SUGAR BEET INVESTIGATIONS IN ILLINOIS.

REPORT OF PROGRESS.

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To the Advisory Committee of the Sugar Beet Growers’ Association,

Gentlemen:

As you are aware the plans for conducting sugar beet investigations in Illinois comprise four general lines of work:

1. The growing of beets in all sections of Illinois in cooperation with farmers who are interested in this subject, and the determination of the yield, purity, and sugar content of beets grown on different types of soil in different parts of Illinois.

2. The testing of different varieties of beets by the Experiment Station on a scale of sufficient magnitude to obtain as reliable information as possible regarding varieties of sugar beets best adapted to the soils and climate of this state.

3. The determination of the value of different kinds of soil treatment, of the applications of farm-yard manure, and of various other fertilizers, for use in growing sugar beets on Illinois soils.

4. The breeding of sugar beets for the purpose of determining whether seed which is produced in Illinois from home-grown beets of the best quality obtainable will not be found equal or superior to imported sugar beet seed for the production of sugar beets in this state.
1. Coöperative Experiments with Farmers.

Regarding the coöperative experiments, we may say that the Experiment Station furnished imported sugar beet seed to about 500 farmers, representing nearly every section of the state. A circular of definite directions for growing sugar beets was furnished to every farmer to whom seed was sent. These directions included a concise statement of the methods which have been found to be the most practical and successful in growing sugar beets for factory use, not only in the United States during the past ten or twelve years, but during many years in Germany and France.

During the growing season an employee of the Experiment Station visited a large number of the farms in different sections of the state where sugar beet seed had been furnished in order to make accurate observations and obtain as much reliable information as possible regarding the actual condition of soil, cultivation, etc., which obtained on the sugar beet plots.

One result of this inspection was to prove quite conclusively that this method of investigation by miscellaneous cooperation with farmers who express an interest in the subject and a willingness to accept seed and grow a plot of sugar beets frequently furnishes data which are not only unreliable but which are absolutely misleading. In many instances it was found that the seed had been received but had not been planted, but in other cases the seed had been planted on odd patches of soil which were neither suitable nor properly fitted for growing sugar beets. Again the beets were frequently planted in rows wide apart or the entire plot consisted of only one or two rows, whereas, long years of experience have fully demonstrated that, to produce beets which are rich in sugar, they must be planted in rows which are close together, about 16 to 18 inches being the proper distance, and that outside rows are nearly always low in sugar and purity. Very commonly the beets were not properly taken care of even after they were planted. In many instances no report was made to the Experiment Station by the farmers who grew the beets, and samples of beets were not sent in for analysis. From the 500 samples of sugar beet seed sent out in this miscellaneous manner, about fifty samples of beets were returned to the Experiment Station in the fall. About one-half of these were found to be beets of poor quality, but the meager reports frequently showed that the poor quality might well be attributed to the improper method of planting and cultivation. Over thirty samples were received whose sugar content varied from 12 to 18 per cent., and in several cases a very satisfactory yield was also reported. To be sure these results were of some value. They show that sugar beets of high grade and of good yield were grown by farmers during the season of 1902 in several different
sections of Illinois, and hence they prove the possibility of growing sugar beets successfully under proper conditions. As a rule, the failures prove nothing, unless it be that good beets were not grown under conditions and by methods of treatment which are well known to be unfavorable.

2. Variety Tests of Sugar Beets.

Regarding the variety tests, we may say that this work was carried on principally on the experiment field at Urbana under the full control and direct management of the Experiment Station, and 14 different varieties, or strains, of sugar beets were included in this test; and, with one exception, all of these different kinds of seed were tested in duplicate; that is, two tenth-acre plots of each kind of seed were planted. The yields obtained varied from about 12 tons per acre to more than 21 tons per acre, and the sugar content of the beets at the time of harvest varied from less than 13 per cent. to more than 16 per cent. as the averages of the different plots. These results show very conclusively that there are very great differences both as to yield and quality of different varieties of beets or of beets produced from different kinds of seed, even on the same kind of soil. The best yielding variety averaged more than 20 tons per acre when grown on good soil and with proper cultivation but without any application of farm-yard manure or any kind of fertilizers, and when harvested this variety of beets contained an average of more than 15 per cent. of sugar. At factory prices which commonly prevail for sugar beets, these beets are worth $1.90 per ton or $98 per acre. On the other hand results obtained from the poorest variety under the same conditions of soil and cultivation, namely, about 12 tons per acre of beets, containing 13 per cent sugar, which were worth $4.30 per ton, would give a total value of $51.60 per acre.

If we bear in mind that the cost of raising an acre of sugar beets, including the average rent of good Illinois land, is from $32 to $40, it will readily be seen that the best varieties of sugar beets which were included in the tests produced very much larger profits than are ever secured from the ordinary farm crops, while the poorest varieties were probably not so profitable as a good corn crop.


The cultivation experiments included under different methods of soil treatment furnished no results of practical value during the season. The experiments comprised different depths of cultivation and frequency of cultivation, but no marked differences were produced.

In testing the value of fertilizers our principal work at Urbana was with lime, phosphorus, and potassium. One of our regular experiment fields comprising ten tenth-acre plots whose history was well known, crop yields having been taken on all these plots for several years, was used
for these experiments. These plots had all received uniform treatment for twenty-five years previous to the fall of 1901. During 18 years previous to 1895 the field was in pasture, and since 1895 it has been cropped heavily and continuously with no application of manures or fertilizers until the fall of 1901. That all of these plots were originally uniform has been clearly shown by the yields of previous crops which have been obtained. The averages of three consecutive crops of corn grown on this field in 1895, 1896 and 1897 varied from 64.7 bushels to 71.8 bushels on the ten different plots. Other crops taken from these plots during subsequent years include two crops of sugar beets (1898 and 1899) the yields of which were not taken by plots, soja beans grown in 1900 and corn in 1901.

The following table shows the average yields of corn for the years 1895, 1896, 1897, the yields of corn for 1901, the different kinds of treatment which were applied to these ten different plots in the fall of 1901, and also the yields of sugar beets in tons per acre which were obtained from these different plots in 1902:

<table>
<thead>
<tr>
<th>Plot No.</th>
<th>Corn (bu. per acre)</th>
<th>Treatment applied</th>
<th>Sugar beets (tons per acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>av. yields 1895-67</td>
<td>yields 1901</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>66.8</td>
<td>59.6</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>67.0</td>
<td>60.9</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>66.3</td>
<td>65.1</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>71.8</td>
<td>65.0</td>
<td>Lime</td>
</tr>
<tr>
<td>5</td>
<td>71.7</td>
<td>61.2</td>
<td>Lime</td>
</tr>
<tr>
<td>6</td>
<td>68.0</td>
<td>58.3</td>
<td>Lime and Phosphorus</td>
</tr>
<tr>
<td>7</td>
<td>67.4</td>
<td>55.8</td>
<td>Lime and Phosphorus</td>
</tr>
<tr>
<td>8</td>
<td>68.7</td>
<td>53.9</td>
<td>Lime, Phosphorus, Potassium</td>
</tr>
<tr>
<td>9</td>
<td>67.4</td>
<td>54.6</td>
<td>Lime, Phosphorus, Potassium</td>
</tr>
<tr>
<td>10</td>
<td>64.7</td>
<td>57.9</td>
<td>Lime, Phosphorus, Potassium</td>
</tr>
</tbody>
</table>

For a few feet on one end of plots 1 to 5 the beets were injured to some extent by water standing on them for a short time during the latter part of the season, and the yield of beets is probably slightly less than it otherwise would have been, and because of this the results given in the tabular statement are probably slightly exaggerated, but this exaggeration must be very slight as not more than one-eighth of any one of the plots was thus effected by water standing on them, and even on this small part of the plot the crop was not destroyed, although it was apparently somewhat injured. Plots 1, 2, and 3, to which no fertilizers were applied, not only showed a much poorer growth during the season but the beets growing upon these plots appeared to be more susceptible to disease or other injuries, although so far as is known there was no other reason why the better plots escaped such injuries, excepting because of the increased vigor and growth due to the application of fertilizers.
These results show that applications of different elements of plant food produced a strong healthy growth and finally increased the yield of sugar beets from an average of about 9 tons per acre to a maximum of about 23 tons per acre. The fact that this field had been heavily cropped, including two crops of sugar beets previous to 1902, probably accounts in large measure for the very marked effect of applying the different elements of plant food.

Between the different tenth-acres there were narrow division strips about one-half rod wide to which no application of plant food was made, although they were planted to sugar beets the same as the plots themselves. The beets growing upon these division strips were very much poorer than upon the plots which had received applications of fertilizers, the line to which the applications were made being distinctly discernible during the entire growing season.

The plots which averaged about 23 tons per acre received about $1 worth of lime, $4 worth of phosphorus, and $7 worth of potassium, making the total application about $12 per acre. Considering that the yield was increased from 9 tons per acre to 23 tons per acre by this treatment, in other words, that $1 worth of fertilizer produced in a single season more than one ton increase in yield of sugar beets, worth about $4.60, is strong evidence that for such intensive farming as the growing of sugar beets heavy applications of the proper mineral elements of plant food may be applied even to certain Illinois soils with great advantage and profit. Of course, these results may be considered as preliminary and tentative and they should certainly be verified by further experiments before being applied to large areas.

A somewhat similar series of experiments was conducted upon one of the University experiment fields which is located on the farm of Mr. John Zeter, near Lincoln, Illinois. Similar results were secured, although by no means so striking as upon the worn soil at Urbana. Applications of lime, phosphorus and potassium increased the yield of beets on Mr. Zeter's soil 4.8 tons per acre. The plot to which no application was made yielded at the rate of 14 tons per acre, while the plot to which lime, phosphorus, and potassium was applied yielded at the rate of 18.8 tons per acre. Even here the application of $12 worth of plant food produced an increase per acre of 4.8 tons of sugar beets worth more than $22. Considering that these results were obtained the first year after the applications were made and that probably from one-half to two-thirds of the plant food added still remains in the soil, the evidence is rather strong in favor of the application of the proper fertilizers for sugar beets.

Applications of farm-manure and commercial nitrogen were also tried on the Lincoln field, but the first year's results do not furnish
very conclusive information regarding the ultimate effects of these applications, especially of the farm-yard manure.


The progress of the work in the breeding of sugar beets is certainly encouraging. About 300 individual beets were analyzed in the spring of 1902, the beets having been saved from the 1901 crop, and the best beets were selected from all of those analyzed and were planted as seed beets. Owing to the very wet season only a small quantity of seed was produced but this has been saved and will be planted in 1903. From the best variety of beets grown during the past season of 1902 more than 1,000 seed beets were carefully selected and these individual beets have already been analyzed. About 200 of the best beets from this lot of 1,000 are now in cool storage and will be planted as seed beets in the season of 1903. These 200 seed beets are all exceptionally rich in sugar, the poorest beet selected containing not less than 17 per cent of sugar and the richest containing as high as 23 per cent. It is hoped that a considerable quantity of very high grade sugar beet seed may be produced from these seed beets in 1903.

When we remember that beets containing 12 or 13 per cent of sugar are considered very satisfactory for factory use, the possibility of growing high grade pedigreed sugar beet seed from such a stock of selected seed beets as the 200 we now have in cool storage, will be apparent and its importance will be appreciated.

In conclusion we may say that the evidence of the investigations conducted during the past season points very definitely to the conclusion that large yields of sugar beets of most excellent quality can be produced in Illinois, provided varieties are grown which are adapted to our soils and climate, and further provided that the beets are properly planted on suitable soils and cultivated by methods which have been shown by past experience to be the most successful for the growing of sugar beets. In our judgment these investigations should be extended to several different sections of the state and continued for a few years, until it shall be definitely demonstrated through a series of seasons whether or not it is possible to grow sugar beets in sufficient quantity and of a sufficiently high quality to make it profitable for the state to produce within her own boundaries the eighteen million dollars worth of sugar required annually for consumption in Illinois.

We may add that the complete data obtained from the investigations of which we have merely given you an outline are being compiled and will be published in the form of an Experiment Station bulletin as soon as practicable.