

1) **COLORADO**

Payne

3) Bulletin 59.

December, 1900.

4)  
The <sup>2</sup>Agricultural Experiment Station

OF THE

Agricultural College of Colorado.

---

INVESTIGATION OF THE GREAT PLAINS.

---

# FIELD NOTES

—FROM—

TRIPS IN EASTERN COLORADO

—BY—

J. E. PAYNE.



Library

of

W W Howie

PUBLISHED BY THE EXPERIMENT STATION  
Fort Collins, Colorado.  
1900.

# THE AGRICULTURAL EXPERIMENT STATION,

FORT COLLINS, COLORADO.

## THE STATE BOARD OF AGRICULTURE.

	TERM EXPIRE
HON. JAMES L. CHATFIELD, . . . . . Gypsum, . . .	1901
HON. A. LINDSLEY KELLOGG, . . . . . Rocky Ford, . .	1901
HON. B. F. ROCKAFELLOW, . . . . . Canon City, . .	1903
MRS. ELIZA F. ROUTT, . . . . . Denver, . . .	1903
HON. P. F. SHARP, <i>President</i> , . . . . . Denver, . . .	1905
HON. JESSE HARRIS, . . . . . Fort Collins, . .	1905
HON. HARLAN THOMAS, . . . . . Denver, . . .	1907
HON. P. A. AMISS, . . . . . Pruden, . . .	1907
GOVERNOR CHARLES S. THOMAS, . . . . . } <i>ex-officio</i> .	
PRESIDENT BARTON O. AYLESWORTH, . . . . . }	

## EXECUTIVE COMMITTEE IN CHARGE.

P. F. SHARP, CHAIRMAN. B. F. ROCKAFELLOW, J. L. CHATFIELD  
P. A. AMISS, JESSE HARRIS.

## STATION STAFF.

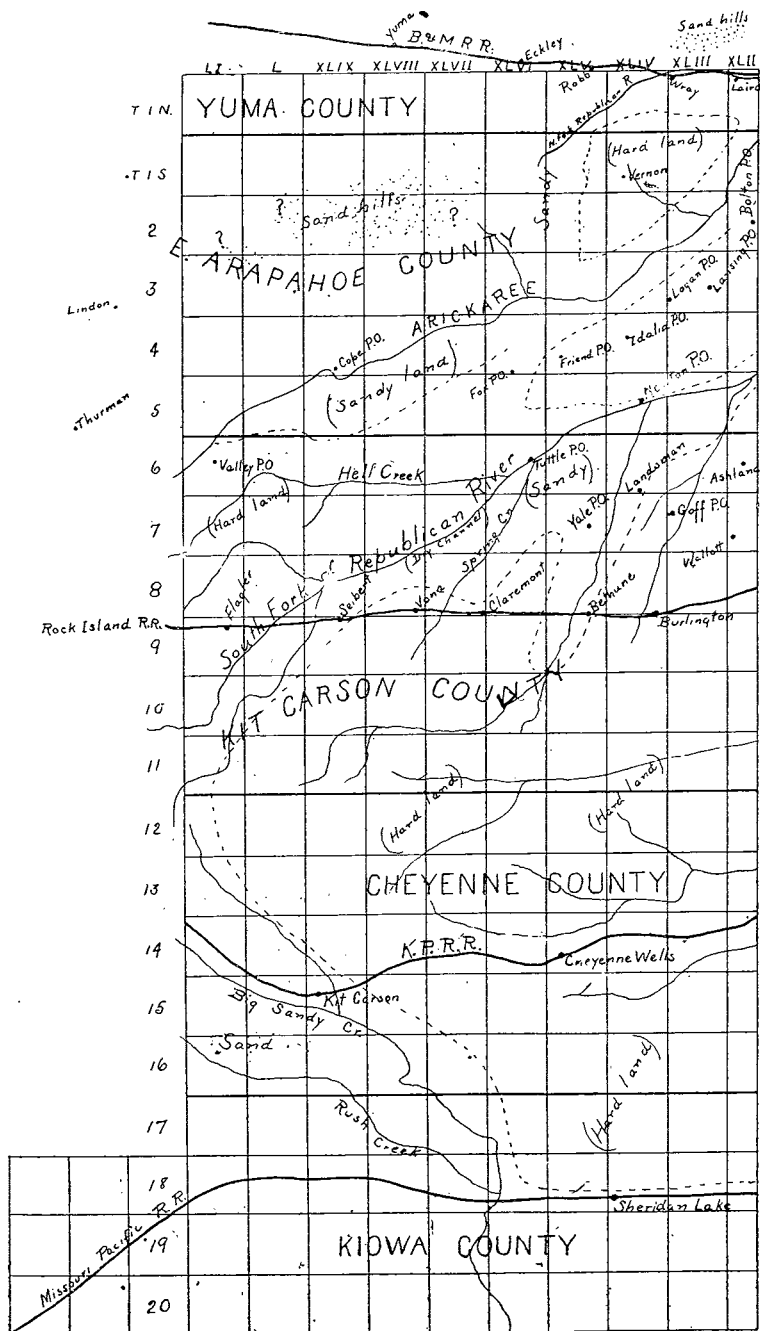
L. G. CARPENTER, M. S., . . . . . METEOROLOGIST AND IRRIGATION ENGINEER  
C. P. GILLETTE, M. S., . . . . . ENTOMOLOGIST  
W. P. HEADDEN, A. M., PH. D., . . . . . CHEMIST  
B. C. BUFFUM, M. S., . . . . . AGRICULTURIST  
W. PADDOCK, B. S., . . . . . HORTICULTURIST AND BOTANIST  
R. E. TRIMBLE, B. S., . . . . . ASSISTANT METEOROLOGIST AND IRRIGATION ENGINEER  
F. L. WATROUS, . . . . . ASSISTANT AGRICULTURIST  
L. A. TEST, B. M. E., A. C., . . . . . ASSISTANT CHEMIST  
E. D. BALL, M. S., . . . . . ASSISTANT ENTOMOLOGIST  
C. H. POTTER, M. S., . . . . . ASSISTANT HORTICULTURIST  
\* JOSEPH LOWNES, B. S., . . . . . ASSISTANT CHEMIST  
F. C. ALFORD, B. S., . . . . . ASSISTANT CHEMIST  
H. H. GRIFFIN, B. S., . . . . . SUPERINTENDENT ARKANSAS VALLEY SUBSTATION  
Rocky Ford, Colorado.  
J. E. PAYNE, M. S., . . . . . SUPERINTENDENT PLAINS SUBSTATION  
Cheyenne Wells, Colorado.

## OFFICERS.

PRESIDENT B. O. AYLESWORTH, A. M., LL. D.

L. G. CARPENTER, M. S., . . . . . DIRECTOR  
A. M. HAWLEY, . . . . . SECRETARY  
W. R. HEADDEN, B. S., . . . . . STENOGRAPHER AND CLERK

\* Died December 9, 1900.



MAP OF REGION EXAMINED.

## INTRODUCTORY.

Some years since (in 1894), a substation was organized at Cheyenne Wells, in Eastern Colorado, for the purpose of testing plants and methods adapted to that region. A report of the trials was given in the Annual Report for 1899. \*

During the past year a different plan of work was adopted, both because it seemed that greater results could be secured, and because the authorities at Washington had ruled that the maintenance of permanent substations was not contemplated by the Hatch Act. The work was lessened so that the superintendent had fewer duties at the station; he was furnished with a team, and his time largely given to a study of the methods of those who have gained a foothold, and to derive therefrom lessons of greater value than could come from the tests of a single person. The work of the year has been preliminary, but was necessary to establish a sound basis for future investigation or discussion of the problems of the Plains.

The reconnaissance covers only a small part of the Plains portion of the State, and, therefore, the statements are not necessarily true for the region outside that considered.

The Plains portion of Colorado extends from the eastern border of the State to the foothills of the Rockies. Fort Collins, Boulder, Golden, Colorado Springs, Florence and Trinidad are at or near the western border. Along the eastern border the elevation is from 3,500 to 4,500 feet, and along the foothills from 5,000 to 7,000 feet, the latter elevation being found on the Divide between the Platte and the Arkansas rivers. The Plains are thus an inclined plane, rising almost imperceptibly from ten to twenty feet per mile.

Limitless in expanse, with scanty, though nutritious, grasses, the Plains form the natural home of the stock industry, as they once did of vast herds of buffalo.

This is not the place to discuss the Plains problem. With an area greater than most of the states east of the Mississippi, the magnitude of the area justifies a serious examination.

L. G. C.

---

\* Also issued as an excerpt.



SORGHUM ON OLD GROUND.



SORGHUM ON SOD.

(Same row, planted same day as preceding.)

# INVESTIGATION OF THE GREAT PLAINS.

---

## FIELD NOTES

—FROM—

### TRIPS IN EASTERN COLORADO.

By J. E. PAYNE, M. S.

*Superintendent of the Plains Substation.*

---

This work was done by traveling about the country in a spring wagon. Over thirteen hundred miles were traveled during the progress of the work. Settlers were interviewed, and their evidence recorded. The investigation was confined mainly to Kit Carson county and the eastern half of Arapahoe county.

Contrary to my rule, I have recorded my opinions and impressions in this report. These opinions are based upon a mass of evidence which is almost too extensive to record.

With the exception of small areas near Idalia, and Vernon, stock raising is the principal business of the people. Those having small herds usually raise some rough feed for use during storms. The Vernon settlement seems to be the only one which has held its own and held to the idea of grain raising exclusively. Many near Vernon believe in stock raising, but the country is occupied so fully that there is no range for stock. At Vernon, and near Lansing, Idalia and Friend, sentiment has made a local herd law which persuades each man to fence or herd his stock during the growing season. In all other communities, crops must be fenced to protect the cattle, but in those neighborhoods, the saying has become proverbial that, "No one has ever known a wheat field to chase cattle to their injury." So if a man keeps stock, he must keep it away from his neighbor's crops. These people, living from one hundred and thirty to one hundred and fifty miles from their county seat, do not often feel the force or effect of ordinary State laws; so they have been forced to allow a few customs suited to their conditions to crystallize into laws, so far as it is possible in the time they have lived in these communities.

*Depopulation*—Almost the whole of Eastern Colorado was settled quite thickly during the years from 1886 to 1889. Lansing, Idalia, Friend, Cope, Arickaree City, Thurman,

Lindon and Harrisburg all aspired to be large cities, county seats or railroad centers. Lansing has disappeared and left only a few cellars to mark its site. Idalia still has two stores, two blacksmith shops, a school house and a few dwellings. At Friend, one old building, now used for the school, remains. Cope still has a store, a few dwellings and a school. One store building (now used as a residence by a family of four) still stands on the site of Arickaree city, and Arickaree P. O. is located on a ranch eight miles away. About Lindon, nearly all the land for miles around was once filed upon. Failure to get water in necessary quantities caused the whole country to be depopulated. At one place, I drove eighteen miles between Cope and Lindon without seeing a house. The site of old Lindon is now marked by a few heaps of earth and a few holes in the ground. Lindon postoffice is four miles south-west of the old town site, and the nearest house is two miles away. At Harrisburg, one family still lives. Thurman, also called Stone city, once had two banks, and two railroads were surveyed through it during "boom times." Now one family lives in Thurman. But a colony of hardy Mennonite farmers still hold claims near enough together to make lanes necessary. Two lanes cross at Thurman postoffice. These farmers are all getting to be quite well-to-do. They make stock raising their main business, but they usually raise grain, and always produce plenty of rough forage for their cattle. By these people, the Russian thistle is considered a friend. If the wheat crop fails, the Russian thistle grows among the wheat, and Russian thistle and wheat mixed make excellent feed. Before the introduction of the Russian thistle, they had no winter forage when their wheat crop failed.

#### **TREES—*Timber Claims.***

Of the thousands of claims planted to trees, only a few groves remain to-day in thrifty condition. I made it a point to visit every grove which was said to be in good condition and still cared for.

Observation has shown that groves cease to do well as soon as they are abandoned and permitted to become scratching places for cattle. After inspecting several hundred claims, we decided that the trees which have been able to withstand the conditions best are ash, honey locust and black locust. I photographed two of the best groves I saw. One of these is one-half mile west of Logan post office. The other is seven miles north-east of Lansing post office.

These have both been thinned to eight feet apart each way. They are nearly all ash trees. The tallest tree in each grove is an elm. The grove north of Lansing is on a high divide, while the one near Logan is on flat land where it may get some extra water.

There are many other places where small groves are still kept in good condition. Near Thurman, Mr. Joseph Schrock has a row of ash trees near his corrals which measure from thirteen to twenty-nine inches in circumference. These are planted where the snow piles up around them every winter. At the same place, a cottonwood tree growing near a water tank is kept in a thrifty condition by the waste water.

One of the most widely known of the groves on high prairie is that of Success Kerns who lives three miles northeast of Claremont. Intensive cultivation has been practiced, and no irrigation. Mr. S. L. Howell, near Vona, has raised some nice groves on the high prairie.

I have taken records of many other groves, but these are the ones that seem most likely to receive continuous care.

Of the trees growing where water is near the surface, Cope's grove, at Cope, on the Arickaree bottom, presents the best example. About twenty acres were planted to trees there during the years 1887—1890. Cottonwood, boxelder and ash are the principal varieties, between five and six acres of trees still remaining. The best part of the grove is cottonwood trees which grow where water is from two to five feet below the surface. Many of these are forty to fifty feet high, and some are three feet in circumference.

#### **TREES—*Miscellaneous.***

The best example of how one may use the natural conditions, as slopes, ravines, and so on, to help trees and crops is found at the place of James Howell, who lives seven miles northeast of Flagler. The forest trees which are mainly black locusts are set in clumps and hedges so as to make a dense windbreak. The orchard is on the right bank of a creek which runs southeast. A well at the southeast corner of the orchard, supplemented by a small storm-water reservoir at the northwest corner, supplies water for irrigating, in a small way, where need is greatest. The ravine has been dammed and the extra water conducted past the grove through an artificial channel, leaving the old channel dry below a pond of water which at times is several feet deep.



The sides and bottom of this old creek bed were recently planted to fruit trees—mostly cherry trees. On one bank stand several plum, cherry and walnut trees which have reached the bearing age. Just above each of the trees on the bank is a large hole into which water from higher levels may flow during rains. The walnut and cherry trees bore good crops in 1900. Some apples were seen on the apple trees. The grapes, strawberries and currants also showed fair crops.

#### FRUIT TREES—*Not Irrigated.*

When the country was first settled, hundreds of orchards were set out. Lack of skill, bad nursery stock and drought reduced the number of orchards to one here and there where a combination of circumstances kept alive the hope that a successful orchard could be produced.

Many orchards were kept in good condition until 1893 at which time they were about five years old. The unfavorable conditions of 1893, 1894 and 1895 reduced the number of experimenters to a few, who were as stubborn as Colorado droughts. One of the best orchards given up in 1894 was that of A. C. Willis, three miles north-west of Kanorado. For a time, he had the best trees in the county, but dry weather and hail damaged his trees so badly that he became discouraged.

The following table gives a summary of the present condition of orchards on uplands, or where it is impossible to get sufficient water for irrigation. I include James Howell's place in this because he has made his success by taking advantage of natural conditions, just as hundreds of others could do if they would use the same amount of thought and labor.

It is generally conceded that cherries, currants, plums and gooseberries can be produced in moderate quantities without irrigation. Apples and peaches are not considered sure although some have been produced.

<i>Owner.</i>	<i>P. O. Address</i>	<i>Trees still thrifty.</i>	<i>Trees which have pro- duced fruit</i>
R. F. Davis,	Vernon,	Apples, peaches, plums, cherries.	Apples, peaches, plums, cherries.
James Slick,	"	"	"
W. S. Calloway,	"	"	"
Joseph Miller,	"	"	"
Allan Smith,	Wray,	plums, cherries,	plums, cherries.
Wm. M. Barnes, Jaqua, Kan.,	"	peaches,	peaches,
J. Brigham,	"	"	"
S. L. Howell, Seibert, Colo.,	"	"	"
James Howell, Flagler,	"	"	"
P. J. Nicholls, Cope,	"	"	"
W. J. Brooker, Cheyenne Wells,	"	peaches,	Apples, plums, cherries.
The Plains	"	"	"
Substation,	"	"	"
J. S. Johnson,	"	"	"
J. B. Robertson,	"	"	Apples, plums,

Gooseberries and wild currants generally do well with-

out irrigation. I found grapes bearing at Peter J. Nicholls' garden and also at Joseph Schrock's. Grapes found in bearing at James Howell's place had received some extra water.

*Ornamental Plants*—We have found roses doing well without irrigation at several places.

#### IRRIGATED PLACES.

John Rose, who lives five miles northwest of Seibert, has been the most successful with a fruit garden of any one we have seen. He began by irrigating only a few trees and a few rods of garden. He extended the plat to include about one fifth of an acre which was watered from one well. The water was pumped by wind power from a well eighteen feet deep. Later, he dug another well and built a reservoir and extended his patch so as to include nearly two acres. We attribute his success to his ability to begin on a small scale and slowly enlarge as he learned how to handle his water economically, and as he found profitable market for his products. We shall file photographs\* of an apple tree and a plum tree as they appeared in his orchard in September 1900, also a photo of his reservoir. Charles Blake and James H. Priest who live in the same neighborhood are making a success of their irrigated fruit gardens also. All raise apples, plums, cherries, gooseberries, currants and strawberries. Mr. J. C. Cope, at Cope, has a good fruit garden which is irrigated from a well.

But the most successful irrigation where deep wells are used, is that of Peter Eckert who lives about four miles southeast of Thurman. His two wells are each one hundred and twelve feet deep. The water is pumped by windmills into reservoirs for storage. The pumps run day and night to water about two acres and supply water for a large herd of cattle. The place is located on a hill. All the ground irrigated is nicely terraced so as to use the water to the best advantage. One part of the place is laid out for ornamental plants and a vegetable garden, another for fruit trees, excluding apples, another is the apple orchard, and the other is planted to grape vines. Hail and wind has prevented the production of much fruit of any kind. But the place is well kept notwithstanding the fact that it does not give large financial returns. The owner loves his trees and vines as he does children. He is too feeble to work in the field, so he spends nearly all his time with his trees and his garden.

A few who live around the south fork of the Republican

---

\* Not suitable for reproduction.

or its tributaries, water their trees and gardens from ditches. Among the most successful of these are G. B. Kuk and Wm. P. Baily near Newton, and C. Waline who lives about five miles southwest of Jaqua. Mr. Waline uses a storage reservoir in connection with his ditch. He also uses a well to help out in times of scarcity.

Those who are using windmill power to pump water for the irrigation of vegetables are too numerous to mention, but the really successful plants are few. The main trouble is that they usually attempt to do too much—spread over such a large area that when crops are most in need of water the supply is insufficient.

I saw one place where a man had built a reservoir and planned to irrigate five acres of very sandy land from one well. When the supply of water is sufficient we sometimes find that insufficient reservoir space is another weak point. The wind may refuse to blow during the driest weather of the summer, and when it does blow, the water is often applied to the crops just as it comes from the well. This chills the roots and checks growth.

But the cause of the abandonment of many successful small irrigation plants has been the increase of the herd of cattle kept to be watered from the same well upon which the garden was dependent for its supply.

*Storm Water from the Prairies*—Mr. W. V. Erickson, who lives three miles southeast of Burlington, is one of the most successful of those who have watered gardens from wells. He has planned to catch the storm water from several hundred acres of prairie in a reservoir which he was making when I visited him. We shall watch the result of his work with interest. Mr. James Howell, near Flagler, who was mentioned before in the discussion of trees, has the only storm-water reservoir which we saw in operation. His main reservoir would be likely to benefit his trees mainly by the seepage of water down the old creek bed, thus furnishing natural sub-irrigation.

#### IRRIGATION DITCHES.

There are two ditches in the valley of the South fork of the Republican river. These were planned to supply water to large areas; but they seem to be failures. Small ditches water considerable areas planted to alfalfa near Tuttle, Landsman and Newton. A few small private ditches are successfully operated on the lower part of the Arickaree. One very successful ditch is operated in the valley of the North fork of the Republican.

UPLAND FARMING.

In every community through which I have traveled, except small areas near Idalia and Vernon, stock raising is considered the principal part of farming. Other communities are in various stages of transition from grain to stock raising.

*Cheyenne County*—All given over to stock raising and practically no grain raising attempted.

*Kit Carson County*—I divide into districts as follows:

1. All south of the Rock Island railroad and nearly all west of Claremont given over to stock with but little grain raising.

2. Yale, Wallet, Goff, Ashland and Burlington—Stock raising is considered first by practically all the settlers. But some plant grain hoping to harvest a crop if the season is favorable; but if the season is unfavorable, they expect a crop of forage from the grain fields.

3. Valleys of the Landsman and South fork of the Republican—Nearly all occupied by stock men before the wave of settlement came. Still given up to stock exclusively, except a few places near Seibert where men have obtained a foothold and are developing horticulture on a small scale. Alfalfa-growing is quite general wherever there is water enough for irrigation.

*Eastern Arapahoe County*:

1. Lindon—Given up to stock exclusively.

2. Thurman—Grain is sown quite extensively. There is some threshing done nearly every year. When the season is unfavorable for wheat, it is a good season for Russian thistles. The wheat and thistles are cut for hay, and make good feed when used together.

3. Kirk and Fox—On the border line between a stock raising district and a grain-growing district. Here we find that nearly all are still raising grain; but all are getting into the stock raising business as rapidly as their means will permit.

4. Friend, Idalia, Logan, Lansing and Bolton—This district is devoted to grain growing. But there is a strong sentiment in favor of stock raising exclusively wherever large areas are available for free range.

5. Vernon—This district is devoted to grain growing. Some people own cattle which are kept in the sand hills during summer and brought in to winter around the straw stacks. Many around the edges of this settlement favor stock raising exclusively.

6. The Sandhills in Eastern Arapahoe—This district is devoted to stock grazing exclusively.

7. The valleys of the Arickaree and the South fork of the Republican river are devoted to stock raising exclusively.

*Yuma County*—That part of Yuma county lying on the divide between the north fork of the Republican and the Arickaree belongs with the Vernon neighborhood. The valley of the North fork of the Republican is used mainly for stock raising. The fields of alfalfa furnish winter feed for cattle which are kept in the sandhills on the north of the valley.

#### CROPS RAISED.

*Sorghum*—Generally grown where stock raising is the main business. Many cattle men object to it on account of the heavy work required to harvest it. Yield from one-half to four tons per acre. Average probably one ton per acre.

*Broom Corn*—Usually successfully raised. Uncertainty of price has prevented extensive planting.

*Millet*—Quite a general favorite among cattle men. They claim that it requires less exertion per ton to raise and harvest millet than any other cultivated crop. Yield from one-fifth to two tons per acre.

*Corn*—Corn is generally planted in small areas in nearly all neighborhoods investigated. Many claim that if the season is favorable, corn can be raised cheaper than it can be bought. But if the season is unfavorable, a crop of fodder will be raised. The average yield is best on black, sandy land. Yields as high as fifty bushels per acre have been reported. The usual yield is from two to twenty-five bushels, while the average for the whole region will not exceed ten bushels per acre.

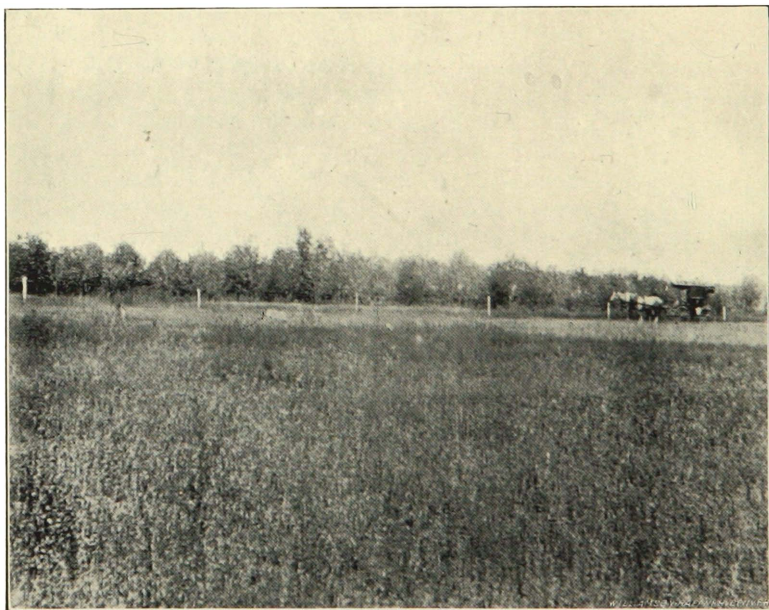
*Oats*—Usually considered an uncertain crop. Less popular than wheat or millet. Considerable is sown for hay in some places. Reported yield per acre from nothing to thirty-five bushels. Probably the average is near ten bushels per acre.

*Wheat*—The most popular of small grains. Reported yields from nothing to forty bushels per acre. The general average yield per acre for the region is probably about six bushels. Some have reported average yields of eleven bushels per acre, including twelve years cropping. From observation, I believe the men who produced these crops to be far above the average as farmers, and so cut down my estimate of the average yield accordingly.

*Barley*—A crop which is but little grown, as compared with wheat. Many consider it the surest grain crop that has



GROVE OF MILTON MORRIS, NEAR LANSING.



GROVE OF HUGO KURZIDIM, NEAR LOGAN.  
(Tallest tree in each case is an Elm.)

been tried. Yields of eighty-three bushels per acre have been reported. The average yield is estimated at fifteen bushels per acre. The variety planted is mostly "California Feed" barley, and it is used at home for feed almost exclusively.

*Rye*—This crop is but little grown. Not enough found upon which to base an estimate. But, in 1899, a crop was grown on a field of black sandy soil near Cope which yielded seventeen bushels per acre. No rain fell upon this field between seeding and harvesting.

*Flax*—We have found men near Ashland and Thurman who have raised good crops of flax. So few raised it that what was raised was not readily sold, so production ceased. It has not been generally tried.

*Native Hay*—The valleys of the North branch of the Smoky Hill river, the three valleys of the Republican, the valley of the Big Sandy, and the Sand hills furnish considerable native hay every year. We made no attempt to make a collection of native hay plants this year. Hay is usually cut about two years in every five on the uplands. This consists mainly of several species of grama grass and Colorado bluestem (which is known also as bluegrass, elk grass, June grass and probably by several other names.) In traveling over the county, I noted that Colorado bluestem is taking possession of land which has been broken, and abandoned. It appears to successfully dispute the right of occupancy with the Russian thistle. We have also seen it invading uncultivated timber claims and growing quite rank among the trees.

*Russian Thistles*—Russian thistles are quite common in all the regions studied except in about two townships near Idalia and five near Vernon. Wherever the Russian thistle has obtained what seems to be a permanent foothold, the settlers are using it quite largely for forage. Thousands of tons of it are now stacked up for use during the winter. We issued a press bulletin concerning "The Russian Thistle as a Forage Plant," in July, 1900. This bulletin was widely quoted.

*Salt Weed*—(*Atriplex*, sp?) This plant is found on the upper part of the South fork of the Republican as far down as Seibert, and in the western half of Cheyenne county. It seems to prefer an adobe soil containing considerable alkali. The stock that range where it grows do not eat salt, as they get enough salt to supply their needs by occasionally taking a bite of salt weed.

Wm. Lang, who lives near Cheyenne Wells, made hay

of "salt weed" several years ago. He reports that his sheep did well on it. Last year, a cattle man on the South fork of the Republican put up some for hay. He reports good results. September 22nd., 1900, I photographed a rick of salt weed one hundred and twenty feet long. This was put up by Mr. Thos. McCallum who lives ten miles south of Arriba. He intends to give it a thorough trial this year.

#### SOIL STUDY.

As I traveled I examined the soil by occasionally boring and noting the appearance of the soil and sub-soil.

A traveler could go from Sheridan Lake in Kiowa county to Wray in Yuma county (one hundred and ten miles) and think he was traveling over the same kind of soil all the way, except short stretches on each side of the larger streams. The whole distance traversed would be on practically the same kind of soil which is known locally as "hard land." It has enough clay in it to make a good road bed. This land sustains a growth of the short grasses—as buffalo grass and grama grass. Along the streams is found a sandy soil upon which sage brush is the principal vegetation.

This "hard land" is the principal type found on all the uplands of the region investigated. Between this upland soil and the valleys is usually a strip of sandy soil which may be from a few feet to several miles in width. The river valleys proper frequently have an "adobe" upon which "alkali grass" grows. Usually where "alkali grass" does not grow the soil is too sandy for profitable cultivation. The sandy soil is usually considered best for corn, while the "hard land" is thought to be best for wheat.

#### METHODS OF PLANTING AND CULTURE.

*Corn and Sorghum*—The lister drill is generally used for planting corn and sorghum. After planting, the harrow is used by many until the plants are so high that the harrow may break them down if used. Weeders are coming into use also. We find many who advocate frequent culture to preserve a "dirt mulch" on the top. This is supposed to require stirring the ground after each rain, and occasionally during prolonged droughts. But many object to doing this because it requires too much labor.

Observations made during this year have confirmed my belief in the value of a "dust mulch," but I am also convinced that the "dust mulch" may be just as valuable when covered by a light crust such as is formed by a light rain as when no



crust is allowed to form. I saw dust blankets on prairie where no tool had ever tickled the earth.

Once, when crossing a sandy stretch of country, I saw some fields of corn which were looking healthy, notwithstanding the fact that no rain had fallen for several weeks. The corn had not been cultivated for at least a month; so I examined the soil in the corn. I found a light crust, then a dust mulch from two to three inches thick and below that, moist soil. I then turned to the unbroken prairie and found practically the same conditions. I afterwards examined dozens of cornfields and found the same conditions wherever the cultivation had been thoroughly done, even if it had been several weeks since the soil had been stirred.

*Millet*—Methods of planting differ widely. Practically all seeding is done broadcast. Some plow shallow, some do not plow at all, but broadcast the seed and cover with the disc harrow afterwards. Results reported to be about the same from all methods.

*Small Grain*—It is generally agreed that small grain does best when sown on ground which has been cultivated the year before in some hoed crop. The most generally used method is to broadcast the seed on unprepared land (not plowed or disced but the sod broken, of course) and cover with disc harrow or cultivator. Some use disc press drills and some use the other kind of drills. There are men who hold to each of the methods.

Some claim that they have always harvested heavy crops when enough rain fell at the right time, no matter how the grain was put in; and that they never got anything when the season was against them no matter what method they had used.

*Pests*—The two pests which do the most damage to crops in the region investigated are potato beetles (*Meloidae*) and grasshoppers. There are few years when the settlers could not raise enough potatoes to supply the local markets if the crop could be protected from the potato beetles and grasshoppers.

In 1896, one man had to move his cattle to another range on account of the ravages of a variety of grasshopper which ate grass exclusively. This year I saw many fields of grain which were badly damaged by grasshoppers. They reduced the yield harvested, by cutting the heads off the wheat and oats before the grain was ripe enough to cut.

#### CONCLUDING OBSERVATIONS.

Natural conditions seem to have fitted this region for a

grazing country, but the hardships encountered by people in gaining a living in the crowded eastern states have pushed people into what the cow-man once thought his exclusive domain. After settlers got in, many found that, hard as conditions were on the plains, they could do better here than they could with the same capital in any other place with which they were acquainted. These men have built themselves homes, and, in a measure, made the nomadic life of the old-time cow-boy an impossibility in the future.

Nearly all the settlers have been compelled to turn their attention to stock raising, on account of crop failures during some years and low prices other years. The main drawback to grain raising in the region near Idalia is the distance from market. All wheat raised on that divide must be hauled in wagons from thirty to forty miles. Considering these factors, almost any business farmer would decide to raise crops which could walk to market, or crops which could be condensed. And nearly all who live there believe in doing this, even if they do not practice it.

At present, on account of the demand for beef cattle and the confining work connected with dairying, only a small amount of butter is produced. But when the price of cattle goes down again the same natural business law which has forced people to go into cattle raising will compel them to turn their attention to the production of butter and cheese. Free range, cheap rough feed and inexpensive warm stables will help them to make winter dairying profitable. When they get to this, all products will be sent to market in condensed form, and the importance of the problem of transportation will be reduced. The country can then support sufficient population to supply good schools for the children. Each family can have a small garden, a few fruit trees and some small fruit for home use. These can be irrigated from a well. Natural conditions, such as are used by Mr. James Howell, will probably be taken advantage of more freely than at present. People who are either unwilling or unable to adapt themselves to the new conditions will move away, and their places will be taken by others who are better adapted to the conditions.

The valleys of the Big Sandy, the South fork of the Republican and the Arickaree may someday support quite a population. Much of the land near these streams is too sandy for profitable farming. But, if those streams were turned out of their courses and the water taken out into the uplands, and the storm water stored in reservoirs, large bodies of good land might be irrigated and hundreds of homes maintained in what is now merely a cattle pasture.