, is the cause of the "rind" disease of the sugar cane.

On referring this fungus to its systematic position it is evident that, in the absence of any higher fructifications than those described, it must be placed in the *Fungi Imperfecti*, and that it falls into Corda's genus *Colletotrichum*. From its characters and its parasitism on the sugar-cane it evidently agrees with *C. falcatum*, Went a form which causes the "Red Smut" disease of the sugar-cane in Java.

Thus the "rind" disease of the West Indies and the "Red Smut" of Java are identical. This conclusion was strengthened by the examination of specimens of sugar-cane, said to be attacked by "rind" disease, from other parts of the West Indies and Surinam. In all cases the characters of the disease were identical with those given above, and most of the specimens showed both *Melanconium* and *Colletotrichum*. Further, careful examination of many of the cane-fields of St. Vincent in January, 1902, where the Bourbon is almost exclusively cultivated, and where the "rind" disease makes its appearance every year in December, showed that the disease was identical with the "Red Smut," and that the fungus *Colletotrichum falcatum* was present.

The fungus appears to be widely distributed. In addition to the West Indies it occurs in Java, Madras and also in Queensland.

Since *Melanconium* always appears on canes attacked by the "rind" disease, it seems probable that it must infect the canes after they are diseased. Accordingly the effect of this fungus on a part of the sugar-cane attacked by *Colletotrichum* was compared with its effect on the still healthy portion. The experiments were as follows:—

1. Two canes which had been inoculated on December 4 with spores *Colletotrichum*, and which showed from the outside that infection had taken place, were reinoculated on December 21 at the affected region, and also near the base, in the still healthy tissue, with spores of *Melanconium* from a pure culture. On January 23, it was found that at the upper part numerous filaments of *Melanconium* had developed, but at the base infection had not taken place.

2. On December 19, three canes, which had been inoculated at the upper parts with spores of *Colletotrichum* nine days previously, were reinocvlated with *Melanconium* spores from a pure culture. A second inoculation with these spores was made at the base of these canes in the still healthy portion. On January 27, *Melanconium* filaments were evident round the upper wounds, but no infection had taken place below.

These experiments show that the part played by *Melanconium* in the "rind" disease of the sugar-cane is that of a follower of *Colletotrichum*, and that it only invades previously diseased cane.

REMEDIAL AND PREVENTIVE MEASURES.

The nature of the "rind" disease having been determined, it became possible to consider the question of how far its ravages may be diminished and prevented. It is then that the real difficulty in such matters is encountered. It is usual when diseases of economic plants are studied for the investigator to base recommendations of a remedial nature on the results of his researches. These are published for the information of the planter, who is supposed to adopt them in practice. Only on very rare occasions does the practical agriculturist pay any attention to this advice.

For this attitude he is unjustly blamed by his would-be advisers. A little consideration will show that the scientific investigator, and not the planter, is in the wrong. If the investigation of plant diseases has any economic value, it should be possible to demonstrate this to the practical man. In any given disease, therefore, the investigator should test the value of his own advice by experiments on a sufficiently large scale on the estates themselves, and then lay the results of such trials before the planters. This proceeding is especially necessary in the case of fungoid diseases, as their nature is not always clearly perceived by agriculturists. Unless, therefore, these trials are carried out in an adequate manner, it is hopeless, and perhaps even unreasonable, to expect any practical results to follow from investigations on plant diseases.

The necessity of conducting such large scale experiments as those indicated above was clearly impressed upon my mind while temporarily employed by the Imperial Department of Agriculture for the West Indies. The planters are willing and even anxious that such work should be done, and several placed their estates at my disposal for the purpose. Unfortunately, however, an unexpected difficulty arose which put the proposed experiments out of the question, and the suggestions could not be carried out. It is gratifying to notice, however, that the principal outlined above has been already applied in another direction in one locality in the West Indies in connection with sugar-cane investigations. I refer to the large area tests of new seedling varieties of promise lately instituted in the British Guiana sugar estates. The credit of having carried out this reform belongs to Professor Harrison. There can be no doubt that in the case of cane diseases a similar method might be adopted before any real results might be achieved.

In the absence of data obtained on the estates themselves, all that can be done is to indicate the lines on which such trials might be conducted. For convenience, these are discussed separately.

1. *The destruction by burning of diseased canes at reaping time.*— There can be no doubt that the "rotten canes" are covered with the spores of the "rind" fungus, and that they are capable of infecting healthy canes. On general grounds, therefore, they should be destroyed. The Java method of pouring kerosene oil on a heap before igniting it, would seem to be a practical method of getting rid of this diseased material. It would be easy to conduct experiments to show the amount of damage done when the "rotten canes" are left on the ground. Fields of young canes could be selected, on the leeward half of which diseased canes could be scattered leaving the windward half clear. The amount of "rind" diseases in both cases could be compared, and data would be available to show whether or not it really pays to carry out this recommendation

2. *The early reaping of fields in which the "rind" disease makes its appearance to any considerable extent.*—The planter is here confronted with a problem which can only be solved by large scale experiments. On the one hand, the canes improve in quality as they ripen. On the other hand, the fungus is spreading, destroying larger and larger amounts of sugar, and giving rise to impurities which will affect the juice of the healthy canes. The question to be answered is, whether it is better to reap early when the canes are not perfectly ripe, and when there is little disease, or at the usual period when the canes are riper, but when the disease is much further advanced. It would be easy to reap one-half of a diseased field early and the rest later, and to compare yield of sugar with tonnage of canes in both cases. An advantage of early reaping would be that the fungus at this stage would not have formed spores, and would be destroyed in the megass before it could spread to other canes.

3. *Removal of the dead leaves of the cane during the period of growth.*—There would seem to be several advantages in this proceeding. The atmosphere around the cane stems would be rendered much drier, and the chance of infection by the spores of the "rind" fungus would be diminished. The drying of the canes by evaporation of water through the rind could also be promoted and the work of concentrating the juice lessened. Since several parasitic fungi often occur on the old leaf sheaths and leaves it would be interesting to find whether it would pay to burn the old leaves when they are removed. The value of this stripping of the canes could easily be decided by suitable experiments.

4. *The use of the best cuttings as plant material.*—Much advice has been given to the West Indian planters on this question, but the matter does not seem to have received that amount of experimental attention it would seem to deserve. The produce obtained by planting the best cuttings could easily be compared with that resulting from poor and diseased plant material and the value of both crops determined.

5. *The control of boring insects.*—As the "rind" fungus is often a wound parasite, and gains access to the canes at the tunnels made by boring insects, such as the moth-borer, it is clear that steps should be taken to limit the damage done by these pests. In the West Indies the eggs of the moth-borer are laid on the leaves of the canes and are destroyed in large numbers by a small fly which lays its own eggs in those of the borer, and thus destroys these latter. The collection of the eggs of the borer during the early period of growth of the canes is quite practicable, and besides is not an expensive proceeding. It all these eggs, many of which contain the larvæ of the small fly referred to above, were allowed to hatch in the canefields in such a manner as to ensure the destruction of those which are normal, while at the same time all the parasites are preserved, the pest would be diminished, and its natural enemy increased. Zehntner's method of placing the

egg clusters in a dish standing in a wider outer vessel containing molasses, the whole being encased in netting, would seem to be a practicable suggestion for the canefields of the West Indies. By this device the larvæ of the borer are destroyed as they crawl into the molasses after hatching from the egg, while the flies escape and destroy further egg colonies on the leaves. This measure, as well as that of cutting out and burning dead-hearts containing developing larvæ, if carried out systematically, should tend to diminish the damage done by the moth-borer, and also indirectly that wrought by the "rind" fungus.

One further point deserves mention. In the early part of the present article it is stated that the amount of "rotten cane" left when the crop is reaped is not an accurate index of the disease-resisting capacity of the particular variety cultivated. It is only an imperfect indication of the amount of the "rind" disease present. Many of the other fungoid diseases of the cane are represented not by "rotten cane," but by a diminished tonnage of apparently normal cane. This is especially the case with the destructive root disease of the cane so common in Barbados. An example will make this point clearer. The seedling B 147 seldom contains much "rotten cane," as it is attacked by the "rind" disease to only a limited extent. It is, however, prone to root disease, especially in the second crop; so that although it yields few rotten leaves, nevertheless it is far from being immune to fungoid disease.

In conclusion, I wish to express my indebtedness to the Editors of the Annals of Botany for their kind permission to reproduce, from No. 64 of that Journal, the figures which illustrate this paper. Mr. Eric T. Molecey has been good enough to copy these drawings for reproduction in the present paper.

SUMMARY OF CONCLUSIONS.

1. The "rind" disease of the sugar cane in the West Indies is identical with the "Red Smut" disease of Java, and is caused by the fungus *Colletotrichum falcatum*, Went. It can infect ripening canes at wounds and at old leaf-bases, and can overcome the tissues of young canes which are capable of growth and development.

2. The *Melanconium* found on diseased sugar canes in the West Indies is a saprophyte, and is not the cause of the "rind" disease. It infects canes easily at points when they have been invaded by *Colletotrichum*.

3. The directions in which experiments should be conducted, on an estate scale, to test the value of remedial and preventive measures against this disease, appear to be as follows:—

(*a.*) The destruction by burning of the diseased canes at reaping time.

(*b.*) The best time to reap fields in which the "rind" disease makes its appearance to any considerable extent.

(*c.*) Stripping the growing canes.
(*d.*) Planting from the best cuttings.
(*e.*) The control of boring insects.

—[International Sugar Journal.]

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HISTORY OF THE SUGAR CANE.

It is claimed, and probably true, that sugar cane was first cultivated in China, and sugar manufactured from it over a thousand years before its introduction into Europe. Undoubtedly the Chinese were early manufacturers of sugar, and claim that they were the first, but on this point there is considerable doubt. They themselves candidly confess that it came to them from the East. In their most ancient works no allusion to it has been found. In the second century B. C. its authors speak of it, and in the fourth century A. D. it is described in a work which calls it the "Kan-che," (Kan-sweet and che-bamboo). "It grows in Cochin China. It is many inches in diameter and resembles bamboo. The stalk broken into fragments is eatable and very sweet. The juice which is drawn from it is dried in the sun. After some days it becomes sugar." In the year 286 A. D. the Kingdom of Turran in India sent sugar as a tribute to China.

De Condolle says, "it has been demonstrated by a crowd of historical witnesses, that sugar cane was first cultivated in meridional Asia, whence it has spread into Africa and later into America."

Karl Ritter stated, that all the varieties of cane known in a wild state and belonging to the genus "saccharum" grew in India except one which was in Egypt.

Linguistic and historical facts support the claim of Asiatic origin. All European languages of Aryan origin have names for sugar, derived from the Sanskirt "Sakkara or Sarkara," but those not of Aryan origin have a great variety of names for both "sugar" and "cane." This similarity of names on the one hand, and the diversity on the other, support the presumption of the great antiquity of its culture in Asia, where botanical indications presumed its origin.

Sugar cane was found growing in many of the Pacific Islands at the time they were discovered by the white man, and it was inferred that it was indigenous, but it has since been indisputably proved that it, with many other useful plants, was carried by the Maori race in all of its migrations, and that they had obtained it from India. As far as modern reseach has been able to ascertain, it came to China from Cochin China, and had its origin either in that country or Bengal.

The Greeks and the Romans were acquainted with the propagation of sugar cane in the West of India, as is shown by the writings of Paulus Aegineta, Theophrastus, Dioscorides, Pliny, Varro, Seneca and others. Sugar was called "Indian Salt," "honey from bamboo," "a honey concocted in India and Arabia," "a honey produced either by the dew of heaven or by the sweet and thick sap of the reed," "a concretion similar to our own salt, and which, when subjected to the teeth, breaks up after the manner of salt."

Hebrew writers do not mention sugar or sugar cane, and it is inferred that the culture of cane did not exist in the East of India at the time of the "Captivity of the Jews at Babylon."

From what has been said, the deduction follows, that its seemingly trustworthy history makes India the original home or at least the first place where it had food, or commercial value, and from there into China, where it has been extensively cultivated for many centuries. Thence it passed to Arabia, Nubia, Ethiopia and Egypt.

The Venetians (about 1500 A. D.) introduced sugar cane into Syria, Cyprus and Sicily. Dom Henri, King of Portugal, imported it into the Madeira and Canary Islands, where for 300 years all of the sugar consumed in Europe was manufactured. It was next introduced into Southern Spain, where its culture still prevails, though within a restricted territory. At the beginning of the sixteenth century it was carried from the Canaries to Brazil. Soon after the discovery of the New World, Peter Etienza took his cultivation to the Island of St. Domingo, whence it spread over all the West India Islands and Central and South America.

In the United States it is now cultivated along the entire Gulf coast. It was introduced into Louisiana in 1757, and became, in 1795 extensively cultivated, and has since then been the chief crop of the state. In Florida it had a checkered career from 1757 to 1825, when it became permanently domesticated and has since been extensively grown for syrup making.

In Georgia, Mr. Thomas Spaulding began its cultivation in 1805, and soon after large estates were devoted to it and sugar houses were established. The discovery of the cotton gin and the wonderful impetus, which it gave cotton culture, caused an abandonment of cane growing by the large planters on the alluvial coast lands, but the small farmers of the interior took it up and grew it in patches and manufactured it, by the crudest machinery, into syrup for home consumption. Today sugar cane is grown in over fifty counties of this state, and an enormous quanity of excellent syrup and some sugar is annually made. Georgia syrup finds its way to nearly every market in the United States.

In the southern parts of South Carolina, Alabama and Mississippi numerous small patches of sugar cane are cultivated and converted into syrup and sugar by the same primitive methods as in Georgia. Only Texas and Louisiana are deeply interested in the manufacture of sugar. In the former state there are twenty or more large sugar houses, and in the latter over four hundred, yielding in the aggregate annually nearly 400,000 tons of sugar. This does not include the large number of scattering patches, in each state, grown for the home manufacture of syrup for home consumption.

The manufacture of syrup upon a small scale, with horse mills and small kettles or open pans, is an enormous industry when considered in the aggregate. From Wilmington, N. C., on down the Atlantic coast and across to the Gulf, following its coast to the Rio Grande, is a section of country well adapted to the growth of cane.

It varies in width from 100 to 300 miles, and a traveler through it in the growing season, is rarely out of sight of a cane patch. The methods of manufacture are extremely primitive, almost criminally wasteful, yet the syrup made is excellent in quality, and quantities of it find their way, at profitable prices, to the North and West after the home demand has been supplied.

Better methods of cultivating, fertilizing and harvesting the cane, improved machinery for larger extraction of the juice and more skillful and economical ways of clarification and evaporation, would almost double the yield from the present acreage, which itself can be very greatly increased. In fact the present consumption of sugar in the United States could easily be met by this section, provided the prices of sugar would justify the erection of factories by those having the capital—the cane could easily be grown. This section alone can grow sufficient cane to meet all the present demands for sugar in the United States, and, it is believed, will do so as soon as the price of sugar justifies putting so much capital into its factories.—German Kali Works' Pamphlet.

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ROOT-BORER.

In a recent issue the Barbados Advocate states that one of the most interesting papers in the current issue of the West Indian Bulletin is that by the Rev. N. B. Watson, Vicar of St. Martin's, on the root-borer of the sugar cane. For some time there has been an idea that the white grub often found at the bottom of a cane stump was the "lady bird," but to Mr. Watson belongs the credit of establishing its identity.

Owing to the fact that the grub's life of 312 days underground is not commensurate with that of the sugar-cane, and that it does not feed on decaying vegetable matter, the close of the reaping season would be a bar to its further development, were it not that it is capable of adapting itself to other fare. As an illustration, Mr. Watson refers to the large percentage of dead and dying plants, so noticeable in the fields of ground nut and sweet potato planted during the first week of June 1902. An examination made at the time disclosed that, in every instance, the underground stem of the dead plant had been attacked at its lowest extremity by the root-borer and eaten from below upwards. Mr. Watson also points out that fields not under cane in 1901, and at some distance from fields that had been, were practically free from the ravages of root-borer during the months of June, July and August, 1902.

The root-borer, Mr. Watson says, might have been regarded as of comparative insignificance until within the last two or three years. Prior to 1901 its attacks were but little noticed, but since that date its numbers have increased to a great extent and its ravages are more apparent. The existence of the pest, it has been pointed out, has been made easy by cultivating, in infested fields, plants from which it derives food. But its rapid increase, Mr. Watson declares,—and the increase of most insect pests in Barbados—is to be traced to the mungoose. This animal, it will be remembered, was introduced into the colony to destroy rats, and for years it was protected by law. Anyone killing a mungoose was subject to heavy panalties. But rats seem to have palled on the appetite of the mungoose after a time. At any rate it did not confine its diet to them. It soon became a terror to the peasantry who went in for raising feathered stock; and, incidentally, it turned its attention to those reptiles and birds that kept the insect pests of the island in subjection. The ground lizard is believed to have fed principally on the root-borer; hence it was to be regarded as a valuable ally to the planter. But the mungoose regards this lizard as a great delicacy, and has almost exterminated it.

Amongst remedial measures pointed to are the use of lime and the alternation of crops which do not supply the grub with food. Its favourite plants are sugar-cane, sweet potato, imphee, ground nut and Guinea corn. None of these should immediately succeed each other, unless lime has been forked into the field. It is unwise to plant canes in a field that contained sweet potatos during August and September, which is the egg-laying period. Another check on the increase of the pest would be removal of stumps from infected fields as soon as the canes are reaped. The grubs will live without food from twelve to fifteen days in moist earth, and about five days in dry earth. Ochro, cassava, yams, eddoes, woolly pyrol, pigeon pea, bonavist, rouncival and beans, are among the plants that do not appear to be subject to the attack of the grub.

In concluding his paper Mr. Watson says:—"The above suggestions aim principally at checking the increase of root-borer by cutting off its food supply either in the earlier stages of its growth, or during the later period of its larval existence. The use of lime has also been suggested as a direct means for the actual destruction of this pest, but, after all, its complete control must depend on the re-adjustment of our fauna, which will at once displace the exotic mungoose, and restore to the predaceous reptiles and insectivorous birds of Barbados that place and protection which nature assigned them."

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VOLCANIC ASH IN CANE JUICE

Consequent on the three falls of volcanic ash at Barbados, during the crop season of 1902, planters have experienced trouble in grinding their canes, owing to the fact that in some cases the canes have been coated with volcanic ash that had lodged in the axils of the leaves. The mill rollers have been polished to such an extent as to require re-chipping. Further, the juice has contained an appreciable amount of ash that had to be got rid of in the process of manufacture. Recently a sample of "filter press cake" and "filter press mud" was forwarded for examination to the Government Laboratory in order to determine whether its use was likely to be injurious to cattle. In the filter press cake Professor d'Albuquerque found 14.20 per cent. of volcanic dust; while in the filter press mud there was found 2.40 per cent. of volcanic dust. Professor d'Albuquerque adds: "The mud and, therefore, the filter press cake contains a notable proportion of volcanic dust which, consisting in part of angular fragments is likely, when fed to cattle, to set up irritation in the walls of the alimentary canal. Whether on this account the use of this food auxiliary should be entirely discontinued, or simply diminished in proportion to other foods, is a question that can only be answered by careful observation of the effects when employed in varying quantities on the cattle themselves." — [Barbados Agricultural News.]

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FOR SALE.

PLANTATION DIRECTORY.

ISLAND AND NAME.		MANAGER.	POST OFFICE.
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Apokaa Sugar Co.	*	G. F. Renton	Ewa
Ewa Plantation Co.	*	G. F. Renton	Ewa
Waianae Co.	***	Fred Meyer	Waianae
Waialua Agricultural Co.	*	W. W. Goodale	Waialua
Kahuku Plantation Co.	x*	Andrew Adams	Kahuku
Waimanalo Sugar Co.	**	G. Chalmers	Waimanalo
Oahu Sugar Co.	x	Aug. Ahrens	Waipahu
Honolulu Plantation Co.	**	J. A. Low	Aiea
Laie Plantation	x*x	S. E. Wooley	Laie
MAUI.			
Olowalu Co.	**	Geo. Gibb	Lahaina
Pioneer Mill Co.	x	L. Barkhausen	Lahaina
Wailuku Sugar Co.	**x	C. B. Wells	Wailuku
Hawaiian Commercial & Sug. Co.	x*	H. P. Baldwin	Puunene
Paia Plantation	x*	D. C. Lindsay	Paia
Haiku Sugar Co.	x*	H. A. Baldwin	Haiku
Hana Plantation	xx	E. K. BULL	Hana
Kipahulu Sugar Co.	x	A. Gross	Kipahulu
Kihei Plantation Co.	x*	James Scott	Kihei
Maui Sugar Co.	x**	J. R. Myers	Huelo
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Hamakua Mill Co.	*x	A. Lidgate	Paauilo
Kukaiau Plantation	x	J. M. Horner	Kukaiau
Kukaiau Mill Co.	*x	E. Madden	Paauilo
Ookala Sugar Co.	**x	W. G. Walker	Ookala
Laupahoehoe Sugar Co.	*x	C. McLennan	Papaaloa
Hakalau Plantation	**	Geo. Ross	Hakalau
Honomu Sugar Co.	**x	Wm. Pullar	Honomu
Pepeekeo Sugar Co.	*x	H. Deacon	Pepeekeo
Onomea Sugar Co.	**x	J. T. Moir	Hilo
Hilo Sugar Co.	**	J. A. Scott	Hilo
Hawaii Mill Co.	x	W. von Graevemeyer	Hilo
Waiakea Mill Co.	*x	C. C. Kennedy	Hilo
Hawaiian Agricultural Co.	**x	John Sherman	Pahala
Hutchinson Sugar Plantation Co.	**	G. C. Hewitt	Naalehu
Union Mill Co.	*x	Jas. Renton	Kohala
Kohala Sugar Co.	*	E. E. Olding	Kohala
Pacific Sugar Mill	x**	D. Forbes	Kukuihaele
Honokaa Sugar Co.	x**	K. S. Gjerdrum	Honokaa
Kona Sugar Co.	xxx	E. E. Conant	Holualoa
Olaa Sugar Co.	xx*	F. B. McStocker	Olaa
Puna Sugar Co.	xx*	W. H. Campbell	Kapoho
Halawa Plantation	x*x	T. S. Kay	Kohala
Hawi Mill & Plantation	††	John Hind	Kohala
Puako Plantation	††	W. L. Vredenburg	S. Kohala
Niulii Sugar Mill and Plantation	*x	Robt Hall	Kohala
Puakea Plantation	*x	H. R. Bryant	Kohala
KAUAI.			
Kilauea Sugar Plantation Co.	**	A. Moore	Kilauea
Gay & Robinson	x*x	Gay & Robinson	Makaweli
Makee Sugar Co.	....	G. H. Fairchild	Kealia
Grove Farm Plantation	x	A. H. Smith	Lihue
Lihue Plantation Co.	x	F. Weber	Lihue
Koloa Sugar Co.	x	P. McLane	Koloa
McBryde Sugar Co.	*x	W. Stodart	Eleele
Hawaiian Sugar Co.	x*	B. D. Baldwin	Makaweli
Waimea Sugar Mill Co.	*	J. Fassoth	Waimea
Kekaha Sugar Co.	x	H. P. Faye	Kekaha

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**	W. G. Irwin & Co.	(8)
***	J. M. Dowsett	(1)
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xx	M. S. Grinbaum & Co.	(2)
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††	Hind, Rolph & Co.	(1)

HONOLULU STOCK AND BOND EXCHANGE, AUGUST 17, 1903.

STOCK	Capital Authorized	Shares Issued	Capital Paid up	Par Value	Last Sale
MERCANTILE					
C. Brewer & Co.	$ 1,000,000	10,000	$ 1,000,000	$ 100	390
L. B. Kerr & Co., Ltd.	200,000	4,000	....	50	
SUGAR					
Ewa Plantation Company	5,000,000	250,000	5,000,000	20	21¼
Hawaiian Agricultural Co.	1,000,000	10,000	1,000,000	100	215
Hawaiian Com'l & Sugar Co.	10,000,000	100,000	2,312,750	100	45
Hawaiian Sugar Company	2,000,000	100,000	2,000,000	20	22
Honomu Sugar Company	750,000	7,500	750,000	100	105
Honokaa Sugar Company	2,000,000	100,000	2,000,000	20	13¾
Haiku Sugar Company	500,000	5,000	500,000	100	100
Kahuku Plantation Company	500,000	25,000	500,000	20	22
Kihei Plant. Co. Ltd.	2,500,000	50,000	2,500,000	50	10
Kipahulu Sugar Company	160,000	1,600	160,000	100	....
Koloa Sugar Company	500,000	5,000	500,000	100	164
McBryde Sug. Co. Ltd.	3,500,000	175,000	3,500,000	20	3½
Oahu Sugar Co	3,600,000	36,000	3,600,000	100	102
Onomea Sugar Co	1,000,000	50,000	1,000,000	20	23½
Ookala Sugar Plantation Co.	500,000	25,000	500,000	20	10½
Olaa Sugar Co. Ltd.,	5,000,000	250,000	5,000,000	20	9½
Olowalu Company	150,000	1,500	150,000	100	.....
Paauhau Sug. Plantation Co.	5,000,000	100,000	5,000,000	50	12
Pacific Sugar Mill	500,000	5,000	500,000	100	.....
Paia Plantation Company	750,000	7,500	750,000	100	250
Pepeekeo Sugar Company	750,000	7,500	750,000	100	.....
Pioneer Mill Company	2,250,000	22,500	2,250,000	100	100
Waialua Agricultural Co.	4,500,000	45,000	4,500,000	100	50
Wailuku Sugar Company	700,000	7,000	700,000	100	300
Waimanalo Sugar Company	250,000	250,000	250,000	100	160
MISCELLANEOUS					
Wilder Steamship Company	500,000	5,000	500,000	100	100
Inter-Island Steam Nav. Co.	600,000	6,000	600,000	100	114
Hawaiian Electric Company	500,000	5,000	500,000	100	100
				.....	.....
Honolulu R. T. & Land Co.	1,000,000	P. 2,090	1,000,000	100	100
		C. 7,910			78
Mutual Telephone Company	150,000	13,900	139,000	100	10
Oahu Railway & Land Co	4,000,000	40,000	4,000,000	20	90
Hilo Railroad Co.	1,000,000	50,0 0	1,000,000		
BONDS	Amt. of Issue				
Hawaiian Govt. 5 per cent	1,251,200	Dec. 31, 1900	....	....	98
Hilo Railroad Co., 6 per cent	1,000,000	750,000	....	....	100
Hono. R. T. & L. Co, 6 p. c.	300,000	....	....	....	100
Ewa Plantation 6 per cent	500,000	....	....	...	100
Oahu Railway & L'd Co 6 p. c.	2,000,000	....	....	....	104
Oahu Plantation 6 per cent.	750,000	....	....	....	100
Olaa Plantation 6 per cent	1,250 000	....	....	....	100
Waialua Agr. 6 per cent.	1,000,000	....	....	..	100¼
Kahuku 6 per cent	20 .000	....	....	....	100
Pioneer Mill Co., 6 per cent	1,250,000	....	.....	....	100