THE POTATO INDUSTRY OF COLORADO

BY

E. R. BENNETT

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THESIS

Economy in production is the key note in modern business. The growing of our three great food crops, wheat, corn and potatoes has to conform to this law the same as other productive industries.

In the early history of this country, the wheat that fed the people of the East was produced in the States where it was consumed. As soon as the great level plains of the West were brought under cultivation, wheat could be produced so much more cheaply than in the East that the farmer of the latter place was compelled to turn his attention to some other branch of farming. We believe the same thing is becoming true of the potato production. Since the potato came to be used as a food its use has steadily increased till now it is a staple food in all civilized countries. The potato crop of Europe represents more money each year than the wheat crop of the whole world. As the population of the United States increases, the total consumption of potatoes must increase. The consumption per capita without a doubt will also increase as it has done in Europe, for the potato is the poor man's food.

The question for this discussion is: Will the growing of the hundreds of millionsof bushels of potatoes to supply this demand in the United States be to a large extent localized as is the wheat production, And, Has Colorado and the

other Rocky Mountain States advantages for potato growing sufficient to make the potato industry, to these States, what the wheat growing industry is to the States of the plains?

In making a study of the probabilities of success in any competitive enterprise, there are many factors that must be considered.

In the order of relative importance these divisions of the discussion may be given as follows:-

FIRST, Climatic adaptability.

SECOND, Geographical position with relation to markets.

THIRD, Soil fertility.

FOURTH, Moisture control.

FIFTH, Insect pests and plant diseases.

SIXTH, Relative cost of production.

SEVENTH, Available land.

CLIMATIC ADAPTABILITY.

For a plant to make its maximum growth, it must have surroundings that are friendly to it. A climate similar to that of the habitat of a plant can generally be relied upon to produce the plant's best development.

The habitat of the potato (Solanum tuberosum) is in the mountain districts of South America. There the Spaniards

found it in use among the natives and the tuber was introduced from there into Europe by them. An interesting fact that has been observed by the writer in talking on potato culture to the Mexicans in Southern Colorado is that the name "papas" used for potato by these people is the same as that used by Pedro Cieça de Leon in his "Spanish Chronicles of Peru, 1550".

The potato still grows wild in the high mountain valleys of Western South America and Mexico and a species of the same genus (Solanum Jamesii) grows in the high mountain valleys of La Plata and Montezuma Counties in Southwest Colorado.

In the past the production of potatoes in the United States has been largely in the States along the Northern borders. Of the two hundred ninety eight million bushels of potatoes produced in the United States in 1907,☆ more than sixty per cent were grown in nine of the Northern States including Maine, New York, Pennsylvania, Ohio, Illinois, Michigan, Wisconsin, Minnesota and Iowa. At the same time by the same authority the price of potatoes in Michigan, Wisconsin and Minnesota was from forty one to forty five cents per bushel, while the price in Texas, Oklahoma, Alabama, South Carolina and Georgia, was

☆ Crop Reporter, U.S. Dept. of Agriculture, Dec. 1907.

from one dollar to one dollar and ten cents per bushel.

Plenty of evidence could be given were it necessary that in all the Southern States, the yield of potatoes per acre is low and the quality poor.

The habitat of the potato, the high production of the North and the high price of potatoes in the South are sufficient evidence to show the potato grows best in more temperate climates.

Experiments and statistics of yields show the potato delights in a climate of cool nights and warm days. The Northern States because of the high latitude have the required cool nights. The Rocky Mountain States, even as far South as New Mexico (in the high mountain valleys) also have cool nights, because of the high altitude. Then we may conclude that from the standpoint of temperature the two sections of the country are equal.

Another branch of climatic adaptability must be considered which, from the standpoint of the potato grower, is possibly more important than temperature. Something over four fifths of the composition of all plants is carbon. This element is taken directly from the air through the leaves of the plants in the form of carbon dioxide. Plant physiologists tell us that this process of absorbing carbon from the air takes place only in the presence of light and most rapidly

with most plants in the direct rays of the sun. The difference between these two sections of the country in the amount of sunshine is quite marked. Eighty five per cent of the days of the year in Colorado* are clear. During the growing season nearly constant sunshine is the rule. Many authorities attribute the great yields of grain and potatoes obtained in Colorado, more to this constant bright sunshine, than to either the natural fertility of the soil or to the control of moisture.

GEOGRAPHICAL POSITION WITH RELATION TO MARKETS.

It would seem that with a crop seventy-five per cent of which is water, and with the dry matter of low food value, that long distance shipments would be impracticable. This has been an important problem but is becoming less so as transportation facilities become better. During the past winter, potatoes from the British Isles were marketed in the United States as far West as Kansas City, Mo. At present one of the greatest advantages that Colorado has over the Northern States in potato production is in the fact of close proximity to the high priced markets of the Southern States. The home market for Colorado potatoes is of comparatively little importance as less than twenty-five per cent of the crop is con-

* Meteriological records, Colo. Agrl. Ex. Sta.

sumed in the State. The markets of Oklahoma, Texas, Louisiana and New Mexico are at present the competitive points for all the large shippers West of New York and Pennsylvania. The chief competitors of Colorado for these markets are Minnesota, Wisconsin and Michigan. These States have the disadvantage of a much longer haul and in winter have the increased danger from loss by freezing in transit.

These Southern States, however, are not the only market reached by Colorado potatoes. The potato shipments of the Greeley district, ordinarily reach Kansas City and Chicago on the East; frequently to Florida and Cuba on the South and to California on the West. Also the high class trade of New York City and the dining car service of the New York Central and Lake Shore Railroads have for several years been partly supplied with potatoes by Colorado growers. Therefore the market for Colorado potatoes extends over more than one half of the territory of the United States.

SOIL FERTILITY AS A FACTOR IN POTATO PRODUCTION.

Without a doubt the greatest single item of cost at the present time of crop production in the East is the artificial maintenance of the fertility of the soil. The enriching of the soil by the application of the three essential elements nitrogen, phosphorus and potassium in the form of commercial fertilizers is almost universally practiced in the East.

No data is obtainable as to the average cost of this material to the grower but according to different authorities it is between ten and thirty dollars per acre for the initial cost, beside the expense of application. The experiments of Prof. W. Paddock in Colorado shows that no increase in yield was obtained in the Greeley District from the application of any of these elements or from a combination of them. The soils of the West are naturally moderately well supplied with phosphorus and potassium salts, but are deficient in nitrogenous matter. In the rotation of crops the alfalfa plant is grown at least two years out of five on nearly all potato land. This plant has been known to send its roots into the soil in Colorado to a depth of fourteen feet. In this way the available phosphoric acid, potash and other mineral salts are brought to the surface and as the plant takes nitrogen from the air, the essential elements are provided in sufficient quantities without the aid of commercial fertilizers. The roots of this plant in penetrating the sub-soil also act as disintegrating agents so it may be said that Colorado soils are tilled to a depth of from four to fourteen feet, or to the water table.

MOISTURE CONTROL.

Other things being favorable, the yield and quality of potatoes in the rain belt sections depends upon the amount of precipitation during the growing season. If the rainfall is light, the yield is correspondingly light, but is usually

attended by good quality. On the other hand, if excessive precipitation occurs, the crop will be cut down or the quality seriously impaired.

In the irigated sections of the West, the loss from excessive precipitation is very unusual and while the quality of the product is frequently impaired by over-watering, the outcome as to yield and quality is a matter of skill with the growers rather than chance with the weather. The argument is sometime advanced that the labor involved in irrigating in the West is a serious handicap in the competition with the East. Careful estimates☆ as to the cost of irrigating potatoes in the Greeley District, show this to be about one and one half dollars per acre. This we believe is off-set in the rain belt states by the time lost from unfavorable weather conditions.

INSECT PESTS AND PLANT DISEASES.

In a general way new countries, are less troubled with insect pests and plant diseases than the older farm communities. Reasoning from this standpoint, we would expect that while the West has comparative few troubles along these lines at present, it would be only a question of time when all

☆ Bulletin 117, Colo. Exp. Sta.

the pests of the East would be equally as troublesome in the West. The facts in the case, however, do not justify this conclusion even with insects.

The striped potato beetle (Doryphora decemlineata) is a native of the East slope of the Rocky Mountains, and may be found in the potato fields of Greeley and living on the various species of wild Solanums that grow on the plains. The insect is kept in control in Colorado by its natural enemies to such an extent that the damage done by it is not usually noticeable even in the Greeley District and on the West slope the insect is unknown.

Two soil fungi, Corticum vagum, and Fusarium, do considerable damage on certain type of soils. These fungi are notpeculiar to Colorado or the West, however,. Both are known in the East but possibly do less damage than in the alkali soils of the West. No specific treatment for these diseases is known and in consequence the yield of tubers obtained is not at an increased cost because of them.

The dreaded late blight (Phytophthora infestans) that causes the great loss to the potato crop in the East has never as yet appeared in the arid sections of the West. The question of the possibility of this fungus becoming prevalent in the West is often brought up. In a general way the dry climate of the arid sections is not conducive to the growth of any of the mill-dews, scabs, rusts or other fungi that work on plants

above ground, so that the West is comparatively little troubled with this class of fungi. The potato blight fungus particularly demands a humid, cloudy atmosphere for its development, even in the East. Many affected tubers are brought to Colorado from the East each year and as yet this fungus has never, so far as known, appeared in the State. With our knowledge of the nature of this disease and the fact of its not having appeared here would lead us to think that we are justified in saying that the Colorado grower need have no fear of this dread pest. In the East the spraying of the potato plant with Bordeaux mixture to prevent this trouble, brings to the grower an added expense in growing the crop of from five to ten dollars per acre.

RELATIVE COST OF PRODUCTION.

A comparison of cost of production of potatoes between the East and the West is somewhat difficult owing to the difference in methods of culture. The cost of the seed, preparation of the land and planting is practically the same for each. The cultivation of the land after planting is probably somewhat more expensive in the East than in the West because of the necessity of more or less hand work in preventing weeds. This may be partly offset by the ditching for

irrigation required in the West, though the ditching practically takes the place of one cultivation. The work of application of the water to the potato fields of the latter, an expense of between one and two dollars per acre, together with the rent value of the water used, approximately two and one half dollars an acre, are practically all the items of difference to offset the cost of the commercial fertilizer, its application and the spraying for insects and fungus diseases of the former. Altogether the cost of the production of potatoes in irrigated sections is not far from thirty-five dollars per acre. The yield of potatoes per acre for Colorado as given by the statistics of the U. S. Department of Agriculture for 1907, was 150 bushels as against 90, 98 and 97 for Michigan, New York and Wisconsin respectively. This yield in Colorado included much land in the Eastern part of the State not irrigated and a considerable irrigated land that is not adapted either by climate or character of soil to potato production. The yield of potatoes in the sections of the State that are adapted to this crop have for at least the past few years been not less than 100 sacks or 200 bushels per acre. Therefore, the cost of producting and putting the crop on the market in these favorable sections of the State is from 15 to 20¢ per bushel.

The price of land in these sections might be considered to have a deterent influence on the development of this industry in the West. It is true that land in the Greeley District (the oldest District of considerable size in the West that produces potatoes) sells at from $100 to $250 per acre depending on distance from shipping points and quality of land. This price of land, however, is largely the direct result of the income from the potato industry for the past thirty years, so it can hardly be expected to have that effect.

AVAILABLE LAND.

The argument that has been used most by the producers of the specialized crops of the East and by the land owners there, is that the amount of land in the West that can be economically irrigated and that is adapted to this industry is too insignificant to be considered. This comes, however, only from a misconception of the agricultural possibilities of the West. It is true that the plains of the East slope of the Rockies that can be watered, have been largely developed. Probably the Greeley potato growing district will never become, owing to a lack of water for irrigation, more than twice its present proportions. That would mean, at the present proportion of land planted to potatoes each year, a production of from eight to twenty million bushels annually. The mountain valleys on the other hand, have, we might say, hardly been developed

enough to estimate the possibilities. The San Luis Valley, a mountain basin at the head of the Rio Grande River, in Southern Colorado, is a tract of land as large as the State of Connecticut. This basin of over three million acres can and may some day in the not distant future all be irrigated and cultivated.

The record yield of potatoes for the State of Colorado, 847½ bushels on a measured acre, was obtained by R. A. Chisholm at an altitude of 7,800 ft. in this valley. If one tenth of the land in this Valley were to produce 200 bushels of potatoes per acre, the total yield would be more than one fifth of the annual potato supply for the United States.

An estimate of the available land in the other valleys is impossible to make accurately. That covered by the Gunnison Tunnel project in the Uncompahgre Valley is 165,000 acres. This with the land of the North Fork and that above the Gunnison Tunnel water, would make from two hundred to two hundred fifty thousand acres for this valley. The Valleys of the Roaring Fork, Crystal, Eagle and Grande Rivers are already noted for the quality and yield of their potatoes, yet but a small part of the land in these valleys is developed. From one half million to one million acres of land in La Plata, Montezuma, San Miguel, Delores and Western Montrose Counties, still in the wilderness, are largely adapted to the culture of

this crop and will undoubtedly become in the near future one of the most productive districts in the country. Again, Middle and North Parks and the great valleys of the Yampa and White Rivers contain unknown resources in agricultural land.

All these various sections of Colorado are to a large extent as well adapted to potato culture as those which have already become famous for this product, and easily have a possibility of producing along with the practiced rotation of grain and alfalfa one hundred million bushels potatoes per year.

C O N C L U S I O N .

In summing up the possibilities for potato culture in Colorado, we find first, the Rocky Mountain States have, particularly at the higher altitudes, a climate that, from the standpoint of temperature and sunshine, is adapted to induce the greatest development of the potato plant and the highest quality of tubers.

Second, the geographical position of Colorado is such that the highest priced potato markets of the United States are in close proximity to the grower, and the central location in the country gives the State an advantage in shipping to any place where a shortage in crop may occur.

Third, the potato soils of Colorado are sufficiently

fertile so that with the rotation of crops practiced, a maximum yield of potatoes is obtained and the fertility of the soil is maintained without the use of commercial fertilizers.

Fourth, with an insufficient rainfall, loss from too much water is unusual. On the other hand, irrigation puts in the hands of the grower the power of supplying the water at such times as will give the crop the opportunity for its best development.

Fifth, the damage to the potato crop from insect pests such as the Colorado potato beetle, has been comparatively small, because of the insects control by its parasitic enemies. The little black flea beetle and insects of that character have caused some trouble, but not more than in other parts of the country. Plant diseases caused by fungi and bacteria, cannot in any way be considered a menace to the industry. Nothing but soil fungi cause trouble and these only under certain conditions of soil and temperature.

Sixth, from a practical standpoint the history of the industry bears out to a large extent the theoretical advantages that have been mentioned. The cost of production per acre is hardly more than two thirds that of the Eastern States.

The yield per acre has been, even with the poor system of growing practiced in some parts of the State, about one half more than that of Michigan, Wisconsin and Minnesota. The average selling price for the past ten years at the local stations in Colorado, has been 65¢ per hundred, which with a 100 sack yield, leaves a net gain of 30¢ per hundred, or $36 per acre.

The total yield of the State has not been large as compared with the production of the United States, yet enough of the crop has been marketed in competition with the other big potato producing states, to show that Colorado potatoes can be sold at a profit to the growers in competition with any of the larger potato producing states.

With all these advantages for growing and marketing and the opportunity of development, we believe Colorado and its neighboring mountain states are destined to become the great center of production for this industry in the United States.

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