THE
Sugar Beet Industry
AS AFFECTING
American Agriculture
ADDRESS BY
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THE CARE OF THE SOIL AFTER
SUGAR BEETS
Ft. Collins, Colorado, January, 1910
The Sugar Beet Industry as Affecting American Agriculture.

Address by Truman G. Palmer, Secretary of the American Beet Sugar Association, Delivered at the Twentieth Session of the Trans-Mississippi Commercial Congress at Denver, Colorado, August 17, 1909.

At Muskogee, two years ago, I told you something of the great work the U. S. Department of Agriculture is doing in behalf of the American farmer.

Today I mean to touch on the food supply of the world, a problem which is engrossing the attention of thinking men more and more with each succeeding year. To do this, I shall bring to your attention the difference in methods employed here and in Europe to solve this greatest of all problems.

It would seem to be a difficult undertaking today to find a pessimist on the subject of American agriculture, and I trust that in my handling of this subject no one will consider me as belonging to that undesirable school. From one end of the country to the other we are harvesting bumper crops. The present estimate is that we will harvest 500,000,000 more bushels of the leading cereal crops than we harvested last year, and that the total produce sold from our farms this year will yield our farmers over eight billion dollars. Nebraska farmers alone will receive $50,000,000 more for their surplus corn and wheat than they did last year, and Kansas having risen from her funeral pyre of farm-mortgage ashes, now is said to occupy second place in the Union in per capita wealth. As well look for a hen's tooth as to look for a pessimist on this subject this year.

And still there are phases of the agricultural question which deserve our most careful consideration, even with all this abundance.

During the past century inventive genius has been multiplying our necessities and our luxuries at a pace never before experienced, and to supply us with these necessities and luxuries means an ever increasing tax on the farms. It is estimated that next year the American people will pay out $200,000,000 for automobiles, and that means that a myriad of bread eaters, and not bread producers, will be engaged in the manufacture and distribution of these automobiles, thus imposing an additional tax on our farms. Every luxury, every necessity we add, places an additional burden on our food supply, and this multiplication of luxuries and necessities has gone on at such a rate that in human food supply we, the former so-called granary of the world, are but little more than self-sustaining, and unless conditions are changed bid fair soon to be greater importers than exporters of food products.

Evolutions of great moment have occurred in other lines of industry and various makeshifts are available, but, with few exceptions, the staple food crops of the world are the same as they were at the beginning. As our forests gradually disappeared, we delved into the bowels of the earth and there found a fuel to take the place of the wood we had been burning. Then, as one school of scientists began to figure on the date when our coal mines would become exhausted, another school of scientists evolved a way of har-
nessing our water-powers and generating and transmitting electrical energy to take the place of the energy heretofore generated by the consumption of wood and coal. Steel has superseded in great measure the use of wood and stone in the construction of our great buildings; and now, reinforced concrete is beginning to supersede steel.

We could exist and be comfortable if there were no railroads or steamships or telegraphs or telephones and a thousand and one other seeming necessities, but we could not exist without the staple food crops, for which no substitutes have been found.

Under these conditions it would be a wonder indeed if the problem of human food supply did not engage the attention of the world's deepest thinkers.

THE UNITED STATES THE GRANARY OF THE WORLD.

For decades the United States has been alluded to as "The Granary of the World," and the public prints frequently "point with pride" to our exports of food stuffs, but for some reason, our imports of food stuffs rarely appear outside of a government statistical document. Only a few months ago there appeared in a prominent magazine an elaborately illustrated article under the caption, "The United States Feeding the World." The writer was a prominent official of one of our executive departments and should have known how misleading such a caption was. In 1907 our total exports of cereals and all other food stuffs except live stock and packing house products, were valued at $244,000,000, and of food stuffs such as we are producing or are capable of producing at home, not including live stock and packing house products, our imports were valued at $234,000,000, leaving a balance of but $10,000,000 in our favor. Of other food stuffs, such as coffee, cocoa, bananas, etc., but not including live stock and packing house products, we imported to the value of $118,000,000, thus leaving a net balance against us on everything but live stock and packing house products, of $108,000,000. Of live stock and packing house products, including all such products whether for food or otherwise, we exported to the value of $240,000,000, and imported to the value of $98,000,000. It thus will be seen that our total export of food stuffs, including all packing house products, exceeded in value our imports of like products by only $33,000,000, hardly enough to justify the statement that we are feeding the world, or more than even a very minute portion of it.

In this article the writer stated that alongside of the cotton we send to Western Europe, we export the food stuffs with which to feed the countless laborers who work it up into the finished article, the idea being conveyed that we feed the people of Western Europe.

UNITED STATES EXPORTS OF PRINCIPAL FOOD STUFFS TO CONTINENTAL EUROPE.

The latest available statistics for Europe are for the year 1907. In that year we produced wheat, rye, corn, barley, oats and potatoes to the value of $2,500,000,000 and the same year Western Europe produced these products to the value of $7,000,000,000, or nearly three dollars' worth to our one; the values in both cases being based on the United States farm value on December 1, 1907. From our $2,500,000,000 worth of these products, we exported to the entire continent of Europe $68,000,000 worth, or less than one per cent of the quantity they raised at home. In addition to cereal food stuffs, we supplied them with something less than a million dollars worth of live stock; $3,000,000 worth of beef products; $8,000,000 worth of bacon, hams and salt pork; $19,000 worth of mutton, poultry, game, butter and
cheese, and $29,000,000 worth of lard, a total of less than $110,000,000 worth of both cereal and meat products, which is only 1.6 per cent of the value of the cereals and potatoes they raised at home.

Another prominent magazine writer told us a few months ago that “it is true that the American farmer grows only about one-fifth of the world’s wheat, but that it is about twice as much as all Europe produces.”

Were it not for the fact that such statements have a tendency to lull us to sleep, I would not allude to them, for they sound well and they tickle our pride and stimulate our patriotism. But it is an old saying that the worst deceiver is he who deceives himself, and this is a good time to undeceive without running the risk of being considered a pessimist on the subject of American agriculture.

Inasmuch as the impression seems to prevail that what we fail to supply Western Europe in the way of foodstuffs is supplied by Russia, the other granary of the world, and for the further reason that Russia produces 3,335,000,000 bushels of wheat, rye, barley, oats and potatoes a year, compared to our production of 1,870,000,000 bushels of the same products, I will give you the figures for Western Europe without including Russia, except where otherwise stated.

WHEAT AND RYE PRODUCTION IN EUROPE AND THE UNITED STATES.

Instead of Europe producing but one-half as much wheat as is produced in the United States, as stated in the magazine referred to, France alone produces more than one-half as much wheat as we produce by 60,000,000. Europe, without Russia and Turkey, produces nearly twice as much wheat as we do, and including Russia, Europe produces more than two and one-half times as much wheat as we produce in the United States.

The total land area of France is 130,000,000 acres, compared to 148,000,000 acres for our three leading wheat states—Kansas, Minnesota and North Dakota. In 1907 France had 16⅔ million acres in wheat, and these three great wheat states had 16⅔ million acres in wheat, hence you may think of France as being as much of a waving wheat field as are these three granary states of the Northwest.

But this is not the most astonishing phase of the cereal question. From our 16⅔ million acres of wheat in these three states we harvested 188,000,000 bushels, while from her 16⅔ million acres France harvested 381,000,000 bushels. From the virgin soil of our greatest wheat states we harvested 11.2 bushels per acre, while France, from her so-called “worn out soil of Europe” harvested 23¼ bushels per acre and produced ten bushels of wheat for each man, woman and child in the French republic, as compared to our production of 7.3 bushels per capita for population in the United States.

In 1907 from 4,316,000 acres of wheat Germany harvested 128,000,000 bushels, or 60,000,000 more bushels than Minnesota harvested from 5,200,000 acres; 72,000,000 more bushels than North Dakota harvested from 5,500,000 acres and 62,000,000 more bushels than Kansas harvested from 5,960,000 acres. From one-eleventh the acreage, Germany harvested one-fifth as many bushels of wheat as we did in the entire United States in 1907.

Our greatest rye producing states are Michigan, Pennsylvania, Wisconsin and New York. The 1,100,000 acres of rye in these four states yielded 18,000,000 bushels. Diminutive little Holland and Belgium harvested an equal acreage and secured a yield of 35,000,000 bushels, or double our yield, from the same area, while Germany, from 15,000,000 acres, secured a yield of over
384,000,000 bushels, or 38.2 bushels per acre, compared to our average of 16.4 bushels per acre the same year. Germany raises more rye in one year than is raised in the entire United States in twelve years.

Six nations of Europe each raised more bushels per capita of the two great flour crops, wheat and rye, in 1907 than was raised per capita in the United States, and of wheat, rye, barley, oats and potatoes, Austria, Hungary, France, Germany, Belgium, Denmark, Holland and Sweden each raised more bushels per capita than we raised in the United States.

**BARLEY PRODUCTION IN THE UNITED STATES AND EUROPE.**

Our greatest barley states are California, Minnesota and South Dakota. From the four million acres of barley in those states we harvested 32,000,000 bushels in 1907. In the same year Germany harvested four and one-half million acres of barley, from which the German farmers secured a yield of 160,000,000 bushels, their yield per acre being seventy per cent in excess of what it was in our greatest barley states.

**OAT PRODUCTION IN THE UNITED STATES AND EUROPE.**

Iowa, Illinois and Minnesota are our greatest oat states and between them they harvested 11,000,000 acres in 1907, but Germany, with the same land area as these states, harvests nearly as many acres as do they. From their 11,000,000 acres of oats, Iowa, Illinois and Minnesota secured 272,000,000 bushels, or 24.7 bushels per acre, while Germany, from her 10,800,000 acres harvested 620,000,000 bushels, or 58.3 bushels per acre, or nearly two and one-half times our yield per acre.

**POTATO CROP OF EUROPE AND THE UNITED STATES.**

In the entire United States we planted 3,100,000 acres to potatoes, while Germany alone planted 8,148,000 acres, or two and one-half times as many acres as we planted in the United States, and secured an average yield of 205 bushels per acre to our 95.4 bushels, this one nation thus producing five and one-half times as many potatoes as we produced in the entire United States, while Europe, not including Russia, produces eleven and one-half times as many potatoes as we produce, and including Russia, Europe raises as many potatoes in one year as we raise in fifteen years.

**TOTAL CEREAAL AND POTATO PRODUCTION IN EUROPE AND THE UNITED STATES.**

With less than one-half the total land area of the United States, Europe without Russia and Turkey, produced in 1907 1,142,000,000 bushels of wheat to our 2,400,000,000 bushels; 703,000,000 bushels of rye to our 31,000,000 bushels; 566,000,000 bushels of barley to our 153,000,000 bushels; 1,729,000,000 bushels of oats to our 754,000,000 bushels, and 3,468,000,000 bushels of potatoes to our 298,000,000 bushels, a total for the five crops of 7,608,000,000 bushels to our 1,871,000,000 bushels, and including Russia, Europe with four and one-half times the population to feed, produces 11,000,000,000 bushels of these crops, or nearly six times the number of bushels we produce, or 27.8 bushels per inhabitant, to our 21.6 bushels per inhabitant, or more bushels per inhabitant than we produce, by 28 per cent. and yet we are represented as feeding these people and keeping them from starvation which otherwise would overtake them.

**AVERAGE ACREAGE PRODUCTION AND VALUE PER ACRE, EUROPE AND THE UNITED STATES.**

Our average production of these five crops was 21.2 bushels per acre, and the average production in Europe, not including Russia, was 43 bushels
per acre, or more than double our average. Based on American farm values per bushel, our farmers secured from these crops an average gross return of $13.53 per acre and the European farmers secured an average return of $27.13 per acre, or just double what our farmers secured.

To produce our 1,870,000,000 bushels required the cultivation of 88,546,000 acres of land, while to produce their 7,608,000,000 bushels required but 176,727,000 acres. In other words, Europe, without Russia, tilled twice the area and harvested four times the number of bushels we harvested. If we include Russia, we find that Europe with four and one-half times the population produces two and one-half times as much wheat as does the United States, three and one-third times as many oats, six times as much barley, eight times as much sugar, fifteen times as many potatoes, and forty-eight times as much rye. We are said to be feeding the world and yet Europe produces 52 per cent of the world's wheat to our 20.3 per cent; 95.7 per cent of the world's rye to our 2 per cent; 71.9 per cent of the world's barley to our 12.1 per cent; 69.5 per cent of the world's oats to our 21.1 per cent; 91 per cent of the world's sugar to our 6.5 per cent; 16 per cent of the world's corn to our 75 per cent and 46.3 per cent of the world's sugar to our 5.3 per cent although we consume nearly one-quarter of all the sugar produced in the world or three-fourths as much as is consumed in all Europe, outside of Great Britain.

Germany alone, with a land area no greater than that of Minnesota, Iowa and Missouri, raises, as compared to the entire United States, one-fifth as much wheat, three-fifths as many oats, four-fifths as many hops, an equal amount of barley, one-tenth as much tobacco, three times as much sugar, six times as many potatoes, and twelve times as much rye.

From 88,586,000 acres of wheat, rye, oats, barley and potatoes, we produced 1,871,000,000 bushels in 1907, while Germany, from 42,812,000 acres produced 2,976,000,000 bushels, or sixty per cent more bushels from fifty per cent of the area.

**INCREASING ACREAGE PRODUCTION.**

The fact is that while we have been increasing our production of staple food crops largely by increasing our acreage, Europe has been increasing her supply by increasing her yield per acre. What we by main strength and awkwardness are accomplishing through increasing our acreage, Europe is accomplishing by the application of brains. Since 1883 France has increased her average yield of wheat per acre from 17 to 23½ bushels; Germany, from 18 to 29; Belgium, from 25 to 33½; Denmark, from 34 to 43; The Netherlands, from 26 to 32¼, and the United States from 12.2 to 13.9, based on five year averages.

During the same period Europe has increased its yield of rye from 16 to 22 bushels per acre and the United States has increased its yield from 12.5 to 15.8 bushels. During the same period, Hungary has increased its acreage yield of barley from 16.4 to 22.6 bushels; Germany from 22.7 to 35.2; Belgium from 34 to 48; Denmark from 27 to 37; The Netherlands from 42 to 51, and the United States from 22.2 to 25.5. Still during the same period Austria has increased her acreage yield of oats from 26½ to 35½ bushels; Hungary from 21 to 28; France from 32 to 36; Germany from 27½ to 53½; Belgium from 41 to 62; Denmark from 30 to 43; The Netherlands from 38½ to 52½, and the yield in the United States has fallen from 28.1 to 23.7 in 1907.

If today Western Europe secured no greater returns per acre from her staple food crops than is secured in the United States, a goodly portion of her people would be compelled to migrate or starve. Had the average Ger-
man yield per acre of wheat, rye, barley, oats and potatoes in 1907 corresponded to the average yield we secured the same year, the German farmers would have harvested one and one-half billion less bushels, and at our average farm price on December 1, 1907, they would have lost $913,000,000 on the season's yield of these five crops. Such a result in Germany would have been considered a crop failure and would have constituted a national calamity from which it would have taken years to recover.

If, on the other hand, our farmers had secured the same average yield per acre of these five crops that the German farmers secured, they would have increased their yield by 2,258,000,000 bushels, for which surplus alone they would have received the enormous sum of $1,390,000,000.

**FARM RESULTS—GERMANY AND THE UNITED STATES.**

Acreage, Yield and Value of Five Leading German Crops in 1907, Also Showing What the Yield and Value of the Same Acreage of Crops Would Have Been Had They Secured the Same Average Yield as Was Secured in the United States the Same Year.

<table>
<thead>
<tr>
<th>CROP</th>
<th>Area Harvested in Germany (Acres)</th>
<th>Total Yield (Bushels)</th>
<th>Total Value (Dollars)</th>
<th>Total Yield (Bushels)</th>
<th>Total Value (Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>4,316,400</td>
<td>127,844,000</td>
<td>$111,736,000</td>
<td>60,430,000</td>
<td>$52,816,000</td>
</tr>
<tr>
<td>Oats</td>
<td>10,816,000</td>
<td>630,325,000</td>
<td>279,234,000</td>
<td>256,339,000</td>
<td>113,558,000</td>
</tr>
<tr>
<td>Barley</td>
<td>4,563,900</td>
<td>160,650,000</td>
<td>106,993,000</td>
<td>108,621,000</td>
<td>72,342,000</td>
</tr>
<tr>
<td>Rye</td>
<td>14,931,500</td>
<td>384,150,000</td>
<td>280,814,000</td>
<td>244,877,000</td>
<td>179,005,000</td>
</tr>
<tr>
<td>Potatoes</td>
<td>8,148,200</td>
<td>1,672,773,000</td>
<td>1,032,101,000</td>
<td>777,338,000</td>
<td>479,618,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>42,812,000</td>
<td>2,975,742,000</td>
<td>$1,810,878,000</td>
<td>1,447,605,000</td>
<td>$897,339,000</td>
</tr>
</tbody>
</table>

**Net Loss in Yield and Value of Same.**

<table>
<thead>
<tr>
<th>CROP</th>
<th>Yield (Bushels)</th>
<th>Value (Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>67,414,000</td>
<td>$58,920,000</td>
</tr>
<tr>
<td>Oats</td>
<td>373,986,000</td>
<td>155,676,000</td>
</tr>
<tr>
<td>Barley</td>
<td>52,929,000</td>
<td>34,651,000</td>
</tr>
<tr>
<td>Rye</td>
<td>139,273,000</td>
<td>101,509,000</td>
</tr>
<tr>
<td>Potatoes</td>
<td>895,435,000</td>
<td>552,483,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,528,137,000</td>
<td>$913,539,000</td>
</tr>
</tbody>
</table>

Average Yield Per Acre in 1907. Money Returns Per Acre (a).

<table>
<thead>
<tr>
<th>CROP</th>
<th>United States (Bushels)</th>
<th>Germany (Bushels)</th>
<th>United States (Dollars)</th>
<th>Germany (Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>14.0</td>
<td>29.6</td>
<td>$12.26</td>
<td>$25.87</td>
</tr>
<tr>
<td>Oats</td>
<td>23.7</td>
<td>58.2</td>
<td>10.51</td>
<td>25.78</td>
</tr>
<tr>
<td>Barley</td>
<td>23.8</td>
<td>38.2</td>
<td>15.86</td>
<td>25.44</td>
</tr>
<tr>
<td>Rye</td>
<td>16.4</td>
<td>25.7</td>
<td>11.98</td>
<td>18.78</td>
</tr>
<tr>
<td>Potatoes</td>
<td>95.4</td>
<td>205.3</td>
<td>58.86</td>
<td>126.67</td>
</tr>
</tbody>
</table>

(a) Based on United States farm values, Dec. 1, 1907.
FARM RESULTS—GERMANY AND THE UNITED STATES.

Acreage, Yield and Value of Five Leading American Crops in 1907, Also Showing What the Yield and Value of the Same Acreage of Crops Would Have Been Had We Secured the Same Average Yield as Was Secured in Germany in the Same Year.

<table>
<thead>
<tr>
<th>CROP. in the U.S.</th>
<th>Area Harvested</th>
<th>Total Yield</th>
<th>Total Value</th>
<th>on German Yield Per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>45,211,000</td>
<td>634,087,000</td>
<td>$554,192,000</td>
<td>1.388,246,000</td>
</tr>
<tr>
<td>Oats</td>
<td>31,037,000</td>
<td>754,443,000</td>
<td>334,218,000</td>
<td>1,852,913,000</td>
</tr>
<tr>
<td>Barley</td>
<td>6,488,000</td>
<td>153,597,000</td>
<td>102,296,000</td>
<td>247,842,000</td>
</tr>
<tr>
<td>Rye</td>
<td>1,260,000</td>
<td>31,566,000</td>
<td>23,075,000</td>
<td>49,498,000</td>
</tr>
<tr>
<td>Potatoes</td>
<td>3,124,000</td>
<td>297,942,000</td>
<td>183,830,000</td>
<td>641,357,000</td>
</tr>
<tr>
<td></td>
<td>88,586,000</td>
<td>1,871,635,000</td>
<td>$1,197,611,000</td>
<td>4,129,856,000</td>
</tr>
</tbody>
</table>

Net Excess Yield and Value of Excess.

<table>
<thead>
<tr>
<th></th>
<th>Bushels.</th>
<th>Dollars.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>704,159,000</td>
<td>$615,435,000</td>
</tr>
<tr>
<td>Oats</td>
<td>1,098,470,000</td>
<td>486,622,000</td>
</tr>
<tr>
<td>Barley</td>
<td>94,245,000</td>
<td>62,767,000</td>
</tr>
<tr>
<td>Rye</td>
<td>17,932,000</td>
<td>13,108,000</td>
</tr>
<tr>
<td>Potatoes</td>
<td>343,415,000</td>
<td>211,887,000</td>
</tr>
<tr>
<td></td>
<td>2,258,221,000</td>
<td>$1,389,819,000</td>
</tr>
</tbody>
</table>

(a) The average yield per acre in the United States for the year 1907 was: Wheat, 14 bushels; Oats, 23.7; Barley, 23.8; Rye, 16.4; Potatoes, 95.4.
(b) The average farm value per bushel on Dec. 1, 1907, was: Wheat, 87.4c.; Oats, 44.3c.; Barley, 66.6c.; Rye, 73.1c.; Potatoes, 61.7c.
(c) The average yield per acre in Germany for the year 1907 was: Wheat, 29.6 bushels; Oats, 58.2; Barley, 38.2; Rye, 25.7; Potatoes, 265.3.

From 1868 to 1897, a period of thirty years, agriculture in this country was pursuing a downward course so far as yield per acre was concerned. During that thirty years the yield of corn fell off one-tenth of a bushel per acre; oats 2.4 bushels, rye 2 bushels and potatoes 15.7 bushels, while the yield of wheat increased but one-tenth of a bushel and hay one-one-hundredth of a ton. But this downward course has been checked and the losses largely regained since James Wilson became Secretary of Agriculture in 1897. The gain in yield per acres which have been brought about since that date are 1.6 bushels of wheat, 1.5 bushel of corn, 4.1 bushels of oats, 2.3 bushels of barley and of rye, 12.9 bushels of potatoes and 1.5 ton of hay. These increases in acreage yields may sound small, but in the aggregate they amount to an enormous sum. On the 1907 crop alone the value of these excess yields amounted to over $270,000,000 to the American farmer, and from 1897 to 1907 they amounted to over $2,500,000.

No one so fully appreciates our lack of Agricultural skill as does our Secretary of Agriculture. That grizzled veteran brought to our Department of Agriculture a combination of sense and agricultural science such as it had
never seen before. He coaxed and begged and cajoled and forced Congress to double and treble and quadruple the annual appropriation for the department, and he built it up until now it employs 10,000 people, of whom over 2,000 are trained scientists. Some years ago when begging the agricultural committee of the House for an increased appropriation, the chairman of the committee exclaimed, with some feeling: "Mr. Secretary, your department is fifty years ahead of the times." The old Secretary looked him straight in the eye and yelled back at him: "On the contrary, Mr. Chairman, we are a hundred years behind the times!"

Now that we have checked the downward trend of agriculture in the matter of yield per acre and finally have succeeded in making some slight gains, what of the future? With better soil and climatic conditions will we continue to allow every third-rate nation in Europe to outclass us at every turn? Are we to continue to produce 14 bushels of wheat to Germany's 29.6; 23.7 bushels of oats to Germany's 58.2; 23.8 bushels of barley to Germany's 38.2; 16.4 bushels of rye to Germany's 25.7, and 96.4 bushels of potatoes to Germany's 205.3? Are we so rich or so foolish as to continue to do this, or are we going to endeavor to correct it and place ourselves in agricultural science where we stand in mechanics?

FEDERAL APPROPRIATIONS FOR INTERNAL IMPROVEMENTS.

Can we induce our federal or state governments to make the necessary appropriations to establish an agricultural school or experiment station in every county or cluster of counties? Our revenues are less than our expenditures; already the policy of retrenchment has set in with our federal government and the paring down of appropriations for agricultural and other bureaus has begun. We have become a world power, and that's an expensive luxury. The annual appropriations of Congress have passed the billion dollar mark, and, strange as it may seem for a peaceful and impregnable nation, just two-thirds of our total annual appropriations are for wars, past and prospective.

The world-power craze seems to have blinded us to the need of internal development. We have just appropriated $375,000,000 to build a world waterway across the Isthmus of Panama, but nothing has been appropriated toward building a United States waterway from the Great Lakes to the Gulf. With the greatest network of inland waterways in the world, we make no use of them, while other nations expend hundreds of millions of dollars to improve inferior channels and thereby save their people untold millions of dollars in transportation charges.

Just imagine, if you will, that this scene behind me is a huge map of the United States. Up there at the right hand of the top of the map and forming our extreme northern border you see the chain of our Great Lakes. At some considerable expense the United States Government improved the Soo at the foot of Lake Superior by putting in a system of locks, thus making it navigable. And what has been the result? It has decreased the cost of the transporting grain from the Northwest to Europe by three cents per bushel and thus added that much to the price our farmers get for their grain. Those Great Lakes are teeming with the finest system of freighters in the world. The figures are incredible. In 1907 the Soo Canal was open for 233 days, while New York harbor was open 365 days. The total number of vessels which passed through the Soo Canal was 20,437; through the Detroit River 34,000 and the total number which entered the port of New York, where three-fourths of our imports arrive and a goodly portion of our ex-
ports, and European tourists depart, was 7,100, the Soo leading the great port of New York by nearly three to one and Detroit River leading her by nearly five to one. Forty-four million registered tonnage passed through the Soo Canal, fifty-four million tons through the Detroit River and only twenty-one million tons entered and cleared from the port of New York. If making the Great Lakes on our extreme northern boundary navigable will create such a tremendous traffic, imagine, if you can, what it would mean to construct through the heart of the greatest valley in the world the Lakes to the Gulf deep-waterway, supplementing this with the opening up of the Red, the Arkansas, the Ohio, the upper Mississippi, the Missouri and the dozens of smaller tributaries which would be feeders to it, a territory 1,500 miles in width, extending from Canada to the Gulf, a territory which supplies us with the bulk of our food stuffs and cotton and a goodly portion of our manufactured products, a territory already supporting 30,000,000 people in affluence and capable of supporting 300,000,000 people. But this we neglect, while Europe improves every waterway, however small, wherever navigation can be maintained. Deep waterways is not my theme today and I trust you will pardon this seeming digression. My object is to bring to your attention the golden opportunities we are neglecting because of the fact that we haven't the revenue to develop the rest of the world and our own country at the same time, and it appears that the world development comes first and our own development second.

We now annually appropriate $125,000,000 for our War Department, but not a dollar for good roads, and we have the greatest traffic and about the poorest roads of any civilized country in the world.

We are appropriating $100,000,000 annually for the creation and support of a navy, but not a dollar for the reclamation of our arid empire, outside of the money which comes from the sale of our public lands, and this arid empire is the richest domain on the face of the globe. In addition to the $32,000,000 a year which we have been taking out of our Federal Treasury and handing over to the sugar planters of Hawaii, Porto Rico and Cuba, under the new tariff law we take out $11,000,000 more a year and hand it over to the sugar planters of the Philippines in order to coax them to supply us with 300,000 tons of sugar a year, instead of stimulating its production on the arid plains of this Western Empire.

During the past ten years our Federal Government has expended $820,000,000 on our navy and less than $80,000,000 on agriculture and our present annual appropriations are $100,000,000 for the navy and $10,000,000 for agriculture. For the $820,000,000 expended on the navy, we perhaps have secured dollar for dollar in satisfying our vanity and for the $60,000,000 we have expended on agriculture, we have secured increased yields, which on five crops alone have enriched our farmers by two and one-half billion dollars. The present annual appropriation of the Federal Government for agriculture will scarcely suffice to build and equip one modern battleship, which becomes obsolete in ten years, while the science instilled in our farmers continues to be a constant and ever increasing source of revenue and wealth.

But to kick against the pricks will not accomplish immediate results. Expansion as a world power at the expense of internal improvements and betterment has been drilled into our people carefully and Congress is powerless to stem the tide. We haven't enough revenue for both purposes, in fact already are running behind, and so far as Federal appropriations are con-
cerned, internal improvements and agricultural education must wait, or at least drag along at a slow pace until the reaction comes.

And so, if without increased direct appropriations we are going to try and raise the standard of agriculture, how best can it be accomplished? To reach the German standard of productivity on five crops alone means that $1,400,000,000 will be added to the wealth of our farmers each year without cultivating an additional acre of land and in addition to this vast sum, a still greater amount from the enhanced acreage yields of all other crops. It is a big stake to play for and well worth any effort that can be made.

**HOW BEST TO INCREASE OUR ACREAGE PRODUCTION.**

The Secretary of Agriculture says that the production of our sugar at home will go farther toward raising our standard of agriculture than will any other one thing. The agricultural scientists I met in Europe last year told me that the production of sugar had been the greatest factor in the advancement of agricultural science in European countries. It should be patent to anyone that inasmuch as we are perfectly capable of producing at home the enormous quantity of sugar we annually import, we ought to produce it at home. In the second place, inasmuch as it takes all the money we secure from 13,000,000 acres of wheat to purchase the sugar we could produce from 2,000,000 acres of sugar beets, it would appear that we would make more money if we grew the 2,000,000 acres of sugar beets and turned the remaining 11,000,000 acres into meadows, and thereby increase our rapidly decreasing herds. But these reasons pale into insignificance when compared to the indirect agricultural advantages to be gained by producing our sugar at home. The main advantages come through rotating other crops with sugar beets and through the agricultural science which a beet sugar factory brings into a community.

European economists told me that if cane and beet sugar could be produced alongside of each other, the former at a direct cost of 2 cents per pound and the latter at a direct cost of 4 cents per pound, the 4-cent beet sugar would be the cheaper sugar for the nation, because the indirect agricultural advantages which are to be obtained through rotating with sugar beets amounts to even more than the entire cost of producing the sugar while sugar cane is an agricultural juggernaut which mows down and blights every other form of agriculture with which it comes in contact. Wherever sugar beets are grown every other kind of crop is produced to better advantage than where beets are not grown, but where sugar cane is grown no other crop is produced to advantage.

Every beet sugar factory is equipped with a corps of men skilled in agricultural science and these men are in touch with the farmers of the community constantly. Not only do they teach the farmers as to how best to grow sugar beets, but they teach them how to grow other crops, and, most valuable of all, they teach them the necessity and the science of rotation. In Europe a beet sugar factory is regarded as being as valuable to the nation as a government agricultural school, of which they maintain vast numbers.

**WHY SUGAR BEET CULTURE HELPS THE LAND.**

Before touching upon the results obtained by rotating other crops with sugar beets, let me give you a few of the reasons why these results are obtained:

In the first place, let me say that no sagebrush farmer, who farms sugar
beets in a slipshod manner can make a cent at the business. Shiftless farming methods may yield a small profit when applied to producing most of our other crops, but every farmer who does not take reasonably good care of his sugar beets will lose money on the crop. This is a fact which the factory agriculturists din into the farmers' heads from morning to night, and wherever you find farmers making money in growing sugar beets it is safe to conclude that in the production of this crop at least, they use better farming methods than do farmers who do not raise beets. In due course of time the employment of these better cultural methods extend to other crops and then you have a scientific farmer. In the next place, sugar beet culture rids the land of weeds, wild oats and other undesirable vegetation. And now we come to the greatest factor of all.

In plowing for grain, we usually turn the soil over to a depth of six inches, sometimes seven, but more often five. Beneath the soil we turn over, the ground is so hard the grain roots will not penetrate it and consequently all the nutriment our crops receive is drawn from the five to seven inches of top soil. To prepare the soil properly for sugar beets a sub-soiler is employed which stirs the soil to a depth of from twelve to fourteen inches. The general conception of a sugar beet is that it is one large root, but this is erroneous. In addition to the main root there are a multitude of small fibrous roots which nourish the main one (exhibiting beets showing fibrous root growth). These fibrous roots go down as deep as the earth is stirred and sometimes even deeper. When the main roots are plowed up in the fall, these fibrous roots are broken off in the ground, and, in rott ing, add humus to the lower strata of soil, also leaving minute interstices to the full depth that they have penetrated. When other crops follow beets, the roots, instead of going down only to the depth of the plowing, find the little enriched interstices left by the decayed minute beet roots and follow them down they draw nutriment from twelve inches of soil instead of from six inches of soil! In other words the culture of beets doubles the soil without adding to the acreage.

These beets were washed out of the soil and shipped to me here, by Dr. Harry B. Shaw, scientific assistant in sugar plant investigations for the United States Department of Agriculture at Garland, Utah, where the department is carrying on a large amount of experimental work. They arrived by express last night. Sugar beets are drilled in in rows, eighteen inches apart, and are thinned in the rows to eight inches apart. With a perfect stand, this gives over 43,000 beets to the acre. You will observe that while all of the longer fibrous roots, from the size of a pin to double the diameter of a knitting needle, have been broken off, many of them still are from one to two feet in length.

When dried, the fibrous roots attached to each beet perhaps will weigh only one or two ounces, possibly even less than an ounce. If they average but three-quarters of an ounce to the beet, they carry down into the under strata of soil over one ton of humus per acre. Is it any wonder that such wonderful results are obtained through rotating other crops with sugar beets? How much money do you suppose it would cost to purchase a ton of decayed vegetable matter and distribute it evenly over an acre of ground and then bury it to a depth of six to fourteen inches, where it is most needed? Such an operation on a field of any size would bankrupt any ordinary farmer. Yet this is just what the culture of sugar beets does for our farmers, and at no expense whatever. In fact, it does it for him and pays for the privilege.
of doing it, inasmuch as without considering this advantage, the beets themselves yield the farmer the greatest profit of any crop he can raise.

Besides this, sugar is carbon, hydrogen and oxygen (C₁₁₂H₂₂O₁₁), drawn wholly from the atmosphere, being merely the sunlight, the rain and the wind which sweep over the fields. The farmer who turns back all the by-products loses nothing from his soil, while with wheat, every 30 bushels carries away 62 pounds of nitrogen, 20 pounds of phosphoric acid, and 26 pounds of potash, fertilizing elements which today are worth $9.28 in the markets of the world.

KNOWN RESULTS OF SUGAR BEET CULTURE AS AFFECTING THE YIELD OF OTHER CROPS GROWN IN ROTATION.

And now as to the known results of beet culture as concerning the indirect agricultural advantages. I have a German report, made many years ago, which opened the eyes of all Europe and which to no small extent accounts for the prevailing desire in Europe to produce all the sugar possible and export it at a loss if necessary. In this connection I might state that the average yield of sugar beets in Europe in 1907 was 10.17 tons per acre, as compared to 10.16 tons the same year in the United States, a difference of but one-one-hundredth of a ton per acre in favor of Europe, and as the farmers of Europe get far less money per ton for their beets and more money per bushel for all other crops they raise than do the farmers of the United States, it plainly is to be seen that it is not the direct results which attract them to beet culture.

This German report I speak of, which I believe was made back in the sixties and seventies by a pupil of Prof. J. Conrad, the highest German authority on agricultural economics, is made up from an accurate record of thirty-five farms in Saxony of 500 to 1,000 acres each, the record being for a period of ten years prior to beet culture and five years subsequent to the adoption of beet culture on the same farms, showing in pounds per acre the amount of crops taken off before beet culture was introduced, and after beet culture was introduced when the crops were rotated with beets, beets being grown on the same soil once every five years.

Reduced to bushels, this report shows that on these thirty-five farms the average yield of wheat per acre prior to beet culture was 30.8 bushels per acre and that after beet culture the yield was 38.2 bushels. The present average yield for all Germany is 29.6 bushels and so it will be seen that in wheat production these farms prior to beet culture were above the present average yield of wheat, which is more than double our average yield. The rye produced on these farms prior to beet culture was 26 bushels per acre, a fraction above the present average yield of 25.7 bushels for all Germany and after beet culture it averaged 29.8 bushels. The barley yield on these farms was 34.8 bushels per acre, a fraction under the present average yield of 35.2 bushels for all Germany and after beet culture it was 43.6 bushels per acre.

The average yield of oats before beet culture was 42.3 bushels per acre and after beet culture it was 59.9 bushels, which is just above the present average yield of 58.3 bushels for all Germany. The average yield of potatoes before beet culture was 111.9 bushels per acre and 225.5 bushels after beet culture, which exceeds the present average yield for all Germany by 21.5 bushels. The yield of peas was increased 86 per cent through the introduction of beet culture.

Reduced to dollars and cents, the value of this increase in the yield of
other crops through rotation with sugar beets, far exceeded the gross amount received for the beet crop. In round numbers, Germany today grows 1,100,000 acres of sugar beets, the returns from which amount to about $50,000,000. In rotation with these sugar beets the German farmers cultivate some 4,400,000 acres of wheat, barley, oats, rye, and other crops, and from the excess yield of these other crops by reason of growing them in rotation with sugar beets, the German farmers receive over $100,000,000, or double what they get for their beets. Is it any wonder that Germany produces over 1,200,000 tons of sugar annually for export and is willing to sell it in the world’s market at a loss, when for every dollar’s worth of beets they grow, they get two dollars worth of excess of other crops? German officials told me that if by trade treaty we could enable them to market an extra million tons of sugar in the United States without injuring their other foreign markets, they would be willing to throw down all trade barriers to the United States and let our goods in there free of duty. They admitted that they would be by far the largest gainers by such a trade deal.

To produce at home the sugar we now import from foreign countries would require some 2,000,000 acres of sugar beets and by practicing a five-year rotation, would mean that we could grow 8,000,000 acres of wheat, barley, rye, potatoes and other crops annually in rotation with the beets. Based on the increase secured in Germany by rotation with sugar beets, a farmer who grows 20 acres of sugar beets and rotates with them 80 acres of cereals and potatoes, increases his annual revenue by over $2,500 a year, in addition to the money he gets from the sale of his sugar beets. The farmers who in like manner grow 5,700 acres of sugar beets to supply a 600-ton factory with beets enough for a 90-day campaign, will produce an excess of other crops which will bring them over $750,000 besides the $290,000 they get for their sugar beets, while the farmers of the nation in producing the beets from which to make the sugar we now import from foreign countries would get $102,000,000 for their sugar beets and $270,000,000 from the sale of the excess of other crops which they would produce through rotating them with sugar beets.

If we produced at home the sugar we consumed, the advantage of the cultural methods employed in growing the beets, eventually would become known and be adopted throughout the country as they have been in Germany, and then our extra yield of five other crops would bring our farmers an additional $1,409,000,000 a year.

Sugar beets are not overly rich in fertilizing elements, but by opening up and enriching the lower strata of soil, and making it pay tribute to the farmer, they increase the productivity of the land even more than do fertilizers, though to obtain maximum results, both should be employed. When we apply fertilizers, the only return for the expenditure of money and labor is in the increased yield of the crops, but when we apply sugar beets, we more than get back our money from the sale of the beets and we secure larger yields of the other crops which follow, than as though we had expended a large amount of money in applying fertilizers. What would we pay a ton for a fertilizer which in itself would return a by-product worth far more than its cost, and in addition, on the land to which it was applied, would increase the production of all other crops to a greater extent than will any other fertilizer we can buy? Considering the fact that sugar beets are one of the most profitable crops which a careful farmer can grow and the further fact that they so materially increase the yield of other crops, they come nearer
than anything else to disproving the old statement that “you can’t eat your pie and keep it too.”

**RESULTS OF SUGAR BEET CULTURE IN THE UNITED STATES.**

Unfortunately we have kept no such accurate records in this country as we have been kept in Europe, where thousands of owners know to a pound just what they have marketed each year from every field for generations while studying rotation, fertilization, soil treatment, etc. Only in rare instances can we go back and show what has been done in the past, but the universally marked effect of beet culture on the production of other crops have been so astonishing that many farmers now are keeping records of what their fields are yielding when rotated with sugar beets and wherever beet sugar factories have been established, the proof is at hand that the industry is having a more marked effect on the increase of yield of other crops than it has had in Europe.

I have the record of Mr. R. W. Kennedy, a young man in Michigan, who lives at Grand Ledge, and who is one of the door-keepers in the House of Representatives. He is not a farmer but he owns a seven-acre tract on the edge of the village, and three years ago, as a result of my talking with him, he planted the tract to sugar beets and sold his crop to the Lansing factory. He plowed deep and gave the beets the best of care and harvested an average of 14 tons to the acre. He hired everything done and felt that he did not make as much on his beet crop as he ought to, but the next year he sowed the tract to oats and harvested 95 bushels to the acre, as compared to an average yield for the state of 35 bushels per acre.

For ten years past, the average yield of wheat in California has been 12 bushels per acre. I recently received a report from near the Hamilton, California, factory, where a 135-acre field, which has been in sugar beets for two successive years, and was then sown to wheat, had been harvested and the yield was 56½ bushels per acre.

For ten years past the average yield of wheat in the state of Iowa has been 14½ bushels per acre. I have reports from about the Waverly, Iowa, beet sugar factory, showing yields of 35 bushels per acre where the wheat has followed a crop of beets. The average yield of corn in Iowa for the past ten years has been 32.5 bushels per acre, the highest average being 39.5 bushels in 1906. I have reports from farmers at Waverly stating that following sugar beets, they harvested a hundred bushels of corn to the acre, and the barley crop, which averages less than 26 bushels per acre, has jumped to 45 bushels, and hay, from 1½ tons to 2½ tons per acre.

Just as I was leaving Chicago to attend this Congress, I received three reports from Utah, as follows:

“W. T. Wayment, Warren, Weber County, Utah. Ten acres. Previous to raising beets this land produced twenty-five bushels of wheat to the acre. Beets were grown on the land for three years, after which it was planted in wheat again, producing forty-five bushels to the acre.” An increase of twenty bushels to the acre.

“J. F. Stoddard, Hooper, Weber County, Utah. Five acres. Previous to growing beets the land produced thirty-five bushels of barley to the acre. Beets were grown on this land for four successive years, after which the land was planted in barley again and produced fifty-five bushels to the acre.” An increase of twenty bushels to the acre.
“Thomas Jones, Hooper, Weber County, Utah. Ten acres. Previous to planting of beets this land produced twenty bushels of wheat to the acre. After growing beets for three successive years it was again planted in wheat and produced thirty-five bushels to the acre.” An increase of fifteen bushels per acre.

Anyone who will traverse the regions where there are sugar factories and look over the fields of corn or other crops where part of the acreage has been in sugar beets and part has not, can tell to a row just where the beets had been planted the year before.

The average wheat yield of the State of Colorado for the past ten years has been twenty-five bushels per acre, and now, where wheat is grown in rotation with sugar beets, forty to fifty bushels is considered an average crop and the general opinion about the sugar factories is that by rotating with sugar beets, the yield of all cereals has been increased from forty to fifty per cent.

I have mentioned only a few of the instances which have come to my notice, scores of which can be observed by anyone who will travel about any beet sugar factory in the United States. That sugar beet culture in itself, without taking into consideration the indirect agricultural advantage, is profitable, is shown by the fact that the longer a farmer grows beets, the more anxious he is to do so, and the further fact that in spite of the advice of the sugar company's agriculturists they will persist in growing beets on the same land year after year instead of but once in five years and meanwhile secure such enormously increased crops of everything else by practicing a scientific system of rotation.

Economically, here is the crux of the situation. Last year we exported 182,000,000 bushels of wheat, which we grew on 13,000,000 acres and for that wheat we secured the money with which to purchase the sugar which we could have produced from 2,000,000 acres of sugar beets. Each bushel of wheat exported, carried with it nitrogen, phosphoric acid and potash to the value of 31 cents, or a total of $56,000,000 worth of fertilizing elements which must be replaced to put the land in as good condition as it was before we took off the wheat. The sugar we brought back simply was the rain, the wind and the sunshine which swept over foreign countries and yielded us not one dollar's worth of fertilizing elements. Had we raised 13,000,000 acres less wheat and 2,000,000 acres more sugar beets, growing the 2,000,000 acres of sugar beets in rotation with 8,000,000 acres of other crops, we not only would have saved the $56,000,000 worth of fertilizing elements we exported, but would have increased the value of yield on the 8,000,000 acres of other crops by $270,000,000; our sugar beets would have yielded $103,000,000 and if the remaining 11,000,000 acres of wheat land had been put into some crop which returned but $7 per acre, that would have brought us $77,000,000 more. It thus will be seen that by abandoning the policy of exporting wheat with which to purchase sugar and producing our sugar at home, we will profit agriculturally to the extent of half a billion dollars a year, less the value of the wheat we now exchange for sugar, not to mention the building up of prosperous communities throughout the land, the enhancement in value of agricultural land about the factories, the market it would create for millions of dollars' worth of fuel and other supplies too numerous to mention and the employment of vast numbers of skilled and unskilled laborers.

Without expense to the nation or to the individual, but with great profit to our farmers and to the nation, we can solve the question of food supply by producing our sugar at home.
The sugar beet is of humble origin. It might be said that it hadn't even the advantage of gentle birth, though it has age to its credit.

After the fall of the Roman Empire, the returning barbarians carried back to Bohemia a scrubby little root which, however, failed to attract any particular attention at that time, and it was not mentioned again until 1705, when Oliver de Serre became convinced that it contained sugar. Nearly fifty years later Marggraf, director of the physical classes in the Academy of Science at Berlin, obtained real sugar from this little strayling, and in 1801 Aschard, a pupil of Marggraf, erected at Cunern, Silesia, the first beet sugar factory in the world.

This modest little root was not of such account then, for it averaged to weigh but a few ounces and contained less than five per cent. of sugar. Nor was Aschard's factory a pretentious affair, for it could produce only six tons of sugar per season and the sugar cost 30 cents a pound to produce.

At the Sugar Institute at Berlin I saw Aschard's original little filter press, which was about a foot square and at the time it was made it was thought to be impossible to make them any larger. We now make them a hundred feet in length.

In 1836, thirty years later, Germany had 3,250 acres in beets, which yielded 7.7 tons per acre. She had 122 little factories, which averaged to extract 5½ per cent. of the weight of the beet in sugar, sliced 208 tons of beets per factory and turned out 11 tons of sugar per factory per season.

Germany's beet sowings have increased from 3,250 acres in 1836 to 1,100,000 acres in 1907; the tons of beets per acre from 7.7 to 12.8; the sugar in the beets from 5½ per cent. to 15.7 per cent.; the sugar per acre from .43 of a ton to 2 tons; the number of factories from 122 to 369; the sugar produced per factory from 11 tons to 6,026 tons; and the total sugar produced per annum from 1,408 tons to 2,223,000 tons. Nor is this progress confined to Germany. Napoleon started it in France and all other leading European nations followed suit. From 4,500,000 acres Europe annually harvests 47,000,000 tons of sugar beets, from which their 1,300 huge factories extract 6,700,000 tons of sugar, which supplies not only their entire population, but furnishes nearly 3,000,000 tons for export.

It is a demonstrable fact that the average value of the sugar beet crop in Europe is in excess of $200 per acre and is more valuable than that in this country. From 4,600,000 acres of beets, Europe supplies her people with 3,900,000 tons of sugar, which would cost not less than 5 cents per pound, or $390,000,000, to import, if the tropics were levied upon to supply all, instead of one-half the world's consumption of sugar. In addition to this, Europe's exports of sugar, though made at an apparent loss, bring her $143,000,000 a year, on the basis of 2½ cents per pound. By rotating 4,500,000 acres of sugar beets with 18,000,000 acres of other crops, Europe secures an excess yield of the other crops to the average value of $22.70 per acre, based on our farm prices per bushel, or $410,000,000, a grand total of $943,000,000 cash returns through planting 4,500,000 acres of sugar beets, or $210 per acre, not to mention countless other advantages, both direct and indirect.

It is safe to say that since the creation of the world no other factor has had such an influence in the production of human food supply as has that pithy, fibrous, woody little root which the barbarians brought back from Italy and planted on the Bohemian plateau.
SOME POINTS

ON THE CARE OF THE SOIL

WITH

SUGAR BEETS

ALVIN KEYSER, Professor
Colorado Agricultural College
Experiment Station
Some Points on the Care of The Soil with Sugar Beets.

Alvin Keyser, Professor Colorado Agricultural College, Experiment Station.

There is a general complaint in all the Colorado Sugar Beet districts that the yield of beets and the yield of crops following beets is steadily declining. This complaint is based on real conditions and is not merely the result of exaggerated fancy. On the other hand, we know that the beet yield in European beet districts has steadily risen. Likewise the yield of all other crops in the beet districts has gone up. The reason for these wide differences is to be found in the different care of the soil. In the first place, most of our beet fields receive no cultivation from digging time until the following spring. The operation of beet pulling usually leaves the land very cloddy. The lumps are of large size and dry. Consequently they are not reduced by the freezing and thawing of winters. If they were moist they would slake down during the winter, but in our climate they are seldom moist. The soil left with the surface in this open, coarse, lumpy condition dries out and gets sadly out of tilth or condition. So much so that a good crop is rarely raised on such land until another winter has passed, a gross waste and inexcusable loss. Land out of condition cannot be put back into condition immediately. It takes time and work. The remedy in this case is to not let it get out of condition.

As the beets are removed from the land, the pullers should be followed with the disk harrow. If the lumps are very bad, a clod crusher can profitably be used. In this manner the soil is worked down into condition and a soil mulch produced on the surface. The mulch protects the moisture supply in the soil, preventing it from drying out, as is the case when left rough, open and lumpy. Thus the tilth can be maintained. The fertility is available for a succeeding crop instead of being locked up in incongenial lumps.

On soils which are very lumpy after the pullers, it would often pay to give a fall irrigation, where possible, and follow with cultivation as soon as the surface could be worked without puddling. The treatment outlined consists in keeping the soil in condition, not letting it get out. If the practice were generally adopted, the crops following beets would be more abundant and profitable.

The neglect of land after the pullers is a serious question and becomes more serious as time passes, as the lands are longer under cultivation. In Germany such a condition would not be permitted. An agricultural inspector, in the employ of the Imperial Government, would come along and say to the farmer, “It is time to work that lumpy field down into condition.” In a few days he would come along again and if the lumpy field had not been worked into good condition, the farmer would be taken into court to show
cause why the order had not been obeyed. If a good cause could not be given, the jail or a fine would result. Of course, such a system is impossible in this country. But the farmer who neglects caring for his land pays his fine, not to a court, but in unprofitable crops.

In Germany more than two beet crops on the land in succession is not permitted by law. A rotation of crops must be followed. In addition to the beneficial results from rotation, the German feeds his beet crop. Manure he must have, so stock is fed. If the stock returns a profit on the feeding, well and good. If not, the loss from feeding is charged to the cost of the manure. In addition to the manure, the German uses large quantities of commercial fertilizers. Thanks to the virgin mineral fertility of our soils, we do not as yet need commercial fertilizers, and will not for some time. But we do need better tillage after beets, more rotation and more manure. Tillage, rotation and manure are necessary to unlock the stores of mineral fertility we possess. Continuous beets “kill” the land, make it sticky and untractable. Beets not only destroy that tilth so desired, but they are gross feeders and sap the available plant food. So that in beet culture a rotation is necessary, not only for the beets but for the crops that follow. Beets respond wonderfully to manure. The beneficial effects of the manure may be seen in the crops following the beets. On a farm near Fort Collins, the owner says that with his best rotation he is unable to get over fifteen tons of beets to the acre. But with manure and rotation his yield rose to twenty-three tons per acre and the following crops were correspondingly better.

Three things are fundamental for the continued prosperity of the beet growing regions—rotation, manure and fall tillage of land after the crop is removed.