



The Montana Agricultural Experiment Station and the development of dry farming techniques :
1902-1920

by Peter Dennis McGorry

A thesis submitted in partial fulfillment of the requirements for the degree MASTER OF ARTS in
History

Montana State University

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Abstract:

The Montana Legislature established the Montana Experiment Station in 1893. The first ten years of its existence saw staff discontent and continued turnover, an absence of interest and financial support from the state government and a lack of strong directing leadership. In 1904, the Board of Executives of the Experiment Station asked Frederick B. Linfield, the station's Agriculturalist, to accept the position of station director.

Linfield served the State of Montana and the Experiment Station for almost forty years, but it was the years before 1920 that witnessed the real substance of his contribution. During those years under Linfield's leadership, the station grew to become a sound, stable and vital research institution capable of dealing with the awesome challenges of Montana agriculture. The experiment station was able to expand at home in Bozeman, as well as to establish and maintain three research sub-stations around the state. State support for the stations went from less than five thousand dollars a year to over one-hundred thousand dollars. The total staff grew from ten members to twenty-nine at the home station alone. By 1920 Linfield and the Experiment Station were able to challenge the agricultural problems facing the state; such as, drought, insect plagues, inflation- and falling grain and livestock prices.

The study undertaken here is not to determine how the Experiment Station coped with the drought years and the agricultural depression, which inflicted many hard years on Montana farmers, but how the station grew from an ill-directed, poorly funded and little recognized form in 1902 to a stable, funded and recognized institution with the vision and ability in 1920 to challenge the future.

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PETER DENNIS McGORRY

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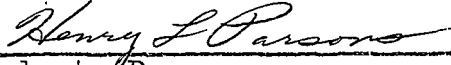
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Approved:


Chairman, Examining Committee


Head, Major Department


Graduate Dean

MONTANA STATE UNIVERSITY
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Preface

The Montana Legislature established the Montana Experiment Station in 1893. The first ten years of its existence saw staff discontent and continued turnover, an absence of interest and financial support from the state government, and a lack of strong, directing leadership.

In 1902 the Board of Directors hired Frederick B. Linfield to take the place of Robert Shaw, the Station's agriculturalist since 1898. Linfield was the fourth man in nine years to hold that position. In 1903 the Director of the station, Samuel Fortier, took a leave of absence to go to California to work on an irrigation project for the United States Department of Agriculture. The Executive Board of station named Linfield temporary Director. In 1904, when Fortier resigned, the Board appointed Linfield permanent Director. He was the third director in eleven years.

Linfield remained at the station as director and later as Dean of the Agricultural Division until 1937. Clyde McKee, the assistant Director replaced Linfield, who took the position of Dean Emeritus, one of partial retirement. In 1942 Dean Linfield severed his official connection with the Experiment Station and the College and retired completely.

When Linfield turned over the direction of the station to McKee in 1937, it was a well organized and functioning institution with clear and positive direction. It had come a long distance with Linfield since 1903.

Linfield had served the state of Montana and the Experiment Station for forty years, but it was in the first eighteen years from 1902 until 1920 that witnessed the real substance of his contribution. In the period from 1902 to 1920 Linfield worked, wrote, petitioned, taught, criticized and directed, and as he did, he grew, the Experiment Station grew and Montana Agriculture grew.

In the period from 1900 to 1920 the State's population exploded as settlers from a wide variety of places and backgrounds took up homesteads on the dry benchlands of the state. Although optimism among the people of the Experiment Station and the farmers dominated the early years, one homesteader after the other began to fail and move out of the state. Drought, insect plagues and ultimately a severe drop in the price of grain all but destroyed Montana's agricultural future. In order to cope with these problems the farmers needed to have a clear view of the situation, locate the source of their difficulty and accept the challenge before them. Leadership that had a good perspective on the problems as well as the

experience and facilities to challenge them, became the primary need.

Linfield and the Experiment Station were in a position to fill that need. They had the facilities, they had the organization, they had the staff, they had the moral and financial support of the state, as well as the Federal government, they had an established communication with the people, and most important of all, they had already challenged the enemy and suffered failure, and as such understood the vastness and complexities of the various problems.

The study undertaken here is not to determine how the Experiment Station coped with drought and agricultural depression during the 1920's and 1930's, but how it grew from an ill-directed, poorly funded and little recognized farm in 1902 to a stable, funded and recognized institution with the vision and the ability in 1920 to challenge the future.

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Abstract

The Montana Legislature established the Montana Experiment Station in 1893. The first ten years of its existence saw staff discontent and continued turnover, an absence of interest and financial support from the state government and a lack of strong directing leadership. In 1904, the Board of Executives of the Experiment Station asked Frederick B. Linfield, the station's Agriculturalist, to accept the position of station director.

Linfield served the State of Montana and the Experiment Station for almost forty years, but it was the years before 1920 that witnessed the real substance of his contribution. During those years under Linfield's leadership, the station grew to become a sound, stable and vital research institution capable of dealing with the awesome challenges of Montana agriculture. The experiment station was able to expand at home in Bozeman; as well as to establish and maintain three research sub-stations around the state. State support for the stations went from less than five thousand dollars a year to over one-hundred thousand dollars. The total staff grew from ten members to twenty-nine at the home station alone. By 1920 Linfield and the Experiment Station were able to challenge the agricultural problems facing the state; such as, drought, insect plagues, inflation and falling grain and livestock prices.

The study undertaken here is not to determine how the Experiment Station coped with the drought years and the agricultural depression, which inflicted many hard years on Montana farmers, but how the station grew from an ill-directed, poorly funded and little recognized farm in 1902 to a stable, funded and recognized institution with the vision and ability in 1920 to challenge the future.

Introduction: Land and Climate

The first ten years of the Twentieth Century in Montana saw more homestead claims filed than the last thirty years of the Nineteenth. In the period from 1900 to 1920, the public domain in Montana dropped from over sixty-five million acres to less than six. Yet even with such a high influx of homesteaders, a settler on the eastern benchlands of Montana may have gone weeks without seeing another human being. The county seat, to which he had to go to file his claim may have been several days-ride away. Although the homesteader did not realize it at the time, he was living in a state over twice the size of the New England states combined.

As the homesteader came into the state from the east, he found the land rolling gently westward for almost three hundred miles, sometimes interrupted by valleys, dotted with irregular hills and buttes, yet consistently climbing until it reached over four-thousand feet in the foothills of the Rockies.¹ In the western mountain regions he found high parallel ranges, often exceeding five-thousand feet, but interspersed with numerous fertile valleys often covered with timber and promise.²

If the settler crossed the state in the north, he encountered the Missouri River, which flowed north from the Gallatin Valley in the southwest to the Great Falls in the

north. Here it dropped over five-hundred and fifty feet, turned east and flowed across the northern reaches of the state into North Dakota.³ If the settler chose a southern route across the state, he could follow the Yellowstone, which reached out from northwestern Wyoming to encounter the Missouri as it crossed into North Dakota.

In the western regions of the state the Clark Fork of the Columbia dominated the region, flowing westward, joined by the Blackfoot, Bitterroot and Flathead Rivers, occasionally turbulent but generally moving along slowly towards the Columbia River and the Pacific.⁴ Dominating the river's flow and often obstructing the settlers' drive westward was the Great Divide which dominated the western third of the state.

The tremendous expanse of Montana was not the only intimidating factor the settlers had to face. The climate of the state was as varied and often as awesome as its geography. The homesteader often found himself being baked by an over-powering summer sun at one minute and being pitted with hail the next. The average precipitation in the state was about fifteen inches annually, but variations throughout all areas of the state were persistent. In the western regions of the state alone, variations went from ten inches a year to thirty inches a year; nevertheless, almost two-thirds of the state, largely encompassing the eastern bench lands, where

most of the homesteaders of this period settled, did nearly approximate the state average. But even then, yearly variations and monthly variations were significant.⁵ The only consistent factor about precipitation that the homesteader could find was that most of it occurred in May, June and July, if it was to occur at all.

The homesteader in Montana had more to contend with, however, than the annual rainfall. Temperature also threatened his crops. The temperature determined the growing season, which in the western regions of the state barely amounted to ninety days, but it also affected the evaporation rate.⁶ The higher the temperature the greater the amount of soil moisture lost through evaporation.⁷

Earlier histories identified the Great Plains, wherein much of Montana resides, as desert. Later works called it a garden. To the homesteader in Montana after 1900, sometimes it fit one description; at other times, the other. Montana's extreme size, its low precipitation extremes, its high and low temperatures were often what many people pictured Montana to be, but to the homesteader, and to the experiment stations set up to cope with his farming difficulties, these factors were not significant. The greatest challenge came from the variation in terrain and soils, as

well as the unpredictability of the climate. Often the environment created problems with too many variables for one group of individuals to handle. But eventually, after much labor and hardship, after many homesteaders came and went, and after much research and organization, the station and the farmers it served eventually won.

MONTANA AGRICULTURAL EXPERIMENT STATION: 1893-1902

In the first twenty years of the Twentieth Century the Montana Experiment Station launched a program of research designed to bring success to thousands of homesteaders attempting to farm without irrigation in the drier high plains regions of the state. The beginnings of this program, however, date back to the last ten years of the previous century and the creation of an experiment station in 1893.

The establishment of a Land Grant College and Experiment Station in Montana was not unique, but consistent with events in the country throughout the period particularly since 1897 with the passage of the Hatch Act. However, the Legislature had to deal with the questions of a Land Grant College and Experiment Station, amid the politics and discord of setting up all state offices and institutions, since Montana had only obtained statehood four years earlier in 1889.

Although the Montana Legislature set up the Montana Experiment Station in 1893 it did not begin to function as a viable institution until after the appointment of Frederick B. Linfield in 1904. In its last ten years it lacked financial support from the state, was subject to a continued turnover in

staff and was void of any clear direction or leadership. In effect, the state passed the necessary legislation to establish the stations and then cast it adrift with only federal funds to support it.

On February 16, 1893 the Legislature of the State of Montana approved "an act providing for the location and establishment of the Agricultural College of the State of Montana, and an Agricultural Experiment Station in connection therewith." The purpose of the station was "to aid in acquiring and diffusing among the people of the State of Montana useful and practical information on subjects connected with Agriculture, and to promote scientific investigation and experiments respecting the principles and application of agricultural science ...". According to the Montana Legislature, the money to fund this experiment station would come from a Congressional act which Congress approved on March 3, 1887. Researches referred to it simply as the Hatch fund.¹

Section two of the State Law commissioned the State Board of Education to locate a permanent site for the College and Experiment Station at or within three miles of the city of Bozeman. Section four empowered the governor to appoint, with the consent of the State Board of Education, an Executive Board "consisting of five members, at least three of whom shall be residents of the County wherein said institution is situated."²

Section five authorized the Executive Board to "appoint a President and faculty of said College ... subject to the approval of the State Board of Education."³

Acting in accordance with this legal directive, Governor John E. Rickards appointed an Executive Board for the Experiment Station which, in turn, selected a staff. The Board appointed S. M. Emery as Director and Horticulturist; Luther Foster, M.S.A., Agriculturist and Botanist; F. W. Traphagen, who held a P.H.D. in F.C.S., Chemist and Veterinarian; W. L. Williams as Veterinary Surgeon.⁴

On March 22, 1893 the Board of Executives and the State Board of Education met in Bozeman to choose a site for the College and Experiment Station. For the College, the Board decided to accept a gift of twenty acres of land from Nelson Story, a member of the State Board of Education.⁵

Contiguous to the college site was a tract of land owned by Gallatin County and used as a County Poor Farm. After some discussion, the County and the City of Bozeman donated the tract to the State for use by the Experiment Station.⁶

The Experiment Station officially came into existence on July 1, 1893 and Emery and his staff began work in earnest.⁷ The Agriculture Department began investigations into a variety of subjects dealing with cereal irrigation and potato

culture. The Department of Veterinary Science began investigations into animal diseases particular to the Rocky Mountain area, while the Chemistry Department worked in conjunction with the Agriculturalist on foods used in stock feeding, and the Veterinarian examining the effects of "loco" weed on domestic animals.⁸ The Horticultural Department set out a wide variety of trees and plants.⁹

In the course of the next ten years they published studies dealing with potato production, swine feeding, small grains, alkaline soils, sheep feeding, sugar beets and strawberries.¹⁰ Although virtually all studies dealing with the duty of water also included studies of irrigation, and that all grain studies utilized available irrigation, the Agricultural Department did in 1898 do several tests of the Campbell Soil Culture System; they reported no significant results at this time.¹¹ However, reports later revealed that Robert Shaw, who conducted the tests, felt that the Campbell System was basically inadequate since irrigated grains had superior yields.¹²

Although Shaw discounted the value of pursuing Campbell's theories any further, Director Emery was under continued pressure from Paris Gibson at Great Falls. Gibson continually pointed to the success of many dry farmers on

the tableland above Great Falls and called for Emery to begin experiments in dry farming practices.¹³

Director Emery was a horticulturalist and spent much of his time introducing fruit to Montana agriculture. Robert Shaw was from the Great Falls region and remained in Montana less than four years. While in Montana he showed very little interest in the Campbell Soil Culture System and preferred to devote his time to Agronomy studies conducted with the use of irrigation.¹⁴

Emery and Shaw had little interest in developing dry farming techniques, which partially explained why they did so little research that was to prove so vital to Montana agriculture in the future. This does not, however, provide a complete explanation.

When the Montana Legislature created the Experiment Station in 1893 it refused to provide any additional revenue to support the station. The Legislature made it clear that the station would have to operate strictly on the Federal revenue provided from the Hatch Fund.¹⁵ Under the Hatch Act the station received fifteen thousand dollars each year.¹⁶ Only one thousand of this was to be used for building construction, such as barns, sheds or storehouses.¹⁷ The only exception to this curtailment permitted by the Hatch Act was in the first year of the station's existence.

In 1894 the station spent almost ten thousand dollars on salaries, labor, chemical supplies and building.¹⁸ In the fiscal year 1895-1896, it spent over ten thousand dollars to cover salaries and labor alone.¹⁹ The situation in 1898 saw little change. Salaries and labor cost the station over nine thousand dollars.²⁰ The only other source of income came from the proceeds of the crops grown on the farm. Those receipts, which generally amounted to less than two thousand dollars a year made up the total income for farm improvements.²¹ The lack of funding not only made it difficult for the station to expand as rapidly as needs demanded, but it also made it somewhat dangerous, from a financial point of view, to experiment with a crop or conditions that could result in failure.

The lack of financial support from the State definitely hindered the amount of experimenting possible and the choice of conditions used, but it also hindered the usefulness of the station in other areas. In the early years of the station there was no Extension Service with which communication could be maintained between the station staff and the farmers they were trying to serve. The Farmers' Institutes were the only vehicle in a position to serve the purpose, but the institutes, too, lacked financial support from the State. The Farmers' Institutes relied solely on private contributions

and volunteer lecturers.²²

The Station staff volunteered their time and conducted meetings throughout the western part of the state, whenever transportation and lodging could be arranged.²³

In 1895 and 1896, and again in 1898, however, problems arose when the railroads refused to provide transportation to the Station staff.²⁴ In many instances, Director Emery had to beg the railroad and local people to obtain transportation or lodging for his staff.²⁵

The Farmers' Institutes were not the only factor affected by the severe shortage of funds. The salaries provided for the Station staff were inadequate and often created severe financial hardships for those involved. Not only were the salaries low, but each member of the staff paid almost forty percent of his salary for lodging.²⁶

Turnover of the staff occurred often, creating a situation where it was almost impossible to conduct any studies or maintain any form of continuity.²⁷

This question of continual staff resignations in the early years of the station was a definite result of the lack of financial support. In addition, Director Emery proved a source of friction. Robert Shaw, who worked under Director Emery for two years was highly critical of him. In writing

to Linfield, Shaw stated that "You will understand, of course, that we were all in too close relationship to the devil during '98 and '99 and part of 1900. It was not until Director Fortier's appointment that any work of consequence was started. During all those years there was very little money to work with and little encouragement to try to use what there was."²⁸ In another letter, Shaw remarked that "suggestions of all kinds were invariably thwarted in some way," by "that man Emery."²⁹

It was difficult to determine the exact nature of the problem with regard to the relations between Emery and his staff, but it was clear that he had much difficulty developing a working relationship with the men under him. They disliked him, and he became highly critical of them.³⁰

In 1898 the Executive Board hired Samuel Fortier. Fortier was from Ogden, Utah and although interested primarily in irrigation studies, he was receptive to the possibilities of dry farm studies in Montana.³¹ In 1900 Emery resigned as Director and the Board appointed Fortier to replace him.³² Nineteen-hundred also marked the first year that the State Legislature approved appropriations from its annual budget for the Experiment Station. The Legislature furnished twenty-five hundred dollars to build and equip a

dairy. The Legislature also agreed to a two-thousand dollar expenditure to collect data on irrigation.³³

In 1902 Robert Shaw resigned his position with the station to accept a similar appointment at the Michigan Agricultural College in Lansing. In October of that year the Executive Board, upon the advice of President Reid and Director Fortier, unanimously decided to accept Frederick B. Linfield's application for the vacant position.³⁴ When Linfield arrived later in October, he found the station completely disorganized and totally inadequate.³⁵

Inadequate facilities and disorganized tests were not the only problem still besetting the station in 1902. In spite of Legislative reorganization of the Farmers' Institutes in 1901, problems still existed.²⁶ The State had appropriated funds but only enough to support a Board of Administrators. Much needed money for transportation and lodging was still not available.³⁷ To compound the situation, internal feuding broke out over the selection of a Secretary of the Board of Farmers' Institutes.³⁸

In 1903, Samuel Fortier, still much involved in irrigation studies, took a leave of absence to go to California to work on an irrigation project for the United States Department of Agriculture.³⁹ The Board appointed Linfield

Linfield Vice-Director in charge of the station. In 1904 Fortier resigned and the Board of Executives named Linfield Director.⁴⁰ Linfield was the fourth man in nine years to hold this position of agriculturalist, and the third in ten years to hold the position of Director.⁴¹ In ten years only four students in the Department of Agriculture had graduated.⁴² Its buildings, livestock and equipment were not equal to what a good farmer would consider necessary to his success ..."⁴³ It was clear to Linfield that there was much to be done if the Experiment Station was to become more than a silent partner in the development of Montana Agriculture.

II

F. B. LINFIELD AND THE MONTANA EXPERIMENT STATION: 1902-1920

In 1902 the direction of the Montana Agricultural College and Experiment Station took a dramatic shift with the arrival of Frederick B. Linfield. Contrary to previous leaders, Linfield refused to permit the station to remain the step-child among the State's institutional offspring. He envisioned the station as a leader in the economic development of Montana and proceeded immediately to project it as such. In his first fifteen years as Director of the station, Linfield altered the research direction in such a way so as to play a more realistic and decisive role in the state's overall development. Although he recognized the value of irrigation in Montana farming, he knew that irrigation could not be employed throughout the state; and lest Montana's resources remain dormant and her place in the community of states remain lost, the station needed to pursue and succeed in developing Montana's agricultural potential to the fullest. Linfield realized that complete agricultural development would provide the necessary foundation for the growth of a viable, home-supported industry in the state.

Linfield complemented his vision with vigorous leadership as both the Director of the station and primary farmer in the state. He became actively involved in political affairs

whenever he felt it in the best interests of the Station and the farming community. He publicly presented his views on tax questions and campaigned for responsible land-use legislation. He took the time to defend both the station and farmers from attacks by the public press, national and local, as well as by recognized leaders in the dry farm movement, such as Hardy Webster Campbell. He actively participated in dialogues concerning educational systems and the relationship of the Experiment Station to the University system. But, most significantly, he recognized the need for the sound development of dry farming research and campaigned vigorously for it. When Linfield arrived at the station in 1902 he brought vision, energy and courage, and the course of the station changed.

Frederick Bloomfield Linfield was born on July 18, 1866 on the Island of Twillingate, north of Newfoundland. As a boy he moved with his family to Goodrich, Ontario and in 1894 graduated from Ontario Agricultural College of the University of Toronto. After his graduation he accepted a position as an assistant in the Dairy Department at the Agricultural College in Toronto.¹ For two years he traveled around the Province conducting a dairy school in various farming communities.² In 1893 he accepted a position as Professor of Animal Industry and Dairying at the Utah Agricultural College in Logan, and began with the task of organizing a Dairy Department.³ In

1902 the Executive Board of the Montana Experiment Station, after hearing strong endorsements from President Reid and Director Fortier, voted unanimously to ask Linfield to accept the position as Agriculturalist, just recently vacated by Robert Shaw.⁴

Linfield was not at the station in Bozeman a full year when he agreed to accept the position of Vice-Director and run the station during Fortier's leave of absence. In 1904 Fortier resigned and Linfield accepted the position as Director.

Alfred Atkinson, formerly the President of Montana State College, credited all the good results of experimentation work at the station directly to the outstanding leadership of Dean Linfield.⁵ Local commentators credited Linfield with having played a major role in providing direction and ideas for the development of Montana's agricultural resources, including the development of its farms and ranches to the status they now hold.⁶

Linfield devoted most of his forty years at the station to the development of research organization in agriculture, but he was not a man of narrow interests. He was much aware and often involved in various public issues in the State, particularly those which involved the questions of either taxes or land use. In 1910 Linfield became so involved in

tax reform proposal that he went to the lengths of writing out his views on the subject, publishing his article in pamphlet form and then sending it out to various railroad and businessmen in the state for dispersment to the public.⁷ Although, in principle, Linfield favored tax reform, he was strongly opposed at that particular time and did not hesitate to explain his position. He felt that valid reform would have to come from an independent tax commission since the political interests of Helena, Butte, and Anaconda dominated the Legislature.⁸ At one point he expressed his willingness to cease all effort at reform and live under the existent state levy if it were "possible to get some particular industries in this state to pay their just proportion of taxes ..."⁹

Land use was also a major issue with Linfield. In 1907 when J. W. Dixon pressed for the Enlarged Homestead Act, Linfield expressed strong opposition. He was not opposed to the homesteaders having the opportunity to claim additional acreage when necessary, but he did oppose the concept of having one law govern all situations.¹⁰ He wanted the lands in question surveyed and rated according to their potential as farm land or grazing land and then dispersed to the homesteaders according to their agricultural potential.¹¹ In 1908 the Northern Pacific did conduct just such a survey of their land and hired Montana State College students, under the

direction of Alfred Atkinson to do it.¹²

Linfield also actively involved himself in the question of Timberlands and their disposal. He argued that these lands, too, be surveyed to determine their suitability for cultivation, and if found to have good agricultural potential, then the state should require that the buyer cultivate them after he has utilized the timber. If the survey determined that the land was not suitable for cultivation, then the state should not sell them.¹³ Linfield also argued that much of the land, even without timber, was too rugged for the plow and should be designated as range land. He considered almost half the acreage in the state in that category.¹⁴

As the Director of the station, Linfield became an outspoken defender of the station and the farmers it existed to serve. Many times in this role as defender he took vigorous issue with criticisms from the public press, both local and national. In 1907 he openly charged the Rocky Mountain Husbandman with misrepresentation and distortion of the truth in its reporting on the station's experiment work done in that year. The Husbandman had reported that the station suffered total failure in 1907. The newspaper had based this report on a statement from the station which had expressed dissatisfaction with some results obtained, indicating that they were simply not as successful as anticipated.¹⁵

In that same period, Linfield took issue with the Anaconda Standard which had printed a banner article announcing the opening of an engineering program at the University of Montana in Missoula. Finally, according to the Standard, Montana students would not have to leave the state to obtain a sound education in Engineering. Linfield, charging the Standard with irresponsibility, suggested that it not only recognize the programs offered at the State College in Bozeman, but publicize them and campaign statewide against the financial wastes of duplicity.¹⁶

Misrepresentation by elements outside of the state also came under strong attack from Linfield. In the early '20's the Nation's Business attempted to explain the reason for the deepening agricultural depression, which they ultimately identified as "shiftless farmers." Linfield took strong issue with such over-simplification and explained that the income of farmers in the central and north-central mid-west had in just two years from 1919 to 1921 dropped an average of eighty per cent. This indicated that, according to Linfield, if the Nation's Business was correct, the richest agricultural regions of the United States were inhabited by "shiftless farmers."¹⁷

While serving the State of Montana, Linfield made an effort to remain in close touch with agricultural development

on a national level. He maintained strong communication with directors of the various experiment stations around the country and oftentimes called on them for information or assistance, particularly in the area of dry farming research.¹⁸

Linfield's position as Director of Agricultural Research in Montana, coupled with his strong faith in his own judgment, eventually brought him into conflict with Hardy Webster Campbell, the nation's most noted author on dry farming techniques. Campbell's years of experience, national recognition and then position as editor of Campbell's Scientific Farmer were not enough to intimidate Linfield. In 1907 Linfield urged Gallatin County farmers to use the weighted-disc-harrow after plowing, rather than follow the Campbell method of using the sub-surface packer.¹⁹ Linfield made this recommendation because the growing season in the valley was precariously short and, as a result, it was necessary to introduce time saving techniques.²⁰ Campbell refused to accept Linfield's explanation that different areas create varied conditions and thus call for new techniques. Campbell accused Linfield of misleading Montana farmers; however, he made no effort to refute Linfield's arguments, complaining that he did not want to waste his time in useless correspondence.²¹

In his communications with other people in Agriculture, Linfield was not always seeking advice nor arguing over methods.

Oftimes directors and experimenters wrote to him seeking his advice. In 1909 the Canadian Province of Alberta was organizing an Agricultural College. They had to decide whether or not the Agricultural College should be joined with and share the same site as the University, or be completely separate from the University. A request from the Minister of the Department of Agriculture in Alberta, Canada, prompted Linfield to publicly express his views concerning the relationship of the Agricultural College and Experiment Station to the University system.²²

Linfield stated that ten years earlier he would have strongly advocated that the two systems remain separate. In the intervening years, however, the status of experiment stations nationally had improved and other state institutions such as the University system had recognized their value and integrity. He would now strongly endorse placing the two institutions together. He explained that "... the Agricultural Department has nothing to lose and something to gain by being closely associated with the other lines of education, provided, always, that the head of the institution is in full sympathy with industrial and agricultural education, and that a strong, well-rounded agricultural faculty is engaged."²³

Linfield realized that if both systems recognized each other's purpose and needs, an efficient and valuable partnership could be drawn. The Agricultural School in particular

would profit from such an arrangement since students would be able to draw on the resources of the University for liberal arts work such as foreign language study, English or history.

Linfield agreed that in some states the two institutions did not work well together, such as in Nebraska and Minnesota, but he felt that the fault was in the personnel, not in the structure of the system.²⁴ In the case of Montana, Linfield pointed out that the separation of the two systems had little to do with educational philosophy, but rather "selfish local interest which scattered the institutions," and that, although a majority of Montanans recognized the mistake, they had already made the investment. Any effort to make a change would result in much local fighting.²⁵ Linfield exhibited definite tones of regret over the division of the Montana Systems, however, as the Agricultural College grew, more and more choices were made available to the students. Linfield must have been pleased that as the College grew and took on more of the attributes of a university, it had Alfred Atkinson an Agronomist, as President.

Linfield spent almost his entire adult life in the American West, and most of that in Montana. He loved the mountains and was particularly fond of Western Montana because of its timber-covered slopes, which he said, appealed to his humid East background.²⁶ In spite of his love for the West

and desire to see it develop, he took a practical view whenever anyone raised the question about people moving west. On a visit to the East around 1909 he strongly urged young Ontario farmers to think seriously and examine all the options before deciding to seek land in the West. He pointed out that sometimes far richer land at less the cost was available right at home. A move West could be the wrong decision.²⁷ This is not to say that Linfield did not believe in the future of the West and particularly Montana, for he strongly supported its future; but his belief was based on what he considered to be sound, practical judgement, which he thought should be encouraged and exercised at all times. It was just this kind of sound, practical judgement that led Linfield to his convictions that dry farming would be successful in Montana and with this success would also come the rise of Montana Agriculture and subsequent industry.

Within a very short time after his arrival in Montana, Linfield concluded not only that dry farming would be successful, but that it held the key to Montana's future economic development. Linfield drew his conclusions on the generally accepted premise that industrial development was preceded by agricultural development. He argued that successful agricultural development would bring capital into the state for the future development of industry, as well as a market capable of

supporting home industry.²⁸ Linfield further argued that the key to Montana agriculture was farming the dry benchlands in the central and eastern regions of the state.

Linfield developed his convictions about dry farming after a review of the available agricultural areas. Although he revised his position over the years, the changes were never enough to alter his basic conclusion. Linfield estimated that at the outside it was feasible to irrigate only six-million acres.²⁹ This left an estimated twenty to thirty-million acres of potential farm land if the farmer could employ dry farming techniques. According to Linfield, if left as rangeland, they would never provide the economic impetus that cultivated land would.³⁰

With this belief that dry farming was necessary for Montana's future, came the conviction that farming without irrigation was not only possible in Montana, but would be highly successful. Linfield based his early judgement on several factors. He had spent nine years in Utah, much of it observing dry farming experimentation. When he came to Montana he observed that the vegetation was much greener and covered more of the land than in Utah.³¹ A colleague from Utah noted the same thing. "The poorest dry farm areas in Montana are equal to the best in Utah."³² Linfield was supported in his beliefs by Paris Gibson of Great Falls, who never missed an opportunity

to endorse dry farming.³³

As Linfield became more familiar with Montana, his convictions grew stronger. He saw Montana's fourteen or fifteen inches of annual precipitation as wetter than average for the western country, and further noted that over half occurred in the growing season of April, May and June. He also noted that the heat in Montana was less than the South plains regions and therefore evaporation of surface water would be less. Although the growing season was shorter, the days during the season were longer. Much of the eastern two-thirds of the state was in the moderating Chinook belt. As a result of this, winters were milder than in either North Dakota or Minnesota. Finally, the soil which was mostly sandy or clay-loam, was six to twenty feet deep and capable of holding moisture.³⁴

Linfield acknowledged the variations of climate and physical settings which covered the state. He did not realize the extremes of variation possible from section to section, month-to-month, or year-to-year.³⁵

With his goal of developing Montana Agriculture to its maximum capacity, so as to set the stage for industrial development of the state fully in mind, Linfield set out to achieve his desired end. Linfield saw two vehicles available to him: the Experiment Station to develop proven techniques, and the Agricultural College and Extension Service to promulgate these

proven methods throughout the state. Both vehicles needed to be reorganized.

When Linfield took over the direction of the station, he believed it to be totally inadequate to meet the demands he intended to place upon it.³⁶ He saw the high rate of turnover as creating severe instability which hampered the continuity of research projects. He felt the station was understaffed and that the qualifications of some members working in agricultural work were questionable. He insisted that the station needed agricultural specialists, not scientists simply transferred into the area of agriculture.³⁷ The farmer was a specialist; he needed the assistance of a specialist. He felt that the three departments of Agronomy, Animal Industry and Horticulture were too general. He wanted each one immediately divided, creating Agricultural Mechanics, from Agronomy; Dairying from Animal Industry; and Forestry from Horticulture.³⁸ And as was mentioned above, Linfield regarded the buildings and equipment as totally inadequate.

In order to overcome these problems and create the type of organization capable of pursuing constructive and meaningful research, Linfield felt that two essentials, which had been lacking in the station's early years, must be provided; those of leadership and funding. Although the

need for leadership was an obvious requirement, its existence was in question. Linfield did not outline a program or provide a set of rules in order to fill the leadership vacuum, but he did identify what he felt one might look for to determine its existence. If members are talking to one another in an atmosphere of mutual respect and cooperation the ultimate success of the project's goals are assumed.³⁹ "I have changed my mind more than once," Linfield said, "in the past fifteen years; even backed up more times than that and have not lost thereby. We proceed on a basis that we are a unit of a democracy and that if we are willing to give and take, we have found no difficulty, in time, in settling our differences ... I hope the time will come when we will think as much of the other fellow's rights and the effect of our actions on him or them as of ourselves."⁴⁰ With this objective in mind for himself, Linfield proceeded to attack the station's financial problems.

In his efforts for financial support, Linfield explored all avenues available to him, even to the point of writing to the Director of the Colorado Experiment Station and asking how he was able to support a larger staff than Montana on less money.⁴¹ He looked to manufacturers of agricultural instruments to help. They had helped the station

before and in this area he met considerable success. In 1905 alone, the station received a sixteen and an eight horsepower gas engine, a sixteen-inch riding plow, a surface corn cutter and several pieces of dairy equipment.⁴² In 1906 the United States Department of Agriculture extended franking privileges to the Experiment Station.⁴³ Throughout this period Linfield urged local communities to set up their own demonstration farms and hire qualified people to operate them and demonstrate techniques.⁴⁴

The first major break-through came in 1905. Linfield went to Dickinson, North Dakota on an invitation from Thomas Cooper of the Northern Pacific Railroad.⁴⁵ Cooper committed the railroad to spend twenty-five hundred dollars in that year to set up dry farming sub-stations along its line. Linfield left this meeting to lobby in Helena for an additional two thousand dollars. After much pleading the Legislature appropriated one thousand dollars to help set up dry farming sub-stations.⁴⁶ This marked the first time that the Montana Legislature appropriated money specifically for dry farming work. A further assist came at this time from the Great Northern Railroad, which agreed to spend two thousand dollars along their line.⁴⁷ The Irrigation Director of the USDA also contributed one thousand dollars.⁴⁸

Although the one-thousand dollar appropriation by the State Legislature was not all that Linfield had requested, it marked the beginning of a strong lobbying effort on Linfield's part, which ultimately led to success. In the beginning, Linfield decided to follow the line of least resistance with the Legislature. He lobbied for expenditures for livestock development.⁴⁹ He then began to appeal to the financial instincts of the Legislature. He argued that as each farmer came into the state he would bring in capital. The farmer, both as a consumer and provider of capital would stimulate local industry. Linfield also pointed out that as more farmers came into the state the value of public land would rise. This would create an additional source of income for the state.⁵⁰ Gradually the State Legislature began to agree that the appropriations were needed and would be well spent. In 1905 the Legislature appropriated one-thousand dollars for dry farming demonstration farms. In 1907 they appropriated three thousand dollars plus an addition of two thousand for basic maintenance of the station.⁵¹ The Legislature also was appropriating, at the time, over seven-thousand dollars for the home station in Bozeman.⁵²

Another avenue which Linfield aggressively pushed at this time, in order to insure enough financial support to maintain the Station's programs was the constant effort to prevent both the State and the Federal government from

making the appropriations ineffective by spreading the farming over too large an area. Linfield believed strongly that if money was to be effectively spent it must be concentrated. in areas that he could directly control, such as the home station and the demonstration farms. Linfield did make an effort to concentrate, coordinate and control the money being spent. In 1913 Linfield was made Dean of the Agricultural College as well as retaining his position as Director of the Experiment Station. Linfield agreed that under this condition he could coordinate both programs and spending, and thus maintain the highest efficiency.⁵³

Even as the amount of demonstration farms were growing, largely at the expense of the railroads in the state, Linfield stated that they would be terminated whenever "the problem of the immediate present can be studied and applied. As soon as people get acquainted with dry farm methods they will have served their purpose ... Our aim is to put as little as possible into capital accounts, but rather to devote all the funds available to the work on the farm ... Experiences in other states have demonstrated conclusively that it would be a mistake to make these permanent stations."⁵⁴ Linfield also pointed out that demonstration farms in Montana were unusually costly when compared to other states. "When they were set up in populated areas, local support and assistance can be called upon; but if they were set up in relatively unpopulated regions

specifically to attract the newcomers, the entire cost must be carried by the owner or demonstrator."⁵⁵

Linfield's efforts to coordinate activity also reached outside of his own immediate direction. He became highly critical of the state for spending money on advertising instead of spending it on efforts to survey the agricultural lands of the state before the settlers arrived.⁵⁶ In the beginning Linfield merely sounded criticism, but gradually he extended his attack to a warning. He agreed that the state should realize that the key to successful advertising was the farmer's success. The money should be spent to make those on the land successful, then more people would come. He warned that a major agricultural failure would destroy the effectiveness of any amount of money spent on advertising.⁵⁷

Linfield also strongly opposed the use of Federal funds on a wide basis. He insisted that here, too, the money should be concentrated in the hands of the station or the state, but not given out to individual communities or counties. In 1908 he urged J. W. Dixon to oppose HR 24757 which would provide funds for individual county or community high schools which set up agricultural or mechanical training programs. Linfield argued that in order to be effective, each community would have to augment the program with money of their own,

money they would not have. He was also afraid that some school districts would put any kind of a program together just to obtain Federal funds.⁵⁸ Several years later Linfield opposed a similar movement on a statewide level. People began to call for more state agricultural and technical schools similar to the one the state already had on the Northern Montana Station near Havre. Here again, Linfield opposed the program as an ineffective use of funds.⁵⁹

Linfield's efforts to set the Experiment stations' programs moving in the desired direction began to show definite signs of success by 1906. An obvious change by this time was an increase in the station staff. When Linfield took charge of the station in 1903 there was a total of seven men on the staff.⁶⁰ By 1906 the station staff numbered twelve.⁶¹ One man, Alfred Atkinson, was actually hired to replace Linfield as Agronomist. Atkinson had graduated from the same agricultural college and subsequently spent two years as an assistant to Professor Perry G. Holden before joining the Montana Experiment Station staff in 1903.

By 1906 the station, in conjunction with the railroads had established a clear pattern of growth in the area of dry farming research. The Montana Experiment Station had established a sub-station at Wayne Siding, near Great Falls

in 1903.⁶² The purpose of this station, which received considerable support from the Irrigation Division of the United States Department of Agriculture, was to conduct experiments primarily with irrigation engineers; nevertheless, the station was able to conduct some dry farming experiments.⁶³ But it was not until the railroads began to participate that the station was able to make real progress in this area. By 1906 the station was supervising experiments on only six stations, but the pattern for growth of a network of stations across the state was clear.⁶⁴

Money in 1906, from the State Legislature was still in short supply, but assistance began to come in from other sources, both local and national. Mr. N. H. Hobson of Lewistown, Montana, and the people of the Judith Basin area in Fergus County approached the Experiment Station without any direct or indirect "solicitation on the part of the Experiment Station staff" with a plan for a permanent sub-station in Fergus County.⁶⁵ Shortly after this proposal, at the Dry Farm Congress at Denver, Linfield was able to secure the assistance of the United States Department of Agriculture's Bureau of Plant Industry, which agreed to pay the Superintendent's salary.⁶⁶ N. H. Hobson donated one hundred and sixty acres of land, plus an additional twenty-five hundred dollars for buildings and equipment.⁶⁷ The State Legislature

appropriated one thousand dollars to help set up the station.⁶⁸ Linfield considered this station to closely approximate "average dry farm conditions for the state." The result of dry farm tests here would represent close to the average that would be obtained over the state.⁶⁹

The Federal government also in 1906 increased its assistance to the experiment stations. On March 20, 1906 Congress approved the creation of the Adams Fund.⁷⁰ The money from the Adams Fund, which would in several years reach fifteen thousand dollars annually, could only be used for original research and had to be diverted into wholly new lines of exploration.⁷¹ Linfield wanted to use this additional revenue for the development of a comprehensive research program on moisture studies, but this would again bring him into confrontation with the Legislature. "It would appear ... that while the state should supplement the Hatch Fund, it must supplement the Adams Fund, if we are to make proper use of it."⁷²

After 1906, with the impetus of new federal money, the continued assistance of the railroad and the emergency awareness on the part of the State Legislature as to the role it must play in the development of Montana agriculture, the Montana Agricultural Experiment Station marked a period of rapid expansion which did not dissipate until 1914.

By 1908 the Agronomy Department, which was in charge of the dry farming experiments had grown into the largest department in the Station.⁷³ In that same year, T. R. Larkin and C. M. Cambell, with the assistance of the Commerce Club of Great Falls, established another demonstration farm near Great Falls to replace a former station which closed in 1906, due to a labor shortage.⁷⁴

In 1909 expansion continued at an even greater pace. The Experiment Station purchased additional acreage at the home station in Bozeman. This purchase was augmented by Governor Norris who made Linfield, as the Director of the station, the custodian of the Fort Ellis Reservation adjacent to the Station. This increased the size of the Station in Bozeman to nine-hundred and sixty acres.⁷⁵ Linfield noted that much of the additional land would be "suitable for dry farming work, but it will also afford some opportunities for fall, winter, and early spring irrigation."⁷⁶ The Legislature demonstrated even further support at this time by approving increased appropriations for both the home station and the permanent sub-station in the Judith Basin. The sub-station's appropriation went from three-thousand dollars in 1907 to five-thousand in 1909 and eight-thousand in 1910.⁷⁷

By the end of 1909 the Experiment Station had, under its supervision, thirteen temporary sub-stations, all of them

supported by the various railroads in the state or the local residents.⁷⁸ The Northern Pacific was responsible for stations at Adams, thirty miles north of Glendive; Lake Basin, north of Billings; Forsyth and Terry. The Great Northern maintained demonstration farms at Great Falls, Chester and Harlem. The Chicago-Milwaukee and Puget Sound Railroad had stations at Baker and Roundup. Local farmers supported stations at Fort Benton and Havre.⁷⁹

This practice by the railroads of supporting demonstration farms was by no means unique to Montana, nor was it unique to the railroad industry.⁸⁰ In 1913 International Harvester maintained five demonstration farms in the Midwest and Northern Great Plains regions. One of these farms in South Dakota was three hundred acres in size.⁸⁷

The 1910 season was the driest "experienced since the dry farming studies were started," but, in spite of this lack of rain, expansion continued. The Northern Pacific set up another station at Helena and one at Clyde Park. The Chicago-Milwaukee and Puget Sound Railroad also set up another station near Harlowton.⁸² In July the Judith Basin Station hosted a picnic for twenty-five thousand people, many of them arriving on special trains from Great Falls and Billings. Linfield took this opportunity to make it clear that he believed Agronomy was the most important aspect of Montana agriculture.⁸⁴

In 1911 the Office of Western Irrigation and Agricultural Investigations and the Office of Dry Land Agricultural Investigations, both in the Department of Agriculture, established a sub-station at Osborn on the Huntley Project. They conducted most of their studies below the ditch however, some work was done in the area of dry farming. The Montana Experiment Station, in exchange for an annual contribution of seven-hundred and twenty dollars, participated in some of the experiments and obtained the results of all.⁸⁵

Expansion occurred in other areas as well at this time. The Legislature approved a special appropriation for new construction at the Judith Basin Station in addition to doubling its annual budget of eight-thousand dollars.⁸⁶ The number of demonstration farms had increased to nineteen and the now annual picnic at the Judith Basin station brought in an estimated three-thousand people.⁸⁷

In spite of the rapid growth of the Experiment stations during this period, Linfield felt that the station's facilities were still inadequate. Although he had earlier stated that the Judith Basin station represented average farming conditions, he soon recognized the need for additional permanent sub-stations in other areas of the state, particularly at this time. He planned to discontinue the nineteen demonstration farms scattered throughout the state⁸⁸

because the railroads had discontinued their direct⁸⁸ financial support.⁸⁹ Linfield began lobbying for an additional permanent sub-station in the North Central part of the state, one in the Eastern benchlands, preferably in Dawson County, and a third in the Flathead district.⁹⁰

Nineteen-thirteen marked the tenth anniversary of Linfield's directorship. In that ten-year period the land area of the station had gone from one-hundred and sixty acres to nine-hundred and sixty acres. The station established and maintained two permanent sub-stations and participated in the experiments of a third. They supervised demonstration work on seventeen other farms scattered across the state.⁹¹ In 1903 seven men made up the staff of the experiment station; the number had now increased to twenty-two.⁹² The primary concern of the station had gone from farming below the ditch to farming above the ditch. In 1903 one man staffed the Agronomy Department. By 1913 the department had grown to eight staff members fully employed plus an innumerable amount of student assistants and laborers. Agronomy consumed almost forty percent of the salaried force of the station.⁹³

A major factor which supplied the impetus for this rapid rate of growth was the annual revenue available to the station. In 1894 the station received fifteen-thousand dollars from the Federal government. Its only other source of income

was one-thousand and forty dollars from farm produce. This situation persisted until 1901, at which time the State Legislature appropriated one-thousand dollars per year for the maintenance of the station. In 1903 this state appropriation was increased to five-thousand dollars. The farm produce in that year supplied over four-thousand dollars. By 1911, however, significant changes had taken place. The Federal government now supplied thirty-thousand, farm produce almost seven-thousand and the state, over forty-two thousand. By 1913 the state's annual appropriation was sixty-six thousand and in 1918 exceeded one-hundred thousand dollars.⁹⁴

The above figures do not identify special appropriations made by the state for specific purposes, such as eighty-thousand dollars for building needs in 1908 or thirty-two thousand in 1910 for sub-station building improvements.⁹⁵ During this period the station did receive much financial assistance from other sources. The Federal appropriation of thirty-thousand dollars per year did not include salaries, material aid and cooperation by the Bureau of Plant Industry, at the Judith Basin Station.⁹⁶ Linfield also estimated that by 1913 the station received sixty-five thousand dollars "from other than State or Federal sources."⁹⁷ Twenty-three thousand dollars alone had come from the Northern Pacific Railroad. Until the fall of 1909, at which time the State

Supreme Court ruled it unconstitutional, the Station received free passes from the railroads.⁹⁸

The above figures by no means provide a comprehensive breakdown of the station's income receipts during this period; they do clearly demonstrate, however, that by 1911 the State Legislature had committed itself to an active support of the station and that assistance from the railroads, although helpful, played a minor role.

This growth of support from the State Legislature culminated in 1913 with the beginning of four areas of development which greatly improved the effectiveness of the station. Farm management studies were introduced as a separate department at this time.⁹⁹ The Legislature appropriated money to purchase five thousand acres of the old Assiniboine Reservation for use as a northern sub-station.¹⁰⁰ The Legislature also approved funds to establish the grain laboratory under the direction of the experiment station; but the most significant change occurred with the establishment of the Agricultural Extension Service as a distinct branch, separate from the Experiment Station.¹⁰¹

The creation of farm management studies in 1913 marked a major growth in the role of the Experiment Station. Yet Linfield, even as he brought about the creation of this department, had only begun to recognize its importance. He

stated that the "results of recent studies made in some Eastern states indicate that a thorough knowledge of farm management may be worth more to the farmer than many other kinds of agricultural knowledge."¹⁰² Even with the beginning of farm management in 1913, it was not until 1915 that investigations were done on dry land areas, and the conclusions of those studies were not published until 1911.¹⁰³

The purchase of the Fort Assiniboine Reservation from the Federal government provided Linfield with part of his request for three additional "field crop stations."¹⁰⁴ It was the only one provided for the Station before 1920 and its purchase was not actually completed until 1915. It took the Federal government two years to work out the procedures involving the change of ownership.¹⁰⁵

The establishment of the grain laboratory was less complicated. The Legislature appropriated two thousand dollars for equipment, as well as an additional four thousand dollars for maintenance. The purpose of this laboratory was to test "the purity and germination of agricultural seed" and "the baking qualities of flour made from Montana wheats."¹⁰⁶

The most important addition to the station in 1913, however, was the establishment of the Extension Service as a separate branch on equal footing with the College and the Station. Linfield had long been calling for the establishment

of a separate branch to deal exclusively with educating the farmers, a role vital to the total success of the Station and possibly the most difficult to achieve.

For many years farmers had maintained a strong prejudice against agricultural colleges and experiment stations. Efforts on the part of colleges and experimenters to communicate with the farmers often ended in failure. This situation was not always due to the intransigence of the farmers. In the early years during the 1870's and 1880's no qualified agriculturalist existed; trained teachers were educated only in the classical sciences. Oftentimes experienced and successful farmers attempted to take on the role of teachers, but they lacked teaching experience and all-around education in general.¹⁰⁷

Even with the increase in available teachers and agricultural specialist, communication and farmer education proved difficult to achieve. A study done around 1910 in Wisconsin revealed that after Farmers' Institute workers and the agricultural press labored for ten years, preaching this gospel of alfalfa growing, only one farmer in forty was growing alfalfa.¹⁰⁸

Linfield acknowledged that this communication problem existed in Montana as well as other areas of the country and credited some of the problem specifically to the farmer. He

felt that many farmers desired "to get the longest possible present return with the least regard to what the future may bring as a result of present practices."¹⁰⁹ Nevertheless, in spite of any disregard the farmers had, he felt strongly that it was necessary, especially in Montana, that they reach the farmer and improve his farming techniques for "the man who attains a large success under these new conditions in a new country must be well informed and must know how to do his work right."¹¹⁰

Linfield believed that success in educating the farmer depended on the presence of several characteristics in the Extension program. The people in the program must be well trained and always available to the farmer. The information must be reliable and accurate and consistent with other studies. It was essential that all the branches of the Agricultural Division, the College, the station and the Extension Service publicly agree with one another and teach the same thing.¹¹¹

Linfield approached the farmers of Montana two ways: publications, and direct teaching, which he considered the more effective method, although the more costly as well. The Station continually published bulletins on all their experiments, but these were highly technical, often unreadable by

farmers and generally aimed at other experimenters. To communicate the results of various experiments to the farmer, the Station published circulars and leaflets which merely described the results of experiments and how these conclusions could be utilized by the farmer. If the farmer felt that he needed more information then he could consult the bulletin.¹¹²

Linfield recognized, however, that the real challenge of extension work was not the writing and printing of bulletins and circulars, but in the problem of making the farmer aware of just what material was available and how he could utilize it. Linfield suggested first that County Extension Agents, agricultural instructors in the high schools and local businessmen be used to disseminate this information to the farmer. Beyond this, the Station would print about two thousand posters listing the material available and display them in areas where farmers generally congregated. In addition to these large posters, small card posters calling attention to a particular circular or bulletin would be printed and mailed out to all of the people on the Station's mailing list. Ultimately a list of all publications available would be printed twice a year and sent out upon request.¹¹³

The newspapers, however, were the most effective vehicles the Station could utilize in its efforts to communicate with the farmer.¹¹⁴ By 1913 the Station supplied a

minimum of five-hundred words per week to all the newspapers in the state, in addition to six-thousand words of special agricultural material available upon request.¹¹⁵

The second method was to reach the farmer directly. Linfield considered this to be the most effective method and continually urged local organizations and communities to assist the Station in bringing it about. The Experiment Station gradually began to adopt a multitude of forms and methods with which to obtain direct communication with the farmers. It organized movable schools, conveniently located and staffed with qualified teachers. Local communities organized fairs, encouraged exhibits and brought in experienced judges. In conjunction with this, communities organized industrial clubs through which boys and girls could compete in corn growing or sheep raising.¹¹⁶ In 1910 James J. Hill offered a prize of one-thousand dollars to the best corn grown in Yellowstone County.¹¹⁷ Linfield urged that rural communities introduce agricultural education into their school curriculums, and that high schools throughout the state hire qualified lecturers and organize lecture courses for both students and adults in the community.

In 1910, with a strong assist from the railroads, the Station began using demonstration trains oftentimes, with as many as fifteen to twenty instructors. The Station staff also

set up correspondence courses for farmers that they could not reach.¹¹⁸

At one point Linfield tried to get the local farmers to develop a system of county agriculturalists. Borrowing from a method which the Ontario Agricultural College had developed, he urged local community high schools to hire agricultural graduates as part-time teachers. The local farmers could then also employ these people to advise them and keep them informed about new methods which might be of use to them. The cost under these circumstances would be distributed over a larger area and thus become far less prohibitive.¹¹⁹

By 1914 Linfield finally achieved in establishing an agricultural school in Bozeman which could accept eighth grade graduates. Agricultural courses and elementary science replaced foreign language studies and mathematics courses. The school year began in late October, after the harvest, and ended in April, before the spring planting. The total program lasted three years. If the student desired to attend college he could take a fourth year, consisting of mathematics and foreign language.¹²⁰

The Station also offered a two-week course in January, specifically designed for farmers who had difficulty finding time to be away from their work. The subject matter

of these short courses varied each year so that, over a period of time, the farmer could obtain a wide range of knowledge. For those farmers in the dairy business, the Station offered a dairying course in January, as well.¹²¹

A short time later the Station set up another agricultural school on the Northern Montana sub-station near Hayre.¹²² Linfield generally voiced opposition to the establishment of agricultural schools around the state. He felt that they represented an inefficient use of funds. Schools established on an experiment station started with all the facilities necessary to construct a valid curriculum. Schools separated from the experiment station's facilities would have to spend large amounts of money simply to duplicate these facilities. Linfield felt that duplication represented a high potential for waste.¹²³

The most important method and most commonly used one for reaching out to the farmer was the Farmers' Institutes. The Farmers' Institutes played an extremely important role in the work of the experiment station in its early years because there was no extension service. The Farmers' Institutes had to be employed as an extension service, and the station would have to bear its costs.

Farmers' Institutes first appeared in Michigan in 1876, but Ohio in 1880 was the first to organize a statewide

comprehensive system of institutes with an effective force of instructors.¹²⁴ In Montana the Farmers' Institutes came into existence with the Experiment Station in 1893.¹²⁵ At that time financial support came solely from private sources; oftentimes in the early years of the station money was in such short supply that the Experiment Station cancelled Institute meetings for over a year.¹²⁶ In 1901 the State Legislature organized the Farmers' Institutes under a Board of Administrators. The Legislature appropriated two thousand dollars for its support.¹²⁷ The Director of the Experiment Station was to be the Secretary of the Board, and since there was so little money, the Board decided not to hire a Superintendent. The responsibility of organizing the Institutes fell to the Secretary.¹²⁸

In 1904 when Linfield accepted the position of Director of the Station he equally accepted charge of the Institutes. The lack of funding continued to severely hamper the program. Attacks on the Institutes and its Secretary invoked strong responses from Linfield. At one point Linfield felt that one particular attack was so irrational that he told the individual that if he was so ignorant that he could not recognize the value of a specific discussion, then he could just "go to ----."¹²⁹

By 1906 Linfield was lobbying for an independently funded extension service. In that year he had spent one-hundred and ten days in the field working for the Farmers' Institutes. He simply could not afford the time.¹³⁰

In 1907 the Legislature acted. It did not create the desired extension service, but it did agree to fund the Institutes and hire a Superintendent. The Legislature provided seven-thousand five-hundred dollars. Professor Cooley, the Station's Entomologist from the Massachusetts Agricultural College, became the Superintendent.¹³¹

In the next seven years the situation continued to improve. In 1909 the Legislature raised the Institute's appropriation, and in 1911 it reached ten-thousand dollars.¹³² In 1911 the Station organized a demonstration train with the help of the Northern Pacific. For two months in the spring it traveled across the state carrying fourteen teachers and experiment station staff members. Linfield estimated that the train and its personnel reached twenty-five to thirty-thousand people.¹³³

In 1913, the Legislature finally agreed to Linfield's request and created the Department of Agricultural Extension. Although Director Linfield would still have authority over the Extension Service, it was to function as an independent branch of the station under the direction of Professor Cooley.¹³⁴

The 1913 decision of the Legislature was vitally important to the success of the Experiment Station. Administering the research work, as well as the extension work, created too much of a burden on the Director. The success of each program depended directly upon the success of the other, but under the combined leadership they threatened one another. With the Extension Service no longer his direct responsibility, Linfield was able to devote most of his time to the management of the Station.

The growth of the Experiment Station after 1913 was far less spectacular. The physical plant necessary to meet the immediate needs of the Station and the state was relatively complete. Linfield continued to pursue his request for additional sub-stations, particularly his request for an Eastern station in Dawson County. He argued that the present sub-stations conducting dry farm studies were all in the Chinook belt and at higher elevations than the Eastern benchlands. A station in the East was necessary for corn and forage experiments.¹³⁵

In 1915 the Station separated farm management studies from the Agronomy Department and set up an independent Farm Management Department. Linfield seemed to be growing more impressed all the time with the importance of farm management

work. He felt the greatest amount of progress was taking place in the farm management area.¹³⁶

In 1917, World War I created havoc with Montana agriculture. Demand and prices soared. In spite of extremely dry conditions, Montana farmers produced "three times the home demand for wheat."¹³⁷ This high production was brought about because farmers, anticipating inflated prices, plowed and planted on marginal land. Many farmers who had previously marketed their grain through livestock, anticipating a higher profit, ceased to do so.¹³⁸

Nineteen-seventeen also marked the beginning of four years of unprecedented drought, but in their efforts to meet the demands of war, both the Station and the farmers concerned themselves with production rather than the drought or the long-term future of Montana agriculture.¹³⁹ It was not until after the war that the station fully and publicly realized the seriousness of the situation, and that crisis was upon them.¹⁴⁰ By 1920 a combination of severe natural disorders and unstable economic forces had combined to create for the Station its greatest challenge.

III

THE STATION'S WORK IN DRY FARMING: 1902-1920

In this period from 1902 to 1920 the Montana Experiment Station and particularly the Agronomy Department grew at a tremendous rate in their knowledge of dry farming techniques as well as their awareness of the size and complexity of the problems facing the flood of Montana homesteaders at that time. Alfred Atkinson, the head of the Agronomy Department, described dry farming as "raising crops in regions of less than eighteen inches average annual precipitation without the aid of irrigation."¹ Evidence indicates that this type of farming appeared in ancient Mesopotamia, Tunisia and Pre-conquest Mexico.² "The practice is reported to have been introduced into the United States in California during the Gold Rush of 1849."³

The area of the United States that most closely approximates Atkinson's eighteen inches or less rule is the Great Plains. This region which lies between the Rocky Mountains in the west and the thirty-eighth meridian in the east generally receives an annual precipitation of twenty inches or less. The ninety-eighth meridian passes through central Kansas and Oklahoma and separates eastern Texas from the central and western portions of the state. In the north this line "approximates the twenty-inch total

annual precipitation line." In the south it more closely marks the thirty-inch precipitation level; however, "evaporation reduces the effectiveness of this added ten inches."⁴

The Great Plains region incorporates the western and central parts of the Dakotas, Nebraska, Kansas, Oklahoma and Texas, as well as the eastern portions of New Mexico, Colorado and Wyoming. In Montana, the Great Plains region encompasses the eastern and central portions of the state.⁵

Linfield testified that Colorado was the first state in the Great Plains to begin systematic dry farming studies. He stated that Colorado began experimenting in 1894, but eventually abandoned the work because of a shortage of funds.⁶ They resumed operations again around 1901. Utah set up its first stations in 1904, closely followed by North and South Dakota and Kansas.⁷

Although in Montana many farmers, particularly those in the Great Falls area, practiced dry farming techniques before 1900,⁸ it was not until after the turn of the century that the Montana Experiment Station committed itself to pursuing dry farming research. In the fall of 1902 Director Fortier and the station Agriculturist, F. B. Linfield, considered asking the State Legislature for an appropriation specifically for dry farming experimentation, but eventually decided to concentrate these efforts on obtaining appropria-

tions for other needs, such as equipment and building supplies. Little was done until in 1905 when the Northern Pacific Railroad decided to become involved in dry farm studies themselves. The company withdrew large sections of its land in Montana from the market and invited Director Linfield to attend a meeting in February of that year to discuss the matter.⁹ The Northern Pacific decided to spend twenty-five hundred dollars with which to start. The United States Department of Agriculture contributed one thousand dollars and the Montana Legislature also agreed to spend one thousand dollars. With these payments secured, Linfield approached the Great Northern Railroad and was able to obtain an additional contribution of two thousand dollars.¹⁰

The people of Montana also contributed both money and labor. In Helena the people fenced off two hundred acres, built a house and dug a well at a cost of three hundred dollars. In Forsyth the people contributed one hundred dollars to get the breaking started.¹¹

The railroads set up and maintained five sub-stations. Three were on the Northern Pacific line from Billings eastward and two on the Great Northern route. The Experiment Station supervised the farm work.¹²

In the beginning the station researchers knew little about the duty of water, so it was to this that Atkinson

and his staff turned their attention. They reasoned that successful crop growth required the presence of five basic elements; i.e., heat, air, moisture, light and plant food. They took for granted that heat, air, light, and plant food were in abundant supply. Water they knew was not. In order to achieve success, the dry farmer needed to conserve and preserve every ounce of moisture available to him; therefore, the researchers had to know everything about water and its relationship to plant growth.¹³

A strong note of optimism prevailed as experimentation began. The researchers drew conclusions readily. Precipitation tables for Miles City, Forsyth, Billings, Great Falls, Choteau, Havre and Chinook showed that over thirteen inches was the average annual rainfall, with about a four-inch variation from one year to the next. "The variations noted on these two years (1905-06) are about as wide as occur."¹⁴

Atkinson used several other experiments that also helped to draw a bright picture for the future. The Wisconsin Experiment Station, under the guidance of Professor King, had experimented with the relationship of water to plant growth. The Utah Experiment Station also pursuing this study, augmented King's work and ultimately were able to draw several useful conclusions. In a sub-humid climate, one inch of precipitation will produce two and a half bushels of wheat per acre.

"... a very paying crop could be raised."¹⁵

How to preserve the moisture in the soil then became the key to success. King had determined that water existed in the soil in three ways: free water, which filled up all the air pockets; capillary water, which provided a thin layer of film around each soil particle; and hygroscopic water, which existed inside the soil particle. Free water smothered the soil; hygroscopic water was present in such small amounts that it could not act as a carrying agent; capillary water was the most important.¹⁶

Atkinson believed that capillary water moved up and out of the soil from wet places to dry places. His objective, therefore, was to prevent capillary action from taking place in the soil and thus preventing water loss to the atmosphere. Atkinson went back to King's experiments which pointed to the fact that moisture would not rise through a disturbed area.

"Knowing then that by disturbing the soil so as to break the soil ladder, or by allowing the soil to become dried out, the movement of capillary water may be interfered with, and we are in a position to control the loss of moisture in the soil ... Both the breaking of the soil ladder and the drying out of the surface, result from surface cultivations ... In other words, continued cultivating of the surface soil will imprison the moisture."¹⁷

In 1907, notwithstanding the fact that the Montana sub-stations only existed for one year, Atkinson issued several specific directions designed to hold soil moisture. He recommended plowing to a depth of eight to twelve inches and, if possible, sub-soiling with a special plow to a depth of sixteen inches.¹⁸

Not all state experiment stations concurred with Atkinson at this time. The Utah Experiment Station in 1906 stated that, "deep plowing or even sub-soiling for every dry farm section of Utah and for every season is not always conducive to the best results. In as much as conditions vary so widely from year to year ... it would be going beyond our knowledge of the subject to say that deep plowing is in all cases indispensable to the best results in dry land farming." This, however, was the only time that Professor Jardine at Utah came in conflict with conclusions drawn in Montana.

Atkinson also had recommended cultivation immediately after plowing. "immediately in this connection meaning the same day,"²⁰ as well as continuous cultivation while summer fallowing, especially after every crust-forming rain. In other areas other than those directly related to moisture control, he urged the use of hard strains of grain, thin seeding and nitrogen-gathering crops.²¹

In 1908, after further experiments, the Station enlarged on this advice. They recommended that Turkey Red Wheat, which produced an average of thirty-seven bushels per acre, was the strain with the greatest potential.²² In fact, all "fall sown crops yielded better on the average than spring-sown crops." They also regarded Turkey Red as an excellent baking wheat.²³

It did not prove as easy to draw conclusions on other grains. The researchers found little differences among the spring-sown wheats, although they were impressed with white Hulless barley. They were not able to draw conclusions concerning crops such as flax, alfalfa, corn, sugar beets and potatoes; nor were they able to make recommendations concerning the rate or intensity of seeding. Some tests had indicated, however, that light seeding, from three to five pecks per acre, was better in the case of grain crops, than a lighter amount.²⁴

They recommended summer fallowing, but were not willing to overwhelmingly endorse it. Even though summer fallowing definitely brought about a higher yield per acre, that extra yield did not equal the total yield for two years of cropping. It could be financially impossible for a newcomer to let his whole field or any part of his field remain idle for an entire year. The Utah State Experiment Station

however, was more decisive. "At the present time arid farming within the Great Basin is somewhat precarious, unless the land is clean-fallowed every other year; if fallowing is carefully practiced, however, crop failures on the arid farms are almost unknown."²⁵ It was not really until the Montana station fully recognized the need and importance of farm management and utilizing forage crops such as corn, in four and five-year rotation cycles that fallowing became more palatable to the average farmer.

In 1908 the Station was able to publish information on areas other than specific. At this time they supplied some detail as to just where they were conducting their experiments. In 1907 the State Legislature had established a permanent dry farming sub-station near Moccasin in the Judith Basin in Fergus County,²⁶ however, it did not begin operations until the spring of 1908.²⁷ Prior to the establishment of this permanent sub-station, much of the work directly related to dry farming took place at the demonstration farms which the railroads had set up around the state. In some instances the station conducted experiments on privately-owned farms. In Dawson County work had started on the farm of Jacob Mullet, but the station later transferred it to Mr. J. J. Bointraegger's farm. In Forsyth the station conducted experiments on Mr. L. T. Pemberton's farm and in

Yellowstone County on Mr. John H. Shroeder's farm. Mr. R. S. Ford offered his farm in Cascade County for use by the station and in Choteau the state used land donated by the Federal government.²⁸ Although it was several years before Linfield identified these temporary stations as demonstration farms, a resemblance to some of the teaching techniques developed by Seaman Knapp in the South were clearly visible.

The Station also attempted in 1908 to try and determine to just what extent local farmers were utilizing generally accepted dry farming techniques. In May and June of that year Mr. W. W. Spain, working for the Montana Station interviewed seventy dry land farmers in Fergus and Valley counties. All but five had settled on their present farm after 1900. Sixty-six of the men had filed under the Homestead Law; however, only a few of them owned less than 160 acres, and more than half believed that three-hundred and twenty provided the best unit with which to work the land purchased. The price averaged a little over ten dollars per acre.

One half fully recognized the need for heavy cultivation and the employment of winter grains; however, less than half practiced summer fallowing. Deep plowing, to depths of eight to ten inches was non-existent. Most farms averaged about seven horses, eight cattle, and six hogs. The estimated cost to begin farming varied considerably, from

five-hundred dollars to sixty-five hundred; however, most of the settlers agreed that a minimum wage of one-thousand dollars was essential.²⁹

In 1910 the Station published its last general statement on dry farming. It was an effort by Atkinson to summarize six seasons of work, and provide some general conclusions which would be of some use to Montana's dry farmers.

In the summary, Atkinson was able to identify few changes from previously published material. He still recognized that Turkey Red was the most profitable wheat, although the emphasis was now on Kharkov, a type of Turkey Red originally imported from Southern Russia.³⁰ He strongly endorsed summer fallowing, provided that the farmer tilled the fallow throughout the summer. He also concluded that fall plowing or spring plowing made little difference in the total yield.³¹

Atkinson made an attempt at this time, as well, to defend himself and the Station from critics of the Station's dry farming efforts. He stated that "those who were familiar with the conditions in Montana when the non-irrigated lands were considered as valuable for range purposes only, sometimes, he suggested that the amount of annual precipitation has been much greater than normal during the past five or six years. To find out if such were the case, a careful study of the Weather Bureau records was made."³²

The statistics presented by the Weather Bureau and the various weather stations around the state identified little variation from one year to the next; however, the statistics presented to the Station left many questions unanswered. The conditions and manner in which they obtained the older records were not clear, nor was it clear in the case of averages just how many years the examiners were able to obtain the data.³³ This did not deter the Station, however, from drawing definite conclusions. "We believe the figures presented will justify the assumption that so far as precipitation was concerned the six years during which (dry farm study) was carried on, were as nearly representative as any like period which might have been selected."³⁴

The study did clearly demonstrate that the greatest amount of rainfall occurred on the average in June, and that in most areas up to sixty percent of the annual precipitation fell during the growing season. "This makes possible the very fullest use of the water by nature."³⁵

A summary of the grain studies that the Station had conducted over the six-year period served only to further strengthen Atkinson's optimism for the future of dry farming in Montana. "As a general summary of the six year's work, it is fair to say that non-irrigated land of Montana may be made to raise profitable crops under proper methods of tillage and

crop management. Such acre yields as 32.45 bushels of Turkey Red wheat; 16,86 bushels of Kwbanka spring wheat; 40.06 bushels of Sixty-day oats; 32.36 bushels of matured corn; 105.32 bushels of potatoes, and 1.87 tons of alfalfa ... warrant this statement."³⁶

This statement marked the end of six years of experimentation, but it also marked the point at which the experiment station staff realized that dry farming was an extremely complex study, and that they could no longer treat it in general terms. They divided and sub-divided experiments into specific categories: grain studies, climate studies, rotation studies, culture studies, corn studies, fallow studies and forage studies. Atkinson and his staff now realized the need to treat each one in detail, and that failure in one area did not mean failure throughout; nor did success in one area indicate success for the future of the whole dry farming program.

By 1910 grain studies had grown to be an integral part of the dry farming experimentation program. Formerly the Station had conducted grain experiments under irrigation in Bozeman, but with the establishment of the dry farm sub-station in the Judith Basin, they transferred most of their grain work there.

The Legislature had appropriated one thousand dollars for the Judith Basin Station in 1907. Originally it contained

one-hundred and sixty acres, but expansion took place early. By 1912 the Station had six-hundred and forty acres with two-hundred and eighty of them broken and under cultivation.³⁷

Peculiar soil conditions made it almost impossible to store any appreciable amount of water, so annual rainfall and seasonal distribution was extremely important.³⁸ From 1898 to 1915 the Station averaged over sixteen inches of precipitation per year, recording an annual maximum of 23.76 inches in 1909 and a minimum of 10.42 inches in 1900. The Station averaged almost nine and a half inches of rain per year during the prime growing season, April through July.³⁹

The staff found it difficult to locate ground water. In 1912, over five years after the Station began, the personnel were still hauling water one and a half miles.⁴⁰

Although the Montana Agricultural Experiment Station owned the Judith Basin Station and organized its research program, the Federal government, through the Office of Dry Farming Agriculture, paid the salary of the Superintendent, and the Office of Grain Investigations paid the salary of his assistant.

The investigations conducted followed several lines with a series of goals in mind. The Station wished to clearly identify the best winter and spring wheat, as well as the best barleys, oats and flax. They were also attempting to

determine the most favorable time and rate of sowing and the best techniques for planting.

Publications issued in 1910 and up through the drought years were consistent in their choice of wheats. Winter wheat resulted in higher yields than spring wheat, and of all the winter wheats, Kharkov was the highest producer.⁴¹

Kharkov had first appeared in the United States in 1901.⁴² The Station introduced it into Montana in 1908 and by 1913 it dominated the list of most profitable producers.⁴³ The Station also found that Kharkov was more drought resistant than any other grains tested. By 1915 the Station had distributed over two-thousand bushels of this grain to farmers around the state.⁴⁴

The researchers placed much less emphasis at this time on spring wheat, even though its yields were impressive. Later as farming on the benchlands increased, spring wheat grew in popularity. Farmers found that winter wheat on the benchlands was highly subject to winter-kill. Of the spring wheats studied, Pelissier and Marquis were the most successful, averaging almost thirty bushels per acre at the Fergus County Station in 1914.⁴⁵

From 1909 to 1913 Montana's winter wheat averaged 27.2 bushels per acre, while the national average was only 13.4.⁴⁶ In this same period, total production of winter wheat

in Montana doubled, and by 1915 set its highest records for wheat production prior to the drought.⁴⁷ These figures provided ample evidence to Montana's optimists, who believed that the future of Montana agriculture was bright.

In studies conducted on other types of grain, the tests found Sixty-day oats to be superior, while in the barley classification, they clearly indicated that Smyrna was the most productive.⁴⁸ Variety tests on flax supported the belief that the Russian types were superior.⁴⁹ In 1915, of all varieties of grain tested, Kharkov yielded the highest value per acre, while White Smyrna and Russian flax classed second and third respectively.⁵⁰

The Station researchers conducted a variety of other tests with grain. They wanted to determine the most appropriate time to plant, as well as how many pecks per acre would be most efficient. The tests indicated that from August 10 to September 12 was the best time to plant winter wheat. The farmer should plant his spring wheat as soon as the ground was ready.⁵¹ With regard to the intensity of seeding, the tests indicated that the farmer should plant his winter wheat at three pecks per acre and his spring wheat at four. The Station was also conducting experiments in the practice of drilling wheat in between rows of standing corn. The results were so promising that they encouraged Atkinson to

speculate that grain in the future would be grown in this way in corn-growing areas of the state.⁵²

Beyond grain studies, other areas of major emphasis appeared. The Station had already committed itself to elaborate studies of soil moisture and its retention in the soil. It was clear that the Station staff regarded the quality of the farmers' cultivation techniques and his ability to preserve the existing soil moisture as the most important aspect of Moisture studies; however, they did also do climate studies, particularly statistical studies of precipitation.⁵³

It was not until 1914 that the Station published a comprehensive study of Montana climate; however, isolated studies and their results did appear earlier.⁵⁴ As already noted, the Station staff was sensitive to critics who felt that they were misleading potential homesteaders by quoting statistics recorded after 1905. Critics argued that these years were continually making above average rainfall.⁵⁵ Whenever the Station published precipitation statistics, they made a point of stressing that these statistics were truly representative of their respective areas, as well as many other areas of the state.⁵⁶

One of the difficulties confronting climate research at the time was the lack of long-term records throughout the

state. Statistics recorded at Helena, Kalispell, Miles City and Havre all preceed 1900 and were credited to the United States Weather Bureau, but other records cited by the Station came from private sources around the state, such as Peter Koch, who supplied Bozeman records from 1880 to 1900.⁵⁷ The problem with these private records was that the Station was not always sure who recorded them and under what conditions. Many times these records were also incomplete.⁵⁸

The most complete record located by the Station dated back to 1878 and monitored the Miles City area.⁵⁹ According to this record, precipitation in Miles City dramatically increased in the period 1905-1910. Of those six years, only one year, 1905, was below the average. Nowhere else in the entire record did the Station note such a drastic increase. In fact, with the exception of 1878-1880 and 1893-1894, they were not able to locate any other consecutive above average years.⁶⁰

Miles City continued to record high precipitation figures well into the period described in the twentieth century. By 1920 the average annual precipitation of Miles City had gone from 12.93 inches in 1910 to 13.55 inches.⁶¹

The Judith Basin area also recorded increases in precipitation at this time. In 1920 the Station was able to compute the annual precipitation for the Basin area over a twenty-year period at 16.87.⁶² From 1908 to 1911 precipitation

increased almost fifty percent. Such an increase would have to have had dramatic effects, since dry farming experimentation began at the Fergus County station in the Judith Basin the spring of 1908.⁶³

Annual precipitation statistics such as the above, however, were definitely misleading, regardless of who was using them. In Dawson County, just north of the Miles City weather station, precipitation in 1907 and 1908, contrary to Miles City statistics, was well below normal.⁶⁴ Yet even this statistic said little other than to point to the fact that regional variations accompanied seasonal variations.

In 1924 the Station organized and published a complete report on climate in Montana in an effort to clear up any misunderstandings as well as to answer Station critics.⁶⁵ In this report they collated average monthly precipitation statistics for June and July from thirty-seven stations in Montana. The records, with some exceptions, cover the years 1891 to 1910.⁶⁶ Although they noted some increases for the years 1906 to 1910, some of which were quite dramatic, they also noted decreases in other areas, often just as dramatic.

This 1914 climatic study sustained the general conclusion that the annual and monthly precipitation varied considerably from region to region and year to year, "but the climate does not change." The only fault that one might

ascribe to the Station staff of this time was not that they read these statistics from their own point of view, but that they failed to recognize the significance and potential danger of extremes. If three extremely wet years could occur consecutively in any one area, then three severely dry years might also occur consecutively. But even here, the record provided no precedent which might hint at such a possibility. Miles City revealed consecutive dry years from 1881-1885 only, and they were not severe in nature.⁶⁷

The Station performed many climatic studies in direct conjunction with experiments dealing with crop rotations. The objective of these rotation studies was to find a way to efficiently utilize both soil moisture and soil nutrients.

By 1910 the Experiment Station staff had fully accepted the principle that it was "more profitable to raise grain crops under a system of alternate cropping and summer fallowing or tillage than to raise them continually."⁶⁸ The challenge faced by the Station was to find a crop which could take the place of summer fallow at least periodically. As already noted, farmers often refused to use summer fallowing because it spread their profits over two years. At Fergus County the staff investigated all varieties of grain and forage crops in various rotation cycles: crop following

crop; crop following fallow.⁶⁹ While the Station was experimenting, farmers in the Judith Basin were following a rotation cycle that used summer fallow every third year.

In 1922 Atkinson recommended this possibility of raising corn or potatoes as a substitute crop for fallow. The farmer could inter-till both of these crops and neither would use as much soil moisture as a grain crop.⁷⁰ Serious studies involving corn began in 1908; however, no type could mature fast enough to beat the first killing frost.⁷¹ The short growing season was not the only limiting factor; the lack of sufficient moisture also determined growth.⁷² Finally the Station researchers discovered that Dent and several others were almost capable of reaching maturity, and in this later stage could serve as an excellent fodder or silage.⁷³

As experiments continued corn began to look more and more valuable. An average year of corn fodder in the rotation was twice as great as an average yield of alfalfa, Brown grass or red clover.⁷⁴ Winter wheat yielded a much greater profit following corn than coming after fallow in the rotation. Spring wheat also proved more profitable following corn in the rotation.⁷⁵

In the spring of 1914 corn of several varieties "was furnished to farmers in every county in Montana."⁷⁶ The Station sent out two hundred and fifty-six samples.⁷⁷

When the drought years arrived, corn's role in the rotation appeared to be clear. Agricultural survival for the dry farmer in Montana would depend on the efficiency of its management.⁷⁸ Livestock played a major role in the farmer's chance of success, and as such a good forage crop was valuable and necessary. In 1919 Linfield stressed a five-year rotation involving two forage crops, preferably corn, two grain crops, and one summer fallow.⁷⁹ By 1920 experiments with corn were still far from conclusive. Linfield felt that the need for more experiments justified his requests for an Eastern Montana sub-station.⁸⁰ Yet it is clear that an understanding of the problems and a recognition of the need for managed and efficient crop rotation was much present in 1920.

Rotation studies, in order to achieve success, relied to a large extent on companion studies on cultivation techniques. These studies also played a role in emphasizing the value of corn in the rotation. Tillage was a primary factor in preserving moisture, and corn allowed for inter-tilling of the crop throughout the summer; thereby, providing the farmer with both an income for that year and moisture enough in the soil for a grain crop the following year.

Experiments with various cultivation methods were of supreme importance to dry farming. The farmer had no control over the amount of precipitation but he could possibly improve

or preserve the soil moisture content immediately at hand. Moisture was in such short supply that the farmer simply could never afford to waste any.

In examining moisture control and preservation it was necessary for the Station to pursue a varied course of study. By 1908 it was clearly established "that growing grain each alternate year, with properly cultivated summer fallow between, will bring decidedly more profitable returns than growing grains every year on the same field."⁸¹ Although earlier in the decade researchers had raised some questions about the practical use of fallow, by 1908 and certainly by 1909, they all fully accepted the practice.⁸²

However, even though researchers generally accepted fallow, they did not understand the movement of water in the soil under fallowed conditions. Particularly puzzling at this time was the nature of evaporation and how to prevent it from taking place or, at a minimum, to hamper it.

By 1911 experimenters in Forsyth, trying to understand some of the problems of retention and evaporation prevention, conducted tests on range land. They found that under grazing and pasture rotations they were able to retard evaporation and concluded that "the covering of grass holds the moisture and lessens evaporation, while the water rapidly escapes from bare exposed soil."⁸³

They also conducted tests on the techniques of caring for fallow. Merely to let the soil lie fallow was not enough. The surface soil needed continued work. In 1907 Atkinson stated that "both the breaking of the soil ladder and the drying out of the surface result from surface cultivations."⁸⁴ Based on work that they completed after 1907, the Station staff was able to clearly demonstrate a "rapid decrease in the percentage of moisture in the uncultivated fallow soon after the warm period of June and July sets in ... This suggests the importance of prompt and thorough attention to fallow about the time that the spring rains close and the warming period commences."⁸⁵ In the following year the Station recorded decidedly better yields on the fallow plots that they had repeatedly cultivated. Those plots that they did not cultivate showed a poorer yield.

Several other conclusions related to moisture studies emerged at this time. Test results indicated that before the warm weather arrived in late June, much of the moisture of any value had left the soil. This necessitated early maturing crops "which have their growth period well advanced by the end of June, so that after this time the crops will have to complete the ripening process only."⁸⁶

The approximate time for plowing was another question which remained of some concern; however, "it is evident that,

when the fallow was carefully cared for, the time of plowing could be left to the convenience of the farmer."⁸⁷ Atkinson recommended that the farmer plow in the spring simply because it took much less effort than fall plowing.

The first tests completed at this time indicated that if the farmer cropped and cultivated the soil for several years he developed a higher percentage of moisture content. Atkinson stated that the ramifications of this situation "on climate or other conditions must be determined by investigations of another sort."⁸⁸

By 1908 the Station was able to eliminate fallow from a two-year cycle and utilize it only once in a five-year rotation. They had done much experimenting with inter-tillage crops such as corn and potatoes, as well as green manure crops. Corn, as mentioned earlier, because of its tendency to use little moisture and provide some return in an otherwise non-profit year, was able to replace one of the fallow years. It was clear, however, by 1918, that even if the farmer did not use corn or another forage crop in the rotation cycle, but simply employed fallow every other year, he would in the course of a ten-year period net a higher overall yield and financial profit, than he would have had with continued cropping. By this point the Station was able

to clearly state that the practice of continued cropping was both unprofitable and dangerous.

Another area of concern throughout the studies done on the preservation of soil moisture was the depth of plowing. Considerable disagreement existed on this question. Some advocates supported twelve inches;⁸⁹ the Montana Station argued that six was sufficient.⁹⁰ Since no consensus existed the farmer was left to choose his own method.

A final point to note was the developing interest, especially on the part of Director Linfield, with experiments involving the growing and feeding of sunflowers to dairy cows. In 1917 the Station published a brief report concerning the use of sunflowers as silage; and although they drew few conclusions, the future for sunflowers as a forage crop appeared promising.⁹¹

In 1919 a more complete report was published. At this point the Station stated several favorable conclusions. They considered Mamouth Russian to be the most productive strain and tested out well when they compared it to corn silage. The researchers found little difficulty in getting the cattle, or for that matter, hogs, to eat sunflower silage, nor did they find any flavor or odor in the milk.⁹²

Linfield saw the value of sunflowers as a potentially inexpensive forage crop which could be kept over from one

season to another as silage. The drought years had demonstrated a need for economic management which in turn emphasized the need to develop the most efficient crop and livestock operation possible. Linfield envisioned sunflowers as a major contributor in such a system.⁹³

By 1920, although the Station's work was yet incomplete, it had made fantastic progress, and because of this progress it was able to attack the agricultural problems facing the state. The Station could now advise the farmer on specific truths such as the need for rotation, summer fallow, and systematic management, as well as ^{to} continue to research questions in soils, grains and forage areas. By 1920 the environment had made its challenge and the Station was ready to accept.

IV

A Changed View

The period from Linfield's arrival at the Experiment Station in Bozeman in 1902 until the onslaught of the drought years following 1916 marked a period of immense growth for both Montana agriculture and the Experiment Station. In 1917 disaster struck as nature and the first World War created havoc with Montana's agriculture. Gradually the economy of the state began to collapse. Farmers gave up hope and left the state.

At the Montana Experiment Station, however, the collapse brought on a resurgence of determination. As the agricultural problem began to mount, the Station grew; but it was not the physical facilities that expanded. The objectives of the Station began to enlarge and mature. Linfield and the Station began to recognize the need to serve the farmers in a much more comprehensive way than earlier. The emphasis shifted from the need to improve the farmer's profit to the need to improve the overall quality of his life and that of his family.

The stage for agricultural collapse began to develop in 1900. At that time the number of farms in Montana totaled 13,370, of which 8,043 utilized irrigation. In 1910 the

total figure had grown to 26,214 but those supported by irrigation had only risen to 8,970. By 1920 the total figure reached 57,677 but only 10,807 employed irrigation. In the period from 1900 to 1920, the same period in which the experiment station was only beginning to cope with dry farming techniques, the amount of dry farms in Montana increased over eight times. In that same period, as Linfield had predicted it would, the value of Montana's land and buildings increased from a little over sixty-two million dollars to over seven-hundred and seventy-six and a half million.¹

Apparently the boomers and the optimists were right. The populations of the state had exploded. Farming the benchlands had proved profitable. Growth and prosperity had reached Montana. The statistics, however, were misleading. By 1925 the number of farms in Montana had decreased to twenty percent, the total value of land and buildings had dropped forty percent.² In 1923 alone, over five thousand farms foreclosed.³

Although the statistics did not indicate it, agricultural collapse began in Montana well before 1920. In 1915 the wheat harvest was the highest yet achieved, and in the fall, the spirit of the people was high, but the winter struck hard. Winter-kill destroyed much of the winter wheat crop.⁴ Four of the driest years on record followed the devastating winter of 1916.⁵ By 1920 the optimism of the earlier years had

totally disappeared. Farmers abandoned their homes, their machinery, their debts and their hopes. They packed up whatever they could carry and left Montana behind them.

Much debate has surrounded this agricultural failure and depressing exodus. People have tried to locate the villain, someone to shoulder responsibility and take the blame.

Linfield did not accept the blame, nor did he look to the farmer. He recognized that high wheat prices due to the high demand for food credited to the War had led to unwise farm practices for a dry farming country but this had only intensified the problem which would have occurred anyway with drought.⁶

Lindfield did, however, spend much time in the years following the collapse, examining the causes, not for the purpose of establishing responsibility, but for the purpose of organizing policy for the future. He felt that much of the problem developed because the state expanded too rapidly.⁷ Much of this expansion would have occurred anyway, but high Eastern and Midwestern land values easily attained credit and an increase in precipitation all served to overstimulate it.⁸ The state was not ready to handle such growth.⁹ Over half of those who came were not farmers. Many of them, storekeepers, clerks and bankers "homesteaded a piece of land on

a speculative venture." Many of the farmers who came with the necessary capital with which to start, spent it in a nearby town. As a result, the towns, reacting to this high influx of capital, over built.¹⁰

The speed with which the population increased, as well as the ignorance of many of the newcomers, and not just ignorance of the region but of agricultural practices in general, put the state and the station in an extremely difficult position.¹¹ The state needed but lacked both the interest and the funds to establish a clearly defined land policy. In 1907, ten years before the drought struck, Linfield had called for land surveys.¹² The state, however, was too busy trying to settle the land, much less survey it.¹³ The United States Department of Agriculture at the same time ruled that "none of the Federal grants given to the state for agricultural research could be used for soil surveys."¹⁴ The result of this, Linfield pointed out, was that "much land has been homesteaded and attempts made to crop it, that should have been left as nature gave it to us."¹⁵

The lack of proper land and soil surveys or ignorance on the part of the homesteaders was not the only reason that many farmers plowed and cropped marginal land. America's entry into the War in Europe in 1917 had not only increased the demand for increased wheat production but it had also

a speculative venture." Many of the farmers who came with the necessary capital with which to start, spent it in a nearby town. As a result, the towns, reacting to this high influx of capital, over built.¹⁰

The speed with which the population increased, as well as the ignorance of many of the newcomers, and not just ignorance of the region but of agricultural practices in general, put the state and the station in an extremely difficult position.¹¹ The state needed but lacked both the interest and the funds to establish a clearly defined land policy. In 1907, ten years before the drought struck, Linfield had called for land surveys.¹² The state, however, was too busy trying to settle the land, much less survey it.¹³ The United States Department of Agriculture at the same time ruled that "none of the Federal grants given to the state for agricultural research could be used for soil surveys."¹⁴ The result of this, Linfield pointed out, was that "much land has been homesteaded and attempts made to crop it, that should have been left as nature gave it to us."¹⁵

The lack of proper land and soil surveys or ignorance on the part of the homesteaders was not the only reason that many farmers plowed and cropped marginal land. America's entry into the War in Europe in 1917 had not only increased the demand for increased wheat production but it had also

driven the price up. In 1914 wheat sold for ninety-seven cents a bushel, but in 1918 it had risen to two dollars and five cents per bushel. The lure of profit was drawing the farmer to over extend his credit to acquire marginal land, and at the same time, the Station and the state were urging him to produce more.¹⁶ By the end of the War many of the farmers in the state had over-extended themselves financially and physically; they had cultivated land that never should have been broken and they had produced more wheat than the home market could ever consume and had now found themselves in four of the worst drought years known to the state.¹⁷

After 1920 the situation became even more untenable for the farmers who had managed to hold on, as the value of agricultural products, particularly grain and livestock dropped severely. In 1920 livestock in Montana was valued at one and a half-million dollars, but by 1925 it had dropped below ninety-million.¹⁸ At the same time that agricultural prices dropped, shipping rates rose and the distance between Montana farmers and their markets became more costly.

It was clear that the state was in a severe agricultural depression, and although no one person or group of people were solely responsible for it, Linfield called upon himself and his staff to re-evaluate their priorities and

in research as well as the objectives and role of the Station in light of the new challenge it had.¹⁹ Clearly the Station needed to examine its past performance and determine to just what extent it was meeting its responsibilities to the Montana farmer.

In the early years of Linfield's term as Director, the Station had concentrated on growth. In 1904 Linfield had determined that the Station lacked both the equipment and the financing to seriously study the acceptability of dry farming in Montana.²⁰ As a result of this situation, the Director and his staff spent much time and thought in perfecting the organization and building adequate equipment and facilities to cope with the demand. As a result of this, the Station conducted only the most basic of experiments.²¹ However, the homesteaders did not wait, and as a result the station "followed rather than led the work of the pioneer farmer."²²

As these newcomers came into the state they had a tremendous need for information and the Station set about in earnest to meet that need. The Station emphasized work in basic cultivation techniques, as well as fundamental studies of soils and crops, with the expressed purpose of obtaining larger and more economic results in the field.²³ The Station at this time saw the farm as a factory.²⁴ This view recognized the need of the farmer to put something into the soil if he

to obtain something from it; yet it did not recognize that the farm was more than a factory; it was also a home. The Station still regarded the farmers as the "sturdy yeomen, conservative independent workers."²⁵

The first sign that Linfield had begun to enlarge his view of the farmer's needs occurred after 1915. He was still emphasizing production; however, he included in the objective of the Station a desire to improve the farmer's ability to handle the business aspects of the farm.²⁶

With the onslaught of drought and the breakdown of agriculture in the state, the overall needs of the farmers became more apparent and with that, the course and objectives of the Station. Linfield pointed out the need to spend some time, not on how to conquer the adversities of the region, but how to recognize and handle the limitations that these adversities placed upon all,²⁷ and above all, learn to accept drought.²⁸

He recognized other specifics that needed investigation. The Station must conduct at all reasonable speed, an in-depth soil survey of the state.²⁹ They should also conduct a comprehensive meteorological survey of the entire state and attempt to determine to what extent they could predict rainfall variations.³⁰ A third area of research that Linfield called attention to involved the role of micro-organisms in soil, and in the process of plant growth.³¹

Besides re-emphasizing specific studies necessary at this time, Linfield re-evaluated the overall role of the Station, and its obligations to those it served. While continuing to recognize and endorse investigations into specific agricultural problems, he raised the objectives of the Station much higher than efforts at record yields. He declared that the over-riding objective of the Station was to raise the farmer's standard of living, improve the quality of his life and provide assistance in his effort to meet his social and educational needs. He emphasized that "during the past fifty years the farmers have increased largely their control over the crops on the farm, but they appear as helpless as ever in the matter of controlling their living from the farm."³² Country life had changed and production of more crops could not be viewed as the solution to the problem. "My thought is not to change but to broaden the basis of our study and extend our field of operation "to include problems fundamental to the life of the farmer."³³

Linfield felt that the key to improving the quality of life for the farmer and his family was to establish and maintain economic stability on the farm. He strongly opposed any "back to the farm" movements, arguing that the situation did not call for more people but more efficiency on the part

of those who were already there.³⁴ In order to bring about improved efficiency Linfield urged more diversification and moves away from one-crop farming.³⁵ "Livestock must enter more largely into the role of the farm." Calves should be sold in the fall to avoid feeding, and the overall size of the herd should fluctuate with available forage. Farmers should utilize silos to carry feed over into a second winter.³⁶ He also urged that dairying be used to diversify, and that the farmer remain sensitive to local market demands and control the size of his herd accordingly.³⁷

Diversification was not the only avenue to economic stability. Linfield directed research to consider the lowering of production costs rather than continually attempting to increase yields.³⁸

Linfield's ultimate attack in his goals to bring economic stability to Montana's farmers was on the agricultural marketing policies of the United States government. He began to call for Federal assistance to control and stabilize a fluctuating market. Linfield was highly critical of Eastern business and manufacturing interests who insisted on tariff regulations to protect their products, but balked at the farmers' demands for similar protection.³⁹ He called upon government officials to recognize that the farmer bought in a protected market but was forced to sell in an open market.

Linfield wanted the farmer to underwrite the farmer's losses whenever he was forced to sell in a depressed world market.⁴⁰

In his efforts to obtain national recognition of the farmer's problems, Linfield took strong offense to publications which misrepresented the problems of the farmers. He went into great detail in 1927 with the Nation's Business for trying to identify agricultural problems with "shiftless farmers." He not only explained to them why they were wrong, but strongly urged that in the future they try not to be so ignorant.⁴¹

In his efforts to re-organize and re-evaluate to meet the challenges of the crisis before him, the Station and, above all, the Montana farmers, Linfield was confident. He stated that "during these fifteen years there has been built up at the State College an agricultural organization second to none in the Northwest; able men have been gotten together who from years of study of Montana conditions were and are able to advise on the agricultural problems and practices of the state at a time when these services were most urgently needed."⁴²

Linfield may have boasted somewhat, and possibly the Montana Experiment Station was not necessarily "second to none in the Northwest," but it was both capable and prepared. In the years since Linfield had taken over, the Station had accomplished much and in so doing it demonstrated its ability to accomplish more.

More was demanded. Although the rains returned to some degree in the years following 1920, agricultural prosperity did not. The farmers called upon all the resources available to the Station to seek solutions to periodic drought and economic strangulation, from inflation and an inactive market. Ground work done in grain studies eventually yielded drought resistant grains. Preliminary studies done in farm management and diversification set the stage for more efficient use of farm resources such as land and marketing, and ultimately led to a more stable farm life. Early efforts at soil studies yielded to more thorough and elaborate research in efforts to classify soils and identify the best use of the land. In 1920 agricultural success for Montana was still in the future, but the resources to achieve that success were complete. The way was open.

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and
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