1892

Sugar cane : field and laboratory results of 1891

William Carter Stubbs

SECOND SERIES.

No. 14.

BULLETIN

OF THE

SUGAR EXPERIMENT STATION

AT

AUDUBON PARK, NEW ORLEANS, LA.

WM. C. STUBBS, PH. D., Director.

SUGAR CANE,

FIELD AND LABORATORY RESULTS.

OF 1891.

ISSUED BY THE BUREAU OF AGRICULTURE.

T. S. ADAMS, COMMISSIONER.

BATON ROUGE, LA.

PRINTED AT THE TRUTH BOOK AND JOB OFFICE.

1892.

LOUISIANA STATE UNIVERSITY AND A. & M. COLLEGE.

BUREAU OF AGRICULTURE.

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LOUISIANA SUGAR EXPERIMENT STATION,
AUDUBON PARK, NEW ORLEANS,
January, 1892.

Capt. T. S. Adams, Commissioner of Agriculture, Baton Rouge, La.:

DEAR SIR—I hand you herewith Field and Laboratory results of experiments made with Sugar Cane during the past season and ask that it be published as Bulletin No. 14.

Respectfully submitted,

WM. C. STUBBS, Director.

EXPERIMENTS.

WEATHER SYNOPSIS.

The Station has kept an accurate weather record and diary since March 1, 1886. In order that an accurate account of each year's weather may be carefully compared the following condensed record of rainfall and temperature is given.

Condensed Weather Record of Sugar Experiment Station from March 1, 1886, to January 1, 1891.

Month.	Average Temperature, Degrees.	Maximum Temperature, Degrees.	Minimum Temperature, Degrees.	Rainfall Inches.
1886.				
March	63	80	37	9.13
April	69	87	41	7.32
May	76	93	57	3.59
June	83	97	69	11.5
July	83	95	68	3.25
August	84	96	66	4.18
September	80	91	59	5.24
October	73	87	39	1.
November	66	75	33	5.55
December	65	79	26	2.75

Condensed Weather Record—Continued.

Month.	Average Temperature, Degrees.	Maximum Temperature, Degrees.	Minimum Temperature, Degrees.	Rainfall Inches.
1887.				
January	57	82	22	3.31
February	65.4	80	30	5.23
March	58.2	81	40	3.27
April	71.7	89	57	2.21
May	78	94	59	6.56
June	84	94	62	10.35
July	84	97	68	7.86
August	82.5	95	69	6.7
September	79	92	56	3.3
October	69.5	86	40	6.39
November	60	80	30	.11
December	54.6	77	30	7.14
1888.				
January	56.6	77	30	3.77
February	59.8	76	37	9.8
March	59	78	36	5.79
April	73.4	85	54	.91
May	76.7	92	54	11.77
June	79.8	92	65	8.69
July	82	98	71	5.49
August	81.2	95	70	15.8
September	77.3	89	57	3.29
October	70.6	85	53	3.4
November	62.4	84	34	2.5
December	63.6	71	27	4.12
1889.				
January	54	71	34	8.3
February	55	75	31	3.21
March	63.6	79	40	2.38
April	72	86	47	3.28
May	78.1	91	48	.76
June	82.3	96	57	9.43
July	85.6	92	68	7.15
August	81	90	66	5.74
September	79.1	91	51	5.3
October	68.1	86	51	....
November	58.9	82	30	....
December	63	80	45	.43

Condensed Weather Record– Continued.

Month.	Average Temperature, Degrees.	Maximum Temperature, Degrees.	Minimum Temperature, Degrees.	Rainfall Inches.
1890.				
January	61.8	80	32	1.00
February	62.8	81	36	3.10
March	60.7	79.5	27	1.98
April	69.7	84.5	42	3.27
May	74.7	87.5	56	10.71
June	87.8	94	68	4.15
July	81.7	95	69	7.30
August	79.8	92.5	67	7.75
September	76.3	90	56.5	4.56
October	67.45	87	38	4.41
November	61.70	82	39	.87
December	55.30	78	33	3.55

SUGAR EXPERIMENT STATION.

SUMMARY OF METEOROLOGICAL OBSERVATIONS MADE AT AUDUBON PARK DURING THE YEAR 1891.

Name of Month.	Monthly Mean Temperature.	Mean Maximum Temperature.	Mean Minimum Temperature.	Hightest Temperature.	Date of Occurrence.	Lowest Temperature.	Date of Occurrence.	Monthly Range.	Rainfall in Inches.
January	52.3	59.3	41.9	75.	31	32.	13, 14, 19, 20, 26, 27	47.	5.69
February	63.1	69.	53.2	78.	18, 19, 20, 21	32.	27	56.	11.25
March	59.3	67.8	49.4	78.	6	38.	14	40.	3.36
April	66.1	76.7	57.	84.	17, 25, 27	37.	4, 5	47.	.80
May	72.0	83.2	63.	90.	24	52.	7	38.	2.37
June	80.2	90.9	71.9	96.	6	66.	3	30.	5.84
July	79.6	89.7	72.5	95.	14	65.	9	30.	5.50
August	80.3	90.3	71.3	98.	12, 14, 21	57.	24	41.	2.05
September	76.7	84.9	63.1	95.	1	54.	7	41.	9.79
October	67.1	76.2	59.1	90.	1	51.	7	39.	1.35
November	56.5	68.3	48.6	79.	1, 5, 6, 7, 8, 15, 16	29.	29, 30	50.	3.95
December	55.9	62.3	49.2	75.	6	29.	8	46.	4.42

In the following table is presented the six years in a comparative form, and it may be useful in determining some of the factors which go toward solving the problem of good crop years.

The winter of 1886 was very severe, destroying much of the seed and stubble, the spring was late and cold, and good stands of cane, were not obtained until May. The subsequent seasons were fair, and where good stands prevailed the crop was medium.

The winter of 1887 was mild and conducive to excellent seed cane, the spring was moderately dry and warm; followed by a warm and wet summer grading into a cool dry autumn; conditions favorable to heavy tonnage.

The winter of 1888 was fairly propitious, but the spring was excessively wet, preventing the proper cultivation of the cane. The wet weather extended to July, causing a serious postponement or abandonment of the regular "lay-by" of cane. These rains were succeeded by a dry, cool fall, giving us light tonnage, but heavy sugar yield, due more to the low glucose content than excess of sugar in cane.

The year 1889 will always be remembered as the year of drought. The rainfall for the year was only 46 inches, and this fell mostly in the winter and summer, giving us a spring and fall of unexampled dryness—a dryness which was prolonged into the winter of 1890.

The year 1890 will be memorable for the enormous crop produced. It was ushered in amidst a drought lapsing from 1889, with mild, fair weather in January and February, giving an early germination and growth to both plant and stubble cane—both to be cut down by an unusual freeze early in March; followed by a propitious spring, with an abundant rainfall in May, preceding enough dry weather in June to permit a careful "lay-by" of the crop. Copious showers, at no time excessive, prevailing through July, August, September and October, which together with an abundance of sunshine and a continuance of warm weather, all conspired to give us the largest tonnage perhaps ever known in our history. The season was favorable throughout to the growth of cane, and hence the large crop was harvested in a very immature condition. Neither the temperature nor rainfall was excessive, but well distributed throughout the season, extending well into the fall.

The year 1891 has been characterized by frequent prolonged droughts--particularly during the growing season. From the 13th of March to 21st of June less than four inches, distributed in small showers, occurred. Besides this, less rain fell in the summer than in any year since the organization of this Station. Only 13.49 inches, or six inches less than any previous year. Again in August there was a large deficiency of rain, the entire month and extending well into September, giving a little over two inches. Of the 56 inches, nearly one-half fell in winter and nearly two-thirds in winter and fall, leaving a little less than one-third for the growing crops. The mean annual temperature has been the lowest for years. Under such conditions, the crops have been light in tonnage and rich in sugar.

The following is the comparative weather statement for six years:

	Average Temperature.	Maximum Temperature	Minimum Temperature	Rainfall
	degrees.	degrees.	degrees.	Inches.
1887	70.3	97.	22.	62.43
1888	69.3	98.	27.	75.33
1889	70.1	96.	30.	45.98
1890	69.98	95.	27.	52.65
1891	67.43	98.	29.	56.37
Spring months, 1886	69.3	93.	37.	20.04
Spring months, 1887	69.3	94.	40.	12.04
Spring months, 1888	69.7	92.	36.	18.47
Spring months, 1889	71.2	91.	40.	6.42
Spring months, 1890	68.4	87.5	27.	15.96
Spring months, 1891	65.8	90.	37.	6.53
Summer months, 1886	83.3	97.	66.	18.93
Summer months, 1887	83.5	97.	62.	24.91
Summer months 1888	81.0	98.	65.	29.98
Summer months, 1889	82.9	96.	57.	22.32
Summer months, 1890	83.1	95.	67.	19.20
Summer months, 1891	80.0	98.	57.	13.49
Fall months, 1886	73.0	87.	33.	11.79
Fall months, 1887	69.5	92.	30.	9.80
Fall months, 1888	70.1	89.	35.	9.19
Fall months, 1889	68.7	91.	34.	5.30
Fall months, 1890	74.5	92.5	38.	9.87
Fall months, 1891	66.8	95.	29.	15.09
Winter months, 1887	59.	82.	22.	15.68
Winter months, 1888	56.6	77.	27.	17.69
Winter months, 1889	57.3	82.	31.	11.94
Winter months, 1890	62.5	81.	45.	4.53
Winter months, 1891	57.1	78.	29.	21.36

Taking the table and the seasons, we find that a dry, warm winter followed by a moderately dry spring, and this in turn succeeded by a hot, wet summer, are conditions favorable to maximum growth of cane. It seems, too, that a dry, cool autumn, beginning early in September, is necessary to produce a large sugar content.

After the cane is laid by, frequent showers of considerable intensity appear highly beneficial, and if not supplied, the crop will not reach the maximum tonnage.

Experiments in Cultivation, Stubble Shaving, Etc.

Mr. James Mallon, the inventor of many implements used by the sugar cane planters of Louisiana, claims to have a cheap and effective method of cultivating the cane crop. He uses two cultivators only. One is familiar to all as Mallon's Rotary Hoe or disc cultivator; the other is a walking cultivator with five small plows attached. These plows can be removed or adjusted at pleasure. He breaks the middle with the latter and pulls up the dirt to the cane with the former. At lay-by he uses the large discs on his riding cultivator, followed by his walking cultivator with only three plows on. He has given his method to the public press.

In 1890 we had duplicate plats in foreign varieties, one arranged to be irrigated, if necessary, and the other not. They were to be otherwise treated alike. On account of the favorable seasons both received the same treatment. In the winter of 1890 one plat was tiled. These plats were continued into stubble in 1891. The tiled plat was turned over to Mr. Mallon to be cultivated according to his direction. The untiled plat was cultivated by the usual methods of the station. Mr. Mallon shaved his piece as a part of his process, while the other piece remained unshaved. They were fertilized alike. The following are the details of each cultivation:

Plat 1—Mallon's cultivation; offbarred and stubble shaved February 23; ran stubble digger March 2 and March 31; hoed April 1; fertilized and dirt thrown to stubble, with one mule plow, April 15; hoed slightly April 16; worked out with Mallon's disc and walking cultivator April 24, May 8, May 25

and June 15; laid by with Mallon's disc and walking cultivator June 24.

Plat 2 was not stubble shaved; offbarred February 23; ran stubble digger, March 2 and 31; hoed April 1; fertilized and dirt thrown to cane with one-horse plow April 15; hoed lightly April 16; threw furrow to the cane with Sunbeam cultivator April 21; Mallon's disc cultivator April 27; split out middles with Advance plow May 4; Mallon's disc cultivator May 6; broke middles deeply with two-horse plow May 11; Mallon's disc cultivator May 16, May 25 and June 15; laid by with Mallon's large disc, followed by double mould-board plow, June 23.

Other conditions of these plats were the same. At harvest first plat yielded 33.16 tons, and second, 30.87 tons. There was a difference of 2.29 tons in favor of first plat. There were two factors in first plat not in second plat, besides the cultivation, viz.: tiled drainage and stubble shaving. How far either one or both contributed to the increased yield is not known. Mr. Mallon's system of cultivation is rapid and economical. He claims to be able to cultivate fifty acres of cane with one pair of mules. The cane was certainly *not injured* by his system. His method has much to recommend itself to the planter.

Stripping Cane.

In tropical countries it is a universal custom to strip the cane several times during the season of its dead leaves. In a recent report of a committee, of which Mr. W. H. Rickard was chairman, to the Planters' Labor and Supply Company, of Hawaiian Islands, the following is found:

A FEW WORDS NOW ON STRIPPING.

"It has been thought—by some—unnecessary to strip cane and looked upon and considered as an unnecessary expense. This, however, is overruled by the opinions of the 'many.' A great part of the expense of stripping is made up in its assistance in the culling of the canes for manufacture. But the most important benefits resulting from prudent and careful stripping are: That it allows the cane to breathe freely, provides for the free and necessary circulation of light and air in and around it to open it for manufacture. Again, the dead leaves removed, allow light showers of rain to reach the cane roots, where most

needed, and the dead leaves thus removed form a coat and covering for the soil by which undue evaporation of moisture is checked and the canes are benefited thereby. We favor the constant removal of all dead and withered leaves from the cane."

Several times has the Sugar Experiment Station tried the stripping of dead leaves from the cane with no perceptible benefit. This year, having duplicate experiments in our striped and purple canes, the experiment was again tried on both. Six rows, six feet wide of each, were taken. Three of each were stipped carefully of all dead leaves on September 7, and the other three left untouched. They were carefully harvested, weighed and analyzed on December 7. Unfortunately two of the samples for analyses were overlooked until they had fermented. There are, therefore, only analyses of the striped cane. The following are the partial results:

COMPARISON OF STRIPPED AND UNSTRIPPED CANE.

	KIND.	How Treated.	Yield Per Acre.	ANALYSES.		
				Total Solids.	Sucrose.	Glucose.
1	Striped Cane.	Stripped.	34.82	12.62	9.1	1.61
2	Striped Cane.	Unstripped.	30.20	23.05	9.5	1.44
3	Purple Cane.	Stripped.	32.73	lost	lost.	lost
4	Purple Cane.	Unstripped.	31.69	lost	lost	lost

The increase in tonnage was in no way due to stripping; both of these experiments were manured, while the unstripped were not. It was not to test tonnage—only to increase sugar content—mature the cane. The cane which remained almost naked for months failed to give as much sugar as those untouched. It is greatly to be regretted that the analyses of the purple cane were not made promptly.

Irrigation.

The very dry season just passed has been so destructive to all crops that extensive experiments were made in irrigating cane, corn, cotton, sorghum and cow peas. The results were very satisfactory on all the above crops.

In this bulletin only results on cane are given.

Experiments in Surface and Sub-Irrigation.

There was left on Audubon Park, as a legacy from the great Exposition of 1884-85, a system of water works constructed for use during the fair. Near the river is the boiler-house, with boilers and Deane pump. The latter is connected with the river by a 13-inch pipe. This pump is only one of three that did work during the exhibition. This pump has a 6-inch discharge and empties into a 16 inch main, which runs under the ground to the tall water tower over one half mile distant. In removing the Main Building the connection with this stand pipe was broken. This main crosses ten of our plats. Beyond the limits of the Station, this pipe was plugged. Wherever this main crossed our quarter drains 2-inch plugs were inserted on each side of the pipe. From these plugs the water was distributed over the plats.

The drought began on March 11. In April it became severe, and preparations were begun for irrigation. Unacquainted with the underground arrangements of the pipes, it required more time to perform our work than was anticipated, and it was May 4th before we installed irrigation. Our experiments in cane consisted of five plats with open ditches, and five plats with tiled drainage. It was predetermined to irrigate four of the plats with open ditches and three of those that were tiled, leaving one untiled and two tiled unirrigated, but subsequent developments left us only one-half of a plat unirrigated, the other two being sub-irrigated, as will be presently explained. Each plat will be described in detail.

UNTILED PLATS.

PLAT VIII. "c."

This sub-plat was planted with foreign varieties of cane on December 9, 1890. Many of these canes showed no sign of germination above the ground when first irrigated, May 4. Very soon thereafter a full stand was secured. It was irrigated again on May 18 and June 3. The previous culture was pea vines, removed for hay in September. Land broken in October. The yield of cane on this plat was at the rate of 35.95 tons per acre.

PLAT VIII. *"a,"*

contained sixty-seven rows, thirty-four of our common ribbon cane and thirty of our common purple cane. Previous culture same as Plat VIII. *"c."* It was planted November 7 and 8, 1890. It was irrigated May 4 and 18, June 3 and September 7, *four times.* It yielded on an average 36 tons per acre, while a portion, well watered, gave over 50 tons per acre.

PLAT VII. *"b,"*

was in newly acquired foreign varieties; one-half the plat was spring plant; the remainder fall plant. The last was planted October 18, 1890, the former March, 1891. The fall plant was irrigated three times on the same dates as Plat VIII. *"c,"* while the *spring plant remained unirrigated throughout the year.* The former yielded 38 tons per acre, while the latter gave only 7.89 tons per acre of short inferior cane. A row of Japanese cane, which separated the two, one side of which was irrigated and the other not, gave a yield of 50 tons per acre. The previous culture of the fall plant was same as Plat VIII. *"c,"* while the spring plant was succession cane, the second year in cane.

PLAT VII. *"c,"*

was stubble cane—foreign varieties—and was a duplicate on untiled land of Plat VII. *"a,"* tiled drained. It was irrigated three times, same dates as Plat VIII. *"c."* It yielded 32 tons per acre, while a portion of the plat gave over 45 tons per acre.

PLAT VII. *"d,"*

was last year in sorghum. The sorghum stubble was broken up in October and the land planted in foreign canes on December 9, 1890. On account of the inequalities of this plat, it was impossible to get water entirely over it. Hence a portion of it was never thoroughly wet, though the plat was irrigated four times, on the same dates as Plat VIII. *"d."* The yield was 33 tons per acre, with a portion going as high as 45 tons. Many of these canes showed no signs of vegetation when first irrigated, May 4.

TILED PLATS.

As previously mentioned, there are five plats tiled drained. It was intended to leave two of these unirrigated. It was found on first application of the water that it accumulated on the plat very slowly. On inspection, it was discovered that it was pouring out of the main as fast as it was delivered on the plats. A wooden plug was at once inserted in the end of the main to stop the flow. This main was the common discharge of all the plats. In an hour or two afterwards it was found that the water had risen to the surface in Plat No. 5 and ran freely down the middle of the rows. In Plat 7, which occupied a higher elevation, it rose everywhere within a few inches of the surface, but no surplus water appeared on the surface. This experiment was repeated with each irrigation, giving us results in surface and sub-irrigation on tiled drained lands. The following are the results of

SURFACE IRRIGATION.

Plat III. "*a*," devoted to potassic manures (see results under potassic manures) gave 28 tons per acre.

Plat IV. "*a*," with phosphatic manures (see results under phosphatic manures) yielded 31 tons per acre.

Plat VI. "*a*," physiological experiments (see results under physiological experiments) returned 34.70 tons per acre.

SUB-IRRIGATION RESULTS.

Plat V. "*a*," with nitrogenous fertilizers (see results under nitrogenous fertilizers) gave 33.68 tons per acre.

Plat VII. "*a*," the tiled duplicate of Plat VII. "*c*," untiled, and which was also stubbled shaved, and treated throughout by Mallon's system of cultivation, gave thirty-two tons per acre, with a large portion going over fifty tons per acre.

All of these five tiled plats were in stubble cane, and were irrigated May 4, May 19 and June 4—three times in all. In June showers began, making further irrigation unnecessary.

RESULTS OF IRRIGATION.

The results given above are the actual yields of all the cane on the station. They really do not represent the true effects of

irrigation. On several of the plats devoted to varieties, good stands were not secured or expected, since the amount of seed used was limited, and in planting no aim was made to determine tonnage. Other varieties, of which an abundance of seed was used in planting, yielded enormously. Eliminating the low yields, due entirely to poor stands, the average yield per acre on the station was a little over 40 tons.

The actual average, including all the acreage irrigated, was 34 tons per acre. The average of that unirrigated was 7.89 tons tons per acre. Plat VI. "*a*" was situated immediately between Plat V. "*a*" and Plat VII. "*a*." The former was surface irrigated, while the latter were sub-irrigated. A comparison of the yields of these plats will show little or no difference, when it is remembered that on Plat V. "*a*" were several experiments unfertilized, and several without the nitrogen element; and on Plat VII. "*a*" were a dozen or more rows of defective stands, which greatly diminished the average; while on Plat VI. "*a*" the stand was good and uniform, and the same fertilizer regularly distributed through the plat.

At present either method seems to be effective in the production of plant growth. What effect sub-irrigation may ultimately have on the efficacy of the tiles in draining the land is entirely a question of the future. It is impossible to draw from these experiments the exact increment produced in our crops by irrigation. The results obtained were drawn from plats which in the beginning of the year had been dissimilarly treated with a view of solving other questions, and irrigation was simply an incidental one, made possible by the drouth. Enough is known, however, to justify the assertion that the profits of irrigation were very large in tonnage. This has been done, too, without a sacrifice of the sugar content of the cane, for analyses elsewhere given and the sugar house results show our canes to be richer in sucrose than last year—at least up to the killing frost on November 30. These gratifying results have been obtained under many difficulties. No thought or provision had been given to irrigation until the serious spring drought was on us. Then preparations, more extensive than at first anticipated, had

to be made for irrigation. This delayed our first inundation until May.

In the meanwhile the young canes had suffered greatly, and the effects of this drought were apparent at harvest this year. By examining the tables under Physiological Experiments, these facts will become apparent. The cane again suffered from drought in August and early September, and it was with some apprehension that we irrigated two plats on September 7, when individual canes showed, upon analysis, 8 to 10 per cent. sucrose. Under these circumstances, the results are most gratifying, and suggest the possibility, upon well drained lands, of producing maximum crops of cane annually, by irrigating, whenever needed, from January to December.

Irrigation might also be successfully practiced upon freshly planted or wind-rowed cane in dry weather, especially in cloddy land.

In establishing irrigation ditches, the reverse of drainage ditches must be observed. In the latter, the line of lowest level from the levee to the swamp, is found and followed, while in establishing the main irrigating ditch the backbone, or line of highest elevation, is carefully determined and pursued. This ditch transports the water through the plantation. From this ditch on both sides water may be drawn into lateral or quarter drains, following still the lines of highest elevation.

From these laterals, water may be drawn into the lowest parts of the field. Our plan in irrigating was to fill the middles of the row nearly full, permitting the water to remain all night and drawing it off in early morning through the drainage ditches. By accident, however, it was found that cane would stand a complete inundation for forty-eight hours, with the temperature at 72 degrees, while the maximum temperature recorded in the station's weather bureau was 90 degrees F. No fears should be entertained of injuring the cane by too much water, or a reasonable time, say two days, in applying it, provided that when it is drained off, it is well and quickly done; in other words, the land is well drained.

It may remarked incidentally here, that corn irrigated three times yielded on six acres an average of over 100 bushels per acre. Sorghum, cotton and cow peas were also successfully irrigated.

FIELD EXPERIMENTS

have this year been continued in the investigation of the following:

1. Physiological questions.
2. Foreign varieties of cane best adapted to Louisiana.
3. Manurial requirements of cane.
4. The comparative merits and demerits of our two home canes, the ribbon and the purple.
5. Experiments in cultivation, etc.

PHYSIOLOGICAL QUESTIONS, No. 1.

The plat was devoted to the study of these questions last year has been followed into stubble this year.

The following, taken from Bulletin No. 6, second series, will explain the character of the experiments:

1. What distance apart shall we give our cane rows?
2. What part of the cane is best to plant?
3. What amount of seed is required for best results?
4. Does cutting the cane injure it?
5. Is stubble or plant cane best for seed?

To determine the first question,

WHAT DISTANCE APART SHALL CANE ROWS BE?

In 1890 the following experiments were made:

Rows were laid off, three, four, five, six, seven and eight feet, and three taken for each experiment. These rows were exactly one-half acre in length. They were planted with our home striped, or ribbon cane, using three running stalks. On May 17 all the stalks on each experiment were carefully counted, and at harvest every stalk was again counted and the cane weighed.

The following are the results of 1890:

EXPERIMENTS IN DIFFERENT WIDTHS OF ROWS IN PLANT CANE FOR 1890.

KIND OF EXPERIMENT.	Number of Stalks May 17.	Number of Stalks Harvested.	Weight of Cane in Pounds.	Average Weight of a Stalk	Number of Stalks per Acre.	Tons per Acre.	ANALYSIS OF JUICE				
							Total Solids.	Sucrose	Glucose.	Glucose Ratio.	Purity Coefficient.
3 rows 3 feet wide	1177	555	1848	3.33	25,900	43.12	13.0	10.00	1.67	16.7	76.9
3 rows 4 feet wide	1156	784	2408	3.10	27,440	42.14	12.5	9.30	1.69	18.1	74.4
3 rows 5 feet wide	1292	917	3034	3.31	25,976	42.47	13.5	10.45	1.61	15.4	77.4
3 rows 6 feet wide	1207	1095	3300	3.01	25,550	38.50	13.3	10.20	1.67	16.3	76.6
3 rows 7 feet wide	1396	1308	3766	2.88	26,160	37.66	13.3	10.00	1.47	14.7	75.1
3 rows 8 feet wide	1382	1420	4244	2.98	24,850	37.13	12.8	9.60	1.48	15.3	75.0

VARIETY OF CANE.	Width of Rows.	Yield per Acre. Tons.	ANALYSIS OF JUICE.							
			Total Solids.	Sucrose.	Glucose.	Solids not sugar.	Fibre.	Glucose ratio.	Purity Coefficient.	Pounds of Sugar per Ton Cane
Striped	3 ft.	43.92	13.48	10.10	1.31	2.07	9.48*	12.97	74.93	182.85
Purple	3 ft.	35.18	13.92	10.25	1.30	2.47	11.02†	11.71	73.63	182.40
Striped	4 ft	35.30	13.57	10.30	1.53	1.74	.....	14.85	75.90	186.47
Purple	4 ft.	34.92	12.97	9.40	1.44	2.13	.....	15.32	72.48	167.28
Striped	5 ft	31.07	13.45	10.22	1.35	1.88	.....	13.20	75.98	185.02
Purple	5 ft.	34.74	13.10	9.40	1.34	2.36	.....	14.25	71.75	167.28
Striped	6 ft.	32.29	13.12	9.42	1.45	2.25	.....	15.40	71.80	170.56
Purple	6 ft.	33.24	13.17	9.98	1.36	1.83	.....	13.63	75.78	177.54
Average of both	3 ft.	39.55	13.70	10.18	1.26	2.26	.....	12.34	74.28	182.63
Average of both	4 ft.	35.11	13.27	9.85	1.49	1.93	.....	15.09	74.19	176.89
Average of both	5 ft.	32.90	13.28	9.81	1.35	2.12	.....	13 78	73.86	176.15
Average of both	6 ft.	32.75	13.15	9.70	1.41	1.99	.....	14.52	73 79	174.05

*The average of all the striped.
†The average of all the purple.

This table upon close inspection, will furnish valuable food for thought to the student of sugar cane agriculture. Here the tonnage of the 3-foot rows of both varieties exceeds every other distance. This is followed in order by the 4-foot rows, while the striped 5-foot rows alone have deviated from a constant result, viz.: that the narrower the row the greater the tonnage. The averages of both varieties conform strictly to this rule, and also give the sucrose, purity coefficient, and pounds of sugar per ton of cane, inversely as the widths of the rows. Previous experiments have shown that the 6 foot rows were the equal, if not the superior, in results to the 7 and 8-foot rows. Therefore, in the above experiments, the latter have been omitted. While the increase in the narrow rows is quite apparent, the increments have hardly paid for the increased seed used in planting. Deducting excess of cane used (see Bulletin 28, page 523), we have the following results in plant cane:

	Tons.
Net increase of 3 feet rows over 6 feet	2.13
Net increase of 3 feet rows over 5 feet	2.92
Net increase of 3 feet rows over 4 feet	2.11
Net increase of 4 feet rows over 6 feet	0.03
Net increase of 4 feet rows over 5 feet	0.81
Net decrease of 5 feet rows under 6 feet	0.79

For the stubble cane, where allowance was made last year for increased seed used in planting, we have:

	Tons.
Net increase of 3 feet rows over 8 feet	6.30
Net increase of 3 feet rows over 7 feet	5.80
Net increase of 3 feet rows over 6 feet	5.40
Net increase of 3 feet rows over 5 feet	3.85
Net increase of 3 feet rows over 4 feet	8.24
Net increase of 5 feet rows over 8 feet	2.15
Net increase of 4 feet rows over 7 feet	1.94
Net increase of 4 feet rows over 6 feet	1.55
Net increase of 6 feet rows over 8 feet	0.90
Net increase of 6 feet rows over 7 feet	0.39
Net increase of 7 feet rows over 8 feet	0.01

The 4-foot rows, for some unaccountable reason, are below the rest in yield. The above shows conclusively that there is nothing gained on the tonnage or sugar content by very wide

It is apparent from the above that the part of the cane used for seed has little or no effect on the stubble. The effect seems to be entirely with the first year. It may be noticed in the above, that the upper thirds gave the lowest results both years. This is evidently due to some local defect in the soil—not yet positively discovered, since cultivation, etc., were identical with the rest of the plat.

WHAT NUMBER OF STALKS SHALL BE PLANTED?

In 1890 experiments were made to test this question, duplicating with cut and uncut canes. Purple cane was used for the experiments. The following table gives results of last year:

EXPERIMENTS IN PLANTING DIFFERENT NUMBER OF STALKS, "UNCUT AND CUT," PLANT CANE, 1890.

HOW PLANTED.	Number of Stalks May 17.	Number of Stalks Harvested.	Weight of Cane in Pounds.	Average Weight of a Stalk.	Number of Stalks per Acre.	Tons per Acre.	ANALYSIS OF JUICE.				
							Total Solids	Sucrose.	Glucose.	Glucose ratio.	Purity Coefficient.
1 stalk uncut	749	1065	3260	3.06	24,840	38.01	13.2	9.20	1.62	17.6	69.7
1 stalk cut	641	1180	3248	2.80	27,580	37.87	12.4	9.00	1.56	17.3	72.5
2 stalks uncut	909	1200	3698	3.08	28,000	43.14	13.4	9.80	1.56	15.7	73.8
2 stalks cut	775	1180	3208	2.72	27,580	31.42	12.2	8.65	1.57	18.0	70.9
3 stalks uncut	1378	1257	3742	2.91	29,330	43.42	13 4	10.05	1.43	14.2	75.0
3 stalks cut	997	1240	3080	2 48	28,910	35.93	13.3	9.90	1.51	15.2	74.4
4 stalks uncut	1511	1382	3900	3.04	29,890	45.50	13.4	9.50	1.71	18.0	70.8
4 stalks cut	1279	1324	3676	2.70	30,670	42.91	13.6	9.75	1.71	17.5	71.6

per acre; in 1891, it was only 1.08, showing that evil effects of the knife had been nearly, if not entirely, overcome in the stubble. The continuance of these experiments emphasize the suggestions of last year, viz: That one good sound cane with a lap, properly planted, may give excellent results, while more than two is a waste and extravagance to be severely reproved, and that the knife should be used as little as possible in the planting of cane.

Which is the Best for Seed, Plant or Stubble Cane?

These experiments were begun in 1890 by using plant, first, second and third year stubble for seed. After planting it was found necessary to run a ditch through two rows of the first year stubble, and thus destroyed accurate comparison of results. These were, however, given in Bulletin No. 6. Since that time, in completing the plans of the grounds, it became necessary to run a cross headland through the second and third year stubble, completely obliterating them. There were left, then, only three rows of plant and one row of first year stubble. These have been carefully harvested, weighed and analyzed, but the results are so largely in favor of the stubble that it would probably be misleading to publish them. There is much room for error always in comparing results from one and three rows, and this error is probably augmented in this instance by being a ditch-bank row, and receiving the cleanings from the ditch, etc.

It may be again observed, however, that good stubble cane seems to be the equal, if not the superior, of plant for seed.

Varieties of Cane, No. 2.

The continued cultivation of foreign varieties has enabled the Station to reduce its numbers by proving the identity of many canes which had come to it from various parts of the world under purely local names. It is curious to witness the changes in a foreign variety, brought about by its new conditions. The following groups have been positively determined:

FIRST CLASS.

White, Green, or Yellow Canes.

GROUP I.—Nos. 1, 2, 3, 4, 5, 6, 7, 53 and 55 are so nearly

alike that the closest examination could detect no difference. The yield in tonnage and the chemical composition of the juices vary, but this may be due to the degrees of acclimation of each variety. It is curious to note the origin of these canes.

No. 1, Panache, obtained from Mr. R. Beltran, and by him grown extensively; No. 2, LaPice; and No, 3, LeSassier, obtained from Mr. Henry LeSassier, are all from the same importation. The following courteous letter from Mr. Burgundy LaPice explains their origin:

LAUDERDALE PLANTATION,
St. James Parish, October 20, 1891.

The cane is called LaPice. My father, P. M. LaPice, in 1872, at the age of 75, went to Java and imported several varieties of cane, among which is the cane that bears his name, called in its own country, "Canne Panachee," because it tasseled very soon. When this cane first arrived, it was of a bright yellow color, with a very soft rind. At first it was very delicate and could stand no cold. On account of the beautiful quality of sugar and molasses made from this cane I would not give it up, and I feel that it has now become thoroughly acclimated and stands the cold as well as any cane. I am so much pleased with the results of this cane that I am abandoning the red cane for it. It has changed color considerably and is now greenish-yellow; the rind, too, has become much thicker. I always get more yield per ton and better quality of sugar and molasses when I grind a cut of this cane. The fancy sugars and molasses of Westfield and Annalese are made from this cane.

BURGUNDY LAPICE.

No. 3, Tibboo Merd was received from Manilla Islands; No. 5, Bourbon, came from Trinidad; No. 6, Crystallina, from Cuba; No. 7, Green, from Cuba; No. 53, Light Java and No. 55, Hope, were received from Jamaica.

All of these were imported by the Station, and in acclimation have passed through the same metamorphosis described by Mr. LaPice.

These are excellent canes, and worthy of extension among our planters. Hereafter, they will all be known and described

as the LaPice, in honor of their first patron in Louisiana, though the "Light Java" would better indicate its original habitat.

GROUP II.—In this are included No. 8, Yellow, No. 9, Blanca d'Otaheite, and No. 11, Loucier. Two of these are extensively cultivated under the above names. The Otaheite in the West Indies and the Loucier (spelt there Losier) on the Island of Mauritius. It is difficult to select between the two last named. All of these canes were received from Cuba, though it seems that a cane under the name of Otaheite was one of the earliest introduced into this State. This group came originally from Tahiti Islands, and to indicate its nationality it would probably be best to call it "White Tahiti." They are of very little value so far in this country.

GROUP III.—No. 10, Poitier; No. 12, Lahaina; and No. 20, Keni Keni, are unquestionably the same cane and came originally from Marquesas Islands. They are rapid growers, slow in coming up in the spring, and rattoon very imperfectly. They have fair sugar contents, and may, in the future, by acclimation, become excellent canes. At present they are unworthy of extensive culture.

GROUP IV.—Closely allied to above, are the following: No. 22, China; No. 24, Green Elephant, which have not been fully tested.

GROUP V.—This group it characterized by paralleled narrow cracks or streaks of a brownish color upon the maturer joints of the stalks. No. 19, Rose Bamboo, a large, fine cane, is a conspicuous example. No. 23, Salangore (faintly streaked), and No. 21, Vulu Vulu, (faintly streaked). Some of these are promising.

GROUP VI.—No. 15, Pupuha, and No. 17, Kokea, both from Hawaiian Islands, are fine, clean canes, tonnage large and sugar content good. Very promising.

GROUP VII.—No. 16, Uwala (of no value so far), and No. 25, Lakoua, not yet fully tested, are closely allied.

GROUP VIII.—No. 20, Cuban, and No. 27, Sacuri; both clean, smooth canes, not sufficiently tested yet.

GROUP IX.—No. 13, Caledonia Queen; a stout, short green cane, with few recommendations after several years' trial.

GROUP X.—No. 14, Creole cane; too well known to discuss; of no value. A history of its introduction in this State is found elsewhere.

GROUP XI.—No. 28, Japanese or Zwinga; this cane is *sui generis;* it is extremely hardy, and enormously productive under good cultivation; but exceedingly woody, difficult to crush, and low in sugar. This year it gave a yield of 51 tons per acre, containing 89 per cent. sugar Its vigorous, hardy habits are quite attractive, and proper cultivation might diminish its present objectionable qualities.

GROUP XII.—No. 18, Bamboo; another cane "without a fellow" in our collection; its enlarged nodes and prominent eyes are peculiar characteristics; it has not yet met our expectations.

SECOND CLASS.

Striped Canes.

GROUP I.—No. 30, Malay; No. 31. Brisbane, and No. 32, Green Rose Ribbon, are apparently the same canes, and are quite unpromising.

GROUP II.—No. 33, Red Ribbon; No. 34, Mexican Striped, and No. 35, Batavian Striped, our own importations, are identical with No. 36, our home striped cane. The first has not yet been acclimated, while the others are magnificent types of this kind of cane.

GROUP III.—No. 37, Tsimbic; No. 38, Ysaquia; No. 39, Vituahaula; and No. 40, Horne may for the present be classified together, though No. 38 has streaks similar to Group V., Class I., and No. 40 resembles somewhat Group VI., Class I. Not very promising.

GROUP IV.—No. 41, Ainakea; No. 42. Kainio, and No. 43, Akilolo, light striped; are peculiar canes, with many common characteristics—dark, closely appressed foliage, large, straight-growing canes, but of little value.

GROUP V.—No. 44, Akilolo (dark striped), and No. 45, Manulete; both of dark foliage, and apparently identical.

GROUP VI.—No. 46, Cavengerie; No. 47, Attamattie, and No. 48, *Poaole,* are beautiful, vigorous canes, identical in every way. Could a fair sugar content be coaxed into this plant, it would be one of the most valuable ones in our collection.

THIRD CLASS.

Solid Colors other than Class One.

GROUP I.—No. 50, Norman; No. 51, Grand Savanne; and No. 53, Naga, are unlike canes of the same type; they are small, vigorous canes, and said to be well adapted to high, dry latitudes.

GROUP II.—No. 54, Black Java, is identical with our purest common purple cane, and is called Black Java, in contrast with the white cane in Class I., No. 53.

GROUP III.—No. 56, Breheret; and No. 57, Marabal, are so nearly identical, that doubts have been entertained whether the former has not been sent through mistake.

GROUP IV.—No. 58, Purple Elephant, is unlike any other cane in the collection. A description of its introduction by Mr. Eugene A. Duchamp, of St. Martinsville, in 1875, has been given in *The Louisiana Planter.*

GROUP V.—These constitute the clean, claret colored canes: No. 61, Ohia; No. 62, Honuaula; and No. 63, Papaa, are Hawaiian Island canes, appear identical in every respect. No. 59, Cuapa, is smaller and of lighter colored foliage, while No. 60, Liguanea, is a short, stout cane of moderate habits, none of them are promising here.

A REVIEW OF OUR HOME VARIETIES.

The Jesuits, of Leogane, sent from San Domingo, in 1757, the first cane ever introduced into this State. It was the Malabar, or Bengal variety, which has since been called "Creole.";

SMITH

The Otaheite was introduced from the same island about 1796, the year that Etienne Bore made the first crop of sugar in this State. It is worthy of remark here, that this crop was made upon or adjoining the present grounds of the Sugar Experiment Station.

These canes furnished the sugar of Louisiana until the year

1825, when the red ribbon and purple varieties were introduced. A detailed history of this introduction was republished in The Louisiana Planter of October 24, 1891, and from the paper, by Mr. J. B. Avequin, the following is extracted:

"The red or purple ribbon cane, as we have said, is a native of Java, and probably of some other parts of India. The Dutch had already met with it in Batavia, in a stage of cultivation. They introduced it about the middle of the last century to St. Eustatius, Curacoa, Guiana and Surinam. It thence was spread over all the West Indian islands and part of the American continent.

"In 1814, or thereabouts, an American schooner from St. Eustatius, a Dutch colony, imported a few bundles of this cane into Savannah, Ga. They were planted by a Mr. King, not far from the mouth of the Savannah river, on St. Simon's Island. They grew well, and Mr. King began the manufacture of sugar.

"In 1817, a dozen or so of the plants were brought to New Orleans by John Joseph Coiron, who planted them in his garden at Terre-aux-Bœufs. Having succeeded admirably with these, Mr. Coiron, in 1825, imported a sloop load from Savannah, which he planted on his estate, known as the St. Sophie plantation, about thirty-six miles below New Orleans. Thence originated the ribbon cane or Javanese, which is the one most generally grown in Louisiana.

"The red or purple ribbon cane and violet (which is a degenerate species) are the two best varieties ever cultivated in Louisiana. They are hardy, and are not injured by a cold of two or three degrees of the centigrade thermometer. They are, however, not equal to the Otaheitan or the Salangore in the tropical regions. They are less juicy than the Malabar, Bengal Tanna or Otaheitan; and although their juice is a little impure, it possesses excellent manufacturing qualities when mature. These varieties have made the fortunes of the planters of Louisiana. They only have stood the severity of the seasons; the other kinds are not suitable to the climate of Louisiana. The planters of this State owe to John Jos. Coiron a debt, which should be recognized and paid by a statue or some public monument

equally lasting and conspicuous. He died about twenty-five years ago, without having lived to realize or anticipate the extent of the benefits and wealth he had conferred on Louisiana."

The above clearly explains the history of our striped cane. But the assertion that our purple is a degenerate variety of the striped is seriously questioned. It is claimed, even by some old planters, that this degeneration is constantly going on, and that a plantation started with striped cane will ultimately have mostly purple left on it. This they substantiate by reference to the predominance of the purple cane throughout the State. Others claim that they are and have been distinct species all the time, and that in the vessel load, introduced by Mr. Coiron, were some of both varieties, though overlooked at the time. These mixed canes have been since planted, and the fact of the predominance of the purple may simply be a declaration of the "survival of the fittest" within its environment.

It may here be remarked that in the hill countries of Georgia, Alabama, Mississippi and Louisiana, the writer has found only purple cane grown as a crop. May not its better adaptability to such northern latitudes account for its presence there, without the striped? The purple was either introduced as a separate variety, along with the striped, or else has originated as a bud variation from the striped with more vigorous tendencies. The Station several years ago began the separate culture of these two canes. Each year the best types of each variety are carefully selected and planted. Up to date we have found the purple constant, but each year reveals a few purple canes in the striped. A majority of the cane used for seed on the Station is purple. It is not unfrequently the case that a plowman or common field hand picks up a piece of *"ploughed-up"* cane and puts it in the ground indiscriminately.

In this way every year a few stalks of purple might slip into the striped. But there are found several white canes, identical in appearance, except color, also scattered through the striped, and every shade and width of stripe between almost solidly purple. These have been carefully examined and noted. Sometimes a stalk is distinctly striped in the lower joints, and very

faintly, if at all, striped in the upper. The latter peculiarities have been noted in the Batavian striped and Mexican striped, recently imported, and a careful study has been made to try to connect the stripes with the effects of exposure to sunshine. These facts substantiate a declaration often made, that the striped varieties of cane have greater tendency to variation than the solid colored canes.

As an illustration of bud variation, three years ago some stalks of cane, partly white and partly purple, were selected from the field of Soniat Bros.' Tchoupitoulas plantation. They were called by them bastard canes. These stalks were taken and planted as follows: First row, the entire stalk; second row, the white joints of each stalk; third row, the colored joints of each stalk. At the end of the season four distinct canes, as far as color could direct us, were obtained. Types of the four new varieties were selected and separately planted, and this year were found to be nearly pure. Selection and separate plantings were again made and the rest harvested and analyzed. These canes have been named as follows: First, a white cane, No. 29, Soniat, after the owners of the plantation; second, a light striped, No. 59, Nicholls, after the Governor of our State; third, a light purple cane, No. 64, Bird, after the Commissioner of Agriculture; fourth, a dark-striped, No. 65, Garig, after the the other member of the Board of Agriculture. The yield and analyses of these canes are given elsewhere. These canes, except the white, are entirely different from any other cane in our collection.

The Japanese, or Zwinga variety, was imported by Mr. Le Duc, during his administration of the National Department of Agriculture; and the Purple Elephant, as before remarked, by Mr. Duchamp in 1875. This gives us a pretty accurate history of the introduction of all the canes in our collection.

FIELD AND LABORATORY RESULTS WITH FOREIGN CANES.

Table No. I. gives results of the varieties which have been on trial for over three years. The tonnage is given from "tiled" and "untiled" stubble, and from "plant." In the tiled plat, the stubble was shaved and worked under the direction of Mr. Jas

Mallon, with his horse hoe and cultivator (see elsewhere for details).

The untiled plat was not shaved and was worked as the rest of the cane.

Table No. II. represents the results of the varieties which have been mainly received in the last two years and from only plant cane. All of these canes were worked up after they had been injured by the frost of Nov. 30.

The tables given below do not represent the varieties as they were before the killing frost. On the night of 30th of November, a severe frost killed all the standing cane on the Station. After that it was worked up as rapidly as possible, without resorting to windrow. It, however, decreased in sucrose daily, and on the last run, December 23, it was with difficulty that the syrup could be grained in the pan. It was impossible to windrow a part to test against standing cane, since in no instance were three duplicate experiments, and to windrow one variety and leave another standing would have given no comparable results. Just before the freeze, three stalks selected with great care from each variety were weighed and analyzed. The following table gives the results. The varieties are given in the order of their percentages of extraction. The fibre is also given. These two factors, with chemical analysis and tonnage (given elsewhere), give all the information necessary to judge of the merits of a cane :

RELATIVE HARDNESS OF DIFFERENT VARIETIES OF CANE, DETERMINED BY PERCENTAGE OF EXTRACTION ON A THREE-ROLLER HAND MILL, RUNNING THEM THROUGH ONLY ONCE.

VARIETY.	Per Cent of Extraction.	Fibre	ANALYSIS OF JUICE.	
			Total Solids.	Sucrose.
Calledonia, No. 13	65.05	8.93	13.91	9 4
Marabal, No. 57	63.10	9.84	15.19	11.98
Cavengerie, No. 46	62.20	10 98	14.67	11.81
Norman, No. 50	61.70	12.18	14.49	10.92
Green Elephant, No. 24	61.50	7.82	10.93	6.4
Portier, No. 10	61.35	.....	15.24	11.80
Ainakea, No. 41	61.23	9.19	12.93	8.31
Malay, No. 30	61.20	9.13	13.13	8.40
Lahaina, No. 12	60.80	.....	15.47	11.27
Kainio, No. 42	60.80	11.61	13.21	8.65
China, No. 22	60.60	8.24	14.77	10.16
Rose Bamboo, No. 19	60.58	10.29	13.09	8.86
Ohia, No. 61	60.00	8.63	13.49	8.76
Brisbane, No. 31	59.50	7.10	13.27	8.18
Pupuha, No. 15	59.40	12.89	17.27	14.53
Loucier, No. 11	59.40	.....	15.96	12.40
Tibboo Merd, No. 3	59.10	7.84	14.67	11.43
Kokea, No. 17	58.90	12.56	15.01	11.57
Bird, No. 64	58.50	11.79	16.56	14.52
Honuaula, No. 62	58.95	12.07	13.19	8.42
Panache, No. 1	58.80	9.84	17.03	14.83
Liguanea, No. 60	58.40	10.70	15.69	12.80
Bourbon, No. 5	58.30	10.14	15.84	12 38
Ysaquia, No. 38	57.90	9.76	12.58	7.40
Vituahaula, No. 39	57.90	11.51	15.03	10.82
Horne, No. 40	57.70	10.74	13.62	10.14
Naga, No. 53	57.69	9.36	13.65	10.12
Green Rose Ribbon, No. 32	57.50	7.60	12.78	7.70
Batavia Striped, No. 35	57.40	9.91	17.73	15.57
Tsimbic, No. 37	57.20	11.51	13.93	9.42
Akilolo, (L. S.) No. 43	57.10	10.75	14.07	9.48
Poaole, No. 48	56.60	11.60	13.51	9.01
Vulu Vulu, No. 31	56.58	9.70	12.45	7.87
Cuapa, No. 59	56.00	10 72	13.63	9.77
Home Striped, No 36	55.88	.....	14.95	12.30
Red Ribbon, No. 33	55.10	9.51	16.19	9.82
Yellow, No. 8	54.60	.....	15.43	11.26
Sacuri, No. 27	54.30	8.80	15.59	11.35
Home Purple, No. 54	53.40	.....	16.61	14.99
Soniat, No. 29	53.37	11.79	13.93	10.76
Cuban, No. 26	52.83	9.93	15.15	12.73
Grand Savanne, No. 51	52.70	9.49	14.34	9.70
Le Sassier, No. 4	52.50	.....	16.47	13.65
Light Java, No. 53	52.38	11.65	15.05	12.11
Nicholls, No. 49	52.08	11.79	16.15	13.10
Hope, No. 55	51.70	10.00	15.13	11.70
Purple Elephant, No. 58	50.00	7.97	13.89	9.52
Otaheite, No. 9	47.90	.....	14.31	10.78
Farwell, No. 66	30.80	.....	12.52	6.04
Japanese, No. 28	33.30	.....	13.53	8.84

It will be seen that only a few of our new varieties are very promising. However, many are yearly improving, and it is expected that in a few years some valuable varieties can be found in our collection.

TABLE I.—YIELD OF FOREIGN VARIETIES OF CANE FOR 1891.

NUMBER AND VARIETY.	1st Stubble Cane. Tons per Acre.		Plant Tons per Acre.	AVERAGE ANALYSIS.							When Harvested
	Tiled Land.	Untiled Land.		Fibre.	Total Solids.	Sucrose.	Glucose.	Solids Not Sugars	Glucose Ratio.	Purity Coefficient.	
1. Panache	35.61	.....	43.75	9.84	15.27	10.40	.....	.....	.....	68.1	Dec. 2.
2. LaPice	33.72	.....	38.36	9.37	13.16	9.43	.....	.....	.....	71.7	Dec. 2.
3. Tibboo Merd	36.26	.....	35.84	.....	13.99	10.58	.....	.....	.....	75.6	Dec. 2.
4. LeSassier	36.89	.....	37.03	.....	13.50	9.67	.....	.....	.....	71.6	Dec. 2.
5. Bourbon	35.84	33.74	38.99	10.14	13.61	9.53	.....	.....	.....	70.0	Dec. 2.
6. Crystallina	41.57	30.17	33.74	9.18	12.46	9.31	.....	.....	.....	74.7	Dec. 2.
7 Green	43.19	29.82	33.18	9.89	13.36	9.52	.....	.....	.....	71.2	Dec. 2.
8. Yellow	42.91	40.46	31.08	.....	12.32	7.63	2.36	2.33	30.9	61.9	Dec 4.
9. Otaheite	40.39	.....	26.81	.....	12.14	7.42	2.52	2.20	34.0	61.1	Dec. 4.
10. Portier	34.58	17.29	25.90	.....	12.10	7.42	2.00	2.68	27.0	61.3	Dec. 4.
11. Loucier	46.62	47.46	34.37	.....	13.35	8.67	2.23	2.45	25.7	64.9	Dec. 4.
12. Lahaina	33.32	22.86	35.46	.....	13.40	9.18	1.87	2.35	20.4	68.5	Dec. 4.
13. Caledonia	48.72	30.52	31.38	8.93	11.50	7.20	1.97	2.33	27.3	62.6	Dec. 16.
15. Puuuha	53.62	47.88	39.83	12.89	15.50	11.75	.91	2.84	7.8	75.8	Dec. 6.
16 Uwala	19.25	18.83	.....	.....	12.60	7.92	2.25	2.43	28.4	62.8	Dec. 6.
17. Kokea	50.96	49.77	38.43	12.56	13.70	9.91	1.50	2.29	15.9	72.3	Dec. 6.
18. Bamboo	55.58	45.71	39.62	9.39	11.80	8.00	1.81	1.99	22.6	67.8	Dec. 16.
19. Rose Bamboo	24.85	18.62	34.44	10.29	11.65	6.50	2.12	2.43	32.6	58.8	Dec. 16.
41. Ainaken	25.34	21.63	27.02	9.19	10.78	6.04	2.44	2.30	40.4	56.0	Dec 23.
42. Kainio	22.54	20.09	26.04	11.61	10.38	5.40	2.63	2.35	48.7	52.1	Dec. 23.
43. Akilolo, L. S.	26.53	26.11	20.37	10.75	10.67	6.40	2.48	1.79	30.9	59.9	Dec. 18.
44. Akilolo. D. S.	25.48	30.03	23.10	9.61	10.82	6.20	2.25	2.37	36.3	57.3	Dec. 18.
45. Manulete	25.69	.....	28.16	8.10	9.06	5.06	2.38	1.62	47.0	53.8	Dec 18.
46. Cavengerie	42.35	.....	40.46	10.98	10.52	6.17	2.10	2.25	34.0	58.6	Dec. 18.
47. Attamattie	57.59	42.77	35.00	12.70	10.93	6.46	1.90	2.57	29.1	58.2	Dec. 18.
61. Ohia	20.09	23.94	22.21	8.63	8.88	5.25	2.45	1.18	46.7	60.2	Dec. 23.
62. Honuaula	32.12	24.61	24.29	12.07	10.67	5.67	2.35	2.65	41.4	53.1	Dec. 23.
63. Papaa	34.44	.....	25.97	11.13	9.37	5.60	2.40	1.37	42.9	59.8	Dec. 23.

TABLE II.—YIELD OF FOREIGN VARIETIES OF CANE-PLANT FOR 1891, HARVESTED DECEMBER 14.

VARIETY.	Yield per Acre in Tons.	ANALYSIS.						REMARKS.
		Fibre.	Total Solids.	Sucrose.	Glucose.	Solids Not Sugar.	Glucose Ratio.	Purity Coefficient.	
Keni Keni, No. 20	24·22	8·29	12·18	8·1	1·92	2·16	23·7	66·5	Unpromising.
Vulu Vulu, No. 21	28·70	9·70	11·58	6·6	2·52	2·46	38·2	57·0	Unpromising.
China, No. 22	24·08	8·24	12·78	8·5	2·27	2·01	26·7	66·5	Some promise.
Salangore, No. 23	52·65	8·72	12·18	7·9	2·40	1·88	30·4	64·8	Some promise.
Elephant, No. 24	17·50	7·82	12·05	8·0	1·94	2·11	24·2	66·4	Some promise.
Iakoua, No. 25	32·20	8·85	13·05	9·5	1·41	2·14	14·8	66·4	Promising.
Cuban, No. 26	27·30	9·48	.....	7·8	1·48	.....	19·0	.....	Unpromising.
Sacuri, No. 27	37·31	10·48	12·75	8·8	1·61	2·34	18·3	69·0	Promising.
Japanese, No. 28	50·75	.....	13·40	8·9	1·91	2·59	21·5	66·4	Unpromising
Soniat, No. 29	31·92	11·79	12·91	9·6	1·32	1·99	13·8	74·4	Promising.
Malay, No. 30	8·75	9·13	10·68	6·0	2·52	2·46	43·0	54·7	Unpromising.
Brisbane, No. 31	30·10	8·06	11·08	7·1	2·40	2·18	33·8	60·8	Unpromising.
Green Rose Ribbon, No. 32	25·48	7·60	10·55	5·9	2·45	2·20	50·0	55·9	Unpromising.
Red Ribbon, No. 33	23·93	9·51	12·07	8·4	1·55	2·12	18·5	69·6	Promising.
Batavian, No. 34	36·79	9·91	14·07	11·0	1·09	1·98	9·9	78·2	Very promising.
Tsimbic, No. 37	19·60	11·51	12·55	8·5	2·03	2·02	23·9	67·7	Some promise.
Ysaquia, No. 38	18·31	9·16	11·51	7·3	2·00	2·21	27·4	63·4	Unpromising.
Vituahaula, No. 39	21·10	11·51	13·05	8·1	2·77	2·18	34·2	62·1	Unpromising.
Horne, No. 40	31·68	10·74	13·15	8·5	1·70	2·95	20·0	64·6	Some promise.
Nicholls, No. 49	.....	11·79	13·59	10·3	1·85	1·94	13·1	76·5	Promising.
Norman, No. 50	.....	12·18	12·03	7·12	1·81	2·30	22·8	65·8	Unpromising.
Grand Savanne, No. 51	19·04	9·49	12·43	7·70	2·48	2·25	32·2	61·9	Unpromising.
Naga, No. 52	31·15	9·26	13·33	9·26	1·70	2·37	18·3	69·5	Some promise.
Light Java, No. 53	18·55	11·65	11·91	7·80	1·94	2·17	24·9	65·5	Promising.
Hope, No. 55	25·0	10·00	12·55	8·00	1·75	2·20	20·4	68·5	Promising.
Marabal, No. 57	35·73	9·84	12·75	9·10	1·64	2·05	18·0	71·4	Very promising.
Elephant Purple, No 58	26·11	7·97	11·83	7·7	1·79	2·34	23·2	65·1	Unpromising.
Cuapa, No. 59	.....	10·72	11·08	6·92	1·56	2·60	22·5	62·5	Unpromising.
Liguanea, No. 60	.....	10·70	12·38	9·04	1·09	1·65	11·3	77·9	Some promise.
Bird, No. 64	29·47	11·79	14·73	11·80	1·05	1·88	8·9	80·1	Very promising.
Garig, No. 65	.....	11·79	12·45	8·80	1·54	2·11	17·5	70·7	Promising.
Poaole	.....	11·60	12·12	7·8	1·71	2·61	21·9	64·3	Promising.

Manurial Requirements, No. 3.

Another year's experiments at the Sugar Experiment Station have failed to throw any light upon the kind of fertilizers required to give us high sugar content in our canes. For the first time in the history of the Station, irrigation has been practiced, and it was hoped that, by a regular and systematic watering of the plants, in addition to the multiplicity of fertilizers used, some information might be gained on this important subject. Irrigation, however, was not begun until May 4, some time after the existence of the drought, and the cane had already greatly suffered. With a tonnage nearly as large as last year, our sugar content has been greatly increased. Was this increase caused by irrigation? Is it not possible, by judicious irrigation and economic fertilization, to start our canes off early in the spring, force them to their utmost during the growing season, and cause them to mature by withholding water after August? The fertilizers should be used in such quantities that, by proper watering, they should be entirely consumed by September. In this way we should have large canes in September, and, the fertilizers being exhausted and irrigation stopped, the crop should rapidly mature, unless excessive rains (which rarely occur) should prevail during this month to keep them green and succulent. This will be fully tested next year. Our irrigation plant is now in order, our ditches established, and our limits of profitable fertilization fairly determined. It is the intention of using water next year whenever we are without seasonable rains for one week. In these experiments we hope to get results which may determine how to grow maximum crops with large sugar content.

Our experiments with fertilizers have this year been continued with much better results, though not yet entirely satisfactory. Last year, on account of the freshness of our soils and inequalities in our plats, due to the process of leveling them, etc., fertilizers failed to show any material difference in results. These same conditions prevailed this year, but to a much less extent. In a few years these troubles will disappear and fertilizers will give normal results.

The same plats have been used as last year. The enormous crops of last year left a stubble, which has been very favorable for the trial of different fertilizers.

All of these plats have since been tiled drained, otherwise they remain as last year. The following description of last year will then explain them:

"Plats 3a, 3b and 3c were devoted to manurial questions. The first to potash, the second to phosphoric acid, and the third to nitrogen. The questions asked are: (1) Do these soils need each of these ingredients to grow a maximum crop of cane? (2) If so, in what forms shall these ingredients be used? (3) In what quantities per acre? The potash has been used under the forms of kainite (12 per cent. of potash), sulphate of potash (50 per cent.) muriate of potash (50 per cent.), ashes of cotton seed hulls (20 per cent.) nitrate of potash (46 per cent.) The phosphoric acid has been used as dissolved bone black (15 per cent. soluble), acid phosphate (15 per cent. soluble), bone-black (24 per cent. insoluble) and bone meal (24 per cent. insoluble), South Carolina floats (24 per cent. insoluble), and Thomas slag (21 per cent. insoluble). The bones had in addition 3 per cent. ammonia.

"The nitrogen was furnished in the form of cotton seed meal (7 per cent. nitrogen), dried blood (13 per cent.). sulphate of ammonia (21 per cent.), nitrate of soda (15 per cent.), tankage (6 per cent.) and fish scrap (9 per cent).

"In using the above such quantities of each were taken as to represent equal quantities of nitrogen and potash and soluble phosphoric acid. In the insoluble phosphates the same number of *pounds* were used as with the soluble—since the cost was about the same. The substances were also used in one and two rations. Nitrogen was used at the rate of 24 pounds (one ration) and 48 pounds (two rations) per acre, soluble phosphoric acid 36 pounds (one ration) and 72 pounds (two rations), and potash 25 pounds (one ration) and 50 pounds (two rations). In experimenting with any one ingredient, of course, all of the others were present in excess."

The following cultivation occurred: Offbarred February 25. Ran stubble digger March 2 and March 30. Hoed April 1.

Fertilizers applied April 17, throwing them across the stubble ridge, and dirt thrown to cane with Sunbeam cultivator. April 27, Mallon's disc cultivator. May 4, split out middles with double mould board plow, and irrigated. May 6, ran Mallon's disc cultivators. May 12, ploughed out with two horse plow. May 16, ran Mallon cultivator. May 19, irrigated. May 25, ran Mallon cultivator. June 4, irrigated. June 15, ran Mallon cultivator. June 23, laid by with large discs and double mould board plow.

PLAT 3A, POTASSIC MANURES.

In this plat, nitrogen and phosphoric acid are the constants and potash the variable. The first was used at the rate of forty-eight pounds per acre, the second seventy-two pounds, while the third, twenty-five and fifty pounds in the various forms. In this plat there are one experiment without manure and two without potash. The expression nitrogen phosphate is used in the table as an abbreviation of forty-eight pounds of nitrogen and seventy-two pounds soluble phosphoric acid. The nitrogen was furnished this plat under the forms of nitrate of soda and dried blood, and the phosphoric acid as acid phosphate. Ashes of cotton seed hulls are used alone, with nitrogen, and with nitrogen phosphate.

The following table shows the field and laboratory results:

PLAT 3A. POTASSIC MANURES. RESULTS ON STUBBLE CANE, 1891.

Number of Experiment.	FERTILIZERS USED PER ACRE.	Yield per Acre in Tons.	Difference in Level of Ground.	ANALYSIS OF JUICES					
				Total Solids.	Sucrose.	Glucose.	Solids Not Sugar	Glucose Ratio.	Purity Coefficient.
1	210 lbs kainite	29.98	+6 ins	14.90	11.0	1.88	2.02	17.10	73.90
2	210 lbs kainite and nitrogen phosphate	29.82	+5 "	13.90	9.4	1.91	2.59	20.30	67.60
3	420 lbs kainite and nitrogen phosphate	29.89	0 "	14.10	9.9	1.87	2.33	18.90	70.20
4	Nitrogen phosphate	25.34	−3 "	13.70	9.6	2.02	2.08	21.00	70.60
5	50 lbs sulphate potash	27.16	−1 "	14.70	10 8	1.74	2.16	16.10	73 50
6	50 lbs sulphate potash and nitrogen phosphate	29.07	0 "	13.70	9.4	1.90	2.40	20.20	68.60
7	100 lbs sulphate potash and nitrogen phosphate	28.84	−1 "	13.50	9.3	1.39	2.81	14.90	68.90
8	No manure	28.02	−0 "	14.40	10.4	2.01	1 99	19 30	72.20
9	50 lbs muriate potash	25.90	−2 "	15.30	11.7	1.58	2.02	13.50	76.50
10	50 lbs muriate potash and nitrogen phosphate	37.30	−¼ "	15.00	11.4	1.70	1.90	14.90	76.00
11	100 lbs muriate potash and nitrogen phosphate	26.15	−1½ "	14.70	11.1	1.72	1.88	15.50	75.50
12	Nitrogen phosphate	27.16	−½ "	14.90	11.4	1.74	1.76	15.30	76.50
13	200 lbs ashes cotton hulls	25.78	−1½ "	15.20	11.7	.....	.....	.....	77.00
14	200 lbs ashes cotton hulls and nitrogen	26.72	0 "	15.10	11.1	1.84	2.16	16.60	73.50
15	200 lbs ashes cotton hulls and nitrogen phosphate	28.45	0 "	15.20	11.2	1.84	2.16	16.40	73.70
16	54 lbs nitrate potash and nitrogen phosphate	26.95	0 "	14.50	10.7	1.90	1.90	17.80	73.50
17	108 lbs nitrate potash and nitrogen phosphate	32.36	0 "	15.90	12.3	1.52	2.08	12.40	77.40

comparison of this year's yields with last shows relative
Nearly every experiment falls below last year by
a constant quantity, showing local causes disturbing
When irrigating, it was found that this plat was very
on the surface and measurements were made which are
above, and which may partially explain the discordant
Only one conclusion can be drawn from above, *i. e.*, that
ic fertilizers have had little or no effect, even after two
application.

PLAT IV. A, PHOSPHORIC ACID MANURES.

this plat the *nitrogen* and potash were the constants and
osphoric acid the variable. The nitrogen was furnished
form of sulphate of ammonia, and the potash as sulphate,
highly desirable forms. The nitrogen is supplied at the
48 pounds per acre and the potash 50 pounds. Basic
re then means 230 pounds sulphate of ammonia and 100
ls sulphate of potash. The soluble phosphoric acid is sup-
at the rate of 36 pounds (one ration) and 72 pounds (two
s) per acre.

he insoluble phosphates are used as boneblack, the refuse
sugar refineries; basic slag, a by-product in the manufac-
f iron from highly phosphorized iron ores by the Thomas
ist process; Charleston floats, an impalpable dust made from
harleston phosphates by the Duc process, and finely ground
the latter contain 3 per cent. ammonia and are used alone,
otash and with basal mixture.

he results of this plat are fairly satisfactory, though slight
alities of surface also exist here. The following table gives
sults:

PLAT IV. A PHOSPHORIC ACID MANURES. RESULTS ON STUBBLE CANE, 1891.

Number of Experiment.	FERTILIZERS USED PER ACRE.	Yield per Acre in Tons.	ANALYSIS OF JUICE.					
			Total Solids.	Sucrose.	Glucose.	Solids Not Sugar	Glucose Ratio.	Purity Coefficient.
1	258 lbs dissolved bone black	32.13	14.40	11.00	1.58	1.82	14.4	76.4
2	258 lbs dissolved bone black and basal mixture	33.11	13.59	9.30	1.62	2.67	17.4	68.6
3	516 lbs dissolved bone black and basal mixture	33.60	14.47	10.60	1.77	2.19	16.9	73.2
4	Basal mixture	32.11	13.66	10.20	1.84	1.58	18.4	74.7
5	258 lbs acid phosphate	30.73	14.66	11.10	1.82	1.74	16 4	75.7
6	258 lbs acid phosphate and basal mixture	32.11	14.08	10.30	1.69	2.09	16.4	73.1
7	516 lbs acid phosphate and basal mixture	33.30	14.28	11.10	.....	.....	.....	70 7
8	No manure	27.81	14.48	11.10	.....	.....	.....	77.0
9	516 lbs bone black	28.14	14.00	10.30	.....	.....	.....	73.6
10	516 lbs bone black and basal mixture	29 21	15.00	11 08	1.67	2.25	15.1	74.9
11	516 lbs slag meal	29.96	14.40	10.70	1.60	2.10	15.5	74.3
12	516 lbs slag meal and basal mixture	31.32	14.77	11.00	1.49	2.28	13.6	74.5
13	Basal mixture	31.36	15.16	11.60	1.53	2.03	13.2	76.5
14	516 lbs Charlest n floats	31.08	15 46	12.24	.....	.....	.....	79.2
15	516 lbs Charleston floats and basal mixture	31.57	14.36	11.00	.....	.....	.....	76.6
16	No manure	28.74	15.30	12.30	.....	.....	.....	80.4
17	516 lbs ground bones	30.10	15.87	12.60	1.26	2.01	10.0	79.4
18	516 lbs ground bones and 100 lbs sulphate of potash	28.69	15.47	12.00	1.38	2.09	11.5	77.6
19	516 lbs ground bones and basal mixture	26.92	15.00	12 20	1.35	2.05	11.1	78.2

The arrangement of results in tabular form shows the effects
rtilizers used. The average of the two unfertilized experi-
s, Nos. 8 and 16, will give the natural fertility of the soil.
excess produced by the phosphates alone over the unma-
d parts is ascribable to phosphoric acid. The basal mixture
so used twice to determine the variance due to nitrogen and
sh, without phosphoric acid; then the phosphates are used,
bined with the basal mixtures, and any increment must be
gned to phosphoric acid.

Last year it gave no decided responses. It is believed that
r the freshness of this soil is removed, it will respond freely
ne soluble forms of phosphoric acid in proper combinations.

The following is the table:

	TONS.		TONS.		TONS.
Average of unfertilized is	28.23	No. 8 is	27.71	No. 16 is	28.74
Dissolved bone black alone	32.13				
Increase over average	3.90	over No. 8 is	4.32	over No. 16 is	3.39
Acid phosphate alone	30.73				
Increase over average	2.50	over No. 8 is	2.92	over No. 16 is	1.99
Bone black alone	28.14				
Decrease under average	.09	Increase over No. 8 is	.27	Decrease under No. 16 is	.60
Slag meal alone	29.96				
Increase over average	1.73	Increase over No. 8 is	2.15	Increase over No. 16 is	1.22
Charleston Floats alone	31.08				
Increase over average	2.85	Increase over No. 8 is	3.27	Increase over No. 16 is	2.34
Ground bones alone	30.10				
Increase over average	1.87	Increase over No. 8 is	2.29	Increase over No. 16 is	1.36
Average basal mixture is	31.74	No. 4 is	32.11	No. 13 is	31.36
Basal mixture and one ration dissolved bone black	33.11				
Increase due to dissolved bone black	1.37	over No. 4 is	1.00	over No. 13 is	1.75
Basal mixture and two rations dissolved bone black	33.60				
Increase due to dissolved bone black	1.86	over No. 4 is	1.49	over No. 13 is	2 24
Basal mixture and one ration acid phosphate	32.11				
Increase due to acid phosphate	.37	over No. 4 is	.00	over No. 13 is	.75
Basal mixture and two rations acid phosphate	33.30				
Increase due to acid phosphate	1.56	over No. 4 is	1.19	over No. 13 is	1.94

By comparing the others we will find losses everywhere save in two rations of Charleston Floats, where the gain is only .21 of a ton.

inspection of above shows that this soil responds slightly
phoric acid manures, and has a decided preference for the
forms. It shows also that excessive quantities are not
le.

PLAT 5A, NITROGENOUS MANURES.

e phosphoric acid and potash are the constants in this
th *nitrogen* as the variable. Acid phosphate (15 per
luble) furnished the phosphoric acid, while as in plat 4a,
e of potash supplies the potash. Soluble phosphoric acid
at the rate of 72 pounds per acre and potash 50 pounds.
minerals means then 480 pounds acid phosphate and 100
sulphate potash per acre. The nitrogen is used at the
24 pounds (one ration) and 48 pounds (*two rations*) per
It must be remembered that cotton seed meal, tankage,
h scrap, contain phosphoric acid as well as nitrogen, and
t also a little potash.

e following table shows the field and laboratory results :

PLAT V. A. NITROGENOUS MANURES. RESULTS OF STUBBLE CANE, 1891.

No. of Experiment	FERTILIZERS USED PER ACRE.	Tons per Acre.	ANALYSES OF JUICES.					
			Total Solids.	Sucrose.	Glucose.	Solids not Sugar.	Glucose Ratio.	Purity Coefficient
1	350 lbs cotton seed meal	34.04	14.10	10.10	2.06	1.94	20.4	71.6
2	350 lbs cotton seed meal and mixed minerals	36.02	13.60	9.40	1.85	2.35	19.7	69.1
3	700 lbs cotton seed meal and mixed minerals	36.47	13.20	9.30	1.66	2.24	17.8	70.4
4	Mixed minerals	33 57	13.10	8.60	1.64	2.86	19.1	65.6
5	200 lbs dried blood	30.10	13.70	9.50	2.38	1 82	25.0	69.4
6	200 lbs dried blood and mixed minerals	33.32	13.80	9.80	1.38	2.42	14.1	71.0
7	400 lbs dried blood and mixed minerals	31.52	13.90	10.50	2.12	1.28	20.2	75 5
8	No manure	28.91	13.20	9.30	2.00	1.90	21.5	70.5
9	115 lbs sulphate ammonia	32.36	14.00	9.70	2.27	2.03	23.4	69.3
10	115 lbs sulphate ammonia and mixed minerals	35 53	13.80	9 90	1.46	2.44	14.7	71.7
11	230 lbs sulphate ammonia and mixed minerals	40.15	14.00	9.78	1.97	2 25	20.1	73.0
12	Mixed minerals	35.56	13.50	9.26	2.08	2.16	22.3	68.6
13	160 lbs nitrate soda	34.58	14.30	10.34	1.19	1.77	11.5	72.3
14	160 lbs nitrate soda and mixed minerals	33.43	14.66	11.44	1.53	1.69	13.6	78.1
15	320 lbs nitrate soda and mixed minerals	33.85	14.50	11.27	1.24	1.99	11.0	77.7
16	No manure	31.80	15.00	11.90	1.29	1.81	10.4	79.3
17	400 lbs tankage	33.13	14 73	10.90	1.60	2.23	14.7	74.0
18	400 lbs tankage and mixed minerals	33.96	14.29	10.50	1.77	2.02	16.9	73.4
19	280 lbs fish scrap	33.21	13.90	10.10	1.76	2.04	17.4	72.7
20	280 lbs fish scrap and mixed minerals	32.48	15.20	10.6	1.51	3.09	14.2	69.7

r making comparisons similar to those under phosphoric
t is found that nearly every form of nitrogen *alone* has
increased yields over the unfertilized plats—in some
ces over 5 tons per acre and averaging 2½. The combina-
of cotton seed meal with mixed minerals alone has given
nt increments in yield. Dried blood under similar condi-
hows a loss. Sulphate of ammonia shows decided gains.
st exhibit no gains by combination.
nly with sulphate of ammonia has the double ration been
ible. It is therefore apparent that nitrogenous manures
have been productive of increased yields, averaging over 2½
per acre, and when combined with mixed minerals have
5½ tons per acre over the unfertilized experiments. The
minerals in this plat have, however, given very high
s, and when the combinations are compared with these,
or no gains are perceptible; but the average yield of all
ilized experiments on the Station, has this year been 28.80
per acre, and the average on this plat is 30.35 tons. It may
sitively assumed, first, that these soils require nitrogen,
cond, that when properly combined with mineral manures,
s its best results; third, that while all forms have given
sed yields, sulphate of ammonia and cotton seed meal
given the largest.
has been almost an annual observation of the slight supe-
of sulphate of ammonia over other forms of nitrogen, as
nure for sugar cane on our alluvial soils; but, unfortu-
, its high cost will not justify its use, especially when we
t a cheap home product—cotton seed meal—which stands
er, if not a superior, among the other commercial forms.

ch is the Best Cane, Our Striped or Purple?—No. 4.

is question is a vital one to the planters of this State, and,
e to say, has never yet been fully decided. Each planter
individual preference, but can give you but few real reasons
stantiate this choice. To decide this question the Station
s year grown twelve duplicate experiments in each of the
rieties, growing them side by side. Four of each were
lized and eight were fertilized. They were also grown in
f different widths. See tables for the results in plant cane.

RESULTS OF EXPERIMENTS WITH STRIPED CANE.

HOW TREATED.	Middle Row.	Yield per Acre in Tons	Fibre.	ANALYSIS OF JUICE.						
				Total Solids.	Sucrose	Glucose.	Solids not sugar.	Glucose Ratio.	Purity Coefficient.	Pounds Sugar per Ton Cane.
Fertilizer No. 1	3 feet.	56.23		14.09	10.50	1.31	2.28	12.5	74.5	190
No manure	3 "	35.07		13.12	9.80	1.42	1.90	14.5	74.7	177
Fertilizer No. 2	3 "	40.46		13.22	10.10	1.19	1.93	11.8	76.4	183
Fertilizer No. 1	4 "	32.83		13.09	10.00	1.48	1.61	14.8	76.4	181
No manure	4 "	32.81		13.33	10.00	1.48	1.85	14.8	75.0	181
Fertilizer No. 2	4 "	40.27	9.48	14.29	11.10	1.63	1.56	14.7	77.7	201
Fertilizer No 1	5 "	31.24		13.77	10.60	1.22	1.95	11.5	76.9	192
No manure	5 "	30.82		13.20	9.45	1.28	2.47	13.5	71.6	171
Fertilizer No 2	5 "	31.16		13.40	10.62	1 34	1.24	14.5	79.2	192
Fertilizer No. 1	6 "	31.86		13.70	9.65	1.31	2.74	13.6	70.4	175
No manure	6 "	30.20		13.05	9.50	1.44	2.11	15.2	72.1	172
Fertilizer No 2	6 "	34.82		12.62	9.10	.....	.....	.....	72.8	165
Average of all Striped		35.65	9.48	13.41	10.04	1.39	1.97	13.5	74.8	182

HOW TREATED.	Middle of Row.	Yield per Acre.	Fibre.	Total Solids.	Sucrose.	Glucose.	Solids Not Sugar.	Glucose Ratio.	Purity Coefficient	Pounds Sugar per Ton of Cane.
Fertilizer No. 1	3 feet.	32.55	11.02	13.77	9.95	1.34	2.48	13.5	72.3	177
No manure	3 "	36.12		14.04	10.30	1.11	2.63	10.8	73.4	183
Fertilizer No 2	3 "	36.68		13.94	10.50	1.15	2.29	10.9	75.3	186
Fertilizer No. 1	4 "	36.04		12.12	8.50	1.46	2.16	17.2	70.1	151
No manure.	4 "	28 56		13.54	10.00	1.40	2.14	14.0	73.9	178
Fertilizer No. 2	4 "	39.16		13.24	9.60	1.47	2.17	15.3	72.5	171
Fertilizer No 1	5 "	34.39		13.91	10.10	1.41	2.40	14.0	72 6	180
No manure	5 "	32.86		13.77	10.10	1.26	2.41	12.5	73.3	180
Fertilizer No. 2	5 "	29.97		11.61	8.00	1.36	2.25	17.0	68.9	142
Fertilizer No. 1	6 "	35.30		13.17	9.98	1.36	1.83	14.5	75.8	178
No manure	6 "	31.69		.....	.....	.....	.....	.....	.....	.....
Fertilizer No 2	6 "	32.73		.....	.....	.....	.....	.....	.....	.....
Average of all purple		34.35	11.02	13.31	9.70	1.34	2.28	13.97	72.81	173
Average of all striped (see above)		35.65	19.48	13.41	10.04	1.39	1.97	13.50	74.80	182
Average of purple, fertilizer No 1		34.57	.....	3.24	9.64	1.39	2.21	14.30	72.70	171
Average of striped, fertilizer No. 1		38.04	.....	13.66	10.19	1.33	2.14	13.10	74.55	185
Average of purple, fertilizer No 2		38.13	.....	12.93	9.37	1.38	2.24	14.40	72.23	166
Average of striped, fertilizer No 2		36.63	.....	13.39	10.23	1.45	1.58	13.63	76.52	185
Average of purple, unfertilized		32.31	.....	13.78	10.13	1.26	2.39	12.40	73.5	180
Average of striped, unfertilized		32.22	.....	13.17	9.64	1.40	2 08	14.50	73.4	175

Fertilizer No. 1 was a mixture of cotton seed meal, acid phosphate and nitrate of potash.

Fertilizer No. 2 was a mixture of fish scrap, nitrate of potash, acid phosphate and muriate of potash. Both were mixed in such proportions as to give the ratio of 1 to 2 to 1 of nitrogen, phosphoric acid and potash, a ratio found by past experience to be well adapted to plant cane. In the tables above, results of each experiment are first given, then the average of all the experiments with each variety, and then an average of each variety with different manurial treatment. In this way a full comparison of the two varieties can be made. There are here data enough for one season to draw very just conclusions, were it scientifically accurate to deduce conclusions on any field crop from the results of ONLY ONE year. The striped cane was worked up December 9, and the purple December 11, both having been previously killed by the frost of November 30, and left standing until used. Appearances in the field and work in the sugar-house indicated no material injury from the frost. They were worked up separately and careful notes made during the entire process from diffusion juice to sugar. No difference was discovered until reaching the centrifugal. They were cooked in the pan to about the same density, and yet, on drying, the striped showed marked superiority both in time required and in sugar obtained. The purple gave a masse cuite which was far more difficult to centrifugal, and ultimately a lower grade sugar. This may have been due to some accidental imperfection of cooking, which sometimes occurs even with the best sugar makers, and not to any inherent property of the juice. Yet, an inspection of our tables shows uniformly higher quantities of "solids not sugar" in the purple than in the striped.

This is the first year that the Station has systematically investigated the merits of these two canes, although it has been growing them separately for several years, more with the idea of completely separating them and determining positively the question whether our purple and common white canes are degenerate varieties of the striped, as claimed by Mr. Avequin and other writers.

In this way we have other data, though not prepared for this special case, that may with propriety be introduced as *res gestae.*

The following table represents the averages of all the experiments grown in these canes in 1890 and 1891, save the experiments of this year given above:

AVERAGES OF ALL EXPERIMENTS WITH STRIPED AND PURPLE CANES GROWN ON EXPERIMENT STATION IN 1890 AND '91.

Kind of Cane.	Tons per Acre.	Weight of Each Stalk.	Fibre.	ANALYSIS OF JUICE.					
				Total Solids.	Sucrose.	Glucose.	Solids Not Sugar.	Glucose Ratio.	Purity Coefficient.
Striped '90	44.05	2.94	8.34	12.50	9.45	1.65	1.40	17.5	75.6
Striped '91	40.83	2.61	9 81	14.00	10.60	1.71	1.69	16.1	75.7
Purple '90	39.92	2.64	9.27	12 80	9.25	1.78	1.77	19.2	72.3
Purple '91	36.46	2.28	11.61	14.21	10 80	1.54	1.87	14.2	76.0

Besides the above, hundreds of analyses have been made on stalks, running them through a three roller hand mill used at the laboratory. At considerable cost of time and labor, these analyses have been hunted up, and the average mill extraction of each year carefully determined, with following results:

AVERAGE EXTRACTION OF JUICE BY HAND MILL FROM STRIPED AND PURPLE CANE.

Kind of Cane.	1888. 2 Pressures.	1889 2 Pressures	1890. 2 Pressures	1891 1 Pressure.
Striped	65.15	67.56	72.20	56.13
Purple	62.60	64.76	70.10	53.40

In every instance the records show a higher extraction from the striped cane than from the purple. As far as we can definitely decide from our books, the purple cane has invariably given an increased percentage of fibre, though our information on this subject is by no means so conclusive as that on extraction. As to sugar and glucose content, our records show little or no difference, but a decided increase of solids not sugar in the purple.

THE MERITS OF THE TWO CANES.

This is difficult to decide. Each cane has its peculiar merits. In sugar and glucose contents, and perhaps in tonnage per acre, both have equal claims. The purple contains larger percentages of fibre and solids not sugar, and yields less juice under pressure. It is harder and therefore in mill work more objectionable. It has long been a matter of comment that the striped stood the effects of dry rot better than the purple, while the latter more successfully resists an excess of moisture and cold. These observations are doubtless correct and may be due to the excess of juice in the one and of fibre in the other. The excess of solids not sugar (whatever they are) should manifest itself somewhere in the manufacture of sugar, either in an increase of scums in the clarifier or as an obstacle in the pan or centrifugal. Of this I have heard no complaint heretofore, from sugar makers, and yet our records for diffusion would strongly suggest such interference. This point can be more carefully guarded in the future, since the Station is getting its field plats down to pure varieties. Hitherto it has used the common seed of the country, which contains purple, striped, and an occasional stalk of white. By careful selection our future plats will be in distinct varieties.

In their capacity to imbibe fertilizers our experiments would indicate little or no distinction. Under irrigation they have both prospered equally as well. Their capacity to withstand droughts has not been determined, and yet the tendency of both to fall down when nearing maturity would indicate a shallow root development. This is an objection to each of the varieties, and was this year made clearly apparent, in the contrast of the erect position of several foreign varieties of greater tonnage growing side by side with the prostrated home varieties. Whether these foreign varieties, on acclimation, will succumb to the same habit, is yet uncertain, with chances at present favorable to erectness. The striped cane has a larger and more foliage than the purple, and of rather a lighter green. This would indicate a greater capacity for growth, which is apparent in the larger size of stalk, but with a diminished number in a giv

area. The purple is smaller in size, but more numerous on the row.

It would seem from present investigation, that the striped possessed more good qualities for South Louisiana than the purple.

The Composition of Sugar Cane at Various Stages of Growth.

To determine the composition of sugar cane at different periods of growth, and incidentally how far the mother cane supplies the growing sprouts, the following experiments were made upon the State Experiment Station:

The cane used was of the purple variety, first year stubble, windrowed November 20th. On February 15th it was taken from the windrow and planted. On this day three average stalks gave a juice which analyzed: Total solids 16.00 per cent., sucrose 12.6 per cent., glucose 1.95 per cent., solids not sugar, 1.457; Purity coefficient, 78.75; glucose ratio, 15.48. The "marc" or "fibre" was not determined, a fact greatly to be regretted. Fourteen average stalks were selected for planting and three reserved for complete analysis. Each of the stalks planted was weighed and numbered, and its relative position in the row was carefully noted in order that the individual stalk might be located when samples were taken for analysis at a subsequent period. It was intended to analyze monthly the original stalk and the canes growing from it, and thus determine positively the composition of the cane at different periods of growth, and approximate the ingredients taken by growing plants from the mother cane. The chemical work was performed by Prof. B. B. Ross, aided by his assistant, Mr. Bird, and to the former much of this paper is due. The three stalks reserved for analysis at planting, were weighed, cut up into small pieces, dried, and finally ground to a fine powder in a mill. The following proximate analyses were obtained:

	Original Sample.	Water Free Sample.
Water	78.48	
Ash	0.61	2.37
Albuminoids	0.47	1.85
Fat	0.64	2.51
Fibre	4.87	19.09
Carbohydrates	18.93	74.18

In the above the fibre is the residue insoluble in water, dilute acid and alkali, and is not the "marc" usually called "fibre" which represents the insoluble part of the cane.

The ash analysis of many plants, however, vary within certain limits, according to the soil upon which it is grown, and cane is no exception to this rule. Again, there is absolutely no homogeneity of composition in different stalks of cane grown in this climate—none are mature, and no two stalks are *exactly* at the same stage of development towards maturity. Hence results hereafter given have been effected by these facts.

The cane was planted February 22. It was very slow in germinating and developing. It was not until June 2 that development was deemed sufficient to justify analysis. Accordingly on this date, the seed cane, with all the young plants and their adherent roots, were carefully removed, freed from adhering dirt, and separately analyzed, with the following results:

COMPOSITION OF THE SAMPLE AS TAKEN FOR ANALYSES.

	Seed Cane.	Young Cane Stems and Leaves.	Roots of Young Cane.
Water	83.38	83.15	62.60
Ash	0.73	2.52	8.59
Albuminoids	0.31	1.55	1.92
Fat	0.36	0.71	0.99
Fibre	4.99	4.78	11.62
Carbohydrates	10.23	7.29	14.28

COMPOSITION OF THE WATER FREE SUBSTANCE.

	Seed Cane.	Young Cane, etc.	Roots.
Ash	4.39	14.99	22.93
Albuminoids	1.87	9.25	25.93
Fat	2.17	4.21	2.76
Fibre	30.03	28.41	31.07
Carbohydrates	61.54	43.14	38.16

It will be seen by comparing this analysis of the seed cane with that made at planting, that the albuminoids, fats and carbohydrates have all considerably decreased, and the fibre is about constant—just what was to be expected. But the increase in the ash can only be accounted for on the variableness of this proximate element in different canes, a fact already mentioned. The weight of the young canes was now nearly two-

thirds that of the seed cane—therefore only a small part of the essential organic elements of plant food could have been furnished to the young plant by the seed cane.

It may be remarked here that the composition of cane at this period of growth corresponds closely with that of many forage plants, while in its subsequent growth it departs further and further from this resemblance in composition.

The second lot of samples were taken for analysis on July 14, the growth of the cane having progressed, in the meanwhile, extremely well. The following are the results:

	Seed Cane.	Young Cane, Stems and Leaves.	Roots of Cane.
Water	83.86	81.84	77.57
Ash	0.48	1.57	3.13
Albuminoids	0.51	1.03	0.70
Fats	0.41	0.72	0.73
Fibre	4.95	5.65	6.54
Carbohydrates	9.80	9.19	11.33

ANALYSIS OF WATER FREE SAMPLE.

	Seed Cane.	Young Cane, etc.	Roots.
Ash	3.01	8.65	13.93
Albuminoids	3.15	5.68	3.12
Fat	2.46	3.95	3.28
Fibre	30.67	31.11	29.16
Carbohydrates	60.71	50.60	50.51

The composition of the seed cane shows little variation from the previous analysis of June 2, indicating that since the young plants had secured roots for themselves, they had not drawn on the mother cane for sustenance. Here, as elsewhere, the younger the plant the greater its percentages of albuminoids and ash, and less the fibre and carbohydrates.

The next sample was taken September 25, when the cane had obtained nearly its full growth, though far from maturity. The roots of the cane had now become so extensively ramified, that it was impossible to secure anything like all of them—so they were not analized. The proximate analyses of the cane, including tops and leaves, are first given, and then of the stalks and leaves separately, is here given:

	Cane including Tops and Leaves.	Stalks.	Tops and Leaves.
Water	72.18	74.00	68.86
Ash	2.02	1.32	3.29
Albuminoids	1.63	0.62	1 79
Fat	0.64	0.57	0.78
Fibre	9.63	8.61	11.49
Carbohydrates	14.50	14.88	13.79

ANALYSIS OF WATER FREE SAMPLE.

	Cane with Tops and Leaves.	Stalks.	Tops and Leaves.
Ash	7.01	5.08	10.56
Albuminoids	3.33	2.38	5.07
Fat	2.30	2.18	2.52
Fibre	34.43	33.08	36.89
Carbohydrates	52.93	57.28	44.96

The ash found in the above was completely analized, with the following results, which are given, first of the crude ash, and second, reduced to the original sample of cane:

	Crude Ash.	Original Sample
Volatile matter	2.05	....
Insoluble matter	30.85	.187
Soluble silica	1 60	.009
Oxide of iron and alumina	1.54	.009
Lime	6.60	.040
Magnesia	6.19	.037
Potash	17.85	.108
Soda	9.92	.060
Phosphoric acid	12.26	.074
Sulphuric acid	8.98	.054
Chlorine	1.27	.008

From the above it will be seen that one ton of cane delivered at the mill would remove from the soil 9.4 pounds albuminoids, or 1.5 pounds nitrogen and 12.2 pounds of ash or mineral matter. This mineral matter would contain 2.17 pounds potash, 1.48 pounds phosphoric acid, .8 pounds of lime.

It will be seen upon examination of these figures, and also of the results of analysis of cane leaves given later, that of the elements ordinarily supplied the plants through the medium of commercial fertilizers, the quantities assimilated and utilized by the cane are relatively very small as compared with those taken up by other staple crops. The excessive weight, however, of a crop of cane grown on a given area causes the total absolute

quantities of the ingredients referred to to more nearly approximate those removed from the soil by other plants.

A marked decrease in water and a considerable increase in the fibre and carbohydrates is observable as the plant approaches maturity. The albuminoids appear to be constant. The fibre is even higher than in the original cane—a fact made apparent in the difficult extraction of the juice from the cane by the mill. Here it was found difficult to find the original stalk from which these canes grew, and hence no further analysis of the original cane was made.

Another complete analysis was contemplated in October, but the patch was so depleted by depredators that a representative sample could not be secured. A few small canes were left untouched on November 1, and these were simply pressed in a hand mill, and juice analyzed as follows:

	Per Cent.
Total Solids	19.3
Sucrose	18.7
Glucose	.46
Solids, not sugar	.14

These canes show an increased elaboration of carbohydrates since the last analysis, and it is possible that even larger proportions might have been developed later.

CONCLUSIONS.

That the mother cane supplies the young sprouts with albuminoids, fat, carbohydrates and (perhaps) ash in the earliest stages of its growth, and there arrives a time, perhaps as soon as the root system of the young plant is well developed, when these sprouts cease to draw on the mother cane for nourishment, and the latter remains thereafter nearly constant, except from decay.

That the composition of the cane plant varies greatly during growth. While young the percentages of ash, albuminoids and fat are the greatest, decreasing until at maturity they become "minima." The fibre and carbohydrates are small in the young plant, increasing with growth and reaching maxima at maturity.