CONDITIONS AFFECTING SUGAR-BEET CULTURE IN THE UNITED STATES

By Henry C. Taylor, M. S.
University of Wisconsin

The relations of the United States with Cuba and other parts of the West Indies are certain to depend largely on the conditions of competition of beet and cane sugar. For that reason this discussion by Dr. Taylor finds an appropriate place in a collection of papers analyzing the present and prospective relations of the United States and Latin America.—[Editor.]

During the last thirty years, beet-sugar production has become a very important industry in Germany. In 1872 Germany was a large importer of sugar, the excess of imports over exports amounting to more than thirty thousand metric tons. In 1898 she was the largest exporter of sugar in the world, the excess of exports being more than a million metric tons. This rapid development of the industry in Germany has led many to believe that the people of the United States may succeed in producing their own sugar supply.

This proposition led the writer to study the conditions under which sugar beets are produced in Germany and to compare the conditions there with those which exist in that portion of the United States which has been designated by the Department of Agriculture as "the probable areas suited to beet culture." The writer is in sympathy with the efforts which are being put forth to extend the sugar-beet industry, but feels that a careful study of the subject from the point of view of commercial agriculture may, to some extent at least, enable the promoters of this industry to avoid misdirecting their energy. It is believed that a comparative study of the crops and field systems of Europe and America will lead to the conclusion that any attempt to establish the beet-sugar industry where it must compete with Indian corn is likely to prove a failure, and that, for this reason, our efforts to establish this industry should be restricted to that part of the beet region of the United States which lies outside of the corn belt.

It has been fairly well demonstrated that vast areas within our borders have the requisite soil and climate for producing beets with a sugar content as high as, if not higher than, those of the best beet regions of Germany; and perhaps it may be conceded that the advantages due to cheap labor in Europe will be balanced by greater skill and the more general use of machinery in the United States. It does not necessarily follow, however, that it will be economical for us to produce our own sugar supply. Suppose that we are able to produce beet sugar at as low a cost in labor and capital as is possible in Germany, and yet in order to do so it is necessary to use land which would yield a larger net return when employed in some other way. Would it then pay to sacrifice the more profitable crop in order to produce sugar? The solution of this problem requires an understanding of the fundamental principles of commercial agriculture. Pliny wrote, that he was a poor husbandman indeed who would buy anything which he could produce on his own estate; but Thaer[1] taught his generation to produce nothing which could be procured more cheaply upon the market. Pliny was writing for a time when the self-sufficient economy of the villa prevailed and when the goal of the husbandman was the direct satisfaction of all the wants of his household. Thaer lived at a time when commerce had so developed and industry had become so diversified that farmers produced primarily for the market, and he stated the most fundamental principle of modern agriculture when he said that each farm should be operated in such a manner as will make it yield the largest long-time average net return, and only those crops which will add to the total net return should be included in the field system, all others should be excluded.

This economic principle, which underlies all commercial agriculture, is an important factor in determining the geographical distribution of farm crops in modern times. It is a commonplace fact that sunshine and rainfall determine in a general way which plants may thrive here and not there, or there and not here. Some plants require much heat, while others thrive best in a relatively cool climate. Some require a great deal of moisture, while others get on with a very little. But while all plants will not thrive under the same conditions, there are always several species present to compete for

[1] Albrecht Thaer wrote extensively on agriculture during the first quarter of the nineteenth century and is remembered as Germany's greatest agriculturist.

each piece of land. This is true on every farm, and the more favorable the soil and climate the greater the number of species which enter into this struggle. When nature is left to herself, the plants which are best fitted for this warfare survive and occupy the land; but when man intervenes plants are divided into two classes, those which are useful and those which are harmful or of no use. The harmful plants are destroyed, the useful ones are cultivated. Under the régime of the self-sufficient agriculture of Pliny's time *all* the useful plants which would thrive were cultivated on each farm. The greater the variety of crops which each husbandman could produce, the greater the degree of his well-being, for each household was a little economic world living unto itself. But under the régime of modern commercial agriculture, where each farmer produces primarily for the city, national or world market and buys upon the same market nearly everything he consumes, his well-being no longer depends upon the variety of his own productions, but upon his power to command the desired commodities upon the market. This power does not depend upon the variety, but upon the cost, quantity and price of the articles he takes to the market. Cost, or cheapness of production, is not the one determining factor; neither is the quantity of the product. The selling price would also be a poor guide in itself. But when the cost of producing an article, the quantity which one man can produce upon a given area, the capacity of the crop to fit itself into the field system, and the farm price of the product, are all taken together, it will be found that, with prices as they are at a given time, some crops will net the farmer a handsome profit, while others can be grown only at a loss. The economic well-being of the modern farmer depends, then, upon his capacity to select and produce that crop or combination of crops which one year with another will make his farm yield the largest net return. Hence, it is no longer natural fitness to win out in the struggle, nor simply some degree of utility to man, but it is fitness to increase the total profit of the farm that determines which of the plants suited to the soil and climate of a region should be allowed to occupy the land.

The largest net return being the economic ideal in modern agriculture, it is the purpose of this paper to point out that even though the conditions with respect to the demands upon soil, climate and labor be as satisfactory, yet the production of beet sugar may

prove relatively unprofitable for the farmers of the corn belt while it is a profitable crop in other parts of the United States and in Germany. This conclusion has been reached by a comparative study of the available crops and of the systems of crop rotation in the two countries under consideration. In central and southern Germany, and in fact almost everywhere in Europe where the soil was not too sandy, a three-field system of crop rotation prevailed during the middle ages and down to the beginning of the present century. This system consisted of winter grain, summer grain and fallow. During the fallow year the land was cultivated carefully to clear the field of weeds and to bring the soil into good tilth. At the close of the eighteenth century the industrial and commercial population was making such demands for agricultural products that the more intelligent farmers began to think it too great a waste to cultivate a third of the arable land each year with nothing growing upon it. A general search was made for crops which could be grown in the place of the bare fallow and at the same time allow the soil to be cleaned of weeds and cultivated preparatory to sowing grain. Unfortunately Indian corn, the one grain crop which can be grown successfully under such conditions, was found to be ruled out by the climate; so potatoes, turnips and beets were resorted to. Besides the root crops, clover was introduced and the rotation changed into a four-course system in which roots, summer grain, clover and winter grain succeed each other in the order given. During the last quarter of the eighteenth century and the first half of the nineteenth this four-course system gradually replaced the old three-field system with its bare fallow. The root crops came to be called "fallow crops" because they were looked upon as incidental to the fallowing of the land in preparation for the grains. The grains continued to be the most profitable crops.

The old three-field system was the rule in northwestern Europe during the first two centuries of American colonization, yet the bare fallow never became permanently established in the colonies. The colonists were, from the beginning, well provided with valuable crops which could be cultivated while growing. Corn and tobacco made the bare fallow unnecessary and practically unknown in this country long before "fallow crops" were introduced in Europe; and while our country has greatly expanded, cotton, corn and tobacco have continued to make fallowing unnecessary in most parts of the

United States. Of these crops, corn is the one which interests us especially in this paper, because of the relation which exists between the corn belt and the area suited to sugar-beet culture.

The beet region of the United States is described in the Yearbook of the Department of Agriculture (1901, p. 501) as "a large strip of land reaching across the northern portion of the country. It starts at the Hudson, takes in the southern half of New York, the northern portions of Pennsylvania, Ohio, Indiana, Illinois, Iowa and Nebraska, the southern half of Michigan, Wisconsin and Minnesota, all of South Dakota, large sections of Colorado, Utah, Wyoming, Montana, Idaho, Washington and Oregon, and the coast side of California." By comparing a map of this beet region with one showing the corn belt, it will be seen at once that from the Hudson River to Central Nebraska the southern half of the beet region passes through the very heart of the corn belt, and if sugar beets are to be generally introduced as a profitable crop in the possible beet areas east of the great plains they must show as large a net return, on the long-time average, as corn. It seems to be true, however, that the beet region extends farther north in Michigan than does the area of very profitable corn production. Here we may expect beets to compete with corn more effectively than in the heart of the corn belt.

But why should we ask that beets be as profitable as corn before we introduce them in the corn belt? We grow oats without asking that they be equally profitable. Why not grow beets for what profit there is in them, even if the cultivation of this crop does prove less profitable than the growing of corn? Or again it may be asked, why not compare the profit to be derived from the growing of oats and of beets instead of comparing that of corn and of beets? The answer to this question is made clear when we study those principles which underlie the organization of the farm economy. The intelligent farmer seeks to operate his farm in such a manner as will make it yield the largest net return. The organization of the farm is essentially different from that of the factory. In mechanical pursuits it is the common thing for each man to devote all of his time throughout the year to the production of that one article or class of articles which he can produce to best advantage. In agriculture, however, the production of any one crop requires the attention of the farmer for only a portion of the year, and various crops

demand his attention at different seasons, so that his labor, horses and machines are usually employed more economically in a system of diversified farming than in a single crop system, even if the crop needing attention at one time is less profitable than that requiring attention at another time.

The crops which require attention at the same time of the year may be looked upon as a group of competing crops. Thus the crops which require cultivation for six or eight weeks during the early period of their growth, such as corn, cotton, tobacco, potatoes, sugar beets, etc., may be classed together as a group of competing crops, because they compete for the attention of the farmer—for his labor, his horses, his tools and machinery. The winter grains, rye and winter wheat, or the spring grains, oats, barley and spring wheat, may be given as other groups. We may call these separate groups non-competing groups, because the members of one group require the attention of the farmer at a different time than do the members of other groups. For example, corn, cotton, etc., do not compete with oats, barley, etc. The farmer who seeks to use his labor and capital to the best advantage should select from each group of competing crops that one which will yield the largest net return and should introduce as many non-competing crops into the field system as will yield a profit. When this principle is followed it will often happen that of two non-competing crops in the field system one will yield a larger net return than the other. Yet, when the year's accounts are balanced, it will be found that the net returns are greatest when both crops are cultivated, even if one is less profitable than the other, for each crop represents the most profitable use to which the labor, horses and machines can be put at the given time, and if not used in that way they must be put to a less productive use or to no use at all. But of two competing crops, only the more profitable one should be produced.

With this principle in mind, let us note that while oats and corn may be brought into rotation so as to supplement each other in the economy of the farm, beets and corn cannot be made to do so. Beets may be brought into a system of rotation with oats, but not with corn. In some places, as where the sugar-beet region crosses the corn belt, in the United States, the one may be made to replace the other, but corn and beets cannot be made to supplement each other. The time devoted to the culture of oats is not subtracted from the

time which the farmer may devote to the corn crop. The oat crop is sown and harvested at just the time when the farmer is not needed in the corn-field, and hence oats fit naturally into a profitable rotation with corn. Beets, however, demand cultivation at the same time when the farmer is needed in the corn-field, and if the beet crop increases the corn crop must decrease. Again, the corn and the beets are both cultivated while growing, so that either one prepares the soil for the small grains and makes fallowing unnecessary. Thus we find that beets and corn are competitors, while oats and corn are not. Oats can be grown with profit, even though they do not yield so large a net return as corn, but unless beets yield as large a net return as corn they can be grown only at a loss. Hence the question arises, is beet culture and sugar production more profitable than corn growing and pork production? If so, there is reason for trying to introduce sugar beets in the corn belt. If pork and beef production and the other industries based upon corn are more profitable than sugar production, the profitable culture of the sugar beet must be found outside of the corn belt.

Corn is the one grain which can easily be cultivated while growing. Where corn will not thrive, as is the case in central and northern Europe, the small grains, wheat, rye, oats and barley are the most profitable crops. In parts of southern Europe where it will grow, corn has replaced the fallow, but in those districts where sugar beets are being grown the climate precludes the growing of corn; hence sugar beets have only to show themselves as profitable as turnip, potatoes and fodder beets in order to enter as a profitable element into the field system. Thus, while in Germany the sugar beet has to compete with a relatively unprofitable element in the system of crop rotation, in the corn belt of the United States it must replace corn where corn is king. Hence, it may be true that were the industry once established in the corn belt, our farmers would be able to produce beet sugar at a lower cost in labor and capital than can the Germans, and yet if corn shows a larger average net return than beets, beets will prove unprofitable in the corn belt, while at the same time they may remain profitable in Germany because no very valuable crop is present to compete with them for a place in the German field system. A high duty on sugar may stimulate the sugar-beet industry to expand within the limits of the corn belt, but from an economic standpoint it will not be profitable to the nation until

the beet regions of the world, where corn cannot be grown, are so occupied with sugar beets and the cane sugar regions are so taken up that the price of sugar on the world market will rise to a level which will enable beets to show as large a net return as corn. Let us consider for a moment what is likely to happen in this regard. In France, Germany, Austria-Hungary, Russia and the western and northern parts of the United States there still remain vast areas which could be devoted to sugar beets if the price of sugar were slightly higher. The cane-sugar industry is capable of very great expansion when stable government makes capital safe in all those countries where sugar cane can be grown. On the other hand, the corn lands of the world are pretty well occupied. The United States is, and will doubtless remain, the principal corn country of the world. The Mediterranean and the Himalayas occupy most of the surface of the Old World which might otherwise have provided the proper climate for corn. Only the narrow part of South America and small parts of South Africa and Australia have a corn climate.

As the population of the world increases there is sure to be an increasing demand for pork and other articles of commerce which are most cheaply produced where corn is plentiful. The demand for sugar will also increase; but when we consider the chances for expanding the two industries, there is no reason for believing that the increasing demand will result in as great a rise in the price of sugar as in the price of corn products. In fact the price of sugar has been falling while the prices of corn products have been rising, and the chances are that the relation between the price of sugar, on the one hand, and that of corn products, on the other, will never be such as to enable sugar beets to compete successfully with corn where the climate is especially suited for corn production. If corn would thrive throughout the sugar-beet region of the United States, the sensible thing would be to abandon the beet-sugar industry at once; for so long as we can get our sugar with less outlay of labor and capital by producing corn and hogs for the foreign market and buying sugar from abroad, it would not be economical to produce sugar beets. There might be political reasons, it is true, for desiring to produce our own sugar supply, in order that we may "be in a position to ignore the foreign product," as Secretary Wilson has said. In this case, however, would it not be wise to look rather

to the promotion of the cane-sugar industry within the United States and her dependencies?

But the "probable areas fitted to beet culture" extend beyond the corn belt to the west and the north. Parts of Colorado, New Mexico, Utah, Washington, Oregon and a narrow belt along the Pacific Coast from the north to the south of California are included within its limits. Here corn will not thrive. Wheat and barley are the most important grain crops. As these states grow older the fallow becomes more and more essential to the successful growing of grain and in the absence of corn as a competitor, sugar beets have only to prove more profitable than fodder-roots, or a bare fallow, in order to be introduced with profit into the field system. Thus so far as competing crops are concerned the conditions are nearly the same in these western states as in the sugar-beet regions of Europe, and there is no reason for doubting that where the rainfall is sufficient the beet-sugar industry of the West will be able in time, without any form of government aid, to compete successfully with the Europeans. A very great deal of the probable beet areas of the West require irrigation, however, and it may well be questioned whether the farmers who must pay the costs of irrigation will ever be able to compete on an equal basis with the European producers in beet-sugar production. It may possibly be found that the humid region outside of the corn belt which is suited to beet culture is sufficient to supply our demand for sugar. But if it is not, and this is questionable, the economy of trying to supply the home demand for sugar by cultivating beets is certainly doubtful.

It may be possible for us to supply our home demand for sugar by developing the sugar industry in the ultra corn-belt areas of beet culture and in the cane-sugar regions of the United States and her dependencies. We find here a suggestion regarding the attitude the government should take in attempting to foster the sugar industry in this country. It is certainly in accordance with our infant-industry policy to encourage, in some way, the development of the sugar industry in the West or any place else where there is good reason for believing that it will be able to stand on its own merits when once established. On the other hand, it is contrary to the same policy to force a growth of the industry in those parts where it cannot be expected to prove profitable longer than while the external stimulus is being applied.