

The analyses were made by one of my assistants, Mr. Henry B. Parsons.

ANALYSES OF URANO-THORITE.

	PRELIMINARY.	FINAL.
Moisture and combined water.....		11.31
Silica, SiO_2	19.43	19.38
Thoric oxide, ThO	52.51	52.07
Lead oxide, PbO40	.40*
Aluminic oxide, Al_2O_333
Ferric oxide, Fe_2O_3		4.01
Uranic oxide, U_3O_8		9.96
Calcic oxide, CaO		2.34
Magnesian oxide, MgO04
Sodic oxide, Na_2O11
		<hr/>
		99.95

April 15th, 1880.

IX.—DEVELOPMENT OF SUGAR IN THE SORGHUMS.

BY PETER COLLIER, PH.D.

During the season of 1879, a series of examinations were conducted upon four varieties of sorghum, for the purpose of learning more about the development of sugar in these plants, and, if possible, of reconciling the conflicting testimony, which has accumulated during the past twenty-five years, since their first introduction into this country.

The results obtained are prospectively of such immense practical importance, that apart from their scientific bearings, it seems that none can but feel a lively interest in them.

The four varieties of sorghum experimented upon, were known as the Early Amber, the White Liberian or Goose-neck, the Chinese or Sumac, and the Honduras or Mastodon.

The seed was planted in the grounds of the Department of Agriculture, at Washington, D. C., on or about the 15th of May, and the culture was in all respects like that of Indian corn.

When the flower head first appeared, the examinations began, and these examinations were continued at intervals of from 5 to 7 days during the season.

For each examination, two or three stalks of each variety were selected, their development, length, weight, &c., noted down. After

* From preliminary analysis.

stripping off the blades, the stalks were equally divided into butts and tops, the juice expressed from each, and its specific gravity, content of sucrose (crystallizable sugar), glucose (uncrystallizable sugar), and total solid matter, carefully determined. Besides these determinations, the water present in the fresh, unpressed stalks was also determined.

The glucose was determined by Fehling's solution, and the sucrose, after inversion, in like manner, and there appeared to be no trouble in securing results of considerable accuracy, as evidenced by repeated tests in duplicate. The polarization of the juice was also taken in every case.

The first examinations of the Early Amber and of the White Liberian varieties, were made July 18th, and through the season these two varieties, although quite unlike in appearance, showed a marked resemblance in their development.

The examinations of the Chinese began August 6th, and those of the Honduras, August 12th. The examinations were concluded upon the 8th of November.

The first examinations of these four varieties gave the following results:

July 18th, Early Amber, 3.77 per cent. glucose and 4.43 per cent. sucrose, in juice from entire stalks.

July 18th, White Liberian, 4.1 per cent. glucose and 5.7 per cent. sucrose, in juice.

August 6th, Chinese, 5.55 per cent. glucose and 1.85 per cent. sucrose, in juice.

August 12th, Honduras, 5.13 per cent. glucose and 1.2 per cent. sucrose, in juice.

The above results represent the percentage of glucose and of sucrose, in the juice from both butts and tops.

Successive examinations showed, in every case, a rapid increase in the amount of sucrose and a decrease in the amount of glucose present in the juice, although the increase of the former was far greater than the decrease of the latter, as will be evident by the following results of examinations made at later periods in the development of the plants.

August 13th, the Early Amber gave 1.74 per cent. glucose and 14.25 per cent. sucrose.

August 13th, the White Liberian gave 2.0 per cent. glucose and 13.8 per cent. of sucrose.

September 13th, the Chinese gave 1.45 per cent. glucose and 13.9 per cent. sucrose.

October 14th, the Honduras gave 1.4 per cent. glucose and 14.5 per cent. sucrose.

It will be observed that the total sugars present had increased in the case of the Early Amber, from 8.2 per cent. to 16.1 per cent., between July 18th and August 13th; during the same period, the total sugar in the White Liberian had increased from 9.8 per cent. to 15.8 per cent. So, likewise, the total sugars in the Chinese increased from 7.4 per cent. upon August 6th, to 15.4 per cent. upon September 13th; and the Honduras, which, upon August 12th, gave 6.33 per cent. of sugars, gave upon October 14th, 15.9 per cent.

It appeared from these examinations, that when the maximum content of sugar had been attained, it was maintained by the plant during the remainder of the season, thus affording ample time to work up the crop for sugar.

Between the 13th of August and the 29th of October, there were made in all, fifteen examinations of the Early Amber, and during this period of 78 days, the average per cent. of crystallizable sugar in the juice was 14.6, the maximum being 17.0 per cent.

Between August 13th and October 29th, there were made in all, thirteen examinations of White Liberian, the average of all giving 13.8 per cent. of sucrose, with a maximum of 15.2 per cent.

Between September 13th and October 29th, there was made seven examinations of Chinese, the average of all, during a period of 46 days, being 13.8 per cent. of sucrose, the maximum being 15.05 per cent.

Between October 14th and October 29th, three analyses were made of the Honduras, which gave, during a period of 16 days, an average per cent. of sucrose of 14.6, with a maximum of 15.1 per cent.

For purposes of comparison, a bundle of sugar cane was obtained from the president of the Louisiana Sugar Planters' Association, consisting of three varieties of cane, viz: ribbon cane, plant of 1878 and 1879, and red cane, plant of 1879.

Triplicate analyses of each of these three varieties were made, and the average of the nine analyses showed an average percentage of sucrose of 14.43.

Analyses of thirteen specimens of sugar beets grown upon the Agricultural College farm at Amherst, Mass., and analysed by Professor Goessmann, gave an average per cent. of sucrose of 11.50.

It appears, therefore, from the above, that we have in these sorghums, a crop as readily grown as maize, and, when cut at the proper time, full as rich in sugar as the best Louisiana cane.

When the season was so far advanced that there was danger of frost, the remainder of the crop of these four varieties of sorghums was cut and worked for sugar, by processes similar to, if not identical with, those employed in the production of sugar from sugar cane; and in each case it was found that the syrups prepared by evaporation of the defecated juices of these plants, became, after standing from 24 to 36 hours, semi-solid, from the formation of crystals of sucrose; and in the case of the Chinese, the syrup yielded 55 per cent. of its weight in the first crop of crystals, a result altogether satisfactory, in view of the fact that this syrup had been prepared by open-pan evaporation.

As to the relative development of the sucrose and glucose in the butts and tops, it was found that in the early stages of the plant's development, the amount of sugar was greater in the butts, but that as the seed became ripe, the reverse became true, and the upper half of the stalks became richer in sugar, although the difference was at no time considerable.

Our experiments made with common field corn-stalks were most interesting, as indicating the possible utilization of what has hitherto been generally regarded, not only as a refuse, but to the large farmers of the West, a positive nuisance.

In the course of other experiments in the field, there was planted a small piece of corn, of the coarse growing White Dent variety. After the fully ripened grain had been gathered, the stalks, which were still green and juicy, were pressed, and the juice was found to contain 10.9 per cent. of sucrose and 2.4 per cent. of glucose. This juice, upon evaporation, gave a syrup which crystallized readily, and yielded at the rate of 960 pounds of sugar to the acre.

The shelled corn was at the rate of $69\frac{1}{10}$ bushels to the acre, 56 pounds to the bushel. Although the above yield of corn is not unprecedented, it is still far above the average yield per acre, and it is obvious that the value of the sugar obtained (which polarized 92°) is fully twice the value of the grain. From this it follows, that it is possible to secure, in sugar, fully twice the value of the grain which has hitherto been the only product which has been regarded as worth earning.

There are at present at the Department of Agriculture, thirty-six other varieties of sorghum seed received from different parts of the country, which have never been examined, and it is not improbable that among this number may be found those adapted to every variety of climate and soil where Indian corn may be grown. It is intended

to repeat the above examinations this year, and to examine these other varieties.

The practical results of the above investigations are, that for the production of either syrup or sugar from the sorghums, the cane should be worked when fully ripe, as evidenced by the seeds having become hard and dry, the lower blades of the stalks drying and falling away, and the appearance of off-shoots from the upper points of the stalks. At this period, not only is the total amount of sugars, both sucrose and glucose, at its maximum, thus giving the largest yield of syrup, but the relative proportions of crystallizable sugar to uncrystallizable, is also at its maximum, thus giving the largest yield of sugar.

X.—ON VIRULENT DISEASES, AND ESPECIALLY ON THE DISEASE COMMONLY CALLED CHICKEN CHOLERA.

By M. PASTEUR.

Translated from the *Comptes Rendus de l'Academie des Sciences*, of Feb. 9th, 1880, page 239, by P. CASAMAJOR.

Virulent diseases may be ranked among the greatest of the evils that afflict living beings. To prove this, we have merely to name measles, scarlatina, variola, syphilis, glanders, the carbuncular disease, yellow fever, typhus and the cattle plague. This list is far from being complete ; the pathology of the most important diseases may find a place here.

When the ideas of Liebig on the nature of ferments, were in vogue, each virus was considered as a substance undergoing an internal change, which could be communicated to living organisms, turning the constituents of these into a virus of the same nature. Liebig was well aware that the first apparition of ferments, their multiplication and their power of decomposition, present the greatest analogies with the phenomena of life, but, in the introduction to his Organic Chemistry, he tells us that these analogies may be considered as deceitful illusions.

All the experiments which I have communicated to this Academy for the last twenty-three years, have demonstrated, either directly or indirectly, the inaccuracy of the opinions of Liebig. A single method has guided me in the study of microscopic organisms. This method has been essentially the cultivation of these minute beings in a pure state, that is: by eliminating the heterogenous substances, living or dead, which accompany them. By the use of this method, the most difficult questions are often solved in the easiest and most