XXVIII.—On Experiments with Fertilizers upon Sugar-cane, at Calumet Plantation, Bayou Têche, La.

By Prof. C. A. GOESSMANN.

It has been my pleasure, in a previous communication, to report through the Proceedings of the American Chemical Society, Vol. II., No. 2, p. 52, the results of a series of experiments with various fertilizers upon sugar-cane, at Calumet Plantation, Bayou Têche, La. The importance of the local agricultural, as well as the general industrial, interests involved in a certain solution of the object in view, have induced the progressive and public-spirited proprietor of that plantation, Daniel Thompson, Esq., Pattersonville, Parish St. Mary, La., to continue his investigations.

The original plan for the field work, which was carried out for two successive years, has been abandoned. A new course of experiments, *proposed by the writer*, at the special request of Mr. Thompson, has taken its place since the spring of 1878. The change concerns the details, and aims at a systematical application of the various fertilizing materials, for the purpose of imparting to the eventual results a better defined meaning. I had occasion to study, in previous years, the general topographical and geological features of the locality where the experiments are conducted, when visiting the Bayou Têche, for several months, as expert in connection with a scientific expedition, to inquire into its industrial and commercial resources. The physical condition of the soil on trial, as well as the nature of its constituents and latent natural resources of plant-food, I had, repeatedly, a good chance to ascertain by chemical tests. As the general character of the soil and the temporary supply of plant food, as far as the kind and the amount of each article is concerned, are known to exert, in most instances, for some time, a controlling influence on the quantity and quality of the resulting crops, under circumstances like those under consideration, I recommended a time honored and well endorsed mode of operation, which, intelligently carried out, cannot fail to secure to the careful observer, in a practical way, much valuable information—a mode which every intelligent farmer may turn to account, to some degree at least, for personal instruction in his own industry. In the making up of the compound manures, the refuse materials from Southern branches of agricultural industry, have been, for obvious reasons, in several instances, selected. Two points which the history of field experiments with fertilizers, in an unqualified manner, endorses, were beforehand conceded, namely:

the results obtained from experiments extending over a certain number of years, are alone entitled to serious consideration ; and even well established results are, in most instances, essentially of local value. The general interest which a well devised series of field experiments with fertilizers may claim, consists chiefly in its educational influence, serving as a lesson for similar investigations in other localities. With these qualifications, the subsequent detailed report of Mr. Thompson's first year's work, upon the new plan, is not without some interest to those engaged in agricultural field experiments in general.

The lands engaged in the trial consist of sixteen acres in one level body. All parts of the area are equally well drained. The soil is so far as general appearance may tell, of an uniform mechanical and chemical condition ; a fine dark brown, clayish loam, rich in rooty fibres. The entire ground has been treated alike since 1863 ; it was left uncultivated from that year until 1871, on account of the war, and served subsequently, alternately, for the production of corn and sugar-cane. Pea-vines were raised at certain intervals for green-manuring, with the exception of 1876, when 500 pounds of cotton-seed meal, per acre, was used as a fertilizer. The entire field has been divided into sixteen plats, each one acre in size. Individual plats are separated by three rows of cane, of six feet each, making eighteen feet of unfertilized space between two adjoining plats. The canes have been harvested in the same order as the plats are numbered. The grinding began on the 9th of December, and closed on the 16th of December. One day passed by, on an average, between the cutting and the grinding of each lot of cane.

The latter were thus from twenty-four to thirty-six hours cut, before the test of the juice by the polariscope, etc., could be attended to. The season was very favorable for the cultivation of sugar-cane. In consequence of the absence of Mr. Thompson during the beginning of the grinding season, the crops of the first four plats failed to be recorded and tested, much to his displeasure. The entire experiment, I am advised, is to be repeated, in all its details, during the present season (see accompanying table).

Results of Experiments with Fertilizers upon Plant Cane at Cabanet Plantation, Bayou Teche, La., 1878.

No. of Plat.	Material used as Fertilizer.	Quantity used in Pounds.	Quantity of Soluble Constituents of the Fertilizers in Pounds.	PLATS, ONE ACRE EACH. Total Cost of Fertilizers.	Per Cent. of Juice Extracted.	Weight of Cane Raised in Pounds.	No. of Gallons of Cane Juice.	Weight of the Juice in Pounds.	Density, Beaume's Saccharometer.	Density Per Cent., Saccharometer.	Result of Polarization.	Total Amount of Sugar Available in Pounds.	REMARKS.
1	Muriate of Potash.	200	Potash 167.50	$4.56	....	....	....	....	....	....	....	....	Results Lost.
2	Sulphate of Potash.	250	Potash 132.50	7.70	....	....	....	....	....	....	....	....	" "
3	Cotton Hull Ash...	500	Potash..... .100.00	5.00	....	....	....	....	....	....	....	....	" "
4	Air-Slaked Lime..	500	....	2.50	....	....	....	....	....	....	....	....	" "
5	Gypsum.	500	....	3.60	52.2	57930	3400	30266	9.25	15.0	14.5	4386	
6	Acid Pho. Lime ...	500	Pho. Acid 72.50	8.90	54.6	56030	3568	31602	9.00	14.5	12.5	3950	
7	Sulphate Ammonia.	150	Ammonia 36.00	8.25	64.0	49630	3587	31790	8.75	14 0	12.5	3974	
8	Cotton S. Hull Ash.	500	Potash.....100.00	12.66	62.0	46780	3257	28958	9.00	15.0	13.0	3766	
	Acid Pho. Lime....	500	Pho. Acid 72.50										
9	Air Slaked Lime....	500	.. ..	7.50	61.8	42250	2937	26124	9.00	15.0	12.6	3292	
	Cotton S. Hull Ash.	500	....										
10	Cotton S. Hull Ash.	500	....	8.60	59.9	46190	3110	27666	9.00	15.0	13.0	3497	
	Gypsum.....	500	....										
11	Cotton S. Hull Ash.	500	Potash.....110.33	10.00	61.6	56150	3898	34628	8.75	14.5	11.0	3811	
	Cotton S. Meal. ...	500	Ammonia 41.66										
			Pho. Acid.....18.83										
12	Cotton S. Hull Ash.	500	Potash 100.00	11.00	62.2	52890	3700	32890	8.75	14.5	11.5	3815	
	Tankage.....	500	Pho. Acid. ...72.00										
			Ammonia .. .42.00										
13	Cotton S. Hull Ash.	500	Potash.....110.33	14.45	63.1	57670	4096	36415	8.75	14.5	10.0	3643	
	Cotton S. Meal....	500	Ammonia. ...41.66										
	Acid Pho. Lime....	250	Pho. Acid..... .55										
14	Cotton S. Hull Ash.	500	Potash.....100.00	15.45	66.0	54500	4051	35965	8.50	14.0	10.0	3595	
	Tankage.	500	Ammonia 42.00										
	Acid Pho. Lime....	250	Pho. Acid ..106.00										
15	Acid Pho. Lime....	450	Pho. Acid. ...65.00	26.60	66.2	54940	4106	36377	8.50	14.0	8.6	2513	
	Nitrate Soda.....	250	Soda 87.50										
	Sulphate Potash....	250	Potash 182.00										
			Nitric Acid....38.70										
			Equal to										
			Ammonia 47.11										
16	Nothing.	..	....	.....	57.3	39400	2511	22393	9.50	15.0	12.0	2687	

The results, although in several instances quite remarkable, are, on the whole, by no means unusual. Without any intention to enter, at this early stage of the investigation, upon a detailed discussion of the various experiments, it seems quite safe to assume, first, that *the richness of the soil* still largely controls the results; and sec

ond, that *a different degree of maturity of the cane*, from the various plats, exerts a serious influence on the total amount of available *cane* sugar, as stated above. The last named circumstance is plainly shown by the remarkable differences noticeable in the percentage yield of the juice from the different lots of cane, varying from 52.2 to 66.2 per cent.; and also, by the not less striking differences in the composition of the juice, indicated by the results of the specific gravity test, by means of the saccharometer, which represents the relative total amount of solid matter in solution in the juice, and the tests by the polariscope, which expresses only the relative amount of cane sugar present in the latter. The actual differences in these tests are due to the presence of more or less foreign nitrogenous and non-nitrogenous substances.

As the above described experiments are instituted mainly for the purpose of finding a fertilizer which will assist in producing, upon a given area, the largest amount of cane sugar possible, and, at the same time, a cane which contains, in its juice, the highest possible percentage of cane sugar under favorable circumstances for separation, the subject of inquiry is of more than ordinary intricacy. A brief reference to experiments Nos. 5 and 13 may not be without interest in this connection. Upon these two plats the total amount of available sugar and of canes, differ in quite different proportions: for the excess of sugar exceeds that of the cane nearly three to one in favor of plat No. 5. This plat had received as fertilizer only gypsum (sulphate of lime), at a money value of $2.50 per acre; whilst No. 13 had received, what ordinarily would be designated, a complete fertilizer, containing besides a liberal amount of potassa, phosphoric acid and nitrogen, a considerable share of sulphate of lime or gypsum, the whole at a money value of $14.45 per acre. To ascribe, judging merely by the yield of sugar and cane, to the gypsum alone a higher power for aiding in the production of vegetable matter—cane sugar included—than to the combined effect of a liberal additional supply of all the essential mineral constituents of plants, as in the case of No. 13, would be in contradiction to the teachings of the best established experimental observations in agriculture. A continuation of these experiments, it may be confidently expected, will find a more satisfactory explanation in a favorable reaction of the gypsum, on either the physical condition or the chemical composition of a rich soil, or in some unsuspected combination of circumstances favorable to an early maturing of the canes.

The sugar industry of Louisiana has to contend to some considerable degree, against climatic disadvantages. The harvest of the cane has to begin at an early date, to escape the destructive influence of the frost. The planter of Cuba begins his operations frequently after the sugar season of Louisiana has closed. As the formation of the cane sugar in the sugar-cane, similar to that noticed in other sugar bearing plants, takes place largely during the last stages of its growth, it seems essential for the best success attainable in Louisiana, and similarly situated localities, to ascertain in particular the circumstances which favor an early maturity of the cane, without interfering with its normal development. Systems of cultivation as well as of fertilization, are known to exert, each in their own way, more or less influence on the duration of the period of growth. The history of the growth of the sugar-cane in Louisiana is but little known. To study systematically, by chemical and optical tests, the changes which the composition of the cane juice suffers during the advancing growth of the sugar-cane, can only increase the chances of success.

XXIX.—Contribution from the Chemical Laboratory of the Massachusetts Agricultural College.

By Prof. C. A. GOESSMANN.

SUGAR IN CORN-STALKS AND MELONS.

The examinations which form the main subject of this communication, were instituted for the purpose of testing the fitness of the juice of corn-stalks and melons, raised in our section of the country, 1876–1878, for the manufacture of sugar and syrup—an application which has been, of late, recommended. The tests were made under my direction by Mr. E. B. Bragg, a graduate of the Massachusetts Agricultural College.

1878. *Fodder Corn (Maize).*

Aug. 19.—Vigorous plants of Northern corn, sown for fodder upon the College farm, with the tassels just appearing, were cut off six inches above the ground, and from two to three feet of their tops, besides their entire leaf mass, removed. The remaining canes were crushed and pressed by a hand-press, to secure their juice.