VIRGIN ISLANDS AGRICULTURAL EXPERIMENT STATION.
LONGFIELD SMITH, Agronomist in Charge.
St. Croix, Virgin Islands, U. S. A.

BULLETIN No. 2.

Under the supervision of the STATES RELATIONS SERVICE,
Office of Experiment Stations, U. S. Department of Agriculture.

SUGAR CANE IN ST. CROIX.

BY

LONGFIELD SMITH, Agronomist in Charge.

Issued September 12, 1921

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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LETTER OF TRANSMITTAL.

Agricultural Experiment Station,
St. Croix, Virgin Islands, November 2, 1920.

Sir: I have the honor to submit herewith, and to recommend for publication as Bulletin No. 2 of the Virgin Islands Agricultural Experiment Station, a paper entitled "Sugar Cane in St. Croix."

The soil of St. Croix is very fertile and well adapted to the cultivation of sugar cane, and now that the island has passed into the hands of the United States Government it seems appropriate to sum up the past history of the industry, and to indicate the prospects for the future, as well as to put on record the scientific work done in the past and still being carried on by the Agricultural Experiment Station in its efforts to place the industry on a more profitable basis.

Respectfully,

Longfield Smith,
Agronomist in Charge.

Dr. A. C. True,
Director States Relations Service,
U. S. Department of Agriculture, Washington, D. C.

Publication recommended.
A. C. True, *Director.*

Publication authorized.
Henry C. Wallace,
Secretary of Agriculture.

SUGAR CANE IN ST. CROIX.

CONTENTS.

INTRODUCTION.

Sugar cane has been grown for many years in St. Croix, where sugar making has ranked as a leading commercial industry. From 1898 the area devoted to the cultivation of cane gradually diminished, and during the 10 years immediately preceding the World War very little planting of cane was done. However, the growing of cane was stimulated in St. Croix, as elsewhere, by economic conditions brought about by the war, and the area devoted to it at present covers approximately 13,000 acres. The average amount of sugar exported yearly since 1898 has been 9,216 tons from an area of about 14,230 acres. This was at the rate of 0.647 ton of sugar exported for each acre under cultivation. If the average amount of 270 tons locally consumed is added to this sum the yield per acre is shown to be actually 0.666 ton.

The quantity of sugar exported yearly from St. Croix has varied greatly from year to year owing to climatic conditions, especially to variations in rainfall. However, that the rainfall was by no means wholly responsible for the variations in yield of cane is proved by the following table, which shows that an increased rainfall was occasionally followed by a much reduced crop.

Sugar and rum exported from St. Croix since 1898.

Year.	Sugar exported.	Rum exported.	Area of cane under cultivation.	Rainfall which produced the crop.[1]	Year.	Sugar exported	Rum exported.	Area of cane under cultivation.	Rainfall which produced the crop.[1]
	Tons.	*Wine galls.*	*Acres.*	*Inches.*[2]		*Tons.*	*Wine galls.*	*Acres.*	*Inches.*[2]
1898	12,077	79,480	16,181	78.81	1911	5,332	59,965	13,710	61.55
1899	15,240	71,097	16,187	70.42	1912	5,016	49,963	13,397	70.26
1900	8,184	42,345	16,298	55.05	1913	3,032	46,393	12,744	59.56
1901	14,520	69,135	16,441	59.94	1914	6,432	86,956	11,898	60.06
1902	14,624	66,806	16,428	84.40	1915	5,293	52,174	12,474	51.86
1903	17,354	99,946	15,820	97.91	1916	15,000	68,592	12,220	88.66
1904	11,665	45,810	15,704	65.82	1917[3]	6,000	125,597	12,627	89.60
1905	13,856	67,088	15,194	56.59	1918	5,400	31,699	12,718	71.86
1906	6,281	35,455	15,068	70.82	1919	9,000	51,360	12,498	59.76
1907	12,190	74,666	13,986	83.80	1920	12,000	142,560	(4)	83.88
1908	5,834	68,599	13,359	70.81					
1909	2,010	63,214	14,007	68.37	Total	211,845	1,533,119	313,060	1,630.86
1910	5,505	34,219	13,901	71.07	Average	9,216	66,657	13,611	70.91

[1] The rain which produced the crop of 1898 is taken to be that which fell between Sept. 1, 1896, and Dec. 31, 1897, and similarly for other years.

[2] Local usage reports rainfall in lines, 8 lines equaling 1 inch.

[3] The poor yield of sugar in 1917 and 1918 was due to the destructive hurricane of October, 1916.

[4] Approximately 13,000 acres were under cultivation in 1920.

The relative area of land devoted to plant cane and ratoon crops has differed from year to year, and this, no doubt, accounts in part for the variations in yield. Cane diseases, more especially root diseases, are also partly to blame. Since the establishment of the agricultural experiment station in 1911, a campaign has been carried on for the use of only sound cuttings for planting, and it is thought that this has had something to do with the better yields of cane obtained in later years. Still greater adoption of sound pieces of cane for planting is much to be desired, however. The breeding and distribution of new varieties of cane by the station has not yet sufficiently progressed to make an appreciable effect on the crop. However, this should soon be apparent.

The following table shows the quantity of sugar, rum, and molasses exported from St. Croix between the years 1835 and 1897, inclusive:

Quantity of sugar, rum, and molasses exported during the years 1835 to 1897, inclusive.

Year.	Sugar.	Rum.	Molasses.	Cane under cultivation.	Year.	Sugar.	Rum.	Molasses.	Cane under cultivation.
	Tons.	*Gallons.*	*Gallons.*	*Acres.*		*Tons.*	*Gallons.*	*Gallons.*	*Acres.*
1835	7,799	.....	.....	.....	1868	8,198	270,400	651,000	17,325
1836	9,303	.....	.....	.....	1869	4,632	212,400	307,900	17,226
1837	7,787	.....	.....	.....	1870	6,865	270,700	491,800	17,276
1838	13,035	.....	.....	.....	1871	12,555	353,800	1,213,800	17,223
1839	11,980	.....	.....	.....	1872	4,928	144,200	354,400	17,781
1840	9,690	1,109,458	21,752	.....	1873	4,961	171,800	345,600	17,137
1841	9,094	1,018,887	23,941	.....	1874	2,336	141,700	209,600	17,088
1842	5,856	721,347	13,556	.....	1875	7,556	245,000	644,800	16,835
1843	7,977	704,717	213,793	.....	1876	3,841	178,700	317,100	16,554
1844	9,339	660,910	551,593	.....	1877	3,595	133,400	265,000	16,608
1845	13,684	857,003	922,338	.....	1878	7,338	145,600	515,000	16,576
1846	9,438	644,012	582,994	.....	1879	6,033	131,800	334,500	16,574
1847	14,662	1,074,899	631,298	.....	1880	7,066	111,100	384,000	15,664
1848	9,539	754,664	302,727	.....	1881	7,332	106,400	393,900	15,980
1849	8,856	654,804	439,167	.....	1882	12,226	150,100	496,800	15,963
1850	5,543	627,447	5,179	20,195	1883	8,035	114,900	254,300	16,486
1851	7,888	705,449	274,608	19,797	1884	10,917	158,500	274,400	16,700
1852	5,449	519,998	81,405	19,438	1885	11,215	125,600	247,000	16,508
1853	7,278	628,554	141,607	19,230	1886	9,712	88,300	209,200	16,548
1854	9,139	975,650	7,537	19,146	1887	10,917	138,000	264,800	16,511
1855	7,928	.....	.....	18,929	1888	9,857	111,600	234,400	16,440
1856	8,366	.....	.....	18,834	1889	13,891	118,000	271,400	16,479
1857	4,313	.....	.....	18,860	1890	11,849	108,100	327,300	16,489
1858	9,034	.....	.....	18,765	1891	2,399	56,300	18,200	16,333
1859	5,031	.....	.....	18,446	1892	11,563	116,400	261,200	16,404
1860	6,364	.....	.....	18,538	1893	7,473	88,800	83,300	16,587
1861	8,059	.....	.....	18,362	1894	14,976	102,100	204,400	16,633
1862	9,807	632,700	454,900	18,074	1895	19,836	97,200	146,700	16,011
1863	7,322	354,700	402,200	17,535	1896	13,430	81,900	166,700	15,974
1864	4,882	233,800	366,100	17,449	1897	14,233	77,900	93,200	16,149
1865	6,115	262,800	446,000	17,602					
1866	9,740	283,900	817,900	17,475	Total	547,858	.....	.....	.....
1867	7,796	272,600	621,100	17,505	Average	8,696	.....	.....	.....

It will be observed that the average yearly export of sugar was only 8,696 tons. Since the average area planted to sugar cane during this period was approximately 18,100 acres, the sugar exported per acre was only 0.48 ton. This difference is chiefly due to the fact that a much larger quantity of cane was turned into rum in the earlier period. The average production of rum during this time was approximately 600,000 gallons, while the average production between 1898

and 1920, inclusive, was only 66,657 gallons. Approximately 3,332 tons of sugar is accounted for by the difference of 533,343 gallons. The addition of this amount of sugar to the above-mentioned 8,696 tons shows that 12,028 tons of sugar would have been produced had not so much cane been turned into rum. Had this conversion not been made, the yield would have been 0.664 ton of sugar exported for each acre under cultivation, since 18,000 were under cultivation. This figure is almost the same as that obtained for the last 23 years.

The quantity of sugar and rum exported from St. Croix between the years 1777 and 1807, inclusive, is shown in the table below:

Quantity of sugar and rum exported from St. Croix during the period 1777 to 1807, inclusive.

Year.	Sugar.	Rum.	Year.	Sugar.	Rum.
	Tons.	*Gallons.*		*Tons.*	*Gallons.*
1777	9,624	673,594	1794	9,176	759,181
1778	10,282	894,355	1795	8,552	816,437
1779	8,073	597,859	1796	11,214	1,175,736
1780	11,651	894,520	1797	8,903	998,085
1781	11,557	988,774	1798	8,770	782,990
1782	12,212	1,009,939	1799	12,658	747,945
1783	9,220	530,123	1800	2,136	212,797
1784	7,930	629,773	1801[1]		
1785	12,431	1,030,133	1802	18,729	1,526,848
1786	10,255	751,223	1803	16,326	1,202,019
1787	10,598	947,917	1804	14,688	1,051,988
1788	12,778	985,812	1805	15,393	1,116,322
1789	5,808	4,308,922	1806	14,604	1,117,606
1790	7,058	644,031	1807	17,257	1,228,144
1791	3,313	320,668			
1792	7,551	673,384	Total	334,143	29,780,488
1793	14,617	1,163,363	Average	10,778	992,682

[1] Data not available.

During the period covered by the above table an average of 10,778 tons of sugar was yearly exported, while the average quantity of rum was 992,682 gallons, or 926,026 gallons more each year than was exported during the 23 years 1898 to 1920, inclusive. Had the cane used in making this large quantity of rum been turned into sugar, it would have produced approximately 5,785 tons of sugar. The addition of this number to the 10,778 tons exported shows that a total of 16,563 tons would have been exported had the excess of rum been turned into sugar. The area planted to sugar cane during this period was approximately 22,000 acres, and the actual amount of sugar exported per acre was 0.75 ton. This figure is about 13 per cent more than that obtained in recent years, but since these results were obtained under slave labor, it is likely that they were largely due to a more thorough preparation and cultivation than is now given the soil.

As a matter of fact, the figures do not seem to show any serious decline in the fertility of the soil during the past 100 years in spite of the lack of crop rotation. The methods of land preparation and manuring commonly practiced seem to have been sufficiently good to

maintain the fertility of the soil. The most conspicuous figure in the table of statistics is the enormous exportation of rum for the year 1789, which amounted to 4,308,922 gallons.

CLIMATIC CONDITIONS AFFECTING THE GROWING OF SUGAR CANE IN ST. CROIX.

While the rainfall and climate of St. Croix are below normal for the most economical production of sugar cane, very good crops can be produced when careful attention is given to the cultivation of the soil and the conservation of humus. The rainfall of the island since 1852 is shown in the following table:

Rainfall in St. Croix during the 69 years, 1852–1920.

Year.	Month.												
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	Ins.	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*
1852	0.37	1.22	1.67	0.54	6.38	1.80	2.37	3.62	15.47	7.47	2.40	4.21.	47.55
1853	2.95	1.30	1.26	2.55	13.86	5.17	3.18	5.41	6.08	6.47	3.85	2.13	54.25
1854	.81	1.87	1.07	3.68	4.55	1.25	3.67	3.56	5.85	18.62	4.85	3.51	53.53
1855	1.95	1.80	.92	1.80	6.75	4.22	2.78	9.43	4.37	5.96	8.41	2.10	50.52
1856	3.23	.80	.75	4.76	1.50	1.65	3.16	3.36	4.20	4.97	7.18	1.85	37.48
1857	.97	3.10	4.10	3.57	5.18	7.15	7.83	1.90	4.75	3.95	5.23	4.03	50.90
1858	1.32	1.28	3.62	4.36	2.28	3.07	1.57	1.82	7.61	11.02	3.00	2.97	44.98
1859	1.70	2.15	.27	.96	8.22	2.95	2.63	4.67	8.91	4.67	5.53.	1.36	44.06
1860	2.46	1.16	1.48	3.57	1.73	1.76	3.78	6.78	9.53	7.62	1.10	1.76	42.53
1861	3.10	1.18	1.58	5.38	4.86	8.65	5.00	7.61	5.77	9.87	2.80	2.90	58.73
Average	1.90	1.60	1.67	3.12	5.53	3.76	3.51	4.92	7.26	8.06	4.43.	2.68	45.98
1862	1.08	.98	1.41	2.77	3.51	3.93	1.81	5.65	6.53	6.37	1.81	5.36	41.26
1863	1.00	1.56	.97	1.53	1.28	1.82	1.06	2.81	6.07	7.62	4.47	3.78	34.01
1864	2.86	1.56	2.31	.67	4.62	1.40	1.83	4.35	3.53	11.97	2.35	2.16	39.61
1865	1.02	.80	1.53	3.22	5.86	8.91	4.47	6.92	4.66	3.10	4.72	4.25	49.50
1866	2.47	2.52	2.22	3.65	2.08	6.35	5.35	3.97	2.41	7.97	5.32	2.02	46.37
1867	2.25	4.86	.86	1.16	7.03	4.61	3.22	2.71	4.91	5.51	6.75	2.70	46.60
1868	1.02	1.37	6.80	2.53	2.78	.63	2.72	1.60	6.20	5.72	4.51	1.83	37.76
1869	3.08	1.43	2.80	9.65	1.53	1.87	3.45	5.13	11.76	6.90	3.91	5.16	47.71
1870	2.97	.72	2.65	1.85	2.48	8.10	4.81	4.98	2.66	13.00	3.26	3.66	51.22
1871	3.50	.62	2.03	2.56	2.27	1.00	2.25	3.71	3.85	7.32	3.77	3.08	34.62
Average	2.11	1.65	2.36	2.96	3.35	3.86	3.10	4.18	5.26	7.55	4.07	3.52	43.00
1872	1.26	1.80	1.30	3.66	1.28	1.20	2.53	2.53	6.43	4.93	3.15	1.76	31.87
1873	2.31	1.31	4.01	1.51	1.56	1.13	.53	2.03	6.91	3.57	2.35	2.46	29.60
1874	2.60	4.03	1.00	1.60	1.56	4.65	2.51	3.72	6.68	4.38	12.98	2.12	48.16
1875	3.78	1.06	1.63	.67	1.41	3.22	3.13	4.10	2.28	3.15	3.90	2.30	30.67
1876	3.68	1.52	.47	2.88	3.21	3.81	2.88	2.02	5.77	2.38	5.03	2.00	35.71
1877	2.66	2.31	.91	2.58	1.12	5.46	7.38	6.13	5.18	4.30	7.18	3.58	48.87
1878	4.28	8.08	2.21	4.28	3.28	2.53	5.23	6.55	4.28	8.78	9.51	1.72	56.80
1879	9.20	3.01	2.15	2.83	13.75	9.80	3.26	5.91	4.76	10.57	8.06	2.56	67.58
1880	5.48	2.45	1.20	2.88	8.01	2.33	22.51	1.57	3.80	4.97	3.76	2.45	41.45
1881	1.31	1.80	.85	1.41	6.67	10.67	3.80	8.00	6.72	3.83	10.45	2.40	57.93
Average	2.85	2.33	1.57	2.43	4.18	3.48	3.37	4.25	5.28	5.11	6.61	2.33	44.86
1882	2.77	1.92	.97	1.17	1.40	1.20	3.42	5.38	7.47	8.38	6.50	3.58	44.21
1883	3.26	2.60	1.72	4.20	3.50	2.73	2.93	4.92	5.81	5.02	5.15	6.27	48.22
1884	2.20	2.42	1.87	.25	4.32	2.38	4.45	3.21	5.01	10.97	4.01	3.31	44.43
1885	1.93	.91	.78	4.72	1.75	.77	3.30	3.20	2.46	14.11	6.07	5.57	45.61
1886	3.93	3.81	1.46	8.65	1.50	2.90	2.78	5.42	4.07	7.32	9.18	3.08	54.12
1887	2.43	2.28	.56	.55	6.11	6.82	4.73	6.00	4.20	3.01	9.87	1.28	42.88
1888	2.08	1.45	1.36	2.53	3.88	5.22	7.48	7.57	5.97	3.75	8.85	4.50	54.68
1889	2.67	1.83	.83	6.95	6.62	10.81	5.28	3.77	6.53	3.96	2.58	2.72	54.61
1890	5.25	1.81	1.60	1.82	.96	1.11	2.36	2.57	2.72	3.83	2.37	3.65	30.33
1891	1.28	1.85	.28	1.91	2.18	5.78	3.92	6.25	3.00	14.46	4.66	2.76	50.37
Average	2.78	2.10	1.15	3.28	3.22	3.97	4.06	4.86	4.92	7.50	5.92	3.67	47.50
1892	2.10	.97	.33	1.88	8.00	1.93	2.00	3.18	5.52	2.78	4.47	1.97	35.18
1893	2.08	3.55	1.63	3.00	5.17	10.50	6.10	9.81	5.22	5.87	1.20	1.83	56.00
1894	1.97	1.62	.97	2.50	5.22	3.12	3.47	2.42	4.50	4.91	5.71	7.48	44.03
1895	1.47	1.43	1.06	.44	9.53	1.60	2.53	4.32	10.28	6.87	5.90	10.31	55.78
1896	2.25	1.80	1.92	1.06	6.57	4.32	9.11	4.47	7.92	3.11	9.47	3.46	56.02
1897	2.00	.91	2.75	5.85	14.75	2.07	4.62	1.91	4.08	5.85	5.91	4.10	54.83
1898	2.68	.47	.74	.87	7.55	1.98	7.78	7.41	7.45	6.66	3.63	3.20	50.37
1899	1.68	.93	.66	.98	1.52	4.72	2.70	6.41	2.22	4.28	6.60	1.37	34.12
1900	2.22	.97	1.50	4.28	2.85	8.18	4.12	3.81	4.53	5.30	4.01	3.45	45.45
1901	3.15	1.82	1.71	.61	2.16	7.05	11.80	1.97	16.38	8.88	7.70	3.66	66.92
Average	2.16	1.45	1.32	2.15	6.33	4.60	5.42	4.58	6.87	5.47	5.46	4.08	49.87

Rainfall in St. Croix during the 69 years, 1852–1920—Continued.

Year.	Month.												
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
	Ins.	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*
1902	4.53	.16	2.57	5.73	12.60	8.87	1.77	1.90	4.01	2.47	8.03	6.11	61.32
1903	1.22	.99	1.20	3.50	1.70	2.94	5.23	9.15	4.03	5.33	4.65	5.26	45.12
1904	1.44	3.65	3.73	3.59	2.17	.40	1.53	3.20	4.56	9.80	1.96	1.40	39.32
1905	4.61	1.5	.91	1.12	3.51	1.42	1.24	11.11	8.22	10.46	7.00	1.99	53.10
1906	1.84	1.72	3.62	1.45	1.47	5.83	5.44	2.17	16.61	3.08	3.11	9.74	56.11
1907	1.18	1.49	1.33	.79	1.09	4.36	2.00	2.68	2.74	7.25	5.15	8.21	38.26
1908	2.07	2.85	2.44	3.21	5.96	3.08	3.05	1.65	6.03	5.02	4.85	3.54	45.05
1909	2.07	2.62	.51	2.23	1.92	5.56	1.80	16.40	3.90	4.37	9.08	.87	51.65
1910	3.12	1.15	3.34	.31	3.93	.90	.96	4.50	15.12	2.50	3.20	3.97	43.05
1911	3.15	6.97	.57	3.35	5.57	.70	1.65	1.12	4.04	6.27	2.60	9.41	45.57
Average	2.50	2.31	2.12	2.52	4.26	3.4	2.47	5.4	6.67	5.68	4.96	5.05	47.62
1912	1.03	1.72	1.68	2.32	1.35	2.49	2.35	2.00	1.32	8.26	8.31	3.19	37.22
1913	3.38	1.86	2.91	2.97	8.72	.61	2.28	1.80	3.51	5.29	2.50	1.87	48.97
1914	2.26	1.88	1.43	1.76	8.43	4.38	1.03	2.78	1.41	2.45	5.88	3.35	37.47
1915	1.41	.86	2.50	12.75	10.05	11.90	2.46	5.51	4.03	4.58	15.56	3.88	75.62
1916	1.70	3.13	1.69	1.05	5.45	4.01	2.99	5.54	3.36	18.48	10.62	3.55	61.32
1917	1.82	1.8	1.25	.86	4.06	4.60	2.69	2.70	2.89	3.15	4.45	5.36	35.88
1918	1.06	2.01	1.24	1.09	8.46	1.08	3.57	1.15	3.48	8.21	10.33	1.86	43.69
1919	2.74	1.76	1.64	1.94	2.31	3.16	8.82	2.10	7.17	2.05	4.32	4.51	42.40
1920	2.73	3.21	1.86	.50	.41	1.13	2.91	1.71	.....	.....	.....	.....	.....

The following table gives the average rainfall for each 10-year period from 1852 to 1911, inclusive. It is interesting to observe that while the total rainfall was either far below or far above the average during certain years and the distribution was very erratic, both the total amount and the distribution were fairly constant when taken over 10-year periods.

Average rainfall for each 10-year period, 1852–1911.

Period.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
	Ins.	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*
1852–1861	1.90	1.60	1.68	3.12	5.53	3.76	3.51	4.92	7.26	8.16	4.43	2.68	48.61
1862–1871	2.11	1.65	2.36	2.06	3.35	3.86	3.10	4.18	5.26	7.80	4.07	3.40	43.00
1872–1881	2.85	1.33	1.57	1.43	4.16	4.48	3.37	4.25	5.28	5.11	6.61	2.33	44.86
1882–1891	2.78	2.10	1.15	3.27	3.22	3.97	4.06	4.62	4.92	7.50	5.92	3.67	47.50
1892–1901	2.16	1.45	1.32	2.15	6.33	4.60	5.42	4.58	6.81	5.47	5.46	4.08	49.87
1902–1911	2.52	2.31	1.12	2.52	4.26	3.40	2.47	5.40	6.92	4.68	4.96	5.05	47.62
Total	14.33	11.45	10.21	15.57	26.90	24.08	21.95	28.11	36.45	39.38	31.45	21.23	281.35
Average for 60 years	2.38	1.91	1.70	2.60	4.47	4.01	3.65	4.70	6.07	6.56	5.23	3.53	44.38

METEOROLOGICAL DATA RECORDED AT THE EXPERIMENT STATION FROM APRIL 1, 1919, TO MARCH 31, 1920.

The following table summarizes the results of observations made at the experiment station during the past year with instruments supplied by the United States Weather Bureau. The anemometer, or wind gauge, was placed near the ground, the cups being 16 inches above the soil and projecting over the evaporation pan. The rainfall for the year was in excess of that usually experienced and the evaporation was probably below normal. These are the first evaporation records ever obtained in St. Croix. In spite of the abnormally high rainfall, evaporation was still more than 10 inches in ex-

cess of rainfall. The methods of preparing the land for cane in St. Croix and the methods of cultivating are largely determined by the large evaporation and small rainfall. Temperature records at the experiment station show that at no period of the year is the climate excessively hot. During eight years' observations the writer has seldom known the thermometer to rise above 90° F., in the shade.

Condensed meteorological data at the experiment station from Apr. 1, 1919, to Mar. 31, 1920.

Month.	Temperature.				Average daily velocity of wind.	Total precipitation.	Total evaporation.
	Maximum.	Minimum.	Mean maximum.	Mean minimum.			
1919.	°F.	°F.	°F.	°F.	Miles.	Inches.	Inches.
April	87	67.0	86.4	69.2	76.4	19.44	6.11
May	88	70.5	85.3	77.4	72.7	2.19	8.56
June	88	72.0	86.7	74.6	52.5	3.16	7.52
July	89	70.0	86.1	73.6	46.5	8.82	6.78
August	89	79.0	87.3	76.2	45.2	2.10	7.42
September	88	69.0	86.1	74.1	43.4	7.17	5.84
October	88	68.0	86.2	69.7	41.9	2.05	5.51
November	88	61.0	85.3	68.0	42.5	4.32	4.67
December	86	64.0	83.3	69.7	44.8	4.51	4.42
1920.							
January	85	64.0	82.1	70.0	55.8	2.73	4.48
February	85	61.0	82.6	69.2	49.1	3.21	4.92
March	87	68.0	83.8	70.8	52.4	1.86	6.38

CANE SOILS IN ST. CROIX.

There are two distinct types of soil on the island of St. Croix: (1) That occurring over the limestone or marl formation, and (2) that occurring over the rock which everywhere underlies the limestone and is known as the "blue beach" formation.

Figure 1 shows a sketch map of the island, and indicates the localities where the writer has taken soil samples for analyses. The unshaded part of the map indicates the approximate area of the limestone formation, and the shaded area the "blue beach" formation. Soil samples from both of these formations have been analyzed, the results being given in the tables below. Sugar cane is grown on all the soils analyzed except that of Shoys plantation.

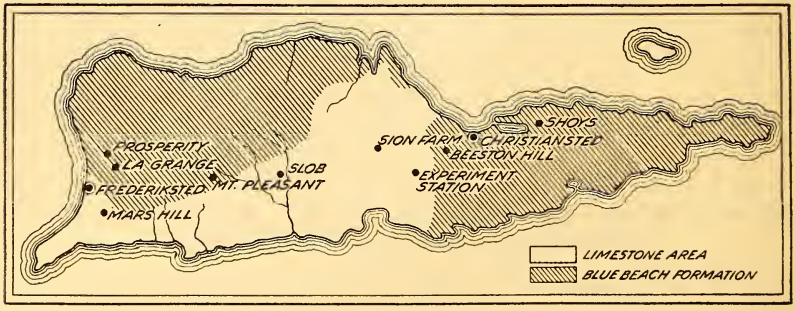

FIG. 1.—Sketch map of the island of St. Croix, showing the approximate area of the limestone formation and the localities where soils have been analyzed. Island 20 miles east to west.

Chemical analyses of St. Croix soils.[1]

Constituent.	Location.								
	Experiment station.	Sion farm.	Slob plantation.	Mars Hill plantation.	Beeston Hill plantation.	Shoys plantation.	Mount Pleasant plantation.	Prosperity plantation.	La Grange plantation.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Combined water and organic matter	8.640	9.130	8.740	14.370	7.503	8.574	13.740	7.550	5.750
Insoluble siliceous matter	47.840	48.55	43.93	49.13	71.308	76.916	62.120	73.370	70.32
Carbon dioxid	11.45	9.90	10.50	1.58	.100	.080	.17	.14	.23
Soluble in hot hydrochloric acid, sp. gr. 1.115 in 12 hours:									
Soluble silica (SiO_2)	.12	.23	.16	.18	.116	.108	.08	.08	.26
Phosphoric anhydrid (P_2O_5)	.27	.26	.24	.21	.185	.113	.26	.22	.39
Sulphuric anhydrid (SO_3)	.11	.08	.09	.03	.051	.093	.08	.07	.....
Iron oxid (Fe_2O_3) and alumina (Al_2O_3)	12.88	14.76	18.08	25.40	16.880	11.200	21.64	15.36	16.40
Calcium oxid (CaO)	16.40	14.96	15.72	5.38	2.600	2.240	.41	2.12	4.68
Magnesium oxid (MgO)	1.44	1.06	.94	1.81	.714	.432	.47	.40	1.43
Sodium oxid (Na_2O)	.27	.29	.49	.54	.170	.074	.16	.10	.13
Potassium oxid (K_2O)	.58	.78	1.11	1.37	.373	.170	.87	.59	.41
Total	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
Nitrogen (N)	.210	.224	.214	.252	.154	.203	.242	.158	.133
Calcium carbonate ($CaCO_3$) equivalent to carbon dioxid	26.000	22.500	23.860	3.580	.227	.181	.390	.320	.530
Phosphoric anhydrid (P_2O_5) soluble in 1 per cent citric acid	.058	.025	.020	.012	.....	.....	.042	.046	.070
Phosphoric anhydrid (P_2O_5) soluble in saturated carbonic acid	.005	.008	.005	.006	.....	.....	.006	.002	.005
Potassium oxid (K_2O) soluble in 1 per cent citric acid	.015	.017	.02	.018	.....	.....	.05	.013	.025
Potassium oxid (K_2O) soluble in carbon dioxid solution	.005	.019	.016	.009	.....	.....	.027	.008	.012

[1] Results calculated to soil dried at 100° C.

Mechanical analyses of St. Croix soils.[1]

Location.	Gravel, 3 mm. to 1 mm.	Coarse sand, 1 mm. to 0.5 mm.	Medium sand, 0.5 mm. to 0.25 mm.	Fine sand, 0.25 mm. to 0.05 mm.	Silt, 0.05 mm. to 0.01 mm.	Fine silt, 0.01 mm. to 0.002 mm.	Clay, 0.002 mm. and under	Total percentage.	Fine soil, 0.5 mm. and under.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Experiment station	8.57	5.33	3.76	37.67	15.01	17.58	12.08	100	86.10
Slob plantation	2.97	1.58	3.06	15.04	34.92	18.95	23.48	100	95.45
Mars Hill plantation	10.16	1.88	1.35	30.19	28.31	13.05	15.06	100	87.96
Mount Pleasant plantation	3.02	1.69	3.19	32.13	28.21	18.99	12.77	100	95.29
Prosperity plantation	36.64	4.12	2.94	20.84	16.54	13.74	5.19	100	59.24
La Grange plantation	50.9	7.01	6.71	21.57	7.03	4.22	1.96	100	42.09

[1] Results calculated to soil dried at 100° C.

These analyses disclosed the following important facts: (1) All the soils are plentifully supplied with available phosphates and potash; (2) the soils in the limestone area contain a large proportion of agricultural clay; the La Grange soil is very porous and deficient in clay; (4) the soils at the experiment station, Sion farm plantation, and Slob

plantation contain a very large percentage of calcium carbonate; (5) the soil at La Grange contains no sulphates; and (6) the soils at the experiment station and La Grange contain an exceptionally large amount of available phosphates.

PREPARATION OF LAND FOR CANE PLANTING.

When the final crop of ratoon canes has been removed, the trash is either raked or burned off, and the land is plowed to a depth of 8 or 10 inches. An ordinary moldboard plow drawn by 8 oxen is generally used for this purpose. About 10 years ago Bartram Bros. imported for use on their plantations a steam plow, which has done excellent work. This plow has also been used to subsoil the land to a depth of 18 inches or more. Land thus treated gave excellent results. (Pl. I, fig. 1.)

The land is well harrowed after being plowed, and then scored out into a series of ridges and furrows, the latter being $4\frac{3}{4}$ or 5 feet apart. An ordinary moldboard plow, which has an extension on the moldboard to throw the soil well back, is used for scoring out. Two cuts are made to produce each furrow, the soil being thrown first to one side and then to the other. After the field has been thus scored out, farmyard manure is generally placed in the furrows, the quantity applied being usually from 20 to 30 tons to the acre, or from 560 to 850 pounds per 100 feet of row. The manure is then covered by an ordinary moldboard plow; and the center between the rows is scored out into furrows by two cuts of the moldboard plow with moldboard extension. The land is thus again made into a series of ridges and furrows $4\frac{3}{4}$ or 5 feet apart, and the manure is placed under the ridges, or banks as they are called. Until about 10 years ago, it was the practice to use hoes to remove the loose soil from the furrows and pile it on the banks. This practice, which left the land in a series of neatly combed banks, presenting a very pretty appearance, was of no practical value. On account of the labor expense involved, and partly because demonstrations carried on at the station showed that fine combing is unnecessary, this part of the work is now seldom done and the banks are combed with a double moldboard plow. The change to the use of the latter was largely due to the demonstrations of the work of these plows at the station. The sugar cane is planted in the furrows. Sometimes, when farmyard manure is not available for application, the cane is planted in the first series of furrows after they have been combed by the double moldboard plow, or by hand labor.

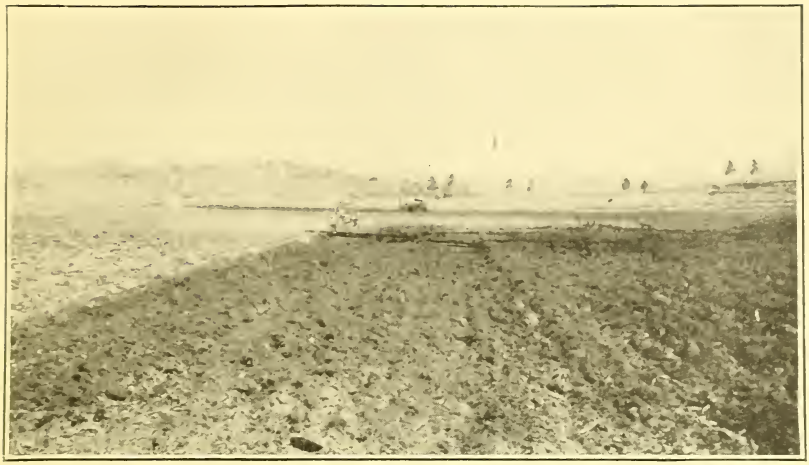

FIG. 1.—PREPARING LAND FOR SUGAR CANE WITH STEAM PLOWING OUTFIT.

FIG. 2.—FIELD OF YOUNG SUGAR CANE. METHOD OF PLANTING IN FURROWS.

SUGGESTIONS FOR IMPROVING AND PRACTICING GREATER ECONOMY IN THE PREPARATION OF LAND.

It is the practice in St. Croix to plant cane continuously on the same land. As soon as the last ratoon crop has been harvested, the land is prepared for the next crop. Rotations with some other crop or crops should be practiced. Cotton suggests itself very naturally as a rotation crop, but in some cases where it was tried on the plantations the results were not very satisfactory. Lack of success is attributed to the fact that cultivation of the cotton crop ceases after the cotton bolls begin to form; consequently, the land is left after the crop in a weedy and foul condition. The experiment station was successful in rotating first with sweet potatoes and then with velvet, or Lyon, beans. Sweet potatoes and velvet beans form such a thick growth of vines that they readily keep down weeds. Planters object to planting fields of sweet potatoes because they can not be sold when the supply is very plentiful and they do not keep for any length of time. The poor-keeping qualities of sweet potatoes are due principally to the attacks of the sweet-potato weevil or scarabee (*Euscepes batatæ*). Experiments made at the station show that the damage caused by this pest can be controlled. Planters will have little trouble with weevils if they use the simple measures recommended. Potatoes which were free from weevils have been kept in a perfectly sound condition for four months at the experiment station. Since the yield of Black Rock sweet potatoes is about 10,000 pounds of tubers to the acre and two or three cents a pound is readily paid for them in St. Croix, this crop should be remunerative when used in rotation with cane. The potatoes occupy the land for four months only; and, in addition to producing a valuable crop of tubers, form an immense quantity of vine which makes excellent feed for hogs, goats, cows, and all kinds of stock. The crop helps to increase the fertility of the plantation lands because the quantity of manure is invariably increased and returned to the ground by the animals pasturing thereon. Ordinarily, the last ratoon cane crop is cut about June or July. If two months are allowed for the preparation of the land after the cane is removed, the sweet potatoes should be planted in August or September. In the latter month St. Croix generally has good rains. The crop should be harvested in December or January. After harvesting the potatoes, the land should be replowed and prepared in a series of banks and furrows for the planting of velvet, or Lyon, beans. For this purpose the banks should be 4 or 5 feet apart, and the beans planted on them. The vines will be ready to turn under as green manure in four months' time. If the beans are planted in April or May, the vines should be ready to turn under about August or September. The vines should be pulled up and

placed in the furrows and allowed to wilt for a week. They should then be covered by the plow, a cut being made on each side of the furrow. The center can then be scored out in the usual manner into a deep furrow, in which the canes can be planted. This method enables the land to be ready for planting to canes in the best months, namely, October, November, and December. The vines will greatly enrich the land in nitrogen and humus. After the canes have sprouted, the land could be further enriched by applying farmyard manure to the young plants, covering the manure by making a cut on each side with a small vineyard or other moldboard plow. It is recommended that planters give this method a trial.

On account of labor shortage and prevailing high wages in St. Croix, it has become necessary to simplify the method of preparing the land for cane. For this reason an entirely new and successful method of preparation has been tried for some years at this station. After the land was thoroughly fallow-plowed, the field was scored out into a series of furrows and ridges by means of a single moldboard plow. Two cuts of the plow were used to score out each furrow, the soil being thrown to one side by the first cut, and to the other side by the second cut. The station tried using a single cut of a double moldboard plow for this work, but found that the local plowman could not make a straight furrow with this implement. Well-rotted farmyard manure was applied at the usual rate in this furrow, and then covered by two cuts of a vineyard plow, one cut being made up the field, and the other, down. The cane was then planted through the manure. This method of preparation, in addition to being much cheaper than that ordinarily practiced, leaves the land almost flat and makes subsequent cultivation easier. Extensive trials have shown that the yield of cane did not suffer by this method, but on the contrary was considerably increased.

At the private station of the Danish West Indies Sugar Factory Co., which is situated on the Slob plantation, Mr. Gedde is making extensive trials with excellent results of planting cane in flat soil after broadcasting farmyard manure. The cost of preparing and subsequently cultivating the cane is much reduced, and the yields do not seem to diminish. In fact, Mr. Gedde finds that the first crop of canes is actually greater than that obtained by the ordinary method of preparation.

METHOD OF PLANTING.

As previously stated, the method of preparation ordinarily practiced in St. Croix leaves the land in a series of ridges and furrows $4\frac{3}{4}$ or 5 feet apart; and the cane is planted in the furrows. (Pl. I, fig. 2.) The pieces of cane used for planting are taken from the top of the cane. Care is always taken to see that the terminal bud of the cane is cut off. If this is not done the terminal bud grows into what is locally known

as a "cow tail," which is supposed to prevent the side buds from growing and to make a stool having less stalks and lower yield. An experiment conducted at the station did not, however, confirm this popular belief. The "plant tops," as these pieces of cane are called, are planted by hand, the workman using either a pickaxe or a crowbar with which to open a hole in the bottom of the cane furrow. Into these holes he slips the plant tops, leaving about 1 or 2 inches of each top showing above ground. It is important that the soil be packed firmly about the plant tops, which are usually spaced 3 feet apart in the rows.

The plant tops are usually taken from a field of old ratoons which have made such poor growth that it is problematical whether they will produce sufficient cane to pay for the cutting and carting if they are left untouched until harvest time. Such pieces are generally full of the fungus *Marasmius sacchari*, and the practice of using them is therefore very harmful. Great efforts have been made by the writer to induce a change in this practice, and while undoubtedly more attention is now paid than formerly to the quality of the tops used for planting, much improvement could be made in this direction. The farmers hesitated to use good cane for planting because they did not know what to do with the remainder of it after removing the plant tops, since the factories were not running between the months of October and December. However, the three or four small sirup factories recently established on the island will readily purchase the cane for sirup making. This difficulty would, therefore, now seem to be removed. Another point in this connection is that all pieces of cane that are planted in October and November germinate well owing to the rainfall being very good during these months. The top alone, therefore, need not be used, but rather any part of the whole cane. All joints showing signs of fungus, presence of borers, or any disease, should be discarded. Clean pieces of cane possessing three or four sound eyes should be used. In dry weather pieces of cane will often rot in the ground rather than germinate, while tops will grow rapidly. This behavior varies considerably with the kind of cane planted. Seedling cane S. C. 13/13 germinates at almost any time of the year as readily from pieces as from top plants.

TIME OF PLANTING.

Cane is usually planted in St. Croix between September and December, which is unquestionably the best time to plant. Owing to lack of labor and to other difficulties, most of the plantations are prevented from finishing the planting work at this season, and desultory planting often goes on until the end of June. From experience gained at the station it is thought that, unless all the cane can be planted by the middle of January, planting should be post-

poned until April or May, when there are usually good showers. An advantage of planting in April or May is that the cutting of cane is going on at the same time so that the "plant tops" can readily be obtained.

FERTILIZATION OF CANE.

In St. Croix it is the practice to manure each field of plant canes with farmyard manure, using from 20 to 30 tons to the acre. This manure is partly produced on the plantation and partly obtained by purchase from the live-stock plantations of the island. The method of applying it will be found under the heading "Preparation of land for cane planting," page 10.

The farmyard manure applied consists of the litter of cane trash, weeds, and sometimes bagasse that has been carted to the pens from time to time for the live stock to lie on, the remains of grass and cane tops that have been carted to the pen every night as food for the animals, and the excreta of the animals. Inasmuch as the pens are usually completely exposed to the sun, air, and rain, a large part of the most valuable portion of the manure is lost in the leaching process which takes place. The following table gives the results of an analysis of the ordinary farmyard manure made in St. Croix.

Analysis of farmyard manure.

Constituent.	Proportion present.	Constituent.	Proportion present.
	Per cent.		*Per cent.*
Moisture	67.75	Potassium oxid (K_2O)	0.85
Organic material [1]	20.84	Undetermined	6.29
Insoluble siliceous matter	3.94		
Phosphoric anhydrid (P_3O_5) [2]	.33	Total	100.00

[1] Containing nitrogen (N), 0.84 per cent.
[2] Equal to tricalcium phosphate (Ca_32PO_4), 0.72 per cent.

Naturally there are great variations in the chemical composition of this material, but the above may be considered an average sample. An application of 20 tons per acre of such manure adds to the soil 148 pounds phosphoric anhydrid, 380 pounds potash, and 376 pounds of nitrogen. Analyses of sugar cane made in Barbados show that 1 ton of cane removes from the soil approximately 1.3 pounds phosphoric anhydrid, 2.3 pounds potash, and 1.7 pounds nitrogen. In St. Croix an acre of land planted to cane, that is retained in the ground until it has borne a crop of plant canes and two crops of ratoons, produces about 50 tons of cane provided the weather is favorable. This quantity of cane will absorb from the ground approximately 65 pounds of phosphoric anhydrid, 115 pounds potash, and 85 pounds nitrogen. Therefore, farmyard manure, applied at the rate of 20 tons per acre every time a field of cane is replanted, should be sufficient to keep up the fertility of the soil, because the

amounts of the most important plant foods carried in the manure are from two to four times as great as the amounts removed by an average crop. Tests carried out by the experiment station show that this conclusion holds good in actual practice. Applications of phosphates, potash, and nitrogen to St. Croix soils have given no increased returns. The application of farmyard manure is of the greatest value in keeping up the fertility of the soil, and the crop yields of St. Croix have been kept up by applying to the sugar lands all available organic matter saved from the plantations. It is not the plant food alone which makes the farmyard manure so valuable; rather it is the humus that is formed in the soil by the decay of vegetable matter. This humus greatly increases the capacity of the soil for water, which is a very important matter in an island such as St. Croix, where the rainfall is scanty and there are no means of irrigating the land.

Recently a tendency has developed to burn off the cane trash before the land is prepared for a new cane crop. This should not be done except in very special cases. The practice of saving all the cane trash for incorporation with the soil is excellent and should be continued.

A more valuable farmyard manure would be obtained were the cattle pens of the island closed in and the bottom of the pens concreted so that the liquid manure could be run off into a tank and returned to the pile from time to time. After having had one or two profitable years with sugar cane, planters would be acting wisely and economically were they to invest part of their savings in this up-to-date pen. Money could hardly be spent to better advantage on the plantations.

CULTIVATION OF THE CROP.

PLANT CANES.

The pieces of cane take as a rule from 3 to 4 weeks to sprout. Usually, as soon as they are sufficiently grown to permit clearing, the field is weeded by hand, and fresh cuttings are substituted for any pieces of cane that have died. From that time until the crop covers the ground, the field is kept clean either by hand labor or by cultivators drawn by one or two mules. Hand cultivation has to be resorted to several times before the furrows are sufficiently filled in so that cultivating machines can be run on the banks when the canes are planted in deep furrows. As this is an expensive process it seems likely that the plantings of cane in deep furrows will have to be abandoned and shallow furrows, or flat cultivation, substituted. The number of times that the fields have to be weeded depends on (1) the natural weediness of the field, (2) the efficiency of the labor gang, and (3) the weather conditions. The last-mentioned factor

is the most important of all. In a dry year hand-weeding and cultivation may have to be carried on for 10 or 12 months, while in a good year the canes may cover the land in 5 or 6 months.

RATOON CANES.

After the stools of the plant canes are cut the trash is usually raked by hand on alternate rows, and the banks between are broken up by making two cuts in each bank with a subsoil plow drawn by two mules. The trash is then raked onto the cultivated banks and the other banks are then similarly treated. This practice is probably a good one because it not only lightens the soil, aerating it and making the plant food more available, but it also encourages the growth of beneficial soil bacteria. Some have objected to the practice, stating that in a dry year loss of soil moisture may be caused by the bursting of the banks. There does not seem to be much danger of this, however, when the operation is performed immediately after the cutting of the cane stools. Fields thus treated look as a rule better than fields where this has not been done. The untrashed banks usually require two or three cultivations during the season to keep down weeds.

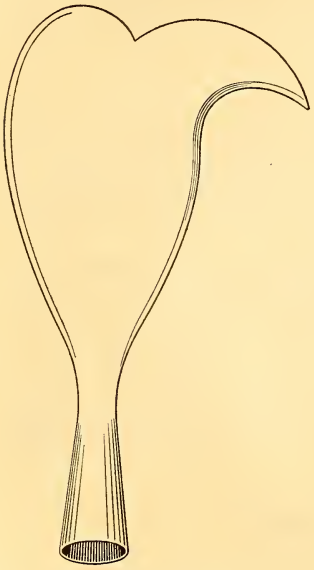

FIG. 2.—A bill used in cutting cane. Cutting edge on left; trash and down cane cut with back as right.

HARVESTING THE CROP.

When the canes are ripe they are cut with an implement known as a bill. In St. Croix the most popular bill is like that shown in figure 2. Its blade is 11 inches long and 6 inches wide; its handle is 6 inches long. Its weight is $2\frac{1}{2}$ pounds. After being cut, the cane is loaded into carts and carried to the factory. There are three central factories in the island; one is situated near Christiansted, another is near Frederiksted, and the largest is in the center of the island. The factories made contracts some years ago with the planters to purchase their canes, paying at the rate of $5\frac{1}{2}$ or 6 pounds of sugar for every 100 pounds of canes delivered.

YIELD OF CANE.

In a normal year an acre of plant canes produces on the average some 18 tons of cane per acre, while an acre of first ratoons produces about 10 tons, and second and third ratoons not more than 6 or 8 tons per acre. These are the average results in an average year.

In a good year and in exceptional cases yields as high as 40 to 50 tons of cane per acre have been obtained from plant canes and 20 to 25 tons from ratoons. These yields are obtained under the best conditions, and it is believed that when greater care is given to the cultivation and to the selection of pieces of cane for planting the average yield of cane in the island may be made to approximate this amount. Some of the new varieties of cane raised at the experiment station promise to do much toward increasing the yield of cane.

COST OF GROWING AND HARVESTING.

During 1915 and 1916, when the experimental work at the station was carried out on a large field scale, an accurate account was kept of the cost of growing sugar cane in St. Croix. At that time the wages averaged 30 cents a day. The results obtained in two typical fields, one of plant canes and the other of ratoons, are given below. In the list of expenses only the actual sums paid to laborers are taken into account. The cost data are summarized in the table which follows:

Cost of preparing land and growing and harvesting cane in field No. 6 B during 1914 to 1916.[1]

Preparing land for plow	$11.64
Motor plowing and harrowing, approximately	32.00
Scoring out furrows for manure and subsoiling furrows	5.25
Applying manure	25.33
Scoring out for cane and banking up by double-moldboard plow	7.82
Planting cane	16.49
Seed cane	7.04
Weeding by hoe and cultivator	68.77
Dusting poison for worms	1.06
Placing trash on part of canes	1.30
Cutting and carting canes	74.94
Total	251.64

When the total expenses for the plantation were added, the writer found that for every dollar spent on field labor in the cane and cotton fields, approximately $2 was spent for general work, including repairs to buildings and roads, taxes, salaries, and incidentals. If the necessary 200 per cent is added to the amount spent on this field the cost of the cane is raised to $754.92. The field produced 273 tons of cane, which was considered a very good yield. Since the price obtained for the cane was $4.40 per ton, the produce brought $1,201.20. This was a profit of $446.28 for the field, or at the rate of $55.78 per acre. The favorable weather was the cause of the heavy yield of cane, which amounted to 34 tons per acre. In a normal

[1] The field measures approximately 8 acres. It was motor-plowed and planted to cane in November, 1914, and the canes were harvested in April, 1916.

year only half of this yield of cane would probably be obtained, in which case the expenses would be greater than the returns. It is of interest also to note that the price obtained for canes far exceeded the price paid during the years immediately preceding. The normal price paid for cane by the factories for several years previous was approximately $2 per ton.

Since the above-mentioned time when the cost of growing cane in St. Croix was determined, wages have advanced from 30 cents to $1 per day. This is an increase of over three times the amount originally paid. All commodities have likewise greatly increased. The cost of growing cane to-day is probably at least three times the amount paid in 1916; that is, it costs approximately $260 per acre to grow a field of plant canes and approximately $105 per acre to grow ratoon canes. Assuming a yield of 20 tons of cane per acre for plant canes and 12 tons for ratoons, it would be necessary to have a price of $13 per ton for cane to make the cultivation clear expenses in the case of plant canes; and of $9 per ton to make the ratoon clear expenses, or an average price of $11 per ton for cane. The cost of growing ratoon canes is shown in the following statement:

Cost of cultivating and harvesting first ratoon canes in field No. 2 in 1914 and 1916.[2]

Hauling trash and cultivating ground	$33.92
Cutting and carting cane	46.27
Total	80.19

The cost of growing the ratoon canes is therefore $240.57, or at the rate of $34.36 per acre, if 200 per cent be added, as before, to the sum of $80.19. In all, 109 tons of cane were obtained, or 15.5 tons of cane per acre, and the price obtained for the cane was $479.60. The profit was therefore $239.03, or $34.14 per acre. The remarks made above concerning weather and prices apply of course to this result as well as to the results obtained with plant canes.

VARIETIES OF CANE.

Up to within the last 25 years the variety of cane commonly cultivated in St. Croix was the Bourbon or Otaheite. Since then, this variety has been gradually replaced by the Blue Ribbon cane, and the variety Crystallina, which closely resembles it in all but color. Tests made at the experiment station have shown little or no difference in yield or chemical composition between Ribbon and Crystallina. Since the establishment of the experiment station in 1911, trials have been made at the station and on plantations with varieties of seedling canes imported from Barbados. Of these imported varieties, superior results have been obtained for a number of years from B 4596, B 3412, B 3405, B 6388, and D 109. At one time B 208 was cultivated on a fairly large scale on one of the plantations.

[2] This field measured 7 acres.

This cane is unusually sweet, but, unfortunately, it is not able to withstand dry weather. Its cultivation has, therefore, been abandoned.

The experiment station has raised a large number of new seedling canes from which most promising results have been obtained. The seedling canes giving the most satisfaction to date are S. C. 12/4, S. C. 12/37, S. C. 13/13, and S. C. 14/93. Below are given the results obtained in 1920 with these canes in plats at the experiment station.

Seedling S. C. 12/37.—This variety has given an average increase per acre over the Ribbon cane of 8.4 tons of cane, and 2,303 pounds of sucrose extracted by the small laboratory mill. The tonnage represents an increase of approximately 31 per cent, and the sucrose an increase of approximately 45 per cent. In actual mill practice, the yield of sucrose per acre would be about 50 per cent more,[3] and the increase would be in the neighborhood of 3,454 pounds per acre. This increase would represent a profit obtained by substituting this cane for the standard variety, Ribbon, of $621 per acre when sugar is selling at $360 per short ton, the price in 1920.

No cuttings of S. C. 12/37 have as yet been distributed, but it is probable that distribution will be made in November since it is making an excellent showing this year. This cane does best in wet weather. In dry weather it remains sound and green, but does not make as much growth as the Ribbon variety. As soon as rain falls, however, it goes ahead and grows faster than the Ribbon. S. C. 12/37 does not arrow, but continues to grow after the Ribbon has arrowed and ceased growing. It is very juicy, the juice being rich and pure. Moreover, it is very healthy and almost immune to Marasmius. Cane 12/37 can now be confidently recommended. Data for yield of this cane at the experiment station in comparison with Ribbon are given in the following table:

Comparison of yields obtained from seedling cane S. C. 12/37 and Ribbon in 1920.

Plat No	Variety.			
	S. C. 12/37.		Ribbon.	
	Cane per acre.	Sucrose per acre.	Cane per acre.	Sucrose per acre.
	Tons.	*Pounds.*	*Tons.*	*Pounds.*
1	33.0	6,387	36.1	6,971
2	41.3	8,705	43.	8,842
3	50.5	11,312	39.	7,487
4	49.5	10,976	18.6	2,971
5	51.5	9,504	17.7	3,394
6	31.5	6,915	29.1	5,691
7	22.6	6,581	22.	3,425
8	29.4	5,018	20.2	3,823
9	23.4	4,487	20.	3,812
10	24.6	4,717	.....	.....
Total	357.3	74,602	245.7	46,416
Average	35.7	7,460	27.3	5,157

[3] The laboratory mill extracted only about 50 per cent of the weight of the cane in juice. A large modern mill will extract over 75 per cent.

Seedling S. C. 12/4.—This cane has given an average increase per acre over the Ribbon cane of 3.4 tons of cane, and 1,197 pounds of sucrose extracted by the small mill. The tonnage represents an increase of approximately 12 per cent, and the sucrose an increase of approximately 20 per cent. In actual practice the increase in sucrose per acre would be about 50 per cent more, that is in the neighborhood of 1,800 pounds per acre. This increase would represent a profit obtained by substituting this cane for Ribbon cane of $324 per acre when sugar is selling at $360 per short ton.

Cane S. C. 12/4 has continued to give good results on the plantations, and over 100 acres of it are now under cultivation in St. Croix. The Mount Pleasant plantation reported an increase of 30 per cent in tons of cane per acre for first ratoons. Definite results from other plantations were not obtained, but it is known that this cane has shown its superiority everywhere, and that the exceptional richness and purity of the juice are important points in its favor.

When subjected to severe drought, the mature cane of this variety has been observed to dry up more rapidly than the Ribbon cane. For this reason it should be cut earlier in the season than Ribbon cane, when there is dry weather. This year some of the plantations delayed cutting cane S. C. 12/4 in order that the top pieces might be used for planting at the time of the spring rains. These rains did not occur, and consequently the canes became overripe and no cuttings could be obtained. On this account the propagation of the cane has received a set back this year. In 1920 at least 42,000 cuttings of this cane were distributed from the experiment station. The Mercedita plantation in Porto Rico is now growing about 30 acres of S. C. 12/4 cane that looks remarkably good. The cane is also being grown in St. Kitts, and cuttings have been sent to Guadeloupe, Louisiana, and other places. The data from plat tests of the experiment station of this cane in comparison with Ribbon are given in the following table:

Comparison of yields obtained from seedling cane S. C. 12/4 and Ribbon.

Plat. No.	Variety.			
	S. C. 12/4.		Ribbon.	
	Cane per acre.	Sucrose per acre.	Cane per acre.	Sucrose per acre.
	Tons.	*Pounds.*	*Tons.*	*Pounds.*
1	34	8,873	27.3	5,797
2	38.4	8,790	32	6,521
3	29.4	6,322	31.2	6,360
4	30.7	5,756	18.3	3,524
5	25	5,107	32	6,659
Total	157.5	34,848	140.8	28,861
Average	31.5	6,969	28.1	5,772

Seedling S. C. 13/13.—This cane has given an average increase of 6.3 tons of cane, but only 207 pounds of sucrose per acre extracted by the small mill. The comparatively small increase in sucrose is due to the high fiber content of the cane. This variety produces good tonnage and good juice, is exceptionally free from Marasmius, and is very little attacked by moth borer. Cuttings of S. C. 13/13 will be distributed in November. The comparative yields of this variety and of Ribbon cane of the experiment station are shown in the following table:

Comparison of yields obtained from seedling cane S. C. 13/13 and Ribbon.

Plat No.	Variety.			
	S. C. 13/13.		Ribbon.	
	Cane per acre.	Sucrose per acre.	Cane per acre.	Sucrose per acre.
	Tons.	*Pounds.*	*Tons.*	*Pounds.*
1	39	7,024	28	5,594
2	36	6,304	39	7,487
3	33.5	5,798	36	6,919
4	37	6,404	31	6,693
5	40	6,577	39	7,487
6	40.2	6,690	27	5,345
7	49	8,155	25	4,211
8	53	8,821	.....	.....
9	45	7,026	.....	.....
10	45	7,056	.....	.....
11	34	5,331	.....	.....
12	44.6	7,223	.....	.....
13	31	5,652	.....	.....
14	25	4,413	.....	.....
15	24.7	4,360	.....	.....
Total	575	96,834	225	43,736
Average	38.4	6,455	32.1	6,248

Seedling S. C. 14/93.—This is one of the newer seedlings of promise. It has given an increase of 5.4 tons of cane and 1,365 pounds of sucrose per acre above the standard variety. By adding 50 per cent to the sucrose to obtain the amount that would be extracted by a well-equipped mill, the increase is shown to be 2,047 pounds per acre over the yield given by the standard variety. This would mean a profit of about $370 per acre were seedling S. C. 14/93 substituted for Ribbon. The results of comparative plat tests of this variety and of Ribbon are given in the table which follows:

Comparison of yields obtained from seeding cane S. C. 14/93 and Ribbon.

Plat No.	Variety.			
	S. C. 14/93.		Ribbon.	
	Cane per acre.	Sucrose per acre.	Cane per acre.	Sucrose per acre.
	Tons.	*Pounds.*	*Tons.*	*Pounds.*
1	30	5,416	31.5	5,306
2	43.9	7,926	.....	.....
Total	73.9	13,342	31.5	5,306
Average	36.9	6,671	.....	.....

INSECT PESTS OF SUGAR CANE.

The most serious pests of sugar cane in St. Croix are (1) the moth borer (*Diatræa saccharalis*), (2) root grubs (particularly *Stratægus titanus*), (3) sugar cane beetle borer (*Metamasius sericeus*), (4) root borer (*Diaprepes farinosus*), (5) longicorn beetle, or cane borer (*Lagochirus araneiformis*). Other insects found attacking cane in St. Croix are (6) the shot-hole borer (*Xyleborus perforans*), (7) the mealy bug (*Pseudococcus sacchari*), (8) the pink mealy bug (*P. calceolariæ*), and (9) the small sugar cane scale (*Targionia sacchari*). For practical purposes only the first five need be considered.

The moth borer (*Diatræa saccharalis*).—To control the moth borer it is most important that (1) selected pieces of cane for planting do not show borer holes, (2) all pieces of rotten cane left in the field after cutting be immediately carted away and burned, and (3) all cornstalks on the plantations be burned or made into silage, or fed to the live stock as soon as the crop is harvested.

Root grubs (*Stratægus titanus* and *Ligyrus tumulosus*).—To control root grubs all manure should be thoroughly examined before it is applied to cane fields. Manure taken from pens where live stock trample every day is not likely to contain many grubs, but manure from pens where cattle have not been kept for some weeks is almost sure to contain them. Since the grubs are likely to be found only around the edges of the pens where the animals can not tread, they can be killed by placing handfuls of bagasse mixed with Paris green at intervals around these edges. A field infested with these grubs should be treated with poisoned bagasse, a mixture made up by thoroughly mixing together 100 parts of fine bagasse with 4 parts of Paris green. Suspend the Paris green in water in a sprinkling can and pour the liquid over the bagasse, which should be spread out on a concrete surface. Go through the rows of young cane and place small handfuls of this mixture in holes every 4 or 5 feet apart. Use a pickax or crowbar to open the holes, and after placing in the handfuls of bagasse, draw soil over the hole with a movement of the foot. If numerous grubs are found when the field is being plowed, have a boy or girl follow the plow and pick up the grubs. When the manure furrows are opened and the manure is placed in, lay handfuls of the poisoned bagasse mixture on the manure at intervals of 4 or 5 feet before it is covered by the plow.

Sugar cane beetle borer (*Metamasius sericeus*).—The sugar cane beetle borer was very prevalent in the island during 1920, and apparently has done an enormous amount of damage. One of the best means of controlling it is to remove the crop as soon as possible after the canes become ripe, since the pest attacks the ripe cane only. The harvest was spread over a long period this year owing to the large crop yield and to the closing down of one of the factory grinding stations. Such conditions naturally greatly favored the rapid increase of the pest, which, according to the entomologist, destroyed 5 per cent of the standard cane Ribbon at the experiment station. Immediately after being harvested, all rotten canes should be carted away from the field and burned, or passed through a mill, to destroy the larvæ. Different varieties of cane were attacked by the pest, the canes freest of attack being seedlings S. C. 12/4, S. C. 12/37, S. C. 13/13, B 4596, B 3412, and D 109, and those most attacked being the varieties Ribbon and Crystallina.

Root borer (*Diaprepes farinosus*).—The root borer sometimes severely damages cane stools. The best method of control is to trap the beetles as they emerge from the ground by planting sunflowers around the cane fields. The beetles congregate on the flower heads, from which they can be daily knocked into pails containing water and kerosene. The beetles also congregate on lime trees and can be similarly collected from them.

Longicorn beetle or cane borer (*Lagochirus araneiformis*).—In 1912 the writer first discovered the longicorn beetle attacking canes, but only a few specimens were

obtained at that time. This year the insect appeared in large numbers and was found on canes in several parts of the island. At the experiment station the entomologist estimated that 5 per cent of the standard variety of cane was destroyed by it. Since the pest attacks only ripe canes, the same remedies recommended for the destruction of cane borer (*Metamasius sericeus*) can be applied to this pest. Considerable differences were found in the percentage of attack in different cane varieties. Ribbon, Crystallina, B 3922, D 109, and some of the newer seedling canes were most severely attacked. The least attacked were B 3412, B 4596, B. H. 10/12, S. C. 12/4, S. C. 13/13, and S. C. 14/7. Seedling S. C. 12/37 was rather badly attacked.

DISEASES OF CANE.

The most destructive diseases of cane in St. Croix are (1) *Marasmius sacchari*, a fungus which attacks the roots, (2) *Colletotrichum falcatum*, a fungus which attacks the stem, and (3) pineapple disease of cane cuttings due to *Thielaviopsis ethaceticus*. The root disease is best controlled by the careful selection of pieces of cane for planting. Too frequently the disease is planted with the cuttings. For planting purposes only sound, clean cane having no adhering trash should be used. It would be the best plan for every plantation to have its own nursery for growing planting material. In preparing this nursery every precaution should be taken to destroy any fungus that may be present in the soil and to plant uninfected pieces of cane. Wherever possible, the place chosen for the nursery should be land that has not been planted to cane for several years. The soil should be thoroughly plowed and treated with freshly slaked lime at the rate of 1 or 2 tons per acre. It would be best not to use ordinary farmyard manure as it usually contains cane trash. Only pure droppings from the animals pasturing on the land should be used, or sheep manure, or green manuring crops such as the velvet, Lyon, or horse bean vines. An expert from the experiment station should examine the cuttings used for planting the nursery. Though this plan has been frequently suggested to the large firms in the island and the cooperation of the experiment station has been offered, no move has been made in this direction up to the present. No doubt the crop of the island could be increased from 10 to 20 per cent if this practice were followed. In addition to careful selection of planting material, all cuttings should be soaked in Bordeaux mixture, which destroys any fungus spores or filaments that may adhere to the cuttings.

The stem disease, due to *Colletotrichum falcatum*, is best controlled by collecting and burning all rotten canes immediately after harvesting. This ought to be a regular plantation practice. At present no one does it, though it has been repeatedly urged at private interviews and at public meetings with the directors of the large firms and the planters of the island.

The pineapple disease of cuttings is controlled by soaking the cuttings in Bordeaux mixture.

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