DRYLAND AGRICULTURAL DEVELOPMENT OF THE MONTANA TRIANGLE, 1890-1945

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Abstract. Successful farming in the Triangle of north central Montana required the development of techniques and tools suited to local climatic conditions and soils. These techniques were produced by private experimentation and the studies and recommendations put forth by the Montana Agricultural Experiment Station (MAES). Initial findings were ignored by farmers, but as the potential for recurring drought and economic devastation became apparent, farmers came to rely more and more on information provided by the MAES in order to make effective farm management decisions. By 1945, the Triangle was a major wheat producing region in the state, and the MAES was regarded as a reliable source of information.

INTRODUCTION

On the Margins of the Good Earth (Meinig, 1962) graphically describes the setting of agricultural operations in the semiarid grasslands of the world. Early farmers in these areas often saw only the tremendous profits from crops that could be produced on the fertile soils and ignored the continual threat of devastating drought. As a result, farms oscillated between years of high productivity and near total crop failure, determined primarily by the amount of precipitation received within any given year. Because of the potential of these areas, semiarid grasslands have been converted to agricultural lands in settings ranging from the Russian Steppe to South Australia. In each case, the story is a compelling one of trial and error and eventually, adaptation to a harsh environment. Although the general climatic conditions and the strategies of overcoming them were similar, each setting required unique technological, economic, and cultural adaptations.

The Triangle of Montana is another area that was once considered "too dry for farming" (Raymer, 1930). However, the development of appropriate dryland farming techniques converted the region to an extremely productive small grain area within 30 years. Successful farming required the development of techniques and tools suitable to local climate and soils. Many of these techniques were based on general concepts practiced in other areas, although they often required refinement through careful research for successful use in the Triangle. The Montana Agricultural Experiment Station (MAES) identified these appropriate techniques and provided information about them to farmers.

The goal of this paper is to combine a study of the settlement processes in the Triangle with an assessment of the impact and role of the MAES in the development of this key agricultural region from 1890 to 1945. As the Triangle developed into a recognized agricultural region, the MAES also grew from a fledgling organization into an established one that supplied farmers with reliable and important information.

Study Site

The "Triangle" is located in north central Montana in an area bordered by the Rocky Mountains to the southwest, the Bears Paw and Highwood Mountains to the southeast, and the Canadian border to the north. Major cultural landmarks include the cities of Great Falls, Cut Bank and Havre, as well as the High Line, the initial Great Northern Railroad route across the northern portion of the Triangle which today is paralleled by U.S. Highway 2 (Fig. 1). Today, the Triangle is an important setting for dryland agriculture in the state in that it contains approximately 29% of Montana's dryland agricultural land (Montana Agricultural Statistics Service, 1990).

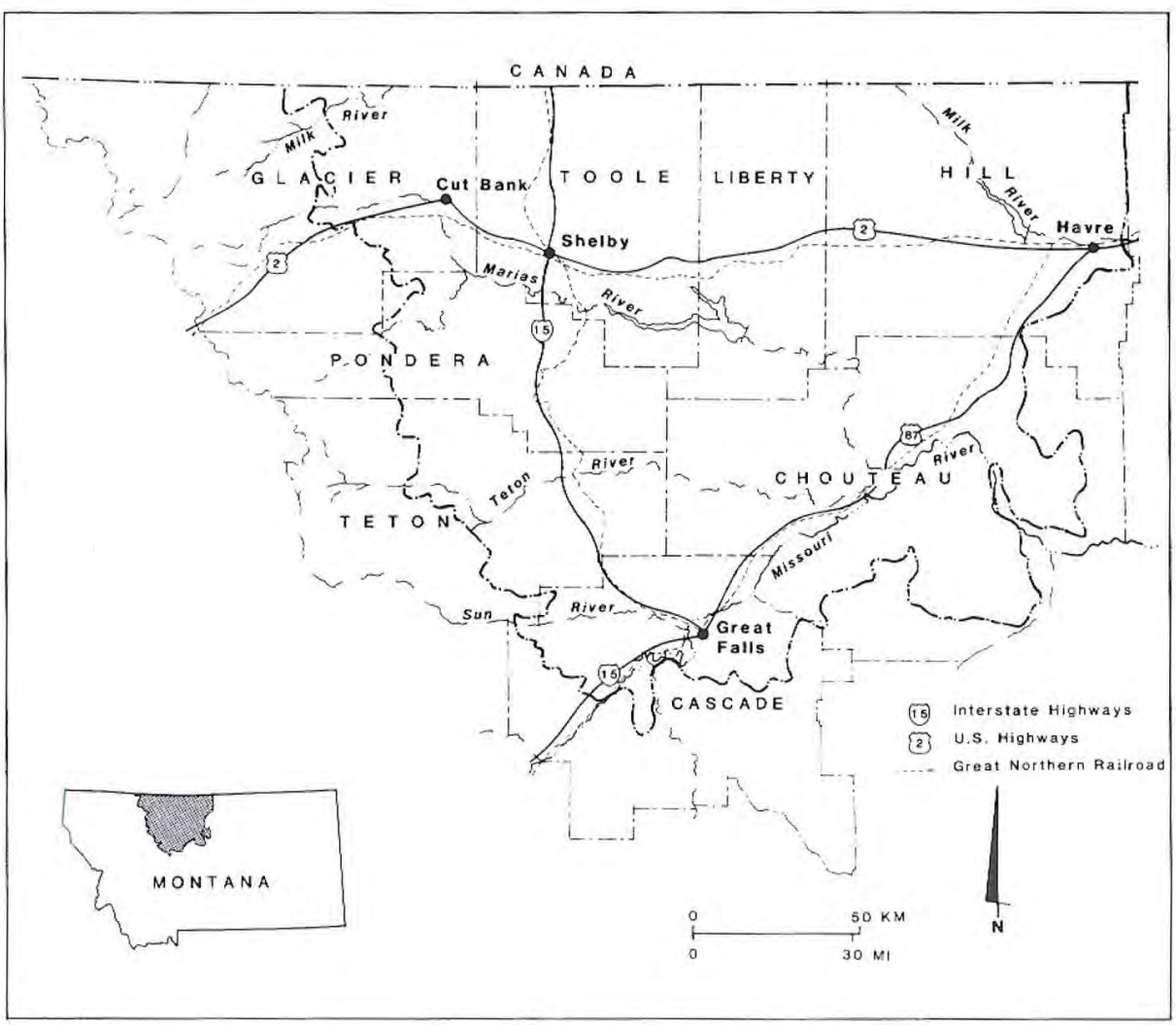

FIGURE 1: The Montana "Triangle"

The land is flat to gently rolling, and the glacially derived soils are productive brown mollisols (Montagne, *et al.*, 1982). The Milk River crosses the northwest and northeast corners of the Triangle, while the Marias, Teton, and Sun Rivers bisect the Triangle farther south. The Missouri River follows a portion of the southeastern border. These rivers are of limited use for irrigation because the river beds are 30 m (100 feet) below the general level of the land in wide, steeply sided gullies or "breaks". Many of the streams feeding these rivers are seasonal.

The climate is semiarid with large daily and annual fluctuations in temperature. Temperatures from -43°C (-45° F) to well over 38° C (100° F) have been recorded. Winds are often strong and may be accompanied by severe thunderstorms and hail during spring and summer, while occasional winter chinooks quickly raise the air temperature causing rapid snow melt (Schafer, 1985).

The main limitation to crop production is annual precipitation, which is extremely variable within the Triangle and from year to year. This is illustrated by the annual precipitation records for Great Falls and Havre, shown in figure 2. The average annual precipitation for Great Falls is 38 cm (15 inches) compared to 33 cm (13 inches) in Havre, but there are years when Great Falls received average precipitation while Havre was very dry (as in 1910) and vice versa. Most of the precipitation falls early in the growing season, April through June, which is critical for small grain production (Johnson, 1939). A key fluctuation was the wet period in the early 1900s, followed by a prolonged, severe drought from 1917 to 1920. This drought proved pivotal in the region's history. Farming techniques which were successful in wet years proved unsuitable in the drought period. The resulting surge in the number of failing farms encouraged a better appreciation for dry farming techniques that were more appropriate to the region.

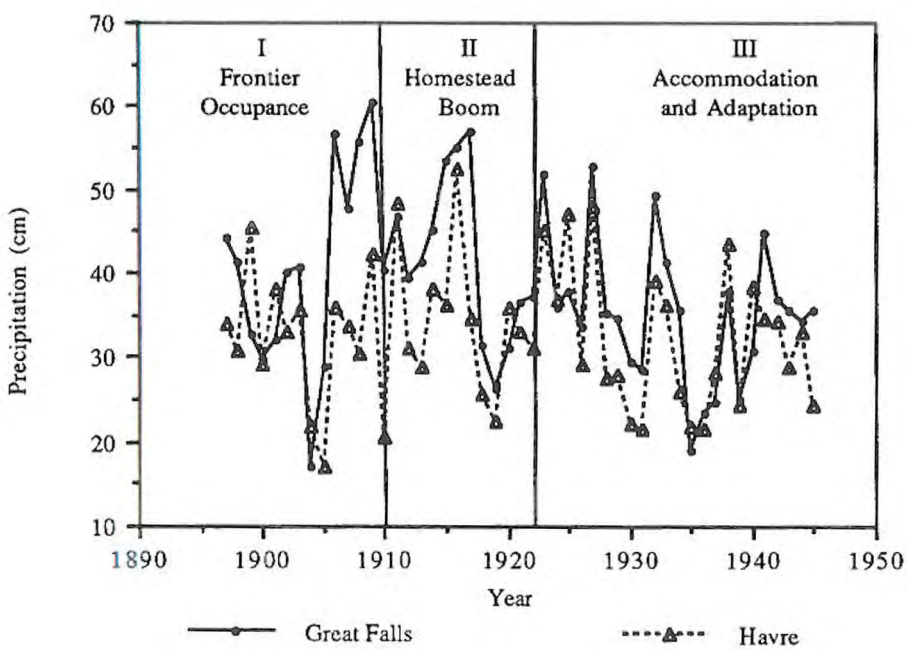

FIGURE 2: Annual precipitation for Great Falls and Havre, MT, 1897-1945 (USDA, 1897-1945)

Three key eras may be identified in the evolution of the Triangle between 1890 and 1945. Early conditions comprised a period of Frontier Occupance from 1890 to 1910, and were followed by the era of the Homestead Boom from 1910 to 1922. The final period, Accommodation and Adaptation, lasted from 1922 to 1945.

FRONTIER OCCUPANCE, 1890 TO 1910

Grazing was the primary land use during the first era. Cattle outfits expanded north of the Missouri and along the Milk River in the early 1880s as Indian reservations were established. There were a few farms along the Sun River near Ft. Shaw west of present day Great Falls, but these were irrigated, rather than dryland farms. Settlement in Montana was concentrated to the south and west, in the wetter regions of the state, and near the gold fields (Raymer, 1930; Johnson, 1939; Hargreaves, 1957), The Great Northern and Northern Pacific Railroads had lines through the state and by 1890, the Great Northern's tracks outlined the Triangle, offering connections to the south and east via Butte, Montana and Minot, North Dakota, respectively (Gunderson, 1957).

The Montana Agricultural College and the Experiment Station were established in Bozeman in 1893. In addition to acquiring necessary land and equipment, research concentrated on improving irrigation techniques for the first decade. Dryland farming was seen as a way of supplementing these techniques, and did not receive much attention from the MAES in the 1890s, although dryland research was being conducted in other parts of the country (Linfield and Atkinson, 1907) .

By 1905 MAES work shifted to dryland agriculture, partially in response to a need for research in order to promote settlement. The Great Northern and Northern Pacific Railroads felt that dryland farming was possible on the northern plains of Montana, and that supporting evidence would encourage settlement and increase traffic on their lines. A joint agreement was established between the railroads and MAES in 1905 to determine the feasibility of dryland cropping. Systematic studies were to be conducted and reported by the MAES. In this way, the railroads became a catalyst in the development of dryland agriculture, and helped set a precedent for cooperative research and extension work (Linfield and Atkinson, 1907; Dunbar, 1957; Roet, 1982).

The results were summarized in 1907 in a bulletin by F.B. Linfield, Director of MAES, and Alfred Atkinson, Station Agronomist. Dryland farming was seen as a supplement to livestock production, offering a way to produce winter feed and meet the restrictions imposed by encroaching settlement. However, this bulletin also offered a number of specific recommendations for dryland farmers. In particular, the report stressed that summer fallow was "essential" and should be alternated with crops; continuous cropping was not recommended; and a deep seedbed and subsurface soil packing as well as continuous cultivation to break capillary action were advised (Linfield and Atkinson, 1907).

In 1908 MAES reported that dry farming was indeed successful. However, this research coincided with a series of wet years which contributed to the encouraging results. The railroads began intensive promotional campaigns to lure settlers to the region and continued to fund dryland studies (Atkinson and Nelson, 1908). The next few years were marked by a variety of systems and recommendations, some vague and some conflicting, as researchers attempted to sort out the importance of tillage, climate, crop rotations, and livestock production (Roet, 1982).

Because these studies took place during a series of years with average or above average precipitation, the dry years of 1904 and 1910 had little impact (Fig. 2). Many farmers were able to irrigate small acreages, and they relied on past experience and individual experimentation, as well as luck and adequate precipitation, for crop production in dryland environments. Farmers remained confident of their ability to produce bountiful crops by devising practices to overcome the temporary shortages of moisture, and were optimistic in the belief that the next year would bring adequate precipitation. They did not see the need for practices such as summer fallowing, which left a field unproductive for an entire year (Wilson, 1923). There were few data to refute these opinions. No soil surveys had been conducted in Montana, and the first comprehensive study of Montana climate was not published until 1914 (McGorry, 1975). Nevertheless, homesteaders soon flocked to the state in hopes of establishing profitable farms.

HOMESTEAD BOOM, 1910 TO 1922

The second period was characterized by a homestead boom and specialization in cash grains. The Enlarged Homestead Act of 1909 allowed a settler to file on 320 acres (130 ha), a size more suited to profitable dryland farming (Hargreaves, 1957). The Havre Land Office recorded 46% of its filings between 1910 and 1914 (Johnson, 1939). Improved acreage, the area actually under cultivation, increased dramatically as settlers poured in (Fig. 3). Improved area in the Triangle jumped from 202,000 hectares (500,000 acres) in 1910 to over 1 million hectares (2.5 million acres) in 1920. The Triangle contained 14% of the state's total improved land area in 1910 and by 1922 this number had climbed to 22% (U.S. Census, 1910, 1920).

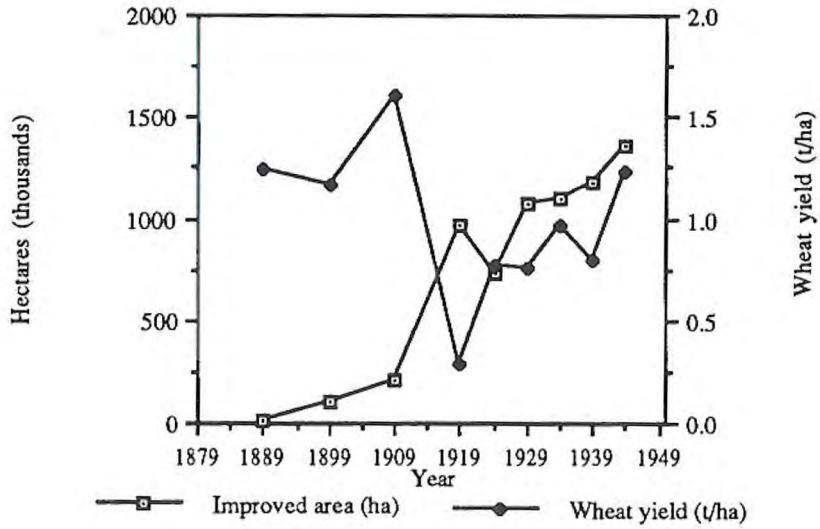

FIGURE 3: Improved area and average wheat yields in the Triangle, 1889 to 1944 (U.S. Census and U.S. Census of Agriculture data)

Good railroad connections were in place, and the railroads' promotional campaigns combined with reports of high yields to attract settlers at a rapid pace (Linfield, 1919). Information trains and demonstration farms sponsored by the Northern Pacific, the Montana Agricultural College, the MAES, and the Farmers' Institute were used to educate settlers and farmers. County Extension agents were also hired to help spread information (Banker, 1916; Roet, 1982).

The Experiment Station's recommendations gradually became more focused with the help of dryland substations established at Havre and at Moccasin, southwest of the Triangle. A four-year crop rotation was recommended in place of alternate crop/fallow. This consisted of one year of summer fallow followed by a small grain crop, a cultivated crop such as corn the next year, and another small grain the fourth year. Diversification was deemed necessary to reduce the potential hazards associated with monocropping. By 1917 tillage was recommended only as needed to control weeds, in place of the continuous cultivation that had been recommended in earlier years. Livestock was seen as a possible supplement to dry farming, a reversal of earlier opinions (Wilson, 1923).

The new settlers in the Triangle continued to disregard this information, however. They came primarily from the American Midwest, attracted by the lure of cheap land and large profits from good yields as wheat prices rose from $0.91/bushel in 1910 to $2.16/bushel in 1919 (Wilson, 1923; Johnson, 1939, Roet, 1982). Their primary concern was producing cash crops and wheat quickly became the dominant crop (Fig. 4). Summer fallow was considered uneconomical, and in some cases unpatriotic, as small grains were in short supply during the first World War (Krall, 1969). The farmers' varied backgrounds and agricultural techniques precluded the development of a single "system" of grain farming for the Triangle. Many different tillage practices were used, based on techniques from humid regions. Despite the variety of approaches, the combination of good precipitation, fertile new fields, and few insect, disease or weed problems resulted in outstanding yields prior to 1917 (Fig.3). In 1909, Chouteau County's wheat harvest averaged 1.68 t/ha (25 bu/ac), while oats averaged 1.52 t/ha (40 bu/ac) (U.S. Census, 1910). Farmers realized large profits, especially with high war time prices. In Hill County there were reports of farms being paid for with the profits from a single crop (Johnson, 1939). Farmers at this time saw little reason to worry about the possible benefits of summer fallow or the problems associated with drought. They concentrated on large acreages of grain, rather than diversifying (Wilson, 1923; Hargreaves, 1957)

As the boom continued, the average farm size increased from 227 ha (560 ac) in 1909 to over 1544 ha (625 ac) in 1919 (U.S. Census, 1910, 1920). Animals provided the major source of power, which was reflected in the relatively large acreage devoted to oats in 1909. Steam tractors were used in some instances, especially for contract sod breaking and threshing (Krall, 1969). Continuously cropped wheat was the primary crop, due in part to government wheat production programs, and farmers took advantage of good yields to expand the acreage under cultivation (Banker, 1917; Campbell, 1920).

The years 1917 to 1920 marked "the most prolonged drought in the weather history of north central Montana" (Wilson, 1923). This drastically changed life in the Triangle. Four consecutive years of crop failure in the Triangle combined with humid region agricultural practices, grasshoppers and hail storms to bring an end to the boom period. Chouteau County's 1919 harvest averaged a mere 0.27 t/ha (4 bu/ac) for wheat, and only 0.50 t/ha (13 bu/ac) for oats. Many farms were foreclosed or abandoned. It was a harsh period of realization that dryland agriculture was different from agriculture in other regions. Careless methods and techniques from humid regions were not sufficient to see farmers through periods of drought. New methods adapted specifically to the Triangle were required (Campbell, 1920; Johnson, 1939).

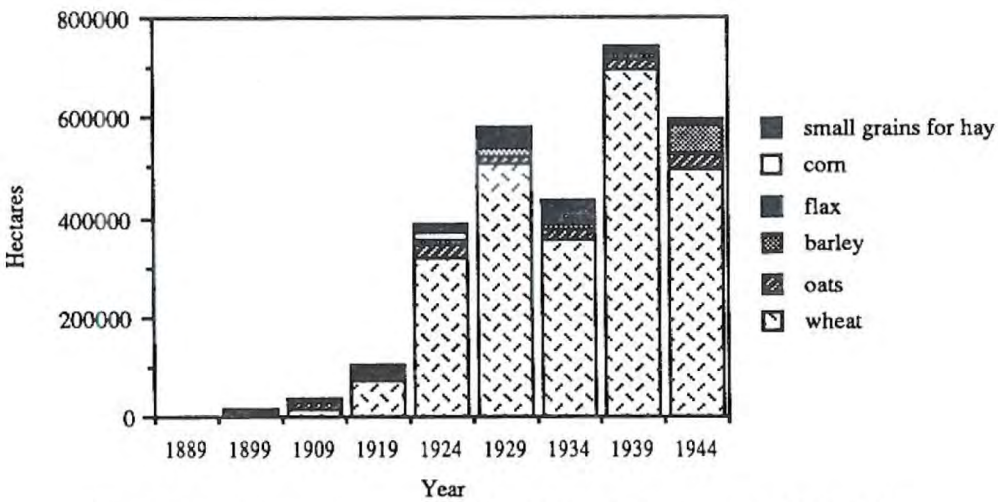

FIGURE 4: Crops harvested in the Triangle by area, 1889-1944
(U.S. Census and U.S. Census of Agriculture data)

ACCOMMODATION AND ADAPTATION, 1922 TO 1945

The drought of 1917 to 1921 marked the end of the Homestead Boom and the beginning of a period of accommodation and adaptation from 1922 through 1945. Land filings dropped off rapidly after 1920 in reaction to the drought and reductions in market prices as wheat dropped to $0.97/bushel in 1922. Many farmers left the area permanently. Four years of total crop failure had taken their toll on people's finances and confidence in the agricultural potential of the area (Campbell, 1921). In the years following the drought, the MAES played an important role, with county extension agents, in stabilizing the population and agricultural practices of the Triangle.

In 1923 MAES published the first evaluation of successful farming methods in the Triangle. Written by M. L. Wilson, the Specialist in Farm Economics, it was intended to "guide the average farmer in working out his own definite program", rather than present the single best method for raising a crop or livestock (Wilson, 1923). Based on a survey of successful farmers, the bulletin outlined a "system" of farming for the Triangle that consisted of five key strategies. These strategies involved putting aside soil moisture, feed, and cash reserves in good years for use in poor years; developing a diversified farming base; grazing livestock on untillable land; growing wheat for the primary cash crop; and using flood waters for dryland irrigation (Wilson, 1923).

The need to manage reserves of soil moisture, feed, and cash had been voiced since 1907 (Linfield and Atkinson, 1907), but this concept was slow to catch on for a variety of reasons. Early farmers enjoyed tremendous yields and profits, and ignored the possibility of drought. Summer fallow was seen as a waste of land because no crop was harvested from the fallow land. The dry years of 1917 to 1920 reemphasized the hazards of dryland farming, but the return of

precipitation brought maximum wheat production in an effort to recover financial losses. Cash and grain reserves were accumulated slowly. As better economic times returned to the Triangle in the late 1920s, many farmers used their income to pay off old debts, buy new mechanized equipment and increase their land holdings in an effort to increase profits. Wheat continued as the dominant crop (Fig. 4).

The years following the drought saw an increase in the influence of the MAES. The farmers that survived the drought came to realize that scientific information was needed in order to withstand the vagaries of weather and economics. As their financial situation improved in the wetter years following the drought, money for changes slowly became available and many farmers looked to the MAES for guidance. After 1928 there were reports of better reception of Extension Service information during prosperous times than hard times (Daggett, 1928) and evidence that some recommendations were being followed. The MAES conducted studies on the various types of equipment available, and publicized its findings to help individual farmers determine what equipment was suitable for their situations (Ogaard, 1926; Dexter, 1930; Bell, 1937; Mercer, 1937; Aasheim, 1949).

The 1930s, however, saw another setback in finances and production, due to the Depression and more dry years (Daggett, 1935; Johnson and Saunderson, 1936). World War II helped to overcome the economic slump, and farmers were able to put aside some reserves of grain as a type of insurance against dry years. By 1945 Hill County's farmers had built storage systems large enough to store up to 60% of the previous year's crop and in this way they carried "their own crop insurance" in anticipation of bad years (Daggett, 1945).

The importance of soil moisture reserves was evident after 1921. Many farmers did not really understand the principles of summer fallowing, and county agents launched an educational campaign in an effort to increase its use (Campbell, 1920, 1921). County agents' demonstrations and circulation of MAES bulletins helped to emphasize the importance of summer fallowing in the conservation of soil moisture, and also offered advice on techniques for properly maintaining summer fallow (Duncan, 1926; Sandberg, 1930; Bell, 1937; Johnson, 1939). Summer-fallowed acreage in the Triangle increased from just over 121,000 ha (300,000 ac) in 1909 to 5.4 million ha (1.3 million ac) in 1939 (U. S. Census, 1910, 1940).

Although crop diversification was recommended throughout the study period, it was only achieved on a limited basis (Banker,1916; Dexter, 1930; Daggett,1945). Wheat continued as the dominant crop after 1920 as tractors and combines replaced horse power. This reduced the need for feed oats. Although the acreage of other crops planted increased dramatically, supposedly in an effort to increase diversity, the ratio of wheat to these crops remained fairly constant, as shown in Figure 4 (Raymer, 1930).

Livestock production was both a part of farm diversification and a recommended use for untillable land. Although it dominated early land use in the Triangle, the livestock industry suffered a severe setback with the drought of 1917 to 1920 and made a very slow recovery. Because wheat was more profitable than cattle, hogs or sheep, farmers in the 1920s and 1930s put most of their effort into small grain production (Johnson and Saunderson, 1936). Another drawback, especially before the 1930s, was the lack of quality livestock for breeding purposes, a condition which county agents worked to improve (Banker, 1916; Duncan, 1925, 1926). In 1930 MAES recommended that combination grain farms raise enough livestock to meet the family's needs, as well as a few extra head to sell off for added income if necessary (Dexter, 1930). By the mid 1940s the number of cattle and sheep in Hill County had risen to over 33,000, but the success of livestock operations still fluctuated with annual precipitation and the price of wheat. Dry years meant failure of feed crops and reduction of already limited stock water supplies while high wheat prices reduced the acreage planted to feed crops (Daggett, 1945).

The use of flood waters from spring runoff was advocated as a means of irrigating dryland farms, but was difficult to achieve on a large scale basis because of limited water supplies and other spending priorities. County agents offered assistance in designing and constructing stock ponds, but had a limited amount of time to devote to this task. The few reservoirs that were constructed provided an important source of water for livestock (Daggett, 1935).

CONCLUSION

The Triangle's agricultural evolution involved a transition from livestock grazing to small grain production. As in similar settings elsewhere in the world, the transition was marked by a generation of experimentation often frought with failure and only gradually revealing the dryland techniques and adaptations appropriate to these marginal lands. The MAES played a central role in this adaptation process but its institutional insights were not heeded by farmers until the bitter experiences of drought compelled them to reject their traditional agricultural practices which were better suited to more humid lands. Only then did the research of the MAES have a profound and lasting impact. In fact, these recommendations proved essential to reaping the potential profits of life on the "margins of the good earth" as found on the plains of north central Montana's Triangle.

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