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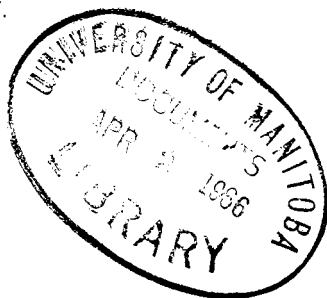
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The Agricultural Experiment Station

OF THE

Agricultural College of Colorado.

Investigation of the Great Plains.
Unirrigated Lands of Eastern Colorado.
'Seven Years' Study.

—BY—



J. E. PAYNE.

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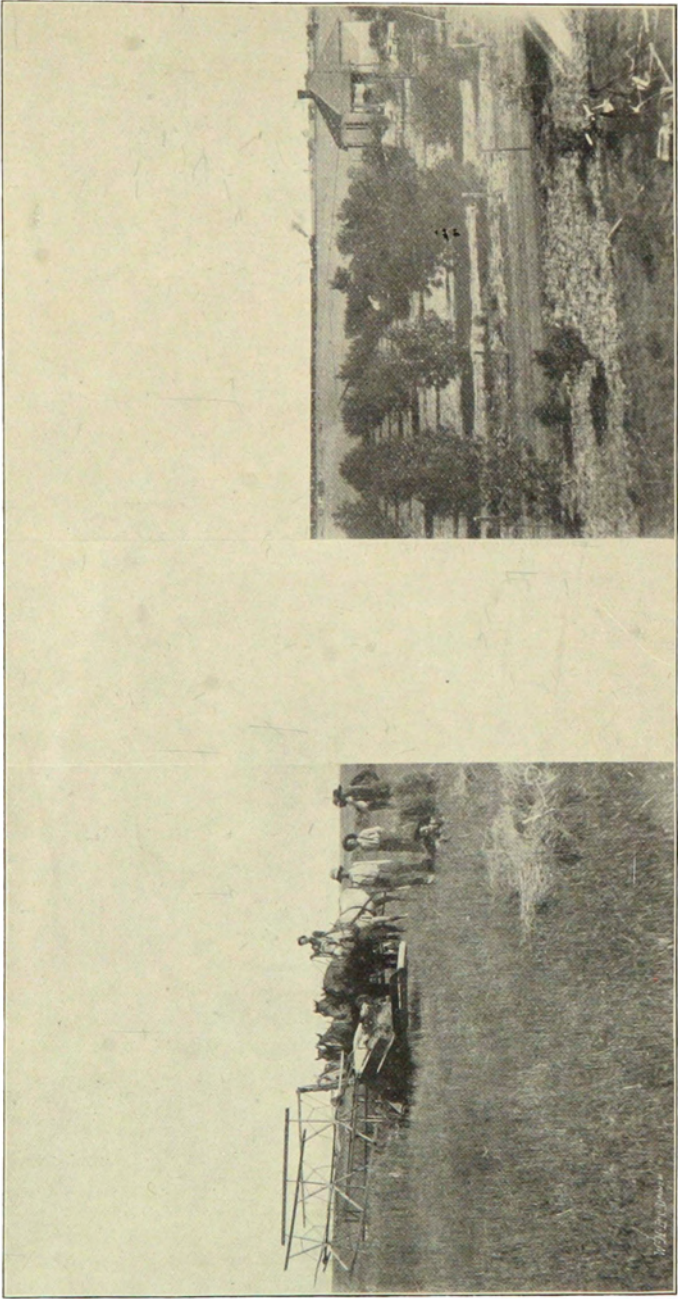
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Twelve-foot binder at work near Wray, Colo.

A part of the orchard, and residence at the Plains Substation.

Unirrigated Lands of Eastern Colorado.

Based on a Study and Residence
of Seven Years.

By J. E. PAYNE, M. S.

After spending seven years on the Plains, three of which were devoted to traveling and making a special study of the country, and collecting information concerning the results obtained by settlers, we give the statements contained on the following pages to the public.

We are often asked, "Can a man make a living on the Plains?" The only answer which can be safely returned is, "It depends upon the man."

Soil. The soil of the country is quite fertile, as a rule, and whenever it is watered sufficiently at the proper time—either by rainfall or irrigation—abundant harvests are reaped. The most of the soil of the region would be classed as sandy loam. But there are large areas of heavy clay soil, and some which is called "adobe." With some exceptions, the more clay there is in the soil, the more water is needed to raise a crop upon it. Good crops have been raised on some dark sandy soils with very little rainfall. On the "adobe" soil "dry farming" is a failure.

Rainfall. The average rainfall of the country is between fifteen and twenty inches. Records kept for a few years indicate that it is not far from seventeen inches, but they have not been kept long enough to be considered reliable.

Wind. During only a few days in any year is there a dead calm. There is nearly always a breeze, varying in velocity from four to forty miles per hour. At first, this seems hard; but when we consider that nine-tenths of the stock must depend upon water pumped from deep wells, we realize that the wind is an extremely valuable free power, and decide to put strings on our hats and not complain.

Sunshine. Eastern Colorado is eminently a land of sunshine. Very few cloudy days occur. Probably, 300 days in the year are

clear days. If the sun-motor is ever perfected, it will be a great help to this region, for on days when the wind does not blow the sun shines, and the sun-motor would do the work now done by horse-powers and gasoline engines.

Hail. During the eight years we have been at work at Cheyenne Wells, several hailstorms have struck the place. However, no hail sufficiently severe to kill the trees has yet struck there. We doubt that fruit trees and crops generally are destroyed by hail any more frequently there than in irrigated regions of Colorado.

Natural Vegetation. Vegetation grows according to the water supply. Most of the country is covered by short grass. In some places, not more than one-fourth of the ground is covered, while in other places where extra water runs on from surrounding land, the grass makes a complete mat, covering the whole surface. The sand hills and the black sandy land support a variety of tall-growing grasses, which usually grow in bunches, but often grow two to three feet high. The low places often support different species of *Agropyron*, or Colorado Bluestem — which starts early in the season and matures early in July — making its growth during the season of maximum rainfall. This grass is called “wheat grass” by many, and its habits may be a hint for those who wish to depend upon wheat raising in the plains region. Some do think that if they could get a variety of wheat which would mature by July 4th, it would be practically sure to produce a crop every year. The region between the Arickaree and the North Fork of the Republican River, lying east of the sand hills, appears like a piece of country taken from two hundred miles east of its present location and set down in Eastern Colorado. Along the Black Wolf and Dry Willow are fringes of trees and plum thickets, and wild grapes are quite common there. The rainfall is about the same as in other parts of the Plains.

Water. The water courses of the Plains are mostly sinuous lines of sand of width rudely proportionate to the areas drained. They may carry no water for one or two years, and then a heavy rain may come which changes them to raging torrents. The water does not *run* down their courses; it just tumbles, scooping out great holes here and making immense sand dykes there. If there is enough water, some of it joins some running stream, but as frequently, it tumbles along over the sandy bed until all is used in saturating the upper layers of sand. The surplus caught in the water holes goes into that indefinite, much-dreamed-of body of water called the underflow. Sometimes this underflow of the plains streams follows the course of the present sand-bed, and sometimes it does not. The Plains seem to have an infinite num-

ber of underground streams of varying width. Some are very narrow, and some are so wide that there are regions which are said to be underlaid by "sheet-water." This suggests the possibility of the existence of an underground water system consisting of rills, creeks, rivers and lakes on the Plains. Also, in the same connection, it must be admitted that hills and mountains exist there. If we could strip the country of the soil so as to uncover the shale beds and water bearing sands, it is likely that we would discover a country not so level as now exists there, but with many hills which are now under hollows, and many streams of various sizes trickling through beds of sand much the same as the waters of the Big Sandy pass through its vast sand bed. There are now quite a number of streams in Arapahoe, Washington and Yuma counties whose outlets are covered by sandhills. One of these in Washington county is over two hundred feet wide where the B. & M. railroad crosses it, but it ends on the west side of a big sandhill. The visible streams of water are few. The Big Sandy shows open water at intervals along its course. This stream seems to have an underflow which follows the course of its sand-bed, although it seems to be much wider in places. The Smoky Hill River in Colorado is crossed at intervals by an underground stream which does not follow the course of the present sand-bed any great distance at any place. The South Fork of the Republican is a visible stream for a few miles just east of Flagler, where it runs over a bed of shale. It then goes under the sand, and does not again appear until near Tuttle. From Tuttle to Benkelman, Nebraska, where it joins the North Fork of the Republican, it is a visible stream. The Arickaree River rises near River Bend. It has no known underflow corresponding to its sand-bed until within a few miles of Cope, at the townsite of Arickaree City. Open water appears several miles below Cope, and a small stream is constant in flow between that point and Haigler, Nebraska, where it unites with the North Fork of the Republican. The North Fork of the Republican is a good stream from its source. It is formed by the union of several spring streams in the sand-hills west of Wray.

When the country was occupied by the stockmen, they took possession of the open water, using the range as far out on the flats as their stock could graze from water. They sometimes pushed their cattle out onto the flats when the lagoons were full of water from rains, but as a rule the flats were not used very far from the streams. Those men seem to have seldom thought of pumping water from deep wells for their stock. But, when the country was settled by farmers, they began to dig deep wells. Their necessities caused the introduction of well-augers and well-drills and powerful force-pumps. Windmills were also improved to meet the needs of the times. Soon wells were found in large

numbers on "the flats," which before could be occupied a short time only each year by cattle on account of scarcity of water. Now almost every settler has his own well and windmill, and the grape vines and cherry trees are increasing.

Settlement. The tide of settlers which filled Western Kansas in 1883 to 1885 overflowed into Eastern Colorado in 1886 and 1887. Kiowa and Cheyenne counties were settled thinly; Kit Carson county was nearly all filed upon—especially the eastern half of it; the Idalia and the Vernon divides were settled thickly—all land on the Vernon divide being filed upon, and all as far west as Kirk postoffice on the Idalia divide being occupied. Then, on the west of the sandhills, the country near Thurman, Lindon and Harrisburg was all taken up. All land near lines of railroad—either real or projected—was taken also. Washington county was thickly settled along the B. & M. railroad.

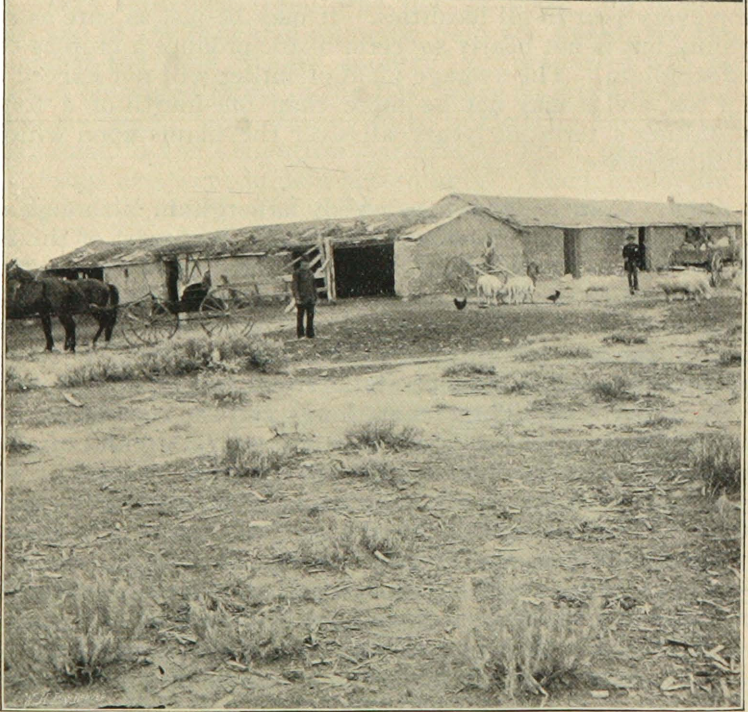
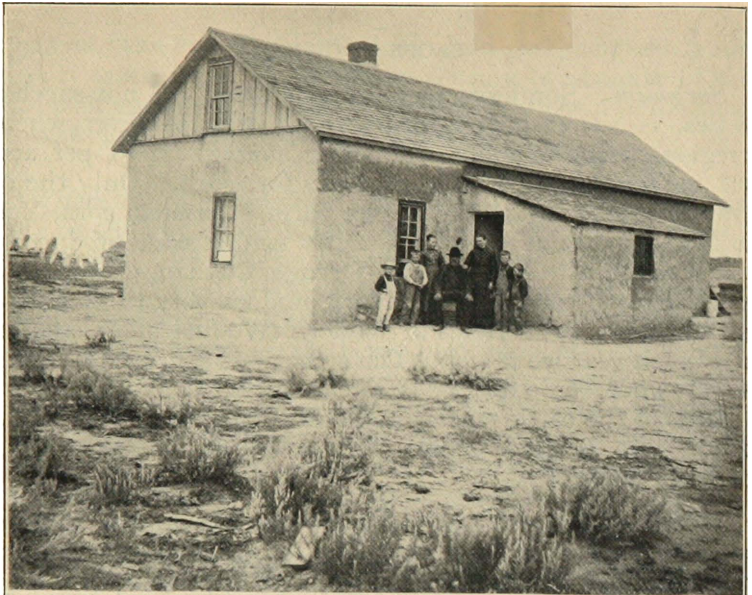
Successes and Failures. The years 1888 and 1889 were quite good years for crops, 1890 was not so good, but 1891 was better, and in 1892 such an immense crop was raised that the settlers called the land "God's country" and wondered why people remained on rented farms in the East when so much free land lay out in this region "only waiting to be tickled by the skill of the husbandman to yield bountiful harvests." Then, people planned large things and went in debt accordingly. Then came the partial failure of 1893, and following this the complete failure of 1894. The year 1895 was much like 1893. In 1893, many left the country. More left in 1894, and in 1895 nearly all who could get away, went. Those who stayed received some help from friends, and worked together to help themselves, and in this way lived through. Each year since 1895, they have raised fair crops. But recognizing the fact that the cows and the hens had saved the country from returning to its old time use as a cattle pasture, the settlers have taken to stock raising, and now the country is upon its proper feet. When the settlers first came in, they attempted to live by grain farming alone. They were taught that grain growing is not the proper basis of successful agriculture on the Plains. They have learned that farming without stock soon impoverishes the man in this country. The country is now resting upon the three legs which are strong enough to sustain it, if used intelligently, through all generations. These are stock, winter forage and summer pasture. It is possible that they may use some cows for dairying when beef cattle prices again go as low as they were in 1889-'94. But the cows are in the country, and they are well distributed now so that no one need leave because he has no cow to tie to.

CROPS GROWN.

Sorghum. Sorghum, including the sweet and non-saccharine varieties, is successfully grown without irrigation everywhere in the region except on adobe soil. The average yield per acre is about one ton, taking a series of years for a test. Only the earliest varieties produce seed. Brown durra, Jerusalem corn, Yellow Milo Maize and some strains of Early Amber cane produce seed; but Red and White Kafir, Early Orange, Colman, Collier and all later varieties of cane and Kafir corn produce very little seed; but these all give good yields of fodder. We find more cane being planted each year we travel. The acreage of sorghum in a neighborhood where crop raising is attempted at all, is a fair index to the status of the cattle raising industry there. In 1900, very little sorghum was planted on the Vernon divide, but in 1902 I saw quite large fields of it.

Millet. This crop is widely grown, and in some neighborhoods is more popular than sorghum. It is not nearly so sure a crop as sorghum, and therefore cannot be depended upon to give a crop every year in all localities. It may be just as sure as sown sorghum, but is not nearly so certain to produce a crop as cultivated sorghum. The average yield of millet will not exceed one-half a ton, and it may not be more than one-fourth of a ton per acre, taking a term of years all over the plains upon which to base an estimate.

Corn. Corn is grown as widely as sorghum, although it is somewhat unpopular in some localities. Over most of the territory a variety is in use which has been developed by the conditions peculiar to the region. It is a low-growing Flint corn. The ears often set on the stalks barely above the surface of the ground. This corn suckers bountifully, so that if the season is a wet one there will be quite a bunch of stalks from the two or three grains planted in one hill. The ears are long, and the cobs large. The grains are so hard that the corn should be either ground or soaked before being fed to horses or cattle. Hogs seem to enjoy grinding the grains, and do well on it, as it seems to be especially rich in protein. This variety, called Mexican corn, is generally grown in the region, except on the Vernon and Idalia divides, where they usually get better results by growing Dent varieties. Outside of the Vernon and Idalia divides, and the black sandy land, the yield of corn is hardly worth mentioning, although some years forty bushels per acre are produced. But the price of grain is usually so high that a very small yield will pay for the work of raising it, and they count upon getting fodder anyway. The average yield of corn on the Vernon divide is probably twenty bushels per acre. On the Idalia divide it will probably average fifteen bushels in a



Grout house of J. Schaal, near Yale, Colorado.
Corrals of J. Schaal, near Yale, Colorado.

series of years. Some years yields are much higher than these figures, and some men may have attained yields averaging much above this for a long term of years, but for the whole district these figures are not far from correct. Some men, single-handed, are cultivating one hundred and fifty acres of corn by the use of improved machinery and a good supply of horses.

Wheat. Wheat growing as a specialty is almost a thing of the past in Eastern Colorado. Men have learned that planting wheat after wheat continuously does not pay. This year we found that wheat following corn yielded about double what wheat following wheat was yielding. This has made corn growing more popular, reduced the acreage of wheat, and has forced people to diversify their crops and engage more and more in general farming, with stock raising as a basis. The yield of wheat on the Vernon divide averages about ten bushels per acre. On the Idalia divide the average is about eight bushels. In the remainder of the territory wheat is so seldom threshed that it would be unfair to publish any estimate, as as high as forty bushels per acre have been harvested, and many years the wheat has been cut for hay when very fair yields might have been obtained. In fact, during the past five years, wheat has been sown more for hay in Kit Carson county than for grain.

Oats. Oats are sown for hay in eastern Kit Carson county, and more or less in all other neighborhoods, except the Vernon and Idalia divides. On the Vernon divide oats average about twenty-five bushels per acre, and on the Idalia divide about twenty bushels.

Barley. This crop is not sown much anywhere in the region studied. The variety raised is one used for feed. Very little is sown outside the Vernon and Idalia divides. There, the yield is usually a little better than the yield of oats.

Rye. Some early varieties of spring rye seem to be gaining favor as a hay crop. There was more rye grown in 1902 than in any other year we have traveled on the plains.

Spelt. This grain is gaining favor also. In July, 1902, I saw a field of fifteen acres of spelt near Vernon.

Trees. Honey locust, black locust and ash are the trees which do the best on the Plains, although elms seem to do quite well if planted among other trees. The hackberry is a native on the Plains, but I have never seen any growing except near streams, or where water was close to the surface. Nearly all the timber claims planted in the early settlement of the country have been abandoned. Just enough trees are alive to show what trees can be

depended upon if given extra care. Upon this subject very little can be added to what was said in Bulletin 59.

Fruit. Of the thousands of orchards planted, only a few trees are alive to show what kind of fruit can be raised in the country. Continued observation has merely confirmed the statements made in Bulletin 59. Gooseberries, native currants, plums and cherries are reasonably sure to produce crops if given especial care. Apples will give crops periodically if not irrigated, and if irrigated are as sure as in other localities. Fruit gardens with facilities for irrigating from wells are growing in numbers year by year.

Irrigation from Wells. As wells are from 80 to 260 feet deep, only very small areas can be profitably irrigated from them. But nearly every settler now tries to have a few square rods of irrigated garden near the well. Some were extremely successful and some were failures; but each succeeding year shows an increase in the number of successful ones. If the sun-motor which is now being worked upon is ever perfected, it may revolutionize the problem of irrigation from deep wells. The main problem will then be to find enough water underground to supply the pumps.

Irrigation from Streams. A few hundred acres are irrigated from each of the main streams. Engineers who have made surveys claim that the flow of the streams is not sufficient to pay for taking the water out onto the flats, and the regular flow is already appropriated for land in the valleys anyway. The fall of the country is so great that ditches two to five miles long would carry the water out onto the flats most anywhere in their courses. If irrigation is ever developed in this region, it must be by catching and holding storm water for use. If a system of low dams for turning the flood water of these streams into reservoirs could be built, beginning at the sources, 5 to 10 per cent. might be irrigated. But this would involve a large outlay of money and labor, and it is to be thought of as a long way in the future. The country is developing along lines of least resistance now, and it is likely to continue in the same way.

Neighborhoods. Kiowa, Cheyenne and Kit Carson county, south of the Rock Island railroad, are quite thinly settled, and stock raising with very little winter feeding is the rule. Only a small quantity of this land has been homesteaded. Settlers live from two to ten miles apart. When claims join, they try to divide the range. Along visible streams and known underground water-courses the land is usually all taken and the stock range over the unoccupied land on each side of the settlement.

Kit Carson county, north of the Rock Island railroad, was quite thickly settled in the eastern half of the county. The settlers who still live there are from one to five miles apart. At Yale post-office there is a small district which is settled solidly. Crop failures in 1893 and 1894 thinned the settlement. In some neighborhoods, the depopulation was made permanent by uncertain water supply. The settlers now in Kit Carson county have settled down to stock raising with farming as a side issue. There are still a few men who say that they cannot afford to raise feed for their cattle any more than enough to carry them through the storms.

Arapahoe county on the Idalia divide as far west as Kirk postoffice was all filed upon. Settlement thinned in 1893-95 on account of crop failures, but people are still too close together to keep their cattle at home during the summer. It is the custom to send the cattle to the thinly settled districts for pasture. On this divide wells are plentiful, but they are from 100 to 260 feet deep.

The Vernon divide lost much of its population in 1894 and 1895, but has regained it since. Practically all of the land on this divide is in private hands, and unimproved land is selling at \$1,000 per quarter section. Except upon a small area of about twelve square miles south and southeast of Vernon, wells are sure on this divide. Water is found at from 90 to 100 feet.

Lindon and Harrisburg lost all population except a few families. Within the last two years some good wells have been found in the neighborhood, and a few ranchmen have quite a number of cattle in the neighborhood now.

Near Akron and Yuma, and along the B. & M. railroad, where nearly all the land was once filed upon, settlers are from two to eight miles apart now. But there is a tendency for new settlers to crowd in there again.

THE LIVE STOCK INDUSTRY.

From the nature of the conditions the live stock industry must always be the main business on the plains. The problem before those who would use the country is: How much stock can be kept on a specified area?

The methods of handling stock are changing gradually from the range system with no feed, to feeding with winter shelter. As the ranges become more crowded, more feed is used during winter. Evidence now seems to show that much of the country will at some time be used as a summer range only, and the cattle will be fed during the winter in adjoining districts where crops of forage are raised.

There is a growing feeling among the wealthier cattlemen that it pays best to use their ranges for the summer only, and bu

young stock in the spring to be sold in the fall. Others are taking up the idea of producing forage on a large scale so that they can feed all stock whenever it is necessary. Still others count upon moving all cattle to where there is plenty of feed and hiring them wintered. It is noted that farmers on the Vernon divide now often take cattle to winter. But the greatest number of cattle will undoubtedly be raised by men who own bunches of from twenty-five to one hundred and care for them by the work of themselves and their families. These people can make a living by milking a few cows when cattle are low in price, and then they can turn the milk more towards beef making when cattle are high.

My travels on "the divide" south of Denver gave me some idea of the possibilities of the dairy business on the plains. Some of the settlers on the plains are now using hand separators and shipping their cream. This simplifies dairying and leaves the skim milk at home for the calves, and at the same time it materially lessens the labor connected with dairying.

Poultry. Some people have made quite a success in raising poultry. The sunshine of the plains, when combined with proper feed and care, makes the laying hen extremely popular. The production of winter eggs, combined with winter dairying, has proved extremely profitable on a small scale in a great many cases. One woman who kept accounts showed me a record of 100 hens for a year. The eggs had given a profit of one dollar per hen for the year, and she had raised 190 chicks besides. Another woman raises several hundred chicks every year, using incubators and brooders. She buys the eggs for hatching from her neighbors as she keeps no roosters. All young roosters are sold when they reach broiler size. The pullets are kept for the production of winter eggs. She raises mostly Leghorns. Of course, there have been many failures in the poultry business on the plains also—failures too numerous to record. Those who succeeded in the poultry were very careful hands, and they have made a thorough study of the business from the beginning.

GENERAL OBSERVATIONS.

Since beginning the investigations, the country has been constantly improving. The houses built of sod from sandy loam soil do not usually stand much more than fifteen years, while those made of adobe soil last indefinitely. However, the sod roofs soon become leaky and need frequent replacing. We find many sod roofs replaced by shingle roofs, and it is rare that the old sod house is replaced by a new sod house nowadays. In nearly all cases wooden houses have taken the place of the "soddies" when they became uninhabitable. When first traveling over the country in 1900, we found very few who were intending to stay in the coun-

try. Each year we have traveled, we have found more people who were improving their places and deciding to stay and make real homes for themselves. The result is that permanent improvements are taking the places of temporary makeshifts which were put up to last until the owners could get away. And now, not so many places have the "I want to sell out" appearance once so characteristic of nearly all.

Near Vernon and Wray, the farmers are becoming comfortably fixed. Many of them are connected with each other by telephones. Once last summer while staying over night at one of the farms an orchestra was called up and all on the line enjoyed a very entertaining concert. This may surprise some who think of the whole country as but little better than a desert.

CULTURE.

The practice of the most successful farmers is to plant all crops which are cultivated during growth with a lister. The harrow is often used in cultivating until the plants are so large that it would break them if used. Gang weed cutters are used by many for cultivating listed corn after it is too large to be cultivated with a harrow. The ordinary shovel cultivator is used for the last cultivation. Some are listing their ground east and west in the fall and listing again in the spring. The fall listing is done in order to catch the winter moisture. The method of culture which is most successful is the one by which a soil mulch is maintained throughout the growing season so as to prevent excessive evaporation. Very few men prepare ground for wheat with turning plows. The cultivators and disk harrows have been found more satisfactory in preparing ground for wheat. One man claims good gains in yield by listing his ground east and west in the fall and discing in the spring. Sorghum is sometimes sown, but is much surer to produce a crop if it is planted with a lister and cultivated. It has been found that much of the winter moisture can be saved for the crop by discing the land in March. Sometimes this will save a crop. Wheat following corn is now giving the best returns in wheat seed. Wheat sown between March 1st and March 15th seems to give the better average yields than later or earlier sowing.

CONCLUSIONS.

1. The country is improving rapidly.
2. The sod house is disappearing. In a few years "soddies" are likely to be rare, except on newly settled places.
3. When prices of cattle are low, the "dual-purpose" cow is likely to become prominent, and creameries and cheese factories will receive support from the owners of small herds.
4. The production of winter eggs should be a good business on the plains.
5. If the country continues to settle up, in a short time all stock must be fed and sheltered during winter.
6. The stock industry is in a transition stage. Unless methods change, a herd of more than 300 cattle owned by one person will soon be rare.
7. Sorghum is rapidly gaining ground as a forage crop, because it is one of the surest crops known where droughts are common.
8. The number of acres it takes to sustain a cow is estimated at from ten to thirty. With a large area of carefully selected land in drought resistant forage crops the number of animals which could be kept in the country could be increased considerably.
9. The Vernon and Idalia divides, especially the Vernon divide, must be considered as farming districts. These communities raise grain for sale practically every year, and they can be depended upon for supplies of winter feed for cattle which graze in the thinly settled neighborhoods in the summer. Many farmers near Vernon now take cattle to winter, and the evidence indicates an increase in this business in the future.
10. In all districts except the Vernon divide and some parts of the Idalia divide, it will probably pay best to confine the farming to raising rough feed for wintering stock.
11. Stock raising must be the basis of all successful agricultural efforts in this region, and crop raising should be generally attempted as an aid to stock raising.
12. Each home can have a few trees, which can be kept in good condition by using the waste water.
13. Some men will fail on the Plains; but we must consider that success or failure everywhere depends upon the man behind the business.