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J. H. Stewart

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WEST VIRGINIA
AGRICULTURAL EXPERIMENT STATION,
MORGANTOWN, W. VA.

BULLETIN 55.

MARCH 1899.

SUGAR BEET INVESTIGATION IN 1898.

BY J. H. STEWART AND B. H. HITE.

[The Bulletins and Reports of this Station will be mailed free to any citizen of West Virginia upon written application. Address Director of Agricultural Experiment Station, Morgantown, W. Va.]

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A PRELIMINARY REPORT
OF THE
SUGAR BEET INVESTIGATION IN 1898.

During the past year the Experiment Station at the suggestion of the United States Department of Agriculture, entered into co-operation with that Department for the purpose of studying the adaptability of West Virginia soils and climate to the cultivation of the sugar beet. The results of the work are given in the following pages and are considered sufficiently encouraging to justify a continuance of the work during the coming season.

Farmers and others interested in sugar beets may care to know that a century and a half has elapsed since Mangraff first succeeded in extracting crystalized sugar from beets. From this humble experiment the refined methods and elaborate machinery of the modern sugar factory have been evolved. No less remarkable has been the improvements in the beets themselves, the sugar content of which has been increased three or four fold. The beets that Margraff had to use in his investigations rarely contained over 5% of sugar, and so would not be regarded as profitable, even with the improved machinery of the present day. A suitable beet had to be evolved, and this re-

quired long years of patient, painstaking work. Just imagine the reception that would await the announcement of such results by an experimenter of the present day! He had succeeded in obtaining a few crystals of sugar from beets, but before these results could be of any "practical value," not only would the machinery of the modern sugar factory have to be created, but even the beets would have to be improved three hundred per cent. We mention this in passing because the profitable production of sugar from beets is pre-eminently the result of patient, painstaking investigations, and these, which like most other investigations that have been of any permanent value to agriculture, have passed through the period when their "immediate practical value" was not so easy to discover.

The humble experiments of Margraff started the long series of investigations and improvements resulting in the gigantic industry that has produced some millions of tons of beet sugar; an industry that has converted nations that had been paying out large sums of money annually for sugar, into heavy exporters of this commodity. It is with the hope that this nation may be able to produce the \$100,000,000 worth of sugar now being imported annually, that the Department has taken up this investigation, and it is for the purpose of determining whether West Virginia can produce her share of this amount, that this Station has asked farmers to co-operate in this investigation.

The only question to be settled in this investigation is: Has West Virginia a soil and climate suitable to the production of beets of a quality to be used in the profitable manufacture of sugar? In pursuance of this object, in the spring of 1898, the Station distributed over different sections of the State, the seed of two improved varieties of sugar beets, namely Vil-morin and Kleinwauzlebener, and at the same time full directions were given for preparation of soil, cultivation, harvesting, etc. Later in the season blanks were forwarded to parties receiving the seed to enable them to report the results. Directions for taking samples, accompanied by franking tags for transmitting

samples through the mails, were also sent. One hundred and ninety-eight packages of seed were distributed, and 125 samples of beets were received at the Station. Quite a number of the samples received were not labelled or marked in any way. It will, therefore, be impossible in such cases, to give the name of the grower.

In some of the reports the yield per acre was not given; in others the reported yields were so manifestly incorrect that no tabulation of this item will be attempted.

The results of the analysis of the samples received are given in Table 1:

TABLE I.

Co-operative Beet Experiment. Analysis of samples grown by farmers in various parts of the State and sent to the Station for analysis in 1898:

Number	County	Grower	Weight Untopped Ounces	Weight Topped Ounces	Brix Density	Per Cent. Sugar in Juice	Co-efficient of Purity
109	Monongalia..	Professor Johnson	16.50	14.50	16.4	14.60	89.0
110	"	"	11.25	9.50	17.4	13.31	76.5
111	"	"	11.75	10.00	18.6	14.21	76.5
112	"	"	9.00	7.25	19.6	14.89	76.0
113	"	"	14.00	12.00	17.2	13.28	77.2
114	"	"	19.00	17.00	13.2	8.80	67.1
115	"	"	26.00	21.00	16.1	12.55	78.0
116	"	"	18.50	15.50	17.1	14.30	83.6
189	"	?	11.50	9.50	23.4	18.11	77.4
190	"	?	11.50	8.50	31.1	23.35	75.0
191	"	?	12.50	10.50	28.0	19.90	71.0
192	"	?	8.50	6.00	28.9	19.90	71.0
165	"	T. G. Bennett	18.20	16.50	20.7	15.38	74.6
166	"	"	13.00	12.00	15.6	8.83	56.2
201	Hancock	R. H. Brown.	23.50	21.50	16.3	13.48	82.7
202	"	"	23.50	21.50	15.2	12.46	80.0
203	"	"	31.50	23.50	15.8	12.40	78.0
204	"	"	21.50	19.00	16.8	13.25	78.8
205	"	"	14.00	12.00	16.0	12.02	80.9
206	"	"	23.50	21.00	16.4	14.50	88.4
207	"	"	34.00	30.00	16.0	12.90	80.6
208	"	"	41.00	36.00	15.8	13.06	82.6
209	"	"	30.00	25.59	14.5	10.14	70.0
210	"	"	22.50	20.50	15.6	12.48	80.0
211	"	"	31.50	27.00	16.3	13.39	82.1
212	"	"	29.00	25.00	16.8	13.40	79.7
213	"	"	28.00	25.00	17.2	14.31	83.3
214	"	"	27.00	22.50	17.2	13.77	80.0
215	"	"	31.50	24.00	16.8	13.54	80.6
216	"	"	22.00	19.50	16.5	13.23	80.1

TABLE I.—*Continued.*

Number	County.....	Grower.....	Weight Untopped Ounces.....	Weight Topped Ounces.....	Brix Density.....	Per Cent Sugar In Juice	Co-efficient of Purity
217	Hancock,	R. H. Brown.	20.50	17.50	16.8	13.64	81.2
218	"	"	22.50	19.50	18.2	14.63	80.3
219	"	"	21.00	19.00	14.6	10.81	74.0
220	"	"	46.00	39.00	12.3	9.66	78.5
221	"	"	8.50	7.50	25.3	20.68	81.7
222	"	"	5.00	4.20	25.3	20.68	81.7
146	Lewis	C. W. Thompson	5.50	5.00	14.6	12.14	83.1
147	"	"	6.50	5.00	14.6	12.14	83.1
148	"	"	6.70	5.50	17.8	10.68	60.0
149	"	"	8.20	6.55	17.8	10.68	60.0
150	"	"	9.70	7.50	18.4	12.48	67.9
151	"	"	7.50	6.05	18.4	12.48	67.9
152	"	"	4.70	3.50	20.0	14.77	73.8
153	"	"	4.00	3.00	20.0	14.77	73.8
154	"	"	4.50	3.50	20.0	14.77	73.8
155	"	"	5.50	4.70	19.0	12.55	66.0
156	"	"	5.70	4.75	19.0	12.55	66.0
157	"	"	6.50	5.50	19.0	12.55	66.0
120	Monroe	A. L. Miller	10.00	8.00	18.4	14.47	78.6
121	"	"	11.50	9.50	16.1	13.09	81.3
122	"	"	14.70	13.00	14.8	8.54	57.7
124	"	"	13.00	12.00	18.8	15.46	82.2
127	"	C. S. Scott.	44.00	33.00	14.9	12.12	81.3
128	"	"	32.00	24.50	16.0	13.54	81.6
162	"	"	36.00	27.50	15.1	11.58	76.6
163	"	"	22.50	18.00	17.5	14.20	81.1
129	Morgan	M. L. Spring.	17.70	14.97	21.8	16.80	77.0
130	"	"	8.20	6.20	24.4	20.10	82.3
131	"	"	10.00	9.20	24.6	20.20	82.1
132	"	"	25.50	21.00	18.1	13.47	74.4

TABLE I.—*Continued.*

Number.....	County.....	Grower	Weight Untopped Ounces.....	Weight Topped Ounces.....	Brix Density.....	Per Cent. Sugar in Juice	Co-efficient of Purity.....
158	Morgan	G. E. Moray	9.50	8.50	15.4	10.92	70.9
159	"	"	28.70	20.00	16.2	13.39	82.5
160	"	"	10.50	10.00	17.0	13.92	81.9
161	"	"	14.00	12.00	17.6	13.60	77.2
171	Calhoun	J. W. Sharp	10.20	6.20	10.0	7.51	75.8
172	"	"	9.70	6.20	10.0	7.51	75.8
173	"	"	12.70	7.50	15.4	8.19	53.5
174	"	"	10.00	6.70	15.4	8.19	53.5
175	"	"	12.00	9.70	16.0	11.86	76.1
176	"	"	9.00	7.70	16.0	11.86	76.1
177	"	"	13.70	11.00	16.9	11.45	68.1
178	"	"	11.00	9.00	16.9	11.45	68.1
167	Berkeley	J. Y. Catrow	18.00	15.00	24.0	19.62	81.7
168	"	"	17.00	14.70	17.0	10.85	63.8
169	"	"	19.50	16.00	16.6	10.53	63.4
170	"	"	18.50	16.70	17.6	11.51	65.4
193	"	?	20.50	18.50	21.3	16.26	75.8
194	"	?	27.00	21.50	17.2	13.57	78.8
184	Mineral	W. G. Workman	17.70	15.50	19.5	14.22	73.2
185	"	"	9.20	7.50	24.0	18.75	78.7
186	"	"	15.00	10.20	19.8	14.40	73.1
187	"	"	15.70	12.00	19.7	14.69	74.9
142	Mason	P. C. Eastham	30.00	23.00	12.5	8.13	65.0
143	"	"	35.00	29.00	13.4	9.92	74.0
144	"	"	35.50	25.00	15.1	10.50	70.0
145	"	"	26.00	20.00	14.2	11.18	78.7
223	Gilmer	C. W. Norris	16.00	13.00	16.7	8.47	50.7
224	"	"	15.20	12.50	14.5	7.66	52.8
225	"	"	9.50	7.50	22.5	17.38	77.2
226	"	"	7.50	6.00	22.5	17.38	77.2
227	Preston	?	27.00	23.50	17.4	12.14	70.0
228	"	?	12.00	10.00	21.6	17.39	80.5

TABLE I.—*Continued.*

Number	County	Grower	Weight Untopped Ounces.....	Weight Topped Ounces.....	Brix Density.....	Per Cent. Sugar in Juice	Co-efficient of Purity.....
229	Preston	?	9.00	7.00	21.6	17.39	80.5
117	Wetzel	J. E. Gorby	34.00	26.50	15.7	9.00	57.3
118	"	"	17.50	14.20	21.1	14.35	68.0
119	"	"	20.70	17.50	20.4	14.16	69.4
133	Wood	W. E. Powell	51.00	33.00	16.6	11.20	67.4
134	"	"	13.00	10.00	17.4	12.39	71.2
135	"	"	17.00	11.70	15.0	9.52	6.40
138	Doddridge	E. W. Davis	24.50	21.00	12.3	7.42	60.3
139	"	"	24.00	20.50	14.2	9.65	68.0
140	"	"	27.50	22.50	16.5	11.95	72.4
141	"	"	25.00	18.50	14.8	9.82	66.3
230	Mercer	T. M. Thornton	16.00	13.50	20.5	15.83	77.2
231	"	"	33.50	29.00	20.4	16.19	79.3
232	Putnam	L. T. Vintroux	21.50	18.00	17.7	12.43	70.2
233	"	"	15.50	13.50	22.2	15.90	71.6
136	Taylor	Geo. W. Chambers	20.00	14.00	19.1	12.98	68.0
137	"	"	21.00	16.00	12.3	7.42	60.3
125	Greenbrier	C. S. Clayford	25.00	17.00	10.7	5.14	48.0
126	"	"	15.00	11.70	14.4	9.64	66.9
164	Webster	?	12.00	10.50	21.6	17.35	80.3
200	Upshur	J. W. Gould	20.50	17.50	14.8	10.81	73.0
123	?	?	30.00	21.00	18.4	14.03	76.2
188	?	?	27.00	20.50	15.0	9.72	65.0
195	?	?	14.00	11.50	18.6	13.54	72.8
196	?	?	11.00	7.50	18.6	13.54	72.8
197	?	?	20.50	17.00	18.6	13.23	73.5
198	?	?	24.50	19.50	18.8	14.84	78.9
199	?	?	26.00	21.00	17.6	13.07	74.2
234	?	?	18.70	13.50	15.3	10.64	69.5
235	?	?	16.00	8.00	18.2	13.22	72.6
236	?	?	8.70	7.00	18.2	13.22	72.6
237	?	?	15.00	12.50	19.0	13.71	72.1
238	?	?	13.50	10.50	17.4	12.29	70.6

TABLE II.

Giving the average analysis of the beets from the counties represented in the co-operative work.

County.	Number of Sample.	Weight, Ounces.	Per Cent. of Sugar.	Co-efficient of Purity.
Hancock.....	22	25.	13.65	82.2
Monongalia	14	14.5	15.08	76.4
Lewis	12	6.3	12.71	70.1
Monroe.....	8	24.	12.85	76.3
Morgan	8	18.7	11.81	78.5
Calhoun	8	11.	9.75	68.3
Berkeley	6	19.8	13.72	71.5
Mineral	4	14.	15.51	74.8
Mason	4	31.	9.95	71.9
Gilmer	4	12.	12.72	64.4
Preston.....	3	16.	15.64	77.0
Wetzel	3	24.	12.50	64.9
Wood	3	27.	11.03	67.5
Doddridge	4	25.	9.71	66.7
Mercer	2	29.	16.01	78.2
Putnam.....	2	19.	14.16	70.9
Taylor.....	2	20.	12.08	65.9
Greenbrier	2	20.	7.39	57.4
Webster.....	1	12.	17.35	80.3
Upshur	1	20.	10.81	73.0

A comparison between the sugar content of the beets grown (as shown by this table) with the reported results of similar experiments in other states, is very favorable to this state. No doubt the variation in the percentage of sugar between samples from various parts of the state, is more largely due to the difference in the soil and the culture given to the plants, than to any other cause.

In addition to the seed distributed as above described, nine plats were planted in beets on the experiment farm at Morgantown. The whole of each plat was fertilized, as stated in the table, and an application of lime at the rate of 30 bushels per

acre was made to one half of each plat. The seed was sown on these plats May 5th, and the beets were harvested October 13th, 1898.

The results are given in the following table:

TABLE III.

Plat.	Dressing.	LIMED.			UNLIMED.		
		Average Weight.	Average Sugar %.	Average Purity %.	Average Weight.	Average Sugar %.	Average Purity %.
1	20 lbs. Nitrate of Soda.....	12.5 oz.	10.43 %.	69.1 %.	22.0 oz.	13.38 %.	85.1 %.
2	20 lbs. Thomas Slag	9.5 "	11.87 "	72.5 "	14.0 "	15.41 "	84.3 "
3	20 lbs. Acid Phosphate.....	20.0 "	13.24 "	94.5 "	15.5 "	16.23 "	87.6 "
1	15 lbs. Sulphate of Potash.....	15.0 "	14.05 "	77.2 "	16.0 "	15.96 "	84.9 "
5	10 lbs. Nitrate of Soda and 10 lbs. Thomas Slag	20.0 "	13.35 "	82.9 "	13.0 "	14.12 "	86.0 "
6	10 lbs. Nitrate of Soda, 7½ lbs. Sulphate of Potash.....	15.5 "	12.67 "	77.5 "	15.0 "	16.20 "	81.6 "
7	10 lbs. Thomas Slag, 7½ lbs. Sulphate of Potash.....	7.0 "	11.90 "	70.8 "	7.0 "	15.92 "	76.5 "
8	6½ lbs. Nitrate of Soda, 5 lbs. Sulphate of Potash, 6½ lbs. Slag.	22.0 "	13.53 "	84.3 "	28.0 "	14.01 "	80.0 "
9	No Dressing	25.0 "	12.94 "	80.2 "	5.0 "	16.73 "	81.6 "

The table shows considerable variation as to weight, the percentage of sugar, and the purity of the juice of the beets grown upon the different plats.

The beets receiving sodium nitrate contained a low percentage of sugar, and the juice of the beets grown upon the limed portion of this plat was very impure. The most marked effect, however, was due to the application of lime, which, as is shown by the averages of all the plats, reduced the sugar content and the percentage of purity.

TABLE IV.

Vilmorin Sugar Beets

Grown on Station Farm, 1898.

Seed planted at different dates.

Dressing consisted of 200 lbs. Blood and Bone; 200 lbs. Slag and 200 lbs. Potassium Sulphate per acre, applied broadcast. Samples taken October 13.

Plat.	No. of Samples	Date of Planting.	Average Weight.	Sugar in Juice.	Purity Co-efficient.	Average of Sugar in Juice.	Average Purity.
1	6	May 14	15 ounces.	12.49	79.0	12.49	79.0
2	6	May 28	17 "	13.86	80.8		
3	6	May 28	16 "	14.31	81.0		
4	6	May 28	16 "	13.15	77.3		
5	5	June 4	12 "	14.80	81.0	15.17	8.15
6	5	June 4	11 "	15.55	82.0		

An inspection of this table shows that the juice of the beets which were planted latest in the season contained more sugar and had a higher coefficient of purity than in the case of those beets which were planted earlier.

A small area in the station garden was sown in beets. This was divided into two plats, one of which received an application of lime at the rate of 30 bushels per acre, the treatment in other respects being the same. Analyses of samples from these plats gave the following results:

	Samples.	Weight Ounces.	Sugar in Juice.	Coefficient of Purity
Limed	5	20.6	14.34	81.2
Unlimed	5	16.6	13.43	77.8

On a small tract of land held under lease in Preston county by the Station, which is one of the few points in the State lying immediately within the so-called "sugar belt," eight plats of one-twentieth of an acre each were planted in beets on the 13th day of May. This land had been thoroughly tile drained in the winter of 1897-8. The soil is a rich sandy loam in excellent mechanical condition, and on which a fine yield of beets was obtained. The results of the analyses are given in the following table:

TABLE V.

Analyses of Sugar Beets grown on Preston County Experimental grounds.

No.	Weight Untopped Ounces.	Weight Topped Ounces.	Brix Density.	Per Cent Sugar in Juice.	Purity Co-efficient.
81	72.0	47.0	12.1	9.83	81.2
82		24.0	11.8	8.50	72.0
83	70.0	59.0	11.6	7.46	64.3
84	16.0	13.9	17.1	13.73	80.2
85	11.5	9.7	17.1	14.21	83.1
86	9.7	9.0	16.8	13.89	83.2
87	10.5	9.2	17.0	13.97	81.7
88	7.5	6.2	16.8	12.72	76.2
89	42.5	37.0	15.0	11.79	78.6
90	37.5	32.0	14.3	12.80	89.5
91	28.0	22.5	15.1	11.92	79.0
92	37.5	30.0	15.5	12.59	81.2
93	14.0	12.0	18.1	15.31	84.5
94	21.0	18.5	16.4	13.61	83.0
95	29.5	27.0	13.4	10.23	76.3
96	35.0	30.0	16.4	13.61	83.0
97	67.5	49.5	13.5	9.18	68.0
98	21.0	18.0	16.1	12.60	78.2
99	26.0	21.5	13.9	9.66	69.5
100	21.0	18.5	17.3	14.40	83.2
101	26.5	23.0	16.1	13.34	82.8
102	51.0	39.5	14.7	11.60	79.0
103	13.5	11.0	16.4	11.96	72.9
104	22.0	21.0	15.6	11.65	74.6
105	32.0	26.5	12.9	9.90	76.7
106	57.0	38.5	12.1	9.28	76.7
107	8.5	7.7	15.8	12.08	76.4
108	6.7	6.2	15.9	12.22	76.0

The total number of samples grown in the State last year and analyzed by the Station, was 238 as shown in the tables. These gave an average sugar content of 13.40%, and purity co-

efficient 76.7. In view of the fact that beets with a sugar content of 12% are regarded as profitable material from which to manufacture sugar, the data in the above table is very encouraging. It should be borne in mind also that the season was not the best for the proper growth of this crop, and that the cultivation of the beets grown was not the best, the farmers taking part in this work having had no previous experience in beet culture. It is quite possible, also, that in many cases the best beets, or even fair average beets, were not sent to the station for analysis, the tendency to send the biggest beets being almost irresistible. As was pointed out in the instructions for taking samples, the largest beets are not the most desirable, but it is a beet of a medium size, say from three quarters of a pound to two pounds in weight, that almost invariably gives the highest percentage of sugar and the highest co-efficient of purity, as is clearly shown in the following table:

VI.

Table showing percentage of Beets of different weights with corresponding average sugar and purity.

Weight.	85		28		125		38		
	Station Farm		Preston County		Co-operative		General Average.		
	Samples.		Farm Samples.		Samples.				
	Per Cent.	Sugar.	Per Cent.	Sugar.	Per Cent.	Sugar.	Per Cent.	Sugar.	Co-eff. Purity
2 lbs. or over..	3.5	10.95	39.2	10.59	8.80	11.78	10.50	11.15	76.2
1½ to 2	4.7	13.05	14.3	11.29	17.60	12.08	12.60	12.10	78.7
1 to 1½.....	34.1	13.43	17.8	13.19	26.40	13.10	28.15	13.25	77.6
¾ to 1	25.8	13.86	7.1	13.63	16.80	13.00	18.90	13.45	77.5
½ to ¾	20.0	16.06	14.3	13.72	20.00	14.64	19.32	15.08	79.1
Less than ½..	11.9	15.54	7.3	12.47	10.40	13.34	10.53	14.11	74.6

SOIL CULTIVATION, ETC.

Any fertile soil will grow sugar beets ; wherever large crops of corn, wheat, potatoes and tobacco are grown successfully, an abundant yield of beets may be expected

A heavy clay soil is not desirable, unless it has been thoroughly tile drained and sub-soiled. After this is done this character of soil, in some respects, is preferable to a sandy soil. But a rich, warm, sandy loam is generally best for the purpose. The land upon which beets are to be planted, should be plowed well, to a depth of eight or ten inches, in the fall. It is best to choose land that has been well manured and cultivated in some hoe crop (other than beets) the year before the beets are grown, in order to avoid trouble from weeds. No barnyard or other coarse manure should be applied during the year when the beets are planted, as it has been found to interfere with the cultivation and also to injure the quality of the beets. If the land has not been well drained, subsoiling to a depth of six or eight inches will be necessary. By this means a loose bed of earth, sufficiently deep, will be afforded the beet in which to develop itself. It has been found that shallow plowing will cause one or both of two results, namely, either a part of the beet will be developed above the earth's surface, or a forked, or so-called "finger and toe condition," will obtain. Beets of this description are worthless.

In the spring, as early as the soil is dry enough to cultivate it should be well harrowed, until it is brought to perfect tilth ; and again just before planting the ground should be harrowed, dragged and rolled until a smooth, mellow seed bed is secured. In short the soil should in all respects have that careful preparation which is so essential to successful gardening.

If a commercial fertilizer be applied it should be thoroughly incorporated in the soil before the seed is sown.

The seed may be planted by hand or machine. The ordinary garden drill can be used, but for small experimental plats, they may be sown by the hand. From fifteen to twenty pounds of

seed per acre are recommended to insure a good stand of beets.

The rows may be made from sixteen to eighteen inches apart. The seed should be covered to a depth of one to two inches, this to be governed by the time of planting, and condition of the soil. A depth of one inch will be sufficient in well prepared, moist soil, but a greater depth will be necessary if the soil is dry; immediately after the seed is covered, in the latter case, the earth should be well firmed.

The early planted beets are said to produce more sugar and a larger yield of beets. In this state from the 1st to the 10th of May should be adopted as the proper time to plant. However should the weather and soil be in proper condition, an earlier planting may be made with success. The beets cultivated on the Station grounds were sown at different periods from the 5th day of May.

When the growing beets are large enough to define the row, cultivation should begin. For small areas this may be accomplished with the hoe. Various cultivators have been specially devised for the cultivation of this plant, but those found in the market gardens will usually serve the purpose.

At all times the ground should be kept as level as possible. As soon as the plants have three or four leaves they should be thinned. One vigorous plant should be left every six or eight inches, the distance apart to be determined, somewhat, by the character of the soil. In soil quite rich the beets should be thicker than in less fertile soil, in order to prevent them from growing too large. Overgrown beets are undesirable, as they uniformly have a low sugar content. A narrow hoe, in careful hands, can be used to strike out beets between those that are to remain. The thinning is an exceedingly important part of the work, and in large areas under cultivation is an expensive operation. Upon the manner in which it is accomplished depends very largely the success of the crop. At this stage of growth the plants are quite delicate and very susceptible to injury, and due precaution should be observed in the thinning process so as to prevent serious harm to the plants that are to make the crop.

Immediately after thinning, the beets should be well hoed, and at least one cultivation given them every week until the leaves fairly cover the ground, after which no hoeing will be needed.

No definite time can be fixed for harvesting. Beets that were drawn during the first three weeks of October at the Station, were found to yield a higher percentage of sugar than those harvested much earlier. It is said that when the leaves turn from a dark to a yellowish green, they should be harvested.

Beets that are to be used for stock feeding may be harvested just before severe freezing and stored in pits in a manner similar to the way that potatoes are stored for winter.

This investigation will be continued during the coming year. The seed is now ready for distribution, and it is hoped that every county in the state will be represented in this work this year, and that those taking part in the experiment will carefully carry out instructions. It might as well be understood that no county in this (or any other state) will produce beets profitably, except by the exercise of the best skill in growing the crop. Unless the work of preparing the soil, seeding, thinning, cultivating, harvesting and selecting samples for analysis is properly done, it will only be so much labor lost. To make a satisfactory test will involve some careful painstaking work, but this state will not be lacking in farmers who will willingly undertake this work in the interest of better agriculture.

NOTICE.

Applications for bulletins of this Station should be addressed to the Director of the West Virginia Agricultural Experiment Station, Morgantown, W. Va.

(The bulletins named below are available for distribution.)

- No. 4. The Creamery Industry; Its Adaptability to West Virginia.
- No. 5. The Selection of Milch Cows.
- No. 6. Six Months Experience in Running a Creamery; Improved Process of Handling Cream and Churning.
- No. 12. The Canada Thistle.
- No. 14. Farm and Garden Insects and Experiments with Remedies; Notes of the Season.
- No. 15. Raspberry Gouty-Gall Beetle.
- No. 16. Yellow Locust, Insect Ravages.
- No. 17. Black Spruce, Insect Ravages.
- No. 19. Your Weeds and Your Neighbor's, Part 1. Weeds as Fertilizers.
- No. 20. Potato Culture and Fertilization. Tests of Some Varieties of Tomatoes.
- No. 21. Injurious Insects and Plant Diseases.
- No. 25. Plat Experiments with Commercial Fertilizers on Wheat.
- No. 26. Inspection of Commercial Fertilizers.
- No. 27. Notes on Pruning.
- No. 28. Plat Experiments with Commercial Fertilizers on Corn.
- No. 29. Experiments with Potatoes at the Station. Experiments on Corn at the Out-Station.
- No. 30. Address and Notes on Sheep.
- No. 33. Sub-Irrigation in the Greenhouse.
- No. 38. Potato Blight, Potato Scab.
- No. 40. Commercial Fertilizers.
- No. 42. Vegetables.
- No. 43. When, Why, What and How to Spray.
- No. 44. Practical Entomology.
- Special Bulletin No. 2. Proceedings connected with the celebration upon the completion of the Station Building and the organization of the Sheepbreeders and Wool-Growers Association and the State Horticultural Society.
- Third Annual Report, 1890.
- No. 51. Commercial Fertilizers Jan. '98.
- No. 52. Strawberries.
- No. 53. Commercial Fertilizers Dec. '98.
- No. 54. Nursery Hints.