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Latest New York dates report very firm market for raws, strengthened by strong market in Europe. Refined in fair demand, with list prices unchanged. Meltings continue about the same as last year at this time.

A leading circular says: "The factors which mainly influence values and regulate the market for securities are favorable. The prosperity of the country is such as to turn the eyes of the whole world upon the United States. Business activity is great, and, while the tendency is to cut down the margin of profits, the enormous volume of trade compensates for this in connection with general results. The iron, steel, and coal industries—the great barometers of trade—are at the high-water mark of production, the gratifying circumstance in this respect being that consumption keeps pace with or exceeds their output. The situation in this respect in no wise resembles that of over a year ago, when manufacturers advanced prices and increased their production to an unwarranted extent. At present, domestic demands for iron and steel have overtaken the capacity of furnaces and mills, and prices profitable to manufacturers have been established as the result of legitimate causes. The influence of such conditions in the greatest of our industries is finding a reflection in other lines, and, with slight exceptions, prosperity in most departments of commerce and manufactures is now the rule. Thus far the crops promise well, and there has been an absence of the scares which usually make their appearance about this period. The railroads reflect prevalent conditions by earnings, exceeding even the remarkably good showings made a year ago. The assurance thus given of sustained or increased dividends in connection with railroad stock investments furnishes a foundation for confidence in transportation facilities."

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The attention of planters is called to the communication of our correspondent "H" on stable manures—showing their value and how they can best be utilized.

**ENORMOUS COFFEE CARGO.**—The arrival in the port of New York of the Lamport & Holt's Line steamer "Rossetti" with a cargo of 126,000 bags coffee from the port of Santos is quite significant as marking a new era in the coffee-carrying trade. Going back some twenty years it was considered quite an event to get a cargo of coffee from Santos in excess of a total of 10,000 bags or from Rio of about 30,000 bags, and in the old days of the Baltimore clippers it was quite a circumstance to have a whole cargo of 12,000 or 15,000 bags of coffee come in here belonging to one firm. The enormous jump during the interval can be understood when we look at the cargo by the "Rossetti" of which nearly 75,000 bags belong to one house in New York, representing a total value of about \$750,000.—Rio News.

In these days of sharp competition between British and American machinery firms, it is instructive to note whence the preference for one or the other arises. From information to hand from Mexico, it appears that, while Mexican sugar planters show a decided preference for British sugar machinery, they are nevertheless led to purchase the stock of American firms, and the reason for their final choice is stated to be owing to the fact that the American manufacturers send out with their machinery duplicates of the parts most liable to breakage. Since these machines go to districts where repairs are executed with difficulty, and often at great expense, it becomes at once apparent that they have a great pull over those of British firms, which, though admittedly superior, have no duplicated parts forwarded with them. This being so, it remains to be seen whether or not the British engineers cannot rise to the occasion and thereby protect their interests.—Int. Sugar Journal.

The United States is now patronizing the banana plantations of the West Indies and of Central America to the amount of about \$8,000,000 a year. That is the exporting, not the retail value. The Island of Jamaica alone is sending to this country over 4,000,000 bunches a year, which means \$1,500,000 to the producers and shippers of the colony.

Willett & Gray's Statistical reports that thirty-six beet sugar factories operated in 1900-1901 produced 22,950 tons. Factories now building will have a total capacity of 4,050

tons. The largest output of a single factory was 3,000 tons, at Spreckles, Cal.; the next, 2,200 tons, at Oxnard, Cal.; third, 1,100 tons, at Rocky Ford, Col.; fourth, 1,000 tons, at Watsonville, Cal.

If it did nothing else, the proposal to tax the sugar imported into Great Britain has elicited some curious and interesting information as to the uses that sugar is put to. At a meeting in London to protest against the tax, the president of the National Union of Mineral Water Manufacturers stated that in the metropolis alone £4,000,000 was spent every year on mineral waters, in the manufacture of which 200,000 tons of sugar were used.

The American Bridge Company report their foreign trade as developing very rapidly. Within the past few days they have received a contract for 20,000 tons of bridges for the Guayaquil & Quinto Railroad Company, in Equador, South America, and a large group of buildings for the Consolidated Copper & Silver Mining Company, of Mexico; and also several large contracts for manufacturing buildings to be shipped to Australia, and a large railroad bridge to go to the Sandwich Islands.

The following table from Czarnekow's circular, shows the world's production of beet and cane sugar at decennial periods from 1840 to 1900 and the percentage which beet supplied of the world's product at each period named:

Years.	Cane Sugar. Tons.	Beet Sugar. Tons.	Total Sugar. Tons.	Supplied by Beet. Per cent.
1840	1,100,000	50,000	1,150,000	4.35
1850	1,200,000	200,000	1,100,000	14.29
1860	1,510,000	389,000	1,899,000	20.43
1870	1,585,000	831,000	2,416,000	34.40
1880	1,852,000	1,402,000	3,254,000	43.18
1890	2,069,000	3,633,000	5,702,000	63.70
1900	2,850,000	5,950,000	8,800,000	67.71

The Census Bureau has issued a report on the manufacture of beet sugar. It says that in 1899 there were 31 beet-sugar factories in the United States, distributed among ten states and one territory, representing an invested capital of \$20,958,-

519, and producing 71,427 long tons of beet-sugar, valued at \$7,323,857. This small product for the amount of capital invested was due largely to the fact that the census year was a disastrous one for the beet-sugar crop. California had eight factories, with a total capital of \$10,139,780, Michigan, nine factories, with a total capital of \$4,013,743, and the combined number of factories in all other states was 14, with a capital of \$6,804,996. This report shows that beets are not a perfectly reliable crop.

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We have long been of the opinion that the process of refining sugar properly belongs to the mill that extracts the juice, and that the time will come when as good refined sugar as the trade calls for will be so produced. This conviction is partly strengthened by the announcement in one of our exchanges that a process has been developed in Porto Rico by which the refined article can now be thus produced. Even if the process is not yet perfected, the time is not far distant when it will be, and a further reduction made in the cost, with corresponding increase in consumption.

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We are acquainted with a grower who has netted over \$2.50 a box for his oranges all through this decidedly "off year," chiefly by the excellence of his packing and the brightness of his fruit. He has conscientiously tried to get as many oranges as possible into a box—not to see how much air space he could leave between them, as rascally wood-choppers do when they pile their cords. It is a discreditable fact that one of the best known shippers of the state has shipped oranges which had to be repacked at New York, simply on account of "slack pack;" a box holding 150 where he had only put in 126.—Cal. Ex.

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As there is ample room for the expansion of the coffee-raising industry in all the islands recently added to the United States, it is only a question of enterprise how soon this country will cease to be dependent for its coffee supply upon any foreign country, and the \$50,000,000 or more which American coffee consumers pay out every year will remain in circulation among the people who live under the American flag.

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The expression, "carrying coals to Newcastle," is often used, but it shrinks into insignificance as a metaphor alongside that

of "carrying ice to Klondike." Yet this last is a practical reality, for it is stated that the White Pass and Yukon railroad is putting on refrigerator cars to White Horse and equipping river steamers with cold storage machinery.

CUBAN SUGAR ESTATES.—What may be the first step in the consolidation of the various large sugar interests in the island of Cuba by the purchase of these interests by American capitalists has been taken. Last week the Chappara Sugar Co., of Cuba, with offices at No. 109, Wall street, placed contracts in this country aggregating over \$2,000,000 for the equipment of the largest sugar plant ever built in Cuba. The company, of which ex-Congressman Hawley, of Texas, is president and in which B. H. Howell, Son & Co. and Theodore Havemeyer are largely interested, has acquired 60,000 acres of land in the eastern portion of Cuba. Nearly 10,000 acres of this land is under cultivation, while on the rest the work of planting sugar cane will be immediately begun. This enormous planting is without precedent in the history of Cuba.—N. Y. Times-Democrat.

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JAMAICA ORANGES.

The Fruitman's Guide of New York publishes the following interesting figures on the receipts of Jamaica oranges in that city from September to March:

Month.	Boxes.
September . . . . .	12,700
October . . . . .	51,200
November . . . . .	105,200
December . . . . .	19,300
January . . . . .	4,700
February . . . . .	800—193,900

This amounts to over 530 carloads, and indicates that Jamaica is quite a factor in the orange market, in spite of the tariff. The crop was a light one this year, and under normal conditions with a lower tariff, the island would easily put 1,000 or even 2,000 carloads of oranges into New York. Naturally the California orange grower does not enthuse over any reciprocity treaty that will increase imports from Jamaica.—Cal. Cultivator.

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*HILO AND HAMAKUA.*

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No stranger who has visited Hawaii in the favorite steam packet *Kinau*, can have failed to notice the beautiful panorama which the approach to Hilo affords. The smooth bay and the shipping at anchor in the foreground, the village skirting the shore, and cottages nestling among the groves of tropical trees, while in the background rise the lofty mountains of Kea and Loa, whose summits often wear snowy caps, even in midsummer, is a sight of incomparable beauty that can no where else be seen to such advantage and at all seasons. To those who have been there before no great changes may appear, except in the outer districts. The road leading to Kaumana, in rear of the town, is a smooth macadam, and affords a favorite morning or evening drive, from which point a fine view may be had of the eastern slope of the great mountain beyond. This section is being rapidly peopled with settlers from abroad, who begin with small holdings and means, and extend as their industry permits. It will be covered in time with an industrious population, as the land is obtained on favorable terms.

The railroad starts from the steamboat landing, and runs to Olaa, through miles of heavy sugar cane, which everywhere shows how rapid and rank it can grow. From Olaa visitors take coaches to the volcano or to Kau, if bound there, reaching the volcano in a ride of three or four hours. A branch railroad runs south from Olaa to Puna, a distance from Hilo of twenty miles, through fields of sugar cane, which seem to grow like magic, changing the face of the country from its dark lava hue of former days to fields of cane, which have robed the land, as with a magician's wand, with a dress of green. The prospects of these two districts certainly look very promising. The erection of the new and very large sugar mill at Olaa and the numerous smaller dwellings has changed the appearance of this section of Hawaii very much.

The plantations in the district stretching from the bay northward from Hilo are looking fairly well, though the rainfall has been less than usual, and this may affect the outcome of this season's crop, as compared with that of last year. The canefields extend higher up the mountain than in former years, which necessitates a slower growth and perhaps a smaller yield of sugar. Less Lahaina cane is planted now on

Hawaii than formerly, the reds being preferred by many as more certain. What is known as the Whitney cane—a cross between the Lahaina and a red mountain cane, the Kōula (or potato cane) is scattered probably through all the fields. It may be known by having the prickles of the Lahaina cane inside the leaves, and a shade darker meat than the Lahaina, but grows upright like a red cane. It was the intention to obtain a cane with the good qualities of the Lahaina, to plant on elevated lands, where the Lahaina cane will not do well except below 1,600 feet elevation. We are not aware that it has proved to be any better than other canes. It very closely resembles the yellow Caledonia as it grows in the field, but the latter is known as a clean cane, that is, has no prickles, and for some localities has no superior.

On most of the older plantations of Hawaii, the Lahaina cane, which has been planted and re-planted, often on the same lands for many years—in some localities thirty or forty years—is being discarded, and the red varieties substituted for it. It is not reasonable to expect that any plant cropped annually for many years on the same land should retain its early prestige—no matter how much care may be bestowed on its cultivation; and as with other plants, so cane demands rotation. Where this is done—and red canes are now extensively planted on Hawaii—a return to the favorite old Lahaina cane may probably be made with as good results as in former years.

A railway from Hilo to Kohala is promised as among the possibilities of the near future. It may prove a difficult task, but its completion will certainly open the district to a much larger population and traffic than it now possesses. A portion of the land along the route not suited for sugar cane may be available for coffee and other minor industries, and with such rapid means of communication established, population will be drawn to it, and various industries established. For small families, coffee is a very sure and pleasant source of income, and one in which children can become useful and reliable, where other help is not obtainable. It is a product too, that improves with age, and one that is always marketable. No better opportunities can be found for industrious families than in some of these retired districts of Hawaii, especially after the opening of the country to railway traffic,

which, as stated above, is likely to take place during the next few years.

The public road from Hilo to Laupahoehoe is kept in first class order for carriages and is a credit to the district. That from Laupahoehoe to Honokaa is fairly good, while that leading over the highlands through the Parker forests and domain is rough and in places almost impassable, till the Waimea plains are reached, from which on to Waimea village, it runs over a grassy plain, with charming and ever-changing views of the Kohala range and Mauna Kea. From Waimea to Kawaihae—11 miles—the road is stoney and very tedious, and no better than it was forty years ago, when the writer first passed over it. Waimea has lost population during the past half century and the numerous native grass houses which dotted the plain, have all disappeared. But they have been replaced with a few score of neat cottages that line the road, some of which are the homesteaders' dwellings, which are surrounded with fruit and flower gardens—affording one of the prettiest sights to be found on the group. When Waimea becomes the terminus or a central depot of the future railroad system that starts at Hilo and makes the circuit of Hawaii, via Kawaihae, Kailua, Kona, Kau and the volcano, to Hilo, this Waimea district will contain a thriving and industrious population, and will become the garden and granery to help supply a population larger than that which Captain Cook found, when he discovered the group in 1778, and his name became identified with it as the martyr of Hawaii.

It was with no little surprise that we learned, while on Hawaii, that a sugar plantation is to be started on the bay, a few miles south of the village of Kawaihae. Those who have ridden along the shore of the bay, as has the writer, may have noticed a green spot running from the shore towards the slope of Mauna Kea. But no one would have dreamed that it could ever have been found suitable for cane planting, surrounded as it is on three sides with fields of black *aa*, almost impassable for man or beast. It is here, on this solitary oasis, washed by the still waters of the bay, that a new plantation is being started. The soil has been found to consist of fine *aa*, of volcanic ashes, the deposit perhaps of a thousand years ago, making it the richest soil for sugar cane, which is now growing on it, a sample stalk of which—twelve feet in length and with long joints, was shown to us—as fine and large as

we have ever seen. Fresh water is obtained in abundance, pumped, of course, from a few feet below the surface.

Parties on Hawaii will supply the capital, and all arrangements have been completed to break ground at once, plant cane and erect a mill, ample capital having been secured for all improvements required, including mill, dwellings, pumping water, and everything necessary to insure the success of the enterprise. The best of wharf and shipping facilities are easily supplied, as Kawaihae bay is known to be one of the safest localities obtainable on the lee side of this island for this purpose.

Speaking of fresh water obtainable near the sea, reminds us that while at Honokaa, Manager Watt showed us a well of fresh water which he had dug through solid rock, within fifty feet of the sea. It is ten or twelve feet square, and has about the same depth, and the water which it supplies, though not so fresh as that obtained from higher elevations, serves for all plantation purposes—animals, workmen, etc. It requires to be pumped to a higher level, but this supply fills a want that has long existed, and during times of drought, like the present very dry season, has proved to be worth all it has cost. The same success can, no doubt, be obtained in other localities where fresh water is scarce, and mountain springs become perfectly dry during seasons of protracted drought.

The lee side of Hawaii has long been known as the breeding ground of some of the finest fish of this group. During recent years both Chinese and Japanese have taken unmolested possession of this side of the island, from Kohala to Kau, and by the use of fine nets made of mosquito nettings, which capture the smallest fishes, have nearly exterminated the choice fishes that formerly abounded there. The natives are thus robbed of one of their chief sources of food, and bitterly complain of the destruction of their staple food. So far no law or police have been able to check this destruction of fish. It is to be hoped that the U. S. Fish Commissioners now here may find some means to check the plunder that still continues unabated.

H. M. W.

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*ENGLISH REFINERIES RESUME OPERATION.*

Messrs. Crosfield, Barrow & Co., sugar refiners, Liverpool, have decided to restart their works. They are among the best known business men in Lancashire, and the firm has been es-

tablished for over 100 years; but about 18 months ago, owing to the competition of bounty-fed sugar, they were compelled to close their works and to discharge some 600 hands. They still retained a portion of their clerical staff and kept the works in good order in the expectation of a resumption of operations, for which they have to thank the Chancellor of the Exchequer and his new sugar duty.

Two other sugar refiners in Liverpool who were losing money from week to week, like Messrs. Crosfield and Barrow, gave up altogether in despair and have gone out of the trade, so that they will not be able to resume at once, if ever. It had been felt that it was only a matter of time, if something was not done for the sugar industry for it to become extinct in England. That "something" is the new tax of a half-penny a pound on sugar. A margin of profit for the refiner is thereby created which Mr. Stein says "will not make us millionaires, but will, at any rate, enable us to make both ends meet. For the first time since 1894 the British Government has recognized the necessity of taxing imported sugar. It is only a small tax, but it is a step in the right direction; and we live in hope that they will see their way to do more for us at no distant date. April 18th will always be a red-letter day in the sugar industry of the country."

The immediate effect of the tax in Liverpool, as stated, is that Messrs. Crosfield, Barrow & Co. will reopen, after 18 months' idleness. They will employ about 600 hands directly, refining 60,000 tons of sugar per annum, and their annual turnover in costs is estimated at a million sterling.

Most of the old hands will be available, and when the news got about among them they were almost in tears of thankfulness; for sugar refiners cannot at once turn their hands to any other industry, and they and their dependants have had a bitter time during the past 18 months. It means a decent living for at least 2,000 people.

Nor will the benefit stop there; stores will be required for the works in the shape of machinery, coal, etc., cartage of sugar is another large item; and a large multitude of smaller industries will all feel a renewed demand, owing to the decision to reopen these works.

There is some talk of five refineries on the Clyde and two at Bristol, which had also been compelled to shut down, reopening; in fact the feeling on the Liverpool sugar market

was one of extreme buoyancy, and as that buoyancy appears to be showed elsewhere, there is every reason to believe that the new tax will lead to general revival of the sugar refining industry of the country.

While the sugar refiners benefit to the extent of a halfpenny per pound on all sugars refined by them, the consumer will have to pay a halfpenny per pound more for his sugar and jam. Retailers in Liverpool quoted sugar a penny per pound higher, but it is expected that as soon as the market is steady the penny will drop one-half; and probably the consumer will not grumble to pay a half penny more for his sugar, or howl at a half penny addition to the price of his jam, when he sees that a stimulus has been given to an old industry by the tax.  
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#### *AUDUBON EXPERIMENT STATION UNDER WATER.*

No greater havoc was wrought anywhere by the storm Wednesday night, the 17th inst., than at the Louisiana experiment station, at Audubon Park.

Eight acres of land on the experimental farm were flooded on account of the bad drainage in front of Audubon Park, between Henry Clay avenue and Walnut street.

Plants of the most valuable kind, which have been nursed through the early periods of experimentation, were destroyed by the water, which spread out over the farm, and Dr. W. C. Stubbs, who is in charge of the station, said that it was simply impossible to estimate the damage in dollars and cents, and many of the plants could not be replaced under a year's time.

But few persons thought that the high region of the city could be injured by any source of flood. In spite of this popular idea, the water Wednesday night spread over eight acres which had been set with plants of the most valuable kind experimentally.

The plant established at the park for the purpose of experimenting with the different processes of water purification was also damaged by the flooded condition, and it was impossible to do any work at the plant yesterday. The water had backed up in the engine room and had otherwise interfered with the machinery and working apparatus of the plant. But the

damage to the plant is not permanent, as the value of the machinery was in no way impaired.

Dr. Stubbs was completely put out by the damage wrought on the experimental farm. Many of the plants injured he counted among his particular pets. He has been conducting experiments that meant a great deal to this section of the country, and many of his experiments have attracted attention in all parts of the land.

He estimates that the flood destroyed about 500 specimens of experiments.

On his farm he has over 100 varieties of cotton plants, and for some time he had been making very interesting tests in the culture of this important product. Planters throughout the cotton growing section have been watching with much concern some of his tests in cotton growing. He could not say yesterday what the extent of the damage had been to many of the specimens he had scattered over his farm, but he was certain that many of the plants now more than a year old had been destroyed altogether by the water.

One of the most interesting experiments being made by Dr. Stubbs is in tea culture, and he has a garden of several hundred plants, some of them near a foot high. The outlook has been very promising, and Dr. Stubbs has been hopeful of the best results. These plants have been damaged considerably.

Adjoining his tea garden is a grove of orange trees, now over a year old. With these plants he is conducting an interesting experiment in the process of grafting in an effort to grow a plant which will thrive in any climate. The orange grove was flooded, and may suffer considerable damage.

In addition to these interesting specimens Dr. Stubbs had many varieties of strawberries, sugar cane, vegetables and fruits of different kinds that he was experimenting with, and many of these specimens were seriously damaged by the flood. He is hopeful of saving some of the plants from the wreck, and while the processes of experimentation will be interfered with to some extent, he will probably be able to continue his work along some of the more important lines.—N. O. Times-Democrat.

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*BET SUGAR EXHIBIT AT THE PAN-AMERICAN EXPOSITION.*

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The progressive spirit shown on other occasions by the beet sugar manufacturers of the United States has again manifested itself; this time by the securing of an exhibit at the Pan-American Exposition, to be held at Buffalo, N. Y., from May 1st to November 11th, this year. In relation to the matter, M. R. Gilmore, Superintendent of Exhibits of the American Beet Sugar Industry, has issued the following report:

A. Comparative exhibits of sugars from cane and from beets so that the visitors may see and taste that they are exactly the same, as there is a very prevalent opinion or prejudice that beet sugar is inferior; also, we have arranged for a display of confectionery made from beet sugar if the factories shall supply the sugar in sufficient quantities to make this display.

B. Display of photographs illustrating features of beet culture and the manufacture of sugar.

C. Maps, charts, diagrams, etc. We wish to have a model of a sugar factory and a wall diagram showing the workings of the factory.

D. Reading matter, consisting of factory reports, government reports on the American Beet Sugar Industry, consular reports bearing on the world's sugar trade, also the sugar journals of the country.

E. Such exhibits as the beet seed companies and implement companies may wish to make.

We have secured space for a plot of growing beets in the grounds to show the nature of growth and the method of culture."—*Sugar Planters' Journal*.

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*STABLE MANURE.*

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The last decennium has witnessed a remarkable animation and progress in our sugar industry. The use of cattle, horses or mules for hauling the sugar cane to the mill and for plowing has long been abandoned by most of our modern plantations. Railroads and steam plows have taken their place. Of course a certain number of draft horses or mules is indispensable for some purposes, but in general there is comparatively very little live stock kept on most of our plantations.

The amount of dung, produced by these animals, is therefor limited and in no case adequate to supply the wants of the plantations for fertilizers, but it is the aim of the following notes to demonstrate to our planters how the proportionately small quantities of this valuable manure can be used to the best advantage, and why the proper treatment of the same is of more value really than is generally known or believed.

Stable manure is a product of the farm composed of the excrements of domestic animals mixed with the necessary absorbent. Its average composition is about as follows: 75% moisture, 20% organic and nitrogenous matter, 5% mineral constituents, and of vital plantfood it contains from 0.3 to 0.75% of nitrogen, 0.2 to 0.5% of phosphoric acid, 0.5 to 1.0% of potash.

Since the actual fertilizing value chiefly depends upon the percentage of the latter three substances, it is important to know, how to treat the stable manure, in order to preserve its full strength until it is applied to the soil. Of course the quality depends upon many conditions and circumstances, all of which a farmer should be acquainted with.

There is a great difference in the composition of manure produced from different kinds of animals; its quality also depends greatly on the amount and kind of the absorbent used. Again it may only contain the solid excrements, the liquid excrements being lost by improper treatment. Well fed animals produce more and better quality manure than those poorly fed. The age of the animal is also a factor which influences the composition and value of the manure and last but not least it is the treatment of the same.

A horse or mule, well fed, will produce about 5 to 6 tons of manure per year in the stable, enough for improving one acre of poor soil, if the manure is properly preserved; but if allowed to deteriorate and leach, it is of very little value. The percentage of plantfood may seem small, but the farm in which it is present and the favorable action of the organic matter on the soil make it exceedingly valuable.

Excessive fermentation and leaching cause a rapid deterioration of stable manure and therefore should be prevented at all hazards. The fermentation liberates ammonia and the leaching removes a considerable part of the soluble plantfood. In fact a manure subjected to the joint action of fermentation, leaching and weathering will, in a very few months, lose

three-fourths of its valuable fertilizing constituents. At all events it is necessary to mix the dung with a suitable absorbent, such as straw, hay, trash or anything available for this purpose; sufficient to absorb and retain all liquid excrements.

With the proper treatment and preservation of the stable manures we have to consider the following principal points:

1. It is necessary to prevent undue exposure to the air and sun.

2. A too high temperature must be avoided.

3. It should neither be kept too dry nor too moist.

The easiest way to avoid heavy losses, would, of course, be to cart the manure directly to the fields, fresh from the stable and plow it under, but as this is not always feasible, other means have to be applied. Besides fresh horse manure is known to be very heating and for this reason it should be composted before it will really be beneficial to our clay soils. On loam soils a direct application is generally advisable, whereas in clay soils it mostly decomposes very slowly and often fails to show any beneficial effects, unless it has been composted. Composting the manure is therefore in all cases the most advantageous method because, if properly heated, the manure will become much improved in quantity and mechanical condition, without losing any of its plantfood. By excluding the air and sunlight, as much as possible, a moderate anaerobic fermentation will be induced, which hastens decomposition, a most vital factor in the composting process.

As a matter of fact, fermentation, to a certain degree, is essential, if the manure is to be properly composted. It is also known that, due to the action of the fermentation bacteria, slight losses in plantfood are unavoidable, and that excessive and prolonged fermentation will become detrimental to the manure in the course of time.

The use of a number of preservatives has been recommended to prevent fermentation losses and to check excessive fermentation. These have been applied with more or less favorable results; in fact in some instances fermentation has been stopped altogether by the use of too strong preservatives, such as sulphuric acid.

Of all preservatives so far tried, the phosphoric acid in the form of ordinary superphosphate has been found to be the most valuable one. It allows a moderate fermentation and at the same time the acid contained therein, when coming in

contact with the volatile ammonia or ammonium carbonate, readily combines with them forming a non-volatile compound. Besides, it increases the phosphoric acid in the manure, which is generally deficient or at least quite low in proportion to the nitrogen and potash. Its gypsum will also add another valuable constituent to the compost.

Superphosphate is used at the rate of about one-half pound per day for each animal. Other preservatives are gypsum and kainit, but both are by far not as favorable as superphosphate.

Quicklime should never be used, for it will deteriorate the manure and liberate its ammonia.

From what has been said regarding the best method of preserving stable manure it is evident that the same should be kept under cover, in stalls or special manure houses. Such manures are always far superior to those produced in any other way.

Not only does the well preserved stable manure add a certain amount of valuable plantfood to the soil but it is also of great benefit to our soil in many other ways, the most important of which are the following: It promotes the formation of humates and thereby improves the physical as well as mechanical condition of clay as also sandy soils.

The water absorbing and holding power is greatly increased, which is very valuable in more than one way.

The temperature of the soil is raised.

It prevents, to a certain degree, the cracking of our heavy clay soils during dry seasons.

Plowing and cultivating is facilitated on account of the improved mechanical condition of the soil.

Doubtless many more valuable qualities could be cited but the writer intends only to show why it should be the aim of every planter to use this material to his best advantage. If there is not enough produced on a plantation to improve all its fields, it should be applied to such fields which are in most need of it.

Comparing the commercial value of well composted stable manure with that of high grade artificial fertilizers, it would be worth from \$2 to \$4 per ton. This may be seemingly low, but the other valuable qualities, which artificial fertilizers do not possess, should in no case be lost sight of.

The above notes contain facts which no practical farmer can

deny and which every one of them should know and put to practical application. Many a dollar may be saved on our plantations by a proper treatment of the stable manure, which fact is, unfortunately, often overlooked.

Honolulu, May 28th, 1901.

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*THE LATE HUGH MORRISON.*

Editor "Planter's Monthly."

DEAR SIR:—Some of the press notices on the death of Mr. Hugh Morrison have been such as to convey the impression that the deceased was entirely self-educated, one paper going so far as to say that he was self-educated from the very rudiments of English. Such sentiments, if true, would but redound to his credit; and as such they are no doubt intended; it is my belief, however, that such was not, strictly speaking, the case. As one who enjoyed the friendship and close acquaintance of Mr. Morrison for a number of years I had many opportunities of learning from himself something of his early life. From the knowledge of his life thus gained, I feel confident he must have had a sound English education before starting out in life on his own account. It may have been the education afforded by the common schools of the country of his birth, but it must be remembered, that the common schools of Scotland at that time, or Parish schools, as they were more familiarly known, were presided over by men whose educational qualifications were necessarily of a high order, many of them holding university degrees, and capable of preparing their pupils for the university direct. The fact that he held responsible positions in commercial houses in Glasgow when quite a young man precludes the possibility of his being without education in his early youth. The education then acquired, however, only whetted his appetite for further knowledge; for while holding a commercial position in Glasgow, and long before coming to California he attended night classes in chemistry and metallurgy in connection with the Glasgow university, the knowledge of which stood him in good stead, in his mining experience in California and his subsequent career in this country. His friends will be pleased to see that Mr. H. P. Baldwin, than whom there is none more

qualified to judge, has paid a high tribute to his work in Hawaii.

GEO. ROSS.

Hakalau, Hawaii, May 30, 1901.

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GOOD ROADS AND HOW TO MAKE THEM.

Our roads are bad because they have been neglected. We have never taken that amount of intelligent interest in the work which we should. We have never organized for the purpose of considering efficient methods for doing the work. We know about how roads should be prepared, and we do this in a careless and indifferent manner, only trying to keep them in a fairly passable condition. This is possibly the first time in a century that people of these States have assembled for the purpose of discussing in a businesslike manner ways and means for procuring better roads. Many things must be considered. That is the system under which we are now working. How is the cost levied? What results are being produced? Are these results consistent with the outlay? Is the improvement of our roads consistent with our requirements? Are we employing the best plans for doing this work? Are we using implements and tools most suitable for the making of those roads in the easiest, cheapest and quickest time?

From what I can learn of your work, as a general thing, you should make some radical changes in your present system, or good roads cannot be expected. Every parish should have prepared a plan of the parish, showing all the roads. These roads should be classified according to their importance.

Main roads should be graded to a width of 24 feet; roads of secondary importance should be made 20 feet wide in grade, and the least traveled should be 18 feet. These widths should be marked on a plan and should be followed in all future work. Specifications should be prepared, showing how the road should be shaped. All roads should be rounded or crowned. This crown should be three-fourths of an inch in sand and one inch in clay; land from the side of the grade to the center, and this crowning should be done by grading machines drawn by mule or steam power traction engine of 17-horse power is the cheapest.

Every grade should contain a dry and unyielding foundation. This is secured by placing a 5-inch porous tile drain

down the center of the grade, or a 3-inch tile on each side of the grade. In retentive soil, such as exists throughout this section, absolute drainage is all important. It should be remembered that the three ruling principles to be observed in road making are, first, drainage; second, drainage, and third, drainage—that is, first drain the foundation by using tile; second, drain the surface by crowning; to shed the water from the center, and make away to natural outlets, and third, make the surface hard and compact, so as to be as near as possible impermeable to water.

After the road has been graded, it should be thoroughly rolled with a heavy roller, so as to compact and harden the surface to prevent the creation of ruts and depression that will hold water. After long seasons of rain the grading machine should be run over earth roads, once properly graded, so as to level the surface and fill the ruts made by wheels. Timber for culverts should be discontinued, and in small sluices on culverts concrete pipes should be used; these can be used up to 3 feet in diameter. Those pipes can be made by the person in charge on the ground. They are simply a mixture of Portland cement and clear, coarse sand, mixed carefully. The molds are made of spring steel, and are very simple and inexpensive. Culverts made of concrete are practically indestructible for wide sluices, or culverts made of the same material for concrete arches. The labor tax should be abandoned and a rate on the dollar levied for road purposes. This should be expended by competent supervisors.—Dep. Minister Public Works of Canada.

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#### THE COFFEE TRADE.

How few know the name of the man who first roasted the coffee bean! Were it generally known it would be imperishable; for always around the world there would be fragrant whiffs of his memory in the morning cup that “comforteth the heart and aideth digestion.”

A legend of the East ascribes to a Dervish named Hadji Omer, the discovery of the merits of the coffee berry. As far back as 1285 A. D., while an exile and driven by hunger, he roasted the berries which grew near his hiding-place, and ate them as the only means of sustaining his life; and steeped the roasted berries in water to quench his thirst. Those who

drove him into exile to perish were astounded to find him alive, and regarded his preservation as a miracle.

Next to knowing who the first roaster was is knowing how coffee is roasted in a first-class modern roasting establishment in New York.

Forty-two years ago there started at Duane and Greenwich streets a small coffee house, which has since developed into the splendid coffee business of B. Fischer & Co., now at 395-597 Greenwich street. Through the courtesy of the firm, we are enabled to present a view of the animated scene in their roasting department, and also describe from personal observation the process of roasting the world's most famous berry. Stepping in the big elevator, we were landed on the fifth floor of the big building. Here green coffee is being deftly mixed preparatory to its being dumped into a hopper connected with the milling machine. This is a wooden cylinder, containing two sets of brushes, revolving in opposite directions, whirling out the chaff and brightening the bean. Out from this battle of the brushes the cleaned coffee drops to the floor below; is caught by elevator cups, returned to the fifth floor, and emptied into separator—a rectangular box with a perforated metal bottom, the whole shaking like a “poor white” with the “ager.” Here the broken beans and other imperfections part company with the perfect product.

Next the chastened kernels, ready for the roasting, are dumped into a hopper, carried to a conveyor—an endless chain of small carriers running over fourteen iron hoppers. Into any one of these, at the pleasure of the attendant, the green coffee is dropped; thence falling into one of the fourteen cylinders, with a two-bag capacity, revolving fifty times per minute, over a fiery furnace. The employees are constantly inserting a narrow scoop through the cylinder opening at the upper part of the front end, drawing out a few beans, and testing by appearance and odor for the proper finish. After twenty to thirty minutes' roasting, a lot is just right, and then the nozzle of a hose is inserted in a hole in the cylinder head, and the caffeine contents are sprayed with cold water for a quarter of a minute. Then a large, flat, cooling-box is pushed over the cement floor, to and under the cylinder head, which is turned round, so that the opening is at the bottom instead of the top, to permit the fragrant cargo running into the cooler; which is next backed against an opening in the

wall that is alive with a cooling draught, which enters the box through the wire-net bottom, cooling every bean in its upward flight. After five minutes the side of the box is lifted, and the cooled beans fall into a large zinc chute. On their way down they are intercepted by a powerful draught, which blows the coffee into a hopper; but the stones, because of their weight, continue falling. Out of the stoner-hopper the perfectly-roasted product falls into bags of 100 pounds capacity.

Between a narrow-gauge track, made for a car hopper-shape, are some twenty spring iron lids, or valves, each at the top or entrance-way to deep bins, reaching from the fourth to the second floor. Standard brands are stored in these bins. Both on the third and second floors there is a narrow glass-covered opening in each bin, showing at a glance how much stock is in store, thereby preventing accumulation of old roastings. For the lower grades there is a finisher—a huge cylinder of sixteen-bag capacity, lined with wire netting, whirling round thirty times per minute. The beans are tumbled in for a general friction scrimmage, and come out cleaner and brighter for the tussle.

A very ingenious machine is the one for separating the round (Peabody) grains from the flat. Two metal gauge aprons, about three feet wide, set at an angle of 25 degrees, slowly revolve upward. The mixed beans fall on the aprons; the round roll to the lower edge and fall off, while the flat catch on the apron and are carried to the upper edge and tumble off.

Packing coffee in pound packages has been reduced to a science. Before a hopper-like machine a girl stands holding a pound-size bag under a chute. She must work quickly, for twenty times a minute an exact pound of coffee drops into the paper. Messrs. Fischer & Co., know how to get out an attractive package, and, at the same time, have it so constructed that the aroma and caffeine richness of the freshly-roasted grain are perfectly preserved. The girl-packer was filling the "Nector-Java" package. It is of red-glazed imported paper; a layer of tinfoil inside, which is also lined with parchment. Coffee is also packed in one and two-pound tins and one-pound cartons, the best brands being "Ambrosia," "Gilt Edge" and "Nectar-Java."

The sample roaster room is worth seeing. Here are five

small cylinders, two-pound capacity, set over gas heaters—a set of cooling-boxes to match, with fan for forced draught. Here the seeker after good coffee can test the various brands, for in the well-appointed office and sample room he will find a mill for grinding, hot water for steeping, and genial expert principals, or employees, to help him decide on flavor and quality.

It is no wonder that an old New Yorker the other day lamented that, while he was willing to pay for it, he could not purchase the fine fragrant blend of genuine Java and Mocha that gladdened his nose and cheered his “innerds” a dozen years ago. We confess the substitution of the poorer for the better is widespread, but we are sure there are yet a goodly number of retailers who can and do give their patrons the real thing.

We hope our “old New Yorker” will try again and discover the fragrance and flavor of his early love. It is to be had, but only from those dealers who conscientiously make quality the first consideration. Coffee is to be had, in this city, of exquisite body and flavor, and fully equal to that which tickled the palates of our fathers and grandfathers.—American Grocer.

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#### *BEEF SUGAR.*

The following historical sketch concerning the growth of the beet-sugar industry in the United States will be of interest:

Until 1879 the history of the American beet-sugar industry is a record of a series of failures.

The first experiments were made in 1830. There is no record of the quantity of sugar manufactured.

The history of the next experiments is also brief. David Lee Child in 1838-39 conducted small works at Northampton, Mass., and made 1,300 pounds of sugar, then discontinued the manufacture.

There is no record of further attempts until 1863, and from that time until 1876 a number of failures occurred in California, Illinois and Wisconsin.

The first factory in California was erected in 1870, at Alvarado, the site of the first successful factory in the United States.

The factory at Soquel, Cal., was in operation in 1879, and reported in Tenth Census. It was operated at a loss for several years, and was abandoned about 1880.

In 1879 four factories were in operation—two in California, one in Maine, and one in Delaware.

Beet sugar was not reported separately in the census of 1890, as only two factories were in operation.

In 1897 the number of factories had increased to nine, with a total of 45,246 short tons of sugar manufactured, or, approximately, 12 per cent. of the total cane and beet sugar of domestic manufacture.

In 1899, as shown by the census statistics in this report, the number of factories operated was thirty.

In 1900 there were thirty-seven factories, with a nominal daily capacity of 22,310 tons; a gain in the number of establishments over 1899 being six.

The average price paid per ton of 2,000 pounds of beets was as follows:

United States .....	\$4.39
California .....	4.47
Michigan .....	4.38
All other States and Territories .....	4.26

The total quantity of raw and granulated beet sugar produced in the United States was 163,458,075 pounds, valued at \$7,222,581, of which California produced 86,741,713 pounds, valued at \$3,490,318; Michigan, 33,708,283 pounds, worth \$1,600,284; and all other States and Territories, 43,008,079 pounds, with a value of \$2,131,979.

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#### THE FATE OF THE TROPICS.

No radical change in commercial geography has occurred since exploration added a Western Hemisphere and a Southern Temperate zone until at the present time the extension of the culture of the sugar beet is transferring to Northern latitudes one of the few staple products of the Tropics, sugar. The chemical laboratory has already robbed the tropics of one of its smaller monopolies, and the Government of India is trying to find something to substitute for indigo. But more than anything else in modern times sugar has conferred wealth upon the Tropics. The Tropical colonies of England

and Spain, France and Holland have supplied the world with its entire supply of what, originally a luxury, has long been one of the prime necessities.

Not only is the seat of the sugar industry being removed to the Northern part of the Temperate zone, but the production is growing so fast that even the beet sugar growers are contemplating the probability of an over-supply with apprehension. In the year 1892-93 five European countries produced 3,181,968 tons, and in the past year they produced 5,365,400 tons. In the earlier year they exported 1,600,626 tons, and in 1899-1900 they exported 2,693,385 tons. In both years the export was about half the production. For the exports there are only two large customers, this country and England. This country has a cane sugar district, and it is likely in the future to develop cane sugar in Hawaii, Porto Rico and Cuba, and it has made a large start in the production of beet sugar, of which its capacity is probably enormous.

The situation of the tropics is shown by the following table of cane and beet sugar production at dates eight years apart:

	1892-3.	1900-1.
Cane, tons .....	3,040,486	3,349,500
Beet, tons .....	3,428,515	6,036,000
Total . . . . .	6,469,001	9,385,500

The increase of production was nearly 50 per cent, and it was almost exclusively in beet sugar. The consumption has increased fast in three countries; in others it is rather small and increasing slowly. In France it is a little larger than in Germany, but the rate of increase is slower. The amount of consumption is mainly a matter of price. Continental nations cannot cheapen sugar much while they derive an important part of their revenues from it, and in England, where the consumption has outrun that in all other countries, the government is about to check the consumption by imposing a tax on sugar. England, which has relieved sugar from taxation and has accepted cheerfully all cheapening of it accomplished by the payment of bounties on exports by continental countries, has run the per capita consumption up to 91.31 pounds. After a long interval comes the United States with a consumption of 61.7 two years ago, which was nearly double the consumption of thirty years ago, and 50 per cent more than

that of twenty years ago. After another long interval we come to France with a per capita consumption of 36.95 pounds, Germany 33.90, an increase of about ten pounds in ten years; Belgium 23.30, Austria-Hungary 17.64, and Russia 13.95.

The future of sugar will be governed by the cost of production, which can be very materially reduced. The profits of raising sugar beet are now several times those of raising other staple crops. This cannot last indefinitely; with the expansion of the cultivation the farmers will have to take less for beets and the manufacturers will sell their sugar at lower prices. This will enhance the difficulties of the tropics in sustaining the cane sugar industry, but that industry is doomed already unless there is a radical change in its methods. Such a change is in progress. The ascendancy of the sugar beet is due to the application of capital and scientific knowledge. These are being applied to sugar cane. More productive varieties of cane will be produced, more cane to the acre will be raised, methods of extraction and evaporation will be improved, and the last traces of tropical business habits and the industrial methods which prevailed in the period of slavery will have to be eliminated. In the British West Indies and in Queensland enough has been done to prove that this is possible. Under favorable circumstances it is still believed that cane sugar can be produced more cheaply than beet sugar, but in order to survive the cane sugar industry will have to adopt the methods of the Temperate zone, and the producers in the Temperate zone will have to content themselves with average rates of profit, and the price of beet sugar land will have to adjust itself to the price of other land. The production of sugar will not afford princely fortunes either North or South. If continental nations will stop paying bounties the production of sugar beets will increase more gradually than during the past ten years.—N. Y. Journal of Commerce.

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#### MOSQUITOS AND MALARIA.

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A British consular report describes the practical results already obtained in the deadly malarious districts of Italy from the recent discovery that certain species of mosquitoes spread

malaria by inoculating human beings with their sting, or more properly speaking, their drill. It appears that a malaria map of Italy was prepared several years ago by the government for military purposes. The worst districts were marked with black, while those in which the fever was less fierce were colored gray. The result was that a very large area of productive country was shown to be uninhabitable in the summer time, and no laborer could live in the worst districts. "To till the land," says the report, "or to perform the duties of the counting house involved a tedious journey every night to neighboring hilltops, often many miles off with the same wearisome journey on the following morning." From all accounts the question of malaria is the most troublesome with which Italy has to deal, and to solve it successfully is to restore to cultivation a large proportion of the best farming lands in that country.

When it was discovered that malaria can be avoided by keeping off the mosquito, the Mediterranean Railway, which traverses a very deadly region, invested largely in wire netting, wire blinds and mosquito-proof clothing for its employes. The railway stations were fitted with wire gauze doors and window coverings and the hands were required at night to wear clothing that the mosquito cannot bite through. Wire gauze porches were added to houses, so that the families of the agents and workmen could sit out of doors on nights when the heat indoors was oppressive. "The result," says the report, "has been marvelous. To be appointed station master in these districts was tantamount to a sentence of death, and no man could have his family to live with him in the summer with any prospect of their escaping the scourge, which affects one-third of the communes in Italy with more or less severity. But now the railway company has secured absolute immunity to its servants and their families, and even in such poisonous localities as Battipaglia and San Nicola the families in protected houses have been perfectly healthy." The lesson is a valuable one and should not be lost upon those parts of the United States that suffer from malaria. And what is good for malaria is good also, we have recently learned, for yellow fever.—New Orleans States.

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*GENERAL TREATMENT OF INSECT PESTS.*

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(Imperial Dept. of Agriculture of West Indies.)

This pamphlet contains brief directions as to the means to be adopted for the destruction of garden and crop pests. In such small space elaborate methods, applying to special cases, cannot be discussed but the directions given may be modified with discretion and rendered applicable to ordinary insect diseases. Many of the remedies described are derived from the published work of entomologists in other parts of the world and are such as have been found to give the best results under the conditions obtaining in the West Indies.

**DETERMINATION OF THE CAUSE OF DISEASE.**—When a plant is supposed to be diseased, it should be carefully examined to find the cause of the injury and any unusual appearance should be noted. There may be some difficulty in discovering, with certainty, the real source of damage but a thorough examination of the plant, in cases where the disease is not at once apparent, will, as a rule, reveal the true nature of the injury and its cause. It is of no use to assign the damage to the first or to any insect that may be found on the plant, and if treatment is adopted for the wrong class of pest the best results are not likely to be obtained.

**INSECT PESTS.**—Plants are attacked by diseases and pests of very various kinds, of which insects form a large proportion. Speaking generally, harmful insects may be divided into three classes according to their mode of attack: (1) Leaf-eating insects, (2) boring, (3) sucking.

Leaf-eating insects may be taken to include those that feed on the leaves and other exposed parts of the plants. Caterpillars ('worms') are the most common, and grass-hoppers often do a considerable amount of harm. A well known instance of caterpillar attack is found in the fiddlewood tree, whose leaves are frequently eaten by large numbers of caterpillars. Other familiar instances are the caterpillars that attack the water-lemon vine, canna, arrowroot, tobacco, sweet potato and cassava. As a rule each kind of caterpillar confines itself to one food plant or to closely related plants.

Boring insects feed inside the tissues of plants, spending the greater part of their lives securely hidden. All parts of plants are attacked; the plantain weevil living in the roots or

in the part of the stem below the ground, the cacao beetle tunnelling in the trunk and branches, and the coffee-leaf miner boring in the leaves are familiar examples. Other boring insects live in dried grain, tobacco, nutmegs, furniture, etc.

Sucking insects are, at the present time, the most destructive insect pests in the West Indies. They include the plant lice (Aphidae) the mealy-wings (Aleurodidae) and the scale insects and mealy bugs (Coccidae). These are all minute insects that suck the juice through a slender tube which is inserted into the tissues of the plant. Instances of this form of attack are sufficiently familiar, though the cause is not always recognized.

Trees are commonly to be found covered with 'black blight'; that is, the upper sides of the leaves are coated with a black layer like soot. It is often thought that this is a serious disease, likely to cause great damage to the tree; the serious disease is present, but it is not the black blight. If the underside of such a leaf be examined, either mealy-bug will be found or small rounded insects (scale insects). These are the real pests, the black blight being merely a secondary result. A plant with black blight will be found to have scale insects on the leaves or branches, or else a neighboring tree is thus infested. Black blight, in itself, does little harm; it is a fungus that lives on the sweet excretion dropped by the scale insects and may be regarded as an indication of the more serious disease. When the scale insects are destroyed, the black blight will in time disappear also, and the plant will regain its normal vigor.

Scale insects may be found on any part of a plant, some attacking the roots, others the stem, branches, leaves or fruits. Other sucking insects occur, but they are usually of far less importance.

PREVENTIVE MEASURES.—Before discussing what remedies to apply, it may be of use to consider how to guard against the attacks of insects and other pests. The point of greatest importance is to maintain the vigor of the plant, to keep it in as healthy a condition as possible and never to allow it to become weak. Plants are particularly liable to disease when they lose vigor, as in time of drought. An additional preventive is to ensure the absence of weeds, and of decaying vegetation of any kind. Rotting fruits, trunks or branches

offer a convenient home to many undesirable insects, and should be dug in, when possible, or removed. If disease comes, it is essential to check it at the outset. A pest should never be allowed to become established; vigorous measures should therefore be taken as soon as it is observed. A small amount of trouble at the beginning may save much labor afterwards, and may preserve the crop from injury. It is most important to be always on the watch for signs of injurious insects, and, as soon as they are seen, to adopt immediate and thorough measures for their destruction.

REMEDIES.—Insects may be destroyed in two ways (1) by catching them and (2) by poisoning them. For boring and leaf-eating insects both methods may be used; for sucking insects the latter only, as a rule. In applying these remedies, it must be remembered that many insects pass through three stages. From the egg comes the caterpillar ('worm') or grub, which is usually the destructive stage. After this has attained its full size and stored up fat, it transforms itself into the chrysalis or pupal stage. This is a resting stage, often passed in a cocoon or other covering. From this resting condition the full grown insect emerges, and this period of an insect's life is usually devoted to reproduction, the food, stored up as fat during the caterpillar or grub stage, being sufficient in many cases, also for the perfect insect. All insects do not pass through these well-marked stages but no insect has wings until it has attained its perfect shape. These facts must be remembered in dealing with moths, butterflies, beetles and two-winged flies, as it is often possible to find one stage in their life when some remedy will be particularly effective.

Insects may be caught in several ways. The grubs of boring beetles can usually be cut out of the trees they attack. This must be done carefully, with as little injury to the tree as possible and the wound should be immediately tarred over. Trap logs are useful in some cases. If it is found that the perfect insects will attack other trees, logs of these trees may be left lying on the ground to attract the beetles. These must be visited periodically and burnt when they contain a large number of the insects. Catching the perfect insects by hand, as in the case of cacao beetles or grasshoppers, and catching them in trays of molasses are also often valuable methods.

The selection of particular methods depends on a knowledge of the habits of the insects, and the methods need to be modi-

fied to suit different insects. It is often convenient to catch some insects at one particular stage. Thus, boring insects are often well hidden in their early stages but emerge when they become perfect; then they may be caught. On the other hand, it is easier to destroy the caterpillars that eat many plants than it is to kill the butterflies or moths into which they eventually turn. Occasionally the egg is the most readily destroyed stage in an insect's life. It is desirable therefore that full advantage should be taken of these points.

The use of poisons offers a method that is generally applicable to insect attacks. Poisons are of two kinds, 'Stomach-poisons' and 'Contact-poisons'. The former destroy insects when eaten with their food, the latter destroy them when they come in contact with their bodies. Insects that bite leaves, bark or fruit and eat what they bite, can be killed by putting a stomach-poison on their food. These poisons are enumerated in list A. Clearly, this method is of no use against sucking insects, which push a slender tube into the plant and do not eat the outside. For these, contact poisons are used, and since many sucking insects are fixed to the plant or move but little, this method is very effective: for such poisons see list B.

A number of poisons are enumerated below, with directions for preparing them. By their aid the greater number of insects may be destroyed, provided the applications are thorough and systematic. There are many insects that need special treatment and the application of these poisons needs slight adaptation in many cases. A knowledge of the habits of the pest is the surest guide to good results, and the least amount of treatment will then give the desired result. Substances poisonous to man should not be applied to fruit or vegetables immediately before they are to be picked.

Poisons.—List A. Stomach-poisons. Arsenical Poisons.

1. Paris Green, mixed with twice its weight of flour, dust or lime, both finely powdered.

2. Paris Green, 1 lb. with 2 lbs. of lime, dissolved in 200 gallons of water.

3. London Purple, mixed with twice its weight of flour, dust or lime, both finely powdered.

4. London Purple, 1 lb. with 2 lbs. of lime dissolved in 180 gallons of water.

5. London Purple or Paris Green may be used with soap, by adding 1 lb. of soap to every 50 gallons of Nos. 2 or 4.

Other Poisons. 6. Hellebore, mixed with twice its weight of cheap flour, both finely powdered.

7. Hellebore, 1 oz. in 2 quarts of water.

8. Pyrethrum (Buhach), mixed with twice its weight of cheap flour, both finely powdered.

9. Pyrethrum (Buhach), 1 oz. in 1 gallon of water.

10. Tobacco (refuse), as dry powder.

11. Tobacco (refuse), 1 lb. steeped in 1 gallon of water for 24 hours.

List B. Contact-poisons. 12. Kerosene Emulsion (hard soap). Dissolve  $\frac{1}{2}$  lb. of hard soap in one gallon of boiling water. Add two gallons of kerosene to the hot liquid and immediately churn, with a syringe or force pump, till the mixture becomes creamy. This is the stock solution. Make up to 33 gallons. Use only rain water, or soft water (i. e., without lime, etc.).

13. Kerosene Emulsion (soft soap.) Dissolve 1 quart of soft soap in 2 quarts of hot water; add 1 pint of kerosene to the hot mixture and immediately churn, with a syringe or force pump, till the whole is creamy. Add an equal amount of water, and it is ready for use. Any water may be used.

14. Rosin Wash. Mix 20 lbs. of rosin,  $3\frac{1}{2}$  lbs. of 98 per cent caustic soda, and 3 pints of fish oil. The rosin and caustic soda must be pounded before mixing. Cover this with about 2 inches of water and boil. When the liquid is clear, slowly add water, still boiling the mixture, till the whole is made up to 15 gallons. This is the stock solution and can be made up to 100 gallons when cold, using only rain water or soft water.

15. Rosin Compound. Mix 4 lbs. of powdered rosin, 3 lbs. of powdered washing soda, and 1 gallon of water. Boil, and when all is dissolved, slowly make up to 5 gallons. Boil the mixture till it becomes of a clear brown color. This is the stock solution. Make this up to 30 gallons.

16. Whale Oil Soap. Dissolve 1 lb. of soap in one to two gallons of warm water.

17. Rosin and Whale Oil Soap Compound. Mix 1 gallon of water with 3 lbs. of powdered washing soda and 4 lbs. of powdered rosin. Boil till dissolved and, while boiling, make up slowly to 5 gallons.

In a separate vessel boil 10 lbs. of whale oil soap with 5 gallons of water. These may be mixed while hot to make the stock solution or, when cold, mix these two with 35 gallons of cold water, pouring both into the water together while actively stirring the mixture. However mixed, the final amount must be 45 gallons.

18. Tobacco and Soap. Dissolve 1 quart of soft soap, or  $\frac{1}{2}$  lb. of hard soap, in 5 gallons of water, and add 2 quarts of strong tobacco decoction (No. 11.)

USE OF THE POISONS.—The poisons enumerated above are to be applied as follows: Those in list A are suitable for application to plants that are eaten by caterpillars ('worms') and other biting insects. The arsenical poisons, such as London Purple or Paris Green, are of universal application against caterpillars and other pests that destroy foliage, but it must be remembered that arsenic is poisonous to man and does not quickly get entirely washed off by rain. Hellebore, on the other hand, very soon loses its poisonous properties, and becomes harmless after some exposure to air. Pyrethrum is harmless to higher animals, but has a powerful influence on insects. It may be applied without danger of poisoning human beings or cattle. Tobacco has a special value in a few cases only, and has less claim to be regarded as a general insecticide. Those in list B are the contact-poisons for application to plants infested with mealy bug, scale insects, etc.

When using large quantities of these insecticides, the question of relative cost becomes important.

The prices of the materials mentioned in list A are subjoined, as quoted in New York: Paris Green, 25 cents per lb.; London Purple, 6-15 cents per lb.; Hellebore, 20 cents per lb.; Pyrethrum, 35 cents per lb.

In Barbados (Messrs. C. F. Harrison & Co.) the following may be obtained: Paris Green, 54 cents per lb.; London Purple, 30 cents per lb.; Refuse Tobacco, 4 cents per lb.

The cost of washes in list B, has been calculated, per 100 gallons of wash ready for application, exclusive of fuel and labor. These figures are approximate and represent, as closely as possible, firstly, the cost of the materials in large quantities in Barbados, free of duty, and secondly, the cost at retail prices as quoted in Barbados.

Cost per 100 gallons:		
Rosin Compound .....	\$0.70	\$0.91
Rosin Wash .....	1.29	1.90
Rosin and Whale Oil Soap Compound .....	1.47	2.15
Kerosene Emulsion (Hard Soap) .....	1.87	2.87
Whale Oil Soap (strong) .....	4.50	10.00
Kerosene Emulsion (Soft Soap) .....	22.40	35.00
Tobacco and Soap .....		1.00

These washes vary in ease of preparation and in keeping quality. They can be made, on a small scale, in empty kerosene tins, enough stock solution being thus made in one tin to make 30 or more gallons of wash when made up to the full amount. In making Kerosene Emulsion with hard soap, water containing lime should not be used, as the oil will separate out on the surface after making the emulsion; rain water or soft water is necessary in this case and is preferable for all washes. In selecting a mixture, it would usually be better to choose one of which the ingredients could be easily obtained. But, if a large area is to be sprayed—as in spraying lime or orange trees—it would be well to import the materials on a large scale and then the most efficacious wash could be chosen. The strengths of these washes are intended for plants whose foliage is not very tender or delicate. Many plants, such as palms, would bear much stronger washes; on the other hand, very delicate plants might suffer from a too liberal application. The strength of these mixtures may be varied considerably and they should be made weaker for very delicate plants.

The materials for most of these washes can be obtained in Barbados and in some of the other islands also. These include rosin, washing soda, kerosene, fish oil, hard and soft soap, refuse tobacco. Whale oil soap can be obtained from Messrs. H. E. Thorne and Son, Barbados, in small lots at 10 cents per lb., in large lots at 8 cents per lb., exclusive of packing, etc. This soap is Good's No. 3, caustic potash whale oil soap, obtainable also from the manufacturer, James Good, 941 North Front Street, Philadelphia, Pa., at the following rates:—50 lbs. @ 5 cents per lb., 100 lbs. @  $4\frac{1}{2}$  cents per lb., 170 lbs. @ 4 cents per lb.,  $\frac{1}{2}$  barrel (275 lbs.) @  $3\frac{1}{2}$  cents per lb., barrel (425 lbs.) @  $3\frac{1}{4}$  cents per lb.

APPLICATION OF POISONS.—The liquid preparations are best applied with a spraying machine, but a brush or good syringe

may be used for small plants. The object to be attained is to uniformly wet the affected parts with the liquid; a fine spray like a mist usually does this best, and only a good spraying machine is capable of giving such a spray. Many kinds of spraying machines are now in use and can be obtained from the makers, or from firms dealing in gardening implements. A spraying machine consists essentially of a reservoir containing wash, a small pump, and a length of india-rubber hose, terminating in a nozzle that will give a spray of varying fineness. The success of the treatment depends largely on the nozzle and a thoroughly reliable one is that known as the 'Bordeaux' or 'Seneca' nozzle. The india-rubber tubing does not last long in the tropics and a spare length should be obtained with the machine. Spraying machines are, as a rule, made of copper or brass, as they are not then affected by the constituents of the wash used. Two forms of machines are generally used. The smaller are known as 'Knapsack' machines and can easily be carried strapped to the shoulders. They are so made that one man can operate the pump and also direct the nozzle, whilst walking with the machine on his back. Such machines will hold about 4 gallons of wash. Larger machines are fitted into a barrel, which acts as a reservoir, and the barrel is carried on a light iron truck with two wheels. These machines have a capacity up to 50 gallons and can easily be pushed from place to place. Shrubs and small trees can conveniently be sprayed with an ordinary length of hose, and a metal extension pipe allows for treating taller trees. There are several good machines obtainable, especially in the United States. Those most in use in the West Indies at the present time, are manufactured by the Deming Company, Salem, Ohio, and by the Gould's Manufacturing Company, 16 Murray Street, New York. The 'Success' knapsack spraying machine made by the former company and the 'Fruitall' spraying machine made by the latter may be seen at the Botanic Stations and are thoroughly reliable. The following can be obtained from Peter Henderson & Co., 35 Cortlandt Street, New York.

'Success' Knapsack Sprayer .....	\$11.00
'Henderson' Hand Bucket Pump .....	3.75
'Henderson' Garden Spray Outfit .....	6.00
'Fruitall' Spray Outfit "A" .....	10.00
'Gem' Spray Outfit "A" .....	5.00

'Pomona' Spray Outfit "A" .....	13.50
'Sentinel' Spray Outfit "A" .....	34.00

The 'Fruitall', 'Gem' and 'Pomona' have to be fitted into the end of a barrel similar to that imported into the West Indies with cooking oil, usually blue outside. This barrel can then be mounted on Henderson's water-barrel truck (costing \$11.00) and the whole forms a very convenient and powerful machine. The 'Sentinel' is a more powerful pump, and has to be fitted on a cart, with a barrel to supply the wash. It works two nozzles at once.

The 'Henderson' hand bucket pump fits any bucket or small tub and is adapted only for treating small plants, ferns, etc. The 'Henderson' garden spray outfit is a more complete arrangement of the same machine. There are many more outfits for spraying plants, but the above list will enable any one to provide himself with a reliable machine. When ordering it is necessary to specify the 'Bordeaux' or 'Seneca' nozzle, which appear to be the best.

Powders are applied by dusting them over the plant. This may be done with a tin can perforated with small holes, or by placing the powder in a coarse sack and beating it. Special appliances for blowing powder are found very useful in applying Paris Green, sulphur, or other finely powdered poisons. The 'Little giant powder gun' is one of many forms sold by dealers in gardening implements, and may be obtained from P. Henderson & Co., 35 Cortlandt Street, New York, for \$5.00, complete.

Thoroughness in application is absolutely essential to success. Next in importance is observation of the results and repetition when necessary. One dose is often sufficient, but, for scale insects, more applications are required. The first dose will destroy the mature scale insects but not their eggs and a second or third dose, at intervals of about a week, are usually necessary.

OTHER REMEDIES.—Trees may often be preserved from the attacks of boring insects by white-washing with lime and water. This requires renewal once in three weeks. Special preparations are sold for applying to trees. In the form of greasy mixtures, rosin and castor oil, whale oil soap and washing soda, soft soap and carbolic acid are recommended for this purpose, but these must not be allowed to remain long on the trees. After 2 or 3 months, at most, they should

be washed off. Trunks of valuable trees can be protected by tying tarred paper, or newspapers, around them, or by fixing wire netting one inch away from the bark closed at the top and bottom. Lime, ashes and soot can often be employed very usefully in gardens, especially against snails and slugs.

Stored crops are very liable to the attacks of insects. Grain may be freed from weevils by exposing it for 24 hours in an air-tight receptacle, to the fumes of carbon bisulphide at the rate of 1 teaspoonful (1 drachm) per cubic foot of space. This will kill every insect within 24 hours and will not damage the grain. Carbon bisulphide is obtainable in cans from 7 lbs. upwards at about 5d. per lb. in England or the United States. Benzene may be used in the same way, taking rather more per cubic foot as it is less powerful. As both these substances are very inflammable, care must be exercised in using them.

Cockroaches can be destroyed by mixing equal parts of molasses, or chocolate, and boracic acid, and spreading this on small pieces of tin or cardboard, which are placed in cupboards or under furniture. The mixture is not poisonous to dogs and other domestic animals, but will destroy the cockroaches. Books in the tropics should always be lightly painted over with the following mixture to preserve them from cockroaches: 1 oz. Corrosive Sublimate, 1 oz. Carbolic acid, 2 pints Methylated or Rum spirits. The paste used for binding books and similar work should be poisoned by adding half an ounce of copper sulphate (blue stone) to every pound of paste.

Wicker and other furniture attacked by small beetles should be thoroughly painted with kerosene oil and then placed in the sun for a few days. Woolen goods, clothes, etc., can be preserved from the clothes' mold by the use of naphthalent, but better by being thoroughly sunned for a whole day once every two months.

USEFUL INSECTS.—Insect pests, like other organisms, have enemies that prey on them; clearly, these are of value and deserve to be encouraged. A common pest destroyer is a green fly about an inch long with large transparent wings, and beautiful golden eyes, which emits a very unpleasant smell. Its eggs are found on the bark or leaves of plants infested with plant-lice, and are easily recognizable, resembling small white grains on a slender stalk. The grub is a very voracious animal and devours large numbers of plant lice, etc. Other

useful insects are the small round beetles known as ladybirds. Their grubs are usually colored black and yellow, and are very active. They eat large numbers of plant lice, away from which it is rare to find them.

Should other parasitic or predaceous insects be found, they should be preserved; but as a rule it is not an easy matter to determine those that are useful, without a special study of their habits.

INTRODUCTION OF PESTS.—It is a very easy matter to introduce injurious insects or plants from other localities and care should be taken to avoid doing this. A pest introduced into a new locality is likely to be more destructive than those already established there. Cuttings, plants or seeds are very likely to carry the eggs of scale insects, or the scale insects themselves, and all importation should be examined on arrival. If possible, it is wise to plant such things by themselves so that any disease that may show itself will not readily spread and can be treated before the plants are put out with others.

SOURCES OF DANGER.—Badly diseased plants, if few in number, should be cut down and burnt, lest the disease spread to neighboring plants. This is always necessary even with scale insects and mealy bugs. A diseased plant should never be cut down and left lying on the ground. Any pest on it will spread to other plants on which the insects can live, since they will at once leave a plant when the sap ceases to flow. It is sometimes possible to discover the sources of insect pests. Some trees are continually attacked by scale insects and they communicate their pests to many others of various kinds. In Barbados, the Frangipani trees are very dangerous in this respect, having usually scale insects that will live on a great variety of other trees and shrubs. It would be of little use to treat the other trees and leave the Frangipani, as it would immediately communicate the disease afresh. Such dangerous trees should not be allowed to grow near fruit trees or valuable ornamental plants.

COLLECTING AND FORWARDING SPECIMENS.—Injurious insects may be forwarded for examination through the Curator of the Botanic Station or some other officer of the Imperial Department of Agriculture. They should in every case be preserved and packed as to arrive in the best possible condition for examination.

Flies, butterflies, moths, bees, etc., should be sent dried and, if possible, either carefully pinned or at any rate prevented from rolling about and becoming injured.

Soft-bodied insects such as caterpillars, grubs, 'worms,' etc., are best preserved by being dipped in boiling water and then dropped into a small bottle of strong spirit or rum. They may also be placed in the spirit direct, which will be sufficient to preserve them.

Beetles should be sent wrapped in paper or in any other soft packing material, but no insect should be packed directly in cotton wool: a layer of paper should always be placed between the cotton wool and the insect. Scale insects are best preserved on the leaf or part of the plant they attack. Several leaves should be dried carefully, packed and forwarded in a box. It is often possible to send living insects especially those that bore in plants or live in earth. They should be supplied with food but no provision need, as a rule, be made for air. In every case a specimen showing the damage done should be sent. When possible living insects, on or in their food plant, should be forwarded and if there is risk of the insects dying a few should also be sent preserved.

Full particulars should accompany every specimen; such as: Nature and extent of damage, time of its appearance, previous condition of the plant attacked, the name of the plant, the locality and every fact that may be known of the pest in question. Great care should be taken to make the specimens fully representative of the insect and its work, and to ensure their arrival in good condition.

H. MAXWELL-LÉFROY.

Note.—All correspondence and specimens intended for the Head Office of the Department, should be addressed to: The Commissioner, Imperial Department of Agriculture for the West Indies, Barbados.

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GREAT SUGAR CANE.—The cutting of cane is well under way at all plantations and the scarcity of field hands will compel much work to be done in over-time. The few negroes, Portuguese and Porto Ricans recently brought to the Islands increase the labor supply by only a small fraction. The first plantation to offer to the public a sample of the season's crop is Oahu, whose manager shows four sticks of cane of an average length of 25 feet. Oahu is perhaps the banner plantation of Hawaii, many of its acres yielding twelve tons each. It is fortunate in being one of the latest plantations organized, profiting as it does by the various experiments in the field and mill work of older estates.—Paradise of Pacific.

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WASHED SOILS: HOW TO PREVENT AND RECLAIM THEM. FOREST PLANTING.

U. S. Department of Agriculture.

The denudation, or washing, of lands of the higher levels of the earth's surface is a process which no human precaution can wholly prevent. It has been one of the most important forces and factors in the geological changes which have so modified the surface of the earth. The present surface of the largest portion of the United States is made up of this "sedi-

mentary" or "drift" material which has been moved from the place where it was formed through the disintegration and decay of the old crystalline rocks, by water, wind, or moving ice, and which has accumulated to a depth of hundreds or thousands of feet over nearly the entire surface of the country. It is estimated that the general surface of the land in the area of the crystalline rocks of the Piedmont Plateau has been lowered at least 2,000 feet by this continual washing. This vast amount of material has been slowly removed and deposited elsewhere by the very same agents which we are contending with today in our gullied fields; for this denudation, or erosion, is still going on, as it has been for ages past.

As a rule this denudation is exceedingly slow and the general level of large tracts of country is not lowered more than an inch or two in a hundred years. Where the change is as slow as this it is undoubtedly of benefit to the human race, as in the course of time it must carry off the soil which has been used over and over again for vegetation and expose fresh material to the roots of plants. With this slow change the natural forces are amply sufficient for the decay of the subsoil and for the conversion of this freshly exposed material into a good soil. When the rate of denudation is excessive, however, and more rapid than the natural decay of the subsoil material which is exposed, it may work serious injury to agricultural lands.

Along the banks of the Ohio river and in very many portions of the South hundreds of fields that were once covered with sturdy forests of oak, maple, walnut, and pine, and which bore under cultivation, after being cleared of the natural growth, large crops of wheat, maize, tobacco, and cotton, may now be seen furrowed with gullies as with the wrinkles of age, and abandoned to brush and briers.

A surface layer of good agricultural soil 6 inches deep resulting from the slow and gradual disintegration and decay of rocks and accumulation of humus may have required hundreds of years for its natural formation, and yet it is liable to be washed away in a single storm.

This excessive erosion, or washing, of lands may be prevented, and the already gullied fields may be recovered, and steep slopes of loose material may be held and prevented from washing—

- 1.) By chemical means, in the application of manures and fertilizers and in the accumulation of organic matter, which change the texture of the soil and make it more porous and more absorbent of water, so that there is less to run off over the surface.

- 2.) By means of cultivation and underdrainage, which prevent erosion by distributing the surface flow over the ground and increase the amount carried off by underdrainage.

- 3.) By reforestation, or the planting of trees, which act mechanically to prevent washing.

(4.) By grass and similar vegetation, which bind the soil grains and prevent their washing away.

The erosion of a soil is caused by the wearing of the rain and snow waters which can not penetrate into the soil fast enough to be carried away by underdrainage, and which, by reason of the slope or contour of the land, run off over the surface, carrying along particles of sand and clay. When this water accumulates in a depression in the fields the force of the torrent may be sufficient to cut out a great gully in a short space of time.

The extent of washing to which the soil is exposed depends upon the quantity of rainfall in a given time, the slope or contour of the surface, the texture of the soil, the vegetative covering of the surface, and the kind and condition of cultivation. A soil composed chiefly of moderately coarse grains of sand, and having good underdrainage, will absorb the heaviest rainfall without much danger of surface erosion. A clay soil, on the other hand, into which the water can not percolate with anything like the rapidity of the precipitation, will be washed and gullied by the torrent of water which must flow over the surface.

#### CHEMICAL RELATIONS OF THE SOIL TO SURFACE WASHING.

It has been repeatedly shown by experiments and by the experience of farmers that a soil, as a rule, absorbs water more readily as the content of organic matter and humus increases. Surface erosion can, therefore, be largely prevented by such a system of cultivation and cropping as will introduce as large a quantity of organic matter into the soil as possible. A very old method of recovering washed and gullied lands is to place straw in the furrows while plowing, the straw not only acting mechanically to hold the soil in place and prevent surface erosion, but also in a very efficient way to increase the quantity of humus, thus making the soil hold large quantities of water which otherwise would have passed off over the surface. In this simple way fields which have been badly washed and gullied and entirely abandoned may be recovered and made highly productive.

The most important thing in the recovery of waste fields is the incorporation of organic matter of some kind in the soil; pea vines, stubble, briars, or leaves from the forest may be used as a source of the organic matter. The straw from one acre of land which has been recovered, as mentioned above, will be sufficient to start the recovery of another acre, even if this be deeply furrowed with gullies. Where enough organic matter can be used as a surface dressing, this layer helps greatly to retain water and to make the underlying soil more absorbent.

As soon as a sufficient supply of humus has been accumulated and the lands are brought up to an adequate condition of fertility, clover or grass should be seeded, if the land is at all suited to these crops, or rye, oats, or field peas should be

sown to help hold the surface. Little by little, but more rapidly than would be expected from the forbidding aspect of the field, the land can be reclaimed again and made productive through the accumulation of humus and organic matter. A soil containing a fair quantity of humus will wash less readily than one nearly destitute of this matter.

A soil containing a fair supply of lime is much less liable to wash than one similarly situated and exposed which is deficient in lime. The reason of this is that clays which are deficient in lime, when once brought into suspension by moving waters, will remain in suspension and keep the water turbid for a long time. Clays which are heavily impregnated with lime salts, on the other hand, are in a flocculated state, the fine grains of clay being held together and in contact with the larger grains of sand. This flocculated mass quickly settles and is originally not so easily disturbed and carried off by moving water. A field treated with an abundance of lime is thus less easily washed by heavy rains. The results of investigations by Schulze, Schloesing, and Hilgard have shown in a most emphatic way the beneficial changes which take place, especially in stiff clay soils, by the application of lime.

The change in the physical condition of the soil which is produced by the lime, and which is likewise produced by a number of other chemicals ordinarily used in commercial fertilizers, is another important factor worthy of consideration. A stiff clay soil is practically impervious to the penetration of surface water when it is delivered in such torrents as we are liable to have in our summer storms. A well-limed soil, on the contrary, although it may contain as much clay but in which the particles are flocculated or drawn together, is much more pervious to water, and the amount of water which the soil will carry down through underdrainage is increased, and the excess which has to flow off over the surface is diminished. The surface washing of cultivated fields, especially those which are naturally deficient in lime, can be greatly diminished, therefore, by the free application of this substance to them.

A number of the ordinary fertilizing materials have an important effect upon the texture of soils and upon the permeability of soils to water, but few systematic investigations have been carried on in this line and not much, except of local importance, has been definitely settled by experiments or by the experiences of farmers.

#### WASHING OF LANDS MAY BE PREVENTED BY METHODS OF CULTIVATION AND UNDERDRAINAGE.

The depth and character of the tillage are very important factors in the washing of lands. A field in a condition of fine tilth and plowed to a depth of 10 inches will hold 2 inches of rainfall and absorb it very readily, and a soil in such a condition will suffer no surface washing from any ordinary rainfall. Where it is possible, therefore, land which is apt to

wash should have the soil gradually deepened and be kept in a fine state of tilth so as to increase the storage capacity for excessive precipitations. This will not only save the surface from being washed and gullied, but it will also increase the store of moisture held by the soil, which is of very great value in the time of drought.

It is important also for this, as for other reasons, that the soil be covered with vegetation as much as possible throughout the year, as the roots and organic matter serve to bind the grains of the soil together. In some parts of Holland the drifting sands of the coast, which shift their position with every storm, often cover up valuable farming lands. Vast areas of these sands have been reclaimed and made productive by being covered with vegetation, while the roots and remains of organic matter hold the soil grains in place and prevent them from drifting and covering up more valuable lands. Any crop which requires very clean culture, as for example, cotton, is exhausting to the land for the reason that constant exposure of the surface to the sun and storms uses up the organic matter, makes the soil less porous, and the soil particles themselves are more easily washed away; so that, this clean cultivation is in its effects very favorable to excessive erosion.

Another very effective method, when properly carried out, to prevent the washing of lands is to underdrain the soil with tile or other drains. These drains carry off quite rapidly an excess of moisture, so that much more of the rainfall is absorbed by the soil and carried off through the drains and less washes over the surface of the land. Not only this, but a well underdrained field is usually dryer and more porous, and has a greater capacity for absorbing the excessive rainfall and thus preventing surface washing. A field thoroughly underdrained with tile drains will carry off the water of any ordinary rainfall without any surface erosion. This method is very effective, but is likewise very expensive, and can not be used economically in extensive farming solely for this purpose of protecting the land from washing.

While the land may thus be made more porous and more absorbent of water—through the increase of the amount of organic matter or of humus, through the use of lime and other fertilizing material, through the deepening of the soil by gradually increasing the depth of cultivation, by so cropping it that it shall be covered with vegetation as much of the year as possible, and by underdraining the land—still, these methods may not be sufficient to so change the chemical and physical texture of the soil as to enable it to absorb the rain as it falls and to prevent an excess of water washing and eroding the surface where the contour of the land is such as to promote erosion from the surface flow of the excess of water.

It will be necessary in this case to provide for a more uniform distribution of the flow over the surface, and to prevent

any accumulation of water which would have the effect of a torrential stream. This is secured in a great measure by laying off the rows according to the contour of the surface, so that each row will have a very slight incline of not more than from 1 to 7 inches in 100 feet, and in which the flow of water would be so slow that there would be little or no erosion. Theoretically, this is a fine idea, to let each row carry off its own proportion of the excess of rainfall so gently that there shall be no erosion, thus acting as a miniature drain. Practically, however, it is often impossible to keep these rows from breaking through, and when the bed is once broken and the water overflows into the next row the accumulation of water is sufficient to break down bed after bed until the rows from all the field are discharging into this narrow channel.

To overcome this difficulty sidehill ditches may be used in which larger and more substantial ditches are provided, following very nearly the contour of the field, so that there shall be a fall of from 1 to 6 inches in 100 feet. The distance apart of the ditches will depend upon the slope of the field; with a very steep slope they should be close together, often not over 6 to 10 feet apart; with a gentle slope they should be at intervals of 15 or 20 feet, or even further apart, depending upon the texture of the soil and the contour of the surface.

These sidehill ditches are very easily constructed, being made almost entirely with the plow. A bank is formed by running a number of furrows, throwing the dirt toward the middle. The last furrow on the upper side is cleaned out with a spade to form the bottom of the ditch. If the plow is well handled it takes very little work with the spade to make a very substantial ditch. It is well to get the bank forming the lower side of the ditch sodded with grass to help hold it and to lessen the danger of its giving way during a heavy rainfall. When the slope is thus protected with a number of ditches at the proper distance apart, the rows can be given a rather steeper fall so that they shall run out into the drains at frequent intervals and not have to carry the water so far. These ditches have to be constructed with care and have to be strengthened where they cross any depression or sudden curve by building up an embankment with sticks and brush thrown across to support the embankment. Unless these ditches are thoroughly constructed they are worse than useless, for if they break they concentrate a volume of water upon one point in the field which would otherwise have been distributed over the surface, and this often forms a torrent which does great damage.

It is essential that these ditches and rows be run according to the contour of the surface of the land, and that there shall be no low places where the water would accumulate and gather force. They should always be run with a level, of which there are several forms on the market suitable for this work.

A more efficient, but at the same time much more expensive, method of preventing the washing of lands where there is a considerable slope is to terrace the fields so that there shall be level steps upon which the water can rest for a while and be absorbed. In terracing, the lines are run with a spirit level following the contour of the surface so as to give a perfectly level line. A furrow is run along this line, and a similar furrow is run along a lower contour, the distance apart depending upon the nature of the land and the slope of the surface, as in case of sidehill ditches. Theoretically, it is intended to have the surface between these two furrows level so that there will be no chance for the water to run off over the surface. On a small scale this levelling can be done with a horse shovel, and the land thus put at once into a condition to prevent washing. In this case the banks of the terrace are sowed or seeded with grass to prevent them from washing. In field practice, however, the soil is moved gradually with a plow, the furrow being thrown always downhill and the soil gradually worked down to a level plain. There are several forms of reversible plows which are admirably adapted to this purpose, being turned readily from a right to a left handed plow, so that in going back and forth the furrow is always thrown downhill. It requires, of course, a number of years of such cultivation to get the surface into even approximately a level condition, but with patience and thorough cultivation the soil very quickly assumes a comparatively level aspect, and erosion is reduced to a minimum. This is a more expensive method, but if intelligently done it is much more efficient and much more durable than depending upon sidehill ditches to prevent erosion. As was said in the case of the sidehill ditches, unless this work is well done it had much better be left undone, as it may seriously injure the field.

Where erosion has proceeded so far as to render the land at present unfit for cultivation, or where the land is not needed for cultivation and it is desired to prevent erosion, the land should be given up to trees, herbs, or grasses of some kind according to one or other of the following methods.

#### RECOVERING GULLIED HILLSIDES BY REFORESTATION.

Forest ground is not subject to this erosive action of the rainfall because in a forest a large part of the rainfall never reaches the soil as 20 or 30 per cent. is intercepted by the foliage and evaporated before it reaches the ground. The rainfall which reaches the surface is rapidly absorbed as the soil is kept granular and loose and much more of the water is carried off by underdrainage rather than by surface drainage.

The forest covering protects the soil in the following ways:

(1.) By preventing rain from falling directly upon the soil, the foliage of the tree crowns intercepting and breaking its

force, the water reaching the soil more gently from the leaves and along the branches and trunks of the trees.

(2.) By interposing a loose cover or mulch of litter formed by the fallen leaves and branches, which breaks the direct force of the raindrops and keeps the soil from being compacted or puddled by their blows.

(3.) The deeply penetrating roots, and holes left from decayed stumps and roots of trees, assist in this underground drainage.

(4.) The litter with the stumps and projecting roots and trunks of trees prevent the water from rapidly running over the ground and from gaining the momentum and force which is necessary in order to erode and gully the soil.

If the forest floor is not disturbed by fire, nor the litter trampled and compacted by cattle, it always reduces rapid surface drainage and largely, if not entirely, prevents erosive action.

#### RECOVERY OF WASHED SOILS.

Just as deforestation of hillsides and hilltops is the first cause for inducing erosive action, so is reforestation the most effective means in curing the evil. This has been demonstrated in France, where the Government and the farmers together have spent, during the last thirty years, over £40,000,000 and expect to expend three or four times that amount to reforest 1,000,000 acres of denuded mountain sides, the soil and debris from which has been carried by the torrents of water into the plain, covering over 8,000,000 acres of fertile ground and making it useless for agriculture. Sodding for pasture has been found mostly less effective and on the steeper slopes entirely ineffective.

Wherever the ground in the hill country is not fit for agricultural use it should be set and kept in forest, not only to make it produce a timber crop, but also to prevent the erosion which finally becomes dangerous to the lower valley lands. Wherever agriculture is possible and profitable there should be such a distribution of forest, pasture, and field as will secure the greatest immunity from erosive and torrential action of the waters. The forest should occupy all hilltops which, as a rule, have too thin a soil to allow profitable agricultural use; it should be kept growing on the steeper slopes where the water acquires the greatest momentum and the loosening of the soil by the plow furnishes a most favorable condition for erosive action; it should be placed on all rocky, uneven, agriculturally useless spots, because it will produce useful material even on such unfavorable situations, and, finally, forest belts should be maintained on long slopes alternately with fields and pastures, running along the brow of the slope of widths and at distances proportionate to the character of the land and the angle of the slope—on the steeper slopes closer together, on the gentler slopes further apart.

These belts, acting as a barrier to break the force of the water, will prevent an undue accumulation of surface waters and will protect to a considerable degree the lower fields from washing. Farmers, therefore, living in the eroded hill country should start upon the work of reforestation with a well conceived plan. They should determine beforehand which parts ought to be in forest, and which they may reasonably expect to adapt again to agricultural uses. They should understand that they must begin this work at the origin of the evil, at the very tops of the hills, where the water begins to gather and acquire its force, and gradually proceed with their work down to the lower levels.

#### PREPARATION FOR PLANTING FORESTS.

Although cultivation of the soil for tree planting in the manner practised for field crops is advantageous to the young plants for the first few years of their life, it is by no means necessary, and rough, broken and stoney ground, which could not be plowed and prepared for ordinary field crops can be readily planted in trees. If the ground is in such a condition that it can be plowed, this is decidedly the best method of preparing the land. The plowing should in all cases follow the contour of the hill and be as deep as possible, in order to allow as much water as possible to soak into the soil and so diminish surface erosion and prevent the young trees being washed out. The occasional gullies must be filled with brush and soil, or stones, rubble and dirt.

In the deeply gullied hill lands, where plowing has become impracticable, other ways must be provided against the further erosive action of the water, which would otherwise be apt to break the force of the water by constructing brush dams across the gullies, and roughly fill in the latter with stone, gravel, earth, etc., in front and rear if they are shallow and at least in the rear if they are deeper. Where the ravines are especially deep and wide it may become necessary to supplement and strengthen the rough dam with a loose rubble embankment or a dry wall of stone. A simple and efficient method has been practised in France, which consists in filling up the ravine with brush placed lengthwise and keeping this down by poles laid across and fastened in the sides of the ravine. The waters are thus allowed to drain off, while the soil carried by them is retained in and over the brush, and in a short time the gulley will fill up of its own accord. Then alders and willows are planted along the edge and soon finish the work of securing the ravine against washing. The means for thus breaking the force of the water in the gullies and changing it from a rushing torrent into a series of gentle falls, and in part from surface drainage into subterranean drainage, and of filling up the gullies themselves will have to be devised in every special case as circumstances permit and the ingenuity of the operator suggests. The brush dam is prefer-

ably made of readily sprouting material, which becomes alive and by striking root adds to the firmness of the dam.

It is especially needful, as in all kinds of dams, to fasten the ends securely. According to the steepness, depth, and width of the ravine more or less frequent dams are necessary. After the brush dams, walls and other breastworks have been established, the waters may be allowed to do the work of filling up the gullies themselves, which they will do sooner or later, or else, where it can be readily accomplished, the filling may be done by hand.

It may be understood that unless this preliminary work is well done and systematically, beginning at the very tops of the hills where the waters start, it is not worth doing at all, since the water if allowed to get headway would soon wash away and destroy any imperfect work.

#### PLANTING.

To cover the soil as quickly as possible with a dense and permanent aborescent cover is the object to be attained. Where the soil has not been so far eroded that plowing could be done, it might be best for the first season to sow field peas, or other crops that will readily grow and make a cover. This may be cut for green fodder, leaving a high stubble, and tree seed can be sown broadcast with the fodder crop in the early summer, or over the stubble after the crop is cut in the late summer and fall. The cheapest and most readily germinating tree seed should be looked for and the quantity used per acre should be lavish to secure a dense stand from the first.

Where the ground is too much cut up and too uneven to permit of plowing, recourse must be had to sowing of seed in plats, or planting of seedlings or cuttings by hand. This is naturally much more expensive, and therefore should be done with greater care and foresight. Plats may be made by loosening the soil with a hoe or spade, and sowing the seed into these seed beds covering the seed only slightly. The plats should be 3 to 4 feet apart to make sufficiently rapid cover. The success of this method is, however, very questionable, as not only the germinating of the seed under the prevailing conditions is precarious, but rains are apt to wash out the seed or young seedlings. The surer method, however, will be found in planting seedlings or cuttings. Seedlings are not only expensive but also more precarious to handle, hence for the bulk of the plantation such kinds as can be readily obtained and propagated by cuttings are used, and if desired a sufficient number of seedlings of better kinds can be added to increase the timber value of the plantation.

The first and principal object being to break the force of the surface waters, the arrangement in setting out the plants should be as nearly as possible in horizontal and parallel rows along the brow of the hill, following the contours. To get a full cover as soon as possible the plants should be set not farther apart than 3 to 4 feet and even less, making from

5,000 to 7,000 per acre. If this is found too expensive, or for some reason impracticable to be done at once, the work may be reduced and divided into several seasons; the rows then may be made farther apart, say from 6 to 16 feet, according to the slope, and the plants in the row 2 feet, when the number will be one-half, or less. \* \* \* \*

Whatever is done in such a work of recovering lost ground, let this fact never be forgotten, that it is better to do a small part well than a large part indifferently, which usually means lost labor.

#### GRASSES AND SIMILAR VEGETATION PREVENT EROSION AND WASHING OF AGRICULTURAL LANDS.

On gentle slopes a good turf of perennial pasture grasses, especially those with creeping rootstocks, prevents erosion, or washing, of lands, and short steep embankments may also be protected with this same covering. On longer and steeper slopes, however, this method is not so effective as that of reforestation.

In enumerating the effects to be obtained by the growth of grasses and other herbaceous vegetation on washing lands, or lands liable to be eroded, it should be stated that such growths are calculated to break the force of the rainfall and prevent its packing the soil; to render the ground more porous through the root penetration into the subsoil; to make the soil more absorbent and more retentive of moisture through the addition of humus to the soil from the decay of the plants; to retard the rate with which the surface water flow off, and lastly to bind the particles of soil together, which is especially effective in the case of light sandy lands and of newly formed embankments, whether of sand or clay.

The turf which would answer the present purposes should be composed of perennial grasses of varieties which have creeping rootstocks, and it is frequently essential that they be able to grow upon an impoverished and often hard soil. To secure a strong turf on lands of this character it is very important the soil should be thoroughly plowed or loosened, and some variety of field pea or clover be seeded down, such as the cowpea, well adapted to this purpose. These crops may either be cut off, leaving a high stubble to be turned under, or the whole may be plowed under, thus furnishing a quantity of organic matter to the soil as a preparation for the grasses which are to be seeded.

With this preparation of the soil Bahama grass is one of the best grasses for the purpose of preventing erosion, or of reclaiming eroded land. This should be planted by cutting up a turf rather than by seeding, as the seeds do not germinate very readily, even where they have been gathered in a mature condition.

Where the soil will support other good turf grasses of higher value for hay or pasturage, or where the soil can be brought into a condition to support them, these more valuable grasses should be introduced.

HONOLULU STOCK AND BOND EXCHANGE, JULY 12, 1901.

STOCK	Capital Authorized	Shares Issued	Capital Paid up	Par Value	Last Sale
MERCHANTILE					
C. Brewer & Co. ....	\$ 1,000,000	10,000	\$ 1,000,000	\$ 100	415
N. S. Sachs' Dry G'ds Co. L'd. ....	60,000	600	.....	100	100
L. B. Kerr & Co., Ltd. ....	200,000	4,000	.....	50	.....
SUGAR					
Ewa Plantation Company ...	5,000,000	250,000	5,000,000	20	26
Hamoia Plantation Company	175,000	1,750	175,000	100	.....
Hawaiian Agricultural Co. ...	1,000,000	10,000	1,000,000	100	275
Hawaiian Com'l & Sugar Co.	10,000,000	100,000	2,312,750	100	80
Hawaiian Sugar Company ...	2,000,000	100,000	2,000,000	20	30
Honoum Sugar Company ...	750,000	7,500	750,000	100	172 $\frac{1}{2}$
Honokaa Sugar Company ...	2,000,000	100,000	2,000,000	20	33 $\frac{1}{4}$
Haiku Sugar Company ...	500,000	5,000	500,000	100	.....
Kahuku Plantation Company	500,000	25,000	500,000	20	25
Kihei Plant. Co. Ltd., ....	2,500,000	50,000	2,500,000	50	11
Kipahulu Sugar Company ...	160,000	1,600	160,000	100	.....
Koloa Sugar Company ...	300,000	3,000	300,000	100	150
Kona Sugar Company ...	500,000	5,000	500,000	100	.....
McBryde Sug. Co. L'd. Assess	1,850,000	.....	1,036,000	20	8
McBryde Sug. Co. Ltd. Pd up	1,650,000	.....	1,650,000	20	10 $\frac{1}{2}$
Nahiku Sug. Co. Ltd. Assess.	675,000	33,750	.....	20	.....
Nahiku Sug. Co. Ltd. Pd. up	75,000	3,750	.....	20	.....
Oahu Sugar Co. ....	3,600,000	36,000	3,600,000	100	137 $\frac{1}{2}$
Onomea Sugar Co. ....	1,000,000	50,000	1,000,000	20	30
Ookala Sugar Plantation Co.	500,000	25,000	500,000	20	14
Olaa Sugar Co. Ltd., Assess.	2,500,000	125,000	865,000	20	3
Olaa Sugar Co. Ltd., Paid up	2,500,000	125,000	2,500,000	20	13 $\frac{1}{2}$
Olowalu Company ...	150,000	1,500	150,000	100	.....
Paauhau Sug. Plantation Co.	5,000,000	100,000	5,000,000	50	.....
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	10
Waiialua Agricultural Co. ...	4,500,000	45,000	4,500,000	100	90
Wailuku Sugar Company ...	700,000	7,000	700,000	100	370
Waimanalo Sugar Company	250,000	250,000	250,000	100	155
Waimea Mill Company ...	125,000	125,000	125,000	100	87
MISCELLANEOUS					
Wilder Steamship Company	500,000	5,000	500,000	100	100
Inter-Island Steam Nav. Co.	600,000	6,000	600,000	100	100
Hawaiian Electric Company.	300,000	3,000	300,000	100	110
Honolulu R. T. & Land Co. ...	250,000	2,500	250,000	100	.....
Mutual Telephone Company	150,000	13,900	139,000	10	9 $\frac{5}{8}$
Oahu Railway & Land Co. ...	4,000,000	40,000	4,000,000	100	105
People's Ice & Refrig. Co. ...	150,000	1,500	150,000	100	85
BANKS					
First National Bank ...	500,000	5,000	500,000	100	.....
First Am. Sav. B. & Trust Co.	250,000	2,500	250,000	100	.....
BONDS					
Amt. of Issue					
Hawaiian Govt. 5 per cent. ...	1,251,200	} Dec. 31, 1900		.....	92 $\frac{1}{2}$
Hilo Railroad Co., 6 per cent	450,000	}		.....	100
Hilo R. R. Co., 6 per cent	150,000	}		.....	.....
Hono. R. T. & L. Co., 6 p. c.	300,000	}		.....	.....
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	}		.....	.....
Olaa Plantation 6 per cent. ...	1,250,000	}		.....	.....
Waiialua Agr. 6 per cent. ....	1,000,000	}		.....	.....