


No. 66.

June 1923

# DRY FARMING

in the  
North Central Montana  
"Triangle"

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Farm Economics  
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Montana Extension Service  
in Agriculture and Home Economics

Published by the Montana Experiment Station, Bozeman, Montana

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Montana State College Extension Service

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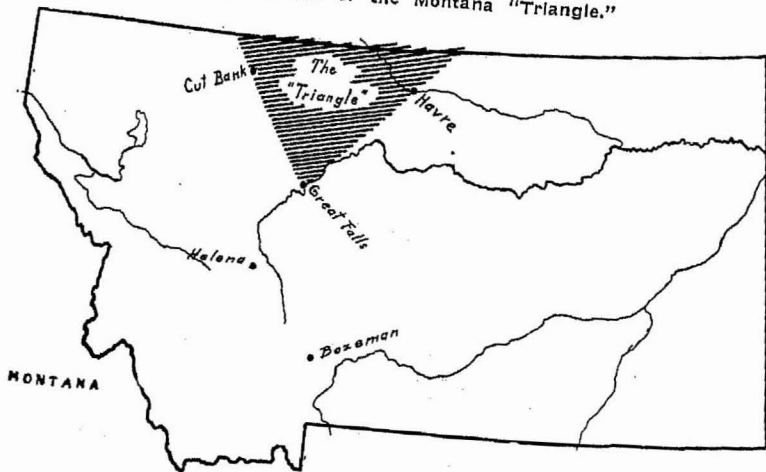
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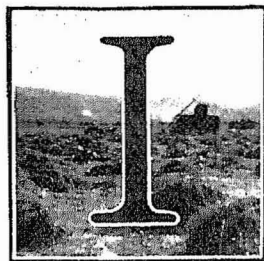
Montana Extension Service in Agriculture and Home Economics;  
F. S. Cooley, Director.

Montana State College and the United States Department  
of Agriculture, Cooperating; Acts of Congress  
May 8 and June 30, 1914

The Location of the Montana "Triangle."



# Foreword



IN THE north central part of the State of Montana there is a vast area of dry farming country known as the "Triangle" where there is being worked out on a gigantic scale a problem which is new in the experience of the local pioneer farmer but old in the history of agriculture. It is the same problem that other men have faced in the development of other big agricultural areas—

the problem of changing their old farming methods and practices to meet the requirements of soil and climate of the new farming area. The need of meeting these natural requirements in the "Triangle" is readily apparent, for here is a vast inland dry farming empire equal in area to half the State of Iowa, with 18,000 farms grouped about 75 towns and cities in all or part of eight counties, and with the prosperity and happiness of thousands of people depending upon farm success.

Here in the Montana "Triangle" there is now the same sort of crisis which was met and passed in Kansas decades ago, (Note<sup>1</sup>) the same general condition which was at one

(Note 1). "From what you say, your people in Montana are having the same experience that the pioneers in Kansas had. Many of the Kansas pioneers believed it would be impossible to farm any portion of Kansas outside the river bottoms. All the first claims were taken along the streams and the prairies were entirely neglected. Later when it was realized that the prairie soil was fertile it took a long time to get the country subdued. The Kansas pioneer had grasshoppers to contend with. In 1874 they were very bad and devoured every green thing. A great many people abandoned their farms and went back to the wife's folks, mostly in Indiana and Ohio. In 1860 there was a drouth extending throughout the year. Claims were abandoned at that time which are now worth \$250 an acre. Western Kansas has been settled and almost depopulated more than once because of climatic conditions. The soil is good and with enough moisture immense crops are raised. It is now well settled and land is advertised at \$35 per acre in Wallace county. As people become more familiar with the soil and climate they know what crops to plant and they always have enough feed for their stock. Those who settle down and stay through these vicissitudes of pioneer life win out. Sometimes they do not know how they can stay, but they have remained through all sorts of misfortunes until many of the citizens of the western half of Kansas are as well-to-do today as those of any other agricultural or stock raising country. I have no doubt but that those settlers in Montana who stick to their homesteads and stay through all the calamities that overtake them eventually will be as well-to-do as those in any other part of the country."—William E. Connelley, Secretary, Kansas State Historical Society, 1923. Also see discussion of "Experiences of Other Agricultural Sections With Temporary Farm Failure and Depression," in the Appendix of this bulletin.

time faced by farmers of the Palouse country in Washington and the Red River Valley of Minnesota and Dakota. And like the crisis that left its great mark in the history of Kansas, the crisis in north central Montana has brought with it years of privation and suffering; years when the high hopes of the homesteaders withered in the continued blast of drouth, when bad weeds spread a plague over the land, and when the broad dreams of the first years of success gradually sank into the commonplace of deserted shacks and untilled fields.

But following the same experience as these other dry farming sections, (Note<sup>2</sup>) the Montana "Triangle" is passing its crisis and there is developing a type of farmer with a new type of farming to meet and conquer the apparent disadvantages of the country. That type of farming which can and will build the "Triangle" into permanent agricultural territory now is developed to the point where it is swinging the tide of hope back to north Montana. The farmer, business man and investor who yesterday judged the country by the signs of failure visible on every hand, today are working hand in hand toward what seems the inevitable prosperity of the same section. In this new hope there is a background of bitter years of experience to guarantee the solid basis upon which the new type of farming will be practiced.

To hasten the development of this type of farming which will build the permanent success of the "Triangle," the Montana State College Extension Service publishes this bulletin. It is the first detailed printed report of a survey made in 1922 on the more successful farms of north central Montana. The survey was made to determine the methods used by farmers who had succeeded in spite of years of drouth and other hardship. Naturally it has become known in Montana as a "farm success survey" for it was an attempt to gather the experiences that had brought success under the worst conditions possible for the area. Where any farmer was found making an apparent success in spite of the widespread failure, a careful study was made of his methods and practices. His tillage, his resulting crop yields, his various farm activities and his scheme of farm manage-

(Note 2). In this sixty-seventh congress, and on March 6, 1922, Mr. Mann of Illinois said: "Men have gone out to this—I would call it a semi-arid region—pledging their lives and all they have in an effort to cultivate the soil, not merely in their own interest but in the interests of the country and the whole people. They have undertaken a task commensurate with any of the tasks of the old pioneers. I sometimes have wondered at their courage and hardihood. There comes along a time when these men, with no accumulation of property, meet with average climatic conditions. They cannot raise a crop. In the course of time we will perhaps better learn how to handle the soil in these localities. I can remember back to the day when the pioneers who went to western Kansas came flocking back to the eastern portion of the country, and yet civilization and man practically have captured Kansas and the cultivation of the soil there."

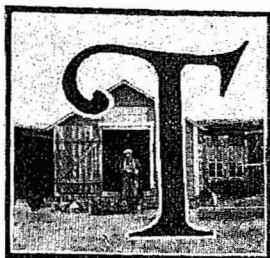
ment all were considered in so far as they were found to succeed against the prevailing odds of soil and climate, weeds and insect pests. The success of the farmer, in the eyes of the men conducting the survey, was measured almost wholly by the amount of his "labor income" through years of drouth and economic depression.

It was not surprising that the survey developed great similarity between practices of different successful farmers. The facts gathered on these farms made a program of methods of success, and this program of success naturally becomes the index to that general type of farming which is to point the way for other farmers in the section. It is confidently believed by men who conducted this survey, and by those practical and successful farmers whose co-operation made the survey possible, that the adoption of this general program will lighten the chance of failure and broaden the prospect of success in the "Triangle." It is not claimed for this bulletin that it presents the future type of permanent farming in all detail, for many changes and modifications will occur in natural course. But it surely is the first index to this permanent type of farming, and it is worthy of adoption by every farmer who finds his own methods failing to bring the success gained by men whose farming experiences are told in this story.

The reader is asked to keep in mind that this bulletin is written as a popular presentation, and not a scientific presentation. There may be words which, in a scientific sense, may seem misleading, but the bulletin is written in popular form to be of highest value to the farmers of the "Triangle" and to the people vitally interested in the development of the new type of farming for this section.

If between the lines in this farming summary there appears at times the hint that the story has left its strict purpose, it must be remembered that behind the whole outline of facts and figures there stands the stirring drama of life itself. Each deserted homestead shack is a key to some unwritten story that strikes deep into the heart and soul of agricultural America; each successful farm is a monument to a glorious battle on an agricultural frontier. It would be difficult to write a "Triangle" summary that did not take color from the background of pioneer men and women who have written the greater story into their own lives. There will surely appear at times in this bulletin, then, something of the high respect and sincere admiration that is felt for the pioneer farmer of north central Montana and for the farm women who, in their great home building instinct, often have pointed the way past the threatened failure.

## Description of the "Triangle"



THE AREA in north central Montana which has become known locally as the "Triangle" is that last broad sweep of the Great Plains from the Bear Paw mountains to the Rocky mountains. (See Figure 1). Its form is roughly that of a great triangle, with its apex at the south near the City of Great Falls and with its sides spreading wide until they form a base line of about 130 miles along

the Canadian border. Because cities help to fix the location of indefinite areas, the "Triangle" points often have been said to lie at the cities of Great Falls, Havre and Cut Bank. (Note<sup>3</sup>).

Across the widest part of this country runs a trans-continental railroad, and other important branch roads intersect its area. Along these railroads have sprung up towns of varying size to serve as primary markets for the grain and livestock products. Telephone lines reach many of the farming communities and the rural free delivery is common to the region.

The topography of north central Montana is similar to that of many other sections of the Great Plains. It is a country of inspiring distances, with broad level prairies broken here and there by gently rolling hills. Near the slopes of the mountains to the east and west are areas of rough grazing land, and near the northwest corner the Sweet Grass hills lift lesser peaks that may be seen from great distances.

The soil varies in texture and fertility and ranges from chocolate silt loams to sandy or gravelly areas and gumbos. Over a portion of the northeast corner there is an impervious clay which was but poorly grassed in its native state. Some of the land is rolling hills with poor soil which is suitable only for grazing purposes, yet there are big areas of level or slightly rolling bench land which are well adapted to dry land cropping.

(Note 3). To the north of the Canadian line, in Alberta and Saskatchewan, is a territory of about equal size which also forms a triangle with an apex some 200 miles north of Havre. Its topography, lay of land and grade of soil are almost identical with the Montana section and its ranching history, settlement and recent conditions are in many ways identical with those described for the Montana area.

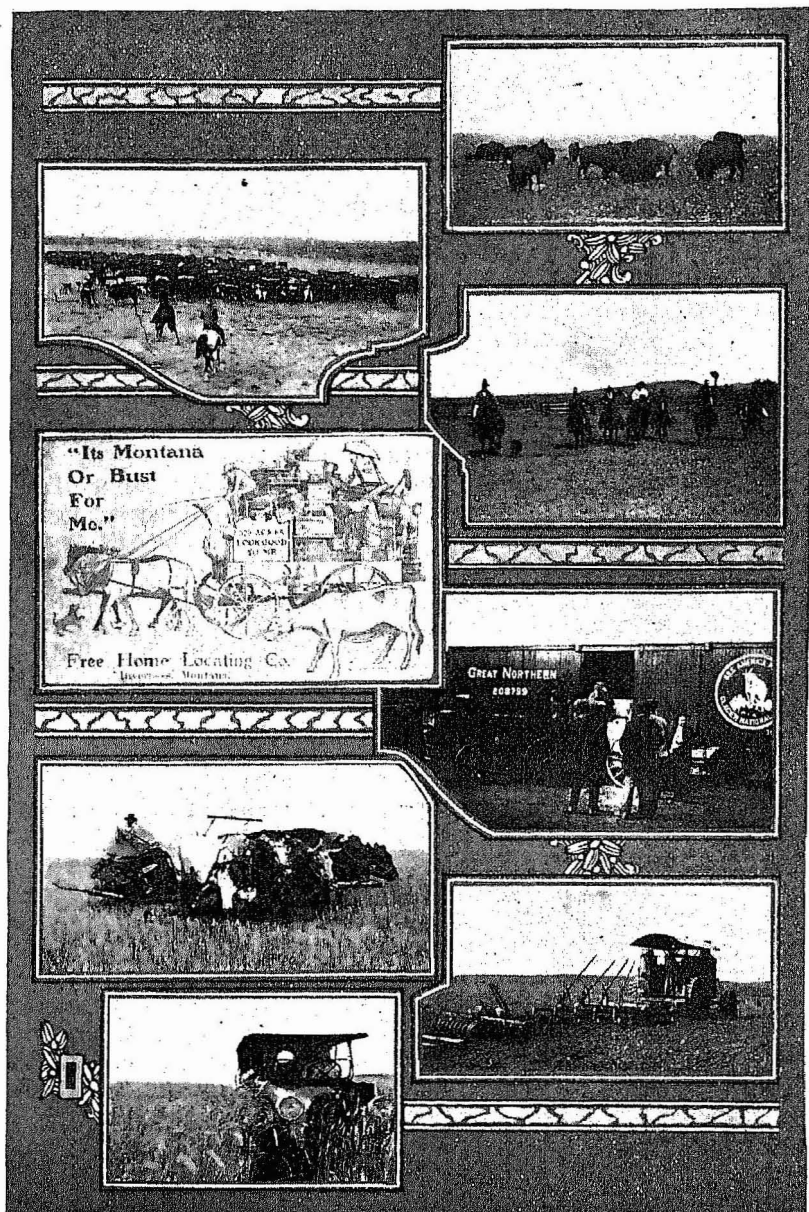


Figure 2—Buffalo days to boom days. Where once buffalo roamed the plains in perfect freedom, they were crowded out by the livestock industry and the cowboys. The arrival of settlers saw another transition, from cattle raising to large scale grain farming, with its attending large outfits.

# PART ONE

## From Buffalo Days to Boom Days



IN ITS virgin state the greater part of north central Montana was well grassed and was the grazing grounds for great herds of buffalo. The wandering tribes of Indians gathered here annually on the buffalo hunt, and on many of the unbroken parts of the "Triangle" today may be found the circles of small stones which only a short time ago marked the edge of the buffalo hunter's tepee.

The buffalo disappeared rapidly with the coming of the white man after 1860, and there soon appeared upon the open ranges the herds of cattle that ushered in the "cattle country" days of Montana. The period from 1880 to 1900 is the period that gave Montana some of its wildest "wild west" traditions and was a day when the cowboy often dictated local law with a quick trigger finger. But as the Indian and buffalo gave way before the advance of the white man, so the big cattle ranch slowly lost its importance in the advent of the homesteader.

Homesteaders began settling upon the public lands in north central Montana about 1907, the heaviest settlement coming from 1909 to 1911. (Note<sup>4</sup>). Owing to a combination of conditions, most of the desirable homestead land was filed by 1914. In the middle west there had been a period of rising prices which sent land values soaring. Ownership of land had become increasingly more difficult for the young man who was land hungry but whose finances were limited. Throughout the old farming sections there was an unusual demand for land, and it was met by land speculation that soon placed prices beyond the means of the farmer of less wealth.

When those interested in the settlement of north Montana sent out their literature urging citizens to "get a free home in the west," it is only natural that the appeal fell upon receptive ears in the middle west. The land hungry hordes

(Note 4). Prior to 1909 immigration agencies had largely passed this section by. There were good wheat yields in 1907, 1908 and 1909. At this time prospective settlers who visited the country were impressed with the big yields and began filing land. They started the "boom" during these favorable years.

turned their eyes to the promised land of the northwest at a time when this section was enjoying favorable climatic conditions, when big yields of grain were obtained upon the freshly broken sod and when weed and insect pests had not yet become noticeable. They saw a region of cheap land that produced at the time big yields of grain that sold for high prices. It was a combination of favorable circumstances which surely will free from blame the brightest claims of the promoters of this new agricultural area. There is no one left to wonder why the immigrants came in such numbers that within a very few years all available land was filed for homesteading.

At this time there was no general public land policy in the United States with reference to the settlement of those lands or the type of farming that should be practiced upon them. The first few years of experiment had convinced many that the old style farming methods would reap big profits in the new country. There was little, if any, attempt to learn if these favorable conditions were common in the section, or if unfavorable years might be expected. There was little thought of the worst possibilities of climate at a time when climatic conditions were at their best.

It is history that during the settlement period in most of the older prairie farming sections the settlers had proceeded at first on a small scale, slowly accumulating capital, practicing the most rigid economy and expanding cautiously within the bounds of their earnings. But in the settlement of north central Montana there were no such conservative checks. The first years of big yields at low production cost, sold at war prices, convinced the average farmer that the amount of his profit would be governed by the amount of ground he could seed to wheat. Credit was comparatively easy to obtain, for with the first fine yields of grain on the new land came a sharp rise in land values. (Note<sup>5</sup>). An optimistic outlook invaded the entire section and expansion was hastened by the purchase of hundreds of engines which could break the sod more rapidly. Farming and the community business of banking, merchandising and marketing which followed, were built on the assumption that this combination of favorable circumstances would continue. Farmers and business men were congratulating themselves that they were "in on the ground floor."

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(Note 5). During this period of rapid expansion ownership of the land passed from the government to private citizens. Usually upon obtaining his patent the homesteader was anxious to obtain a loan. This might be for the purpose of paying existing indebtedness (local bills contracted during the period of homesteading) or in many cases it was used in the purchase of more land or farm equipment. Most of the loans were made from 1914 to 1917 and those other than federal or state loans ran for five years, drawing 10 per cent interest. See also tables on land mortgage indebtedness



Figure 3—Can you blame the investor for putting his money in Montana lands when fields produced a yield like this?

The climax of this optimism came in 1916 when unusual weather conditions prevailed and when farmers harvested extraordinary crops of wheat which they sold at war prices. (See Fig. 3). There had been no insect pests, no bad weeds to cut their yields. (Note<sup>6</sup>).

Naturally there was little thought about good or bad farming. Under these extraordinary conditions farmers obtained high grain yields under even the most slipshod methods of farming, and they saw no reason for careful farming when careless farming returned big profits. There could be but one result from this combination of conditions—a cry for more land. Farmers began a frantic search for additional acreage to increase their possibilities of profits, and they bought tractors by the hundreds to handle the larger units of ground that they bought. Lands which were just being patented were contracted for at from twenty-five to fifty dollars per acre. Farmers went into debt to purchase the land of their neighbors. They reasoned that as rich farmers of the middle west had made their wealth by increases in the values of land, they could do the same thing in Montana. (Note<sup>7</sup>).

(Note 6). Flax and wheat were seeded upon the sod and since the tough sod rots or decomposes slowly, and because weeds were absent, the sod land was double disced the second year and sometimes the third year, which resulted in good crops being produced. The second or backsetting plowing could not be done satisfactorily until the third or fourth year. Many farmers were contemplating cultivated crops like corn, or summer fallowing in their farming system, but with the absence of weeds and years like 1915 and 1916 no incentive for this prevailed.

(Note 7). The average values of land and buildings per acre in Iowa for various years are: 1900, \$43.31; 1910, \$96.00; 1920, \$227.09.

This made an exceptionally heavy demand for credit and to meet this demand loan mortgage companies sent money freely into the state. These loan companies figured that, although the loans were made at valuations of ten to fifteen dollars per acre, the value would rise rapidly and increase the safety of the loan. Local loan agents competed with each other in placing credit, reaping their commissions on the money loaned. These loans all were made in good faith and followed within the bounds of optimism that prevailed in the country during this period.



And, indeed, the man was a stoic who could not enthuse over the crops of 1915-16. It was not uncommon in those years for north Montana wheat fields to return a harvest of thirty-five to fifty bushels to the acre. At the North Montana Experiment Station at Havre, wheat on sod without exceptional treatment yielded fifty bushels to the acre and was sold at two dollars per bushel. During this period the average character of the weather was lost sight of and the term "dry land farming" was said by the farmers to be misleading. They wanted it called "non-irrigated" farming.

Let us look at the situation in the fall of 1916. Two years of exceptionally high yields, produced cheaply and sold at war prices, gave a big surplus of capital to most of the farmers. The result was human. Instead of placing the big profits in the bank to act as reserves in the inevitable years of changed conditions, the money went into big tractors, automobiles, farm buildings and land—ever and always into

## Havre Land Office

## Applications For Homesteads and Other Entries

Number  
8000-

1911-1921

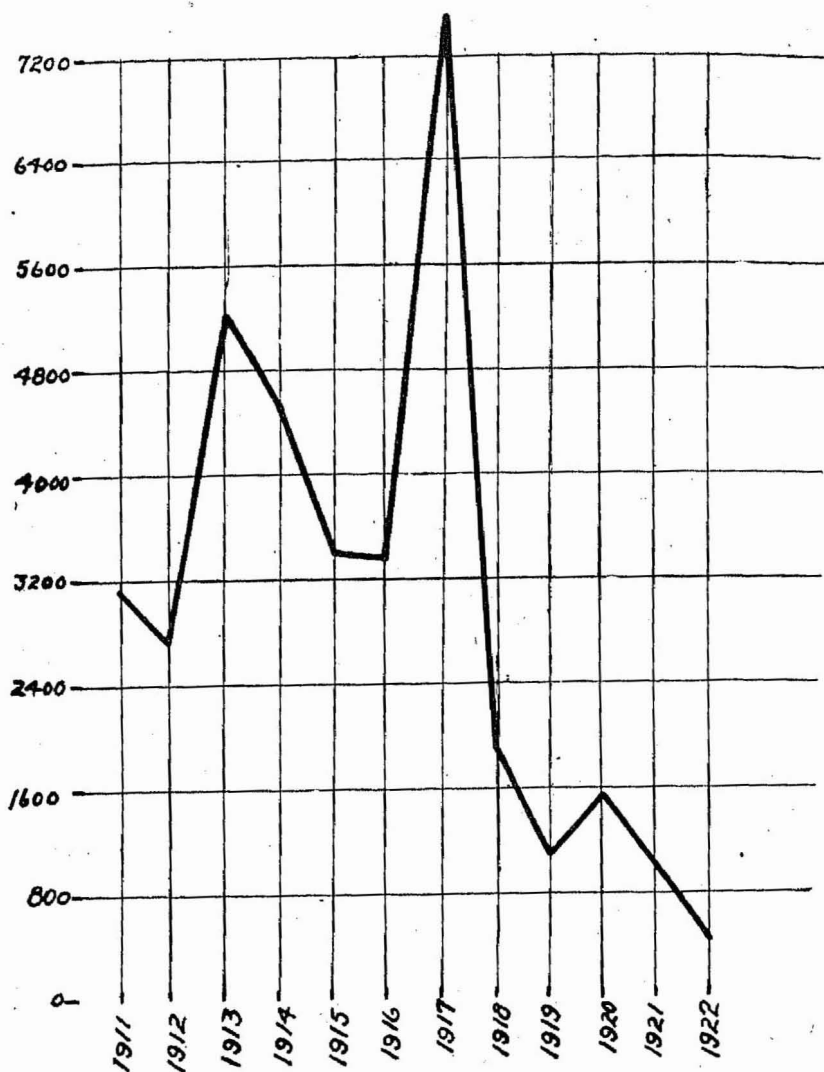


Figure 5—A chart showing the homestead filings at the Havre land office. The filings increased steadily until 1913, fell slightly with the year of 1914, but soared after the big yields of 1915 and 1916. By the end of 1917 the filings had reached the peak and were influenced largely by the big yields and war prices. But the beginning of the drouth in 1917 sent the curve rapidly downward and in the very bad year of 1919 filing had almost ceased. There were a number of filings through 1920, due principally to oil activities in the region. By the end of 1922 practically all available homestead land in the region had been filed upon.

more land. (Note<sup>s</sup>). Yet there are few men in other lines of work today who can criticize out of their own experience. The losses which have occurred in this section are perhaps no greater than the losses which took place in land speculation in Iowa and other states, and they find similar stories in the losses in stock speculation and unsound industrial enterprises which still are seen each year throughout the country.

*Number of School Census Children  
For Chouteau and Teton Counties For 1910  
And The Same Area In 1922.*

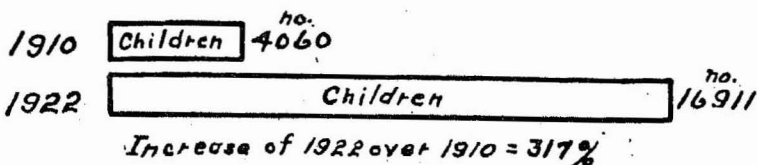


Figure 6—Showing the growth in school population from 1910 to 1922 in the "Triangle." In 1910 this area was Chouteau and Teton counties, while in 1922 five counties were included in the same area. The growth in school population gives an idea of the rapid growth in population of the area.

The period from 1910 to 1916 was a period of sudden transition from cattle country to agricultural country. Figure No. 5, which shows the filing at the Havre land office, and Figure No. 6, which shows the growth in population and schools in the "Triangle" territory, are an indication of the feverish activities of the "boom" days. In 1910 this area was included within two counties; in 1920 it had been split into eight counties. One saw, within a very few years of time the change of the great cattle ranch into an agricultural community, with towns, stores, and a host of smaller farms.

This, then, is the situation in the "Triangle" at the close of the "boom" period. It was indeed the exceptional farmer who had given thought to summer fallowing up to this time. Most of the farmers now had assumed heavy debts to purchase land, tractors, automobiles and buildings. Interest rates on the borrowed money were comparatively high and each farmer felt compelled to plant the largest possible acreage of wheat to meet his interest and taxes and

(Note<sup>s</sup>). There was a similar experience in Alberta. In a report of the Survey Board of Southern Alberta, 1922, we read: "If all concerned had been content from 1916 onwards to follow the practice of cropping and summer fallowing in alternate years that had become established, and to carry on that work carefully, all would have been reasonably well-to-do now, but the fact remains that many who were in comfortable circumstances in 1915 are now as seriously involved as those who had made less progress up to that time. This expansion in acreage was accompanied by a disregard of the summer fallow rule."

still leave profits for further expansion. Wheat was the one dependence, the one general goal of all farming enterprise. The land was being worked to its utmost under ideal climatic conditions, and little consideration was given to any possible catastrophe ahead. And into this situation, in 1917, came the first of the years of severe drouth.

## AT THE END OF THE "BOOM DAYS"

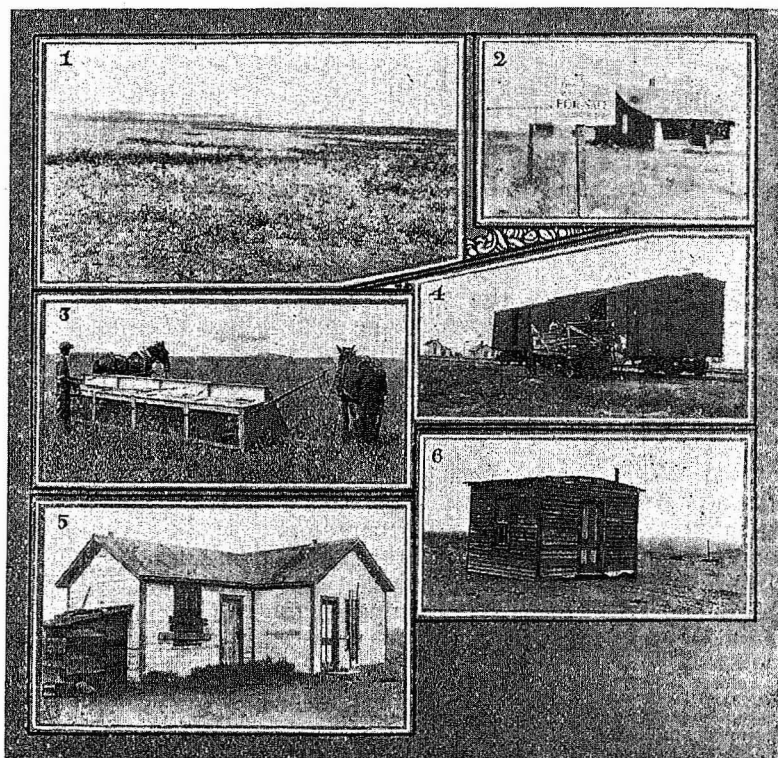
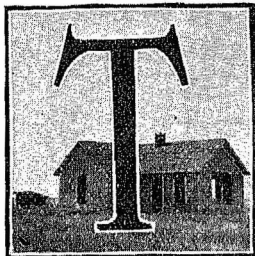


Figure 7—The conditions in 1921: (1) A crop destroyed by cutworms; (2) One of many "for sale" signs; (3) Grasshopper dozer, trying to fight the pest; (4) Loading up and moving out; (5-6) Deserted shacks.

## PART TWO

# The Situation Today, and Its Causes



TODAY THE enthusiasm of 1916 is replaced by a depression that spread fast through years that brought drouth, weed pests and visitations of crop destroying insects. Today this part of Montana is high in number of mortgage foreclosures, (See Figs. 12 and 13) delinquent mortgages and abandoned land. (Note<sup>9</sup>). Only a few of the big tractors of 1916 are working in these fields today. In the

towns there are many abandoned buildings; some of the towns which started with great hopes in 1915 or 1916 now have become little more than cross-road stores. There have been bank failures, (Note<sup>10</sup>) business failures and farm failures in discouraging succession.

Beginning in 1917 a drouth set in and continued practically unabated until 1921, making the most prolonged drouth in the weather history of north central Montana. In 1919 the drouth reached a climax in the driest year on record in this section. In 1919 there was unusually low precipitation with poor distribution, high temperatures, hot and dry winds and dry air. (See Fig. 8).

So the real test of farming began to be seen in 1917. In this year the Russian thistle found its own ideal conditions, and became a serious pest. Farmers had previously taken no precautions against the spread of this weed pest and now they were blown over the entire country, seeding all cultivated fields. Farmers who still practiced the careless methods of tillage had practically no crop this year, although farmers who followed more careful methods harvested fair crops, for there were reserves of moisture in the soil from the year before. In this year good farming returned fair yields where poor farming completely failed. This fact should have been a warning to those who farmed without knowledge or thought of conditions to be faced. But the end of the year found only partial discouragement.

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(Note 9). Based on the total improved farm acreage in Hill county in the 1920 census, 53 per cent of this land has been foreclosed upon or was in the process of foreclosure at the end of 1922.

(Note 10). Complete figures on number of state and national bank failures are not yet compiled.

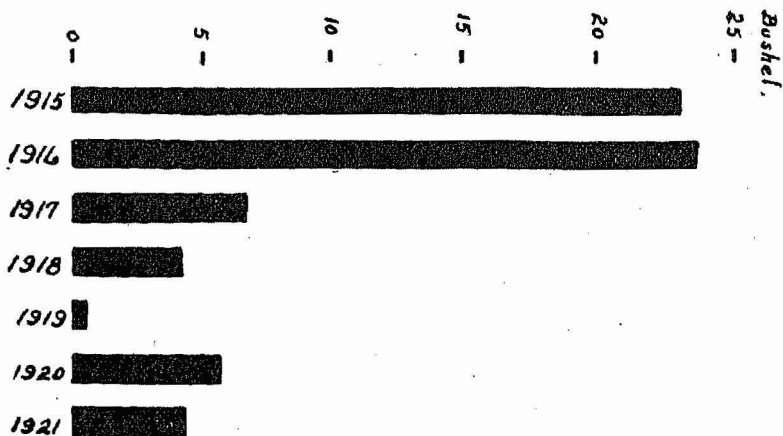


Figure 8—A chart showing the average yields of spring wheat obtained by "successful" farmers of north central Montana from 1915 to 1921. This shows how the weather is the controlling factor in crop production and how even the most successful farmer will have a wide variation of yields between various years.

Farmers and business men alike figured that it was one bad year that could not be repeated. They faced the next year with their enthusiasm only slightly abated.

But in 1918 conditions were worse than in 1917. The drouth continued severe and, except where favored by occasional local showers, the crops were badly burned. Crops that had been "stubbled-in" were almost a complete failure and the homesteader type of farming, with methods learned in other farming sections, failed completely this year. In this year the pinch of the situation in the "Triangle" be-

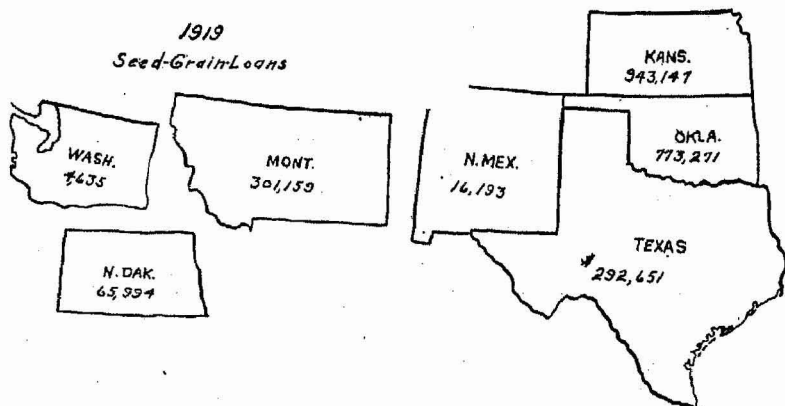


Figure 9—This chart shows the distribution of federal seed loans in 1919 by states. No chart is available showing the distribution of money that year by farms in Montana.

gan to be felt keenly. Most farmers had large land holdings, with mortgages and high interest rates, but little if any cash capital. Two years of failure made interest payments impossible in many cases; failure of the one cash crop left no funds for family living expenses or for necessary farm replacements and repairs. The end of the second year of drouth found many farmers unable even to purchase seed for the coming crop. Banks and business houses of the region stood loyally with the farmer, helping him to obtain necessities of life and providing for his necessary farm expenditures. It appeared as a common misfortune for the entire section, and it is worthy of note that all classes of men faced the situation together, each standing firm in the belief that the district must "come back."

The cry of America in this second year of the World War was for more wheat. Because of this war need, and following two years of drouth in the west, President Wilson set aside five million dollars (See Fig. 9) to be loaned to drouth stricken farmers in the west, (Note<sup>11</sup>) for it must be remembered that the drouth was not peculiar to the "Triangle" or to Montana alone. (Note<sup>12</sup>). These loans enabled the more needy farmers to seed the crop for 1919, and again the population of north central Montana forgot the growing sense of failure in the optimism that comes with the planting of a new crop. (Note<sup>13</sup>).

The year 1919 came as a great climax of drouth to set the seal of broken hope upon a majority of homes in the "Triangle." There was no reserve moisture from the two previous dry years; grass made practically no growth—there was no pasture or feed. Most of the grain that was seeded did not germinate, and as a result the farmers began shipping out their livestock.

The drouth period from 1917 to 1921 is the longest and most severe known in the Havre record, which began in 1882. The following table shows the comparison of the principal weather elements in a good year like 1916, the years of drouth, and the average for all years since 1882:

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(Note 11). Under Miscellaneous Statistics and Tables in the Appendix will be found the federal, state and county seed loans by years.

(Note 12). Loans for seed and relief were made in large amounts in Canadian provinces, the exact figures not being obtainable for publication.

(Note 13). In the Appendix at the back of this bulletin is given the government and state seed loans by counties and by years.

## DRY FARMING IN THE "TRIANGLE"

Year	Total Precipitation	Rainfall Growing Season	Relative Dryness of Air June & July	Days of Hot Winds June & July	Type of Year	Non-Fallow Yield	Fallow Yield Bushels
1916	20.71	13.96	56	* 0	Very Moist	23.6	29.8
1917	13.66	3.99	34	**17	Very Dry	6.8	14.7
1918	10.04	5.29	35	**17	Very Dry	4.1	11.5
1919	8.85	4.10	29	**20	Very Dry	.5	2.8
1920	14.14	9.45	40	**18	Dry	5.7	12.8
1921	13.03	7.87	43	**10	Moist	4.5	11.7
	13.54	8.51	Forty-year Average				
			48				

\* Good Year. \*\*Drouth Period.

The reader will note the small amount of moisture that fell during the growing season in the dry years, as well as the number of days of hot winds in June and July these same years.

The winter of 1919-20 was one of the longest and hardest known in the livestock history of Montana. (Note<sup>14</sup>). Snow came early in the autumn and remained until late in the spring. Farmers who had not sold their livestock were forced to buy feed at high prices. Many went bankrupt trying to feed their stock through the long and severe

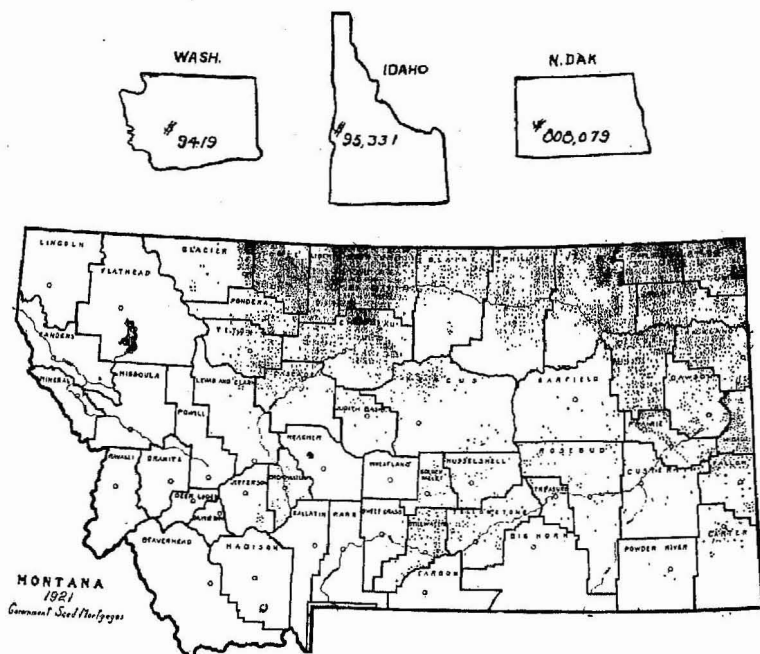


Figure 10—This shows the distribution of federal seed loans in 1921. Above is the distribution by states, while the larger figure shows the distribution of the loans in Montana.

(Note 14). In 1920 seed loans and relief to the amount of \$2,005,505 were made in seven counties to 7,009 farmers. Of this amount \$741,900 was paid back.

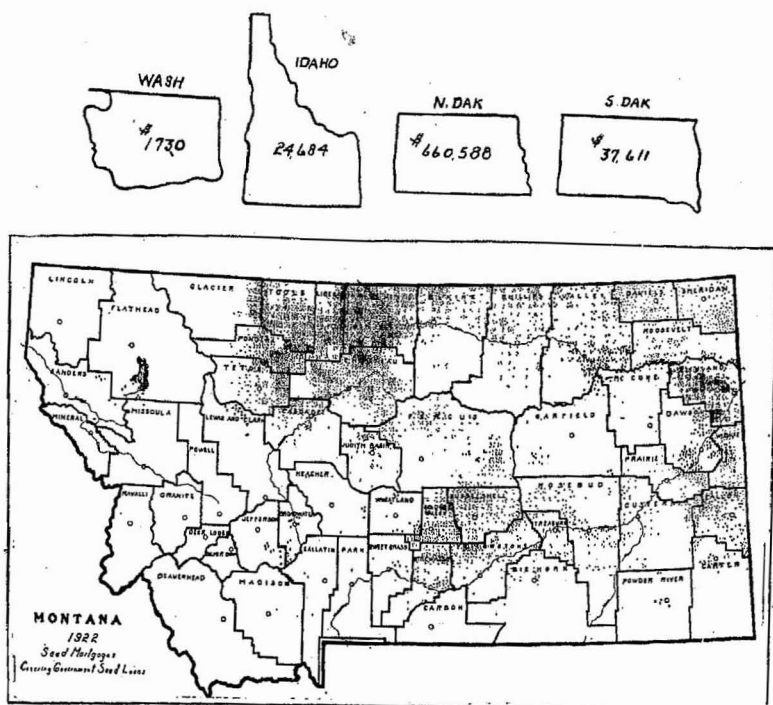


Figure 11—Above is shown the distribution of the federal seed loan of 1922 by states, while on the map of Montana is indicated the distribution of this money by farms in Montana. The shading indicates that the "Triangle" received much of this money distributed in Montana.

winter. Others held out until spring, and then in a rapidly declining market found their livestock of less value than the high priced feeds that had been fed them during the winter. Many of the pioneer settlers left the country with their horses still on the range, or in livestock pools to be shipped out to better country in the east.

What the devastating drouth of 1919 had failed to do in taking the last hope from the settler, the winter of 1919-20 seemed certain to accomplish, yet there remained in the spring of 1920 some of that eternal hope that cannot be denied. (Note<sup>15</sup>). "If we can put in but one more crop," they aid. "One more crop will surely swing us back to the old prosperity." Farmers by now had completely exhausted their credit and reserves and as a result banking conditions were severely strained. But every one joined in the desire to put

(Note<sup>15</sup>). Weather prophets and "wishbone" soothsayers told the farmers that a wet season had always followed a dry season (and it naturally does when the dry season ends) and that since the drouth had been prolonged and there never had been three dry years before in succession, 1920 would undoubtedly be a good year.

in "one more crop." Legislation was obtained in 1919 whereby counties could and did bond themselves to furnish seed and relief for their farmers. (See Fig. 9).

From the standpoint of weather, the crop of 1920 was another comparative failure, and where a fair crop did promise, grasshoppers and cutworms often moved in and destroyed it. There was little faith remaining in the country after this year's disappointment—no capital or reserve with which the farmer could start a comprehensive summer fallowing system. There was little more in the way of defeat that could be experienced. Those farmers who were left on the land in the spring of 1921 were forced to practice the most rigid economy in farming and living expenses. Another appeal was made to congress and a second government loan made possible the funds which provided for the reseed-

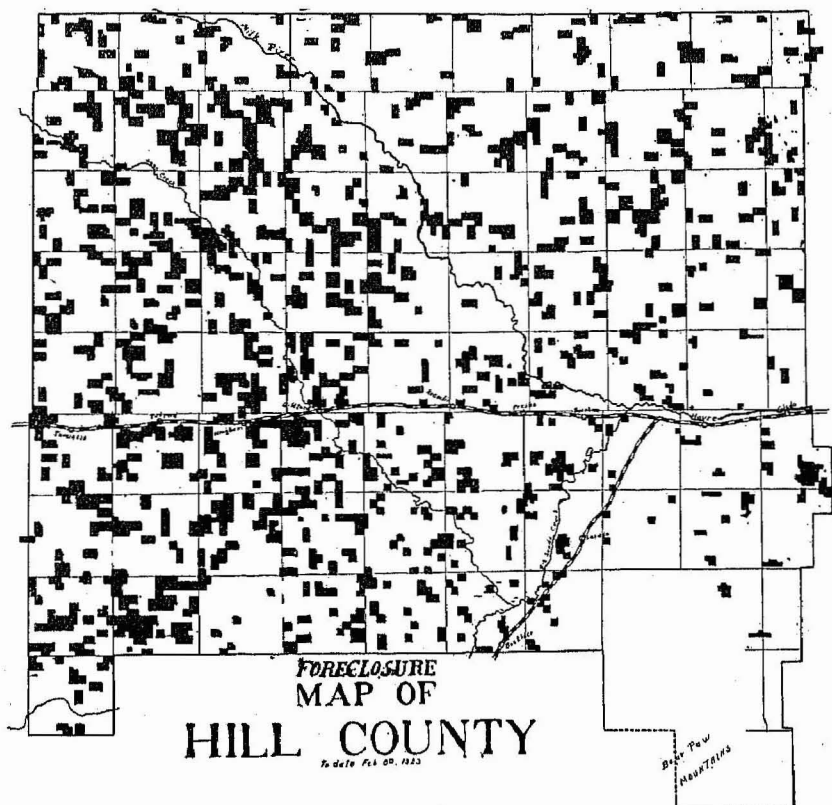


Figure 12—The farms in Hill County that have been foreclosed on and those in the process of being foreclosed.

# FORECLOSURE MAP OF LIBERTY COUNTY

DATE Dec 31 1922

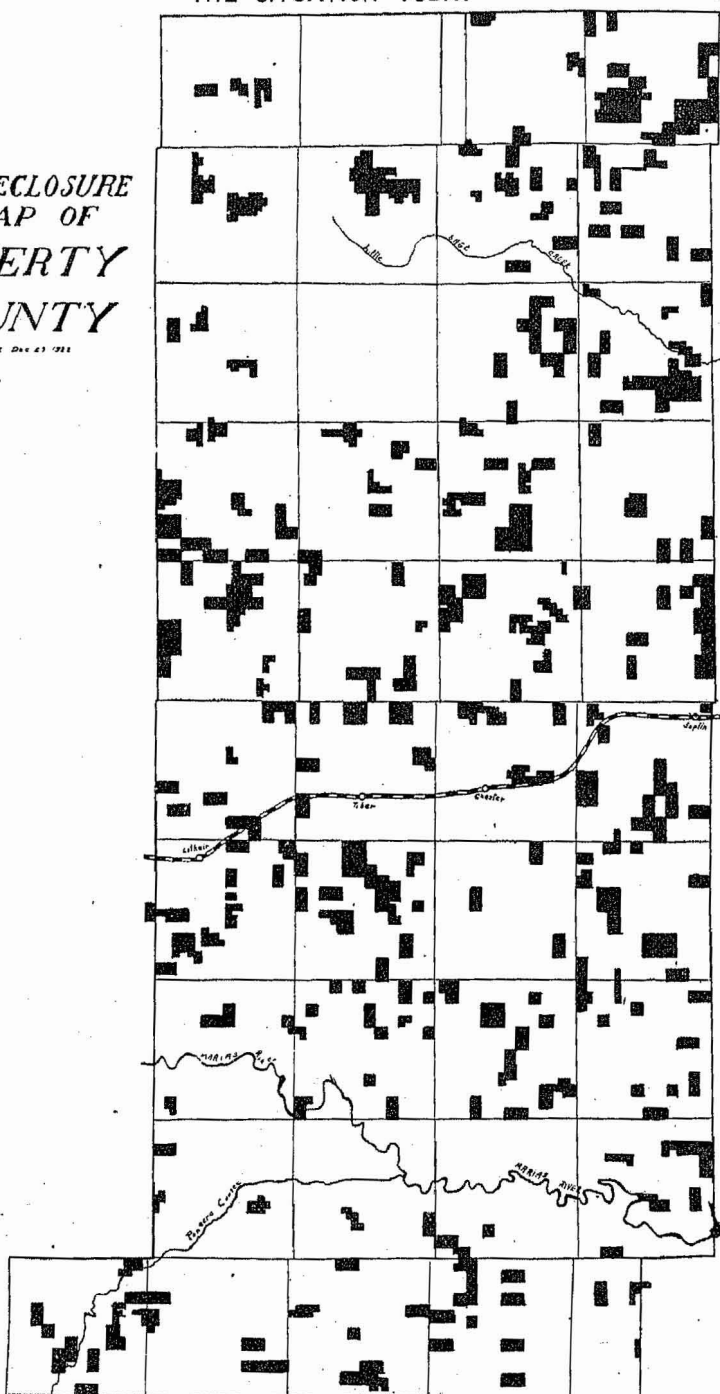


Figure 13—The chart shows the farm land in Liberty county upon which foreclosure had been made or was in process of being made at the end of 1922.

ing of some of the fields for another year. (See Fig. 11). The story of 1922 is a repetition of the story of general crop failure and insect damage. (Note<sup>16</sup>).

This, then, is the situation that exists in the "Triangle" in the spring of 1923. It is natural that farmers and business men alike should ask the question, "is this a farming country?" Again and again it has been debated whether farmers can make a living in the "Triangle," or whether they must accept the alternative of tearing down the fences and abandoning the buildings that the land may slowly revert to native pasture land for sheep and cattle. (Note<sup>17</sup>).

But the investment in terms of money and life has been too heavy to warrant abandonment before all the facts are known. There is too great a contrast between 1916 and 1921 to warrant any belief that the drouth period is typical of the average climatic condition for the "Triangle." Investors who have millions of dollars in north central Montana lands, join with the federal government and the state in asking for information about the highest use to which this section may be placed.

But of far greater importance is the homesteader who still hangs on to a semblance of his first hopes for the country. Where others have staked money, he and his people have staked their happiness. Here is shown what Roosevelt termed the true spirit of the west; the brave, undaunted fight of the real pioneer. It will be a great day when financial investments in the "Triangle" again reap dividends, can again be sure of his long dreamed contentment; when can again be sure of his long dreamed contentment; when the thistle-blown field of 1921 colors the country regularly with the gold of profitable harvest and when on every hand there are the permanent landmarks of human happiness.

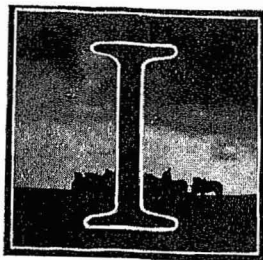
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(Note 16). In the sixty-seventh congress, second session, March 6, 1922, Mr. Mondell of Wyoming said: "Beginning at about the 100th meridian there is a great territory where the settler has been called upon to carry on a great experiment. Can the country be farmed or must it be left to the uses of grazing. From time to time crops have failed. When the failure was for only a year or two the people have been able to tide over the time of stress, but in the Dakotas and Montana there has been a succession of these failures and these failures have come at a time when the costs were high and what the producers produced was low in value. Here we are simply making a loan to these people in the hopes that this small loan, which cannot be over \$300 in any individual case, will tide them over this dry period and will enable them to remain on the lands and fight out the contests which will, we hope, prove that the great area need not be abandoned by the home-builder."

(Note 17). In one county in Minnesota causes of mortgage foreclosure were listed in the report of the Bureau of Labor Statistics, for 1891. The following causes of foreclosure are given: "Twenty-five men who mortgaged land considered it sold, two lost their land through speculation, intemperance is ascribed as the cause of nine foreclosures, three failed because of poor management, family troubles resulted in one foreclosure, poor crops was attributed as the cause for a number of the foreclosures. Twenty-seven of the 245 cases have redeemed their lands since the foreclosure."

## PART THREE

# The Causes of Failure



IN GOING over these causes of the widespread failure of dry farming in the "Triangle," they divide themselves into causes which are unchangeable, and those which are subject to change in some degree. (Note<sup>18</sup>). They might be grouped in this manner:

### Natural Causes (Unchangeable)

- Dry years
- Insect pests
- Some poor land
- Hail

### Causes Other Than Natural

- Unsorted settlers
- Lack of an adapted type of farming
- Poor farming methods
- Periods of over-expansion and easy credit
- Low prices for crops

### Rainfall and Weather

Crops are the result of a combination of weather factors, such as rainfall distribution, moisture in the air and other similar factors. Cereal plants have critical periods in their growth when their yield will be much reduced if the weather at the critical time is unfavorable. Some people fail to realize this important thing in connection with weather—that the distribution of rainfall, condition of the air and other items may often make or ruin a crop in spite of the total rainfall for the year.

In the period from 1893 to 1898 there were poor years in the "Triangle," with drouth conditions. While these years from the weather standpoint were poor, there was no absolute failure condition as in 1919. In the period from 1901 to 1909, with the exception of 1904, there were years when the crop prospects ranged from good to excellent. Some years showed considerable rain during the growing season but weather combinations prevented the fullest storage of moisture.

(Note 18). What is the worst drawback to the "Triangle" country? farmers were asked. They replied: Lack of water 13, drouth 30, hot winds 4, distance to grain terminals 1, market trouble 8, vacant lands and weeds 1, poor farmers 5, wrong farming methods 1, wind storms 1, grasshoppers 1.

It may be held that the drouth period from 1917 to 1921 was the most severe in the history of the "Triangle," and was a series of drouth years which may not be expected again within a reasonable period of farming experience. (Note<sup>19</sup>).

### Insect Pests

Two insects have ravaged in this country during recent years—the grasshopper and the pale western cutworm. Their heavy damage began in 1917 and in each of the dry years they destroyed crops upon thousands of acres. These outbreaks of insect pests have been due, no doubt, to a disturbance in the balance of nature whereby the natural enemies of the insects have not been able to hold them in check. (Note<sup>20</sup>). Improvements in the methods of control of these pests are now taking place and scientists are learning more of the forces which govern the outbreaks. (Note<sup>21</sup>). Experience seems to indicate that these outbreaks are worse when the country is new and when abandoned land and the rubbish of slovenly farming furnish choice breeding grounds for the insects. (Note<sup>22</sup>).

### Hail

The country is more or less subject to destructive hail storms. While these storms are apt to be very destructive over a small area, they are seldom of an extent large enough to threaten an entire community. (See Fig. 14).

(Note 19). A table showing a statistical study of the weather from 1916 to 1921, with total precipitation, relative dryness of the air, days of hot winds, and the yields on summer fallow and non-summer fallow, is found in the Appendix of this bulletin, under Miscellaneous Statistics and Tables.

(Note 20). Visitations of hordes of grasshoppers have been known to many farming communities. In 1876 Governor Pillsbury of Minnesota issued a proclamation "commending to the farmers of the infested districts the advice of the commission to attack the 'hoppers immediately after hatching. . . . By simple devices areas of crops were rescued from total destruction. . . . Governor Pillsbury visited the southwestern counties and after witnessing the ruin and distress called for contributions in relief. The response was immediate and generous. The next spring hatching began in alarming volume. Governor Pillsbury, in expectation that the expense would be reimbursed, distributed 56,000 pounds of sheet iron and 3,000 barrels of coal tar for 'dozers.' (A device to catch hoppers.) When these things were diligently operated the damage to crops was reduced. On April 10, 1877, in response to an expressed desire of various religious bodies, Governor Pillsbury appointed the 26th of that month as a day of fasting, humiliation and prayer. The day was observed in a goodly number of congregations, but there was no great and general humiliation and there was no immediate evidence of supernatural interference. The infernal brood grew wings and began their aerial excursions in various directions. In the last days of June the swarms began to rise high in the air and take flight on different bearings. In the course of 60 days all had arisen and flown out of the state to unknown destinations."

(Note 21). See Circular No. 94 of the Montana Experiment Station, "Our Present Knowledge of the Pale Western Cutworm"; also Circular No. 76, "Grasshopper Control in Montana."

(Note 22). Again in Minnesota records we read: "The old settlers told of a grasshopper scourge at a date forgotten by them, that made a clean sweep of every growing thing, and that grasshoppers were piled by the winds and waves four feet deep on the shores of Lake Manitoba and Shoal Lake."

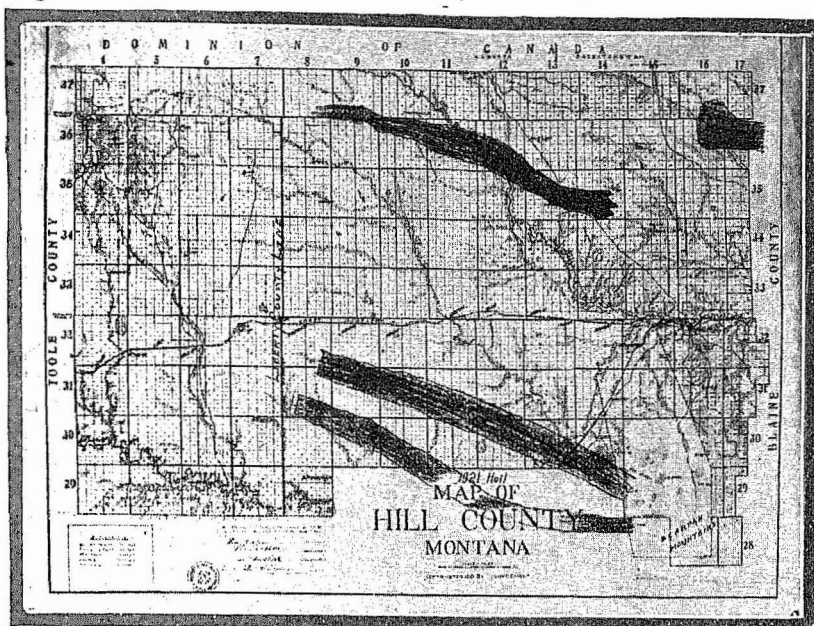


Figure 14—Showing paths of typical hail storms in Hill County. These storms, described by the four shaded areas, occurred, it must be remembered, on different days.

### Poor Land

Soil surveys are needed before the best type of land utilization can take place in this section. In the re-settlement of the "Triangle," the type of farming to be recommended should depend largely upon the type of soil. Some of this land is of a contour and soil texture suitable only for grazing purposes, yet other broad areas are well adapted to dry land cropping. During the homesteading period in the "Triangle" much land was patented and tilled which clearly was not suited to farming purposes. The tillage of this poorer soil will always fail under normal conditions and it should therefore be used for some other purpose. Each farmer of the "Triangle" in the future, as he adopts a permanent type of farming, should know first of all the type and quality of soil with which he has to deal.

### "Unsorted" Settlers

It has been said jokingly that homesteading is "betting Uncle Sam a filing fee that the settler can live on his claim long enough to prove up." No distinction has been made by the government as to the size of a farm unit necessary

for the making of a living, nor has there been any study of the qualifications of men who, in such simple manner, become the nation's producers of food supplies. In fact, many settlers take up land for speculation and with no idea of actually farming it. (See Note 17). The homestead law has not, therefore, been an efficient agency in settlement, but rather a method of passing the land from public to private ownership. The real settlement and development of the country takes place when the lands are privately owned. The government literally invited the butcher, baker, and candlestick maker to "get a free home" on the public domain. In the great wave of emigration that settled the "Triangle," it is very evident that the butcher, the baker and the candlestick maker took Uncle Sam at his word.

To discover the former occupations of homestead settlers and where these settlers came from, a typical township in the "Triangle" was studied. (Note<sup>28</sup>). As far as soil and dry-farming possibilities are concerned, this township was one of the best in the "Triangle." The following tables show the former occupations and states from which the settlers came:

### Former Occupation

Farmer .....	23	Mail Carrier .....	1
Physician .....	2	Carpenter .....	1
Miner .....	1	World Rover .....	1
Deep Sea Diver .....	2	Musician .....	6
School Teacher .....	2	Drayman .....	2
Blacksmith .....	2	Wrestler .....	2
Bartender .....	1	Butcher .....	2
Cowpuncher .....	2	Milliner .....	2
Maiden Ladies .....	3	Jack of All Trades .....	2
Sea-going Engineer .....	1		
			35

### States Represented

Illinois .....	7	Iowa .....	2
N. Dakota .....	2	Wisconsin .....	9
Minnesota .....	2	Wyoming .....	1
Missouri .....	1	New York City .....	3
Vermont .....	1	Eastern Canada .....	3
Western Canada .....	13	Montana .....	1
Louisiana .....	1	Mississippi .....	1

Farming is a business which requires not only natural ability but also a high degree of technical skill. Farmers often do not realize this because they "grow up" in their occupation and pass through a much longer period of ap-

(Note 28). See further statistics on history of settlers in Appendix.

prenticeship than is found in most other trades and professions. Let a city man who has not gone through this farming apprenticeship try to farm and he finds it a highly skilled trade. It takes just as much training and skill to drive horses, to know how and when to plow, to adjust machinery, to take care of work and plan out daily operations, as is required by many highly skilled professions or trades of the city. A successful farmer must have ability as a manager, good judgment, an understanding of the laws of nature and a knowledge of the principles of business.

While the farmer may not appear "dressed up" when seen in his everyday clothes or while he may not always use the kind of grammar approved in text books, yet success demands as much native ability and brains from him as it does from the man who succeeds in other trades or professions. Not every man is a "natural born" farmer, but it takes natural born farmers to succeed at farming. It is no disgrace to a man that he is not born a farmer. This is a complex civilization. All kinds of work must be done. All productive labor is dignified. If nature so fashioned one man that he fails as a farmer it is not a disgrace because he may, when he finds his proper work, become a highly skilled mechanic or tradesman. If the mixed population group shown in the above table were planted on the richest of Iowa farms, it is doubtful if any but the natural born farmers would succeed or remain long upon the land.

In settled farming regions competition is working slowly but surely all the time. Those who are good farmers and good managers are constantly crowding less able farmers off the land and into other occupations. There are exceptions, and accidents in the manner in which this works out, yet it is nevertheless a force working all the time.

### Lack of Dependable Farming System

No single "type of farming" has been generally tried in the "Triangle." There has been a great deal of experimenting with many types of farming. Settlers came from widely scattered sections and brought with them old farming habits, ideas and methods. Thus in the "Triangle" there have been tried out North Dakota and Minnesota types of non-summer fallow farming, Minnesota and Wisconsin dairy farming, Iowa diversified farming, Washington summer-fallow farming, and other types of farming. The settlers did not know how the new country should best be farmed. They therefore farmed it as they had farmed in regions from which they came. The type of farming in this part of Montana has ranged from the use of two-horse implements to one-hundred-and-ten-horse power tractors.

It is frequently said in the northwest that it takes three sets of settlers to transform a virgin western country to a dependable and prosperous agricultural area. First come the mixed homesteaders, who start with a wave of enthusiasm under good weather conditions and rising prices. Then come bad seasons and low prices, when most of the settlers fail and leave the land; the land then passes into the hands of the investors who have loaned money upon it. Then follows a second set of settlers and the story is repeated, but with less failures the second time. Finally the third set of "good farmers" completes the settlement cycle and makes a successful farming country. The accuracy of this old claim is not argued here, nor is it evident that a third set of farmers has been better than the first or second. What really has taken place, however, has been the gradual development of a "type of farming" through these years of experience. Where certain methods brought failure to the first group of settlers they were replaced by other adapted methods when the second settlers took the land.

There are many types of farming and often there may be two or three types in a single locality because of different soil, market conditions or topography. Wheat is the great product in eastern Washington and Oregon, yet the method of farming, or the type of farming there in raising this wheat, is very different from that of North Dakota or Kansas, which are great wheat producers as well.

The great obstacle in Montana dry land farming has been that incoming farmers and settlers have a tendency to carry over and transplant the kind of farming which succeeded in the country from which they came. It would be just as logical for them to expect to transplant the fruit trees and shrubs of Illinois and Kentucky on the plains of the "Triangle" as to transplant the old types of farming.

New types of farming are developing and we may expect in the future a "Triangle type of farming." It will be such that good farmers practicing this type under prevailing land values will be prosperous and make money.

### Periods of Over-Expansion

The "Triangle" was settled under nation-wide boom conditions. Land prices in the corn belt had been rising since 1900. Land speculation was of such a nature that it was difficult for the speculator to lose. Even though he paid a high price for land, the price was continually rising. This produced a feeling that lands would continue to rise without limit, and that one could not go wrong in the purchase of good agricultural land.

This produced a great shifting of population. Corn belt farmers would sell out at a high price and buy land in Minnesota, the Dakotas, Montana or Western Canada at a low price, getting a larger number of acres upon which they expected proportional increases in land value to occur. This was responsible for the shifting of large numbers of people to the Montana "Triangle" during the settlement period.

The speculative land fever, together with the favorable weather and crops of 1913-15-16, hit the "Triangle" like a great tidal wave; it left in its wake the disaster of 1917-21.

During the time when the price of land was rising, the purchasing power of the dollar was relatively lowering. Many examples can be given of extravagant expenditures of money by settlers who, feeling themselves rich because of large crops and high prices, seemed to forget the virtues of thrift. Instead of using their first profits to get out of debt, they went deeper into debt. They sold their small cars and bought six and eight-cylinder cars. Large engine equipment, expensive farm buildings and similar expenditures absorbed great amounts of money. Had the farmers been able to foresee what was to come, the "Triangle" today might have a different history. Had the profits of 1915-16 been husbanded and saved, the country could have tided over the years of adversity. (See Note 8).

### Poor Farming

The gambling farmer who seeded a large acreage in 1916 won out. Very little land was summer fallowed, good farming methods were neglected and much of the engine farming was poorly done, not because it was engine farming, but because of the careless manner in which operations were carried on. Discing or drilling of the grain in stubble without plowing was widely practiced. It will be shown further in this circular how good farming methods proved their worth in a remarkable manner during the dry period.

### Low Prices

Low prices have been a big factor since the crop of 1920. Like all other sections of the country, the crops of 1920-21-22 were sold at a loss, and on top of this were heavy indebtedness, interest and taxes. While the farmer still paid comparatively high prices for goods he purchased, he received low prices for his products. The purchasing power of the farmer's dollar sank very low. (Note<sup>24</sup>).

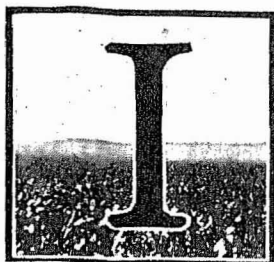
(Note 24). Prof. Irving Fisher of Yale University shows in this table how the relative purchasing power of the dollar has been lowering: In 1896 the dollar represented 100 units of purchasing power, in 1904 it was worth 77 units, in 1912 it was valued at 65 units, in 1916 it had dropped to 53 units and in March, 1920, it had sank to 26 units. This means that the dollar in 1920 had a trifle more than one-fourth the purchasing power that it had in 1896.

### **Lack of Reserve Capital**

Since the country was new, it had built up little if any reserves of capital. During the good years farmers expanded operations rapidly and did not develop reserves to carry them through periods of possible drouth.

## PART FOUR

# Explaining How the New Type of Farming for the "Triangle" Is Being Worked Out



IF THIS bulletin were written in 1928 it probably would be modified in many details. But today it is presented from the viewpoint of 1923 and it presents what we believe to be the key to a type of farming for north central Montana.

In the past each agricultural community has worked out its own type of farming by trial and error, success and failure. This method has been slow,

painful and expensive—a waste of human life and effort. Today agricultural colleges with their agricultural scientists are engaged in the business of assisting in finding "short cuts" through these years of costly experiment. When the farming sections of the east were in process of settlement these agricultural colleges were in their infancy and could contribute but little. Today they are a powerful element in the agriculture of the nation.

Beginning with Part Six of this bulletin the Montana State College, through the Extension Service, presents suggestions which it is believed will help lead toward permanent farm success in the "Triangle." For those people who are interested in knowing how this program has been built up, the following paragraphs will be of some interest. Three studies form the basis of this program, namely:

1. Weather analysis.
2. Experiment station records.
3. Successful farmers.

### Weather

Weather observations have been recorded at Havre since 1882. (See Fig. 15). This long weather record has been studied year by year to determine what crop possibilities there are for the "Triangle" through a long course of years. There are, therefore, 28 years in which weather records were kept but during which no systematic dry farming was prac-

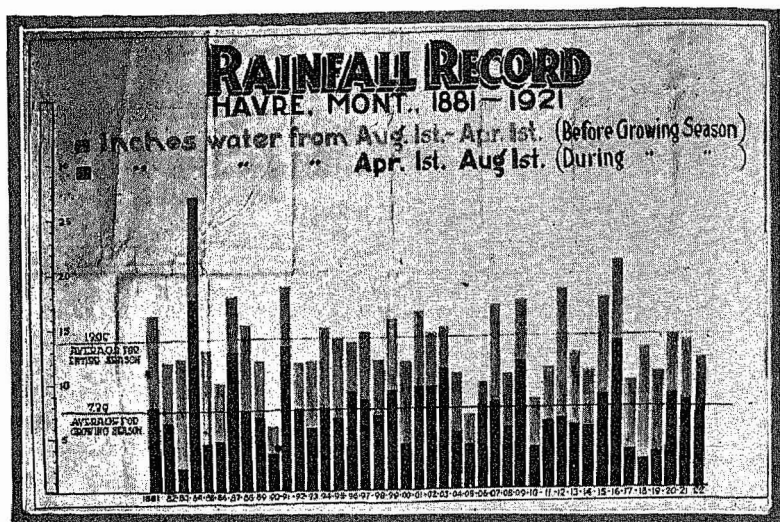


Figure 15—The average rainfall in inches at Havre, Mont., over a period from 1881 to 1922, taken from the U. S. weather bureau records. This chart shows the total amount for the year and for the growing season.

ticed, as cropping did not begin in this region until about 1910. An attempt has been made to analyze and picture the outstanding weather features in relation to crop production for each of these years (See Fig. 52 in Appendix) and to form some judgment as to the probable yields had such crops been raised.

### The Gambling Element

It is easy to see that the weather is the great common denominator in the "Triangle" and by the weather is meant the combination of total rainfall, distribution of rainfall, hot winds, dryness of the air, high or low winds, temperature and other related factors. When the weather factors are just right the "Triangle" land produces an enormous crop and when the weather combination is wrong failure may come in spite of any tillage methods. (See Figs. 16 and 17).

THE KIND OF WEATHER TO BE EXPECTED ANY YEAR IN THE  
"TRIANGLE" IS A BIG GAMBLE

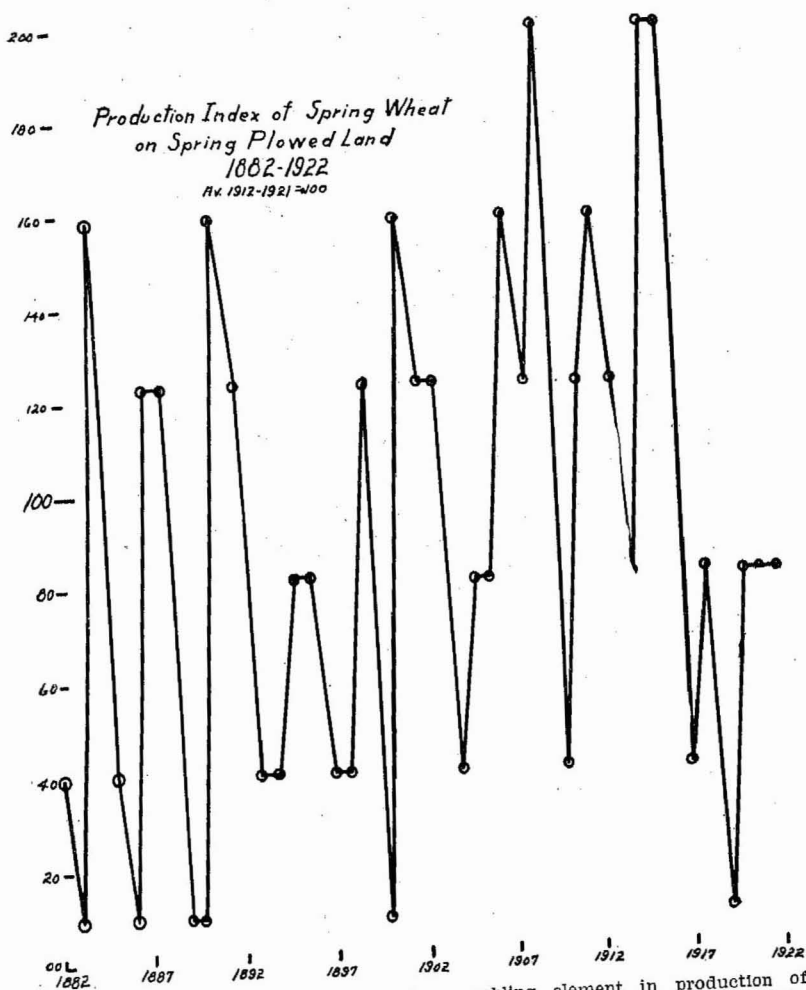


Figure 16—A chart which shows the gambling element in production of spring wheat for this area. This chart is for spring wheat under continuous cropping, and indicates the great variation between years. With a system of continuous cropping the farmer may face a year of bumper crops, or may meet a year of practical failure. Note the wide variation between 1916 and 1917.

BUT THE GAMBLING ODDS SLIGHTLY FAVOR THE FARMER IF  
HE PRACTICES SUMMER FALLOWING

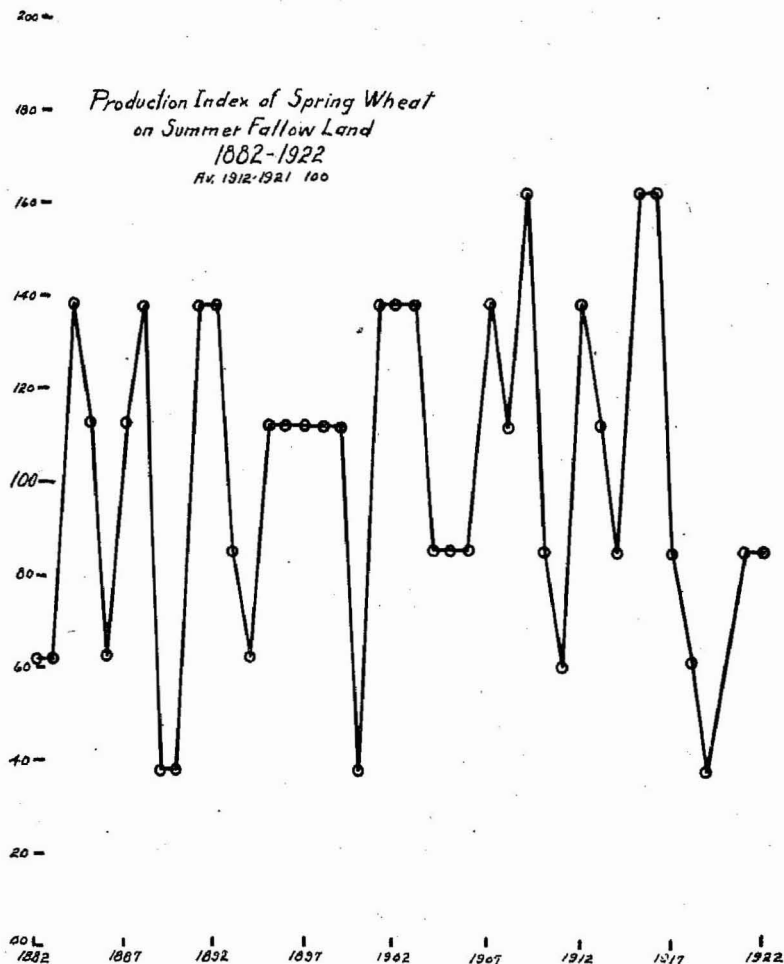


Figure 17—Another chart which indicates the gambling element. This is for wheat on summer fallow and shows less variation between years than does the chart for wheat under continuous cropping. While the big gambling element still is present under the summer fallow type of farming, it is with less variation of crop yield, and with less chance of complete failure, than under continuous cropping.

As we go east the weather becomes more stable as between years. The crop yield for each year shows less variation from the average, and not enough variation to spell failure in any one year. For instance, while the yields of corn in Iowa under right cultural conditions are 36 bushels, the

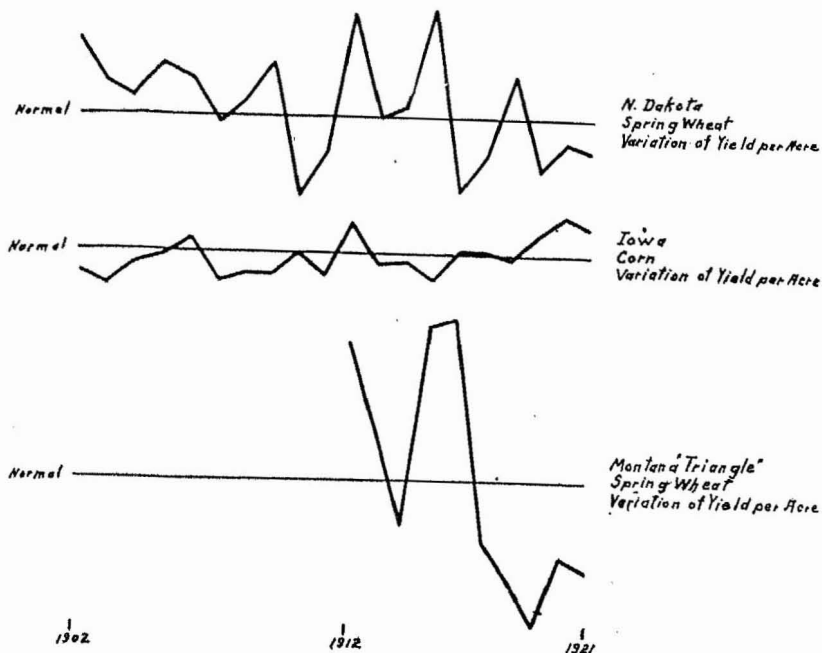


Figure 18—This chart shows the variability of yields between three states. There is much less variation in yields from year to year in Iowa than in North Dakota, while the chart clearly shows the wide variations in north Montana. The variation shows only little "gamble" for Iowa farmers, but a big "gamble" for north central Montana farmers.

range in the average yield of corn for the state is from 29 bushels to 46 bushels. Of course there are certain highly stabilized crops such as fruit which frost or phenomenal weather may wipe out entirely, but the great stable crops of the United States and the types of farming that have developed in their production are primarily in regions of relatively stable weather combinations. Where Iowa has but one type of stabilized season, the Montana "Triangle" has about every kind of season from the bumper crop year of 1916 to the drouth year of 1919 when even native grasses did not grow. (See Fig. 18).

Weather scientists have been unable to recognize any weather cycles or necessary connections between the weather of one year and of preceding years in north Montana. The forces which produce the different kinds of weather are world

wide and perhaps as wide as the solar system. Then each year in north Montana it is a gamble as to what type of season will prevail. There is no way yet known of determining ahead the probable weather type that is to prevail in the "Triangle" for any year or set of years.

Had there been some farmer doing dry land farming near Havre for the past forty years, his experiences would have formed the basis for a permanent type of farming for the section. But since farming has been practiced in this section for only the past decade, the probable experiences of the thirty years previous to 1910 must be found from a scientific analysis of the weather records which extend back that far. (Note<sup>25</sup>). The methods used in analyzing these weather charts and the basis for conclusions as to what would have happened had a farmer been cropping that year, are too complicated a matter for this circular. (Note<sup>26</sup>). The methods used have been the best available. Files of old newspapers and records of ranches, as well as other historical material, have been searched carefully and used for verification of the analysis made of weather records. When the analysis of crop probabilities in those early years is checked against the well-known yields from 1909 to 1922 it is found that they "hit with 85 per cent accuracy."

### Experiment Station Records

The North Montana Experiment Station near Havre began experimental cropping in 1916 under "Triangle" conditions. Records from this station and from the Dominion Experimental Station at Lethbridge, Canada, (Note<sup>27</sup>) have furnished valuable data. Experiment stations try to handle their work in such a way that certain conditions are maintained constant so that results will not vary. But there are cases in north Montana where the same variety of wheat with the same type of summer fallow and soil tillage varied tremendously. The North Montana Experiment Station at Havre raised 48.2 bushels of wheat per acre on summer fallow in 1916. For the next five years wheat of the same kind was seeded under the same conditions of soil and tillage but the total yield for these last five years, added together, was but one-half bushel more than the yield in the one year of 1916. Experiment Stations have shown that in regions of

(Note 25). The study, of course, could not take into consideration the possibilities of grasshoppers, soil blowing and other for these early years, while later years have had these influences to consider.

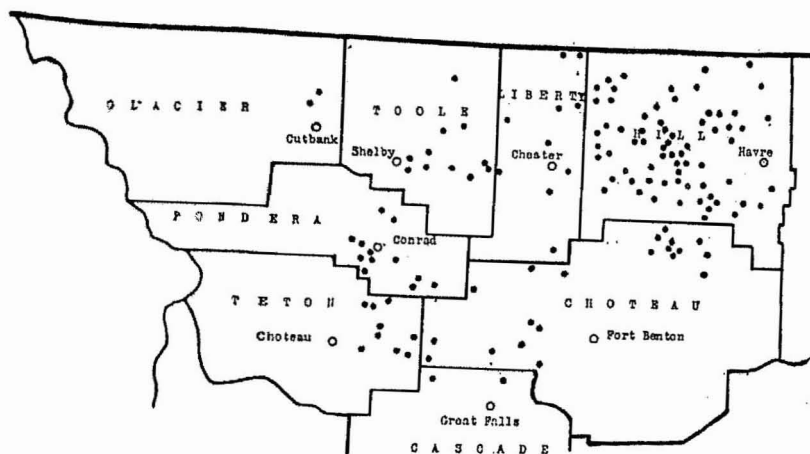
(Note 26). A complete weather analysis of this section will be issued in bulletin form soon by the Montana Experiment Station.

(Note 27). The reader should keep in mind that conditions north of the boundary in Canada are practically the same as in the Montana "Triangle." The experiments of the agricultural station at Lethbridge are generally upon the same problems that we meet in north Montana.

comparatively stable weather conditions the crop yields are correspondingly stable under the same soil and tillage. The variability of the weather in the "Triangle" is in no place more clearly shown than in these results at the carefully handled experiment station at Havre. These experiment station records, then, become an important feature in the forming of a permanent "type" of farming for this section.

### Successful Farmers

The farm survey of 1922 was made upon the farms of men who had succeeded in spite of all the combinations of adversity. (See Fig. 19). Their methods were studied under the assumption that they were practicing the right type of farming and right kind of management for the natural conditions of the "Triangle." (Note <sup>28</sup>). In a section where many



SHOWING APPROXIMATE LOCATION OF FARMS UPON WHICH RECORDS WERE SECURED IN FARM RECORDS SURVEY

Figure 19—Each dot in this chart shows the approximate location of one of the "successful" farms studied in the 1922 survey.

farmers failed completely, it is evident that successful farmers must be those who more nearly met the natural soil and climate requirements of the region. Each farmer's success was measured in terms of his labor income, or the amount of value remaining for his year's work. In figuring this labor income his total income for the year was first obtained; then from this was subtracted his farm expenses, the amount remaining being his farm income. From the farm

(Note <sup>28</sup>). Farmers were asked what type of farming they considered best for the "Triangle." Here are their answers: Diversification 42, summer following 25, diversified and summer following 7, grain farming 13, stock farming 1, hay and sheep 1, straight sheep 1, rye growing 1. Another answered "don't know" and another answered "nothing."

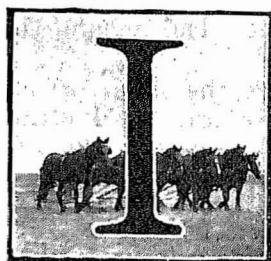
income was subtracted the interest on his farm investment, which leaves an amount called a labor income. Successful farmers, then, were those who had paid all farm expenses, earned an extra amount equal to interest on their investment in the land, and had a labor income remaining.

When the survey started bankers, business men, county agents and others were asked to direct the survey workers to men who appeared to be successful farmers, and to these various men who co-operated so willingly in starting the survey the full appreciation of the Extension Service is given.

Upon these three points the suggestions for the new "type" of farming are based. An analysis of weather for the past forty years for the region, the careful work of the agricultural experiment station since 1916, and the experiences of successful farmers over the same period, all are combined to form the ground work upon which this type of farming is built.

## PART FIVE

# The Type of Farming Recommended for the "Triangle"



**I**N WORKING out this new farming program for north central Montana, the farmer will have five important points to keep always in mind. Each of these five points is important to the general success of the program, and should be followed as closely as local limitations will allow. Each one of the five points of this program is so important that it is discussed in detail in the following pages. Because there is so much information and detail about each of these five points, the farmer here is again warned to keep in mind that it is all one general program. Here are the five points which together make up the type of farming recommended for the north Montana "Triangle":

**First—Building of reserves in good years for use in poor years.**

**Second—Building permanent homes upon a diversified farming base.**

**Third—Live stock farming where untillable lands provide grazing.**

**Fourth—Highest use of tillable land, with wheat the principal crop.**

**Fifth—Greatest possible use of flood waters for dry land irrigation.**

The following is more of an outline of the outstanding features in the recommended type of farming than a discussion of the way to perform each operation. The point of view is not that we are giving the best system for raising each crop or for producing livestock, but rather presenting the results of scientific investigation, weather analysis, and experience of successful farmers to guide the average farmer in working out his own definite program. Details concerning any of the five points discussed in the following pages may be obtained from county extension agents or from the State College Extension Service.

## Point One—Building of Reserves

The idea of reserves carries with it the idea of risk to be overcome. Farmers in climates where crops are fairly certain do not need reserves as do farmers in sections where a crop failure is a possibility in any year. The gambling chances are great in the "Triangle," but the farmer may see to it that in taking these chances the odds are in his favor. He needs to make his farming bet in such a way that if he loses in any one year, or series of years, he still will be able to go ahead and play the game again. This means the continual building of reserves. (Note<sup>20</sup>).

The early Montana pioneer exemplifies the spirit of our race. He was not drawn over the Bozeman trail to Montana by the lure of gold alone. He knew that death lurked in the shadows at his side each night, and that even at the end of his journey there might be disappointment and defeat. But the spirit of the great adventure, the tossing of dice with destiny, drew him unfalteringly on. So it is in a sense with the "Triangle" farmer. He is threatened by failure and discouraged by the succession of the threats, yet he maintains his determination to win. He is pioneering in farming as

(Note 20). The story, with others that show the necessity of building reserves, is found in the Appendix in the back of this bulletin.

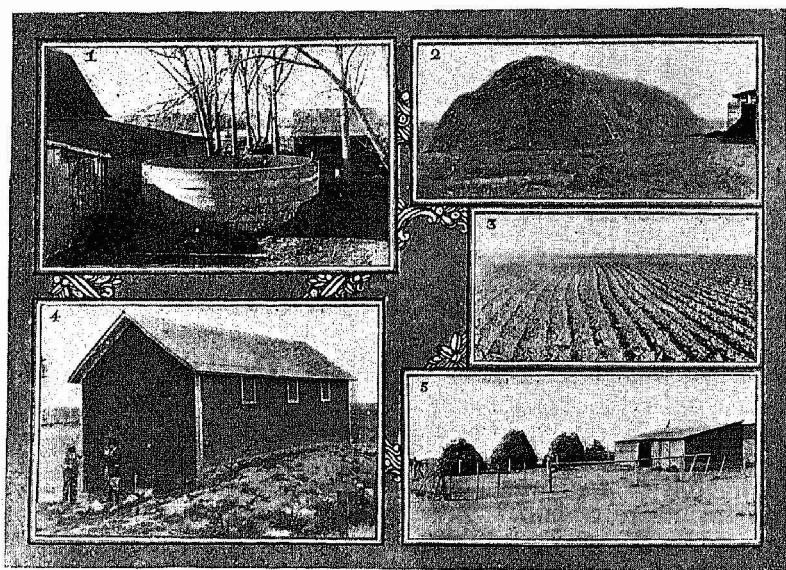


Figure 20—Reserves on the dry farm: (1) The pit silo; (2) Stacks of hay form a good feed reserve; (3) Summer fallowing is a means of storing moisture; (4) The granary that holds reserves of grain; (5) Wheat stacked until convenient time for threshing

the man of '63 pioneered in development of a territory. What we are trying to do here is to make a "short cut" past this pioneer stage, to a point where the risks of farming will be so reduced that there cannot be a repetition of the experience of recent years. We are seeking to find a dependable type of farming together with planned settlement and development. Undoubtedly the building of reserves is the first step toward the reduction of this risk and toward this permanent farming type.

The Mandan Indians, who raised corn for at least 300 years before their discovery by Lewis and Clark along the Missouri river in North Dakota, had a policy of growing each year more corn, beans and other products than they could consume. They saved these reserves in secret caches near their villages, to be drawn upon "when the Corn Mother was unkind to them." It was part of their religion to keep from two to three years supply of choice seed corn in advance, to be used in case there should be a failure in their corn garden. These Indians worked out the necessity of building reserves many hundreds of years ago, and they worked it out through painful experience.

Stories of the necessity of building reserves in regions of uncertain climate might be told in almost endless succession. (Note<sup>30</sup>). The story of Joseph and the Israelites, as told in the Bible, is familiar to all. The story is an early application of the necessity of storing up food where famine is possible. It was because of this necessity that the Mormons, when they settled Utah, established a custom of setting aside each year 10 per cent of all the grain to be held in a common granary for use in periods of possible famine.

It is the wise man everywhere and at all times who looks ahead. "In time of peace prepare for war" means, in the language of north Montana, "in time of plenty build up reserves for the lean years." All lines of business in which there is much risk systematically build up reserves. This is insurance against periods of adversity for them. Banks, not knowing when their depositors may call for their money, are required by law to keep certain reserves. It is just as necessary for the "Triangle" farmer to keep reserves as it is for the banker or the business man of the city. These farm reserves may be developed in three ways:

1. Reserve soil moisture through summer fallow or intertilled cropping.

2. Reserve feed by planting each year more feed crops than it is planned to feed that year and storing the surplus.

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(Note 30). This and similar stories about the building of reserves may be found at the beginning of the Appendix, in the back of this bulletin.

3. Reserve capital—(a) by storing money received from big crops and always keeping some on hand for use in poor years; (b) by growing livestock, which make a form of feed and grass storage and which can be sold off when shortage comes; (c) by holding over supplies of seed grain.

In the case of the farmer in Iowa, the driest years have a reserve of soil moisture that will still give him a crop. His climate creates its own reserve. In Montana the case is different. Here the farmer is always close to the border line. He must build his own reserves and farm with these reserves as a basis at all times. In Montana it is probable that reserves for only one year are not enough.

## Point Two—A Diversified Base for Permanent Homes

The building of permanent homes through the development of diversification in farming has many angles of importance. Among the things to be considered in this outline of diversification are shelter belts, dry land gardens, milk cows, hogs, sheep, chickens, turkeys, forage crops, trench or pit silos and tame grasses for hay or pasture.

There has at times been an inclination to place diversification at the top of important practices for the "Triangle." This is only natural, for in the survey there was a startling repetition of the story of how the chickens, the hogs and cows, the garden or the sheep had kept the family on the farm after the wheat crop had turned out a complete failure. And here was the oft repeated story of the wonderful women of the north Montana farms; how their home building instinct prompted them to extra hours of hard work with chickens or with the garden. It was so common, in hearing the story of the men on these "Triangle" farms, to meet that quiet but sincere statement that "mother pulled us through the worst of it with the garden and the chickens." One farmer near Havre, whose story of success has appeared in the Montana press, complained that credit was given to the wrong person. "You have made it sound as if I made the success, when in fact we would have had to quit the farm in 1919 or 1920 if my wife had not worked early and late with her chickens and in canning the produce from our little garden," he said.

### THE SHELTER BELT

One of the most successful farmers in north Montana told the writer that his wife, shortly after they came to Montana from Minnesota, had come to him with tears in her eyes to say that she could not become accustomed to living in a country where there were no trees or flowers.

"Then we will raise trees, and we will raise shrubs and flowers, or else we will not stay," he told her. This family has "stayed" and their shelter belt, which was planted in 1916 and 1917 and reared through the worst of the bad years, is one of the finest in north Montana. (See Fig. 22).

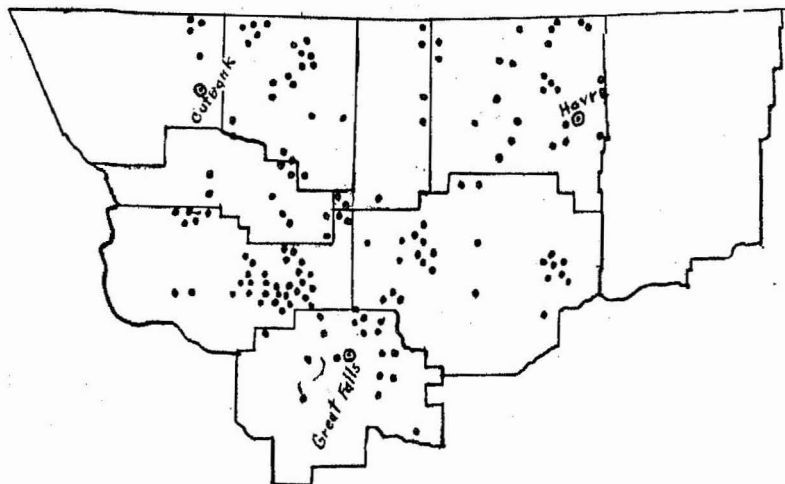


Figure 21—Each dot in this chart shows the location of a shelter belt upon a Montana farm. These shelter belts are being grown under supervision of the Mandan Experiment Station.

Shelter belts, which correspond to the groves of the eastern prairies of Iowa, Nebraska and Minnesota, are long strips of trees planted in a particular way, about eight or ten rows deep. North central Montana, as has been often pointed out, has special conditions and the method of growing trees and shelter belts here must be different from the raising of groves in the eastern prairie countries. A shelter belt breaks the force of the cold winds in winter and hot winds in summer; it catches and holds the drifting snows. All people love things that are beautiful and it is no wonder that farm women and farm families dread the bleak, open, treeless prairie. The farm does not seem like home without trees. Many conservative farmers estimate that a good shelter belt adds at least ten dollars per acre to the value of the farm. To such men a shelter belt is as necessary as barns or granaries.

Settlers who next come into the "Triangle" will be influenced less by land craze than were the original settlers, and they will be more or less critical as they make their first inspection of the country. Nothing will convince these prospective citizens about the farming possibilities of the country as will shelter belts. They will form unconscious judgment

of the country from the appearance of the landscape, and shelter belts will help greatly, probably more than any other one thing, to create a favorable opinion.

Shelter belts are no longer an experiment. They have been tested through the most severe and prolonged drouth known in the section and, where planted properly and cared for, they have come through in fine shape. A dry farm without a shelter belt is more of a farming camp than a farm home.

In the state of Montana the total acreage of co-operative shelter belt demonstration tree plantings is 380 acres, including 911,309 trees. The Office of Dry Land Agriculture of the United States Department of Agriculture has furnished the trees and has been carrying on demonstration work with a number of men in the "Triangle." A small government tree nursery maintained at Mandan, North Dakota, supplies the adapted trees to these demonstrators. The object is not free distribution of trees, but a demonstration of the proper methods of growing shelter belts throughout the northern plains. The "Triangle," like all the northern regions, is a place of cold winter weather where the snow is apt to be "dry" or "fluffy" (most of the moisture in crystalline form which does not stick like wet snow). The prevailing winds of winter, therefore, blow the snow badly. Shelter belts are based on the principle of catching this snow and thus adding moisture to the normal rainfall.

### **A Few Shelter Belt Principles**

While the methods that must be adopted for shelter belts in north Montana are different from tree planting methods of the east, they still are simple. These steps in shelter belt planting are found to be sound:

**First**—Land upon which the shelter belt is to be planted must be summer fallowed thoroughly the year previous. It must be land which has been thoroughly subdued and in which no grass is left because regrassing with native sod among the trees will absorb the moisture before it gets to the tree roots and thus cause the trees to die. Nothing kills the shelter belt more quickly than the taking of moisture by weeds and grass before the trees get a chance at it. The fallow strips, usually laid out on the north and west of the farmstead, must be deeply plowed and well summer fallowed and kept absolutely free from weeds the year previous to tree planting. It is well during the summer fallow year to plant some rows of drilled corn on the north and west side of the summer fallowed layout, so drifting snows of the winter will be caught to make a big snow bank on the land that is to be planted to trees the next spring.

**Second**—The Office of Dry Land Agriculture makes the following recommendations for north Montana: For snow catchers on the outside rows of the shelter belt, Caragana or Siberian pea tree. The Caragana comes from the cold, dry sections of Siberia. It has been uniformly successful in the "Triangle" and not a single successful farmer interviewed had failed to grow Caragana where it had been given proper care. The Caragana grows low and bushy and can be cut back so it will run from 20 to 40 branches per plant. It grows about six feet high and withstands drouth and adverse conditions well.

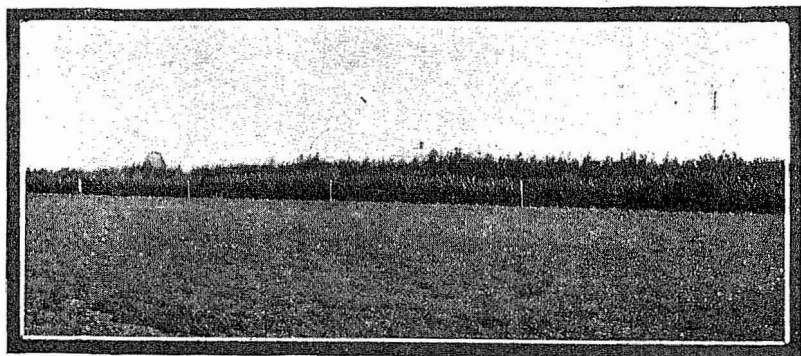


Figure 22—The shelter belt on the farm of M. J. Austin, near Rudyard.

Mr. Austin, whose shelter belt is shown in Fig. 22, attributes his success to the row of Caragana on the outside which acts as a snow catcher. In planting the seedling trees he lost less than four per cent in 1917. There has been practically no loss since then.

Shelter belt trees absolutely recommended: Box elder, green ash and white elm.

Shelter belt trees recommended less strongly than the above list include: Northwestern poplar, chokecherry, buffalo berry and Russian olive.

Recommended evergreens for planting after other trees have become established in the shelter belt: Black Hills spruce, white spruce, Scotch pine and Jackpine.

**Third**—Plant small trees. Seedlings are the cheapest. They start more easily and withstand drouth better the first year. A much larger percentage of these will live than of older trees; they do not require as much moisture and they are lower in price.

**Fourth**—Plant in rows ten feet apart.

**Fifth**—Thoroughly cultivate until forest conditions become established, which will be in five or six years. By that time the trees will be so bushy that they will cover the ground between the rows and shade it so that weeds and grass will not grow.

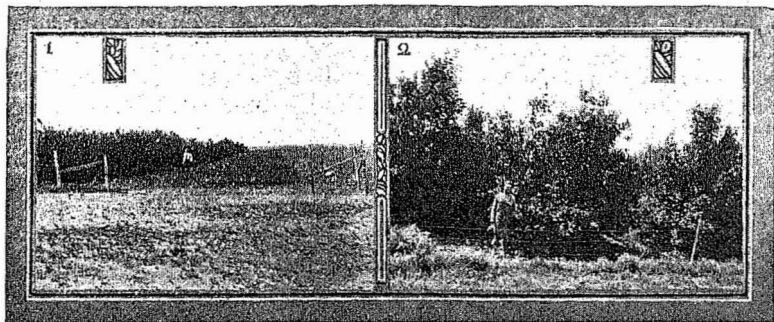


Figure 23—(1) Showing fallow strip beside shelter belt; (2) Showing forest condition in shelter belt.

**Sixth**—Do not prune the trees. Let nature do the pruning. The small branches near the ground protect the trees, catch snow and prevent the loss of moisture. A pruned tree is a spoiled shelter belt tree. Remember that there is a difference between the dry land shelter belt tree and the shade tree of the east. Absolutely do not prune the shelter belt trees.

**Seventh**—Handle evergreens as distinct additions, made by widening the established shelter belt toward the inside or protected side. It is advised that twenty feet be allowed between the first row of evergreens and the older trees on account of the unfavorable conditions of moisture competition from the root system of the older plantings.

**Eighth**—Continuously fallow a strip ten feet outside of the snow catcher row of Caragana. The trees need this extended summer fallow ground for their moisture supply.

### Catching Snows

In an ordinary winter the shelter belt will be drifted full of snow. The snow drifts will range from four to six feet deep, depending upon the winter. The snow tends to blow in during each snow storm. It packs and as it melts it settles down, accumulating a large amount of moisture. Shelter belt snow drifts in the spring are made up of packed snow. Tests indicate that a foot of such shelter belt snow will melt out from one and one-half to three inches of water. If the snow drift in the shelter belt then is three feet deep

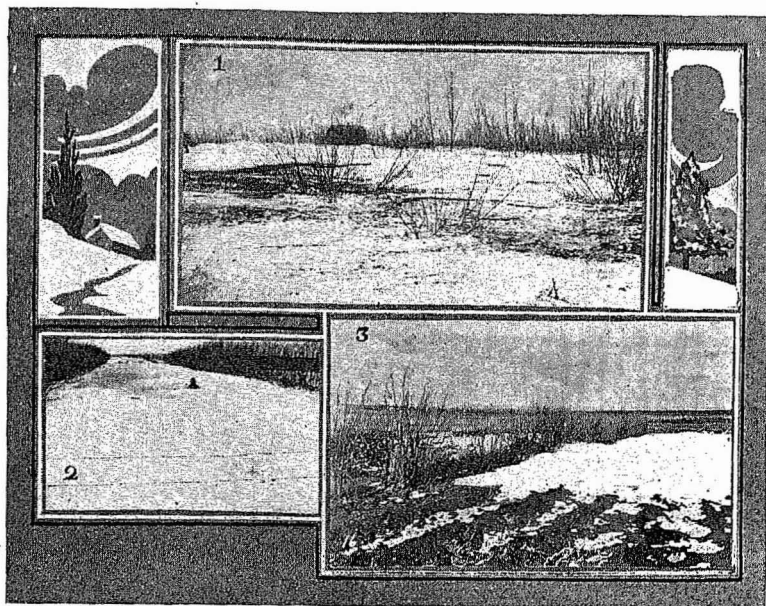


Figure 24—Snow catchers. It is easily seen how these shelter belts have caught and held the drifting snows of winter to add to their annual moisture supply.

and melts out an average of two and one-half inches of water, the shelter belt will receive seven and one-half inches of water in addition to the regular rainfall. Of course some of this would be included in the "annual rainfall," but it is safe to estimate that six inches of the extra amount would be from snow that had blown in. With the rainfall at Havre 13.54 inches per year, this addition would mean annual rainfall or its equivalent of about twenty inches per year for the shelter belt. If the soil in the shelter belt is in the proper condition practically all of this moisture will go into the soil, because it melts slowly and is more effective than if it came in summer rains. Much is yet to be learned about the relation of shelter belts to snow catching. If the shelter belt is too wide it seems to catch all the snow and allows none to drift on the garden that is placed immediately back of it. However most north Montana farmers get the surplus water of the shelter belt and by a system of dikes divert it to the garden.

## HARDY FRUITS

Fruit on the farm is also an important thing in the diversification scheme. One-fourth of all the farmers interviewed in the "Triangle" reported that they had had good success with hardy fruits. Hardy fruit, when protected by

a shelter belt but so located as to get the benefit of drifting snow, does very well. The recommended list of hardy fruits is as follows:

Plums—Cree, Ojibway, Assiniboine, Wolf (Freestone) and Wyant.

Plum—Sandcherry Hybrids—Compass, Opata, Sapa, Sansoto and Zumbra.

Currants—North Star, London Market, Pomona, Red Cross and Crandall. (The last named is a native black variety).



Figure 25—A fine gooseberry patch on the Zentzis farm near Inverness.

Gooseberries—Houghton, Carrie, Champion, Van Fleet.

Sandcherries—Sioux.

Juneberries—Success.

Strawberries—(Irrigation desirable) Dunlap, South Dakota, Easy Picker, Progressive and Duluth. (Last two are everbearing varieties).

Native Fruits—Juneberries, choke cherries, plums, sandcherries and buffalo berries.

Crab Apples—Transcendent, Dolgo, Red Siberian, Virginia and Florence or Whitney. (In well protected places).

Apples—Hibernal, Duchess, Patten Greening. (In well protected places only).



Figure 26—Gardens in the "Triangle": (1) Garden watered from a windmill; (2) Lamsie's garden blade weeder, to be drawn by one horse; (3-4-5-6) Typical gardens found on successful "Triangle" farms.

It will be noted that many of the above list are native fruits. Plums and compass cherries should be pruned so as to make a low, bushy growth. These fruits are dependable and will supply a large quantity for canning, jam and jells.

## GARDENS

Almost without exception "successful farmers" of north Montana were found to have raised excellent gardens each year, enough to supply home needs. That sentence is important enough to be read again, for the importance of a garden on the "Triangle" farm cannot be emphasized too much. Gardens improve the quality of the diet and greatly reduce living costs, both with fresh vegetables and fruits in the summer time and with canned products in the winter. Not a few of the successful farmers of north Montana claimed that the garden had made it possible for them to remain on the farm through the worst years.

The experience of these men will best tell the story about gardens. Seventy-six farmers were asked the question "have you always had a good garden?" Forty-seven replied "yes,"

25 said they always had good gardens except perhaps in 1919, and four reported that they had not had good gardens regularly. Sizes of these gardens ranged from one-sixth acre to six acres. Fifty farmers were asked concerning their method of handling the garden. Continuous cropping was practiced by 33 while the other 17 alternately cropped and summer fallowed. On 54 farms, it was found that the garden was planted in rows on 42 of them, and cultivated by hand on the other 12.

On many farms it is possible to have supplemental irrigation for the garden. This may be by a windmill, which on one farm visited had always made possible a fine garden. (See Fig. 26). Experience seems to indicate that if shelter belts are too wide and turned in certain directions as related to the topography of the land and the direction of the winds, they catch and hold all of the snow without allowing any to drift through upon the garden. For this reason some farmers are planting the garden at one side of the shelter belt, putting a row of Caragana around it to catch and drift the snow. Mr. Austin's garden is to the south of the shelter belt and has no protection from the west except shrubs and bushes. This allows his garden to be drifted full of snow. In one favorable location, a single Caragana hedge has piled from three to five feet of snow on a space 70 feet wide. (See Fig. 24). E. C. Hallman of Acadia Valley, Alberta, is of the opinion that much experience is yet to be gained in the planting and use of Caragana hedge as a snow catcher.

The north Montana "Triangle" is noted for its fine gardens on many farms and for its vegetable and root crops. A number of farmers have been successful in raising sugar mangles for winter feed for chickens and cows. Any vegetables that do well in climates of the northern latitudes will ripen in this section. Tomatoes may be fully ripened most seasons.

### Essentials of a Good Garden

1. Protection by shelter belt or use of a Caragana snow catcher.
2. Where there is no shelter belt, keep half the garden ground in summer fallow each year.
3. Keep the garden always free from weeds.
4. Plant in rows for horse cultivation. This saves hand work and keeps the garden more free from weeds. A bar blade weeder is easily made and will keep the garden in fine condition.
5. Plan the garden so as to provide summer vegetables and enough for canning and preservation. (Note<sup>31</sup>).

(Note 31). Directions for preserving and canning of vegetables and fruits may be obtained free by writing to the Montana Extension Service, Bozeman.

## MILK COWS ON THE DRY FARM

It is not meant in this discussion to give the idea that "Triangle" farmers should in every case go into the dairy business, but that each farm should keep enough dual purpose cows to supply the family with milk and butter, and allow some small surplus for sale. The number and kind of cows kept on each farm will depend upon many points such as the amount of pasture that can be obtained, its distance from the farm, and the amount of family labor available for milking cows.

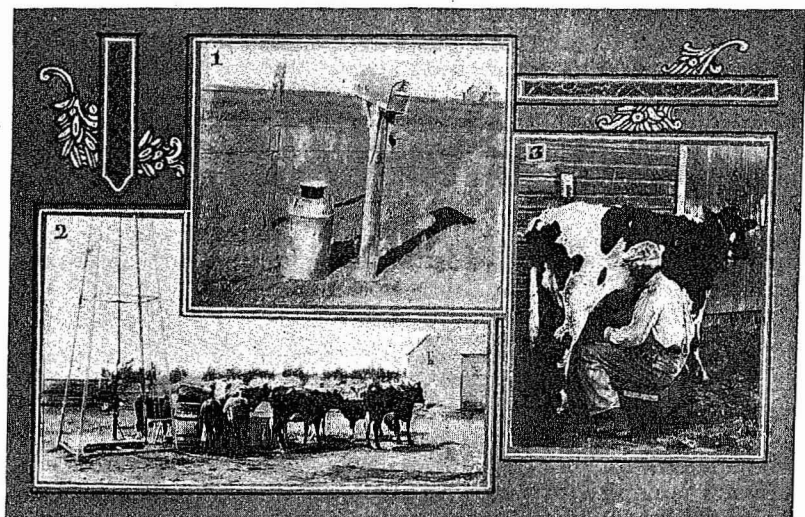


Figure 27—(1) The milk can that means monthly expense checks; (2) The cows that brought one farmer through the bad years; (3) Mr. Nelson of Kremlin believes in milking cows on the dry farm.

Where the hogs are called the "mortgage lifters" of Illinois, the hardy dual purpose cow certainly is the "grub staker" of north Montana dry farms. One farmer called his few cows his "sticking plaster," as they enabled him to "stick" to the farm from 1919 to 1921.

During the survey of successful farms of north Montana in 1922, reports were taken showing 509 milk cows on 117 farms. The average size of each of the farm families was four persons, and the annual sale of cream and butter from these farms averaged \$216.00. This is an average of a trifle more than four cows to the farm, and the value of milking cows is readily seen in the figures. It takes very little imagination to realize that one of these families, with a good garden and with plenty of milk and butter for home use and with \$216.00 profit from the cows, could go through

the worst years when the grain crop failed. On farms where no cows were kept, the reason given was "I don't like to milk cows," or "the cows keep you tied down too close to the farm." Yet with these rather thin explanations is given the fact that the year 1919 was a great back-set for farmers who milked cows. In that year there was no pasture and little feed so that cows and other cattle were shipped from the country. This year there is every indication that the cows are "coming back" into the "Triangle."

Cows are not kept as a commercial proposition. It is doubtful if it would pay to keep so many cows that pasture is always short and feed has to be purchased. The place of the cow on these dry farms is in supplying family food, utilizing cheap and waste feed, and giving profitable employment to children old enough to milk. Several of the successful farmers of north Montana are planning to have their cows freshen in the fall after threshing, then milking them until spring work begins. The feeding of silage from trench or pit silos and of home grown roughage, together with some cheap grain, probably will make this a profitable venture. Such a plan would give profitable employment in the winter when the price of butter fat is up and when the product may be marketed in better condition.

It must be remembered that no general statement can be made as to the number of cows that should be kept on any individual farm. Some farmers are so situated that they can milk several cows with good profit, while others may milk only enough to supply family needs. There seems to be a tendency among farmers who are located close to cheap grazing lands, to keep a large herd of Shorthorn cows, raising a good bunch of calves and milking the cows during the good grass season. This enterprise is not to be considered as a necessity nor is high production per cow to be figured, for it is only a plan of making additional labor income from milking and additional profit from the increase of the herd.

### HOGS IN THE "TRIANGLE"

Practically all of the successful farmers shown in the survey indicated that they produced their own pork on the farm. C. H. Seitters of Inverness, as an instance, has not purchased any lard since 1911.

The uncertainty of grain feed, however, has led to conservatism and some farmers say they will not raise hogs in the future. A few thought it might be best to buy two or three pigs at weaning time rather than raise their own hogs. Many farmers joined with this expression from one prominent farmer: "This is not a hog country. Let us raise just

enough for our home use and leave the raising of hogs on a commercial basis to fellows who have more dependable and cheaper feeds." Feed for hogs, outside of a limited amount of corn, competes with wheat in the farm operations. It is a question which each farmer must settle for himself; whether he can make more money by putting his land into wheat and selling it, than by putting it into barley for hog feed. And it may be remembered that when the wheat crop fails, the barley crop fails, too. Some farmers say that hogs are "worse than no profit at all" in years when there are young pigs and a crop failure.

As yet only a few farmers are doing extensive hogging-off of early flint corn, but some intend to try this out in the future. Most of the hogs that are being raised in the "Triangle" now are fed on rye, skim milk and slop. Figures shown by the survey give an average of two hogs each on 65 farms. Thirty-four of these 65 farmers sold pork.

## SHEEP

Not many farmers in north central Montana keep a flock of sheep. It is certain that many, but not all, farmers in this section can keep a few sheep with profit. On the poorer lands and in regions of greatest farm abandonment, it is probable that bunches of from 300 to 400 sheep will be common in the future. The experience of Thomas McFarlane of Lothair (See story in appendix) will be interesting to those who are interested in sheep raising.

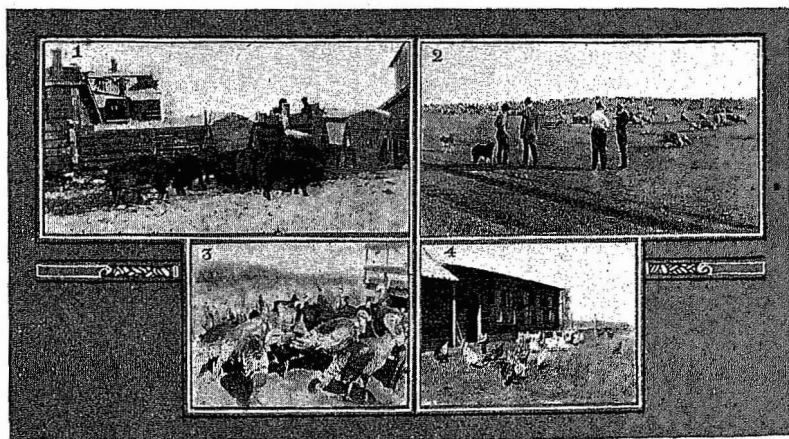


Figure 28—Hogs, sheep, turkeys and chickens all add to the diversity of farm work and each contributes a steady addition to the income, as well as furnishing food for the farm table.

## CHICKENS AND TURKEYS

Poultry plays an important part in the establishment of the diversified farming base. On a number of farms in the survey it was found that the sale of poultry and eggs had kept up the family living expenses in spite of the conditions of the crop.

### Chickens

Chickens do well in all parts of the "Triangle," no particular breed being favored above the others. Some complaint is heard about marketing of eggs, since they are cheap at the time of heaviest production. Merchants explain, however, that eggs could be more efficiently marketed if produced in greater volume. The distance from the town market, lack of refrigeration and other things are against quality egg production and it is doubtful if the surplus eggs can be sold better than for storage purposes. (Note<sup>32</sup>).

### Turkeys

One of the most promising developments in north Montana seems to be in turkey raising. Not many farmers have had experience with turkeys but those who have been raising them report almost phenomenal success. There is little disease among turkeys in the "Triangle" and because of the freedom from damp weather the loss of young turkeys is slight. Turkeys range well in the stubble and destroy many insects. (Note<sup>33</sup>).

## TRENCH SILOS

In the Canadian triangle (Note<sup>34</sup>) there has developed an inexpensive silo known as the trench silo. (Note<sup>35</sup>). It is simply a trench cut in dry, well drained lands by the use of a Fresno or slip scraper. These silos are inexpensive and take but a small amount of labor with man and horses. These trenches are dug usually ten feet deep, the width and length depending upon the number of stock to be fed. The trench is not cemented or lined with boards in any way. The ends are left sloping as they are naturally left in pulling out the dirt. In some cases one end is left sloping and the other end is cut down square.

(Note<sup>32</sup>). Of the farmers visited in the survey one-half or 50 per cent had 50 chickens or more on the farm. The average number of hens per farm was 63 and the average sale of eggs per farm was \$90.

(Note<sup>33</sup>). A lady in Burdette, Alberta, raised 80 turkeys from four turkey hens in 1922. She set part of the eggs under Plymouth Rock hens. She sold \$288 worth of turkeys raised from the four hens and estimates that \$88 would have more than covered the feed she gave them.

(Note<sup>34</sup>). North of the boundary line in Canada there is a section of country in the form of a "Triangle" which is similar in most respects to the Montana "Triangle."

(Note<sup>35</sup>). This trench silo is largely the development of G. H. Hutton, Superintendent of Agriculture and Animal Industry for the Canadian Pacific Railway.

With good horses and a Fresno scraper the trench may be dug quickly. In filling, a silage cutter is set on the edge of the trench and chopped corn, sunflowers or other green crop is run into the trench in the trough from the cutter. The freshly cut feed may be spread evenly and thoroughly tramped down. It has been suggested that the tramping down be done by a small boy riding one gentle horse and leading another, thus packing thoroughly while the filling is taking place. In filling the top, cut feed is heaped about two feet above the surface of the ground so that it will settle to about ground level. For a week after filling it is well to drive a team of horses over the trench a number of times each day to help in the settling and packing. The more thoroughly the feed is packed the less spoilage there will be on top.

Since the silage cutter does not need to elevate the cut feed a cutter less expensive than the ordinary kind can be used. Such a cutter costs about \$200.00. It is recommended that three or four farmers jointly own a silage filling equipment. One north Montana farmer who had a pit silo but did not have a cutter succeeded in getting good silage by chopping the corn bundles in lengths of about six or eight inches by use of a butcher's cleaver. One or two farmers in the "Triangle" have had successful experience with Russian thistle silage.

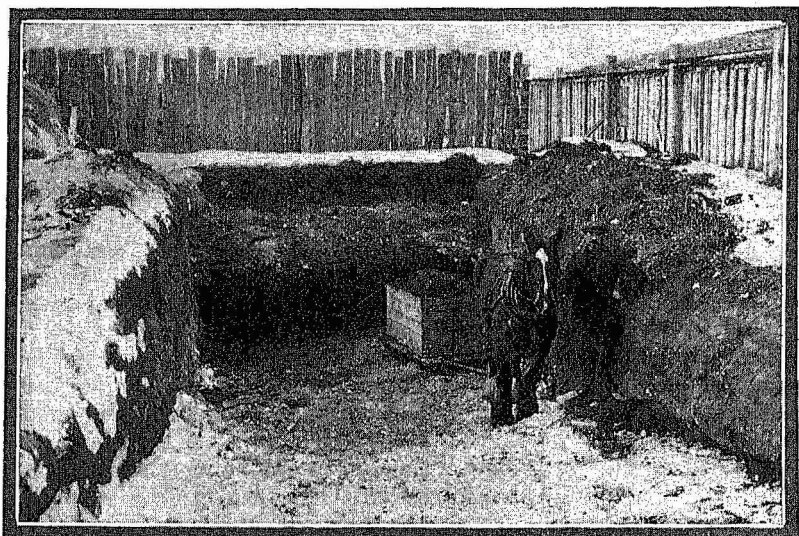


Figure 29—Showing the method of hauling silage from the trench silo to be used for feed. This method entails no more labor than is required in any other type of silo.

In covering the trench various devices are used. Some farmers, after filling the trench with green feed, run ordinary straw through the cutter and cover the feed about eight inches or a foot deep with it. On top of this cut straw they then place a layer of uncut dry straw, weighted down with poles and boards. Other farmers have used wet straw from the bottom of an old stack. An elaborate covering of earth is not necessary for the trench silage. Green hay or anything that will lie close to the silage and exclude the air is sufficient.

In the province of Alberta, Canada, there are now more than 2,000 of these trench silos. They have given uniformly good results and are on the increase. In Alberta both the educational agencies and the farmers advocate their wider use. The experience in Alberta is that trench silage is less liable to freeze than is silage in upright silos.

In feeding the silage the trench is opened at the sloping end and the feed is raked off with a fork or rake as one would cut off slices from a loaf of bread. A small one-horse sled or wheelbarrow (See Fig. 29) is often used to haul the silage. (Note<sup>36</sup>). These trench silos may be conveniently located for feeding. Some farmers have made a sectional roof for the trench, sections of the roof being removed as the silage is used up. This roof provides protection for winter feeding. Others leave the silo with no covering except the top layer of straw.

It must be remembered that silage is not a universal feed but that it is adapted to the feeding of milk cows in winter time, and for other kinds of stock. (Note<sup>37</sup>).

### Silage Reserves

Information is lacking as to the length of time which silage will keep in good condition in a trench silo. We know of no one who has tried to keep trench silage as a reserve from year to year. Silage will keep in pit silos, however, almost indefinitely. In the dry land sections of western Nebraska and eastern Colorado two or more storage pit silos are common on the farms. One may be used for regular summer storage and winter use, while the others are used to store silage from the good years for use in the bad years. They are cheap, practically the only cost being the labor of digging, and this can be done during the winter.

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(Note 36). A cubic foot of trench silage weighs about 40 pounds.

(Note 37). Instructions and publications concerning feeding of silage may be obtained by writing to the Livestock Specialist, Extension Service, Bozeman.

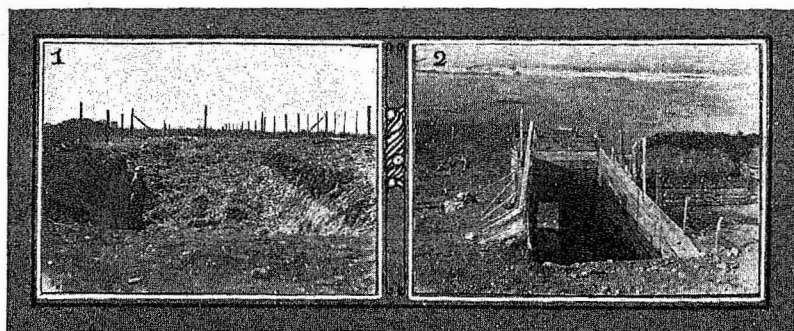


Figure 30—Trench silo at left; side hill silo at right.

Our analysis shows that during the past forty years in the "Triangle" a diversified farmer having cattle and reserves of silage probably would have drawn upon these silage reserves about 14 times. This farmer who had the silage reserves would have been in an advantageous position. He would not have been compelled to sacrifice his growing animals and probably could have bought stock cattle cheaply from neighbors who had no such reserves.

Every farmer who has winter milk cows or other stock that can consume silage economically should have a silo for both the regular winter feeding and for reserve storage. Upright silos are good and nothing which is said here in relation to trench or pit silos should be taken as discounting upright silos. (Note<sup>88</sup>).

## "GRAIN AND FORAGE FOR LIVE STOCK

During the period of settlement in north Montana, and until 1917, much prairie grass was cut for hay. Very little native hay has been cut since that time. There has been as a result a very heavy drain upon farmers in this section for hay and feed for their stock. Records show that in 1921 farmers on 53 farms purchased an average of \$58 worth of hay and that six farmers purchased an average of \$70 worth of ground and mill feeds. This is a great cash "leak" and plans must be made in the future to grow this feed on the farm and to build up reserves of this feed for bad years. Farmers who came from the east were but little accustomed to the use of grain hay, but the records show an increasing tendency toward its use. Much oats and wheat now are being

(Note<sup>88</sup>). The difference in amount of cash outlay between the two types is the principal factor in north Montana.

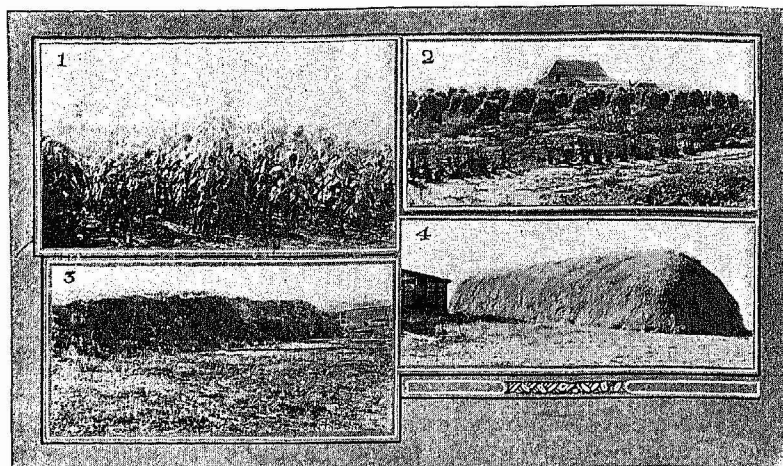


Figure 31—Needs for the diversified base: (1) Sunflowers; (2) Corn fodder shocked near the barn; (3) Russian thistle hay; (4) Rye in the stack.

cut just before they begin ripening and are used for horse feed. Farmers who have had experience in working horses on oat and wheat hay recommend it highly. (Note<sup>39</sup>).

The experience with sweet clover and alfalfa shows great variation and no conclusion can be drawn from these reports from the various farms. So few farmers have tried brome grass, western rye grass and crested wheat grass that it would be impossible to give any general experience from the "Triangle." (See discussion of brome grass under "Tame Grass for Hay and Pasture" a few pages further along).

Northern Montana farmers have had successful experiences with rye hay and the practice of drilling rye in wheat stubble following summer fallow is increasing decidedly. This rye hay in many cases is cut when in the early dough state and before coarseness develops in the stalk. Some of the successful farmers, however, are not satisfied with results from rye hay.

The cheapest way of handling rye is to cut it with a grain binder, the bundles being tied reasonably tight and allowed to cure in the shock. The grain hays may help greatly in the solution of the "Triangle" feed problem.

During the dry years many farmers put up Russian thistles for hay and to the surprise of most people the thistles, when put up before frost, seemed to make a very good coarse stock feed. A number of farmers have com-

(Note 39). In Washington and Oregon wheat hay is fed in large proportion. Around the edges of the big fields is planted a strip of beardless wheat which is cut with a binder and used for feed. This also leaves a cut strip around the field where the combine can begin work.

mented upon the feeding value and the palatability of Russian thistles. If another drouth like 1919 were to occur many farmers would no doubt put up large amounts of thistles for cow and sheep feed. The general experience indicates that they should be fed with straw as they are very laxative in their effect upon the animal.

## CORN AS A FORAGE CROP

There is no coarse forage that is equal to corn. Practically every farmer should raise sufficient corn roughage to feed his live stock. Types of corn adapted to forage production in this area are apt to be fine stalked as compared with corn belt types, making it possible to run the dried stalks through a regular threshing machine. (Note<sup>40</sup>).

Corn fodder is very dependable and one of the cheapest sources of roughage. Reserves will have to be stored in silos as it is doubtful if fodder corn dried in the fall will keep from year to year. It is also doubtful whether the dents and semi-dents will be dependable. Earlier varieties like Dakota White Flint, Gehu and Squaw corn can be expected to produce considerable ear corn each year. The practice of feeding some of this ear corn to hogs and sheep in the field may develop. (Note<sup>41</sup>).

## TAME GRASS FOR HAY AND PASTURE

One of the greatest problems still to be solved for the "Triangle" is that of tame grasses. The problem is not particularly pressing as there still remains considerable prairie native grass land, but there are many farmers who on a large acreage would like to seed some of this acreage with a profitable tame grass. It is also realized that some system of farming must be developed in which tame grass can be introduced to put soil fibre back into the land.

During the survey almost all of the successful farmers asked questions as to tame grasses. There is probably no question in which north Montana farmers are more deeply interested than in securing a dependable tame grass which will work well into the scheme of farm management.

While there is little experience to follow in the "Triangle," one man in Alberta has been very successful with brome grass. This man, E. C. Hallman of Acadia Valley, now has more than 1,000 acres seeded to brome grass. The

(Note 40). See Montana Experiment Station Circular No. 41, Page 67.

(Note 41). The following corn publications have been issued by the Montana Experiment Station: Circular 41, "Corn Growing in Montana"; Circular 53, "Corn in Montana"; Circular 67, "Corn Planting and Cultivation in Montana"; Circular 54, "Selecting and Curing Seed Corn"; Bulletin 140, "Corn Experiments in South Central Montana"; Bulletin 132, "Corn Experiments at the Judith Basin Substation."

rainfall, soil and native grasses in Mr. Hallman's locality are approximately the same as at Havre. After some garden experiments with grasses he began seeding fields to provide pasture and hay for his rather large amount of live stock. He now says "I do not hesitate to say that almost every farmer in this semi-arid section could profit by devoting at least a part of his land to tame grasses." Mr. Hallman is confident that brome grass will yield four to six times as much grazing as will a native pasture and its hay crops have ranged from one-half ton to more than one ton per acre. In 1922 he cut three hundred acres of hay which he had pastured during the spring and summer and which still yielded a total of one hundred fifty tons in a fairly bad year. The grass also restores soil fibre, an essential benefit whose value cannot be judged.

### Special Features of Brome Grass

1. It is the most hardy grass we have.
2. It is extremely drouth resistant and with proper care and culture will last a long time.
3. It withstands drouth, extreme temperatures and hot winds. During drouth or hot winds brome grass merely "sits down and waits." Where such crops as wheat would be blighted, brome grass holds its own until rain comes, and then it advances again.
4. It will crowd out most weeds.
5. It withstands tramping by pastured stock.
6. A thin stand will gradually thicken up.
7. Persistence is its chief virtue; its chief disadvantage is its slowness in getting started and difficulty in getting a good stand.

### Seed Mixtures and Rates of Seeding

Mr. Hallman always seeds a tame grass mixture. He began a number of years ago by seeding seven pounds each of western rye or slender wheat and brome grass, making a total of 14 pounds per acre. Since 1919 he has changed the mixture and now seeds five pounds each of brome, western rye and sweet clover. Brome grass is slow in becoming established and does not reach its stage of productiveness until the second or third year after seeding. Sweet clover and western rye grass develop quickly and produce a crop the first year. After the first year they are gradually crowded out by the brome grass. Under this method the western rye and sweet clover are productive while the brome grass is becoming established.

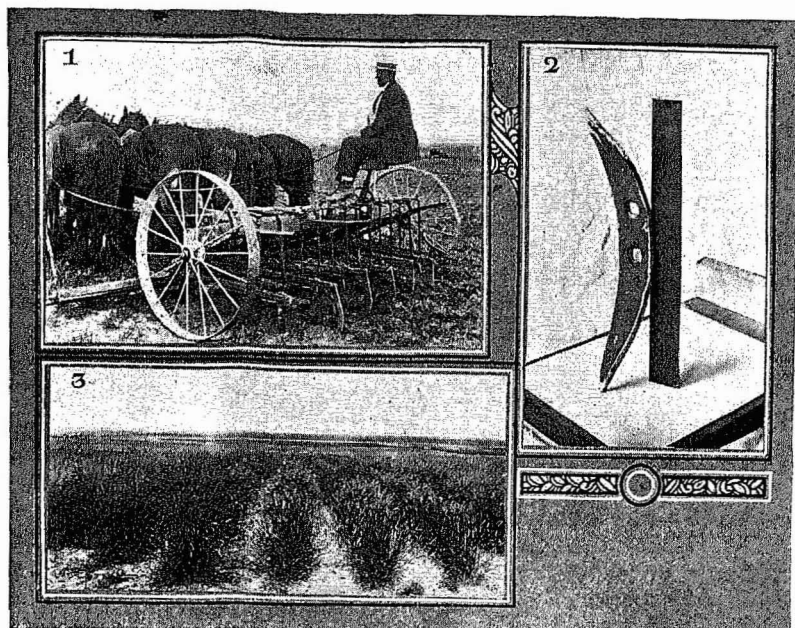


Figure 32—(1) E. C. Hallman renovating his brome grass; (2) Renovating Shovel attached to duck-foot cultivator; (3) Brome grass in rows.

### Methods of Seeding

Planting is always made on clean, well tilled, summer fallowed land. It is seeded with a nurse crop as the grass seed is very light and will go more evenly through the drill if mixed with grain. Mr. Hallman uses a press drill because he strongly recommends putting the seed in a firm soil at a uniform depth of not more than two inches. Mr. Hallman reports success with seeding in these four different manners:

1. In the fall with winter rye on summer fallowed land.
2. Drilled in the spring on winter rye which was seeded the fall before.
3. Drilled with spring grain on summer fallowed land.
4. Seeded alone on summer fallowed land. In this case he cultivated the land the second year as if for summer fallow and seeded between June 15 and July 1 when there was sufficient moisture near the surface to germinate the seed. He recommends seeding with winter rye in soils that blow.

Mr. Hallman has had no trouble in getting started. He prefers fall seeding and thinks that freezing and thaw help

in the germination. The nurse crop is always cut early unless the season proves to be extremely wet. This allows the grass to develop better and gives it more reserve moisture.

### Pasture and Brome Grass

Brome grass should not be pastured late in the season as it is apt to decrease the yields the next year by one-half. Best results are obtained when the grass is pastured no shorter than five inches as the tall grass protects the ground and the tender shoots.

### Renovation

Brome grass has a great network of roots and after becoming established always becomes sod-bound. Mr. Hallman renovates it occasionally with a home made shovel made from old automobile springs. (See Fig. 32). He attaches this to the shanks of a regular duck-foot cultivator and uses a twelve-horse team on a twelve-foot cultivator. Because of the construction of this shovel the more sod-bound the land the more it will be torn up.

### Sweet Clover

A number of farmers are confident that sweet clover will prove beneficial in the future (Note<sup>42</sup>) although the experience up to this time has not been especially favorable.

## Point Three—Live Stock Farming

There is a considerable acreage of land in the "Triangle" which can never be used for more than grazing purposes. It is probable that on this type of land there will ultimately develop a type of live stock ranching which can profitably use large areas of fenced land of low value. Ranch men of experience estimate that where the native grass offers fair grazing three acres will support one sheep and that from 23 to 30 acres will be required to support a cow weighing

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(Note 42). One man voices a common opinion in these words: "I now have 100 acres of sweet clover and it looks like a winning plan. I can understand why it took so long to develop air craft and radio communication, but I would like to have it explained to me why sweet clover has been so long coming in." Prof. Clyde McKee, agronomist at Montana State College, Bozeman, has a detailed report on sweet clover experience on Montana farms which may be had by writing to him.

1,000 pounds. (Note<sup>43</sup>). There is no such thing as average grazing lands in this section and the value of grazing lands will vary widely.

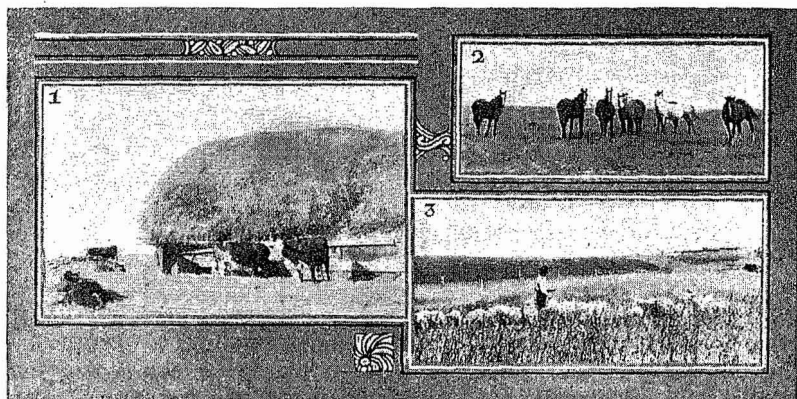


Figure 33—Livestock farmers in many instances and under certain conditions have shown good profit. Here are scenes from north Montana showing cattle, horses and sheep on the dry farms.

If these grazing lands are to be utilized at a profit, they must be held at a low value or low rental charge. Soil surveys would easily determine what lands are suited to wheat growing and which are to be used only for grazing. In the province of Saskatchewan, Canada, certain areas are designated as permanent grazing lands and are under government ownership and control. It is doubtful if government control is within the range of possibilities in Montana because, since the passage of the enlarged homestead acts, practically all of the Montana land has passed into private ownership.

The development of live stock farming on these areas in Montana is now held back because owners are holding this type of land at too high prices for grazing. No expansion in cattle and sheep raising has been in process long enough to bring about readjustments in values. When this type

(Note 43). Russell Thorp, a prominent stockman of Cut Bank, writes as follows: "The Blackfeet reservation, which is made up of exceptionally good grazing lands, will average about 30 acres of grass to the head of grown cattle for year around grazing when supported with feed in form of hay or cotton cake for emergency. At least that is the basis upon which my company works, and this leaves a fair amount of old grass to catch the winter snows and insure an early and heavy growth of grass in the spring. We have worked this out by stocking our pastures for a period of years and have quite an accurate record of the results. This does not cut the grass down and it insures good beef. It is true that you can handle cattle on less acreage, but you will fail in beef and it will be only a question of time until the grass will play out. I would consider any country exceptionally good that could support cattle on a basis of 20 acres to the head and 30 acres is above the average up here. Many parts of Montana require up to 80 acres per head. I note that there is a tendency to underestimate the carrying capacity of grazing lands."

of farming becomes more general care must be used not to over-stock the pastures. This live stock farmer must also grow considerable dry land feed and must take advantage of the diversified base.

## Point Four—Use of Tillable Land

The soil and climate in the "Triangle" is such that this region produces a large proportion of Marquis spring wheat which commands a premium upon the market over No. 1 Dark Northern. (Note<sup>44</sup>). This wheat commands a premium because of its high protein and gluten content. While some prejudice at present exists against wheat raising, no other crop has surpassed wheat as the adapted cash crop for the region. Various estimates have been made as to the amount of land which is adapted to wheat growing in the "Triangle," the majority of estimates making it about 50 per cent. Soil, topography, rainfall, transportation and other factors must be considered before this question can be answered and the answer will not be made until after a soil survey has been completed.

In the early years of farming considerable winter wheat was raised upon sod breaking. Some winter wheat still is being raised in the foothills and close to the mountains but since 1916 it has been largely a failure on the plains. In this north Montana section there are 139 elevators with a storage capacity of 3,744,000 bushels. This clearly indicates that the country is now organized on a basis of wheat as the primary commercial product. (Note<sup>45</sup>). Then if wheat is to be the principal cash crop, the type of farming to be safe must be on a diversified base, for the wheat crop will be uncertain in the worst years. On the other hand, much is yet to be done in working out methods by which wheat can be raised at low cost to compete with the product of other sections of the country.

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(Note 44). A letter from George H. Moran, Montana grain inspector, says: "It may be estimated that between 70 and 75 per cent of the wheat in the 'Triangle' might be considered 'fancy.' The following quotations may be used in arriving at an approximate premium basis paid in this section: January, 1921, to July, 1921, no premium quoted; August, 1921, to October, 1921, average four cents premium quoted; October, 1921, to July, 1922, average one cent premium quoted; August, 1922, to April, 1923, average 11 cents premium quoted. The fact remains that the tariff has cut down the available supply of hard red spring wheat and has narrowed the supply of high gluten wheat of this class."

(Note 45). O. E. Baker of the United States Department of Agriculture calls attention to the fact that population is increasing two and one-half times as fast as agricultural land. He says: "If our population maintains its present rate of increase and present standards of living, in seven years our wheat export surplus will be required for home consumption, provided agricultural land remains stationary." It would seem to indicate that, even should Europe remain a small buyer, that "Triangle" lands will profitably produce wheat for home consumption in the future.

There is not yet developed any definite type of wheat farming for the "Triangle." Much of the wheat farming here up to this time has been in a rather haphazard manner, with a large number of farmers using the methods practiced in the Red River Valley of Minnesota. It is evident from the numerous problems encountered that Red River Valley methods, or methods of other eastern sections, fail in the "Triangle" and that some other type of wheat growing must be developed. The methods for this section must be built upon the variability of seasons, and the farming must be upon a diversified base with reserves for the bad years.

The following discussion of methods of wheat raising in north Montana is only an outline, and details have been omitted. The subject has divided itself into two divisions; the first a discussion of dependable methods, and the second a study of low-cost practices in farming.

### SUMMER FALLOW

Since the beginning of the drouth years in the "Triangle" there has been much discussion of summer fallow. Some have held that summer fallow is the cure for all dry land ills, others are skeptical about its claimed values, while still others hold that it is only one necessary part of the general farming system that is to be established. Summer fallow is one of the important methods of building up reserves of moisture without heavy outlay of cash or labor.

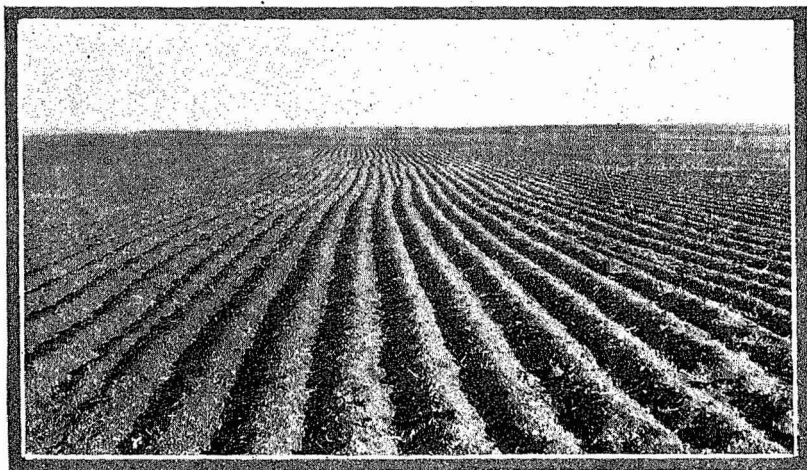


Figure 34—A good type of black Canadian summer fallow.

The best answer to the summer fallow discussion, however, is within the experience of successful farmers. The following table shows records taken on farms in this region from 1912 to 1921 and compares the yield of spring wheat after summer fallow with yield after other systems of tillage:

Year	Summer Fallow		Other Systems	
	No. of Farms	Av. Yield Per Acre	No. of Farms	Av. Yield Per Acre
1912 .....	3	24.0	18	22.0
1913 .....	3	13.6	31	15.2
1914 .....	7	12.0	38	7.9
1915 .....	19	29.4	61	23.0
1916 .....	34	29.8	70	23.6
1917 .....	37	14.7	84	6.8
1918 .....	31	11.5	88	4.1
1919 .....	37	2.8	93	.5
1920 .....	43	12.8	93	5.7
1921 .....	44	11.7	86	4.5

The table may be divided, showing the average yields for the five years of total and partial crop failure from 1917 to 1921, for which a reasonable number of experiences were gathered. In the period from 1912 to 1916 so few records were available that the figures may not be considered so important from the standpoint of accuracy. The average yields for the two divisions may be set down as follows:

	Summer Fallow	Other Systems
Average, 1917-21 .....	10.7	4.3
Average, 1912-21 .....	16.5	11.3

The yields of 1915 and 1916 would have been higher had they not been reduced in some cases by hail damage. It is believed, however, that the comparison is fairly reliable throughout. It must be remembered that during the first period of cropping the old systems of tillage had an advantage because they were upon new land, because of the absence of weeds, the presence of soil fibre and the freedom from soil blowing. A summary of the table would be that summer fallow yielded about twice as much as the other methods during the dry years and one-third more than other methods during the entire ten-year period.

## The Experience of Farmers

Among the 130 farmers interviewed in 1922, an average yield of ten bushels or more per acre had been obtained by 23 of them for each of the years of the period 1916-21. Of these 23 farmers one had used flood water irrigation to some extent and one other was located in the hills where he received more than the average rainfall. The remaining 21 farmers had obtained an average yield of more than ten bushels under typical dry land conditions. All of these 21 farmers were strong advocates of summer fallow. All but two of them had been summer fallowing continuously since 1916 or earlier. This checks closely with the experiences told in the report of the Royal Commission of Inquiry in farming conditions in Saskatchewan. (Note<sup>46</sup>).

It is unfortunate that in the past there has not been enough good summer fallow in the "Triangle" to affect matters materially. During the progress of the survey in 1922 counts were made in typical portions of north central Montana to get an estimate of the approximate amount of summer fallow. Fields were counted on both sides of the roads and for convenience were classed as grain fields, fallow fields, fenced native pastures and broken land which was going back to weeds. Fallow fields averaged less than 11 per cent of the total. In the same kind of count in southern Saskatchewan the fallow fields averaged close to 40 per cent. (Note<sup>47</sup>).

It was also noted that the quality of Canadian summer fallow was better than that of Montana summer fallow. In a count of fallow fields 14 per cent of Canadian fields were listed as "weedy" while the percentage of weedy fallow fields in Montana was 43.

The question is quite naturally asked "why has the Canadian triangle more and better summer fallow than the corresponding region in north Montana?" This is answered by a quotation from Minister Hamilton in the report on Saskatchewan farming conditions. He says: "The system of farming (summer fallow) advised and followed by the first settlers was carried into the larger area of southwestern Saskatchewan with more or less success. Let me say just here that wherever one or more of the settlers from this

(Note 46). The report of the commission said: "The early efforts of the homesteader have had to do with breaking up the prairie and destroying the native vegetation so as to have a place in which to grow crops. Second, however, he has to consider what is the most profitable method of treating stubble land and this introduces the summer fallow and with it come some of the problems of summer fallow. The summer fallow method of using the precipitation of three years to grow two crops, or of two years to grow one crop, has made possible the growing of grain in areas which it is doubtful whether other systems of tillage and cropping would have produced equally good results."

(Note 47). These counts in detail are shown under miscellaneous statistics in the appendix of this bulletin.

old portion of the province went and settled in the newer section, he became a missionary for the summer fallow system of farming."

James Murray, agricultural representative in Alberta, explains the small amount of summer fallow in that province in three ways. First, the farmers have little capital and a small acreage, thus want the greatest amount in grain each year; second, the farmers are willing to "take a chance" that each year will be a good year; third, a lot of summer fallow farming has been done in such a slipshod manner that it has shown poor results.

There are many reasons for the small amount of summer fallow in the Montana "Triangle." First and most important is the bad effect of the phenomenal crops of 1915-16, when any type of farming brought big profits. During the drouth period these farmers were unable to start a system of summer fallow because of lack of capital. During these bad years their hope was in getting a government seed loan which would enable them to seed their crop in "shotgun" fashion, basing their prospect of success upon a favorable year. (Note<sup>48</sup>). Few of the north Montana farmers had come from farming districts where summer fallowing was practiced. The lesson of need of summer fallowing, strange to them, was learned through disaster and suffering.

Many who came to Montana from the Red River Valley of Minnesota tried the system of summer fallow used there. But in the Red River Valley the idea of summer fallow is not moisture conservation, but weed killing. Consequently these farmers in Montana would plow their land for fallow in July after the weeds had made a strong growth and were ready to form seeds, and when the weeds had taken all of the soil moisture. This type of summer fallowing proved worse than continuous cropping. Neither did these early farmers know the proper methods of tillage for summer fallow. They often used disks and harrows which failed to kill the Russian thistles and which left the land in pulverized condition and apt to blow. The lack of summer fallow in north central Montana, then, may be accounted for in the statement that the farmers were not in the summer fallow habit, or because they were reduced to such circumstances that summer fallow could not be started.

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(Note 48). In the "Triangle" the term "shotgun farming" means careless farming. You will hear farmers discuss the type of farmer who is too shiftless to prepare his ground and to plant his seed carefully. They say this type of farmer fills his shotgun full of seed, shoots the seed into the ground, then "cusses the country if he don't get a crop from it."

## Principles of Summer Fallow

In a poster issued by the Montana State College Extension Service, the objects of summer fallow are set forth clearly by A. J. Ogaard, extension agronomist. He says there are four objects of summer fallow:

**First**—Storage of moisture from one season as a reserve and insurance in the production of crops the following year.

**Second**—The accumulation of available plant food resulting from moisture, air and heat—the conditions which are favorable to bacterial action.

**Third**—Control of weeds by clean and timely cultivation.

**Fourth**—Better distribution of labor during the year with more land prepared for seeding at the proper time.

These objects are to be accomplished through early and proper cultivation. Both the Canadian Experiment Station and Montana agronomists agree as to the essential practices for good fallow in the "Triangle." These necessary practices may be stated as follows:

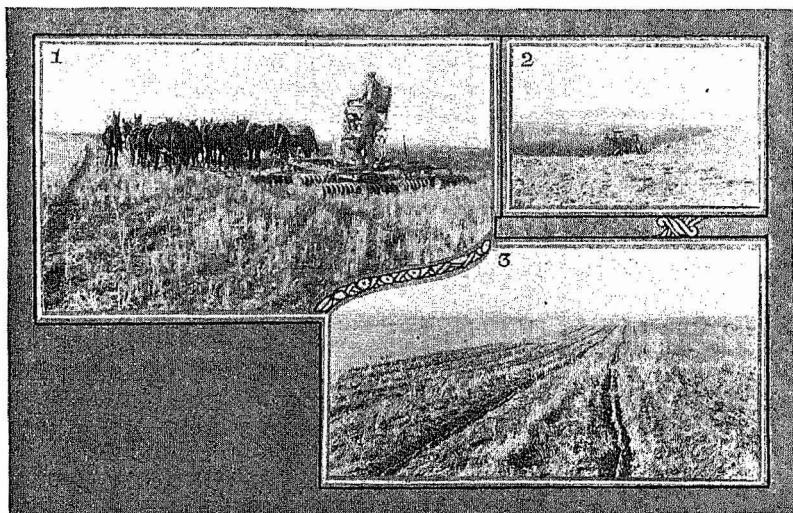


Figure 35—Early discing: (1) Discing with a large outfit on the Noble Foundation farms in Canada; (2) This ground was not disced early and weeds were so high at time of plowing that summer fallow was valueless; (3) This early disced land is in good shape for plowing, as the weeds are germinated early and killed easily.

1. First rake off and burn the Russian thistles and, as early in the spring as possible, disc the land that is to be fallowed. Double discing is better than single discing. This discing tends to germinate the weed seeds that are near

the surface and makes weed control a more simple matter. Weed seeds germinate when near the surface so this early cultivation hastens this germination of weed seed and allows them to be killed earlier. It also opens the soil so that it absorbs the early spring rains and reduces the draft when plowing starts. Agronomists in Canada have noticed that land treated this way pulls much easier in May and June than land which had gone untouched.

2. Early plowing at medium depth is the next step. (Note<sup>40</sup>). If possible the land should be plowed before June 15. Alvin Hull, a prominent and successful farmer of Collins, makes a practice of plowing very early. He also likes the packer and is confident that he obtains results from its use, although other opinions vary on the use of the packer.

3. Until harvest time the fallow should be cultivated only as much as necessary to control weeds and maintain the clod mulch on the surface. If the fallow is kept clean and packed until harvest time the weeds that come later will do little damage and will soon be killed by frost. After weeds grow to a height of about six inches they pump water out of the soil very rapidly, so it is necessary that the fallow be kept quite clean and that tools be used which will cover large areas of fallow rather cheaply, but effectively.

4. The fallow should not be disturbed after the middle part of August so that a crust may form on the surface. The pale western cutworm, which has been a serious insect pest in this section in past years, finds it difficult to lay its eggs in the crusted surface of the fallow.

Many farmers express interest in listing summer fallow in place of plowing. Experience on listing is yet too limited to warrant any conclusion.

### Systems of Summer Fallow

There seemed to be no definite system of summer fallowing, nor uniform ideas concerning the object and practice of summer fallow, among the successful farmers of north central Montana. Their methods and ideas differed widely and some of them fallowed by the "chance method," using whatever plan appeared good at the time. This is why such systematic summer fallow farmers as James Printice of Hill county have had outstanding average yields. The develop-

(Note 40). "The importance of early cultivation of the land to be fallowed, so that full advantage may be taken of the early spring moisture, has been clearly demonstrated during the last few years. The present Minister of Agriculture for the Dominion put the case clearly some years ago when he said that the farmers in the drier regions should spring fallow instead of summer fallow."—From the report of the Survey Board of Southern Alberta, 1922.

ment of a definite type of summer fallow for the "Triangle" is yet to become a part of the farming program for this area.

### Summer Fallow Not a Cure-All

While it would appear from the above that summer fallow is the backbone of any system of farming in this region, it should not be accepted as a "cure-all." The analysis of weather in the Havre district over a forty-year period indicates that weather has a distinct bearing on the value of fallowing. Unless weather combinations are favorable fallow may not by itself produce profitable results. In 1919 little storage of soil moisture under any system was possible, and in other years when storage has been possible there have been adverse conditions which completely spoiled the beneficial effects of soil moisture storage.

The scientific work of the Office of Dry Land Investigations has shown that it is impossible to store enough moisture in the soil to produce a crop without some rain during the growing season. In the "Triangle" the rains which are stored as moisture in the summer fallow come principally in May, June and July. Measurements have shown that it is impossible to store more than 25 per cent or 30 per cent of this moisture because the rains come during periods of high evaporation. Storage of moisture depends upon distribution of rainfall, type of soil, weather conditions and other factors.

If the north Montana region had the same type of weather as the Palouse country or Big Bend country of Washington (Note<sup>50</sup>) there would be little difficulty in getting farmers to go over to a definite summer fallow system. But in Montana fallow may show up well in one year and poor in another year. However, summer fallow is a powerful stabilizer in the "Triangle" and the thing needed is not a blind following of summer fallow as a cure-all but an intelligent understanding of its possibilities under our conditions. Summer fallow must not be judged from its showing in any one year, but over a period of years. It is certain that summer fallowing will stabilize the yield and that it is important from a farm management standpoint in that it allows labor to be better distributed through the year.

In the following table is given an outline of yields on summer fallow. These yields are from five sources; first the yields of two experiment stations in the typical northern dry land regions, the third column is the yield averaged for suc-

(Note 50). In the Palouse country the annual rainfall from year to year is low but is fairly certain for any one year. Their rainfall comes at a different time of the year from the "Triangle" rainfall and they store a higher percentage of this rainfall in the fallow than is possible in north Montana.

cessful summer fallow farmers of the "Triangle" and the last two columns show the yields of two individual summer fallow farmers.

Year	Wheat Yields on Lethbridge Ex- periment Station	Summer Fallow Havre Experi- ment Station	Successful Farmers	Jim Printice	Alvin Hall
1912 .....	24	---	24	---	---
1913 .....	26	---	17	---	---
1914 .....	21	---	12	---	---
1915 .....	63	---	29	51	17
1916 .....	47	49	30	42	50
1917 .....	25	6	15	19	22
1918 .....	14	8	12	14	20
1919 .....	2	3	3	14	4
1920 .....	21	10	13	20	21
1921 .....	9	10	12	14	21
Average .....	25	14	17	25	23

### Adapted Tillage Tools

Summing up the main objects of summer fallow, Mr. Ogaard says "kill the weeds and maintain the clod mulch." But this work is one that requires the proper tillage tools if the farmer is to economize on labor and time. Plowing does not complete the fallow and the remainder of the work must be done with tools fitted to a particular purpose.

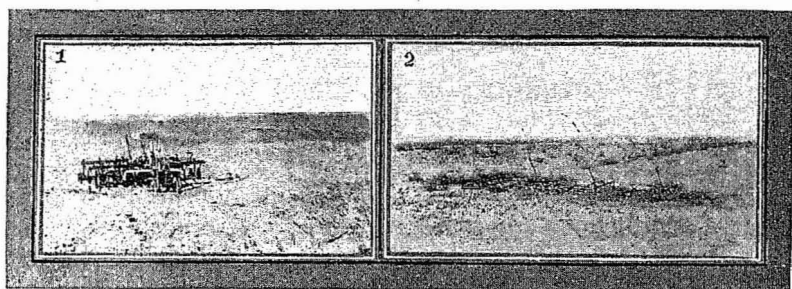


Figure 36—Discs and harrows are not favored under most conditions. The scene on the right shows how the harrow has failed to kill the weeds.

Discs and harrows were about the only tillage tools with which "Triangle" farmers were familiar in the first years in north Montana, and it is natural that they were tried out in this new area. But these two tools are suited to a purpose entirely different in eastern agricultural sections and they soon proved that they were not adapted to north Montana conditions. Instead of cutting off the weeds, discs are apt to prune the roots or just cultivate them, being of benefit

rather than harm to Russian thistles. It is much the same thing with the harrow. In the eastern country fallow is plowed so late that it is not cultivated at all and the disc is used more for spring preparation of land than for weed eradication. Many Montana farmers now are greatly prejudiced against the disc. One successful farmer made the statement that "discs ought to be thrown away and the man who made them hung," while an Alberta farmer believes his government should "compell all farmers to do away with their discs except in fitting land for summer fallow in the spring."

But Mr. Ogaard of the Montana Extension Service is of the opinion that discs have been too much abused and misused and that sweeping blame is not warranted. The disc, he says, has an important place in the preparation of land for summer fallow but certainly is not adapted to the cultivation of land after it is plowed. The rolling action of the disc pulverizes the soil and makes a dust instead of a clod mulch. It also exposes the soil deeply as it cuts, so the soil dries out more quickly.

To produce the proper kind of summer fallow in north central Montana it would seem that tillage tools must embody two principles. First, they must cut off or shear off all weeds below the surface of the ground so that both the upper part and the roots of the plants will be destroyed. At the same time they must tear them in such a manner that they will not be simply "transplanted" if a rain comes soon after the cultivation. Second, the implement should not stir the soil as does the disc but should pass underneath the soil just above the seed bed, to slightly raise the soil and give it a sort of jar that will work the clods to the top and allow the fine soil particles (Note<sup>51</sup>) to sift into the seed bed zone.

There is a right time to kill weeds and if the farmer is fortunate enough to get upon his fallow at this time he will kill a big percentage of the weeds quite easily. The time to kill weeds is when the food supply of the germinated seed is exhausted and before the plant gets well established. This means before the plant really gets green. A small weed of this size is not easily seen from a distance, so the time to kill weeds is before they really become noticeable. The farmer who tills his summer fallow at this time does cleaner work than one who allows the weeds to get a good start.

The survey has shown a great variety of tillage tools used in north Montana. Farmers have had to grope in the dark, first learning the tillage requirements of summer fallow in their region and then working out an adapted type of tool. Roughly speaking, the tools found are divided into four

(Note 51). In talking of soil a "particle" is the smallest possible division, while a "granule" is a combination of these particles.

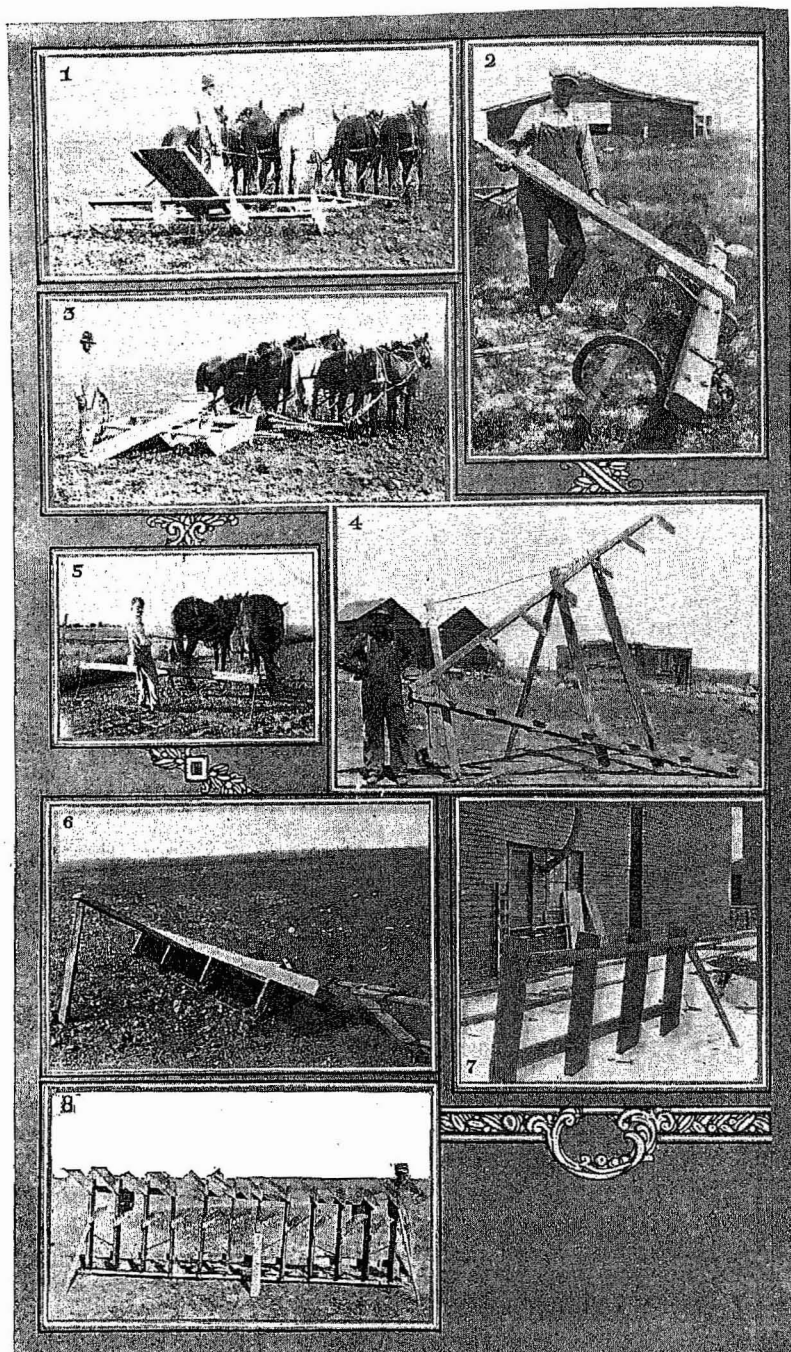


Figure 37—Home made tillage implements: (1) Double rod weeder with front rod in action; (2) Goose neck slicker; (3) Double rod weeder with rear rod in action; (4) "V" plowshare weeder; (5) Dry land safety razor; (6) Single rod weeder with good tightening rod; (7) Bar blade weeder; (8) Plowshare weeder.

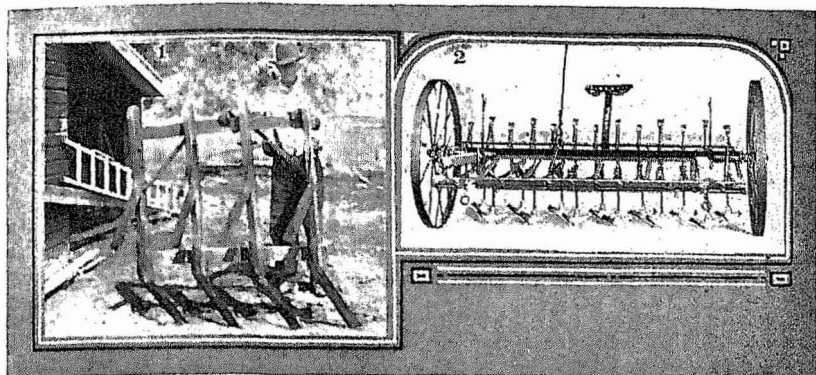


Figure 38—Manufactured tools: (1) Clack weeder. (2) Duck foot cultivator.

types; duck-foot cultivators, bar blade weeders, rod weeders and shearing blades. In the duck-foot cultivators a wide, flat shovel is passed a short distance beneath the ground. In the rod weeders a small steel rod is pulled in the same manner as the bar blades, which consist of blades attached to a sled-like runner or gooseneck support and are pulled about three inches beneath the surface. The shearing blades also pull beneath the ground. (See Fig. 37).

The survey indicates that local adaptations have to be made, as some of the weeders are adapted to stony ground, others work well in trashy soil and others are adapted to varying conditions. Many of the weeders found in the "Triangle" were home made and showed much ingenuity. (Note<sup>52</sup>). There is a tendency, however, to substitute duck-foot cultivators for the home made tools. Without doubt the duck-foot cultivator is becoming one of the standard field implements for this region. Some farmers who have duck-foot cultivators are of the opinion that it is well also to supplement them with rod or blade weeders for use under different conditions.

### Summer Fallow Without Plowing

Summer fallowing without plowing is another instance of means that farmers are using to meet requirements of their section. In other sections of America plowing has become a fixed practice because there was enough rainfall to clog or pack the soil. There has not been enough rainfall in north Montana in the last few years to pack the soil so the reasons for plowing were less marked. C. S. Noble of Noblesford,

(Note 52). See Montana Extension Service Bulletin No. 47, "Home Made Tillage Implements."

Alberta; believes that three cultivations are equivalent to one plowing, and he reminds us that plowing is the big cost in summer fallowing.

Many farmers who have been experimenting with summer fallow without plowing agree with him. They say that where land has been recently plowed and there is no great amount of rainfall, plowing for summer fallow leaves the land light and fluffy. Why plow now and worry about packing next spring? they ask. If you plow the land you still will have to cultivate the summer fallow three times, so why not do without the plowing, they argue. It is said that more horses can be put on the cultivator and that cultivation can be deeper. In this way, too, more land can be summer fallowed as the limiting factor in summer fallowing is early plowing which needs to be done at the same time that spring wheat is seeded. They believe that a more extensive system of tillage spread throughout the months of May, June and July will allow one man to till and prepare a greater number of acres for the coming year. Mr. Noble believes that farmers in his region will have to summer fallow more land because this summer fallow comes nearer to producing a crop in the dry years. (Note<sup>53</sup>).

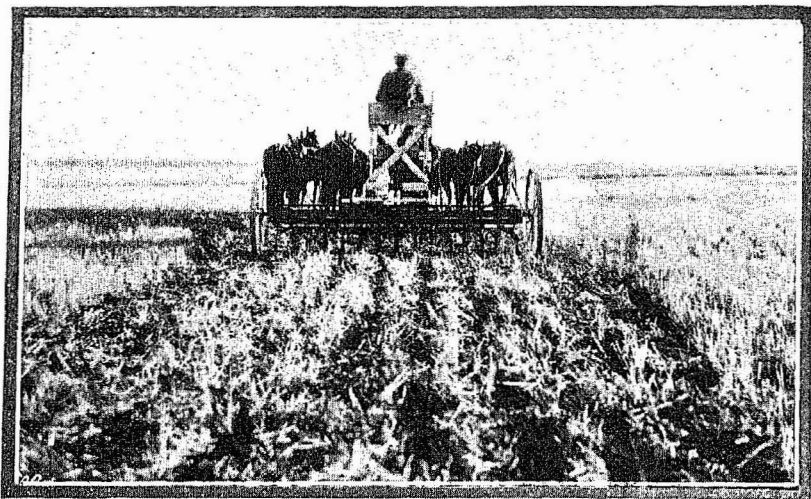


Figure 39—Summer fallowing with the duck foot cultivator on the Noble Foundation farms, in Canada. This is one important method of summer fallowing without plowing.

(Note 53). Mr. Noble's outfits are 12-horse teams which double disc a strip 16 feet wide or duck-foots a strip 12 feet wide. A day's work for a team is 20 miles.

One of the first men to experiment with plowless summer fallow in his locality was R. K. Bohannon of Sibbald, Alberta. He cultivates his land with a nine-foot duck-foot cultivator, using 12-inch blades. The first operation is to double disc the stubble early in the spring. After seeding his spring grain he cultivates his fallow the first time with this duck-foot cultivator, which carries 13 blades and cuts the land about three or four inches deep. After completing the first cultivation he cultivates cross-wise, using eight horses on the nine-foot cultivator and taking off the two outside duck-foot shovels, thus reducing the width to considerable extent. In this second cultivation he goes one or two inches deeper than the first cultivation. Before harvest a third cultivation is given the land with the same outfit, going a little deeper than the second cultivation. This means that during the three cultivations he has gone down a depth of six inches or more. In 1922 his best wheat on land treated this way yielded 33 bushels and his average yield was 29 bushels. In this way he summer fallows about 200 acres with an eight-horse team between the middle of May and the first of August.

The practice of summer fallowing without plowing as recommended by the experiment station at Lethbridge, Alberta, is as follows:

First, single or double disc the land early in the spring to germinate the weed seeds and retain moisture. (Note<sup>54</sup>). Next use a wide 10 or 12-inch shovel, going a little deeper than the discing. The second cultivation should be at right angles to the first and, if the weeds are bad, a narrow toothed shovel can be used, going deeper. If weeds are very bad, a 10 or 12-inch duck-foot can be used for the second cultivation and the third cultivation can be given with the narrow shovel.

C. H. Seitters of Inverness, not knowing of the plowless summer fallow in Canada, got the idea from western Kansas where wheat was drilled in listed corn stubble. In 1919 Mr. Seitters cultivated with the Forkner cultivator, handling 80 acres this way. In 1920 this yielded 14½ bushels to the acre. In 1922 he had some land which was broken in 1917 but which had never been back-set. He summer fallowed it in this manner and estimates that it yielded 25 bushels per acre. Mr. Seitters believes that plowless summer fallow will enable one man with a large team to crop a large area profitably. In 1922 he farmed with 10 and 12-horse teams, raising 310 acres of wheat which produced 3,876 bushels; 55 acres of oats which cut 10 loads of hay and still yielded 1,000 bushels of grain; 15 acres of

(Note 54). Some have double disced a second time and then given two cultivation with the duck-foot cultivator. Others, like Mr. Bohannon, give three straight duck-foot cultivations.

corn which gave 15 loads of corn fodder; and at the same time summer fallowed 240 acres of land, 160 acres without plowing. He did practically all of this work himself, his labor cost outside of harvesting and threshing amounting to only \$40.

This method of plowless summer fallow may prove a great benefit for the "Triangle." In Alberta it is estimated that one-half the land in the southern part of the province will be summer fallowed this way in 1923. It is doubtful if this type of summer fallow yields more than plowed summer fallow; the results will be found probably about the same. The chief advantage is in reducing the cost of summer fallow and allowing a greater acreage of crop per man, as well as controlling soil blowing to some extent. There is much yet to be learned about summer fallowing without plowing, and its strongest advocates believe that occasional plowing may still be advisable.

### SOIL BLOWING

As yet there has not been great damage from soil blowing in north Montana, although it is a serious problem in Canada where it is estimated that 75,000 acres of crops in Alberta were destroyed by soil blowing in 1920. In north Montana winds of more than 30 miles velocity at times are known and they are apt to blow summer fallow land that is dry and fine. At times when the fallow is bare and dry in the winter, and more especially in the spring after the snow goes off, the wind is apt to move a soil that is level and which has a dust mulch.

### Cause of Soil Blowing

When ground is first broken, it has much soil fibre or grass roots to bind it together. As this land is tilled year after year this fibre is gradually destroyed. As the soil becomes finer it is more easily lifted and carried by the wind. It is estimated that over a large part of Alberta soil blowing did not begin until after the land had been cropped and summer fallowed for about ten years.

### Prevention of Soil Blowing

The only permanent cure for soil blowing is the restoration of fibre to the soil. Prominent Canadian farmers, where soil blowing is a serious problem, agree that there can be no cure until they get the soil fibre back, and they are for this reason trying to get fields seeded to grass. It is possible that the experiences of E. C. Hallman (Note<sup>55</sup>) are the most

(Note 55). Mr. Hallmans' experiences with brome grass were given earlier in this bulletin.

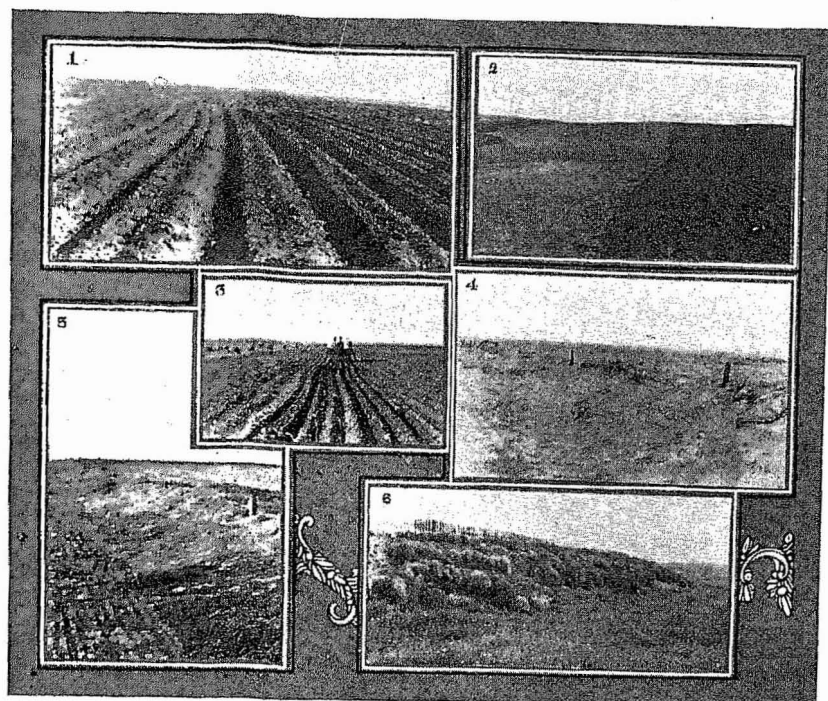


Figure 40—Soil blowing: (1) Listed summer fallow; (2) Ground left rough will resist soil blowing; (3) Using the furrow drill; (4) A fence almost covered with blown soil in the "Triangle"; (5) Soil blowing near Joplin; (6) A hill of blown soil in Canada with the fourth fence on top.

promising along this line as other farmers believe that regions of blowing will have to be seeded and left in brome grass for six or eight years to restore soil fibre.

The following are temporary measures used in preventing soil blowing to some degree:

1. Plowless fallow. This has been described previously. Many farmers in the "blow areas" say that this practice has greatly reduced blowing of their land.

2. Listed fallow. Experience here is limited. A few farmers have used two-row listers to keep the soil from blowing, but there are disadvantages. Weeds are apt to be more troublesome and more of the soil surface is exposed. It is not shown that this method holds as much moisture as the regular or plowless summer fallow.

3. Strip farming. The winds seem to get a harder sweep at the large fields. Some farmers have tried breaking the field up into strips about 10 rods wide, cropping one strip and leaving the next one fallow throughout the field. This has a tendency to break the force of the wind across

the narrow fallow strips but there is a disadvantage in the row of Russian thistles generally found along the edge of the strips. It is an unhandy practice and most of the farmers interviewed in Canada were not well pleased with it.

4. Strip-fallow crop. It has been suggested that from two to four rows of corn or sunflowers be planted across the summer fallowed fields at right angles to the blowing winds and at two or four rods apart. It is argued that these strips not only protect the soil from blowing but also catch and hold snow. Experience with this method is too limited for conclusion.

5. Cultural methods. Cultural methods for control of soil blowing have included use of the furrow drill, the plowing of listed furrows at right angles to the wind and at regular intervals in the field, and harrowing the fallow while wet.

6. Winter rye. Where stands have been obtained, winter rye has been quite effective.

7. Straw on higher knolls. If there are but a few high spots which blow, they can be held to quite an extent by scattering straw on the tops of the knolls in the fall.

8. "Sharing," using the plow without the mold board, is a method employed successfully in Washington.

## SUBSTITUTES FOR FALLOW

To a limited extent the cultivated crops like corn, sunflowers, grain in rows and potatoes may be used as a substitute for fallow. Results at the Lethridge experiment station indicate that these substitutes reduce the wheat yield only about three bushels per acre below fallow yields. In the Montana "Triangle" there is great interest in the proposition of growing corn as a fallow substitute.

The growing of corn, however, competes with summer fallow practice as cultivation for corn is much the same as summer fallow culture. Corn requires a small outfit, two rows being cultivated generally at one time, while summer fallowing can be done on an extensive scale. Naturally, the more corn a man handles, the less summer fallow he can have and hence the less wheat acreage. Corn also competes in the fall, for corn must be handled during the time of wheat threshing and handling. If the spring is late and there is a big wheat crop to be planted, it means that much of the corn will also be planted late.

There is no objection to the farmer raising enough corn to supply feed for his live stock but beyond this point corn does not fit well with the general plan of wheat growing in the "Triangle."

Grain in rows is being proposed by some as a summer fallow substitute but farmers in the survey who had tried grain in rows were not satisfied with it. Mr. Noble says it is useless to try to grow grain in rows where Russian thistles are bad, as Russian thistles will completely clog up 18-inch rows. If rows of wider width then are used, it would be better to use corn than other grains.

### Corn or Sunflowers on Fallow

The suggestion also comes from Mr. Noble that corn or sunflowers be planted in strips of about four rows across the summer fallow, leaving the fallow strips about two to four rods wide. He thinks the corn could be cut high or, in the case of early flint, could be husked in the field. The stalks would then catch and hold a considerable amount of snow that otherwise might blow off the fallow, would protect the fallow from winds and supply enough feed to pay for cultivation.

### Delayed Seeding

Farming in north Montana must be modified somewhat by the Russian thistles and the tumbling mustard, two serious weed pests. They are very prolific seed bearers and are scattered over wide areas by the wind. Although the farmer may have his fallow absolutely clean, weeds from adjoining dirty fields are apt to blow in the winter and seed his clean land. Many farmers now are recommending that seeding be delayed until these weed seeds can be germinated and the young weeds killed. (Note<sup>56</sup>). Many farmers estimate that they gain from five to 14 bushels per acre by cleaning the summer fallow in the spring before seeding. Mr. Ogaard estimates that a ton of dried Russian thistles has removed enough moisture to raise eight bushels of wheat.

If the early part of the season is hot and dry Russian thistles grow rapidly and there is a race of thistles against wheat, with the thistles apt to win. Green Russian thistles also are a bad nuisance in the wheat at harvesting time and when mixed with headed grain are apt to produce moulding in stacks.

(Note 56). Superintendent Fairfield of the Lethbridge Station says: "We used to advocate seeding spring grain on the fallow as early as possible, but we have had to modify this a great deal and now recommend germinating the weed seed and killing the weeds before the land is needed."

### Spring Cleaning of Fallow

The operation of cleaning the fallow in the spring is simple and consists merely of going over the land with a disc or harrow to mix the surface soil so the weed seeds will germinate, then using a rod, blade or duck-foot cultivator to kill the young weeds before drilling. (Note<sup>57</sup>).

### Fighting Russian Thistle

Undoubtedly Russian thistles have had much to do with crop failures in the "Triangle." This weed pest seems peculiarly adapted to the climate of north central Montana and is causing the adoption of a type of farming that is built, to some extent, about its control. Yet the experience with Russian thistle damage is not so bad where delayed seeding has been carefully practiced.

Most of the farmers interviewed last year were firm believers in the raking and burning of Russian thistles. They held that in this way weed seed was destroyed and their time and labor profitably used. Two methods of burning thistles now are popular. One is by use of the flip-flop rake, (See Fig. 41) the other by burning in the harrow.

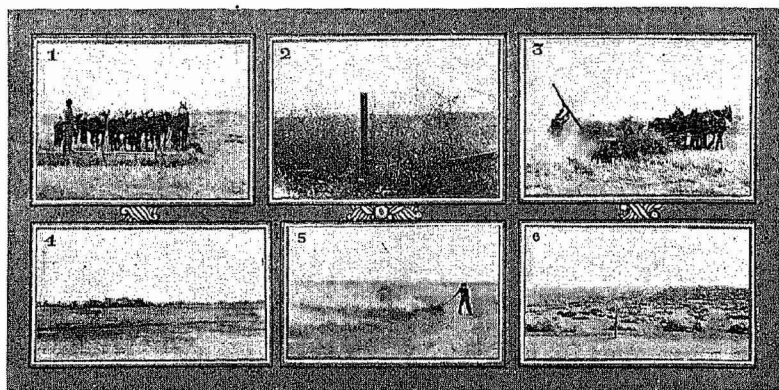


Figure 41—Russian thistles: (1) Raking thistles with the steel harrow; (2) Thistles blown against a wire fence; (3) The "flip flop" rake in action; (4) A pile of thistles blowing across the country; (5) Burning thistles which have been raked into windrows; (6) Thistles in a field, blowing before the wind.

It is not often that conditions will allow a complete burning of all the stubble and some successful farmers make a practice of leaving the stubble standing to catch winter snows. While the burning of stubble undoubtedly reduces the humus of the soil it certainly destroys much Russian thistle seed

Note 57): Mr. Noble has developed a light wire cleaner by which four to six horses take a strip 40 feet wide.

where this weed is bad. The general opinion seemed to be in favor of burning weedy stubble, most farmers holding that control of the thistle is more important than saving the amount of humus that goes up in smoke. Farmers in the "blow area" of Washington have quit burning stubble so as to save humus.

### Cropping With Rye

The summary of this survey points to rye as a very favorable crop for north central Montana. It is believed that it should be raised as a supplementary feed crop as it is very dependable and can be used both for grain hay and pasture. Rye is well adapted for drilling into clean grain stubble that was summer fallowed the previous year. If it can be drilled immediately after harvest, being drilled in with a single disc drill, it is very apt to germinate in the fall. Our weather records show that it would have germinated in the fall 21 times in the past 38 years.

Rye begins its growth early in the spring and thus is a great competitor against the Russian thistle. (Note<sup>58</sup>). It is a fine crop to fight weeds and resists soil blowing to a great extent. One of the most prominent farmers believes that it will pay to raise some rye either on summer fallow land or on stubble the second year after fallow. His plan is to use rye not as a cash crop, but for pasture, hay and feed. If cut for hay it should be cut with the binder when the rye is in the late milk stage because later the stalk becomes coarse and woody. The rye crop ripens before wheat harvest time so it can be cut and out of the road before wheat harvest begins.

Ground rye, because of its cheapness, has been used extensively as feed for work horses in recent years. Experiments under way at the Montana Experiment Station at Havre indicate that it can be used profitably in fattening hogs. It is believed now that all grain growing farmers can profitably raise some acreage of rye because of the manner in which it fits into labor distribution on the farm and because it can be handled at low proportional cost. It is significant that some of the most successful of north Montana farmers are raising rye. It is believed that the growing of rye should be greatly increased in the "Triangle."

### "Stubbling-In"

It has been clearly shown that safe farming for north Montana means the growing of wheat on summer fallow or corn ground. A majority of farmers, however, are of the opinion that there are times when it is advisable to

(Note 58). As a matter of fact, Russian thistles under most conditions are absent from rye fields.

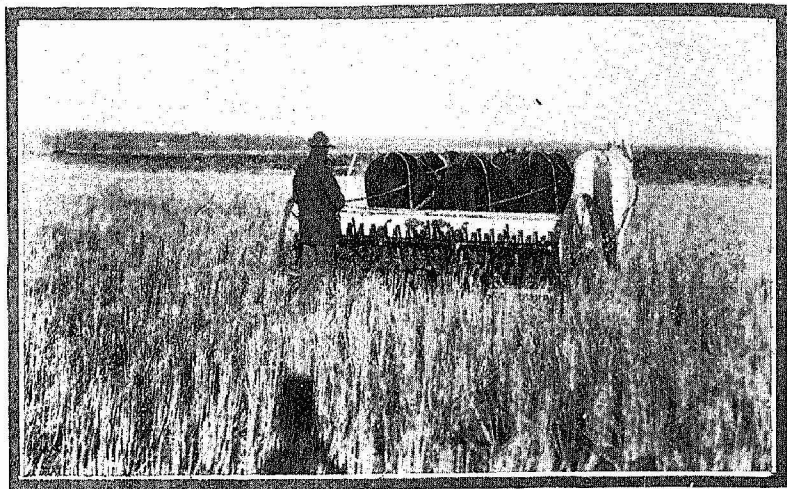


Figure 42—Drilling rye into clean wheat stubble.

"take a chance" on drilling wheat into clean stubble. There is a considerable gambling element in this idea—more gambling with wheat than with rye. It is a gamble but, as one farmer expressed it, "I like to take a little 'flier' on the side. If I win, that's fine; if I lose the loss doesn't cripple me."

Careful summer fallow farmers like Alvin Hull and others of the same type prefer to place all of their labor and equipment on summer fallowed land. Others who are not so methodical are continuously tempted to "play side games" in which they may be justified if there is sufficient moisture in the stubble to give odds in their favor. It is believed by the writer, however, that "stubbling-in" should always be considered strictly as a side issue and should be confined to clean stubble.

### Spring Plowing

Under the discussion about weather, comparative yields from spring plowing and stubbling-in were discussed. If the crop is not put in on summer fallowed land, spring plowed land is next best. There will be many years when the weather combination will give as good yields on spring plowing as on summer fallowed land. These occasional years when spring plowing shows up well are apt to mislead many farmers. It must again be mentioned that the safest way to judge is from the average of a period of years, and not from results from any one year. Again it is explained that grain

farming in the "Triangle" should be based upon summer fallow and that spring plowing should be considered as another side issue.

### Rotation of Crops

Practically none of the successful farmers of the region have yet given serious thought to crop rotations. The immediate problem through the dry years has been to get something that would pay interest, taxes, current expenses and debts. Each farmer has been waiting for a "cash crop next year that would leave a surplus." Soil blowing in the meantime is bringing up the question of rotation more insistently each year. Experiment stations have much information to offer when this problem becomes a little more pressing, although it is not known just how rotations will be worked out for this north Montana section. Sweet clover, alfalfa, brome, slender wheat grass and crested wheat grass are all under experiment now. It is probable that the future rotations will be largely summer fallow and wheat, with some use of crops like sweet clover or perennial grasses which may be used for both hay and pasture.

### The Soil Fertility Problem

There comes up another problem, yet unsolved, in soil fertility. It is shown that in 23 years of farming at one experiment station in western Canada one-third of the nitrogen and one-third of the organic matter had been taken from the top soil. Soil fertility has not been a serious problem in north Montana where the sod was well grassed, yet it may become a serious problem in the future. What is to be done? All we can do is to get possession of all the facts regarding our climate, our soil and its condition and then to adapt our system of farming to the conditions." (Note<sup>59</sup>).

Agricultural land is held under a system of private ownership in which the owner is seeking steady profit. There is plenty of fertility in north Montana lands at present so the owner gives his attention to the scarce elements of capital, labor and reserves. As long as there is plenty of

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(Note 59). Speaking of farmers using up soil fertility, the Survey Board of Southern Alberta says, in 1922: "It is sometimes laid to their charge that they have been soil-miners. The plans of these settlers may not have been far-sighted, but yet it may be doubted if they were so short-sighted as to have come with that design. The great bulk of them came to make permanent homes. That they have wrested these homes from the soil cannot be adjudged adversely against them. And who may say that agricultural science may not help them, even those to whose lands irrigation water cannot be brought, to find means to repay to the rich soil that which is being borrowed?"

fertility this question will not worry him. He is more anxious to "cash in" on a part of this fertility as soon as possible to reduce the burden of debt and build up reserves. There is nothing to indicate that the fertility of these lands will not last as long as coal, petroleum and timber at their present rate of consumption, especially if these north Montana lands have periods of grassing.

The matter of fertility is part of the broader problem of general conservation which requires action of society as a whole. We should not blame the farmer for exhausting fertility when we excuse the lumberman, the miner and other users of natural resources.

## HARVEST PROBLEMS

If north Montana farmers turn more and more to large horse outfits or to tractor operation, where a big unit is operated by one man, it will finally mean a serious problem in harvest labor shortage. Where the operations of the farm are handled by one man up to harvest time, harvest labor is sure to become more scarce in spite of wages paid. Migratory laborers can be depended upon to some extent but they are generally unsatisfactory and the supply is undependable.

The thing needed is some plan of labor efficiency which will carry through the entire season and allow one man with his 12-horse unit to harvest the crop quickly and economically. Each day that the grain stands after it is ripe adds greatly to the risk. Although hail is not as common in August as in June and July, there is still danger from winds and rain. (The weather records indicate that in the past 40 years there would have been 12 years when grain would have been injured by storms between August 10 and September 1.) Tractors without doubt have an advantage over horses in this season for it is so hot that horses or mules to be pushed have to be fed carefully and changed often in the team.

Rye, besides helping in the diversification of the dry land farm, also relieves the harvest pressure. Since rye can either be cut for hay or for grain it is a crop that the farmer can use either way and still have it out of the way before wheat harvest. (Note<sup>60</sup>).

## The Use of Combines

Combines have been used with varying success in the "Triangle," some of the farmers reporting good success with small combines since 1917. It requires about the same crew to work with a combine as with a header. The objections

(Note 60). Mr. Noble thinks this is one of the greatest arguments for raising rye in the "Triangle" country.

to a combine come in the uneven ripening of the grain and the danger from wind and rain. Weather records show that a combine could have been used at Havre an average of 12 days per year (in the harvest season) in the past 40 years. (Note<sup>11</sup>).

### Heading Grain

Because of shortness of straw in this northern section in recent years the header has been widely used. The header requires a good sized crew but it covers land rapidly. A 12 or 14-foot header will cut about 25 acres per day. (Note<sup>12</sup>). The stacking operation, especially in heavy grain, can be lightened by means of a field boom-pole stacker. This is simply a pole with a boom on top of it and which is fastened either to a wagon or a sled-like base. The stacker is staked down by means of cables. Slings similar to hay slings are used in the header boxes and the unloading is done by driving to the stack and swinging the entire header load over on the stack in one or two lifts by means of the slings. This greatly reduces the time required for unloading but means that the stack will have to be made a trifle wider.

In stacking headed grain which is slightly damp it is well to create holes or flues which will provide ventilation. Gunny sacks are filled with straw and placed about on the stack. When the grain is stacked to the top of these sacks the sacks should be pulled up and replaced on top of the grain. This will leave holes or "flues" in the stacked grain. Many farmers leave these flues open a few days after stacking, being sure to have material on hand which can be used in covering up the holes in case of storm. This is a common practice in Idaho, Oregon and Washington. Some of the Idaho farmers cut a few acres with the binder and use this bound grain to thatch the tops of the stacks of headed grain that are waiting to be threshed.

Some farmers with small threshing outfits have been unable to get crews large enough to thresh direct from the header boxes. In threshing direct from the header boxes a canvas may be placed inside the header box in such a way that when it is driven to the threshing machine and where a derrick table is used the entire load may be swung upon the derrick table with one motion. Derrick tables are simply platforms upon wheels and upon which there is a tripod of

(Note 11). L. J. Walker of Hingham, who operates a 12-foot combine, states that he can combine with his outfit whenever the grain is ripe enough to bear and that in the light of five years experience he is thoroughly convinced that on farms which are too large for the single binder unit, the combine would compete very strongly with the header.

(Note 12). In fields where the Russian thistles are bad the green, succulent tips of the thistles are apt to be cut with the grain, causing moulding, heating and discoloration of the grain.

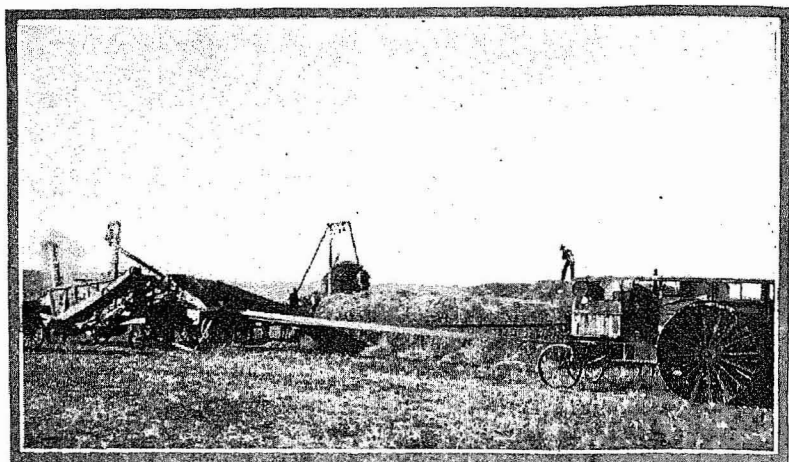


Figure 43—The derrick table at work.

18-inch poles. The derrick is staked to the ground and Jackson forks, cables and teams are used to pull the headed grain from the stacks onto the table. This greatly reduces the amount of labor required to get the heavy headed grain to the threshing machine. Two men with "hoe-down" forks can keep an even stream going into the feeder. Slings and booms for unloading the stack, together with the derrick table and thresher, mark the highest efficiency in header harvesting.

### Harvesting With Binders

Tractor operators frequently pull a string of binders. They believe, with Mr. Noble of Canada, that it is desirable to get the grain down in bundles first and to do the shocking later. (Note<sup>63</sup>). Binders have been used at night by hanging a lantern on the rear single-tree of the horse walking next to the grain. Some farmers for a few days change teams and keep their binders going night and day.

There has been found a variety of experiences with shock loaders. Many farmers who have tried them do not think they make a very big saving. (Note<sup>64</sup>). Some farmers let the bundles remain on the ground in the binder windrows until threshing. There is danger here of moulding and of damage from rain and the amount of labor required for loading at threshing time is greatly increased.

(Note 63). Mr. Noble thinks bundle carriers should carry six bundles, dumping on the seventh.

(Note 64). About 30 acres per day can be cut with a 12-foot push binder.

Some farmers in Alberta and Saskatchewan are experimenting with what they call "rot heaps." These are made by throwing together 25 or 30 bundles in one shock, the shocker having a small special fork in each hand. It is much more rapid than ordinary shocking methods. In setting up this "rot heap" they begin by placing two bundles on the ground and throwing the other bundles around them in a rather rough manner. They are called "rot heaps" because other farmers who saw the first experiment with this plan believed that in case of rain the entire bunch of bundles would absorb so much rain that it would be a pile of rotted grain. But the experience seems to be just to the contrary. It seems that these small stacks withstand rain better than do the ordinary small grain shocks, as there is little exposed except the cap sheaves. No farmers in north Montana were found using the "rot heap" methods but experience in Canada would seem to justify a trial in the "Triangle."

### Threshing the Grain

Because the fields are scattered, little success has been found with the larger threshing outfits. There is a tendency toward small threshers which use a small crew and small tractor, or toward the medium sized outfit which uses a slightly larger crew and a larger tractor which, however, could hardly be classed with the 42-inch separators which seem to be efficient where they can have an uninterrupted run in large wheat fields.

### THE USE OF BIG TEAMS

There is being experienced a swing back toward horse farming in north Montana. In the first days of farming, when credit was easy, tractors were bought by many farmers. At that time horses were high and scarce and the prairie sod was hard to turn over. Those who started before the big years of 1915 and 1916 turned from four-horse outfits to tractors in 1916. When wheat yields were high and when the price was high the farmer did not give so much attention to operating costs.

But the situation now is greatly changed. Low wheat prices and scarcity of labor confront the farmer on every hand. Of the various factors entering into operating costs today, horses and horse feed are the lowest.

### The Logic of Big Teams

Labor is the "scarce" element in farming in north Montana, so the dry land farmer must balance his land, capital equipment, his own labor and his hired labor so he will get the highest return from the scarce element.

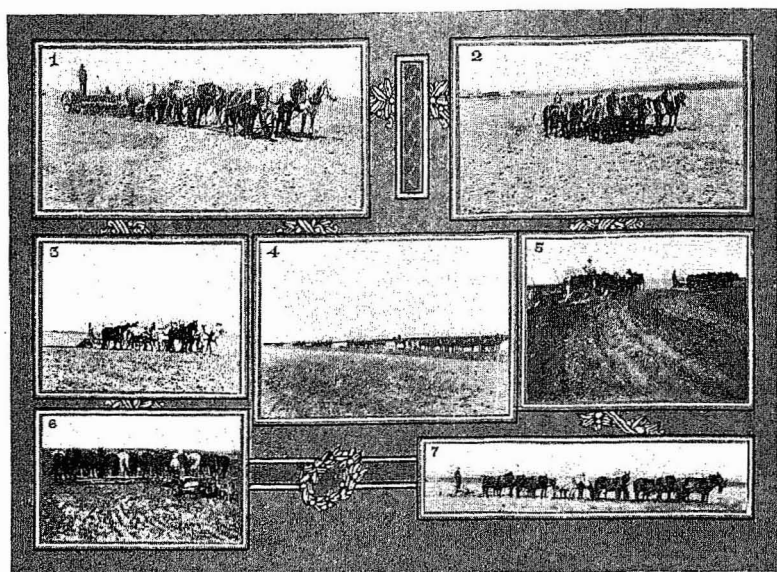


Figure 44—Here are scenes showing big teams in use in north Montana and in Canada. These farmers have learned how to handle large teams successfully and are increasing greatly the earning power per man on the farm.

In Europe where land is scarce and high in price and where labor is plentiful and cheap, labor is massed on the high priced land so as to get the highest possible return per acre. In north Montana these conditions are reversed and with dry lands plentiful and cheap and rents not excessive, the farmer must manage to get the highest possible returns from his own and from hired labor. In the "Triangle" the question is not so much bushels of wheat per acre as it is bushels of wheat per man.

It can be easily understood, then, that the man who grows wheat by using a 12-horse team up to harvest time has farmed three times as extensively as the man who used a four-horse team. The man using the 12-horse team is economizing on man labor, which is the scarce element, while the man with the four-horse team is economizing on land and horses which are not so scarce. If the work is done with the same degree of care in both cases, the man with the 12-horse team will have three times as much wheat to harvest as the man with the four-horse team, and the returns for his labor will be that much higher.

#### The Place of Large Teams

Weather studies show that the weather in north central Montana is erratic from year to year. Weather factors may allow a big grain crop one year and practical failure an-

other year. The wheat farmer therefore must have enough acres of grain so that in the good years he will have a large quantity to sell, and at the same time operate at so low a cost that in the bad years his out-of-pocket costs (Note<sup>55</sup>) will be small and the loss of his labor his greatest loss. While in the bad years he may have to draw from the bank some of the profits of the good years to pay taxes and other overhead expenses, the drain on this stored money will not need to go into high operating costs.

Under present conditions in north Montana plenty of cheap horses are available and horse feed can be raised without seriously interfering with the dry farm cropping system. Farm management studies have shown that men by following this plan have done well in the dry land sections. Here is one instance: Farm No. 235 in the records, a farm in Chouteau county, produced an average yield of wheat of eight bushels in 1922, yet this farmer made a labor income of \$2,062. (Note<sup>56</sup>). This man had 500 acres of wheat, part winter wheat and part spring wheat. He also summer fallowed about 200 acres, doing all the work except heading and threshing by himself and using a 14-horse team. His total current expenses for the year were \$1,107, which included \$270 for harvesting and threshing labor and board for men. His total receipts were \$4,180 and his total expenses (which included depreciation on farm machinery) were \$1,257. He had an investment of \$14,350, which at six per cent makes an interest charge of about \$861. His taxes were about \$200. This man raised most of his horse feed, milked from five to seven cows and kept 100 chickens.

As this man expanded his farm operations and increased his income through the use of big teams, so did E. C. Hallman of Alberta multiply his labor and increase his profits. Mr. Hallman has conditions about the same as those found in Hill county. He farms two sections of land with no hired labor outside of threshing, doing his work with a 12-horse team. Mr. Hallman worked out the scheme of the Hallman feeding rack which is described later. (See Fig. 45). Mr. Hallman states positively that "the cost of production can be reduced greatly by using large power units."

### Doing Extensive Farming Efficiently

The fact that a man is farming extensively does not mean in any sense that he is farming less carefully or less efficiently than the man who uses small outfits. Poor farming may be done with either large or small outfits and

(Note 55). Meaning the costs which must be met by cash payment at the time.

(Note 56). The labor income is the amount left after interest on investment, farm expenses, depreciation and taxes are subtracted from the total farm receipts.

nothing in this discussion must be taken as encouraging slipshod or careless methods of farming. Experience shows that the man driving the 12-horse team and pulling four plow bottoms over 12 acres per day can do just as good work as the man driving a sulky plow. It is a question of the farmer's ability as a manager and his ability to handle the larger team. Let it be stated again clearly that careless farming is to be condemned at all times.

### Effective Large Scale Farming

Because only medium yields of wheat may be expected on the average in the "Triangle" it is necessary that the farmer handle a large acreage at a very low cost. If the total profit at the end of the year is five dollars per acre, the man who farms 100 acres will have a profit of \$500 while the man who farms 500 acres will have a profit of \$2,500.

### Tractors vs. Horses

This discussion of practical methods of management for large teams must not be taken as a condemnation of tractors. Many farmers in Montana are succeeding with tractors. Where the farmer has mechanical ability which enables him to keep the tractor steadily in the field at a low cost of operation, the tractor is generally successful. In considering large acreage, low cost of operation and thorough tillage the question of type of farm power is one that the individual farmer will have to answer for himself. This detail about farming with larger horse outfits is directed to those farmers who raise wheat as a principal cash crop and who favor farming with horses.

There is little to indicate that farming in this section will be profitable enough to justify the farmer hiring a mechanic to operate his tractor, as tractor engineers command comparatively high wages. Studies by the Montana Experiment Station show that most of the successful tractor farmers operate their own tractors. (Note<sup>67</sup>). The tractor operator has rather heavy out-of-pocket costs and must have sufficient capital to tide him over the bad years, while the horse farmer operates with less immediate cash outlay and with less danger from bad years.

Large teams are not practical under all conditions. They fit in where the nature and value of land make wheat the best cash crop, and upon fields of such size that relatively little time need be lost in turning. Land handled by large horse teams also should be land adapted to raising horse feed and should have sufficient pasture to take care of the work horses and the increase from year to year.

(Note 67). See Montana Experiment Station Circular No. 151, "Gas Tractors in Montana."

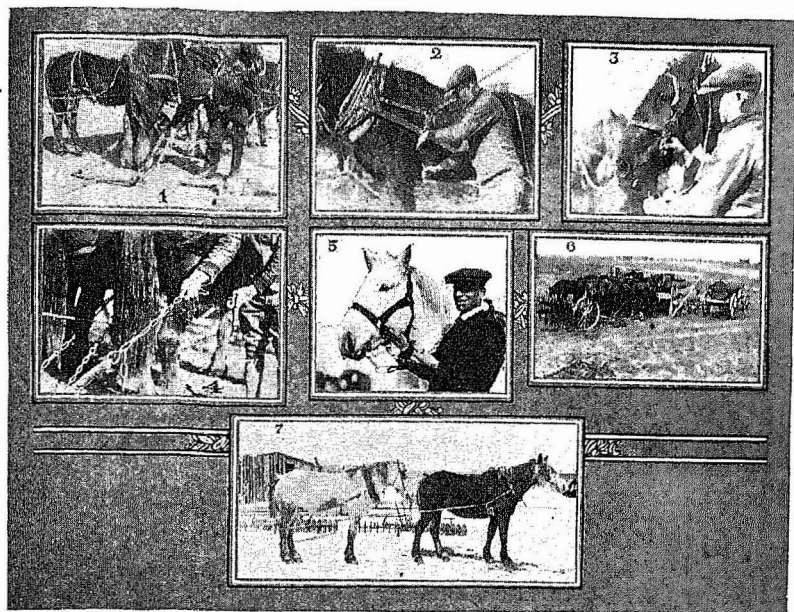


Figure 45—Short cuts in harnessing big teams: (1) The Hallman pulley and chain tug and evener; (2) A belly band that snaps; (3) Snapping the bit into the California halter bridle; (4) The butt chain tug; (5) Hallman's halter bridle; (6) Hallman's feed rack in the field; (7) The Gilchrist rope harness for big teams.

### Hitching Big Teams

There are many types of equalizers by which all horses in a 12-horse team are made to pull equal shares of the load. These range from chain-and-pulley equalizers based on the block-and-tackle principle, to elaborate bar hitches so constructed that any number of horses can be used by simply adding more units of the hitch. The more common equalizers are the bar equalizer, multiple pulley equalizer, and the tandem pulley single tree equalizer.

### Short Cuts

In handling big teams it is necessary to have the harness and other equipment so arranged as to save time in harnessing and hitching. Some short cuts in handling these big teams have been worked out which enable the farmer to handle a large string of horses in very small time. One of the greatest objections voiced against the use of big teams in north Montana has come from farmers who feared that the time required in harnessing and hitching operations was too great. These short cuts reduce the time required in handling the teams to a minimum: (See Fig. 45).

1. Butt chain harness with snap bellyband.
2. Combination halter-bridles with chain halter ties which can also be used for cross-tying the horses and for leading the horses from the barns to the fields.
3. Use of snaps wherever they can be substituted for other ties or knots.
4. Special methods whereby the team is snapped together in the barn and whereby they can be led to water and to the field as a single team.
5. Driving the big team with only two lines by having horses other than the leaders controlled by what is called "bucking in" and "tying back."

### Field Feeding

E. C. Hallman of Alberta has worked out a plan whereby the team is fed and watered at noon without being unhitched from the plow or other implement. He uses a big feeding rack which can be pulled to any part of the field. An accompanying illustration (See Fig. 45) gives an idea of this feeding rack in operation. Water is hauled to the field in a water tank; the team is driven into the rack at noon; bits are unsnapped from bridles; troughs slide across the rack in front of the teams and are filled with water, then drained and filled with feed; after feeding the bits are snapped in place, one side of the feeding rack is swung open like a gate and by making a short turn the team is again at work in the field.

### Rates of Work

A good day's work with a large horse outfit and where turns are not too frequent, is set at twenty miles of distance covered. The load should not be too heavy for the team to walk at this rate. The following are the standard rates of work per day on the Noble Foundation in Canada where 12-horse teams are used:

Implement	Acres per Day
Three bottoms, 14-inch gang plows.....	8½
Four 14-inch gang plows.....	11-12
Two 10-foot tandem discs, 16 ft. wide.....	38
Four 10-foot single discs .....	80
Three 12-foot drills .....	80

## Dry Land Irrigation

The farmer who thinks of irrigation generally thinks of water taken from continuously flowing streams or from dependable reservoirs of water. Another type of irrigation which has been known in the "Triangle" as dry land irrigation is coming rapidly into prominence and already is one of the important parts of the general scheme of farming in this country. It is the holding of surplus water on the land by dikes and other means until the land has the highest possible benefit from it.

Different types of dry land irrigation have been developed in north Montana in the recent dry years. Senator William Cowan of Box Elder, who has lived in this section since 1880, has long advocated dry land irrigation and himself has practiced this type of irrigation successfully. Blaine Ferguson, irrigation specialist in north Montana in 1921-22, helped many farmers develop their reservoir and dike system to hold flood waters. He estimates that more than one-half of the farms in north Montana could irrigate from one to 100 acres. This irrigated land can be best used for forage crops and gardens.

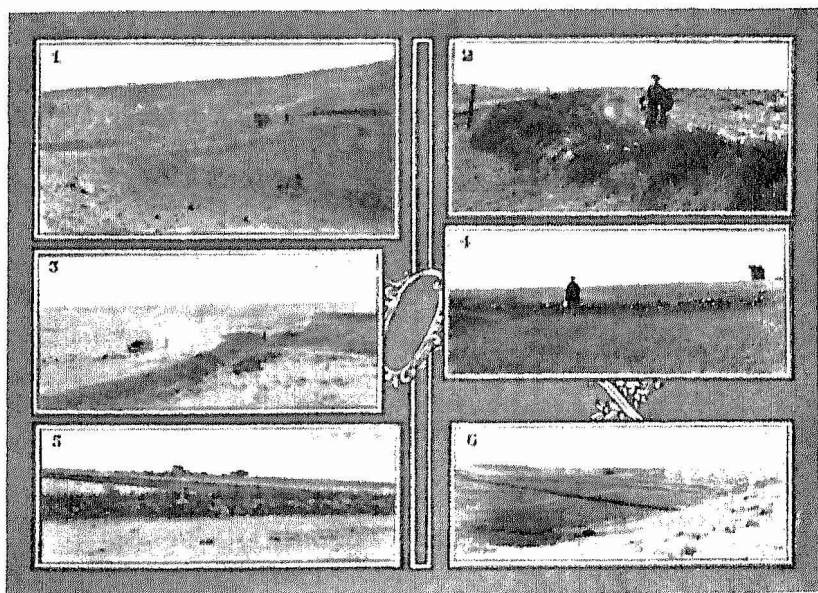


Figure 46—(1) Constructing dam across coulee by use of Fresno scraper; (2) Dike along edge of field; (3) Ditch leading out of coulee; (4) Dike across low part of a field; (5) Another field dike; (6) Contour dikes across flat at mouth of coulee.

There are four principal types of dry land irrigation:

1. Contour dikes upon comparatively level bench lands where the slopes are such that melting snows and heavy rains pass down broad depressions before they reach creeks or other streams.

2. Dikes across a broad, level bottom. The field in this bottom land is so diked that water runs into one section and fills to the top of the dike, when it pours over into the next section and so on until the entire field is flooded.

3. Another plan is using water from a coulee. A dry creek in a coulee runs water only during heavy rains and after snows begin to melt. A ditch taps this coulee at the time and diverts this water to the field, where it is spread over the largest possible area.

4. The reservoir is found on many farms where there is a coulee or depression through which water runs and where a considerable supply of water can be caught and stored. The water is led from this reservoir or dam whenever it is needed by means of ditches. (Note<sup>68</sup>).

There are great possibilities in dry land irrigation in the "Triangle" and farmers of that section should take advantage of every possibility in this irrigation. Dams or dikes cost little except labor and the labor can be done when other work is not pressing. Farmers who contemplate making irrigation systems should get in touch with their county agricultural agent, who will help in determining the dry land irrigation possibilities and in laying out the contour dikes.

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(Note 68). See Montana Extension Service Bulletin No. 59, "Farmers' Storage Reservoirs."

## Appendix

The following pages contain material that is largely statistical and to which reference has been made in various places through the text of the bulletin.

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## Experience of Other Agricultural Sections With Temporary Farm Failure and Depression

### Kansas

In a letter written in 1890 to Senator Peffer of Kansas by Secretary Rusk of the Department of Agriculture the situation at that time is told in this way: "The burden of mortgages upon farms, homes and land is discouraging in the extreme and while in some cases this load may have been too readily assumed, still in the majority of cases the mortgage has been the result of necessity. Those mortgages with which land has been encumbered from the necessity of its owner, drawing high rates of interest and often taxed in addition with a heavy commission, have today in the face of continued depression of prices of staple products become very irksome and in some cases threaten the farmer with loss of home and land. It is a question of grave difficulty to all those who seek to remedy the ills from which our farmers are suffering. At present prices the farmer finds that it takes more of his products to get a dollar wherewith to pay back the dollar he borrowed than it did when he borrowed it. The interest accumulates while the payment of the principal seems utterly hopeless and the very depression which we are discussing makes the renewal of the mortgage most difficult."

### Russia

From an article by N. Tuliakov on "Drought and the Means of Overcoming its Evil Effects in the Volga Region of European Russia": "A reduction in the area of land brought under tillage during the years of the war and of the revolution, the policy of collecting food supplies from the agricultural population without compensation (according to the system of assessment so rigidly enforced by the government until 1921), and the crop failure of 1920 had so undermined the peasants' resources that a recurrence of the drouth and a complete failure of crops in 1921 finally extinguished all hope of the distressed population of being able to outlive the disastrous year until the next harvest. The people fled in vast numbers from the famine stricken country in hopes of finding subsistence elsewhere, in many cases permanently abandoning their homesteads and emigrating with their families to other regions. Subsequently, when seed for growing the winter crops began to reach the famine-desolated districts and hopes of some organized form of help began to revive, the panic subsided and the stream of emigration assumed a quieter and more orderly shape."

### Oregon

Fred Bennion, county agent at Pendleton, Oregon, writes as follows: "Until 1910 the country northwest of Pendleton was not considered sufficiently blessed with soil and proper climatic conditions to make wheat farming profitable. The high prices which came during the war helped to put farmers on their feet and the introduction of better farming methods and a better variety of wheat made it a good wheat country. With a comparatively low price for wheat and with increased costs of production farmers again are having some difficulty in this district."

### Washington

Speaking of the Big Bend country of Washington, a famous wheat raising region, one prominent man writes: "There was never any such crop failure, or series of crop failure years, in that country such as northern Montana has passed through. With one or two failures or partial failures, and in dealing with a lot of speculators who were not real farmers but who homesteaded the land expecting to make some easy money, there was a lot of mortgage foreclosures in the early days. Generally speaking, however, that country produced successful crops with ordinary farming for thirty years, and uniformly good crops with good farming, until seven years ago when the dry cycle came. For six years after that this great wheat producing area has had practically one wheat failure after another."

### Iowa

It may be difficult to imagine the State of Iowa visited by a serious drouth, yet the following is from the "History of Iowa," by B. F. Gue: "In 1886 the first serious damage was done to the crops of Iowa by a protracted season of drouth. The earth part of the season witnessed the ordinary amount of rain. Crops made about the usual growth until July. The small grain was fairly well matured, producing an average yield in most parts of the state. Late in July the rains almost entirely ceased in the central and southern portions of the state and the corn began to suffer seriously. August passed without rain, pastures dried up and entirely failed. The hay crop was seriously injured, thousands of acres of corn were blighted and produced no ears and the stocks were cut for fodder to supply the place of pastures and hay. Wells that had always furnished an abundance of water and creeks that had been considered permanent went dry early in August and stock suffered greatly for water. Ponds, marshes and sloughs on the unbroken prairies as well as on farms failed and muskrats perished by the thousands. From this time for seven years came a succession of dry seasons in which most of the ordinary wells failed and farmers were compelled to have new and deep wells bored down to a permanent water reservoir. Creeks, ponds and springs that had never before failed since the first white settlements were made, dried up and hundreds of thousands of dollars were expended by the farmers in search of permanent water supplies. These dry seasons continued with barely enough moisture to mature most of the crops, until 1894. This year came a drouth which for severity and widespread damage to crops has never been equalled in the state. Hay, pastures and corn suffered to a most disastrous extent. Early in July pastures were as dry as though destroyed by fire. Hundreds of thousands of acres of corn were withered by the hot winds and continued absence of rain, and no ears were formed on the stalks; hay was less than one-quarter of a crop, and the serious problem that confronted the farmers was to keep their stock alive.

"For several years there had been an over production of horses and prices had gradually declined to a lower figure than ever before known. When it became apparent that the crop was ruined, hay reduced to one-fourth the usual yield and pastures dried up, nearly every farmer found himself short of feed. Thousands of horses were sold at from ten to twenty dollars per head to buyers who came from other states; young cattle were sacrificed at ruinous prices and hogs of all ages were disposed of at any price offered. Hundreds of the poorer horses were killed when they could not be sold, to save them from starvation. Still there were localities in the state where sufficient rain fell to mature the crops, so that in the aggregate the state produced

over 123,000,000 bushels of corn and over 107,000,000 bushels of oats. The next year the yield of corn was 285,000,000 bushels and of oats 201,000,000. The hay and forage crops generally suffered in proportion. These dry years were disastrous to the older forest trees which perished in great numbers, especially the oak and black walnut, while the white elms were seriously damaged. The older orchard trees also suffered permanent injury which eventually proved fatal over a large extent of country. As great as was the loss by this unprecedented drouth, by far the most severe that ever existed in the state, there was more than enough food grown and matured to supply its population. The greatest loss was occasioned by the selling off of young stock, which was seriously felt for many years, as stock raising had long been the most profitable branch of farming. This drouth of 1894, however, ended the lengthened dry period; the rains came again from year to year, gradually sending the moisture deep down into the soil and again maturing bountiful crops."

### Minnesota

From the fourth biennial report of the Bureau of Labor of the State of Minnesota for 1893-94, the following is taken: "In all the history of the state there can be traced two sources of farm mortgage foreclosure. The fixed or permanent factor is that which arises from the imperfection of the farm owner, that which is due to his lack of experience, his shiftlessness and want of character or knowledge or energy. The most important variable factors are crop failures and varying prices for wheat. From 1876 to 1881 the greatest single determining factor of mortgage foreclosure was crop failure due to drouth, blight, visitation of grasshoppers and chinch bugs. This caused from 1876-77-78 a rate of foreclosure slightly different from what would have resulted from the action of wheat prices alone. In 1880-81 they caused a wide variation from what would have been noticed had varying wheat prices been the one determining factor. The influence for good of the new system of farming (diversified and dairying) is so great that in 1892 and 1893 it overshadowed and unbalanced in large degrees the evil results that followed the low and falling price of wheat. The farmers have so improved their methods of farming even in the wheat raising sections that the evil effects of low wheat prices in 1893 are reduced to small proportions."

### Nebraska

A. E. Sheldon, Superintendent of the Nebraska State Historical Society writes: "Briefly, the period of depression in Nebraska began in 1890 and continued until about 1900. I would say that in the west one-third of Nebraska, more than one-half of the settlers abandoned their claims and more than one-half of the land went through the process of foreclosure."

### South Dakota

Doane Robinson, Superintendent of the Department of History of South Dakota, writes: "I came west from Wisconsin in 1877 and settled in the western part of Minnesota. It was a time of boom and high hopes but a combination of evil circumstances fell upon us and in 1881 those who remained in this region, now one of the richest sections on earth, remained because they were unable through their obligations to get away. In 1883 I came into eastern South Dakota with the Dakota boom. For five years everything prospered then things began to tighten up and by 1889 or 1890 almost every one 'went back east to live with the wife's folks.' All the lands were mortgaged

for sums varying from \$300 to \$600 the quarter section and many such places were abandoned or the equity deeded over to some one to liquidate a grocery bill or other small obligation. Those lands today are worth from \$100 to \$300 per acre. About 1907 began the settlement of the agricultural lands in this state west of the Missouri river. Practically every quarter section was settled upon during the next three years. In 1911 came an awful drouth and the settlers left in droves. The exodus set the state back tremendously. Whole townships were deserted. Now a reaction has come; there is dairying and the production of alfalfa and corn. The region is now as prosperous as any part of the west."

## How Other Sections Have Developed the Necessity of Reserves

### How the Mormons Stored Wheat

In a letter from Joseph Fielding Smith of the historian's office of the Church of Jesus Christ of Latter Day Saints we read: "The advice given to the early settlers of Utah during pioneer days was most explicit on the point of reserves. This same advice is given now but due to changed conditions is not followed by individual members of the Church as faithfully now as it was then. Not only did President Brigham Young and the other leading men of the Church of Jesus Christ of Latter Day Saints give this advice but they also encouraged the production of everything which the people consumed. In early days it was the custom to keep on hand flour and other provisions which could be stored to last two or three years. We have an organization known as the Women's National Relief Society. One of their duties has been from the beginning and is now to gather grain and store it for use in case of famine or extreme need. These women have gathered millions of bushels of wheat for this purpose and during the great World War they turned over to the United States government the wheat on hand which they had accumulated for years."

### Egypt in the Day of Joseph

The value of reserves is well told in the Bible, beginning with Genesis 41:46—"And Joseph went out from the presence of Pharaoh and went throughout all the land of Egypt. And in the seven plentiful years the earth brought forth by handfuls. And he gathered up all the food of the seven years, which were in the land of Egypt, and laid up the food in the cities; the food of the field which was round about every city, laid he up in the same. And Joseph gathered corn as the sand of the sea, very much, until he left numbering; for it was without number. And the seven years of plentifulness that was in the land of Egypt were ended. And the seven years of dearth began to come, according as Joseph had said; and the dearth was in all lands; but in all the land of Egypt there was bread. And when all the land of Egypt was famished, the people cried to Pharaoh for bread, and Pharaoh said unto all the Egyptians, go unto Joseph; what he sayeth to you, do. And the famine was over all the face of the earth, and Joseph opened all the store houses, and sold unto the Egyptians; and the famine waxed sore in the land of Egypt. And all countries came into Egypt to Joseph for to buy corn; because that the famine was so sore in all the lands."

### The Experience in Russia

From "Drouth and the Means of Overcoming its Evil Effects in the Volga Region of European Russia," article by N. Tulalkov: "The local peasant, fully conscious of his utter dependance on the vicissitudes of the weather resorts to storing up grain in his granary as the only means of insuring himself against the evil effects of an ever-impending drouth and consequent failure of crops. In years of plenty (he stores) two or three years' supply of grain by means of which he has hitherto managed to endure successfully the years of dearth."

### Early Civilization in Dry Climates

"There were four regions in which civilizations developed at a comparatively early date. One of these was in southwestern Asia especially along the Tigris and Euphrates valleys, while Egypt in Africa was another seat of early advancement. In Mexico and Peru the natives of the New World had made great strides towards achieving affluence and social order. It is reasonable to expect to find certain conditions common to all four of these regions which might explain the cause of their civilizations. There is climatic similarity in all four countries, that is, they are all arid to sub-humid and warm to hot. All possess areas of land which are capable of producing abundant food crops. Another feature worth noting is that in all four locations storage of food from one harvest to the next and from periods of plenty for periods of scarcity is not only necessary for the maintenance of a large population but the climate is favorable to such preservation. One looks in vain for a civilization which developed where harvests extended throughout the year as in humid tropical climates. So the storing of food may be added to the list of factors involved in creating a higher order of human beings, and the advancement in that practice played no small part in the spread of civilization."—From Carrier's "Beginning of Agriculture in America."

# A Report on the Survey of Successful Farms in the "Triangle"

By H. E. Selby

Although the farm success survey referred to in this bulletin was carried on primarily for extension purposes, the data obtained have considerable investigational value. A part of the regular farm management survey work of the Montana Agricultural Experiment Station was carried on at the same time in 1922 in north central Montana. This report is a summary of the more important facts which may be gathered from a comparison of successful farms with average farms of the region.

Names of most of the successful farmers studied in this survey were names obtained from bankers and business men. But it was found that only a portion of the number referred to as successful farmers were really found successful under the records of the survey. In a study of 130 farmers that were considered successful, it was found that only 26 could be considered successful from the strict viewpoint. These 26 farmers are those who made labor incomes of more than \$500 in 1921. They were the farmers who, after paying all expenses and allowing for depreciation on buildings and machinery, made six per cent interest on their investment and \$500 or more additional for their labor. All of these 26 successful farmers obtained their results under typical dry land conditions.

Naturally it was found that success was obtained on different farms by different methods of management. On seven farms the receipts from live stock were more than 40 per cent of the total farm receipts and these will be referred to as live stock farms. The other 19 are chiefly grain farms, the live stock receipts being less than 20 per cent.

## LIVE STOCK FARMS

Table 1—Average Amount of Live Stock on Successful Live Stock Farms and on Average Farms

	Successful Farms (7)	Average Farms (62)
	Animal Units*	
Cattle .....	11.9	3.1
Sheep (only 1 farm had sheep).....	1.4	.0
Hogs .....	.4	.1
Poultry .....	1.1	.4
All Productive Live Stock .....	14.8	3.6
Horses .....	12.1	7.5

\*An animal unit is 1 mature horse, cow, bull, or steer; 2 colts or calves, 5 hogs, 10 pigs, 7 sheep, 14 lambs, or 100 chickens.

The most significant differences between the live stock farms and the average farms, perhaps, are the differences in the amount and in the cost of land used for pasture. The average farms had only 215

acres of pasture, while the live stock farms had 687 acres, more than three times as much. The average farms had 20 acres of pasture per animal unit of horses and cattle, while the live stock farms had 29 acres.

**Table 2—Average Amount and Value of Land on Successful Live Stock Farms and on Average Farms**

	Successful Farms (7)	Average Farms (62)
	Acres	Acres
Land Owned by Operator of Farm.....	480	309
Land Rented .....	469	173
Total Acreage of Farm .....	949	482
Value per Acre of Land Owned.....	\$14.30	\$16.60
Cost per Acre of Land Rented.....	.09	.45

Table 2 indicates that much of this pasture land of the live stock farms was rented at a very low cost. Most of it was idle land nearby. If the live stock farms had owned this land, or if they had paid as much for it as the average farms paid for rented land, they would not have made their labor incomes of over \$500. Evidently, then, one of the conditions necessary for their success was cheap pasture land. Cheap pasture land may be idle land that can be rented at a low cost, as in these cases; or it may be rough land of low value; or it may be open range.

The expenses on the average farms were \$866; on the live stock farms they were only \$572, less than two-thirds as much. The difference in the various items of expense may be seen in Table 3. The greatest difference was in the expense for extra labor employed, which cost the average farms \$281, and the successful farms only \$114.

**Table 3—Average Expenses on Successful Live Stock Farms and on Average Farms**

	Successful Farms (7)	Average Farms (62)
Hired and Family Labor .....	\$114	\$281
Seed, Feed and Pasture .....	74	94
Binder, Twine, Threshing, etc. ....	99	125
Repairs of Buildings, Machinery and Fences.....	26	61
Depreciation of Buildings and Machinery.....	129	112
Taxes, Insurance and Miscellaneous .....	130	193
Total Expenses .....	\$572	\$866

The live stock farms bought practically no feed. They depended entirely upon pasture and upon feed crops that they raised. Table 4 shows that they raised a larger acreage of feed crops, chiefly oats, rye and corn, than the average farms.

In addition to having a large amount of live stock, cheap pasture, and low expenses, the live stock farms had almost as many acres of wheat as the average farms and secured better yields of wheat. The average yield of wheat on the average farms was 4.9 bushels per acre. On the live stock farms it was 6.2 bushels per acre, and on only two of the seven farms was the yield of wheat less than 4.9 bushels.

**Table 4—Average Number of Acres of Different Kinds of Crops on Successful Live Stock Farms and on Average Farms**

	Successful Farms (7) Acres	Average Farms (62) Acres
Wheat .....	143	154
Oats .....	20	15
Rye .....	25	5
Corn .....	11	1
Other Crops .....	3	6
All Crops .....	202	181

### The Grain Farms

The grain farms are the nineteen successful farms on which the receipts from live stock were less than 20 per cent of the total receipts. These farms may be subdivided, as shown in Table 5, into the following groups:

1. Farms with wheat yields of less than 10 bushels per acre (6 farms)
2. Farms with less than 150 acres of wheat (5 farms)
3. Farms with 150 or more acres of wheat, and wheat yields of 10 or more bushels per acre (8 farms)

**Table 5—Subdivision of the Successful Grain Farms**

Acres of Wheat per Farm	Number of Farms Having Wheat Yield of:	
	Less than 10 bu. per acre	10 bu. or over per acre
Less than 150 .....	0	5
150 or over .....	6	8

In many respects these different groups are similar to each other and to the average farms. For instance, there is but slight difference in the amount of live stock and in the value of the land. There are certain differences between the groups, however, and between them and the average farms, that are significant.

**Farms with Wheat Yields of Less than 10 Bushels per Acre**—The six farms in this group had the lowest wheat yields of any of the successful grain farms. They are large extensive-grain-raising farms. The significant differences between them and the average farms are shown by Table 6.

**Table 6—Comparison of Successful Grain Farms Having Wheat Yields of Less Than 10 Bushels per Acre, With Average Farms**

	Successful Farms (6)	Average Farms (62)
Wheat Yield per Acre .....	7.9	4.9
Acres of Wheat per Farm .....	266	154
Acres of All Crops per Farm .....	300	181
Total Acres per Farm .....	613	482
Number of Men per Farm .....	1.16	1.25
Acres of Crops per Man .....	257	145
Total Expenses per Farm .....	\$910	\$866
Total Expenses per Acre of Crops .....	3.03	4.78

Even though these farms had the lowest yields of any of the successful grain farms, their average yield of wheat was more than a half larger than that of the average farms. None of them had a yield of wheat lower than that of the average farms.

In order to be successful with even as low yields as they had, it was necessary for these farms to have a large acreage of wheat, a large acreage of crops per man, and low expenses per acre of crops. Their average acreage of wheat was more than a half larger than that of the average farms and none of them had less than 150 acres. They had 279 acres of crops per man, as compared with 146 acres per man on the average farms. Their total expenses per acre of crops were \$3.03, as compared with \$4.78 on the average farms.

**Farms with Less than 150 Acres of Wheat**—These five farms are the smallest of the successful grain farms. They all secured relatively high yields of wheat. Their average wheat yield was 13.6 bushels per acre, and on none of them was the wheat yield less than 10 bushels per acre. Table 7 shows that they were practically one-man farms, and that in spite of their smaller acreage of crops per farm, their acreage of crops per man was almost as large as that of the average farms. Their expenses per farm, and also per acre of crops, were less than those of the average farms.

**Table 7—Comparison of Successful Grain Farms Having Less Than 150 Acres of Wheat, With Average Farms**

	Successful Farms (5)	Average Farms (62)
Acres of Wheat per Farm .....	126	154
Acres of All Crops per Farm .....	150	181
Total Acres per Farm .....	488	482
Wheat Yield per Acre .....	13.6	4.9
Number of Men per Farm .....	1.06	1.25
Acres of Crops per Man .....	141	145
Total Expenses per Farm .....	\$655	\$866
Total Expenses per Acre of Crops .....	4.36	4.78

**Farms with 150 or More Acres of Wheat, and Wheat Yields of 10 or More Bushels per Acre**—In this group are eight large grain farms. Their average acreage of wheat was more than twice that of the average farms. Four of the eight farms are tractor farms.

**Table 8—Comparison of Successful Grain Farms Having 150 or More Acres of Wheat, and Wheat Yields of 10 Bushels or More per Acre, With Average Farms**

	Successful Farms (8)	Average Farms (62)
Acres of Wheat per Farm .....	324	154
Acres of All Crops per Farm .....	368	181
Total Acres per Farm .....	878	482
Wheat Yield per Acre .....	12.4	4.9
Number of Men per Farm .....	1.52	1.25
Acres of Crops per Man .....	241	145
Total Expenses per Farm .....	\$2131	\$866
Total Expenses per Acre of Crops .....	5.69	4.78
Total Expenses .....	\$572	866

Table 8 shows that although these farms employed a good deal more extra labor, they had a larger acreage of crops per man than the average farms. This was because of their much larger acreage of crops per farm. For the same reason, even though their expenses per farm were more than twice as much as those of the average farms, their expenses per acre of crops were only slightly higher.

To be successful, it was necessary for these large farms to secure relatively high yields of wheat. Their average yield of wheat was 12.4 bushels per acre; that of the average farms was 4.9 bushels per acre. If their wheat yields had been low, these farms would have lost more money than the average farms, because their expenses were so much greater. There is, therefore, a large element of risk in this type of farming.

### General Conclusion

It is evident from a study of these successful farms that there is no set formula for success in dry-farming. Different men attain success by different methods. One man is successful with a certain form of farm organization; another man is just as successful with an entirely different organization.

These farms also show that certain popular theories regarding successful dry-farming are not entirely correct. For instance, livestock farming has been recommended by some as the only method of attaining success, and yet only seven of the twenty-six most successful farms were livestock farms. Many people think that it is almost impossible to farm with a tractor profitably, and yet four of the twenty-six most successful farms were tractor farms.

The types of farms that have been described are the only types that were conspicuously successful in the Northern Montana Triangle in 1921. It is possible that other farms similar to these did not succeed, but it is certain that no farms different from these, did succeed. One must not overlook the possibility, however, that under other conditions, in a different region or in a different year, other types of farms might be more successful.

# The Story of Successful Farmers

## John Nabor

Mr. Nabor had \$200 in cash when he homesteaded 14 miles east of Havre in 1912. He came to America from Germany where, as a young man, he had received a high school education and worked as a farm laborer for several years. In 1922 his inventory farm value was \$8,000. Most of this capital Mr. Nabor has accumulated since 1915, as for the first few years he worked for wages on neighboring farms to get enough money to hire breaking and to buy teams.

Mr. Nabor is a good example of a diversified farmer, working out his own system of diversification through knowledge of his own conditions. The farm that he is located on is perhaps below the average in quality and in a country where there is considerable gumbo, heavy soils and buffalo wallows. There has been much abandonment on all sides of him. He owns 400 acres and rents 960 acres for pasture, paying taxes as pasture rent. Last year he cropped 141 acres, summer fallowed 40 acres and pastured 1179 acres.

Crops in 1921 on the Nabor farm were: Three tons of fodder from six acres of corn; an average of six bushels on 50 acres of spring wheat (cut worm damage bad); an average of 10 bushels on 25 acres of oats; average of 10 bushels on 60 acres of rye; average one-half ton per acre on 15 acres of millet.

Live Stock—Six work horses, four Shorthorn milk cows, two brood sows, 14 pigs, 150 chickens.

Farm Sales—Cream \$650, six fat cattle \$280, four fat hogs \$140, eggs \$100, live poultry \$250, crop \$481, total sales and other income \$2518.

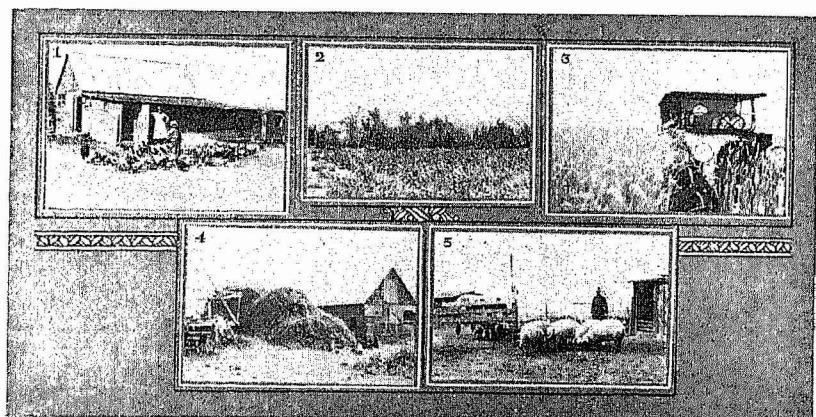


Figure 47—Photos from the Nabor farm: (1) The flock of chickens; (2) The house and shelter belt, looking across the garden; (3) Field of rye; (4) Reserves of feed; (5) Chester White hogs.

Crop History—Average production of wheat per acre by years: 1914, crop cut for hay; 1915, 32 bushels; 1916, 30 bushels; 1917, 10 bushels; 1918, eight bushels; 1919, two and one-half bushels; 1920, four bushels; 1921, six bushels.

Summary—Inventory value \$7464, receipts \$2578, current expenses \$786, farm income \$1732, labor income \$1284.

Winter rye is a big favorite with Mr. Nabor. It is a cheap, dependable crop which does not kill out in the winters, he says. It can be drilled in stubble or put on summer fallowed land. He thinks it pays to put some rye on summer fallow. He feeds rye hay to work horses and milk cows and feeds ground and soaked rye to the hogs.

"Rye will be to the diversified farmer of Montana as corn is to the farmer of Illinois," says Mr. Nabor.

He started with one Shorthorn cow and now has 10, a straight increase. He manages to have his cows freshen in November or December so as to milk them during the winter. Says he would rather grow feed and keep stock than to depend entirely upon wheat. He plans to raise from 50 to 100 acres of wheat on summer fallow or corn land in the future, and says that corn does well with him. "Some summer fallow is no better than corn land," he says. "It is expensive and the weeds are a big trouble."

There is an excellent shelter belt on the Nabor farm and there never has been a garden failure. He raises good potatoes every year and keeps a fine patch of strawberries under irrigation.

"We have farmed on the principle of first making a home," he says. "What we make over and above our living expenses we save. We do not want to sell the farm as this country has done well by us. I do not know any other place where I could have gone and, with a start of \$200, done better in 10 years than I have done here. It surely beats paying all your earnings to a landlord for rent. The big trouble is that we don't yet know how to farm this country, nor have we learned to control the grasshoppers and cut worms. It is a country of varying seasons so we plant more than we need each year and are gradually getting stacks of straw and rye hay to take us through bad years without selling our cows.

"This country is all right; you have to work hard here and you can't spend money foolishly. We are content, and we hope to do a lot better in the next ten years than we have done in the past."

### Farm No. 120

Farmer No. 120 farms north of Havre. He has a farm of 960 acres, 158 acres being in crops and 60 acres in summer fallow.

Live Stock—Six work horses, two milk cows, 60 chickens.

1921 Crop—1,029 bushels spring wheat on 118 acres; average of seven bushels of rye per acre on 40 acres of rye that was cut for grain.

Summary—Inventory value \$1072, current expenses \$565, receipts \$1392, expenses \$702, labor income \$48, farm income \$691.

This farmer said that at the time he had no debts and had his money invested in safe investments. He took the returns of the big crops of 1915 and 1916 to purchase more land and to buy high grade securities. He came to Montana from Canada where he had lived 10 years and where he had learned the Saskatchewan type of summer fallowing.



Figure 48—George Windecker's clean summer fallow.

Crop History—Yields of wheat per acre on summer fallow: 1911, nine bushels; 1912, 40 bushels; 1913, 20 bushels; 1914, five bushels; 1915, 51 bushels; 1916, 43 bushels; 1917, 13 bushels; 1918, 12 bushels; 1919, five bushels; 1920, 14 bushels; 1921, nine bushels.

No. 120 says the seasons vary so much that there is no formula which will work for all years. Some years he finds spring plowing and stubbling-in will be almost as good as summer fallow, but on the whole thinks wheat in this region will have to be raised on summer fallow. He thinks that discs and harrows are poor tools to use on summer fallow because they stir the ground too much and let a lot of moisture get away. He thinks summer tillage tool demonstrations are a great help to the farmers.

He believes there is no use to plow for summer fallow after June 15. He uses a Clack weeder and starts as soon as the weeds start, sometimes using a rod weeder. He believes every farmer should raise from 50 to 100 acres of rye each year. He works the horses when possible and feeds bundle oats. Believes that the tractor may become more general because of shortage of horse pasture. In the future this farmer says he is going to raise more corn, rye for hay and feed crops and that he will milk more cows. He thinks summer fallowing is the only system but believes there must be some farm diversity with it. His worst discouragement in recent years, he says, have been the grasshoppers and cut worms.

### Farm No. 3

Farmer No. 3 is a successful Minnesota farmer who migrated to Hill county to acquire cheap land. He has a very good shelter belt which always drifts full of snow and has a fine garden each year.

Live Stock—Five hogs, 80 chickens, 11 milk cows.

Crop History—Average production of wheat per acre, mainly on summer fallow: 1912, 30 bushels on 120 acres; 1913, 17 bushels on 200 acres; 1914, 12 bushels on 230 acres; 1915, 30 bushels on 240 acres; 1916, 33 bushels on 423 acres; 1917, three bushels on 450 acres; 1918, one-fourth bushel on 400 acres; 1919, three-fourths bushel on 400 acres; 1920, one and one-half bushel on 400 acres; 1921, three bushels on 400 acres.

"We can make our living every year," he says. "In fact it is the easiest country I ever saw to make a living in. We have to farm so as to make a living every year, and make money in the good years. Diversified farming is the best. Our root crops never fail, our rye falls but seldom. We keep enough cows to make our living for grain is a gamble.

"This is a very good country to stay out of debt in, an easy country to get in debt in, and a darned hard country to get out of debt in. When we get our next good year up here I'm going to get out of debt and stay out of debt until Gabriel blows on the horn."

This man thinks there is no reason why a man should fail if he has good land, a few cows, shelter belt, and a good garden with potatoes and root crops. He thinks it pays to raise potatoes on summer fallow land for cow feed. He grows some sugar beets every year and is developing 20 acres of flood water irrigation. He says summer fallow has not been an entire success with him as his trouble has been in getting the right type of tillage tools. Says the discs and harrows will not keep the Russian thistles down. He used a rod weeder in 1921 to good advantage.

He has used wheat and rye hay and now is trying sweet clover and brome grass. He thinks the tame grass is one of the biggest problems in development. He does not want to sell his farm for less than \$40 per acre.

#### Farm No. 100

Farmer No. 100 had several years experience in grain farming in Alberta before coming to Montana and homesteading in Hill county. His farm is a one-man farm of 960 acres.

Live Stock—Two milk cows, two brood sows, 75 chickens.



Figure 49—Jim Printice of Havre believes in proper use of the spring tooth harrow. Mr. Printice was one of the successful farmers studied in this survey.

1921 Crop—Average yield of bushels per acre: One and one-half bushels spring wheat on 60 acres, 14 bushels winter wheat on 80 acres, 25 bushels oats on 24 acres, nothing from 24 acres of corn that the cut worms got, and good returns from four acres of Sudan grass.

In 1922 this farmer threshed 3,876 bushels of wheat from 310 acres, 1,000 bushels of oats from 50 acres and took 15 loads of corn fodder from 15 acres. He summer fallowed 160 acres by cultivation without plowing and plowed another 80 acres for summer fallow. The average of all his summer fallow was 17 bushels. He farms with eight-horse teams and intends to use 12 horses in the future. He expects to seed some rye this year and will experiment with brome grass.

### Farm No. 108

Here is a farmer in eastern Teton county who gets good wheat yields from the straight summer fallow type of farming. He farms 320 acres, only 70 acres in wheat.

Live Stock—Eight work horses and 36 chickens.

Summary—Inventory value \$794.93, current expenses \$585, receipts \$1371, expenses \$819, farm income \$552, labor income \$102.

Crop Record—1917, 22½ bushels; 1918, 18½ bushels; 1919, failure; 1920, 23½ bushels; 1921, 21½ bushels.

This farmer believes straight grain farming is the best thing and that under his conditions it is better than diversification. He feeds rye hay and bundle oats. He thinks that spring plowing does not pay and that stubbling-in is always a failure. In his summer fallowing he double-discs early in the spring six inches deep, pulling a weighted packer and harrow after the plow. Cultivates with the Acme cultivator two or three times. He is beginning to have trouble with soil blowing. Has always practiced summer fallow, coming here from a summer fallow country.

### Farm No. 49

This man is making a success 30 miles from the railroad. He homesteaded 320 acres and purchased an additional 320 acres.

Live Stock—Eight work horses, one cow, 30 chickens, one brood sow.

1921 Crop—Average of 15 bushels of spring wheat on summer fallow, 30 tons of hay and pasture from 40 acres of rye, average of 15 bushels to the acre on 20 acres of oats.

Summary—Inventory \$9799, receipts \$1555, expenses \$707, farm income \$875, labor income \$260.

Crop History—Average of bushels per acre of wheat: 1915, 12 bushels; 1916, 21 bushels; 1917, two bushels (halled); 1918, five bushels; 1919, two bushels; 1920, six bushels (halled); 1921, 18 bushels from clean early summer fallow and four bushels from late plowed summer fallow.

Farmer No. 49 was a renter in Minnesota where land prices were high. He came to Montana where he could get cheap land. Says he has learned valuable lessons from the dry years and learned that moisture must be stored up. He double discs in the early spring instead of the fall then cultivates the fallow two or three times with a home made weeder made from plow shares. He works with an eight-horse team but plans to use 12 or 16 horses in the future. Intends to seed rye and to stubble-in rye on clean stubble for hay, feed and pasture.

**Farm No. 118**

Farmer No. 118 handles 640 acres of land himself, having 310 acres in crops, 170 acres in summer fallow and 160 acres in pasture. He has always lived on a farm and came to Montana from a typical summer fallow country.

**Live Stock**—Seven work horses, three cows, one brood sow, 50 chickens.

**1921 Crop**—Six bushels average from 215 acres of spring wheat, average of 16 bushels of oats from 25 acres, and pasture and hay from seven acres of rye.

**Summary**—Gross receipts \$1965, expenses \$405, farm income \$1275, labor income \$632.

"Farmers around here don't realize the value of rye," says this man. In winter he uses oat and rye hay and straw for horse feed. He believes in summer fallow at all times and says nothing except summer fallowing will pay in his section, north of Joplin. He thinks the biggest handicap to the "Triangle" country is farmers who will not farm systematically. Has little use for tractors and says that tractors were "a big factor in breaking the country." In summer fallowing he discs the land to be plowed early in the spring but does not use a packer. He cultivates with an Acme cultivator and with a rod weeder. Is having some trouble with soil blowing.

**Farm No. 60**

This man was born and raised on a farm. He bought 640 acres of land in north Montana after homesteading 320 acres.

**Live Stock**—12 work horses, five cows, one brood sow, 50 chickens.

**1921 Crop**—Average of seven bushels wheat on 100 acres of summer fallow, four bushels of oats on 50 acres, barley and rye hauled out.

**Summary**—Receipts \$2,022, expenses \$442, farm income \$1,391, labor income \$691.

No. 60 milks cows during the winter and in 1921 sold about \$300 worth of cream. He had \$2,500 when he homesteaded, is out of debt and says he will never get in debt again. Believes in stubbling-in for pasture and hay. He uses bundle oats for horse feed. Handles his summer fallow with a 12-horse team. Expects to develop dry land irrigation possibilities. Does not want to sell.

**Farm No. 17**

Farmer No. 17 raised on a "stump farm" in western Ontario. He homesteaded in Montana and bought a section additional. He crops 240 acres and summer fallows 185 acres.

**Live Stock**—10 work horses, six milk cows, 10 stock cattle, seven hogs, 50 chickens.

**Summary**—Receipts \$1,693, expenses \$785, farm income \$727.

**Crop History**—Average yield of wheat in bushels per acre: 1915, 30 bushels; 1916, 42 bushels; 1917, 10 bushels; 1918, 10 bushels; 1919, cut for hay; 1920, 15 bushels; 1921, 12½ bushels.

He thinks Saskatchewan summer fallow methods should be practiced more in Montana's "Triangle." "A farmer has no show when he ties a rope of debt around his neck," he says. "The way I do when I want something that I have to borrow to get, is to do without."

He plans to raise his own living every year. He milks cows now and plans on milking more. He is experimenting with brome grass and sweet clover. Says he would diversify more if native pasture were not so poor.

### Farm No. 116

Farmer No. 116 says it is no uses to try to raise live stock unless you have an unfailing supply of feed. "I lost more money trying to buy feed for a bunch of stock cattle in 1919-20 than I lost otherwise through the dry years," he says.

Live Stock—17 work horses, eight cows, 10 hogs, 100 pigs.

1921 Crop—Average of  $10\frac{1}{2}$  bushels of spring wheat on 240 acres, 35 bushels of oats from 35 acres, five bushels of barley from 20 acres, average of one ton of corn per acre from 20 acres.

Crop History—Average yield of wheat per acre by years: 1915, 21 bushels; 1916, 30 bushels; 1917, seven and one-half bushels; 1918, one-third bushel; 1919, one-half bushel; 1920, six bushels; 1921,  $10\frac{1}{2}$  bushels.

This farmer says that feed and pasture are his big problems. He thinks rye and brome grass look like the solution of this problem. He farms with a 12-horse team, handling 320 acres of crops and 80 acres of summer fallow.

### Thomas J. McFarlane

Mr. McFarlane is one of the outstanding farmers of the "Triangle." He is located in Liberty county, two miles southwest of Lothair. This is a region of medium soil and indicates less rainfall than Havre. It is one of the driest sections of the "Triangle" and is on the crest of a high ridge west of Chester, a region of high farm abandonment. Mr. McFarlane's farm is an illustration of how the principles outlined in this bulletin can be applied on lands that are not the best.

Farm—640 acres owned, 960 acres rented for pasture. In 1921 there were 224 acres in crop and 90 acres in summer fallow.

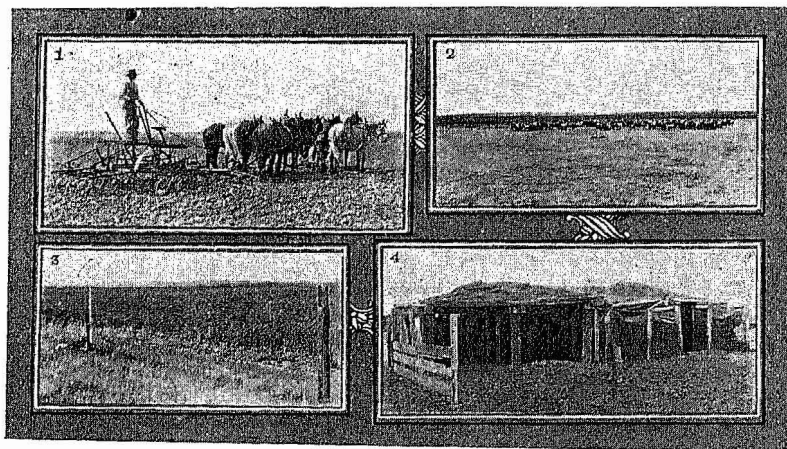


Figure 50—Scenes from the MacFarlane farm: (1) Mr. MacFarlane on his Forkner weeder; (2) The band of sheep on the MacFarlane farm; (3) Rye field pastured by sheep and then cut for hay, beside summer fallow; (4) Mr. MacFarlane's cheap but effective sheep shed.

1921 Crop—Average of 10 bushels spring wheat on summer fallow, 10 bushels of oats on spring plowing, eight tons of fodder from eight acres of corn, one-half acre of good potatoes and a big garden. His crop sales this year were \$1,113. He also had 100 acres of rye which he pastured with sheep until June 15, then cut 15 tons of hay and got 200 bushels of grain.

Live Stock—Eight work horses, three milk cows, 45 old ewes, 15 yearling ewes, 100 per cent lamb crop, two hogs, 50 chickens.

Summary—Live stock, sales, sale of wool and increase \$1173; paid out for hired labor \$36; total farm expense, including taxes, rent, threshing, labor, etc., \$572; receipts \$2446; expenses \$642. This leaves a farm "premium" of \$1263 which, with a deduction for six per cent interest on investment, leaves a labor income of \$1263. This was his labor income in a year when the government made \$84,440 seed loans in Liberty county.

Lessons from the McFarlane Farm—1. Farming system. Rotation with one-third of the area summer fallowed, plowed early and cultivated with a Forkner duck-foot cultivator. One-third spring wheat on clean fallow. One-third winter rye drilled in wheat stubble and used for pasture, grain and hay. 2. Division of Risk. Big shelter belt, three cows, the chickens and the reserves of hay. Has no debts. The ewes help the diversification scheme with steady profit. 3. Dry Land Irrigation. He has three dams to store run-off snow water. Mr. McFarlane uses an eight-horse team.

Experiences—Mr. McFarlane's success is so conspicuous that his experience as a settler is worth noting. He was reared in Minnesota by Scotch parents who lived on the farm. Soon after he became 21 he went into Saskatchewan and took up a homestead in one of the dry sections. While farming there he learned two things; first to summer fallow regularly and, second, never to get into debt. He visited the experiment farm at Indian Head and became personally acquainted with that veteran superintendent and worthy Scot, Angus McKay, who is called the "father of summer fallow" in Saskatchewan. While there he accumulated some debts which worried him. In order to clear his debts he sold his homestead and paid up, resolving never again to contract debts. "I resolved to follow that philosopher, Franklin and never spend any money until I earned it," he says. "I don't know how much money Tom McFarlane will have when he dies, but he certainly won't owe anybody."

He settled on the Montana homestead in 1911. He began summer fallowing as soon as the land was ready, which was in 1913 and has been summer fallowing since. In answer to the question "how should this country be farmed?" Mr. McFarlane said. "We must summer fallow, raise our living and keep some stock."

In fallowing he plows early in the spring, then cultivates with the duck-foot. He has had no blowing since he used the Forkner cultivator. In the last cultivation I leave it rough for winter. Mr. McFarlane's garden never has failed. Recently he has been planting it on summer fallow and with fine results. He raises good currants, gooseberries and other small fruits and berries. He planted a shelter belt of Caragana and cottonwoods. Half the cottonwoods are dead but the Caragana all are living. He says the Caragana is an effective snow catcher.

"I'm in favor of rye," he says. "I will continue to seed it in clean stubble and use it for sheep pasture, for hay and grain feed. It is the surest crop we have and too many overlook it. I am planting more corn, too. I put up Russian thistle hay which took my sheep through the bad winter of 1919. The sheep will leave straw

or other hay for Russian thistle hay any time. I have a big stack of thistle hay that I am holding in reserve. I will insure my flock of sheep if more grazing is available but I cannot pay more for grazing land than the taxes."

Mr. McFarlane was asked if he wanted to sell. He quickly replied that he does not want to sell. "I think I have learned how to farm this country and get along," he says. "I don't know another place on earth where I can raise a living as easily. Everything considered, I have done well."

#### Farm No. 41

Farmer No. 41 has a section of land in eastern Teton county. His farm plan includes the raising of wheat on summer fallow, corn, a few cows and use of horse power entirely.

1921 Crop—Average of  $21\frac{1}{2}$  bushels of spring wheat on 100 acres of early summer fallow; average of 10 bushels of wheat on 50 acres of late summer fallow; 15 bushels of oats per acre on 35 acres.

Live Stock—Six work horses, two cows, two hogs, 60 chickens.

Summary—Butter and egg sales \$180, hired labor costs \$150, current expenses, \$997, total receipts \$3,361, farm income \$2,064, labor income \$1,265.

Crop History—Average yield per acre of wheat in bushels: 1915, 21 bushels; 1916, 40 bushels; 1917, 25 bushels; 1918, 15 bushels, 1919, failure; 1920, 11 bushels; 1921, 21 bushels.

#### Alvin C. Hull

Alvin Hull is another of the best known successful farmers of the "Triangle." He was reared on a farm in Kansas and later moved to the Gallatin valley in Montana. He settled on a homestead in Teton county in 1914. Land was getting too high in the Gallatin valley so he moved to the Collins neighborhood to own a home of his own. He took a relinquishment on 160 acres and purchased an adjoining quarter section. He said they started with the idea of making first of all a good home and owning the land so that "whatever made was ours."

Mr. Hull has been practicing straight summer fallow grain farming and says that under his conditions diversified farming will not pay as well. He believes that each farmer must work out his own particular salvation in his own situation and location.

Mr. Hull has a fine shelter belt and always raises a good garden. In 1919 he sold a surplus of potatoes. He is located not far from irrigated lands and thinks he can better afford to buy alfalfa hay and put his own ground all into wheat and summer fallow. Mr. Hull is rated as a very intelligent and observing man. He is methodical to a remarkable degree and everything works on a careful plan. One sees no tools scattered about his farm. Every piece of equipment, down to a monkey wrench, is in its proper place and the whole place is a model of systematic farming. Mr. Hull is of such a temperament that he could not farm in haphazard fashion if he tried.

Mr. Hull has no special conditions favoring him. His soil certainly is not better than average "Triangle" soil and all about his farm are abandoned farms.

Live Stock—Six work horses, one milk cow, 40 chickens.

In 1921 his sales were \$2,561 and his total expenses, including depreciation in buildings, was \$1,078, leaving a farm income of \$1,483 and a labor income of \$993.

Crop History—Average yields per acre in bushels: 1915, 17 bushels on 40 acres of spring wheat; 1916, 50 bushels on 80 acres of summer fallow; 1917, 21½ bushels on 100 acres of summer fallow; 1918, 20½ bushels on 100 acres; 1919, four bushels on 100 acres; 1920, 20½ bushels on 100 acres; 1921, 21 bushels on 100 acres; 1922, 23½ bushels on 102 acres.

Mr. Hull is neither a plunger nor a speculator. He keeps out of debt, lays up a reserve and is more interested in thorough farming than extensive farming. He double discs the land which he is going to summer fallow before he plows it. He tries to get through his spring seeding so he can plow at least by May 1. He sets the disc plow six to eight inches deep but would use a mold board if it would scour in his soil. He pulls a home made sub-surface packer and a harrow after the plow. Mr. Hull is a firm believer in the value of the firm soil condition which this produces. He cultivates his fallow with an Acme cultivator which keeps the surface cloddy and free from weeds. He goes over the fallow four or five times. The final cultivation is given in the fall with an old Acme harrow which has been remodeled and from which every other blade is taken off, the other blades having been straightened, then bent over like a hoe. This leaves the fallow in ridges and prevents winter blowing. In the spring an Acme or disc harrow is used on the summer fallow land ahead of the drill, depending upon condition. He seeds 30 to 40 pounds of Marquis wheat to the acre with a double disc drill, putting it into the moist soil about two and one-half inches below the surface.

Mr. Hull thinks that spring and fall plowing will not pay unless conditions are just right and that stubbling-in will never pay. He does not want to sell his farm and plans to go ahead with the same type of farming as in the past.

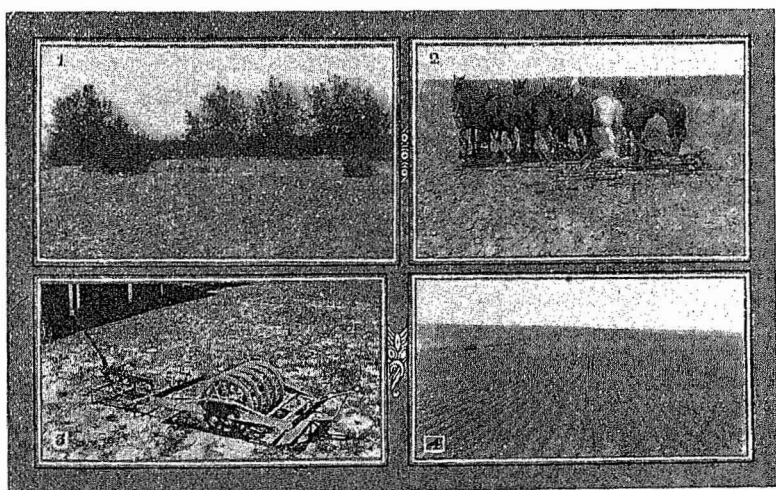


Figure 51—Scenes from the farm of Alvin Hull: (1) The shelter belt and garden; (2) Mr. Hull on his Acme harrow; (3) Mr. Hull's packer; (4) The sort of clean summer fallow always found on the Hull farm.

**Farm No. 46**

Farmer No. 46 has a grain farm of 320 acres in western Hill county.

Live Stock—Nine work horses, 70 chickens, one cow.

1921 Crop—15 bushels of wheat on 90 acres of summer fallow, 30 acres of wheat cut for hay, 20 bushels of oats on 25 acres, 90 acres of rye used for hay and for pasturing horses while summer fallowing and harvesting, 90 acres of summer fallow.

Summary—Crops sales \$1620, labor expense \$28, total expenses \$350, farm income \$1176, labor income \$861.

Crop History—Average yields of wheat in bushels per acre: 1914, cut wheat for hay; 1915, 20 bushels; 1916, 23 bushels; 1917, seven and one-half bushels; 1918, five and one-half bushels; 1919, two bushels; 1920, five bushels; 1921, 15 bushels.

He cultivates his summer fallow twice with a bar blade weeder and once with spring tooth.

**Farm No. 69**

This man lives in north Liberty county. He came to Montana from Minnesota and took his homestead in 1912. He came to Montana for his health and "for the romantic experience of homesteading." He had fifty cents left after paying his filing fee and building check.

Summary—1921 receipts \$1980, current expenses \$791, farm income \$1096, labor income \$617.

Live Stock—Seven head horses, one cow, one brood sow, 40 chickens.

Crop History—Average yield in bushels per acre: 1916, 50 bushels; 1917, 11½ bushels; 1918, five bushels; 1919, three bushels; 1920, eight bushels; 1921, 16 bushels.

He says that for the last three years spring plowing has seemed to be as good for him as summer fallow, although he believes summer fallow is the right thing if it be done right. He feeds grain hay to his work horses. In the future he expects to raise more corn and rye and raise more stock.

"Debts have hurt us worse than dry weather," he says. "Next time I'm out of debt you'll never catch me getting in again."

**Farm No. 50**

Farm No. 50 is located in southern Chouteau county. The farmer came to Montana from the Big Bend country of Washington. He has always practiced Big Bend summer fallow methods. He thinks the "Triangle" is just as good country as the Big Bend. He has a small tractor.

Live Stock—Eight horses, two milk cows, 50 chickens.

This man has never received less than 20 bushels of wheat from early plowed clean summer fallow, except in 1919. He has stubbled in some each year but it never has yielded more than 10 bushels. He thinks it is all right to stubble in rye. For summer fallow he plows early and cultivates with a duck-foot. He says that discs and harrows are absolutely no good. He would like to diversify more but is limited as to native pasture.

Summary—Farm income \$1992, labor income \$1237.

**Farm No. 126**

This farmer owns 480 acres and rents 160 acres of pasture. His farm is a diversified farm where corn is popular.

Live Stock—Eight work horses, 10 cows, 50 chickens.

Summary—Receipts \$1725, expenses \$655, farm income \$782.

Crop History—Average yields of wheat per acre: 1913, 25 bushels; 1914, cut for hay; 1915, 51 bushels; 1916, 19 bushels (hailed); 1917, eight bushels; 1918, six bushels; 1919, failure; 1920, three-fourths bushel; 1921, cut for hay.

He thinks summer fallow and corn make a winning program. He feeds oat hay. He milks cows and tends chickens in the winter time. He also has a big garden. Has never went into debt and plans to keep a year's supply of money always in reserve. He likes the country.

**Miscellaneous Statistics, Tables and Charts****LAND MORTGAGE INDEBTEDNESS AND DELINQUENT TAXES**

(Average of 10 townships in Hill, Liberty and Toole counties,  
July 1, 1922)

Average deeded acreage .....	207,480
Total indebtedness per township .....	\$125,320.00
Average indebtedness per acre .....	8.95
Proportion of acres mortgages.....	67%

**VARIATION IN INDEBTEDNESS**

(Variation in indebtedness of 86 successful farmers)

Indebtedness	Per Cent of Farmers
None .....	35
Less than \$5,000 .....	44
More than \$5,000 .....	21

**SUMMARY SHOWING ABANDONMENT OF FARMS**

(A summary of eight townships in the "Triangle" showing the percentage of various types of farmers who stayed on the farms)

Of the non-farmers: 70 per cent abandoned; 30 per cent stayed.

Of the farmer: 48 per cent abandoned; 52 per cent stayed.

Of married men: 40 per cent stayed; 60 per cent abandoned.

Of single men: 38 per cent stayed; 62 per cent abandoned.

Men without capital: 70 per cent abandoned; 30 per cent stayed.

Men with capital: 42 per cent stayed; 58 per cent abandoned.

The summary for these eight townships shows that 49 per cent of all farms had been abandoned in the spring of 1922.

**AMOUNT OF "TRIANGLE" FALLOW**

In making the 1922 survey fields along both sides of the road were counted to get an idea of the amount of fallow fields, wheat fields, fields going back to weeds, fields in corn, flax and oats. Following is the result of some of these counts:

## Hingham to Shelby

Type of Field	No. Counted	Per Cent
Wheat .....	70	39
Summer fallow .....	24	13
Land going back to weeds.....	77	43
Corn .....	5	3
Flax .....	1	.5
Oats .....	3	1.5

## Glasgow to Opheim

Wheat .....	54	56
Summer fallow .....	7	7
Going back to weeds .....	22	23
Flax .....	7	7
Corn .....	2	2
Brome grass .....	1	1
Oats .....	2	2

## Central Hill County

Wheat .....	65	41
Summer fallow .....	18	11
Going back to weeds .....	67	42
Corn .....	5	3
Rye .....	4	2
Flax .....	1	.6

It must be remembered that this is a count of fields along a road and although fairly indicative of the country, is not absolutely correct for any district. The count shows clearly the small amount of summer fallow in proportion to fields of grain, and it also shows the large proportion of abandoned land. The same type of count was made in southwestern Saskatchewan to get a comparison between the two regions. Here is the Saskatchewan count:

## Limerick to Moss Bank (Saskatchewan)

Type of Field	No. Counted	Per Cent
Fallow .....	71	40
Wheat .....	63	35
Oats .....	22	12
Laid-over breaking .....	4	2
Flax .....	11	6
Wheat grass .....	1	.5
Green feed .....	2	1
Rye pasture .....	3	2

## HISTORY OF 550 HOMESTEADERS

(Showing their former occupations and their native states)

Occupation	No.	Occupation	No.
Farmer .....	278	Cook .....	2
Railroad man .....	11	House girl .....	4
Physician .....	3	Housekeeper .....	2
Circus musician .....	2	Paper hanger .....	1
Carpenters .....	8	Undertaker .....	1
Miner .....	8	Sailor .....	1
Rover .....	4	Ranch hand .....	3
Deep sea diver .....	1	Veterinary .....	1
Musician .....	4	School student .....	1
School teacher .....	7	Miller .....	2

Occupation	No.	Occupation	No.
Drayman .....	2	Tinsmith .....	1
Blacksmith .....	3	Landman .....	1
Wrestler .....	2	Telephone man .....	1
Bartender .....	2	Gambler .....	1
Butcher .....	4	Soldier .....	3
Cowpuncher .....	2	Bank clerk .....	1
Milliner .....	2	Banker .....	1
Handyman .....	3	"Old lady" .....	3
Sea-going engineer .....	1	Rancher .....	1
"Old maids" .....	6	Dressmaker .....	1
Clerk .....	9	"Old man" .....	1
Laborer .....	25	Unclassified .....	78
Lumberjack .....	5	Widow .....	8
Preacher .....	2	Merchant .....	6
Barber .....	2	Well driller .....	5
Laundryman .....	1	Cigar maker .....	1
Plasterer .....	1	Printer .....	2
Bricklayer .....	1	Furnace man .....	1
Cabinet maker .....	1	Shop mechanic .....	1
"Blind pigger" and gambler.....	1	Race horse man .....	1
Professional homesteader .....	2	Sheep herder .....	2
Peddler .....	3	Salesman .....	1
Electrical engineer .....	1	Liveryman .....	1
Machinist .....	1	Teamster .....	2

## Total number of occupations other than farming—63

Native State	No.	Native State	No.
Illinois .....	30	Minnesota .....	83
North Dakota .....	79	Wisconsin .....	26
New York .....	8	New York City .....	1
Wyoming .....	1	Vermont .....	1
Missouri .....	8	Western Canada .....	78
Ontario .....	3	Louisiana .....	1
Montana .....	20	Michigan .....	18
Mississippi .....	1	Idaho .....	11
Washington .....	40	Ohio .....	2
South Dakota .....	12	Colorado .....	1
Kansas .....	17	West Virginia .....	2
Pennsylvania .....	3	Germany .....	1
Alaska .....	2	England .....	1
Netherlands .....	4	Oklahoma .....	1
Austria .....	1	Oregon .....	3
Iowa .....	32	Austria .....	1
		Kentucky .....	2

The summary of the above table shows that only 51 per cent of the farmers were practicing farming before they came to the "Triangle." Of this total number, 260 were married and 277 single. Thirty per cent of these homesteaders report that they started with "no capital."

**TABLE SHOWING LAND MORTGAGE INDEBTEDNESS AND DELINQUENT TAXES**  
**Ten Typical Townships of North Central Montana (As of July, 1922)**

No.	Deeded Acreage	State Land	Government Land	Total Indebtedness	Average Mortgage Per Acre	Per Cent Acres Mortgaged	Acres Mortgaged	Classification	
								Agricul- tural	Grazing
1	21,560	1,480	-----	\$ 143,525.27	\$ 9.50	70	14,720	21,120	1,920
2	21,600	1,280	160	121,495.65	8.40	69	15,080	20,235	2,805
3	21,320	1,400	320	157,793.06	10.75	67	14,720	20,030	3,010
4	19,520	2,240	1,280	47,305.00	4.65	50	10,160	21,388	1,652
5	21,040	1,280	720	150,000.00	9.00	78	16,960	20,490	2,550
6	18,720	3,360	960	113,930.00	9.50	64	12,000	17,865	5,175
7	18,320	4,480	240	167,435.00	13.80	66	12,120		
8	21,560	1,280	200	106,725.00	6.72	74	15,880		
9	21,720	1,280	-----	139,525.00	9.50	67	14,680		
10	22,120	1,280	80	105,463.00	7.70	63	13,720		
Total	207,480	18,400	4,920	\$1,253,201.93	(Av.) \$ 8.95	67	140,040		

Average indebtedness per acre on mortgaged farms.....\$8.85  
 Average per cent of deeded acres now mortgaged.....67.6%  
 Average indebtedness on total deeded acres.....\$6.04

## GOVERNMENT SEED LOANS BY YEARS

(Montana State Loans)

Year	No. of Farms	Amount
1918, fall .....	1,480	\$ 300,919.00
1919, spring .....	6,725	2,150,000.00
1920, county loans .....	.....	3,000,000.00
1921 .....	7,441	1,044,578.00
1922 .....	.....	755,492.00
Total .....	.....	\$7,249,000.00

## Federal Loans, by Counties—1921

County	No. of Farms	Amount
Blaine .....	149	\$ 13,810.00
Glacier .....	116	17,325.00
Hill .....	1,210	168,996.00
Liberty .....	484	72,295.00
Teton .....	125	15,080.00
Toole .....	515	71,127.00
Chouteau .....	432	53,625.00

## Fall of 1918

Chouteau .....	432	\$ 107,949.00
Hill .....	348	71,428.00
Teton .....	15	3,415.00
Toole .....	91	17,195.00

## Spring of 1919

Blaine .....	345	\$ 105,550.00
Chouteau .....	642	228,680.00
Hill .....	645	228,680.00
Teton .....	136	51,470.00
Toole .....	474	185,550.00

## Farm Incomes

(Figures gathered by the Montana Experiment Station on 99 North Montana farms)

Amount	No. of Farms
Less than \$500 .....	31
\$500 to \$999 .....	38
\$1000 to \$1499 .....	20
\$1500 and more .....	10

## Labor Incomes

(Figures gathered by the Montana Experiment Station on 99 North Montana farms)

Amount	No. of Farms
Less than \$0 .....	36
\$0 to \$499 .....	32
\$500 to \$999 .....	20
\$1000 and more .....	11

The Following Seven Charts Show Crop Probabilities in the "Triangle" From 1882 to 1921. To Make Up These Charts the Weather from 1882 to 1921 Was Analyzed Carefully and Scientifically, and the Crop Probability Was Based Upon the Weather. When This Scientific Analysis Is Checked Against the Well Known Yields of 1911 to 1921, It Shows That the Entire Chart "Hits With 85 Per Cent Accuracy" and Gives a Good Idea of the Possibilities of Crop Yields in Early Years When Weather Records Were Kept But When No Farming Was Done.

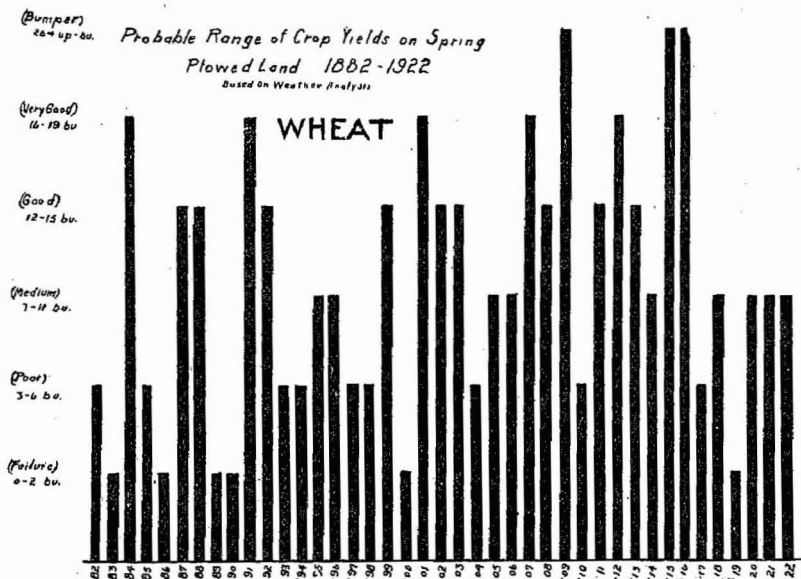


Figure 52—Showing the yields of spring wheat on continuously cropped land for the period. While the chart shows some good years, it also shows a great range between the yields of various years.

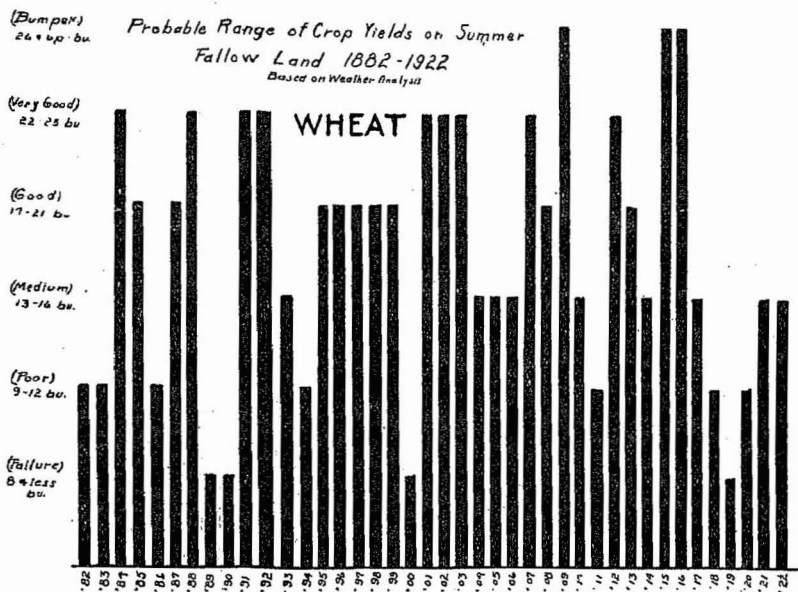


Figure 53—Yields of spring wheat on summer fallow, showing that the variation is less than with continuous cropping through this long period.

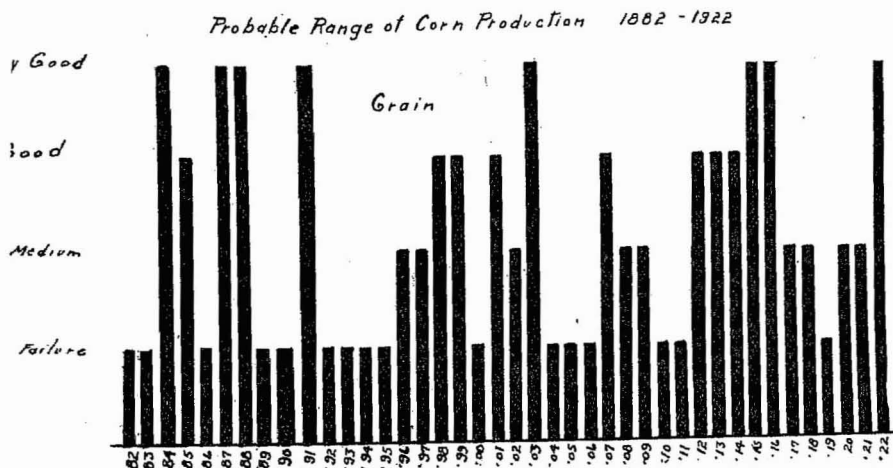


Figure 54—Corn yields are not so certain from the grain standpoint. Sixteen years of possible failure to mature the grain, nine years of medium crops and 16 years of good to excellent grain crops is the possibility for corn.

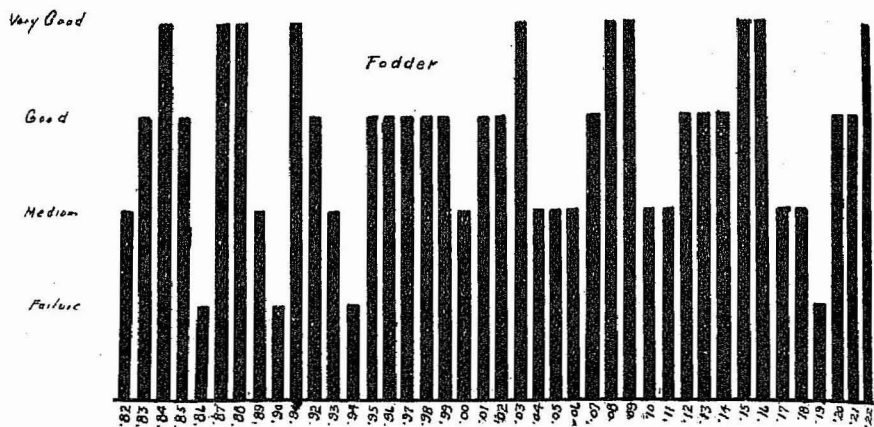


Figure 55—Corn for fodder would have shown good results through this period of years. Only four years could have been considered failure years for this crop.

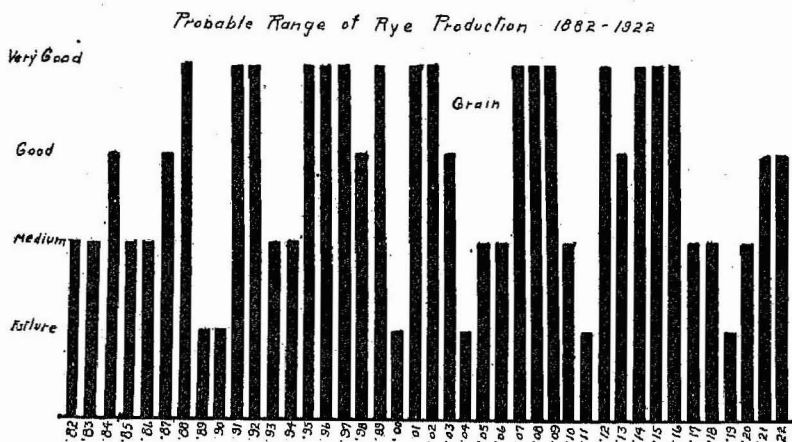


Figure 56—yields of rye for grain. The yields are uneven, with six years of possible failure, 12 years of medium crops and 23 years of good crops.

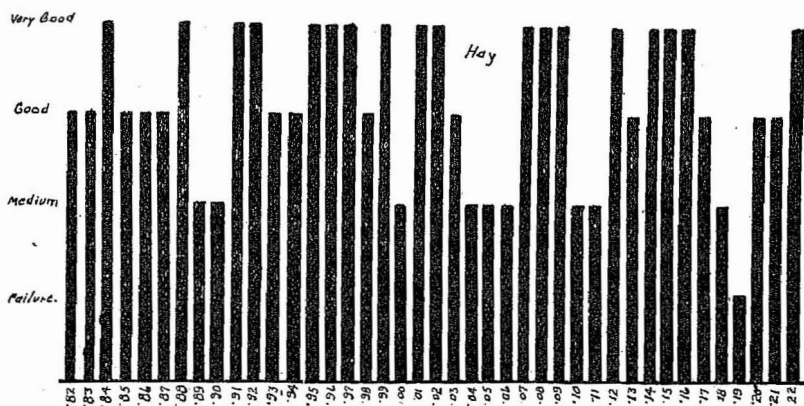


Figure 57—Rye for hay shows up better. In only one year through this long period would it have been a total failure. This illustrates the possibilities of rye as a forage crop.

*Probable Production of Family Farm Garden on Summer Fallow Land  
1882-1922*

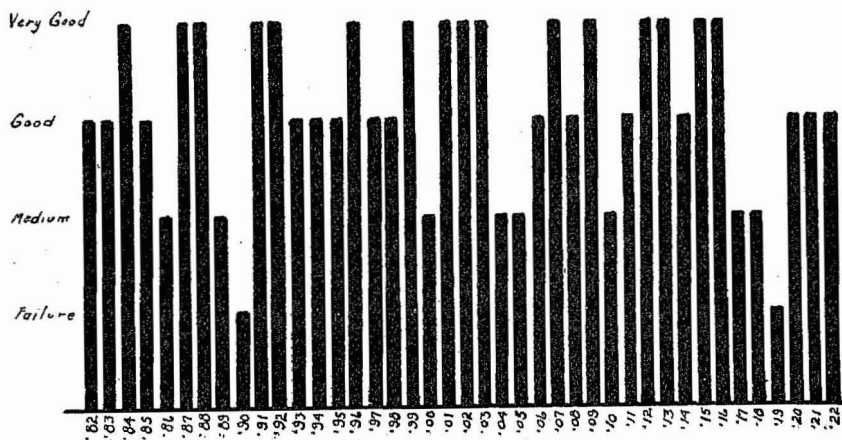


Figure 58—Showing the variation in productiveness of home gardens through this period. Gardens would have been a comparative failure in only two years, would have been medium to good in eight years, good in 15 years and exceptionally good in 16 years.

## ACKNOWLEDGEMENT

The author wishes to express his appreciation for the fine co-operation which has made this bulletin possible. Not a few men have given their time and interest beyond ordinary measure to help build a summary of the "Triangle" situation. To all who have contributed in large or small measure this opportunity is taken to thank them most sincerely, and to express the belief that this appreciation comes not alone from the author, but also from the people of Montana who are interested in the accomplishment of a solution for north central Montana farming.

Especial mention should be made of the following persons who have contributed largely to the making of this bulletin:

E. C. Elliott, formerly chancellor of the University of Montana.

J. W. Freeman, Great Falls.

Robert Wilson, arborculturalist, Mandan, South Dakota.

N. A. Olsen, agronomist in charge of farm seed loans office, Grand Forks, North Dakota.

C. S. Noble, president, Noble Foundation, Ltd., Noblesford, Alta., Canada.

A. J. Ogaard, agronomist, Montana State College Extension Service.

E. C. Hallman, farmer, Acadia Valley, Alta., Canada.

James Murray, district agricultural representative, Medicine Hat, Alta., Canada.

P. Patton, statistician, Montana State College Extension Service.

W. H. Fairfield, superintendent, Experiment Station, Lethbridge, Alta., Canada.

E. L. Currier, professor of farm management, Montana State College.

H. E. Shelby, assistant in farm management, Montana Experiment Station.

George Morgan, superintendent, Experiment Substation, Havre, Montana.

Fergus Mitchell, assistant in field survey work, Montana State College Extension Service.

E. C. Beewar, assistant in field survey work, Montana State College Extension Service.

Officials of the Great Northern Railroad, whose co-operation made possible the demonstration tour of 1923 in north Montana.

The successful farmers, individually and collectively, whose fine spirit of friendliness formed the first and greatest factor in the gathering of data presented in this publication.