THE HAWAIIAN

PLANTERS' MONTHLY

PUBLISHED FOR THE

HAWAIIAN SUGAR PLANTERS' ASSOCIATION.

Vol. XVII] HONOLULU, JANUARY 15, 1898. [No. 1

It is apparent, says the American Grocer, that coffee must be cheap throughout 1898, or until there is some marked change in the crops of the world, or until consumption increases more rapidly than production. It is now growing surprisingly fast, and must continue to increase, as the result of low prices, better average quality, and keener competition.

Another new industry being agitated in the United States is camphor growing, the price of camphor having advanced very much. The United States Government are trying it in Florida, with encouraging results. The tree appears to thrive at any elevation almost, begins to yield camphor from the leaves in about four years, and can be inter-planted in coffee or tea until its success as a separate culture is assured.

USES OF FRUIT—1. To furnish the variety of the diet. 2. To relieve thrist and introduce water into the system. 3 To furnish nutriment. 4. To supply organic salts essential to proper nutriment. 5. To stimulate the kidneys, increase the flow of urine, and lower its acidity. 6. To act as laxatives 7. To stimulate and improve appetite and digestion. 8. To act as antiscorbutics.—Dietetic and Hygienic Gazette.

California lemons are seriously interfering with the Mediterranean article. It is only recently that the California lemons came east of the Mississippi, but now they have made their way into the Central States and this autumn large quantities of them have come to the Atlantic coast. This development of the California lemon trade promises to seriously restrict the business in imported lemons and possibly to drive them out entirely.

A Pomona (Cal.) correspondent writes that an orange grower there has sold the oranges on his ten-acre orchard for $5,300 on the trees. His trees are only eight years old, and since they have come into bearing he has realized $16,000 on them. This is one of California's Klondikes. The orange crop in Southern California is, however, subject to frosts, though not so badly as in Florida. These frosts reduce the crops in each state, not oftener than once in five or more years.

Arbor Day.—When the Hon. J. Sterling Morton was governor of Nebraska—that State of all others which felt the want of trees in its territory—he suggested the establishment of a special day on which instructive lessons should be given to children and others as to the value of trees. In this way Arbor Day was founded. It has been so successful in America that they are thinking of following the example in the Old World. The sentiment is to be favored by the extension of fruit culture, and in England, the apple tree is the one proposed to be selected for the Arbor Day exercises.

Orchard Cultivation.—Good tillage increases the available food supply of the soil; it also conserves its moisture. Trees should be made to send their roots deep into the soil, in order to fortify against drought. This is done by plowing the orchard rather deep. This deep plowing should begin the very year the trees are set out, and it should be continued every spring until the habit of the tree is established. Moisture is retained in the upper soil by frequent, but shallow tillage, by means of which the surface of the land becomes a mulch for the soil beneath.

From Vancouver to the Klondyke fields there are many routes, but the most favored are by steamer from Vancouver to St. Michael's, at the mouth of the Yukon River, and thence up the River to Circle City, or Dawson City (the centre of the fields), or by steamer from Vancouver to Dyea or Skagway, taking the trains thence across the mountains to Lake Linderman, thence by a series of rivers and lakes to Dawson City. There are steamers running regularly from Vancouver to Dyea or Skagway, and the rates are—first class, $40; second class, $25. The fare by the St. Michael's route is—first class, $150; second class, $125, right through to the fields. The Yukon River, however, is only open for three or four months each year—namely, May, June, July and August.—Exchange.

The largest coffee estate in Brazil comprises 110,000 acres, of which 13,000 are planted with coffee, and 20,000 more are suitable for coffee trees. It was sold recently for $5,838,000. The trees in bearing rose from 1,300,000 in 1892 to 2,096,500 in 1895. The profit in 1895 was $637,000; the estimated profit for 1896 is set at $711,000. The total number of trees in this plantation was, in June 1896, 4,426,604, of various ages, and it is estimated that two-thirds of the trees being new, from 1897 onwards, an average harvest of 100,000 bags (13,200,000 pounds) may be expected, and that, in three or four years, the yield may increase to 250,000 bags or about 32,500,000 pounds per annum. The next largest estate in Brazil is of 9,785 acres, with 1,800,000 trees, populated by nine colonies with 260 families, furnishing some 1,500 laborers. There are several other plantations on which grow more than 1,000,000 coffee trees.

It is too early to predict what the sugar crop of these islands will be for the present year, but it will probably not equal the last, as the weather throughout the islands has been very dry during the summer and autumn, but it will not exceed that of 1897, which was 222,000 long tons. Considerable improvements and changes have been made in a number of our mills, with a view to increase the extraction of juice. Several artesian wells have been sunk on Maui, which will bring under cultivation small areas of land that formerly were considered as waste land. At present Kauai, Oahu and Maui are the only islands of the group, on which artesian water has been found and utilized. The lava rock formation of Hawaii is of too recent origin to permit artesian supplies being found, but there are no doubt reservoirs of rain water in the caverns of Mauna Kea and Mauna Loa, which can be tapped, and the water brought down in flumes, as has been done in Kau. But the supply from these sources is quite limited and uncertain. For the main part, the Hawaii plantations will have to rely on rain as heretofore for the cultivation not only of cane, but all other products.

:o:

THE SUGAR MARKET.

There has been a decided improvement in the American and European sugar markets, caused by a discrepancy of 125,000 tons in the European sugar estimates, and also by an exhaustion of the large American overstock imported in anticipation of the increased rates of duty imposed by the Dingley Tariff Act. We stated in August last, that this would probably be the case, about the close of 1897. The latest quotation is $4\frac{1}{8}$ cents for Cuban centrifugals.

Willett & Gray say: "It is becoming evident that some of the cane-producing countries will not have the amount of sugars this year which they had last year. This is particularly true of Brazil, which will produce about 20 per cent. less sugar than last year, and, thus far, nearly the entire amount produced has gone to European markets which have paid $\frac{1}{4}$c. above our parity. This crop will come to an end early next year. Much the same conditions exist in Demerara, and, inasmuch as we received about 700,000 tons beet sugars from Europe last season, it is evident that sooner or later our refiners must enter the foreign markets, but this need not be until some time in 1898. It should also be noted that the European markets are advancing, independent of any demand from America, which is an indication that the supplies of sugar in Europe are not so excessive as they might be, but are sufficiently limited to warrant a further advance under favorable conditions. Taken altogether, the sugar situation is one of great strength, leading to the opinion that a gradual improvement in prices must continue throughout the present campaign to next October."

The lastest summary of the statistical position, as reported by Willett & Gray, shows stocks in the United States and Cuba together of 297,872 tons, against 326,409 tons the previous week, and 288,453 tons last year—a plus of 9,419 tons over last year.

Stocks in Europe last week, 1,907,500 tons, against 1,496,800 tons the previous week, and 2,030,022 tons last year. Total stocks of Europe and America last week, 2,205,372 tons, against 1,823,209 tons the previous week, and 2,318,475 tons last year at the same uneven dates, and 2,502,037 tons at even date of December 1 last year. The deficiency of stock last week was 113,102 tons, against a deficiency of 125,784 tons the previous week, and a deficiency of 6,733 tons December 31, 1896.

———:o:———

A NEW AND VALUABLE AGRICULTURAL SERVICE.

Some two or three years ago, the United States Government established a new branch in its agricultural department, devoted to the investigation of soils in their relation to climate and moisture. This division was placed in charge of Prof. Milton Whitney, whose investigations have been spread over a large portion of the Union. The past year has been devoted to the study of the climatic conditions of moisture and temperature in relation to crops of both cereals and fruits. His work covers a very wide area, and embraces soils and climates in every section of the Union, from the Atlantic to the Pacific, and their relation to growing crops of every kind. Among the things he is investigating is the normal water contents of different soils in different parts of the country, and the amount of moisture required for the successful growth of various crops.

He commenced on soils used by truck gardeners and tobacco growers, and has ascertained some marvelous results. For instance, it is stated, in the matter of growing tobacco, that tobacco wrappers that are grown on the light soils of Connecticut, require but seven per cent. of the moisture, while the fillers, which are best grown on the heavy soils of Pennsylvania and Ohio, require twenty per cent. The investigation of wheat and the actual amount of water required for its maturity will follow next, and subsequently, the data as to other crops.

The investigation of the western soils, made with the aid of the weather bureau, which covers lower California, the San Joaquin valley, the great Palouse district, comprising the fertile wheat growing districts of California, Oregon, Washington and Montana, the Yellowstone valley, the Red river valley and also the Mohave and Nevada deserts, has developed some most astounding facts and some which the department of agriculture is not yet able to explain. Professor Whitney says the results ascertained regarding these soils will make the most remarkable chapter in the history of the world's agriculture. Although these soils, excepting the Red river and desert districts mentioned, have only from one-fifth to one-half of the annual rainfall received by the territory east of the Mississippi river (that is, from seven to twenty inches), they seldom, if ever, suffer from drought.

In the Mohave and Nevada deserts the annual rainfall averages only about five inches, but beneath the alkali crusts the soil is always moist, a fact which the scientists have as yet been unable to explain. In fact, little is yet known of the power of the soils to hold water in different sections of the Union.

As artesian wells show water in all these districts from forty to two hundred feet below the surface, it is considered possible that there is a slow and continuous movement of water upward from the artesian sources which are beyond the influences of the local climate.

It will be remembered that Horace Greeley, after traveling through the State of California in 1850, declared that wheat and other grains could never be successfully grown in that dry state. Yet within ten or fifteen years after his visit, the farmers there raised the finest wheat and made the best flour that has been produced in America. He formed his hasty opinion from the arid appearance of the surface soil in every part of the state. The subsoil, which had not then been turned up, proved to be very different, and just what grains required.

Some thirty or forty years ago, a gentleman desirous of starting a sugar plantation, sent to England a sample of the red volcanic soil that is found so abundant on Kauai, Oahu and Maui, to have it analyzed as to its fitness for raising sugar cane. After some months delay, the answer returned was, that such soil was wholly unfit for growing cane, as it had too much iron in it, and if the cane grew, the chances were that it would produce very inferior sugar. The astonishing results of the past few years, on our red volcanic plains, have demonstrated how little was then known of the requisites for a successful sugar plantation, even among professional experts.

COST OF BEET AND CANE SUGARS.

A correspondent of the Louisiana Sugar Planters' Journal thus writes of the cost of beet and cane sugars, and the dependence of the former on bounties. Not only can cane sugar be produced to compete at less cost than beet sugar, but the latter cannot be produced to compete with cane sugar without assistance from the state. It is not probable that the bounty now given by the European governments to aid the beet interest, will be entirely removed, but it may be reduced in the near future, should one or two of the leading governments initiate the measure.

"Professor Wiley, of the U. S. Agricultural Department, has several times, in his writings upon the cost of producing sugar in the United States, placed the average cost at about 4 cents per pound. Under continued improvements in machinery and methods, the cost has been reduced within the past two or three years and may be fairly set down as not far from 3 cents per pound for raw and 3½ cents per pound for refined beet sugar, to which must always be added the cost of marketing and shrinkage; and home produced sugars must be sold in competition with imported sugars, the price of which to consumers is maintained at the lowest point consistent with the foreign cost, with duty, freight, refining and handling added. As German granulated sugars have been sold in this market as low as the actual cost of producing beet sugars in this country, and are constantly imported at rates pro rata to the actual cost of production in Europe or even less, which can be done under the export bounty system of Europe, it will be seen that the production of beet sugar in the United States is dependent for existence upon tariff protection, or other protection in the form of Government or State bounty.

"That cane sugar can be produced in tropical climates at much less cost than beet sugar can be produced either in Europe or this country, is a fact beyond question, and cane sugar has always this advantage over beet sugar, that it is fit for consumption as food at any stage of its making from low grade yellows to the highest refined granulated or hard crystals; while beet sugar must be refined from the alkaline impurities of the lower grades, in order to make it suitable for food. Hence it is not likely that the production of cane sugar will be superceded wholly by beet sugar; neither can the present export bounty system of Europe continue without detriment and loss of revenue to the sugar bounty paying countries."

———:o:———

THE ANNEXATION OF HAWAII.

Nearly all, if not all, the objections made to the annexation of Hawaii, as a territory, to the United States, are based on misstatements, that can have very little weight when the truth is told, as has also been the case in all previous annexations of territory, from that of Louisiana in 1803-4 to that of Alaska in 1867. In one of our late Louisiana exchanges, we find the following:

"Why admit that country, with its large majority of illiterate people, lower in the scale of civilization than the Negro, and with it bring a territory whose products will terribly cripple the great sugar industry of Louisiana, California," etc.

There are very few "illiterate" Hawaiians, and these are mostly old people, born before the government and schools were established. All those under fifty years of age can read and write, and all children are compelled by law to attend school. In this respect, education and schools in Hawaii are more advanced than in some parts of America; and it may justly be maintained that our school system is as liberal and thorough as that of any European or American country, and Native Hawaiians are far superior to Mexican or Alaskan Indians, to which some ignorantly compare them, although the latter have been received under various annexations, into the Union. Hawaiians are also far superior as laborers and mechanics to Indians or Mexicans, and thousands of them are possessed of comfortable homesteads of their own, with houses and homes of their own, cultivating their own lands, and supporting their families with their own industry. They certainly are equal to and many of them superior to the negroes of the Southern States. In admitting them into the Union, a population will be received, capable of becoming, in all respects equal to the men who are now in Washington, as representatives of the Hawaiian people.

Again, the paper already quoted, says: "It will cost the Government far more to conduct affairs in Hawaii than the revenue received from it, and while sugar would there become a great industry, why break down already established industries here to accomplish that result?"

Hawaii is a self-supporting state, and it will not cost the U. S. Government any more, if as much as did California, Arizona, or Alaska, and probably very much less than either. Hawaii does not seek to come in as a state, but as a self-supporting territory, and would remain such for twenty or thirty years or even longer, capable of re-couping to the national government all that the latter might expend on her.

As to the sugar industry, the United States have had to rely on foreign cane and beet sugar in the past, and will for many years have to import it, as Louisiana cannot, under any circumstances, produce more than one-eighth of the whole consumption, which is every year increasing. Nor will the beet interest receive any check from Hawaii, whose sugar production has about reached its limit, and which will probably always be about the same as that of Louisiana. These combined cannot produce one quarter of the supply required by the United States. Granting that the beet sugar interest in America may, during the next fifteen years increase so as to supply 2,000,000 tons annually at the end of that term—and this amount is more than Germany has been able to do in fifty years, aided with princely bounties—it must not be forgotten that at the end of that fifteen years, the consumption of sugar in the United States will have increased to 3,000,000 tons annually, still requiring importations from foreign countries.

So far as the Hawaiian sugar question bears on annexation, it can have no weight against it. On the other hand, it should be in favor of annexation, inasmuch as the industry is mainly carried on by American capital, employing American labor in American foundries and American shipping. Hawaii is today practically an American colony, and we only ask that it may become such de facto. We believe that all true Americans will view this question in this light, if they examine it impartially. Hawaiian Annexation, once accomplished, will prove to be as wise and beneficial an act as either of the annexations that have preceded it, though each has been opposed by many wise statesmen.

We request our Louisiana exchanges to insert this Hawaiian view of the question now before the public.

———:o:———

REMARKS ON THE PRODUCTION OF HIGH GRADE SUGARS.

EDITOR OF PLANTERS' MONTHLY:—The difficulties of graining the No. 2 sugar in the pan, and obtaining an always even high grade, are well known to many sugar boilers in the islands, and the preplexing nature of them is sometimes annoying and disgusting. While there is occasionally no difficulty to produce such a grade of sugar of 94 and even 96% polarization, at other times a slow drying sugar of 89 or thereabout will result, through which the drying and subsequently the total capacity of the factory may be seriously impaired. In the one case we have to deal with a molasses of high purity, while in the other the special viscous nature and not always low purity of the molasses, renders the production of a higher grade impossible, and if the shipping of such a sugar should be objectionable, remelting must be resorted to, which again may cripple the capacity of the house. As I have also suffered from these difficulties to a greater or lessor extent, I decided, if possibe, to do away with the boiling and graining of the No. 2 altogether, by applying Dr. Bock's process of crystallisation in motion, in part only, to the No. 1 masse cuite. As it gave satisfaction, both in quality and quantity, from the very start, we have been producing our sugar by this method since June last and if properly and carefully carried out gives excellent results.

The modus operandi of this process, which without additional outlay can be introduced into any mill, is as follows: The graining of the No. 1 is started low down in the pan and a medium sized grain is aimed at. As soon as the separation of the grain has taken place, No. 3 sugar remelted in water is boiled in, in proportion to its daily production, and evenly distributed over the daily strikes of No. 1. The strike is then taken along with syrup to within a certain limit of the pan's capacity, to be easily ascertained and fixed after the first strike. Now molasses, resulting from previous strikes, diluted to 30-35° Be, blown up and slightly skinned, is boiled in at the rate of 65 to 75% of the total molasses resulting from a strike, and the strike finished with it to the usual stiffness of the masse cuite, when it is dropped into the mixer and dried immediately. The formation of fine or false grain must naturally be avoided during this process, so as to utilize as much as possible of the sugar contained in the molasses, towards the growing or building up of the existing grain. The molasses resulting from strikes thus obtained, are mixed such as they come along, diluted, blown up, skimmed and boiled in over and over again, until the purity sinks low enough—64 or less—when a certain proportion of it is daily boiled into coolers as No. 3, which when dried is remelted and boiled in immediately, while the No. 2 results as No. 1 sugar of 97, or even higher, polarization, from juices of an original average purity of 87½.

Owing to the viscous nature of the molasses, it sometimes happens, that the boiling in of it, as also the boiling down of the strike, becomes a rather slow and tedious process. This I have found can easily be overcome by Classer's method of introducing steam into the strike through a perforated coil placed on the bottom of the pan, through which the evaporation of the liquid about the coils, especially toward the end of the strike, is greatly accelerated.

Sugars thus produced dry well and do not deteriorate, if sufficiently machine-dried, and obtained from juices properly limed. Under proper liming I understand a distinct alkalinity of the juice and a light-yellow, clean color of the resulting sugar is obtained. The yield, as far as it can be estimated from clarifiers, has been higher than when producing two grades, *i. e.*, first and second, for shipment.

H. POHLMANN.

Pahala Plantation, Kau, Hawaii.

———:o:———

THE MARSH PUMP AT MAKAWELI.

EDITOR HAWAIIAN PLANTERS' MONTHLY:—In answer to inquiries, Mr. O'Dowda, sugar boiler of the Ewa Plantation, has been kind enough to publish in the December issue of your journal, a letter relative to the method used in that mill, for draining the vacuum pan coils and multiple effect, and in closing his article adds, "that if this plan were adopted by the diffusion process mills, their fuel bill would be much less at the end of the season." Now it is very evident from this latter sentence, that your correspondent knows very little about the methods adopted by diffusion process mills, in draining apparatus working under vacuo; or it may be, as I have concluded, that Mr. O'Dowda takes the Ewa plant, as it was when worked by the diffusion process, and compares it with what mills are now working by this method. If so, then for his particular instruction, and those interested in milling in general, I will take in comparison, the methods adopted by the Hawaiian Sugar Company at their Makaweli diffusion mill, and leave it to the judgment of those interested, to decide whether the method adopted at Ewa is more profitable, than that adopted here, or in general use on these islands.

The system employed at Ewa, of the coils draining into a container, which must necessarily carry a certain amount of water (condensed steam) and to which is attached at bottom the suction pipe of the Marsh pump. Here I claim in the first place, a certain amount of steam is lost, the container acting as a surface condenser to tail pipes of vocuum pan, and in a like manner to the first vessel of the multiple apparatus, from the fact of this container having to carry a certain amount of water. We all know that the Marsh pump is a very efficient machine, and as I was informed some months ago, by a prominent planter of this island, it would pump anything, even dry steam. Your correspondent is probably under the impression, that what steam is not being condensed in the coils of his pan, or heating surface of his evaporator, is being pumped back to the boilers in its original state. Now allowing that his steam is all condensed before it reaches the suction valve of his pump, what about the steam necessary to drive it? This raises the question, does the saving of a few degrees in the temperature of his feed water to the boilers (by being pumped back direct) pay for the cost of steam to drive the pump, leaving the cost of the pump aside, and the amount condensed by the water in container? I think not.

The supply of steam to the vacuum pans at Makaweli, is on precisely the same principle, as that at Ewa, *i. e.*, a large reducing steam valve is placed near the pan inlet steam main, to regulate the "what is found locally, to be the most economical pressure for use in the pan coils," to each coil is attached a drain pipe, fitted with an ordinary check valve, so that when steam is opened on any one coil, it does not escape or return to any other on which steam has not been admitted. Each of these tail pipes are connected to a main pipe of sufficient area, to drain all the coils when under pressure, and to this main pipe is attached a "Schneider & Helmecke" steam trap, the dimensions of which for a 25 ton pan is only 18 inches diam. by 24 inches high, leaving a minimum surface for condensation of any steam that may leave the pan coils in a dry state. From this trap, a discharge pipe is led into the hot well for supply to boilers, by the usual feed pump, and where the water from vacuum pans, and first vessels of the evaporator, maintains a temperature of 203° Fah. I may here add that the top vessels of our evaporator are drained in exactly the same way, but without the necessity of a check valve.

I am confident in saying, that the Kealia people with their diffusion plant, understand all about the saving of steam from drain pipes. With reference to Mr. O'Dowda's opinion, that 55 pounds pressure per square inch is the correct pressure to work the vacuum pan coils with, I may state, that in my opinion, this is a point governed entirely by local circumstances, such as length and size of coil, make of pan, etc., and can only be decided by actual experience. At the Hawaiian Sugar Company's mill, our vacuum pans do not require more than 20 pounds pressure per square inch.

I trust that in future, when Mr. O'Dowda has any work for his pen, that he will study well the object in view, before suggesting what should be done by plants of which he is totally ignorant.

Respectfully yours,

JAMES SCOTT,
Chief Engineer.

Makaweli Plantation, Kauai, 23rd December, 1897.

———:o:———

VIEWS OF AN EXPERIENCED BOILER.

In a recent issue of the "Evening Bulletin" the attention of the sugar boiler was called to the report on manufacture of sugar. As I have had some practical experience, both here and in Germany, I beg to be allowed to bring some of my observations to the notice of interested parties.

In the first place there has been but little progress made in the actual manufacture of sugar in the past ten or twelve years. The attention of the planters has been concentrated mostly on the extraction of cane juice, and the boiling department has not kept pace with the milling. I am glad to hear that Professor Maxwell has recommended less maceration; this has been carried greatly to excess since the addition of second and third roller mills. The juice obtained by high maceration we are unable, at the present state of manufacture, to work to any advantage into a marketable product. High maceration depreciates the sugar considerably in quality and has not the effect as supposed to increase the quantity.

I know that this statement will be considered ridiculous by many manufacturers, but for those it is very easy to convince themselves. A test is easily made by running, say, one week with 4 to 5 per cent. and the next week with 14 to 15 per cent. maceration. Of course a scale is necessary for weighing the cane to get at the correct figure. Now with low maceration the mill is running like clock-work; with high maceration there is a little lack of steam, the boiling house is crowded—juice that ought to have been in the effects 40 minutes sooner begins to get cool, inversion sets in on account of the low density, overtime is made, the cooler room gets crowded and low grade sugars have to be dried ahead of the proper time, at a sacrifice, to make room for new lots. At the end of the week we find our effects have accumulated more scale and a larger cleaning force has to be put on. Finally we draw the balance; we find the shipping report a little lower, and the sugar on hand in cooler columns shows higher; the polarization is from 0.5 to 0.8 lower; everybody has worked harder, there has been more wear to the machinery, and what have we gained?

The gain consists in 4 to 5 gallons more of waste molasses to the ton of sugar, with a considerably higher percentage of sugar. Now every manufacturer knows what a nuisance waste molasses is. A market value it has not, under the present circumstances. Even when applied as a fertilizer it is very doubtful as to its value there, because of its tendency to grow a very rank and impure cane. It is my firm belief that maceration has to be moderated until the problem of waste molasses is solved. It is true that the yield of sugar per acre is 30 per cent. higher against former years, but the credit is mostly due to far better cultivation of the cane.

In regard to evaporating effects, the machinery in use here is fully as good as that in Germany. The difference lies chiefly with the juice. In German factories the juice is highly clarified and filtered before being subjected to evaporation, and the accumulation of scale, therefore, but very slight. Besides, the water used for condensing is almost up to freezing point, which quickens the concentration of the juice considerably. It has to be admitted greatly to the credit of the Hawaiian planter that he has spent his money freely for new improvements to effect better results. In regard to the drying of sugar, I doubt very much that any benefit could be derived by the appliance of blasts or pans, as suggested at the last meeting, to obviate the difficulty of the sugar leaving the centrifugals too hot. This should be rectified at the vacuum pan. At the closing in of a strike the temperature of the vacuum pan should be greatly reduced and the sugar be kept as long as possible in the mixer. This proceeding will greatly increase the percentage of No. 1 sugar, besides deriving better results from the low grades.

A certain amount of heat in the sugar is necessary to absorb the moisture, and a too rapid cooling of the sugar will make it clammy and sticky. The general adoption of steel scrapers instead of wood paddles would hardly be advisable. Besides destroying the centrifugal screens, much valuable time will be lost, and time is a rare article in a sugar mill in operation. Carefully prepared sugar will stand the voyage to New York all right without any loss to quality.

I was told once by a prominent Hawaiian planter that he had found pletny of people without money, but never a one without an excuse. Now the excuse about the centrifugals being in bad working order is a very poor one, in my estimation, for any sugar boiler to make. Of late there have been a few young men of sanctimonious habits, after only a few months experience in the mill, pressed into the service, without any previous training whatsoever. A little more prudence in the selection of sugar boiler will undoubtedly bring the centrifugals up to standard work all right. Badly crystallized sugars will not dry well under any circumstances.

The instructions issued by Professor Maxwell in regard to liming juice should be highly appreciated. It shows that the trusty laboratory is alive to the interest of the planter. Perhaps a slight warning against excess in liming would not be amiss. Overlimed juice will form a hard scale in the effects, and a dull evaporator will convert a slight percentage of otherwise crystallizable sugar into waste molasses.—Honolulu Bulletin.

GUS. FROBOESE.

Kahuku, December 1, 1897.

:o:

THE AMERICAN ORANGE CROP.

The following items are from the Los Angeles Rural Californian:

The magnitude of the California orange business is somewhat forcibly brought to mind by the fact that tissue paper wraps are being ordered by the ton for the Riverside district alone. One ton makes about a million wraps, and it is thought that some 150 tons will be required. A goodly portion of this immense quantity will be printed. If the orange growers do not realize remunerative prices for the incoming crop, it will be for want of good judgment in marketing it. If you have realized on your crop get out of debt. Stop all leakages, cease to pay interest, and put the farm into a money-making condition. The matter of enforcing the one cent per pound duty on oranges and lemons is causing the custom house officials some worry. The fruit schedule provides for a duty on the fruit, but not on the box or package containing it, which is, however, provided for in the lumber schedule at 4½ cents per box. To ascertain the net or actual weight of fruit means to take it out of the original package, weigh it, and put it back—an operation liable to cause damage to the fruit for which, in the opinion of good lawyers, the government is liable. The operation of the law under these conditions is liable to bring up some nice legal points for the courts to decide. The Fruitman's Guide estimates the damage on lemons so handled at 50 cents per box, and in some cases even more. The new tariff amounts to about 85 cents per box, instead of from 20 to 23 cents under the old bill. The increase of revenue is estimated at $200,000 more for the season than it would have been under the Wilson-Gorman bill. Five hundred millions of dollars, an agricultural crop sharp estimates to be the increase of the farmers' receipts in this country on account of the rise in prices,—an apt illustration of the law of supply and demand.

REASONS FOR CULTIVATING THE SOIL.

By Milton Whitney, Chief of the Division of Agricultural Soils, U. S. Department of Agriculture.

How Water Enters the Soil.—Water is the most abundant substance found in living crops. Not only does it form by far the largest proportion of all fresh vegetable substance, but, on account of loss through evaporation from the leaves of growing plants and the necessity of replacing this loss, thirty or forty times more water is needed during the growing period of a crop than is contained in the crop when harvested. Plants require a large amount of water for their life and growth, and it is necessary that the supply should be abundant at all times. If the evaporation from the plant greatly exceeds the amount taken in through the roots, the leaves wilt and the plant suffers.

Therefore one of the most important functions of the soil in its relation to crop production is the maintenance of a proper supply of water. Rain falls, on an average, in the humid portion of the United States for two or three days in succession, and is then followed by an interval of eight or ten days of fair weather. As plants are fixed in their relative positions in the earth, the soil, in order to supply them with water during the fair-weather period, has to offer such a resistance to the percolation of the rain that an adequate supply shall be held back. On account of this resistance, due to the friction which the rain encounters in the minute spaces between the soil grains through which it has to pass, the movement is very slow and only part of the water sinks below the reach of plants before the next rainfall occurs.

The resistance which soils, owing to their difference in texture, offer to the percolation of the rain varies greatly. Light, sandy soils maintain comparatively little moisture, because the spaces between the grains are comparatively large and there is relatively but little resistance to the flow of water, so that the rainfall moves down quite rapidly until there is only five or ten per cent. of moisture present in the soil. Strong clay soils, on the other hand, have very minute spaces for the water to move through, and consequently offer a very great resistance to the percolation of the rain. These soils maintain, as a rule, from fifteen to twenty per cent. of their weight of water.

Different plants grow best with different amounts of water.

For instance, the pasture grasses thrive on a soil which is too moist for Indian corn, or even for the largest and surest yield of wheat. Some classes of tobacco thrive well on soils which are very retentive of moisture, while other classes can only be grown with success on drier soils. We are not concerned in this article with the amount of moisture which different soils maintain or with the amount of moisture required by different kinds of plants. We must recognize, however, that it is not possible nor desirable to maintain the same amount of water in all soils, for if this were done there would not be the opportunity for diversity in agriculture which we have under existing conditions.

While water is maintained for a time in the soil, as already explained, it is liable to be lost to the growing crop by evaporation from the surface of the ground or by being used up by weeds. The end sought in plowing and cultivation is to control the water supply by removing weeds and leaving the surface of the soil covered with a loose, dry mulch to retard evaporation. Many of our crops require no subsequent cultivation after they are put into the ground. Wheat, oats, rye, clover, grass, forest, trees, and, in general such crops as cover and shade the ground are not, as a rule, cultivated during their period of growth. On the other hand, such crops as corn, tobacco, cotton, potatoes, and fruit trees require cultivation during their early growing period, although even with these crops cultivation ceases after they have attained considerable size, and is rarely practiced during the ripening period.

The principal object of plowing is to loosen up the soil, for four purposes: (1) To enable the soil to absorb the rainfall more quickly and more freely than it would in its undisturbed condition; (2) to maintain more of the rainfall near the roots of plants; (3) to admit fresh air to the roots of plants; (4) to enable the roots of the young or quickly growing plants to penetrate the soil more easily.

The principal objects of subsequent cultivation, whether with plow, cultivator, cotton sweep, harrow, hoe, or rake, are (1) to prevent loss of water by weeds and grass, which use up great quantities; (2) to keep the surface covered with a loose, dry mulch in order to prevent, so far as possible, loss of water by evaporation. Water is thus conserved for the use of crops, and the supply is more abundant and more uniform than it would have been without the cultivation.

A soil with a compact surface quickly dries out, and the water supply fluctuates rapidly and excessively, to the detriment of most crops during their growing period. Weeds and grass are generally to be excluded from the crop because they transpire great quantities of water which would otherwise have been at the disposal of the crop. Weeds are, however, occasionally of advantage to the crops, especially during the ripening period, because they help to dry out the soil and thus hasten the maturity of the crop.

Some of our crops, therefore, do not require cultivation, because they shade the ground and prevent evaporation and prevent grass and weeds from springing up and diminishing their supply of water, or because they are deeply rooted and can bring water up from considerable depths. Other crops can not protect their water supply in this way, and it must be artificially controlled by methods of cultivation.

PRINCIPLES OF PLOWING.—The common plow is essentially a wedge-shaped instrument, which is forced through the soil to loosen it. The topsoil is forced aside, thrown up, and usually turned over. This action loosens the soil by separating the soil grains. The loose soil occupies more space than the compact soil did, and a cubic foot of the former, therefore contains more space for water to enter. Each separate space, however, is also larger and has less capillary action and a smaller power of drawing water to the surface. If the soil, by reason of its fine texture or wet condition, is lumpy after the plowing, the spaces in the soil will be of very uneven size, and it frequently happens that the surface of the ground is not left in a suitable condition to draw water up from below. If small seeds are sown on such a rough surface, they are liable to suffer for lack of moisture. It is customary, therefore, and very advisable in such cases, to harrow and roll the seed bed until all the larger lumps are broken down and the surface is left smooth and even, in order to insure a supply of moisture to the seed during the germinating period. However, soil which has thus been rolled will lose more water by evaporation than soil which has been simply harrowed. The evaporation of this moisture is an incident which it is not always possible or desirable to prevent. With some crops the surface may be harrowed after the seed has germinated. This is desirable when it can be done without injury to the crop, as i- tends to retard evaporation.

There is one serious defect in the principle of the common plow which, upon some soils and with certain kinds of plowing, is liable to have very serious effects. If a field is plowed for many successive years to a depth of six or eight inches the tendency each time is to compact the subsoil immediately below the plow, thus rendering it more impervious to water; that is, the plow in being dragged along plasters the subsoil just as a mason with his trowel would smooth out a layer of cement to make it as close and impervious to water as possible. This is undoubtedly an advantage to some soils, but, on the other hand, it is very injurious to many.

The injurious effect of this compact layer formed by the plowing is twofold. It makes it more difficult for the rainfall to be absorbed as rapidly as it falls, and increases the danger of loss of water and injury to the soil by surface washing. Soils plowed at a depth of three or four inches, which is quite common in many parts of the country, would have a thin layer of loose material on the surface, with a compact subsoil below, into which water would descend rather slowly. With a rapid and excessive fall of rain, the light, loose topsoil is liable to be washed away by the excess of water, which can not descend into the subsoil as rapidly as it falls. This washing of the surface and erosion of fields into gullies occasion the abandonment of thousands of acres of land. The field will not wash so badly if it is not plowed, and, on the other hand, it will hardly wash at all if the cultivation is deeper and the subsoil left in a loose and absorbent condition. The deeper the cultivation, the greater the proportion of rainfall stored away and the less danger of the erosion of the surface soil and the less serious the defect of our common method of plowing. While there is less danger from washing, however, with deep cultivation, there is still a tendency towards the formation of a hardpan at whatever depth the land is plowed. No simple modification of the ordinary plow or of the subsoil plow will overcome this defect. It will require a change in the very principle of the implement. The plow should not cut through the soil, but break it apart so as neither to compact nor puddle it by being dragged along over the subsoil.

While all other farm implements and machinery have been improved, especially within the last fifty years, so that we are able now to harvest more crops than ever before and to handle our crops to better advantage, our common plow has not been essentially improved or modified in any important particular, except as to mechanical construction, since the days of the early Greeks and Romans. It would seem only necessary to call attention to this, the fundamental and simplest principle of agriculture, to have some new method devised of stirring the soil without compacting the subsoil.

The highest art of cultivation which has ever been practiced is that of trenching, so extensively employed in England and so earnestly advocated by the early English writers on agriculture. With a large class of lands there is no implement so effective for loosening and improving the soil conditions as the spade. The spade does not cut the soil from the subsoil as the plow does, but breaks it off, and there is little or no disturbance and no compacting whatever below that point. Every one is familiar with the difference in the tilth of a garden which has been thoroughly spaded and of a field plowed in the ordinary way. This old method of trenching with a spade can not, of course, be used in the extensive systems of cultivation practiced in this country, and it is now used in England much less than it was years ago, but if this principle could be worked into a practical method of cultivation it would be of great benefit to agriculture.

Principles of Subsoiling.—At the present time little is known definitely about the practical value of subsoiling. In certain localities it has or has not been found to be beneficial to crops. There is a wide difference of opinion upon this fundamental point. Fifteen or twenty years ago it was very generally advocated throughout the East by all of the agricultural journals. It was tried in a great variety of soils and under many conditions, and there is no doubt that in perhaps a majority of cases it showed no beneficial effects. This might have been expected, for no one method of cultivation can be equally valuable under the various conditions of soil, climate, and crops such as prevail over such a great extent of country. At the present the subject is being prominently agitated in some of the Western States, particularly in the semi-arid regions, and very favorable results are being reported through the local agricultural papers.

A few general principles only may be laid down for guidance in this matter. Subsoiling is rarely necessary in light, porous, sandy soils or in a climate where they are frequent light showers. It is not beneficial in heavy, wet soils, unless they are previously thoroughly underdrained. It is likely to be injurious if in the operation much of the subsoil is brought to the surface and incorporated in the surface soil, especially if the subsoil itself is in an unhealthy condition as regards drainage and contains poisonous matters which would be deleterious to plant growth. Poisonous matters frequently occur in subsoils as a result of improper aeration and the growth of certain minute organisms.

Subsoiling when properly done consists merely of breaking up the subsoil without bringing it to the surface or in any way incorporating it with the upper layer of the soil. In this respect it differs from deep plowing. The ideal subsoil plow consists merely of a tongue fashioned much like a common pick and hardly larger in its demensions—slightly smaller at the point than in the rear, but as small in all its parts as is consistent with perfect rigidity and with the nature of the soil through which it is to be drawn. This usually follows an ordinary plow. It should be run at as great a depth as possible, the endeavor being to get it at least sixteen or eighteen inches below the surface. It is often advisable by this means to break up a hardpan formed, perhaps, by long-continued plowing at a uniform depth or existing as a natural formation below the surface.

Subsoiling is likely to be beneficial, under the prevailing climatic conditions east of the Mississippi river, in any soils of medium or of heavy texture, provided the land has fairly good drainage. In the semi-arid region of the West it is likely to be very beneficial upon many classes of soils, especially where the rainfall occurs in heavy and infrequent showers and where it is necessary to increase the capacity of the soils to absorb water readily and rapidly.

Subsoiling, to be efficient, should be done a sufficient length of time before the crops are planted to insure to the soil a thorough soaking with rain; otherwise it may injure rather than improve the soil conditions for the first year. Subsoiling, by stirring the land to an unusual depth, favors the drying out of the soil, so that if it is not supplemented by a soaking rain before the seed is put in, the ground is drier than if the work had not been done.

There are few places in the West where this practice has been carried on long enough and under conditions necessary for beneficial effect. One such place, however, is at Geneva, Nebr., where subsoiling has been intelligently carried on for a number of years under nursery stock. The records of soil moisture which have been made at that place by this division through the present season show that on the average, through the months of June, July and August, there was ten per cent.

of moisture in the soil to a depth of twelve inches where ordinary methods of cultivation had been used, and fifteen per cent. where the land had been previously subsoiled. No crops were growing on the soils from which the records were kept in either case. This difference of five per cent. in the amount of water, or fifty per cent. increase over that in the uncultivated soil, is a very large amount and would doubtless have a very important effect upon the crop yield. This is confirmed by the actual yields on the two soils, as reported by Younger & Co., on whose farm the observations were made.

Further work will be done along these lines by this division, to establish these general principles. In the meantime great care and judgment should be exercised in deciding upon whether it is advisable to adopt this practice in every case.

Cultivation.—Cultivation as here used means the actual stirring of the surface after the crop is planted, either with a plow, cotten sweep cultivator, harrow, hoe, or other implement.

The object of cultivation is two-fold—to destroy weeds and thus prevent the great drain which they make upon the soil moisture, and to loosen and pulverize the surface, leaving it as a fine mulch, the object of which is to prevent evaporation. The first of these objects needs no further comment here. As regards the second object of cultivation, the result to be attained is to have the surface covered with a fine, dry mulch before the dry spell sets in, so as to conserve the water in the soil during dry periods.

Cultivation is usually most effective in the early stages of the growth of crops especially during the growth of the vegetative parts of the plant. It is usual to stir the surface after each rain. If another rain follows within a short time, this cultivation may do little or no good; but if a dry season follows, the cultivation may save the crop by its having diminished the evaporation. While cultivation does not add water to the soil, as some claim, it prevents excessive loss, and thus maintains more water in the soil, which means about the same thing.

The kind of treatment adapted to the cultivation of different soils depends upon local conditions, climate, and the kind of crop. The object sought is the same in all cases but the means of attaining it must be adapted to the local circumstances. As a rule, cultivation should be shallow, for two reasons, namely, to avoid disturbing the roots of the growing plants, and to avoid losing any more of the soil moisture than possible. A single cultivation after each rain is not necessarily enough, especially if a dry season is expected. The surface must be kept loose and dry, and this may require more than one cultivation, even if there has been no subsequent rain.

Few of our agricultural crops require cultivation after they have attained their vegetative growth, and a crop is frequently injured when cultivation is continued too long, because the soil is thus kept too wet, and the plants are not inclined to ripen as early as they should or to mature as large a yield of fruit or grain. Most of our grain crops will mature more seed if the ground is moderately dry during their ripening period.

UNDERDRAINAGE.—A soil containing too much water during the whole or a considerable part of the season should be underdrained to draw off the excessive amount of moisture. Most of our agricultural crops do better in a soil containing from thirty to sixty per cent. of the amount of water which the soil would contain if saturated. With less water, crops suffer; with more, they suffer from lack of air around their roots. Wheat may be grown very successfully, and will attain a perfectly normal development in water culture with its roots entirely immersed in a nutritive solution, provided the water is supplied with air at frequent intervals, but it will not grow in stagnant, saturated soil, not because there is too much water, but because there is too little air. A soil, therefore, which contains too much water contains too little air, and part of the water should be drawn off through ditches or tile drains.

Centuries ago the Romans used to overcome this trouble by planting the crop on very high ridges or beds, often eight or ten feet high and fully as wide. In this way alleys were provided at frequent intervals to carry off the surface water, and the greatest extent of surface was presented for the drying out of the soil, while the roots were kept at a considerable distance from the saturated subsoil. Storer states that some of these ridges are still to be found in localities in Europe. They are used today in a modified form in the cultivation of the sea-island cotton off the coast of South Carolina, but are being gradually given up as the practice of underdrainage is introduced, which is cheaper in the end and more effective.

Tile drainage is usually most effective in stiff clay soils and in low bottom lands, but it is occasionally beneficial in medium grades of loam or even in light sandy soils. It is practiced to a considerable extent in the light sandy soil of the truck area of the Atlantic Seaboard, where the question of a few days in the time of ripening of the crop is an important factor.

IRRIGATION.—If the climatic conditions are such that it is impossible, with the most improved methods of plowing, subsoiling, and subsequent cultivation, to maintain a sufficient amount of moisture in the soil for the use of crops, it is then necessary to resort to irrigation or the artificial application of water to the soil. It is not the purpose here to enter into a discussion of the best methods of irrigation, but simply to discuss briefly the general principles of irrigation as practiced in maintaining proper conditions in the soil.

Our ideas of irrigation should not be confined to the arid regions. To be sure, irrigation is much more important there than elsewhere, for without artificial application of water, crops could not be produced in many localities. In the humid portion of the United States, even in localities in Florida where they have from sixty to seventy inches of annual rainfall, irrigation is used successfully as a means of insuring the crop against drought due to the uneven distribution of the rainfall. It has been pointed out in several publications of this division that where the supply of water in different soils reaches a certain point, which differs according to the texture of the soil, crops suffer for lack of it. In the truck soils of the Atlantic Coast this minimum is approximately four per cent., while in the heavy limestone grass lands of Kentucky the pasture begins to dry up when the soils contain as much as fifteen per cent. of water.

Under our present modes of cultivation the farmer can do little for the crop during the time of actual drought. Ordinary cultivation is of comparatively little benefit during a prolonged dry season. Its most effective work is before the dry spell sets in. No matter what the value of the crop, and no matter how much this value is concentrated on small areas of land, there is practically but little to be done to save the crop. Irrigation should be used as an insurance against the loss of crops. A small pond fed by a wind mill would often save a garden or a small area of a valuable crop from destruction or great injury during a dry season. A small portable farm engine, which would be available at other times for cutting feed, thrashing grain, and other farm purposes, could be used to drive an irrigation pump during the dry seasons.

This would be particularly valuable for tobacco, truck, and other crops which are grown under a very intensive system of cultivation.

The object of all cultivation, in its broadest aspect, is to maintain, under existing climatic conditions, a uniform and adequate supply of water and air in soils, adapted to different classes of plants. This is the object alike of plowing, subsoiling, cultivation, underdrainage, and irrigation; they are all processes to be used in maintaining suitable moisture conditions for the growth of crops.—*To be continued.*

———:o:———

THE PRINCIPAL AMID OF SUGAR-CANE.

By Edmund C. Shorey.

[Reprinted from the Journal of the American Chemical Society, Vol. XIX., No. 11. November, 1897.]

It has been more than forty years since Lawes and Gilbert pointed out that in plants used as feed for stock, part of the nitrogen exists in the amid form. Since then several schemes of analysis have been devised by which to determine the amounts of different forms of nitrogen in plants, and numbers of analyses have been published in accordance with these schemes, so that it has come to be generally accepted by chemists that a part of the nitrogen of all plants, in the growing stage at least, is in the amid form. E. Schulze, who has done more than anyone else to advance our knowledge of the forms in which nitrogen exists in plants, states that the amid compounds vary with different plants, and also with the age and condition of the plant.

In 1892 I determined the total and albuminoid nitrogen content of a number of samples of mature sugar-cane. In the samples then examined I found the albuminoid to be about ninety per cent. of the total nitrogen. Analyses made later of another and less mature variety of cane, showed this non-albuminoid nitrogen to be sometimes as high as twenty-five per cent. of the total nitrogen. The albuminoid nitrogen was determined by precipitating with cupric hydroxide, taking special precautions to prevent any decomposition of the albuminoids by preliminary heating. No attempt was made at that time to determine the character of the non-albuminoid nitrogen.

In January, 1894, a paper was read by W. Maxwell before the Louisiana Sugar Planters' Association on "Organic Solids not Sugar in Cane Juice." The matter of this paper was subsequently issued as a bulletin by the Louisiana Experiment Station. In this paper attention was drawn to the fact already noticed, that all plants contain at some period part of their nitrogen in the amid form: a fact well known to chemists, but apparently overlooked by sugar manufacturers. After giving a number of analyses of cane juice, in which the difference between the total and albuminoid nitrogen was designated amids, Maxwell stated that the amid of cane juice was found to be asparagin, crystallized preparations of this body having been obtained. He made, however, no statements regarding the physical or chemical properties of the asparagin obtained, nor did he give any information as to how it was ascertained to be asparagin.

Some months after the publication of this paper, there was a discussion in the "Bulletin de l'Association des Chimistes de Sucrerie" between H. Pellet and W. Maxwell as to the possibility of the asparagin of cane juice affecting the polariscopic reading of such solutions. In view of this possibility I determined to make some preparations of the amid compound or compounds in cane juice, and ascertain the rotatory power of the same. This work was begun in January and continued until July of the present year, and covers every variation in age and condition of cane delivered at the mill this year, as well as some samples of very young cane.

As a result of this work I have found that the principal amid compound present in sugar-cane is *not optically active*, and is *not asparagin*, but glycocoll or glycocin, an amid not heretofore known to occur in plants.

The method of separating the amid was that commonly used, viz., precipitation with mercuric nitrate. To the juice obtained from the cane sample by pressure, a slight excess of lead subacetate was added, the liquid filtered, and to the filtrate an acid solution of mercuric nitrate was added, and the whole brought to faint acidity if strongly acid, by the cautious addition of caustic soda. The precipitate thrown down, which was white and flocculent, after being well washed, was decomposed by hydrogen sulphide. The filtrate from the mercuric sulphide, after being concentrated to a thin syrup, was allowed to stand, when abundant, well defined crystals were generally formed in thirty-six hours. The filtrate from the mercuric sulphide was always quite strongly acid, and the subsequent crystallization was found to be much more rapid, and the yield larger if the solution were neutralized with ammonia before concentration, and neutrality maintained during concentration by the continued addition of ammonia as the solution became acid again. This addition of ammonia made no difference in the character of the crystalline body obtained. The crystals after separation from the mother-liquor were purified by re-crystallizing twice.

The mercuric nitrate used was prepared as wanted by boiling mercury with an excess of nitric acid until no further reaction for mercurous nitrate was obtained. I have as yet made no analysis of the white insoluble precipitate which mercuric nitrate gives with the amid body in question.

The purified crystals were in the form of plates or four-sided prisms, belonging to the monoclinic system; glassy in appearance, quite hard, grating between the teeth and having a sweetish taste. They were soluble in cold water, but much more readily in hot, soluble in eighty per cent. alcohol, but insoluble in ether. In all, fifteen preparations of these crystals have been obtained, and in all cases the physical properties of the crystals and the chemical properties of the solution have been the same.

The mother-liquor from the crystals was found to contain other nitrogenous bodies not readily obtained in crystalline form, the nature of which has not yet been ascertained; but they are comparatively small in amount, and, since nearly the whole of the bodies precipitated from cane juice by mercuric nitrate can be obtained in a single crystalline form having the properties of an amid, it is quite justifiable to speak of this body as the principal amid of sugar-cane.

In examining this sugar-cane amid to ascertain if it were optically active, solutions containing from two to four grams of the substance per 100 cc. of water were examined in a 200 mm. tube of a Schmidt and Haensch half-shade polariscope, observations being also made on similar solutions after the addition of caustic soda or nitric acid. In no case was any rotatory power shown. As asparagin is slightly left-handed in water-solution, more strongly so in alkaline solution and strongly right-handed in acid solution it was at once evident that the sugar-cane amid must be an inactive form of asparagin, or some other body not asparagin. A more extended examination soon brought out other points of difference between the sugar-cane amid and asparagin; and on comparison of the properties of this amid with those of the other known bodies, it was shown unmistakably to be glycocoll.

The chief points of difference between asparagin and the sugar-cane amid may be stated as below:

	Sugar-cane amid.	Asparagin.
Water of crystallization.	None.	One molecule lost at 100° C.
Optical activity.	Inactive.	Left-handed in water solution.
Behavior with Fehling's solution.	Does not reduce on boiling.	Reduces on boiling.
Behavior when boiled in alkaline solution.	Gives off NH_3 only if alkali is quite concentrated, leaving HCN in solution.	Gives off NH_3, leaving aspartic acid in solutiou.

It will be noted that these properties of the sugar-cane amid are identical with those of glycocoll, and in addition to this correspondence, both produce a gray precipitate of metallic mercury when added to a solution of mercurous nitrate, and both give a red coloration with ferric chloride.

The reaction by which the sugar-cane amid is most readily distinguished from asparagin, and by which also its identity with glycocoll is thoroughly established, is that which results on heating in alkaline solution. As is well known, asparagin gives off ammonia when heated in quite dilute alkaline solution, leaving aspartic acid in solution. On the other hand, glycocoll and the sugar-cane amid do not give off ammonia when heated in alkaline solution unless such solution be strongly alkaline, and after the evolution of ammonia has ceased no aspartic acid is found in the solution, but if hydrochloric acid be added to acidify and the solution heated, hydrocyanic acid is given off and can be detected by the smell, and oxalic acid is left in solution and can be precipitated as calcium oxalate. When operating with very small quantities of the amid, as I often found it necessary to do, the quantity of hydrocyanic acid given off in this reaction is so small that the smell is masked by that of the hydrochloric acid; in this case the presence of hydrocyanic acid can be established in the usual way by placing a drop of yellow ammonium sulphide on a porcelain dish, holding over the boiling solution for a few seconds, removing the excess of sulphide by blowing, and proving the presence of a thiocyanate by the red coloration produced on addition of ferric chloride.

The sugar-cane amid also gives off hydrocyanic acid when heated with dilute sulphuric acid and manganese dioxide.

When heated in a sealed tube with benzoic acid, the sugar cane amid gives hippuric acid, a condensation characteristic of glycocoll, and one by which it is supposed hippuric acid is formed in the animal body.

The hippuric acid so formed was identified by separating it from any remaining benzoic acid by agitation with petroleum ether, evaporating the insoluble residue to dryness with nitric acid and heating, when the characteristic smell of nitrobenzol was detected.

Glycocoll has been prepared in the usual way from hippuric acid by boiling with dilute sulphuric acid, and the reactions given above as characteristic of that body have been verified throughout.

It having been thus thoroughly established that the principal amid of sugar-cane is glycocoll, it is well to note that there are certain points in which glycocoll resembles asparagin, and the resemblance is such that anyone prone to jump at conclusions would on obtaining a crystallized preparation of the sugar-cane amid immediately pronounce it asparagin. The points of resemblance are these: first, the general appearance, solubility, etc., of the crystals; second, neither gives up any nitrogen when treated with sodium hypobromite in alkaline solution; third, both dissolve cupric hydroxide to a blue solution; and fourth, both contain the same per cent. of nitrogen. Asparagin crystallized with one molecule of water of crystallization and glycocoll each contain theoretically 18.66 per cent. nitrogen, while the average of all samples of the sugar-cane amid was 18.69 per cent. The Gunning method was used in determining the nitrogen, and clean, well-defined crystals were selected for such determinations.

In all, fifteen preparations of the glycocoll have been made from sugar-cane; and the samples of cane from which it has been prepared have included young shoots of cane a few weeks old, the green tops of cane one year old, and mature cane growing at elevations from 400 to 1,200 feet above sea-level. It is fair then to conclude that glycocoll is not only the principal amid of sugar-cane, but is also a normal constituent of this plant at all periods of its growth.

I have as yet made no attempts to estimate the quantity of glycocoll in sugar-cane or any of its products, but have noticed that larger amounts have been obtained from young than from mature cane.

The average nitrogen content from mature sugar-cane is probably about 0.30 per cent., and of this at least 0.22 per cent. is albuminoid nitrogen; so that the amido content cannot be higher than 0.08 per cent., and probably is often less than 0.02 per cent. It is easily seen then that the preparation of any quantity of the sugar-cane amid entails considerable labor, and this coupled with the fact that this work has been done at odd times during a busy grinding season, is my excuse for the incompleteness of this research in some respects.

The identification of glycocoll, glycocine, or amido acetic acid in sugar-cane is of interest from several points of view. Its occurrence has not been noted in a plant before, and it has been considered a body belonging wholly to animal chemistry. It can be prepared from gelatin by heating with acids or alkalies, in fact, was first prepared in this way, and it has been supposed that it was formed in the animal body from gelatin or gelatin-yielding proteids.

It does not seem to occur free in the animal body, and the theory of its formation from proteids seems to have been demanded by the following fact: Benzoic acid, when taken into the stomach, appears in the urine as hippuric acid, and to explain this it has been supposed that the condensation already referred to takes place; viz., benzoic acid and amido acetic acid combine to form hippuric acid with the elimination of water.

$$C_6H_5COOH + CH_2NH_2COOH = C_6H_5CONHCH_2COOH + H_2O.$$

This view is strengthened by the fact that when glycocoll is taken with benzoic acid the yield of hippuric acid is increased. In the urine of herbivorous animals hippuric acid occurs in relatively large quantities, and while the food of such animals has been deemed capable of supplying the benzoic acid part, the source of the glycocoll to form such large quantities of hippuric acid has been more or less of a puzzle to physiologists.

The identification of glycocoll in sugar cane and the fact that it has been mistaken for asparagin suggests the probability of its occurrence in other plants, especially the Graminae, which form the major part of the food of herbivorous animals; and it is quite likely that the source of the hippuric acid in the urine of such animals will be found in such occurrence.

In vegetable, as in animal physiology, the question of the constitution of proteids is uppermost. Now glycocoll in the physiology of sugar-cane no doubt plays the same part which other amids are known to do in other plants. It is the form in which nitrogen is conveyed to growing parts, and when maturity is reached the amid becomes the albuminoid to become the amid again when a new growth takes place. A number of facts collected during this study of the sugar-cane amid point to the existence in cane of a gelatin or gelatin-yielding proteid which yields glycocoll as one of the products of decomposition. This coupled with the well known and comparatively simple constitution of glycocoll seems a step toward the understanding of at least one proteid of sugar-cane. The further study of this matter promises to be of special interest, both from a physiological and a technical point of view.

From the sugar manufacturer's point of view the presence of glycocoll presents the following points of interest: It is known that at various stages of sugar manufacture ammonia is given off from boiling cane juice, especially if this juice has been rendered alkaline by an excess of lime. This has been stated as due to the decomposition of asparagin into aspartic acid and ammonia. But since we know that the amid is glycocoll and not asparagin, and that glycocoll is not decomposed unless boiled in strongly alkaline solution, it is plain that the ammonia must be derived from the decomposition of albuminoids. When, as is generally the case, cane juice is maintained approximately neutral throughout the course of manufacture, the whole of the glycocoll originally present in the juice should be found in the final molasses.

Whether this theory always carries out in practice, I have not yet ascertained, but I have obtained glycocoll in comparatively large quantities from several samples of refuse molasses by the same method by which it was obtained from cane juice.

In one sample I determined the amounts of different forms of nitrogen according to a well known scheme of analysis with the following result:

	Per cent.
Nitrogen as free ammonia	0.011
Nitrogen as albuminoids	0.126
Nitrogen as peptones	0.050
Nitrogen as amids	0.201
Nitrogen as other forms	0.228
Total Nitrogen	0.616

Free ammonia was determined by distilling with magnesia free from carbonate, and albuminoids by precipitating with cupric hydroxide. The nitrogen designated peptones is that precipitated by phosphotungstic acid after the removal of free ammonia and albuminoids. In the case of cane juice and its products this precipitate does not contain peptone bodies, and its character will be treated in a future paper. After removal of these three forms of nitrogen, amids were determined by boiling for an hour with two per cent. sulphuric acid, neutralizing and distilling with magnesia free from carbonate and doubling the amount of ammoniacal nitrogen obtained for amid nitrogen. This method which is fairly accurate in the case of asparagin which gives up half its nitrogen as ammonia when boiled with dilute acids, is of no value in the case of glycocoll, so that the above analysis should read amids and other forms 0.429 per cent. instead of

	Per cent.
Amids	0.201
Other forms	0.228

From a number of years' experience in working with cane juice, I am convinced that the formation of molasses is due to mechanical, rather than chemical, conditions, that the presence of viscous non-crystallizable bodies prevents the further crystallization of sugar by rendering the motion of the sugar molecules in the liquid difficult, and the mellasigenic action of crystallizable salts is very slight. A body such as glycocoll would then exert little effect on the crystallization of sugar one way or the other, especially as it exists in cane in such small amounts, but it is likely that the proteid directly connected with glycocoll will be found to be highly melassigenic.

We have been in the habit of associating the so-called gums or viscous bodies in cane juice with the cellulose or non-nitrogenous constituents of the plant, but we may have to modify this view in the presence of a gelatin-yielding proteid peculiar to sugar-cane and allied plants.

Laboratory of Kohala Sugar Co., Kohala, Hawaii, H. I.

———:o:———

THE COFFEE SITUATION.

Downward, still downward, goes the price of coffee, while higher and higher mounts the consumption, due to a supply far in excess of the increased demand. Consumers are now reaping the full benefit of the extension of the industry, stimulated by the high prices ruling from 1886 to 1896. Although No. 7 Rio coffee for November delivery sold at 4.85 cents, we find that lower prices were made for fair to prime Rio, from

1842 to 1850, than are now ruling. In view of the decline, we reproduce the yearly average of fair Rio, from 1869 to 1897, as a table of reference:

	Cents.		Cents.
1897 (to Nov.—)	11.88	1882	9.77
1896	16.22	1881	12.23
1895	18.64	1880	15.12
1894	18.61	1879	14.85
1893	19.28	1878	16.51
1892	18.33	1877	19.72
1891	18.15	1876	17.97
1890	19.64	1875	19.01
1889	18.55	1874	21.08
1888	15.35	1873	19.99
1887	17.80	1872 (free from July 1)	18.42
1886	10.32	1871 (duty, 3 cents)	15.91
1885	9.01	1870 (duty, 3 cents)	16.33
1884	10.92	1869 (duty, 5 cents)	15.82
1883	10.36		

This year opened with No. 3 Rio at 14¼@14½ cents; now held at 8¾ cents; No. 7 began the year at 10¼ cents and now quoted 6½ cents.

From 1825 to 1837 coffee was high; in the former year fair to prime Rio was 17 cents; in the latter 9@12 cents, from which time prices ruled within that range until 1842, when it fell to 6@9 cents, the extremes being 6@10 cents. In 1843, '44 and '45, the price kept from 6@9 cents, scarcely varying in 1844-45, except in July, 1845, when it fell to 5 cents. Low prices continued until 1850, when a rise of 4 cents was held. In 1848-49, for eight months, 5½@5¾ cents was a common quotation. Coffee touched 14 cents in 1850, but fell off again the next year, and did not again touch 14 cents until 1860. Then came the war and disturbance of consumption and a period of very high prices in gold.

Java coffee in 1864 averaged for the year 49.10 cents in gold, having sold at 60 cents gold in August of that year. Fair to prime Rio averaged in April, 1864, 18.16@21.64 cents. During that year gold ranged at a premium of from 151½@285 Coffee then ruled at high prices until 1882, when a period of low prices set in, lasting five years,when they again advanced and for ten years ruled high, stimulating planting in Mexico, Central and South America. The full effect of the growth in production was not felt until this year, during which prices have fallen to a non-productive basis for the planters. If low prices continue, as is likely, for five years, we may look with confidence to a check to the extension of coffee growing and the adjustment of supply to demand and then a return to higher prices. The trade moves in cycles. Sometimes a war comes and disturbs the consumption, as during the Crimean War and the Civil War in this country. Then speculation at times interferes with the natural workings of the law of supply and demand and forces prices too high or too low. In 1870-75, speculation advanced prices until heavy crops broke the power of a formidable syndicate and caused the failure of those forming it. A similar disaster came some years later and is always invited when speculators attempt to control the market. Consumption fluctuates almost as much as supply, and because operators fail to take both factors into consideration or miss their exact relations, they swamp themselves.

For a period of nine years, 1881-89, the yearly average deliveries of Europe and the United States were 658,066 tons, equivalent to 11,187,122 bags. Brazil furnished 50 per cent. of the supply. For the year ending June 30, 1897, the crops of Brazil were over 70 per cent. of the total deliveries in Europe and the United States. Her export from 1881 to 1889 reached a total of 49,060,203 bags—a yearly average of 320,655 tons or 5,451,134 bags. Her export for the year ending June 30, 1897, reached 8,680,000 bags, or over 62 per cent, above the yearly average of five years ending with 1889.

The last seven Brazil crops aggregate 44,117,000 bags, a yearly average of 6,302,000 bags, so that the 1896-97 crop of 8,680,000 bags was exceptionally heavy, and 1,283,000 bags more than the previous largest crop in 1891-92. This year's crop in Brazil is estimated from 8,000,000 to 8,500,000 bags.

In Mexico the ratio of increase in the production is placed at 33 per cent. annually. In 1888, Mexico sent the United States, 7,000 tons; in 1895, 17,631 tons. In Central America and the United States of Colombia there has been a like increase in plantations, a natural result of years of high prices and profitable returns.

In 1889, the world's production was just abreast of the consumption, if anything short. The imports in 1889 into Europe and this country were 4,255 tons less than the crops of that year estimated at 631,498 tons. In 1896, Europe and the United States reported deliveries of 11,662,091 bags, and a total supply for the year of 13,293,061 bags. The stock, January 1, 1897, was 2,138,968 bags. The position on November 1, 1897, was as follows:

Stocks, U. S. and Europe, January 1, 1897	2,128,968
Arrivals, U. S. and Europe, to November 1	11,810,330
Total supply	13,949,298
Less stocks, November 1	3,247,999
Deliveries, U. S. and Europe, 10 mos. 1897	10,701,299
Deliveries, Jan. 1, 1896, to Nov. 1, 1896	9,547,743
Increase 10 months 1897 over 1896	1,151,515

If the November and December deliveries show the same gain that preceding months have, the years' deliveries will be about 13,000,000 bags, and the stocks, January 1, 1898, will be about one-fourth the year's requirements.

The world's visible supply January 1, 1897, was 4,024,968 bags; July 1, 1897, 3,975,880 bags, and on November 1, 1897, a grand total of 6,264,999 bags, a gain over November 1, 1896, of 2,440,472 bags, in spite of a gain in deliveries of 1,151,515 bags, or about 12 per cent., against an increase in visible supply of over 60 per cent. in ten months. It is evident that the productive capacity of coffee growing countries is far ahead of the world's requirements and has not reached the full limit for new plantations are continually coming into bearing. Nothing but a calamity to the world's crops will stand in the way of very cheap coffee for the next two and probably five years.

The October deliveries in the United States were 502,683 bags, a gain over October, 1896, of 75,713 bags, or 17.8 per cent. In Europe they were 1,274,495 bags, a gain over the same month in 1896 of 83,528, or over 7 per cent. This gain in consumption is highly gratifying, particularly in the United States.—"American Grocer."

———:o:———

Manners make the man.

As the man so is his speech.

Much speaking and lying are cousins.

Speak little with others; much with thyself.

Speak well of your friend; of your enemy neither well nor ill.

ECONOMIC IMPORTANCE OF RAMIE CULTURE.

Ramie is the finest and strongest of vegetable fibers. Its earliest use began in the ages of an immortal antiquity. Four thousand years ago, Egyptian cerements were made of this material. Ramie possesses a rare combination of valuable properties. Fine as cotton and almost as glossy as silk, it is cheaper than linen and stronger than hemp. Scarcely inferior to any of its rivals in their distinctive excellencies, it surpasses them all in durability and usefulness. Under favorable conditions of soil and climate, the plant grows with spontaneous exuberance. Its luxuriance discourages weeds, and lightens the labors of tillage. With little need of cultivation, the roots continue, through a life of 15 to 20 years, to yield two or three crops of stalks a season. Both the plant and the fabrics made of its fiber repel the attacks of insects. Though ramie survives temporary exposures to flood and drouth, it cannot withstand the blight of heavy frosts. Washing scarcely impairs the gloss or the coloring of its tissues. The limited cultivation of a textile so lustriously beautiful, so surpassingly strong, and so variously useful, seems to demand an explanation. The earlier reason for this neglect of a valuable staple was found in the difficulty of separating the fiber from the stalks, and preparing it for the loom. The increased culture of later years is due to the invention of improved machinery and better processes for the removal and treatment of the fiber.

The universal recognition of the importance of ramie is primarily to be ascribed to the persistent labors of an Englishman. John Marshall of Leeds devoted the leisure of more than half a lifetime to the study of the best methods of manufacturing ramie. His patient thought and ingenious experiments were crowned with success, and his display of ramie fabrics in the British exposition of 1851 startled the textile world with a splendid surprise. The strength of these goods, their delicacy of texture, lustre of finish, and richness of colors, excited universal admiration. The beauty and excellence of these manufactures not only delighted the myriads of visitors who thronged the halls of the Crystal Palace, but also received official commendation in the reports of European and American commissioners. Mr. Marshall's exhibit awakened a wide-spread interest in the production and manufacture of ramie. The total consumption of this textile is now very large. No statistics record the vast quantity that is needed to supply the domestic wants of China, but the aggregate exports of this material from all the ports of that country now amount to more than 500,000,000 pounds a year.

Among the widely diversified products made of ramie are ropes and cables that exceed the strength of manilla hemp; tablecloths that excel the gloss of Irish linen; lace that equals the delicacy of cotton and surpasses its durability; plushes that rival the lustre of seal skin; velvets, damasks, and brocades whose exquisite finish embarrasses a further advancement in textile art. Ramie is combined with cotton, linen, wool, and silk, and it always adds to the mixed texture an element of greater usefulness or beauty. In handkerchiefs, cravats, and hosiery, in cambrics, camlets, and shawls, in alpacas, carpets, and draperies, it is, with the possible exception of silk, superior to the fibers with which it is interwoven.

Though China has always been the chief producer of ramie, other countries have attempted its cultivation. More than a quarter of a century ago, a systematic endeavor was made to introduce a general culture of this plant into India, and the effort was so successful that in 1865 India exported to England about 70,000,000 pounds of ramie. But the aversion of the natives to the growth of new staples and their ignorance of intelligent methods of extracting the fiber proved to be insuperable obstacles to a national development of the new industry.

Latterly an experimental cultivation of ramie has been carried on in many lands. There have been plantations of this textile in the Sandwich Islands, in South America, in the United States, in northern Africa, and in every country of southern Europe, and though their total extent has not probably exceeded 50,000 acres, yet their existence in so many lands has shown a world-wide interest in the culture of this plant. In the south of France the formation of several companies for the fabrication of ramie indicated the confidence of capital in the success of the undertaking. Their active and aggressive enterprise, not content with the domestic manufacture of the fiber, invaded foreign lands and established plantations of ramie in Spain, Algeria, and Egypt. From a greater similarity of conditions and a more exact record of results, French experience affords the most trustworthy information for the guidance of American planters. The following facts, derived from reports of actual operations, show the luxuriance of ramie, and the possible profits of its cultivation. In the French experiments, the number of roots planted to the acre varied, according to the richness of the soil or the judgment of the manager, from 10,000 to 20,000. After the second year, each root sent forth from 15 to 20 stems. These stalks grew to the height of from 5 to 8 feet, and averaged 200,000 to the acre. There were always two and often three crops a year. At the time of the operations whose results are here recorded somewhat briefly, the prices of dry stalks, ribbons of crude bark, and fiber ready for the comb were respectively 1, 4.38, and 15.9 cents per pound. In one instance where there was need of costly irrigation, careful tillage, and rich fertilization to repair a soil exhausted by centuries of culture, there was a clear profit of from $70 to $90 an acre. In three cases, the total returns from three cuttings a season were $86.85, $124, and $154 per acre. Americans who have tried the experiment of raising ramie in our gulf states have estimated the gross value of the two crops a year at from $90 to $120 an acre. These figures do not refer to the products the first two years after planting. During that time so large a yield would be impossible, but afterwards, in consequence of the luxuriance of the plant, and the small cost of its cultivation, the returns would be large and profitable.

It is certainly reasonable to assume that the unworn soil of our southern states will bear as bounteous harvests as the long-cultivated fields of France, and it is therefore fair to judge of the possible productiveness of American plantations by the richest yield of Gallic lands. The largest gain mentioned in the foregoing statistics is $155 an acre. Official authority entitles this statement to full credence. But to avoid all possibilities of exaggeration, take only one-half of this amount, and then, even after this unwarranted reduction, there remains a net profit of $77 an acre.

The following facts furnished by Mr. Felix Fremerey, an active and zealous promoter of American fiber culture, forcibly illustrates the exuberance with which ramie grows in our southern states.

In July, 1887, a Texas planter set out several thousand ramie roots. The next spring, each root sent forth 30 or 40 sprouts which grew with rapidity. But early in July a drought began which lasted nine weeks. During this period, so great was the intensity of the heat that the soil was dried to a depth of more than two feet. Hundreds of thousands of cotton plants perished, but the ramie survived the drought and, quickened by the fall rains, grew with such luxuriance that often 150 stems were found in clusters not more than two feet in diameter. In one instance, 168 stalks sprung from a single mass of roots. The plants grew so rapidly that, 14 days after the cutting of the mature stems, the new sprouts were 30 inches high. Each root yielded a gross return of five pounds of fiber, the price of which was then 4 cents a pound. From the product of the few plants which were permitted fully to ripen, it was estimated that the average production of seed would not be less than 40 pounds an acre. In previous years, New York firms had sometimes paid Texas planters as high as $4 a pound for ramie seed. The results of his experiments convinced Mr. Fremerey that the portions of Texas best suited to the culture of this textile can produce three, and possibly four, harvests a year, with an average of one hundred stalks to each root.

Formerly the tillage of ramie in the United States was discouraged by the lack of an effective means of removing the fiber from the stalks. But now there are several machines whose practical efficiency, aided by protective legislation, seems to warrant a general cultivation of the staple. A semi-tropical climate, a soil that fosters a rank growth of the plant, a demand for the production that far exceeds the supply, and defabricators whose effectiveness, assisted by congressional duties on competitive fibers, would apparently enable planters to derive lucrative returns from the light toils of tillage, are conditions so favorable to the culture of ramie in our gulf states as to awaken a feeling of wonder at the slow development of the industry.

There has never been—unless the problem has been recently solved—an entirely satisfactory method of defibrating ramie stalks. A cheap and rapid process of preparing the fiber would revolutionize the textile industries of the United States. Ingenuity is exploring the world in quest of opportunities for the profitable exercise of its powers. It is surprising that an invention which would surely reward its author with wealth and fame has so little engaged the attention of inventors. There is scarcely any textile device that would confer a greater benefit upon mankind, or more certainly win for its originator the mead of public usefulness, than a thoroughly successful decorticator. Inventors should not misdirect their efforts. A perfect defibrator is a machine that will strip the green stems. There are important economics in extracting the fiber as soon as the stalks are cut. An immediate treatment saves time and storage room, prevents the danger of heating, and avoids the labor and outlay of a repeated handling of the crops. The hardened gum of dry stalks resists the action of solvents, and the stains produced by the tannic acid of the bark increase the difficulty of bleaching. The removal of the dry filaments is apt to cause a waste of material. The green stems always yield a larger proportion of fiber.—Prof. S. Waterhouse in Rural Californian.

St. Louis, Mo.

———:o:———

THE TESTING OF SUGAR.

The new regulations to govern sugar tests at the custom houses under the Dingley Tariff Act have been prepared and are only awaiting formal promulgation. The committee of experts who framed them consisted of Dr. H. W. Wiley, of the Department of Agriculture, who has had charge of the sugar analysis in that department for many years; Dr. Charles A. Crampton, analytical chemist of the Internal Revenue Service, and Andrew Braid, of the Coast Survey, an expert in weights and measures. With the exception of Mr. Braid, who replaces Otto H. Tittman, this is the same committee that formulated the rules for the sugar tests made by the Internal Revenue Bureau in administering the bounty law of 1890, and it has used the old rules as a basis for the new ones, with such changes as are suggested by the progress of discovery and invention. The most important of these, from some points of view, is the change of polariscopes from the color instrument to the half-shade.

For the benefit of any reader who has not seen a polariscope, it may be explained briefly that it is an optical instrument for examining substances in polarized light. In the case in point it is used to determine the percentage of sucrose or pure sugar, without regard to its color or condition. The sample is first carefully weighed and dissolved in an exact volume of water. The solution is placed in a glass tube precisely 200 millimetres long, and a ray of polarized light is passed through this tube lengthwise. The ray is deviated in proportion to the amount of sucrose contained in the solution, and the deviation is indicated on a scale of 100 degrees. The instrument looks very much like a microscope mounted horizontally upon an immovable standard. There is a long cylinder with a short one above it. Looking into the long one, after the tube containing the solution is in place and an artificial light has been applied at the opposite extremity, one sees a disk, apparently about the size of a five-cent nickel coin, divided vertically into two equal parts, one semi-circle being of one color or shade and the other of another. The effect is produced by the passage of a ray of light through a certain system of prisms and lenses, through the 200-millimetre tube, and finally through a compensating medium in the form of a quartz plate, shaped like a wedge, with one of the flat sides toward the observer. The turning of a screw with a milled head underneath the instrument moves this quartz wedge gradually back and forth, with the effect of reducing the two colors or shades to one in which they are blended—a neutral field, to use the technical phrase.

Corresponding with the movement of the quartz plate there has been a movement of a minute scale, which can be read through the upper cylinder. As soon as the neutral field is procured, a look at this scale shows what percentage of sucrose is contained in the solution, and the work is done.

The half-shade polariscope is unquestionably an improvement upon the color instrument in ease of use and accuracy of results. In the color instrument, it is true, any two complementary colors to which the individual operator's eye is most susceptible may be thrown upon the disk, and by the turning of the screw with the milled head they may be approximated to each other till there is a complete neutralization. But this involves at least an apprehension of color on the part of the operator. In the ordinary half-shade instrument, on the other hand, two neutral tints, differing simply in their intensity, divide the disk between them. Even a person who is color-blind can distinguish light shadows from deep ones; and, as the two shades approach each other and gradually dissolve into one, the hair-line down the centre of the disk seems to fade away till nothing is left of it. At that point the eye with the least possible susceptibility to color could not be greatly deceived; whereas, if it were depending upon color and not upon shade, it might easily fail to distinguish between two mixtures, let us say, of green and red. In short, it takes a practiced eye, one capable of noting even the faintest gradutions of color, to use the color instrument successfully, whereas a tyro can make approximately correct readings from the half-shade instrument. For example, in a laboratory test in which the writer took part today, a wholly untrained experiment, with a color eye which is usually considered very good, came a whole degree out of the way in reading from the color instrument, but missed by only one-tenth of one degree with the half-shade.

There is a later design of the half-shade polariscope than any now owned by the government, which will probably be purchased when new material is needed. This is the triple-shade instrument. It differs from the type now in use simply in the face of the disk, which is cut into three parts instead of two. The division is made by two parallel vertical lines equidistant from the vertical diameter. The two segments are of one shade and the middle zone of the other. Here again the approximation of the segments to the zone seems to obliterate gradually the lines between the three parts. It is a better device than the old division, because its very symmetry is an aid to the eye.

The difference between the color and the half-shade or triple-shade polariscope is simply a difference in the mechanical arrangement of the Nicol prisms and quartz plates used in the body of the instruments. The instruments are almost identical in outward appearance, and are used in the same way. The government already owned a number of half-shade instruments with which it had to supply the internal revenue offices during the continuance of the bounty law, and these it has called in and delivered over to the Coast Survey, where their parts will be carefully readjusted so as to conform to one universal standard. The gréat desire of Secretary Gage, in collecting the sugar duties imposed by the Dingley law, is so to unify the process or to insure the collection of like revenues from like sugars, regardless of the port at which they may have been entered. To this end there will be a co-operation system of sampling, and reports which will enable the Department at Washington to keep in daily touch with what is happening at all the custom houses where sugar is imported.

For example, New York will be expected to send samples to Boston and Philadelphia, Philadelphia to Boston and New York, and Boston to New York and Philadelphia, so that on September 30 an analysis will be going on at Philadelphia and Boston of a sugar which had been analyzed and classified at New York on September 29, and by the first of October the reports on that sugar from all three custom houses will be in the hands of the department here. If the returns agree substantially, this will be accepted as evidence that work is proceeding satisfactorily everywhere. If, however, a marked disparity should be found between the returns from Philadelphia and those from New York and Boston, it would be regarded as a sign that something was wrong in Philadelphia's methods, and an inquiry could be set on foot at once to discover and correct the trouble.

On one occasion heretofore, it may be remembered, a very decided difference in the temperature of the laboratories at different ports was found to have such an effect upon the quartz plates in the polariscopes as to account in no small measure for differences which had been observed in the readings. The weighing of the sugar samples also was rendered unequal in the several laboratories by the same cause. Any lack of uniformity in the conditions under which the tests are made is liable to discredit the results and give to the importers at one point a very great commercial advantage over those at others, or inflict upon them a proportional damage. As the amount of revenue involved is about $60,000,000, uniformity and precision in the administration of the sugar schedule are not only worth some trouble on general principles, but may be trusted to pay for themselves in hard cash.

A certain latitude will be allowed to appraisers, however, under the new regulations as to non-essentials. For instance, where sugar imports are unusually heavy, and a laboratory is short-handed, the continuance tube may be substituted for the ordinary closed tube in using the polariscope. The closed tube has to be thoroughly rinsed before each filling, and the care with which all surplus liquid must be removed from the open end before the cap can be put on, the absolute steadiness with which it must be held, etc., consume a good deal of time. With the continuous tube, however, which has come into use extensively at government stations where beet juice is tested, the process is rapid and simple. The tube has at one end a funnel and at the other an overflow pipe, and its interior is ingeniously arranged, so that when one solution is poured into the funnel the solution already in the tube is inevitably forced out at the other end. The two solutions can not mingle and the separate cleansing process is spared.

In preparing the new regulations the committee has sifted and drawn upon the codes adopted in all foreign countries where bounties are paid for the production or export of sugars of certain grades. They may be said to represent, therefore, the very latest phases of the art of analysis and classification. Although this whole subject falls strictly within the jurisdiction of the customs branch of the Treasury service, its administrative details have been turned over to the control of the special agents, acting under direct supervision of the Secretary of the Treasury himself.—N. Y. Evening Post.

———:o:———

AN INSPECTION SYSTEM AGAINST FOREIGN INSECTS.

At the National Convention for the Suppression of Insect Pests and Plant Diseases by Legislation, held at Washington, March 5-6, 1897, Mr. L. O. Howard, Entomologist of the United States Department of Agriculture, read an interesting paper under the above caption.

The speaker called attention to the fact that fully one-half the principal injurious insects of the United States are of foreign origin, and have at one time or another been accidentally imported into this country, where, in the majority of cases, they have flourished to a degree unknown in their original home. This statement was supported by instancing many important injurious species. It was shown that aside from a large number of insect enemies of field crops, most of the granary pests, most of the household pests, and most of the greenhouse pests belong to the class of imported species. The countries of origin were briefly discussed and it was shown that while Europe is the home of the majority of the imported species, especially China and Japan, in connection with the enormous development of agriculture and horticulture on the Pacific Coast, is now resulting in the arrival at the port of San Francisco of many new insect enemies of vegetation. It was further shown that there is much less danger of importations of this character from the Southern Hemisphere, since such an importation would involve a change of climate. An insect from Chili in midsummer for example, would arrive in this country in midwinter, and such a radical change, involving the complete reversal of the life cycle of the insect, is a practical barrier against the establishment of species imported from such localities.

Widely differing ways in which insects may be introduced were briefly discussed and the known facts regarding the number of our principal imported crop pests were given. It was shown that the present method of packing the cargo of a steamer is admirably adapted to the successful transportation of insects, and of course the faster the steamer makes its way across the sea the greater the danger of importation of injurious forms.

The great difficulties of competent inspection were dwelt upon, but it was shown that a rigid inspection of nursery stock would be possible. The resultant value of such an inspection to the country was illustrated by examples of insects which such inspection in the past would have debarred from entrance. As further illustrating the possibility of this kind of inspection, the work of the State Board of Horticulture of California at the port of San Francisco was described at some length. The possibility of competent inspection of nursery stock in foreign countries before shipment to this country was also mentioned. The speaker followed with a partial list of insects economic importance not yet introduced into this country, but which are still liable to be imported from abroad. It was shown, by referring to several familiar instances, that one great difficulty in the preparation of such a list arises from the fact that we have not only to guard against insects of known economic importance, but against many other species which in their native home have little economic consequence, but which in the more congenial climate of the United States may multiply to excess.

Tables were given showing the importations of nursery stock and plants, as well as fruit, at the different ports in the United States, and it was shown that the principal ports of entry to be guarded are those of Boston, Charlestown (Mass.), New York, Cincinnati, St. Augustine, Key West, Tampa, New Orleans, and Baltimore. This comparatively limited list would seem to indicate that with the aid of State officials, and particularly with the possible co-operation of foreign countries, an inspection and quarantine service need not be excessively expensive to the general government.

As giving an idea of what such an inspection would mean, the speaker presented a table representing the inspection of steamers entering the port of San Francisco from July 2, 1894, to August 29, 1896. From this table it appeared that at San Francisco two hundred and thirty vessels carrying plants were boarded in the twenty-six months mentioned and all plants and trees found on them were carefully inspected. About one-half the plants and trees were found to be infested with scales or other injurious insects, and were disinfected or destroyed. It was shown that this inspection system, conducted under state laws, has been thorough and has undoubtedly saved the State of California many times the cost of the inspection. It was further stated, however, that inspection at San Francisco is but child's play compared with the amount of inspection which will be necessary at the port of New York.

In conclusion, the writer expressed his firm conviction that the establishment of such a service at the Eastern ports, while it might not be commensurate in the value of its results with that of San Francisco, would many times repay the horticultural interests of the country.—Flor. Agriculturist.

———:o:———

THE WORLD'S SUPPLY OF SUGAR.

The total consumption of sugar in the United States for the trade year ending September 30, as estimated by Willett & Gray, was 2,037,737 tons, against 1,921,990 in 1895-96—an apparent gain of 115,747 tons. From this is deducted an estimated increased holding in refiners' and grocers' hands of 75,000 tons, reducing the estimated increase in the consumption to 40,747 tons, or 2 per cent. over 1895-96.

The total receipts of foreign sugar were 1,891,234 tons, against 1,779,778 tons in 1895-96.

The total stock in all principal countries at latest uneven dates was 1,522,980 tons, a decrease as compared with the same time in 1896 of 183,948 tons.

In the following table the compilers, Willett & Gray, have aimed to include the entire sugar production of all countries of the world, including those crops which have heretofore been ignored in statistics, but which have grown to amount in total to some 250,000 tons. These figures include local consumptions of home production wherever known, and are compiled to November 25, 1897, as follows:

AMERICA.

	1897-98.	1896-97.
United States (Beets, 70,000, '97-98; 40,000, '96-97; 30,000, '95-96; 20,443, '94-95	310,000	280,000
Canada (Beets)	300	300
Spanish West Indies—		
Cuba (crop)	310,000	219,500
Porto Rico	52,000	50,000
British West Indies—		
Trinidad (exports)	55,000	55,000

Barbados (exports)	58,000	56,000
Jamaica	30,000	30,000
Antigua and St. Kitts	25,000	29,000
French West Indies—		
Martinique (exports)	35,000	35,000
Guadeloupe	45,000	45,000
Danish West Indies—		
St. Croix	8,000	8,000
Haiti and Domingo	50,000	50,000
Lesser Antilles, not named above	8,000	8,000
Mexico (exports)	2,000	2,000
Central America—		
San Salvador (crop)	500	500
Nicaragua (crop)	500	500
British Honduras (Belize, crop)	200	200
South America—		
British Guiana (Demerara, exports)	100,000	100,000
Dutch Guiana (Surinam, crop)	6,000	6,000
French Guiana	....	....
Venezuela	....	....
Peru (crop)	70,000	70,000
Argentine Republic (crop)	140,000	150,000
Brazil (exports)	205,000	210,000
Total in America	1,600,500	1,403,000

ASIA.

British India (exports)	50,000	50,000
Siam (crop)	7,000	7,000
Java (exports)	515,000	486,051
Japan (cons'n 125,000, mostly imported)	......	......
Philippine Islands	210,000	190,000
Cochin China	30,000	30,000
Total in Asia	812,000	763,051

AUSTRALIA AND POLYNESIA.

Queensland	75,000	75,000
New South Wales	35,000	35,000
Hawaiian Islands	210,000	200,000
Fiji Islands (exports)	30,000	30,000
Total in Australia and Polynesia	350,000	340,000

AFRICA.

Egypt (crop)	95,000	95,000
Mauritius and other British Possessions	110,000	155,000
Reunion and other French Possessions	45,000	45,000
Total in Africa	250,000	290,000

EUROPE.

Spain	20,000	20,000
Total cane sugar production	3,032,500	2,816,051
Total beet sugar production (Licht)	4,925,000	4,915,759
Grand total cane and beet sugar production	7,957,500	7,731,810
Estimated increase in world's production	225,690	....