REPORT BY DR. H. W. WILEY, OF THE BUREAU OF CHEMISTRY, UNITED STATES DEPARTMENT OF AGRICULTURE, IN 1891, ON THE MUCK LANDS OF THE FLORIDA PENINSULA.

[See Annual Report, Secretary of Agriculture, 1891, pp. 163-171.]

The establishment by this department of an experimental station at Runnymede, Fla., for investigating the growth of sugar cane in reclaimed swamp muck has rendered some account of that kind of soil important.

The possibilities of bringing into successful cultivation the swamp lands of Florida have occupied the minds of capitalists for several years. It has now been about 10 years since Mr. Hamilton Disston, of Philadelphia, formed the plan of reclaiming the swamp lands of Florida for agricultural purposes by drainage canals. These lands are found in detached localities over the whole State, but the parts of them which demand our attention at the present time are found extending from near the central portion of the peninsula in a southerly direction to Lake Okeechobee, and thence into the Everglades to the Gulf. It is on these lands that the experiments of reclamation have been made, and several thousand acres of swamp lands have been already freed of water and made ready for cultivation. Of these lands, at the present time, about 2,000 acres are planted in sugar cane, from 5,000 to 6,000 acres in rice, and quite a large area in gardens.

Vast tracts of reclaimed land, however, are still in the wild state, the water simply having been taken off them, but no attempts having been made to fit them for cultivation.

The muck lands, which form the subject of the present paper, begin near the headwaters of the St. Johns, about 20 miles southeast of the town of Orlando. These lands form the borders of the lakes and rivers, but the chief deposits are about the lakes. The configuration of the internal lakes of Florida is of the simplest nature. About the edges of the lakes the waves have thrown up a ridge of sand and muck, and this ridge is usually covered with cypress trees. Back of these come the swamp lands proper, which, during the greater part of the year, before the system of drainage was established, were under water. These swamp lands vary in width from a very few feet to many miles, and are bordered in turn by the sand and pine lands.

The first of these lakes in geographical order is known as Lake Hart. A canal has been cut from this lake to the headwaters of the St. Johns, and a large area of rich vegetable mold has been recovered. All other systems of drainage in the lands to which reference is made are drained toward the south, Lake Hart marking the watershed between the headwaters of the St. Johns and the headwaters of the Kissimmee. Only a few miles south of Lake Hart is found Lake East Tohopekaliga. This lake has been drained by a canal into Lake Tohopekaliga, on the shores of which is found the town of Kissimmee.

Lake Tohopekaliga has also been connected by a drainage canal with Lake Cypress, and Lake Cypress by another drainage canal with Lake Kissimmee. Lying east of Lake East Tohopekaliga is found another series of lakes, viz, Lake Preston, the most northern one, Lake Alligator, central, and Lake Gentry, the most southern of the three. These lakes are soon to be connected by drainage canals, and the last one, Lake Gentry, is to be opened into Lake Cypress. About 60 sections of land, or, in all, about 40,000 acres of rich muck land, will be recovered as soon as these canals are finished.

Passing from Lake Kissimmee into the Kissimmee River, we find a stream bordered on both sides by rich deposits of muck passing gradually into the sand and pine lands back of them. The river is extremely tortuous, and while the distance from Lake Kissimmee to Lake Okeechobee is only about 60 miles in a direct line, a boat, following the course of the river, passes nearly 150 miles in order to reach the lake.

No attempts have been made so far to reclaim the muck lands bordering the Kissimmee River by canals, and it is not possible to accomplish this by natural drainage. The level of the Kissimmee River, even at low water, is almost the same as that of the muck lands bordering it, and during the rainy season, lasting from June till October, the river becomes a veritable lake. There would, therefore, be no possibility of natural drainage for these lands, but by the construction of levees along the river and the introduction of pumps many thousands of acres could be recovered. Artificial drainage is no longer an experiment, but in many parts of the country it is practiced with entire success. The plantations on the Mississippi River below New Orleans are nearly all provided with artificial drainage systems, inasmuch as the natural drainage in that locality is entirely insufficient to free the lands from water. The great fertility of the Florida muck soils would render such a system of drainage profitable as soon as the country is opened up to the markets of the North.

Passing from the Kissimmee River through Lake Okeechobee, we come to the largest body of muck lands in the world. The northern shores of Lake Okeechobee are fringed with a very little muck, but as you approach the southern border the muck deposits become deep and wide, until finally they merge into those vast deposits of muck which form the northern border of the Everglades. The exact extent southward of this body of muck is not known, but it has been accurately surveyed for a distance of about 50 miles and found to be of excellent character throughout the whole of this distance.

As has been said before, the problem of drainage for the muck lands for the central portion of the peninsula, beginning with Lake Hart and continuing to Lake Cypress, is an exceedingly simple one. All that is necessary to secure the drainage is the construction of canals. This is easily done by dredge boats, inasmuch as the muck is easily moved and a good dredge boat is able to cut 300 feet of muck a day, 8 feet deep and 50 feet wide. When, however, we come to the vast deposits of muck on the Okeechobee, the problem is quite a different one. Two methods of procedure have been proposed. One of these contemplates nothing else than the drainage of Lake Okeechobee itself. This body of water is a peculiar one. It receives through its principal tributaries and the Kissimmee River most of the drain-

age of the central peninsula of Florida. It has, however, no outlet except the overflow through the Everglades into the Gulf and westerly through the marshes into the headwaters of the Caloosahatchee. The building of a canal to the Atlantic Ocean, which would remove the surplus water of the Okeechobee and permanently lower its level, would be an undertaking of considerable magnitude. The nearest distance is about 40 miles directly eastward from the central eastern part of the lake. The whole of this distance, however, would be through sand, which, of course, is much more difficult to move, on account of its greater compactness and greater weight, than the muck itself; it is therefore probable that it would be more economical to cut the canal in a southerly direction from the center of the southern border of the lake directly through the muck into the Everglades. A careful computation of the amount of drainage received by Lake Okeechobee would show that for the purpose of securing open drainage during the rainy season, the canal would have to be 300 feet wide and 12 feet deep. Such a canal would permanently lower the water 6 feet in the lake and would make ready for cultivation the vast body of muck lands already described.

The second method proposed is one which is now actually in operation, viz, the drainage of a portion of the muck lands of the Okeechobee. The system which is proposed, and which is now largely completed, looks to the recovery of only a portion of the land on the southwestern border of the lake. Lake Hicpochee is a small body of water, which, at its nearest point, is distant only about 6 miles from Lake Okeechobee. A canal has been constructed from Lake Okeechobee to Lake Hicpochee. A longer canal, about 18 miles, has also been built almost directly east from Lake Hicpochee to connect with Lake Okeechobee at another point. Westerly from Lake Hicpochee a canal has already been built into Lake Bonnet and Lake Flirt connecting them with the headwaters of the Caloosahatchee.

The next step in this scheme for the reclamation of this body of land consists in the erection of a levee along the borders of the lake. This levee is to extend to the pine lands at two points, one about 15 miles north of Lake Hicpochee and another at some point south of it, at such convenient distance as may be found necessary for the work. The levee along the bank of the Okeechobee will completely protect this portion of the land from any overflow from this lake. The drainage through the system of canals established to the headwaters of the Caloosahatchee will be sufficient to carry off the natural rainfall of this body of land. About 50,000 acres of land are included already in the canals which are under construction, and a very little additional expense would increase this area to 100,000.

Col. J. M. Kreamer, at my request, has made an approximate estimate of the total amount of muck lands indicated in the scheme already given. He estimates the amount at 1,000,000 acres. He says:

> These lands are found in bodies of greater or less extent throughout the Kissimmee Valley, the northern limit being in the vicinity of Lake Hart. A map of the region west of Lake Okeechobee shows, in detail, the extent and depth of saw grass or muck soil, and the ease with which it can be reclaimed and cultivated by labor-saving appliances was fully discussed by us during your recent trip through the Okeechobee country. This tract is now (July 22, 1891) virtually dry, due to the low stage of water in Okeechobee and vicinity. The surface of the soil is at least 30 inches above the water level. Reports from Okeechobee show that the muck lands south of the lake

are all at present above the water level from 18 inches to 2 feet. We are cutting a canal to the southwest from a point on the shore of Lake Okeechobee near Rita River.

By the single canal connecting Lake Okeechobee with Lake Hicpochee and thence to the Caloosahatchee, the level of the water in the Okeechobee has been permanently lowered from a foot to 18 inches. If one small canal, through the imperfect drainage system of the Caloosahatchee River, can secure this result, we can easily imagine the success which would attend the construction of the large canal mentioned above.

The total elevation of the highest point of this muck-land system, viz, Lake Hart, above the tide level is about 72 feet. Lake Okeechobee itself is 20 feet above the tide. It is thus seen that there is abundant natural fall to carry off the whole of the water, provided a canal of sufficient size can be constructed.

The origin of the muck soil is, of course, vegetable matter. There are no data for estimating the length of time required for the formation of these muck deposits. It is known that it must have been of great duration. For this reason it is not probable that the flora which is found over the muck region at the present time would represent accurately the character of the vegetation in prehistoric times. I have had samples collected of the principal vegetable growths which cover the muck lands at the present time. The whole of the Okeechobee muck lands is covered almost exclusively by saw grass. This is a cyperaceous plant of the genus *Cladium;* its botanical name is *Cladium Mariscus* or *C. effusum*. During the winter and early spring months this dense growth of grass often becomes dry enough to burn, and large areas are often burned over. Other plants which are at present contributing to the growth of muck, are as follows:

Common name.	Botanical name.
Yellow pond lily	Nymphea flava.
Maiden cane grass	Panicum Curtisii.
Alligator wampee	Pontederia cordata var.
Sedge	Cyperus sp.
Fernbrake	Osmunda sp.
Mallow	Malva sp.
Broom sedge	Andropogon sp.
Arrow weed	Sagittaria.

In regard to the depth of the soil, it varies from the merest covering at the edges near the sand to from 15 to 16 feet in its deepest portions. The greater part of the muck lands, as before indicated, will vary from 3 to 6 feet in depth, while along the Okeechobee the average depth is much greater. The soil varies in color from almost jet black to black brown.

The subsoil lying under the muck in the upper region around Kissimmee is pure sand. The Okeechobee muck, however, is underlaid with a thick stratum of shell marl containing pebbles very rich in phosphorus, and this rests upon a coraline or limestone formation. This limestone formation is very porous in structure, full of cavities of varying sizes, capable of being ground with extreme ease and thus prepared for application to the soil. At distances which vary from 2 or 3 miles to perhaps 15 or 20 from the shore of the lake this limestone formation comes nearest to the surface and forms a kind of a natural dam for the waters of the lake. This line of demarcation may properly be considered as the border between the lower and upper Everglades.

Of course every plan of constructing a canal through the muck lands must include the breaking up of this crust when it approaches the surface. This, however, is most easily done and would oppose no great barrier to the progress of the work. This crust has already been broken through by the drainage company in opening the Upper Caloosahatchee to a freer connection with Lake Okeechobee, through Lakes Flirt and Bonnet, by the system of canals already described.

As will be seen farther on the muck soils of Florida are markedly deficient in mineral constituents. The presence, therefore, of so large a body of limestone, mingled with phosphatic pebbles, is a matter of no mean importance when the agricultural future of these lands is considered. A few of these pebbles were picked up at the headwaters of the Caloosahatchee and examined for phosphoric acid. The mean percentage of phosphoric acid found was 0.697. This region has not been prospected at all for phosphate deposits, but it would not be surprising if they were discovered to exist here in great abundance, as they are found from 60 to 100 miles farther west, in the Peace River region.

The question of the subsidence of these soils under cultivation is also one of considerable importance. If the organic matter which they contain should decay there would, of course, be a marked depression in the level of the soil. The oldest portions of the muck land in cultivation have now been tilled for about eight years. In these lands where sugar cane was planted it has been found that there has been a subsidence of several inches, so that the stubble of the sugar cane has been left protruding to this distance above the surface. This depression, however, seems to have occurred chiefly in the first two or three years of the cultivation, and there seems to have been no such marked lowering in the surface of the soil since that time. It is not likely, therefore, that the soil will ever again be sufficiently depressed to bring it under the level of the water, although it must be confessed that the period of observation has been entirely too short to make any definite prophecy in regard to the future.

The organic matter, however, of the muck lands does not seem to be subject to complete decomposition by the natural processes of decay. The humic bodies, consisting largely of carbon, appear to be capable of resisting partially, if not altogether, the oxidation to which they are exposed by cultivation. There is considerable danger, however, from fire, especially during the dry season. When fires are once started with dry muck they continue to burn until the lands are flooded on the accession of the rainy season. But even in cases where a complete burning of the soils by conflagrations of this kind is observed the depression does not appear to be very great, and these places are entirely above the water line, except, perhaps, in times of very severe rains. There is, therefore, it is thought, no danger in the future of such a depression of the land as to render unavailing the drainage which has been accomplished.

The question of climate is also one of prime importance, especially in consideration of the culture of sugar and rice.

In regard to precipitation the climate of Florida is divided distinctly into a rainy and a dry season. The rainy season begins early in the summer, in the latter part of May or June, and continues until about the middle of September or the 1st of October. From October to June the climate of the central peninsula of Florida is essentially

dry, although showers may frequently occur. This distribution of the rainfall has its advantages and disadvantages. So far as the culture of rice is concerned, it is extremely advantageous. The rainy season occurs during the time when the rice fields are to be flooded, and thus the necessity for artificial flooding is greatly diminished by the great rainfall of the summer. There is also an advantage to the growing cane crop in having the rainfall come during the hot months, at the period of most rapid growth. It is equally as advantageous, however, during the manufacturing period, to have a dry season. For this reason the period of the manufacture of sugar in Florida has many advantages over the same time of the year in Louisiana. In Louisiana, especially after November, the planter is exposed to frequent and protracted rains, rendering the fields muddy and the roads over which the cane is to be hauled almost impassable.

The Florida planter can confidently count on a continuous manufacturing season, being rarely interrupted by rains. The disadvantages of the dry season in the central peninsula of Florida are chiefly felt by the growers of vegetables. These vegetables are grown for the early northern markets, and the gardening period in central Florida begins about the last of December and ends about the 1st of May. It is during this season that rains are most infrequent, and therefore the gardener is subjected to grave dangers from drought. It is during the same period, too, that the spring planting of sugar cane takes place, and, owing to the dry weather, the planted cane may be affected with dry rot. The disadvantages, however, of the dry season are easily overcome by artificial irrigation, which, on account of the level surface of the soil and the short distance which the water must be pumped, is rendered particularly easy. By establishing a pump near a branch of the lake and raising the water about 8 feet the whole of the muck lands can be easily irrigated. It is not necessary that the water be brought to the surface of the soil at all, as, on account of the porous nature of the muck, the land is thoroughly moistened by subirrigation; it is only necessary to bring the water high enough to allow it to flow into the drainage ditch to secure a complete permeation of the soil with moisture. Upon the whole, therefore, in regard to precipitation, it may be said that the climate of the central peninsula of Florida is favorable, not only to the growth of the staples—sugar and rice—but also for market gardening.

In regard to the temperature, equally favorable conditions obtain. Frosts are of rare occurrence, and when they do occur usually do but little injury. Only twice in eight years have the eyes of the cane been injured by frost, and even in these cases they were not all killed. In no instance has cane been known to freeze in the Florida peninsula, during the period over which these observations extend. It may be said, therefore, that no danger need be apprehended by the planter, even in the central portion of the peninsula, from frost. On account of this immunity from frost, the cane may be allowed to ripen during the months of November and December, and grinding operations need not begin until January or even later. The climatic conditions of temperature, therefore, in this respect, approach those of the island of Cuba. This being true of the central portion of the peninsula, it is true in a much greater degree of the lower portion, viz, the Okeechobee section. In this region frosts are almost entirely unknown. The coconut and the date palm flourish, and tropical plants of every

description predominate over the subtropical. In March, 1891, during a visit to this region, numerous fields of cane were seen along the Caloosahatchee which had not yet been cut, and which, although not entirely green, were only affected in color by the maturity of the plant presenting a rich yellowish green. In this region the sugar cane is absolutely free from any danger from frost, although occasionally light frosts have been known to injure more delicate plants. It may be said, then, with confidence that in the region of the Okeechobee Lake the lands which may be recovered for sugar-making purposes have all the advantages of the climate of Cuba.

The manufacture of sugar from the cane in this region may be postponed with perfect safety until the beginning of February, and the months of February, March, and April be the months of greatest activity in sugar manufacture.

On account of the ease of irrigation, the whole area of the muck lands of Florida is particularly well suited to the growth of rice. In regard to the actual success of rice culture, however, it is not possible to speak from any but theoretical considerations, inasmuch as until the present year no experiments of any consequence have been made in rice culture. During the present season several thousand acres have been planted in rice on the muck and semimuck lands of the State, and the result of this trial will be awaited with interest by those interested in the agriculture of that region.

In regard to the culture of rice, it may be said that it can be grown on the muck lands of slight depth, known as prairie lands. These lands often have a covering of only a few inches of muck, underneath of which is found firm, hard, white sand. These lands are not suitable to the culture of cane, but are supposed to be well suited to the growth of rice.

Another important consideration in connection with the muck lands of the Okeechobee country is found in the method contemplated for their cultivation. These lands will be intersected by numerous drainage canals, and by means of these canals not only can the land be cultivated by steam from engines carried on boats in the canals themselves, but also the products of the fields can be transported on the same canal, with an economy which will render the competition of mule or horsepower methods of cultivation almost impossible. Competent engineers have made estimates for the actual cost of steam cultivation, on the canal system indicated above, and, allowing for all contingencies of unexpected expenses, it appears reasonable to say that, with the yield of cane which can be secured on such lands, it will be possible to place the cane at the doors of the factories, by means of a system of canals used in irrigation and cultivation, at an expense which will fall below $2 per ton. This expense includes all the cost of cultivation, harvesting, and transportation.

It is not necessary to dwell upon the fact that with cane produced at such a cost, even the island of Cuba could not compete with Florida in the production of sugar. There is practically no other body of land in the world which presents such remarkable possibilities of development as the muck lands bordering the southern shores of Lake Okeechobee. With a depth of soil averaging, perhaps, 8 feet, and an extent of nearly half a million acres, with a surface almost absolutely level, it affords promise of development which reaches beyond the limits of propheey

THE CONSTITUTION OF THE MUCK SOILS.

Preliminary examinations of the muck lands of Florida have been made by Mr. D. C. Sutton, of the Department of Agriculture, assistant in charge of the experiment station at Runnymede. Three samples of the soil were taken by him, of which No. 1 was from the oldest cultivated land on the estate of the Florida Sugar Manufacturing Co's. station, about 4 miles from the experimental field at Runnymede. Soil No. 2 was from a portion of the field which had been in cultivation for only a short time. No. 3 was taken from a spot farther back, on the lands of the same company near the prairies. The results of the analyses are given in the following table:

	No. 1.	No. 2.	No. 3.
Insoluble matter	23.21	21.45	40.80
Soluble silica	.02	.02	.08
Potash	.11	.10	.07
Soda	.17	.15	.10
Lime	.16	.16	.10
Magnesia	.01	.01	.007
Peroxide of iron, alumina	3.06	2.79	1.83
Phosphoric acid	.19	.16	.09
Sulphuric acid	.01	.01	.01
Organic matter	68.11	70.52	53.65
Carbonic acid, chlorine, and loss	4.95	4.63	2.263
	100.00	100.00	100.00

These analyses were made before the establishment of the experiment station at Runnymede. On the establishment of this station it was deemed advisable to make a more complete analysis of the soils from the station itself. For this purpose, four samples of soil were taken, two of them from the station and two from old cultivated land, in order to determine the degree of change which would take place during cultivation. The two samples which were taken from the station are shown.

Sample No. 1 was taken from the front part of the station, near the cypress grove. Sample No. 2 was taken from the back part of the station land, near the pine land. These two samples show the two distinctive characters of the muck. The first sample is a muck of a brown color which drains easily and is very porous. No. 2 is a muck of a deep black color, more compact, and less easily drained. Sample No. 3 was taken from the orchard of the St. Cloud plantation, about 4 miles from the station, from a portion of land which, at present, is planted in grapes and has been in cultivation for five years, principally in vegetables. Sample No. 4 was taken from a field on the St. Cloud plantation which has been in cultivation in cane for five years.

In samples 1 and 2 is shown a complete section of the soil from the top and the sand below. Samples 3 and 4 were purposely taken from the surface in order to show the effect of cultivation and oxidation on the character of the soil.

Florida soils.

[Dried at 110°.]

	Carbon.	Hydrogen.	Volatile.	Absorption.	Nitrogen.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Soil No. 1:					
8976, first foot	57.67	4.48	90.60	145.14	2.24
8977, second foot	47.07	5.15	72.00	108.50	1.40
8978, third foot	8.52	.53	15.00	46.68	.31
Soil No. 2:					
8979, first foot	56.21	6.08	91.70	151.15	2.33
8980, second foot	58.57	6.04	96.50	188.32	2.83
8981, third foot	48.27	6.34	96.76	156.98	2.33
8982, fourth foot	21.72	2.03	40.88	81.05	.95
Soil No. 3, 8983	18.72	2.72	45.60	114.03	1.26
Soil No. 4, 8984	19.48	2.69	45.70	167.95	1.18

The above figures show the composition of the soil in layers of 1 foot. Sample No. 1 had a depth of 3 feet, but the last foot was largely mixed with sand, as is shown by the decrease in carbon, hydrogen, nitrogen, and absorptive power and the increase in mineral or nonvolatile matter.

Under the column "Absorption" is given the percentage of water which the perfectly dry soils will absorb. It is seen that the pure muck, where unmixed with sand, will absorb more than its own weight of water—in one case almost double its weight. The importance of this property in times of drought and in relation to subirrigation must not be overlooked. The quantity of nitrogen in the layer of muck immediately above the sand is much less than in other parts of the soil, but this is not due to any impoverishment of the muck itself, but to the great admixture of sand. In the dry muck which has not been cultivated the value of the nitrogen reaches in one case $10.19 per ton, estimating nitrogen at 18 cents a pound. Cultivation for a few years reduces the percentage of nitrogen in the surface soils, as is indicated by the numbers obtained with samples 3 and 4. * * *

CANE AND CASSAVA CULTURE IN FLORIDA.

[Address by Dr. H. W. Wiley before Florida Agricultural Society at Jacksonville, Fla. In Bulletin No. 70 of Bureau of Chemistry, U. S. Department of Agriculture; Manufacture of Table Sirups from Sugar Cane, 1902, pp. 9, 10.]

The problems connected with the sugar and starch products are four or five in number.

First of all, the soil is to be considered, and therefore agricultural interests should pay some attention to staple crops—that is, crops that have a market the year round, and can be preserved and marketed at any time. Sugar and starch are types of such crops. These substances take absolutely nothing from the soil; they are fabricated by the plant from the atmosphere and water; hence the sale of such products does not tend to impoverish the soil.

The soils of Florida are largely of a sandy nature—that is, they have been deposited from water; they are typically different from the soils of the great Northwest, which were produced by the grinding effect of moving icebergs, and represent the richest soils, probably, in the world. Sandy soils are not suitable for producing wheat, for

instance, but they are well adapted to producing sugar and starch. In Florida it is more a question of climate than of soil, since, with a favorable climate, scientific agriculture will produce a crop from almost any kind of soil.

The second problem to be considered is that of fertilizers. Perhaps there is no State more favorably situated than Florida in respect to fertilizers. You have here inexhaustible deposits of phosphate. In the leguminous crops which grow here, namely, peas, beans, alfalfa, and beggar-weed grass, you have a most valuable means of assimilating nitrogen from the air. In cotton seed, fish scrap, and other animal refuse you have access to large stores of nitrogen. Through your seaports stores of fertilizing materials, such as nitrate of soda and potash salts, can be brought from South America and Germany. It would be hard to find any other portion of our country where fertilizers could be sold more cheaply than in this State.

CHARACTER OF THE MARKET.

The third problem is the character of the market. This country is the greatest sugar and starch consumer in the world. We use more than 2,000,000 tons of sugar annually. Of this quantity, before the Spanish War, we made only about 300,000 tons—about one-seventh of all.

Since the Spanish War we have acquired Hawaii, Porto Rico, and the Philippines, all of which give us large additional quantities of sugar. This year we will produce about 100,000 tons of beet sugar, so that at the present time it may be said that we produce about one-third of all the sugar we consume; but still there is a vast foreign market which we might supply with the home product. There is no danger, therefore, of overstocking our home market with increased sugar production, nor is there danger of the beet sugar driving the cane sugar out of the market. For many purposes, as, for instance, the manufacture of sirup, beet sugar is unsuitable, and there will always be a demand for all the cane sugar that can be made.

The sugar crop of the whole world for the present year is about 10,000,000 tons, of which nearly 7,000,000 are made from the sugar beet.

THE SUGAR BEET.

The sugar beet can not, however, be grown in Florida profitably. Here you must depend on the sugar cane for sugar and upon the cassava and potato for starch. From starch glucose can also be made, and it seems to me that in the near future the glucose industry will pass from the indian-corn belt to the cassava and potato belt. In one particular industry Florida and the southern parts of Georgia and Alabama stand preeminent, and that is the manufacture of table sirup from sugar cane. It is important, however, to secure uniform grades to hold the markets of the world, and this can only be accomplished by mixing together the products of small farmers or by the establishment of central factories, where the cane grown in the neighborhood can be manufactured under standard conditions.

By the development of these great industries, sugar and starch making, including table sirups, untold wealth will in the near future flow into Florida. From by-products of the factories immense quan-

tities of cattle food can be obtained, both from sugar cane and the starch-producing plants. Thus a dairy industry can be established in connection with sugar and starch making, which will add much to the wealth of the State.

FLORIDA CANES.

[In Bulletin No. 103, by Dr. H. W. Wiley, of Bureau of Chemistry, U. S. Department of Agriculture: Experimental Work in the Production of Table Sirup at Waycross, Ga., 1905, p. 11.]

It is interesting to compare the canes of Georgia with some grown below the frost line in Florida. The figures given in the following table show that in southern Florida, where the canes continue to grow throughout the winter without being frost bitten, they attain a remarkable degree of sweetness. There is a minimum quantity of reducing sugar present, which probably would be indicated as zero by the ordinary volumetric method. It may be considered that the amounts of reducing sugar obtained in the mature cane were in most cases due to the action of the reagents upon the cane sugar. In other words, the canes have apparently attained their normal maturity.

The increasing richness of the canes is shown by comparing those harvested in March with those from the same locality analyzed in November. The cane received on November 11 contained 13.50 per cent of sucrose, while the canes from the same locality received on March 31, and cut probably three days previously, contained 20.90 per cent of sucrose. The purity of the juice received on November 21 is 79 per cent, while that of the juice received on March 31 is 91.30 per cent, the richest cane ever analyzed in this bureau.

Canes of this degree of richness would be of exceptionally fine quality for sugar making, but it would be rather difficult to make a sirup from them which would not crystallize. In other words, the ordinary inversion from evaporation would scarcely be sufficient to prevent crystallization of the finished product.

TABLE III.—*Analyses of Florida canes.*

Serial No.	Description.	Date.	Sucrose.	Reducing sugar.	Purity.
			Per cent.	*Per cent.*	
3800	Red cane, Orange County, Fla.	Nov. 21, 1905	13.50	0.30	79.00
	Manatee County, Fla.:[1]				
4022	D 74	Feb. 19, 1906	15.60	.24	87.20
4023	D 95	do	17.65	.26	89.40
4042	Ribbon cane	Mar. 8, 1906	15.00	.14	88.20
4043	D 95	do	16.40	.15	89.60
4051	D 74	Mar. 31, 1906	16.50	.10	86.00
4052	Green or Simpson cane	do	20.90	.22	91.30

[1] Grown by H. L. Abel at Terra Ceia.