

THE SUGAR BEET INDUSTRY.

FRED N. GILLIS.



It is very difficult to trace the exact origin of the sugar beet, but its cultivation has been known to have taken place in very remote periods of time.

Even so far back as the latter part of the fifteenth century two varieties were spoken of, the red and the white. Oliver de Serres, in his writings in 1590 only mentions the red beet and states that it had not been introduced into Europe. He also said that the juice that this beet yielded on boiling is similar to sugar syrup. The red variety was introduced into England about 1548 while the white variety was first introduced in 1590. A small variety known as "Disceete" which is still grown for feed, to a considerable extent in France, was believed to have originated in Germany.

Up to this date the root was not thought to have any industrial value, but was cultivated only for the table, or for cattle food. In 1747 Margraff believing sugar to be regular constituent of plants other than cane, made an examination of different vegetables and succeeded in separating from several varieties, varying amounts of crystallizable sugar. His method was to cut the vegetable into thin slices, rapidly drying it, reducing it to a fine powder and then exhausting it with dilute alcohol. Of all these vegetables beets were found to contain the largest amount of sugar and although <sup>he</sup> advocated the growing of beet for production as a great commercial product of Europe, yet he was not destined to see the fulfillment of his plans, as his methods were at best very crude and the prices of Colonial sugar were so low as to render competition impracticable.

On account of these drawbacks the great industry which Margraff had discovered lay dormant for a half a century when the work was taken up by one of his pupils who after a considerable amount of work succeeded in extracting sugar from the beets on a large scale. The methods used were entirely his own and they gave astonishing results. He announced these results in 1797, publishing his mode of operation and in the latter part of 1799 presented a sample of his product with a description of his method to the Institute of France, stating that the cost of pro-



duction need not exceed six cents a pound.

Archard's statements were doubted by almost everyone, however, and were even accepted with much reserve by the members of the Institute, although he was held in high repute by that body. The Institute was so aroused however, that they appointed a committee to investigate and after trying Margraff's methods to determine the value of the roots found them to contain about six per cent of sugar. They then tried Archard's process and obtained a brown sugar disagreeable to the taste which however, was rapidly purified by alcohol. This commission found, however, that the cost of refined sugar was about eighteen cents per pound. This report had the effect of killing almost all the enthusiasm aroused by Archard's works and for many years the industry did not develop in France.

In Germany, however, Archard's discovery was taken more seriously and several prominent men took up the work. The Baron De Koppé erected a factory on his estate and a little later Archard built one. Their industry was aided considerably by the decree of Napoleon by which it was forbidden that any English products should be imported. This of course raised the price of sugar and the profit of these two men who had so wisely built their factories were increased.

During Napoleon's wars when almost all foreign products were shut out of France, the Emperor ordered investigations to be made as to the production of sugar from the grapes grown in the southern part of that country. Many experiments were made along this line with the general result that the cost was comparatively too great to make the industry a success. The people of Northern France in the meantime were still working on the sugar beet question. About this time the result of the late experiments by Archard were published and the people of Northern France took up his methods of producing the beet sugar. The first experiments were successful in producing a fine sugar but the cost of production was forty cents per pound. Later experiments however showed that the refined product could be obtained at a cost of twelve and nine tenths cents per pound.

Napoleon's interest in the industry became so great that he offered prizes



each year for the best sample of beet or grape sugar to be accompanied by an essay on its production. Through this means he received several samples of purified beet sugar and found by a comparison with the pure cane sugar that they were identical or nearly so. He then issued a decree setting aside enough land in France to be used in the culture of sugar beets to produce the entire amount of sugar needed in that country and furthermore providing officers to enforce the decree. About forty factories were established and the work was now taken up in earnest. Schools were now established by the Emperor for the education of students along sugar manufacturing lines. The next thing of importance was the establishment of four imperial factories which during the first year manufactured over 132000 pounds of sugar from the crop then on hand.

The German Government was also making rapid strides in the development of this industry. Archard had for several years continued his persistent work never for a moment doubting its ultimate success and as he seemed to be obtaining encouraging results the German authorities now decided to lend him their aid. The German Emperor created two schools for the education of the people along sugar beet lines. People from all over Europe attended this school of Archard's, many of them coming from Russia and later carrying back to their country greater knowledge of the value of the industry. The Czar came at once to their aid, making the lands of those establishing factories exempt from tax and in every way possible encouraging their work. The subsequent Napoleonic wars however, completely destroyed the industry in Russia and Germany and later almost destroyed it in France also. After Napoleon's downfall it took many years to get the industry back to where it was before.

At first Archard and Napoleon were ridiculed both in their own countries and abroad, but this attitude gradually wore off as the industry advanced and England soon began to wonder what the effect would finally be on her colonial commerce. It has been said that the English Government even went so far as to offer Archard thousands of dollars if he would publish a book stating that he had been carried



by his enthusiam and that the industry was impracticable. He refused to do this and finally they induced a certain Englishman to write a volume containing the statment that while beet sugar could be produced yet it was too bitter for consumption.

Napoleon has shown the great possibilities of the industry and in the succeeding reign there was such a high duty on colonial sugar that M. Crispel who then has the only surviving factory in France was able to dispose of his product at a great profit and he soon had ten of the finest factories of his time. Others took up the work again and the industry has been making a rapid progress since.

In Germany the industry lay dormant until 1835 when representatives were sent to France from both Austria and Prussia to investigate the methods used there. They soon returned and factories were erected all over Germany.

Although such great progress was being made in Europe this industry with its great possibilities in the United States lay dormant. True there had been several trials at the culture of the beet here as early as 1830 yet in almost every case they were only grown as the result of enthusiasm and not as a result of sound reasoning and judgement and on this account they failed. A few years later David Child who had, for several years, been in Europe studying the methods used there came home and began to cultivate sugar beets on a small scale in Massachusetts. He devised his own machinery and used the drying process. Later he wrote a volume entitles "The Culture of the Sugar Beet and the Manufacture of Beet Sugar.", which stated that he made the finished product at a cost of eleven cents per pound yet the interest was not sufficient to take up the industry and practically nothing was done until 1863 when two Germans started up at Chatsworth, Illinois. The climate and soil were unfavorable and the business only survived a few years. They next removed to Freeport, Illinois, but climatic conditions were unfavorable there also and the firm finally became bankrupt. The general superintendant then went to Wisconsin and joined a cooperative firm there. Although the experiments there were not long continued on account of adverse conditions, yet they produced



the first good results obtained in the United States.

Even this partial success attracted the attention of many eastern capitalists who offered to furnish Messrs. Bonestell and Otto of this Wisconsin firm, money to continue their operations but they preferred to accept an offer to manage the Alvarado, California, factory, and accordingly went to that place. Here they stayed until 1873 with no very great success, when it was decided to move to some better locality. This was not done but Bonestell and Otto were moved to Soquel, California where they operated a factory successfully as late as 1876. In 1876 the Alvarado company failed entirely as a result of a failure of crops and the enterprise there was abandoned. A little later the Soquel factory also abandoned its operations.

We see that up to this time no attempt to manufacture beet sugar on a large scale had been successful in the United States. As yet no state or combination of states had given this enterprise any encouragement. In 1876 Canada offered a premium of one cent per pound on all beet sugar manufactured, no single firm being allowed to collect premium on more than 700000 pounds annually. This so stimulated the industry that Maine followed her example, and its effect spread to Massachusetts and later to Delaware where prizes were offered with the result that a company was organized with headquarters at Wilmington.

From a botanical standpoint the sugar beet resembles the ordinary beet, being only a different variety of the same order, genus and species. Its scientific name is Beta vulgaris saccharifera of the order Chenopodiaceae. The plant itself resembles a common beet to a considerable extent. It forms a very large root the best varieties having simply a long straight tap root. The tops of the beet stand from four inches to a foot in height and the leaves resemble those of the common beet considerably.

The sugar beet grows best in the north temperate regions. It has been found however, that a greater yield can be raised in the extreme south but these beets on analysis show a much smaller percentage of sugar than those northern grown



beets.

The question of rainfall and irrigation is one of great importance to the sugar beet producer. As is the case with all our cultivated plants sugar beets require a considerable amount of water in the soil. This water must come from the rainfall, from irrigation, or there must be water in the soil below the surface from which the plants can get a steady supply of moisture as in the case in a considerable portion of California where the beets are raised with practically no rainfall during the growing season. If the rainfall is depended upon from two to four inches of water must fall per month during the growing season for the best results. In many sections of our country which are now arid, irrigations could quite easily be carried on and where this is possible sugar beets could be raised successfully. Especially in Colorado, Nebraska, Utah, Idaho and Arizona where irrigation can be carried on the beet has an advantage over the beet in Germany or France on account of the better quality of soil. Irrigated beets have some advantage over the others in that there is a better chance for them to mature as the water may be with held at the proper time and by not allowing the plants too much moisture prevent the second growth which is do destructive to the crop.

Again, the beet in a dry soil will stand much more cold than when in a wet soil and on this account it may be left in the soil later thus becoming more mature. As to soil it may be said that with proper cultivation the sugar beet can be raised on almost any soil, but it does best on a sandy loam. The land should be as nearly level as possible and well drained.

The proper preparation of the soil adds greatly to the success of the enterprise. It should first be plowed in the late fall allowing it to be stirred to a depth of nine inched. The plow should be followed with a subsoil plow which stirs the soil about eight inches deeper. The ground is loosened up thoroughly by allowing it to stand until spring when it is thoroughly pulverized by the use of a cultivator. This final preparation should be done not earlier than the day preceeding planting so that the beets will have an equal start with the weeds.



The seed should be planted as early in the spring as possible but the seasons are such in most beet producing regions of the United States that planting before the first of May is impracticable. As a general thing the beets planted early produce a larger yield as well as a higher content of sugar than do late planted ones. The planting may be done by either of two methods; first by hand sowing which is, however, practical only on a small scale, and second by they may be planted by drills. Many drills have been used for this purpose and in fact any common grain drill can be used. The seed is dropped in rows and singly in the row and at equal distances apart. They should then be covered by from one half to one and one-half inches of soil the depth depending on the moisture contained in the ground.

Cultivation should begin as soon as we can distinctly see the rows of plants, in order that the weeds may not get a better start than the beets. This first cultivation should be very shallow, merely enough to kill the weeds and to establish a soil mulch. One of the best implements for this work is the Horse hoe for which may be set at any depth required.

These cultivations must be kept up at least once per week all through the period of growth and if necessary the last few cultivations may be made deeper. One of the most important things in connection with the production of the sugar beet is the "thinning out" which must be done in the rows. This process should take place as soon as four leaves appear on the plant and great care should be exercised to leave the strongest plants. Only one plant in every eight or ten inches is left but it is always better to leave the strongest plants even if the distance is not uniform.

All the conditions involved in the industry vary greatly in the different parts of the country so that only a general outline of the work can be given here which must be changed to some extent to suit the climate in hand.

The time for harvesting differs greatly in the different climates but it may be said that in general the beets should be left in the ground as long as pos-



sible and still not be in danger of a second growth or a hard frost. Beets planted about the first week in May are usually ready to harvest the first of October. When ripe the leaves will turn from a rich to a yellowish green and droop down to the ground. The harvesting is done by first using a beet harvester the essential part of which is a jaw which runs below the surface of the ground, catching the beet a little below the middle and then in moving forward the plow catches the beets between its two prongs which approach more nearly together in the rear and on account of this angle at which the jaws are set the beet is lifted and the taproot broken off. The beets may now be lifted out of the ground by the tops.

Before beets are piled up the tops must be removed, as the neck of the beet contains much mineral matter which if taken to the factory would have a deteriorating effect on the sugar. As yet no machine has been put into operation for the removing of the necks and this tedious process must be done by the use of a knife. As fast as the necks are removed the beets are thrown into piles and in order to protect them from the sun or extreme cold, weather tops may be thrown over the beets. They are then ready to be hauled to the factory and converted into sugar.

There is still a great deal of work to be done along the lines of improvement in the plant of the sugar beet, the principal object being to obtain beets with a larger content of sugar. Several experiment stations have taken up this work but have secured varied results.

Within the last ten years a new interest has been aroused in many parts of the country and new factories erected. The Alvarado, California plant which was abandoned in 1876 has been rebuilt and is now one of the largest in the world. A very successful factory has been erected at Grand Island, Nebraska, while new ones are constantly being built in Utah, Colorado and several of the other Western States. There has been some talk lately of taking this industry into western Kansas but very little has been done there as yet, though most of the attempts have proven successful. The people of this country see the great value of this industry and are taking a greater interest in it than ever before. It is safe to say



that the beet sugar industry in the United States has come to stay and that it will only be a few years until Uncle Sam will no longer be obliged to depend on the colonies of England for this staple and it is even within the range of possibilities that she, herself, will be an exporter of a fine grade of sugar.