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DRY FARMING IN WYOMING
J. D. TOWAR

Bulletins will be sent free upon request. Address: DIRECTOR EXPERIMENT STATION, Laramie, Wyo.
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Dry Farming in Wyoming.

The dry farming movement in Wyoming has taken such a firm hold and is being undertaken in so many different parts by large numbers of new settlers that it seemed advisable to investigate the experience of some of the older farmers of the state and obtain data as to the success or failure that has accompanied the movement. The U. S. government has been conducting experiment stations at Cheyenne and Newcastle. The reports of these investigations will not be released for publication before the end of 1909. The state has been conducting some interesting experiments, mostly at Cheyenne, and this work has met with varying successful results, and while the outcome promises much for the undertaking, there are still many other parts of the state regarding which the public know but little, and where it is possible that the method may also be tried with even greater success than the districts where experimental work is being conducted. It was with the idea of securing from the experience of practical men some facts and figures which would shed light on the dry farming proposition for the entire state that the writing of this bulletin was undertaken. If the reports which follow in this publication serve as a guide, not only to those who contemplate taking up land and practicing the system of arid land farming, but to those actually engaged in the work, it will have fulfilled its mission.

The conclusions drawn at the close of this bulletin are based largely upon the results recorded in the intervening pages, all of which were gleaned from the more complete replies to letters sent out by this department. These letters consist of a series of questions mailed to every address in the state that could be secured of men who are actually practicing
dry farming methods. A copy of the questions is given below, and a summary of the replies is printed more or less in full.

How many seasons have you been engaged in dry farming?
How many acres do you dry farm?
What crops have you grown?
What is the average yield per acre of each?
When do you plow, fall or spring? How deep?
What kind of harrows do you use?
How many harrowings before seeding?
What is the best style of seed drill?
What cultivation do you give the growing crop?
How often do you consider it profitable to crop your land under dry farming?
What is the annual rainfall in your section?
In what months does most of the rain come?
What are the best implements with which to equip a dry farm?

On the average, will dry farming give profitable crops in your section?
How many acres are required for a successful dry farm?
Give names and addresses of two or three neighbors who have succeeded in dry farming.

Replies were received from Cheyenne, Laramie County; Kirtley, Converse County; Horton and Newcastle, Weston County; Freeland, Natrona County; Evanston, Millburne, and Cokeville, Uinta County. It is the opinion of farmers from all these districts that with the employment of proper methods, combined in a measure with stock raising, dry farming is a profitable enterprise. Thus far, we were unable to secure replies from farmers in some of the other districts of the state, notably Crook, Sheridan, and Johnson counties, where there is every reason to believe that this system of farming would be equally successful. A few replies were also received from
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farmers living just over the boundary line in the state of Nebraska.

George W. Grimes, Kirtley, Converse County.

Has practiced dry farming four years on about 80 acres. Rainfall 12 to 15 inches, coming mostly in May and June. Plows in spring six to eight inches, using gang plows, disk and heavy smoothing harrows, and press drills. Crops the land every season and believes in thorough cultivation. Yields have averaged: wheat, 30 to 40 bushels per acre; oats, 35 to 50; corn about 20; potatoes about 150. Regards 160 acres proper size for farm and says that dry farming has been profitable in the locality for the past 19 years. The principal practices should be deep plowing and early seeding.

Frank Church, Kirtley, Converse County.

Been engaged in dry farming 13 years on 50 acres. The rainfall comes in May, June and July and some in April. Quantity not known. Plows in spring 6 to 8 inches and harrows once with common steel-tooth harrow and seeds with a press disk drill. Does not cultivate growing crops, but crops the land every year. Yields of oats, 40 bushels; wheat, 20; rye, 20; barley, 30; spelt, 30; potatoes, 150 bushels per acre. Regards 50 to 200 acres the right quantity and says that there has never been an entire failure in the locality.

A. Christian, Sr., Kirtley, Converse County.

Been farming 20 years on 250 acres; the rain coming mostly in May, and the annual amount averaging 12.76 inches, while in May alone 8.6 inches of rain fell. Plows in spring as deeply as possible using four-horse plows and harrows entirely, seeding with heavy press drills. Crops the land every year, but gives the small grains no cultivation. Adopts rotation of grain three years and then corn or potatoes. His yields have been: wheat, 18 bushels; oats, 30; barley, 28; potatoes, 75 to 200 bushels with spelt and alfalfa grown for hay
not weighed, and corn and other forage crops for fodder. Regards 100 acres as the minimum for a dry farm and recommends the use of large implements, whereby one man handles at least four horses. Dry farming should always be done in connection with stock business.

Mr. E. N. Boyles, Kirtley, Converse County.

Been farming nine years on 150 acres. Rainfall comes mostly in May, June and August. Quantity not known. Plows in the spring six inches. Uses gang plows, smoothing and disk harrows, and the Little Giant Shoe drill. Gives no cultivation after the crops are sown, and would farm land every year. Has had yields of oats, 35 bushels; wheat, 15 bushels; rye, 20 bushels; barley, 20 bushels. Thinks 640 acres necessary and considers dry farming profitable in his locality.

Walter Boyles, Kirtley, Converse County.

Has been engaged in dry farming ten years on forty acres of land. Rainfall comes mostly in June, amount not known. Plows in the spring about four inches deep; harrows once before seeding; uses Indiana press drill, but gives the grain crops no cultivation after seeding. Farms the land every year; regards the press drill, disk harrow, gang plow as essential implements. Has had yields of 45 to 50 bushels to the acre of wheat and oats and regards dry farming as profitable. A successful farm should contain at least 100 acres.

L. W. Hunt, Kirtley, Converse County.

Been farming one year on 15 acres of new land. Rainfall 13 inches, coming mostly in May and June. Plows in spring three and one-half inches deep, using gang plows, the lever harrow, and the press drill. Recommends good cultivation for potatoes, but none for grain crops. Grew crop of oats last year averaging 25 bushels. Thinks dry farming profitable if one could have 125 acres with proper equipment. Would suggest the dry farmer own additional grazing land.
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T. H. Thompson, Kirtley, Converse County.

Been farming two years on 75 acres. Does not know rainfall, most of it comes in May and June. Uses gang plows; in the spring plows seven inches deep, harrowing twice before seeding, using the press drill. The locality has been cropped profitably for 20 years. Yields: oats, 35; wheat, 18; barley, 20; potatoes, 120; thinks a dry farm should contain 320 acres.

M. H. Hartung, Cheyenne, Laramie County.

Has been farming two years on 40 acres, growing oats only for hay. Yields not given. Plows in fall six to eight inches, harrowing two or three times before seeding and about twice after seeding. Has about 15 inches rainfall, coming mostly in April, May, June and July. Regards small grains profitable, but such farming should be done in connection with stock raising.

Roy L. Zum Brunnen, Kirtley, Converse County.

Been dry farming three years on 120 to 260 acres. Rain comes mostly in April and May, averaging about 14 inches annually. Plows in spring five to eight inches, harrows once or twice before seeding, using the double disk drill. Does not cultivate the grain, but does the potatoes. Would farm every year by practicing the rotation of crops. Believes in the disk plow, steel harrows, and double disk drill. Never had a failure on account of drouth. Yield: oats, 35 to 40 bushels; winter wheat, 11½ bushels, weighing 59 pounds to the bushel; potatoes, 35. Successful dry farm should contain 160 to 320 acres.

J. D. Williams, Kirtley, Converse County.

Been dry farming seven years on 40 to 80 acres. Rainfall not recorded; comes mostly in May and June. Plows in spring five to six inches. Does practically no harrowing before seeding and does not disturb the growing crop. Believes in disk plow, disk harrow and the press drill. Has not had a failure in the entire seven years. Oats yield 30 bushels,
wheat 20, rye 25, barley 25, millet 35, spelt 40, potatoes 60. Farm should consist of not less than 160 acres and from that to 320 acres.

J. H. Christian, Kirtley, Converse County.

Been dry farming 3 years on 80 acres. Rain comes mostly in May and June. Plows in spring six inches, using the spike-tooth harrow, and the double disk drill. Does no harrowing before seeding, but once after. Crops the land every year, but changes the grain each season. Prefers the disk plow and double disk drill. Has raised an average of 30 bushels of oats per acre for the three years.

F. B. Hamlin, Kirtley, Converse County.

Been dry farming 12 years on 240 acres. Has 12 to 15 inches of rainfall, which comes in April, May and July. Plows in spring 4 to 5 inches, harrows once or twice before seeding and uses the double disk press drill. Does no cultivation to growing crops, but considers it a good practice. Has been successful by raising a crop every year. Yields: wheat, 20 bushels; rye, 15 to 25; barley, 20 to 40; oats, 20 to 60, and has never failed to have a fair crop. Believes in the use of the gang and mould board plows, and the press drill. "Plowed land has never paid less than $6.00 per acre, and has paid as high as $20.00; paid $15.00 this year." Recommends 640-acre farms. Mr. Hamlin claims that his particular locality is especially favored, and "will stand more drouth than any other place I ever saw, and raise a crop."

H. T. Davidson, Millburne, Uinta County.

Says no dry farming has been practiced to any extent in the vicinity, but that Turkey Red wheat raised four years in succession without irrigation has yielded 23 bushels per acre, without the application of dry farming principles. Two fields of 50 acres each are being grown this year where dry farming principles are practiced.
Lige Christensen, Cokeville, Uinta County.

Been engaged in dry farming 3 years on about 60 acres. Does not know the rainfall, but most of the rain comes in May and June. Plows both spring and fall about five or six inches deep, preferring disk plow, disk harrow, and disk drill. Harrows and levels the ground carefully before seeding, but gives no cultivation to growing crop. Has yields of: barley, 32 bushels; wheat, 26; oats, 30 bushels to the acre. Regards five or six hundred acres as the size for successful dry farming and thinks that profitable crops can be grown by the system in that section. Has sown alfalfa recently which looks promising.

P. W. Olson, Cokeville, Uinta County.

Been farming 3 years on about 40 acres of land. Heaviest rain falls in May. Does not know the total annual rainfall. Plows part fall and part spring five or six inches deep, using disk harrow twice before seeding. Seeds with Havana press drill, but gives no cultivation to growing crop. Cropped continuously for three years, with average yields of: wheat, 20 bushels; oats, 41 bushels; alfalfa, one ton; rye, cut for hay, estimated 3 tons per acre; good crop of peas, which were fed to the sheep. Regards the business as a profitable one.

A. V. Quinn, Jr., Evanston, Uinta County.

Has been engaged in dry farming 3 years on 40 acres. Rain mostly in May and October; 12 to 14 inches. Plows both spring and fall 12 inches deep. Harrows with disk and smoothing harrows twice before seeding, and once after. Uses Havana press drill. Yields: rye, cut for hay, 1½ tons per acre; wheat, 27 bushels per acre. Grows rye, oats, and wheat. No other successful dry farmers in the neighborhood.

H. J. Church, Kirtley, Converse County.

Has been dry farming 13 years on 100 acres. Estimates annual rainfall 7 inches, coming mostly through the summer. Plows in spring six inches, and uses the gang plows, disk har-
rows, and disk press drill. Cross harrows once after drilling, but gives growing crop no cultivation. Has raised an average of 25 bushels of oats, 20 of wheat, 15 of rye, 25 of barley, 30 of spelt, and 200 of potatoes. Crops the land every year. Says dry farming is profitable and that 150 acres is the proper size of farm.

*Henry Miller, Arcola, Laramie County.*

Been farming two years on 30 acres. Plows both fall and spring six or eight inches deep, harrowing twice before seeding with old style harrows. Sowed grains broadcast and cultivated the growing crop twice. Yields (estimated): wheat, 30 bushels; oats, 50; corn, 35.

*C. J. E. Johnson, Heath, Banner Co., Nebraska.*

Been farming eight years on 50 acres. Rain comes mostly in April and May; quantity not known. Plows in the spring four to eight inches. Uses disk and spike tooth harrows, press drill and gang plow. Does not cultivate small grains after seeding. Crops the land every year, with small grains two years and corn the third. Has yields of wheat 12 bushels, oats 30, rye 20, corn 20. Dry farming is profitable in the section. A farm should contain at least 160 acres.

*Bert Larson, Heath, Banner Co., Nebraska.*

Has been farming 20 years on 80 acres. Rainfall of 12 to 20 inches, coming mostly in April and May; plows either fall or spring six to ten inches deep, using plain harrows and the disk or press drill. Does no cultivating to growing crop. Crops the land every year, alternating corn with small grains. Has had yields of wheat 16 bushels, oats 30, corn 16, spelt 35. One man can farm 100 to 150 acres and grow profitable crops.

*H. P. Fancher, Kirtley, Converse County.*

Been farming ten years on 100 acres. Does not know rainfall. Most of it comes April, May and June. Plows in spring six inches, harrows once with diamond tooth harrow,
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and uses the Monitor disk drill. Cultivates potatoes once and hoes them once. Would crop the land every year, and considers dry farming profitable in the locality. Yields have been: oats 35, wheat 20, rye 20, barley 30, potatoes 125, timothy 1 ½ tons, alfalfa 1 ½ tons. Dry farm should contain 320 acres.

A. G. Cheney, Freeland, Natrona County.

Has done some dry farming in connection with ranching for 21 years. Rainfall about 20 inches, in April, May and June. Believes in fall plowing and subsoiling. Has grown 100 bushels of potatoes to the acre. Regards the Breeds weeder and the disk harrow as important implements for the dry farmer. Dry farming has not been tried much in this locality, but it looks promising. From 320 to 640 acres is probably necessary to make it a success.

Hon. F. W. Mondell, Newcastle, Weston County.

Congressman Mondell has carefully answered every question on the blank sent him, and his replies are given in full, together with the original questions:

1. How many seasons have you engaged in dry farming? I was engaged in farming without irrigation five miles northwest of Newcastle on quite an extensive scale from 1889 to 1893, and for the last three years have been experimenting on a smaller scale five miles southwest of Newcastle. I have been observing the work of others during the entire period.

2. How many acres do you dry farm? Formerly I farmed as high as 800 acres, at this time have only about 25.

3. What crops have you grown? I have grown winter, spring and macaroni wheat of several varieties, oats, barley, rye, millet, alfalfa, brome grass, potatoes and other vegetables.

4. What is the average yield per acre of each? Have raised all the way from 12 to 30 bushels of winter wheat, from 10 to 25 bushels of spring wheat, 20 to 35 bushels of rye, 15 to 35 bushels of barley, fair yields of millet and brome grass, two light crops per season of alfalfa with good pasture, from
80 to 125 bushels of potatoes per acre, 20 to 40 bushels of oats.

5. When do you plow, fall or spring? How deep? Plow in the fall if possible or as early as possible in the spring, and the deeper the better, not less than 5 or 6 inches, 8 is better.

6. What kind of harrows do you use? Any harrow that will thoroughly pulverize and level the ground.

7. How many harrowings before seeding? Harrow enough times to thoroughly pulverize the surface and leave it compact.

8. What is the best style of seed drill? Any good press drill.

9. What cultivation do you give the growing crop? Cultivation depends upon weather. Grain should have at least one harrowing after it comes up.

10. How often do you consider it profitable to crop your land under dry farming? I have generally cropped my ground annually. Consider biennial cropping, with thorough summer cultivation, much surer and in the long run more profitable.

11. What is the annual rainfall in your section? I think you know the rainfall of Weston County, perhaps better than I do.

12. In what months does most of the rain come? Your records will also indicate better than I can tell you the seasons of precipitation. The land I farmed years ago had considerable winter snow fall; that is the best condition for dry farming anywhere.

13. What are the best implements with which to equip a dry farm? Good heavy plows, substantial harrows and press drills and plenty of stock to operate them.

14. On the average, will dry farming give profitable crops in your section? Dry farming has been carried on successfully for 15 years in eastern and northern Weston County and the adjacent region in Crook County. There are large
areas in western parts of these counties as well as in other parts of the state which I think can be profitably farmed.

15. How many acres are required for a successful dry farm? I think the dry farmer should have at least 320 acres.

Andrew Peterson, Horton, Weston County.

Been engaged in dry farming 9 years on 100 acres. Rainfall comes mostly in May and June. Quantity not known. Plows in spring six to eight inches deep. Uses disk and smoothing harrows, but gives the growing crops no special cultivation. Has had average yields of: wheat, 20 bushels; oats, 40 bushels, weighing from 36 to 42 pounds per bushel. Believes in using good seed, and insists that seed should be treated for smut. Fall wheat will yield over 20 bushels to the acre, as one neighbor has had as high as 55. A man should have 75 to 125 acres to work and the balance of a half section for grazing, in order that he may keep livestock to consume the roughage on the farm. Believes in sowing 1½ bushels to the acre. Raised 4,000 bushels of oats, barley and wheat last year.

P. G. Christensen, Horton, Weston County.

Has been engaged in dry farming thirteen years on 125 acres. Rainfall about ten inches, which comes mostly in May and June. Plows in spring eighteen inches, using the John Deere Stag plow, disk harrow and drag harrow, roller, and broadcast seeder. Crops the land every year, but gives the crops no cultivation after seeding. Has grown oats, wheat, barley, potatoes and garden vegetables. Yields not recorded. Considers dry farming profitable and that the farm should contain 320 acres. Regards the heavy snows of winter as the most beneficial agency in dry farming.

H. G. Deuel, Kirtley, Converse County.

Has been engaged in dry farming eleven years on fifty acres of land. Rain comes mostly in May and June. Quan-
tity not recorded. Plows in spring four inches, using common harrows, ordinary drill, and the usual practice of the neighborhood. Raises 17 bushels of wheat, 30 to 40 bushels of oats per acre.

J. J. Zum Brunnen, Kirtley, Converse County.

Been farming 19 years on 175 acres. Rain comes mostly in May. Annual rainfall between 12 and 15 inches. Plows in spring with disk plow six inches deep, using four-horse teams. Harrows with common steel-tooth harrow once before seeding. Uses the press drill, either the double disk or shoe. Has had yields of 15 bushels of wheat, 30 bushels of oats to the acre. Fears the danger of the destructive action of the winds if ground is left uncovered for the year. By leaving high stubbles and sowing to winter wheat, harrowing in the following spring, the difficulty is overcome. Says "A dry spring is the ideal time to put a crop in right."

E. Wellnitz, Cheyenne, Laramie County.

Been farming only one year on ten acres. Most of the rain comes in May, averaging last year 11 inches. Has had no results as yet.

H. W. Bennett, Kimball, Kimball County, Nebraska.

Been dry farming six years on 100 acres. Has annual rainfall of 15 inches, coming from April to July. Plows both fall and spring six to eight inches. Uses the disk harrow once over before seeding, has Monitor drill; cultivates growing crop with smoothing harrow. Has secured the following yield: wheat, 25 bushels; barley and peas both very satisfactory, but the barley was fed as hay and the peas were pastured off by pigs. Usually crops the ground every year, but believes that summer fallowing would give the best results. Dry farming is profitable in this locality, and a successful farm should contain 320 acres.
Dry Farming in Wyoming.

Harry Henderson, Sec. Board of Trade Com., Cheyenne, Laramie Co.

Been farming three years on 30 to 60 acres. Rainfall comes mostly in May, June and July, averaging 10.33 inches. Plows both fall and spring six to nine inches, using disk and smoothing harrow, the disk drill, and harrows the growing crop twice. Yields as high as 53 bushels of barley, 33 bushels of wheat. Estimates average yield of barley 25 and wheat 17. Would crop every alternate year, and regards intelligence as the most important agency in producing good crops. Thinks the farm ought to be at least 320 acres and that under careful management profitable crops could be grown.

H. Altman, Cheyenne, Laramie County.

Has experimented a number of years on ten acres of land, growing sugar beets, milo maize, potatoes, turnips, sweet corn, pumpkins, squash, and peas. Yields not determined. Plows fall and spring 14 inches deep, using chain harrows and giving thorough cultivation to the growing crop. Crops the land every year. Rainfall is mostly in May, June and July.

William Hetsing, Kirk, Banner Co., Nebr.

Has been engaged in dry farming seven years; farms 100 acres; rain comes mostly in April and May. Amount not known. Crops the land every year; plows in spring eight inches deep. Uses disk harrow and press drill, and cultivates growing crops as much as possible. Yields have averaged: wheat 15 bushels, oats 20 bushels, corn 5 bushels, spring rye 18, potatoes 30. Regards dry farming successful in his locality and considers 160 acres the right size for a successful dry farm.

Dr. V. T. Cooke, State Director of Dry Farming Experiments, Cheyenne, Laramie County, Wyoming.

Has been engaged in dry farming over 25 years. During past three years has demonstrated dry farming on from 65
to 100 acres. The rainfall at Cheyenne for the past 30 years averaged 13.55 inches, 75% of which came between April 1st and September 30th. Plows as early as possible in the spring, 8 to 9 inches, would plow in the fall if ground were moist enough. Prefers using a gang plow and the three section steel drag harrow. Also uses disc and Acme harrows. Uses the double disc press drill. Has grown wheat, oats, barley, emmer, field peas, potatoes, sugar beets, brome grass, alfalfa, millet, kaffir corn. Yields in 1906, 56 bushels beardless barley, 38½ macaroni wheat; 1907, crops were partially destroyed by hail. In 1908, 44½ bushels of winter rye and 35 bushels Turkey Red winter wheat. Cultivates growing crops with weeder or drag harrow, generally twice. Would crop every other year unless one gets heavy snow or rain in September or October, and then would crop twice in three years. Has demonstrated that dry farming is profitable when the right principles are practiced.

Averages and Deductions.

From the above reports we find that dry farming has been practiced on the average of 9 years, with a range of from one to 25 years each, and that the average dry farm is 109 acres, ranging from 10 to 800. In answer to the question, How many acres are required for a successful farm? the greatest number of replies favor 320 acres. Several are above this as well as below, bringing the average at 272. The question as to the annual rainfall, as reported from estimates and measurements in the reports, shows an average of 13.2 inches. Practically all of the rain comes from the first of May to the last of July. The highest rainfall is a little over 20, and the lowest is an estimate of 7 inches.

The yields from dry farming practice are as follows: wheat, 21.65; oats, 33.7; barley, 28.83; rye, 20.66; spelt, 30 bushels; Indian corn, 19.2; potatoes, 110 bushels; alfalfa hay, 1.25 tons; timothy hay, 1.5 tons; rye hay, 2.25 tons.
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While most of the plowing is done in the spring, a great many of the replies show a preference to plowing in the fall if the conditions would permit. To the questions, How many harrowings before seeding, and what cultivation is given the growing crop? there is a great diversity of opinion. The dry farming principles require rather more cultivation both before and after the crop is sown than seem to be the practice with a large number of the dry farmers of the state. There seems to be a universal preference to the press drill, which is no doubt the best implement for sowing the seed. A large number crop the land every year, but the consensus of opinion seems to favor seeding alternate seasons, thereby using the moisture of two years for one crop.
Some Climatic Features of Wyoming and Their Relation to Dry Farming.

The following facts are either quoted or extracted from an article on the above subject furnished by Mr. W. S. Palmer, Section Director, Climatological Service of the Weather Bureau for Wyoming:

"From the monthly reports which have been compiled in the Cheyenne office from records kept at stations distributed over nearly all sections of the state, it has been determined that the average precipitation for the state as a whole during the last seventeen years has been 13.68 inches, or a trifle more than thirteen and one-half inches. This average does not take into consideration the heavy precipitation which may fall in the high mountain districts where very few reliable records have ever been kept, but it is a fair average for that portion of the state below 8,000 feet, or for all those districts where cultivation is possible. The precipitation herein spoken of includes rainfall and snowfall, the latter being reduced to its water equivalent.

"GEOGRAPHICAL DISTRIBUTION OF THE PRECIPITATION.

"While the average amount for the state is 13.68 inches, there is a wide variation in the normal amounts received over the various sections of the state. There are portions of Big Horn and Sweetwater counties where the average annual precipitation is probably less than 5.00 inches, while over the extreme northeastern and the extreme northwestern portions of the state there may be a few sections where the annual average is nearly 20.00 inches."

"On the map prepared by the United States Weather Service, there is shown the geographical distribution of rainfall throughout the state. Owing to the complicated and peculiar topography of the state, there is a wide variation in the annual precipitation over the various sections. The un-
shaded portions of the map show areas of the state where the average precipitation is less than ten inches. These areas embrace a portion of the Big Horn County, and seem to be connected by a belt across the state to and including the Red Desert region. Until more land receiving a much higher rainfall than this particular belt has been taken up and developed for dry farming work, it seems probable that the regions of under ten inches should not be appropriated for dry farming purposes. The map shows areas with a rainfall between 10 and 12½; between 12½ and 15, and above 15 inches. Just what portion of these areas it will be advisable to undertake dry farming in is still an unsolved question. There is, however, a considerable area showing a rainfall of over 15 inches where there seems but little doubt that dry farming will succeed under ordinary conditions and that profitable crops grown with intelligence and care may be secured as often here as in the humid regions of the East and Central states. The area showing a rainfall of between 10 and 12½ inches may also remain for some time before it is needed for dry farming purposes, while that between 12½ and 15 will in all probability come under the plow very soon and should give a fairly good account of itself if properly managed.

"ANNUAL DISTRIBUTION OF RAINFALL.

"From the large number of monthly records which have been compiled at the Cheyenne office, covering a period of seventeen years, I have computed the average monthly precipitation for each month of the year, and have shown the amounts graphically on the accompanying chart. By it, you will notice that the monthly amounts of precipitation increase from January to May, which has the highest average of any month of the year; a gradual decrease in the monthly amounts is noted from May to November, which shows the lowest average for the year. From the chart, you can readily see that in this section of the semi-arid region, the rain falls during that time of the year when it is most needed for the crops,
that is, about 70% of the total annual amount falls during the six months, March to August, inclusive. There is some variation in the average amounts for the different seasons for the different sections of the state. I give below the percentage of the total annual averages which falls during the six months' period, March to August, for a number of selected stations:

<table>
<thead>
<tr>
<th>Station</th>
<th>County</th>
<th>Percentage which falls March to August</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheyenne</td>
<td>Laramie</td>
<td>.75</td>
</tr>
<tr>
<td>Buffalo</td>
<td>Johnson</td>
<td>.75</td>
</tr>
<tr>
<td>Ft. Laramie</td>
<td>Laramie</td>
<td>.73</td>
</tr>
<tr>
<td>Laramie</td>
<td>Albany</td>
<td>.72</td>
</tr>
<tr>
<td>Sheridan</td>
<td>Sheridan</td>
<td>.68</td>
</tr>
<tr>
<td>Lander</td>
<td>Fremont</td>
<td>.66</td>
</tr>
<tr>
<td>Bedford</td>
<td>Uinta</td>
<td>.55</td>
</tr>
<tr>
<td>Evanston</td>
<td>Uinta</td>
<td>.54</td>
</tr>
<tr>
<td>Border</td>
<td>Uinta</td>
<td>.54</td>
</tr>
<tr>
<td>Yellowstone Park</td>
<td>National Park</td>
<td>.50</td>
</tr>
</tbody>
</table>
"From the above it can be seen that a much greater portion of the average annual precipitation falls during the six months' period, March to August, over the eastern portion of the state than over the western counties. In Utah less than 40% of the average annual precipitation falls during that period, March to August, inclusive.

"RELIABILITY OF THE SPRING PRECIPITATION.

"The April-May precipitation for the state is a very reliable factor. During the last 28 years, there has been but one year during which the precipitation at Cheyenne has not been in excess of 2.50 inches, for the two months, April and May, and that was in 1886, when it amounted to only 1.44 inches.

"SUNSHINE.

"The percentage of sunshine in Wyoming is much in excess of the percentage which is received throughout the Mississippi Valley, and this excess of sunshine is a very important factor to be considered when discussing the agricultural possibilities of the semi-arid region. The actual number of hours of sunshine which a plant receives during its growing period has never, I believe, received its proper share of consideration when the length of the growing season has been under discussion; other conditions being the same, that plant will make the best progress and development which receives the greatest amount of sunshine. The percentage of sunshine received throughout the central and upper Mississippi Valley is about 45% of the possible amount; in Wyoming and most of the semi-arid region, the percentage is 60% or above. That is, for every three hours of sunshine which is received in the Mississippi Valley, we receive four or more in this section of the country. Thus, if we consider the progress which should be made by growing crops by considering only the one element of climate, the sunshine, the crops in the semi-arid region should make as much progress in three months as the same crops would make in four months in the Mississippi Valley."
## Precipitation Table for the State Arranged by Counties

### ALBANY COUNTY.

<table>
<thead>
<tr>
<th>Location</th>
<th>Period</th>
<th>Years</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ft. Sanders</td>
<td>1869-1877</td>
<td>9 yrs</td>
<td>12.92</td>
</tr>
<tr>
<td>Laramie</td>
<td>1891-1907</td>
<td>17 yrs</td>
<td>9.98</td>
</tr>
<tr>
<td>Little Medicine</td>
<td>1905-1906</td>
<td>2 yrs</td>
<td>14.56</td>
</tr>
<tr>
<td>Moore</td>
<td>1901-1907</td>
<td>7 yrs</td>
<td>14.83</td>
</tr>
<tr>
<td>Centennial</td>
<td>Feb. 1899-June 1903</td>
<td>4.5 yrs</td>
<td>15.97</td>
</tr>
</tbody>
</table>

### BIG HORN COUNTY.

<table>
<thead>
<tr>
<th>Location</th>
<th>Period</th>
<th>Years</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basin</td>
<td>1898-1907</td>
<td>10 yrs</td>
<td>5.37</td>
</tr>
<tr>
<td>(Records not quite complete)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lovell</td>
<td>1897-1900</td>
<td>4 yrs</td>
<td>6.04</td>
</tr>
<tr>
<td>Lolabama Ranch,</td>
<td>1903-1906</td>
<td>4 yrs</td>
<td>12.17</td>
</tr>
<tr>
<td>Painter P. O.</td>
<td>1903-1906</td>
<td>4 yrs</td>
<td>12.17</td>
</tr>
<tr>
<td>Four' Bear</td>
<td>1894-1903</td>
<td>10 yrs</td>
<td>11.39</td>
</tr>
</tbody>
</table>

### CARBON COUNTY.

<table>
<thead>
<tr>
<th>Location</th>
<th>Period</th>
<th>Years</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elk Mountain (Wid-</td>
<td>1905-1907</td>
<td>3 yrs</td>
<td>18.83</td>
</tr>
<tr>
<td>dowfield)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leo</td>
<td>1901-1907</td>
<td>7 yrs</td>
<td>8.61</td>
</tr>
<tr>
<td>Rawlins</td>
<td>1899-1904</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1906-1907</td>
<td>8 yrs</td>
<td>11.34</td>
<td></td>
</tr>
<tr>
<td>Saratoga</td>
<td>1890-1894</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1900-1902</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1906-1907</td>
<td>8 yrs</td>
<td>13.45</td>
<td></td>
</tr>
</tbody>
</table>

### CONVERSE COUNTY.

<table>
<thead>
<tr>
<th>Location</th>
<th>Period</th>
<th>Years</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ft. Fetterman</td>
<td>1869-1880</td>
<td>12 yrs</td>
<td>13.29</td>
</tr>
<tr>
<td>Kirtley</td>
<td>1904-1907</td>
<td>4 yrs</td>
<td>16.32</td>
</tr>
<tr>
<td>Lusk</td>
<td>1889-1907</td>
<td>18 yrs</td>
<td>13.61</td>
</tr>
</tbody>
</table>

(Records previous to 1895 are not complete.)
Dry Farming in Wyoming.

CROOK COUNTY.

Moorcroft 1903-1907 5 yrs 15.13
Sundance 1891-1899 7 yrs 20.27
(Records not complete.)

FREMONT COUNTY.

Ft. Washakie 1881-1883 1886-1906 24 yrs 12.26
Wells 1904-1907 4 yrs 17.70
Pinedale 1906-1907 2 yrs 11.86
Lander 1892-1907 16 yrs 13.92

JOHNSON COUNTY.

Buffalo 1887-1894 1899-1907 17 yrs 10.91
Griggs 1901-1907 7 yrs 14.43
Barnum 1905-1907 3 yrs 11.96
Average for Johnson County 12.43

LARAMIE COUNTY.

Cheyenne 1871-1907 37 yrs 13.55
Chugwater 1901-1907 7 yrs 16.08
Ft. Laramie 1860-1863
1869-1876
1886-1889
1895-1907 30 yrs 11.92
Granite Canon 1905-1907 3 yrs 16.89
Granite Springs Res. 1905-1907 3 yrs 16.84
Phillips 1903-1907 5 yrs 18.05
Pine Bluff 1900-1907 8 yrs 14.40
Wheatland 1899-1907 12 yrs 13.57
(Records not complete.)
Average for Laramie County, 8 stations, with records for an aggregate of 103 yrs 15.16
## Wyoming Experiment Station.

### NATRONA COUNTY.

<table>
<thead>
<tr>
<th>Location</th>
<th>Years</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcova</td>
<td>1899-1906</td>
<td>10.05</td>
</tr>
</tbody>
</table>

### SHERIDAN COUNTY.

<table>
<thead>
<tr>
<th>Location</th>
<th>Years</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eaton’s Ranch</td>
<td>1905-1907</td>
<td>19.09</td>
</tr>
<tr>
<td>Sheridan</td>
<td>1905-1907</td>
<td>14.49</td>
</tr>
</tbody>
</table>

### SWEETWATER COUNTY.

<table>
<thead>
<tr>
<th>Location</th>
<th>Years</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green River</td>
<td>1905-1907</td>
<td>8.46</td>
</tr>
<tr>
<td>Rock Springs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Years</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green River</td>
<td>1905-1907</td>
<td>8.46</td>
</tr>
<tr>
<td>Rock Springs</td>
<td>Fragmentary records, aggregating about 7 yrs</td>
<td>7.66</td>
</tr>
</tbody>
</table>

### UINTA COUNTY.

<table>
<thead>
<tr>
<th>Location</th>
<th>Years</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afton</td>
<td>1903-1907</td>
<td>18.56</td>
</tr>
<tr>
<td>Bedford</td>
<td>1899-1907</td>
<td>18.35</td>
</tr>
<tr>
<td>Border</td>
<td>1902-1907</td>
<td>12.90</td>
</tr>
<tr>
<td>Daniel</td>
<td>1899-1907</td>
<td>11.37</td>
</tr>
<tr>
<td>Evanston</td>
<td>1898-1907</td>
<td>13.72</td>
</tr>
<tr>
<td>Jackson</td>
<td>1905-1906</td>
<td>18.36</td>
</tr>
<tr>
<td>Thayne</td>
<td>1899-1906</td>
<td>14.83</td>
</tr>
</tbody>
</table>

(Records not complete.)

Average for Uinta County: 15.44

### YELLOWSTONE PARK.

<table>
<thead>
<tr>
<th>Location</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18.80</td>
</tr>
</tbody>
</table>
1. There are about fourteen and one-quarter million acres of land in Wyoming with a rainfall of over 15 inches. (See back page of cover.) It is safe to say that the plow land of this area can be profitably farmed on natural precipitation, by thorough practice of dry farming methods.

2. There are about twenty-nine and one-half million acres of land in the state with an annual precipitation of between 12½ and 15 inches. Practically all of the plow land of this area will grow profitable crops by dry farming in a majority of seasons. It is a safe prediction that very much of this land subject to homesteading under the 320-acre law will eventually come under the plow.

3. Of the eighteen and three-quarter million acres under 12½ inches ten and one-quarter million acres probably receive less than 10 inches of rainfall. It is barely possible that a precipitation of 10 to 12½ inches coming largely during the growing season may suffice for the growing of such crops as have become adapted to semi-arid conditions. It is advisable that these areas be further tested either by the State Dry Farm Expert or ranchmen and farmers, exercising especial care to practice the best methods of cultivation to conserve moisture and to determine with accuracy the actual results before judgment can be passed on their adaptability to dry farming practice.

4. Under the most favorable conditions, crops have been successfully grown on a precipitation of less than 10 inches, and while it is possible to succeed with certain crops on this limited supply of moisture, with other conditions right, it would be distinctly hazardous for a settler to venture much in the hope of gaining a livelihood on a 320-acre homestead where he was confident that 10 inches of precipitation was the average and that in one-half of the seasons it would fall short of that amount.
5. Total annual precipitation is no conclusive guide in locating districts where dry land farming can be successfully practiced. The quantity and character of rainfall during the growing seasons, together with altitude, length of season, amount and severity of wind, hailstorms, early and late frosts, are factors which contribute to the solution of the question.

Note.—Included in the above areas are the National Forest Reserves, the mountains, and all the land that is capable of being irrigated. These three classes of land embrace about thirty millions of acres. A large percentage of the land receiving over 15 inches of rainfall is taken up by the National Forest Reserve, as will be seen by a study of the map.

**DRY FARMING PRINCIPLES.**

*Plowing.*—From the evidence above presented, there seems to be no question as to the desirability of having the plowing done some considerable period before the time of planting, and that the land should be so handled during the fallow period as to render it capable of taking up and holding every particle of moisture possible. Fall plowing is recommended where it can be practiced, for spring crops and for seeding the following autumn. It is sometimes impracticable to plow in the fall, but whenever possible the ground should be left as rough as it can be, in order that it may catch the snow. For summer tilling, fall plowed land is the better, but a summer tilled ground for a fall sown crop may be plowed early in the spring. Where possible a depth of eight inches should be maintained while some advocate plowing ten inches.

*Harrowing.*—As a rule, all land should be harrowed almost immediately after it is plowed, the only exception being fall plowed land, which should lie rough during the winter. As a rule, summer tilled land should be plowed after each shower or heavy rain, especially when the storm has compacted the soil in any degree. The harrow should be used on cereal grains in the spring and on cultivated crops, should the ground become encrusted before the crop is sufficiently far advanced to cultivate. The disk or alfalfa harrow should be used on permanent meadows and alfalfa fields early in the growing season.
The Weeder in the Potato Patch.

The Weeder in a Field of Barley.
to aerate the soil and mellow the surface to as great an extent as possible.

The Roller.—The roller and the sub-surface packer are valuable implements in the hands of the dry farmer if used with caution. The ordinary smooth roller should be discarded for the corrugated roller, which serves to pack the ground, at the same time it leaves a roughened surface from which the moisture does not readily evaporate. The sub-surface packer performs the same kind of work, and on fresh plowed, mellow soil, may be more desirable. The corrugated roller serves many purposes, and does not leave the hard, smooth surface which seems to encourage rapid evaporation.

Weeder.—The most useful of implements for rapid work in light cultivation is the weeder. This cultivates the surface of the ground to a depth of one to two inches, is operated very easily, and one team can cultivate a large surface in a short space of time. It is practically a light harrow, and does the work much more cheaply than the ordinary harrow wherever the ground is in such condition that the weeder will penetrate to the necessary depth.

For the cultivation of cereal crops, the first process would naturally be to harrow with the ordinary spike-tooth harrow. Following this, one or two cultivations should be made with the weeder, which may be operated on fields of grain until the growth is a foot or more in height. It serves to preserve the soil mulch, break the crust, and promote ventilation.

Drills and Seeding.—While the above reports indicate that a variety of drills have proved successful, it is universally conceded that some form of press drill is necessary to get the best results from dry land farming. Any means whereby the soil is well compacted around the seed, produces the desired result. Rolling the land, however, should be followed with the harrow or weeder, in order that the surface may be roughened and evaporation checked. Where one is compelled to sow broadcast, the corrugated roller is recommended. Even the
ordinary smooth roller may be employed to compact the ground after seeding, but the process should be followed at once with some sort of light cultivation.

_Crops._—The dry farmer, more than the humid land or irrigation farmer, must select and grow crops adapted to his local conditions. The developing of varieties capable of contending with aridity is progressing rapidly. Rotating of crops, conserving and utilizing of farm manures, and maintaining a full complement of livestock are essentials to the highest degree of success in dry land farming. Some of the crops that have demonstrated their adaptability to Wyoming dry land conditions, are Beardless barley, Macaroni wheat, Turkey Red winter wheat, winter rye, spring rye, oats, spelt, brome grass, alfalfa, potatoes, sugar beets, and, in the lower altitudes, Indian corn and Milo maize.

**GENERAL CONCLUSIONS.**

The dry land farmer must continually bear in mind that in order to succeed, he must study the physical characteristics of his soil and take advantage of every possible means of conserving all the moisture that falls, whether it comes during the preparation of the land for seeding, during the growing period of the crop, or after a crop has been harvested. The foundation principle of conservation of moisture is to provide and maintain at the surface a layer of loose soil which serves to prevent the escape of moisture by evaporation. In the majority of cases, it will be necessary to conserve the moisture of two seasons for a single crop; and early deep plowing, summer tilling of the land, and so arranging the crops that two seasons' rainfall will be largely utilized for each crop, are the means of securing the desired results. The dry land farmer cannot afford to be at all careless about any of these operations. He should also remember that every weed allowed to grow in his cultivated crops saps its proportion of the moisture from the land and thus robs him of a portion of his just dues.