7-15-1999

Historical Evolution of Crop Systems in Eastern South Dakota: Economic Influences

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Economics Research Report 99-2

July 1999

Support for research on which this report is based came from South Dakota State University's Agricultural Experiment Station Project H-056, entitled "Implications of Risk and other Factors for Diversified and Sustainable Farming Systems". We appreciate the reviews of a draft of this report by Larry Janssen and James Smolik. Janssen, Smolik, and Wayne Ellingson offered valuable suggestions on the M.S. thesis (Dumke, 1999) from which this report is drawn. Any remaining shortcomings or errors are our responsibility, however.

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Introduction

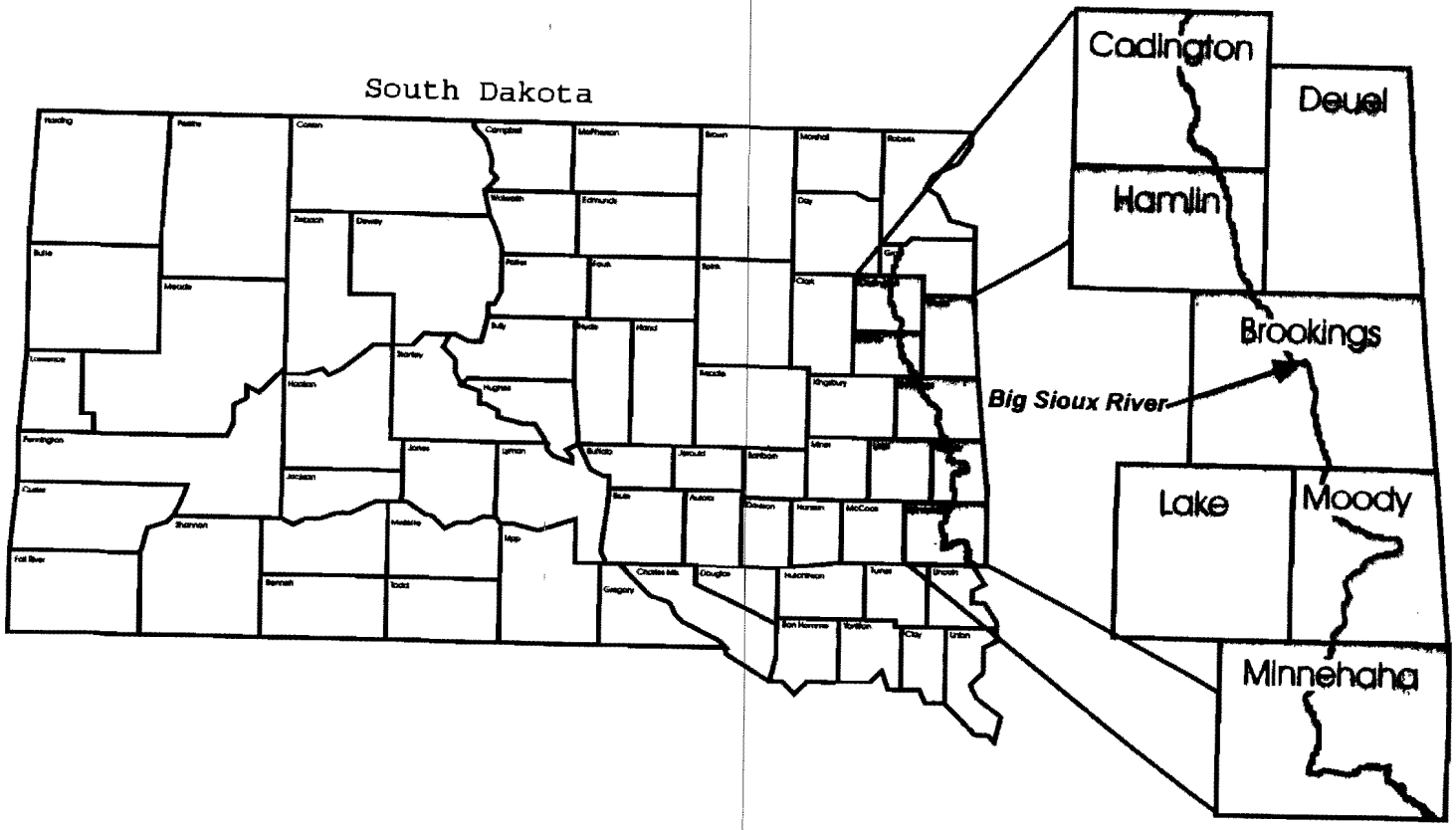
Cropping systems in the United States and throughout much of the world have moved toward shorter and less diverse rotations during the last half of the twentieth century. However, as we approach the new millennium, there is growing concern about the ecological sustainability of monocultures and such narrow rotations as the corn-soybean rotation. Problems of pest control, crop disease, groundwater contamination from chemical pesticides and fertilizers, and soil erosion are proving to be very difficult when crop rotation systems lack diversity. "Silver bullet" technologies sometimes buy time, but without diversity, new ecological problems soon replace the problem just "solved" with the latest pest-resistant crop variety or chemical pesticide.

Concerns about the lack of crop system diversity lead to questions about how public policies might be used to alter agriculture's path. Answering those questions requires a clear understanding of how policies and other economic forces have influenced crop systems in the recent past. We have attempted to gain some of that understanding through a case history of one region within North America's agricultural heartland. The results of our historical analysis are reported in this research report. In a companion paper, we will examine recent policy changes embodied in the 1996 Federal Farm Bill (the Federal Agriculture Improvement and Reform Act) and the potential implications of those changes for future crop system diversity.

Big Sioux Aquifer area of eastern South Dakota

The case study area lies in eastern South Dakota, covering much of the Big Sioux Aquifer (Figure 1). The southern portion of this area is on the edge of the Western Corn Belt and the northern portion is on the edge of the Northern Great Plains. Corn and soybeans now dominate the Western Corn Belt. Historically, wheat and other small grains dominated the Northern Great Plains. However, that region has seen substantial growth over time in acreages of oilseed crops like sunflowers and soybeans, as well as an expansion in corn acreage. Since the study area is in the transition zone between two major U.S. crop regions, our analysis provides insights into forces that historically have been at work in both regions.

Figure 1. Big Sioux River and Study Area



The seven counties that were included in the study area were: Codington, Hamlin, Deuel, Brookings, Lake, Moody, and Minnehaha. Special attention was given to Codington and Moody Counties, as they were chosen to represent the northern and southern ends of the study area. Major crops grown in the seven-county study area over approximately the last half-century are shown in Figure 2[1]. Five-year averages were used, to make trends more clear. Clearly, corn was the major crop in this region throughout much of the 45-year period running from 1950 to 1995. Oats went from a major crop, with more acreage even than corn in the early 1950s, to a minor crop by the 1990s. Flax acreage also declined to negligible levels by the end of this period. The most dramatic increase was in soybean acreage, especially from the late 1970s onward. Wheat acreage increased some in the 1970s, and remained at higher levels than in the first half of the period examined. Hay acreage declined by over 40 percent between 1959 and 1992 (a figure showing hay acreage appears later in this report).

Codington County

Figure 3 shows the major crops grown for Codington County [information obtained from the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS)]. Oats was a major crop for Codington County in the early 1950s. Acres planted reached its peak in the mid-1950s, to a level of just over 70,000 acres. A downward trend occurred until the early 1960s, to a low of approximately 55,000 acres planted, followed by another upward trend. Acres planted peaked at just over 65,000 in the late 1960s, followed by another downward trend. Production tapered off somewhat from the early 1970s to the early 1980s. Then, a sharp downward trend occurred to its early 1990s level of approximately 17,000 acres planted.

Flax was also a major crop for Codington County. Acres planted in the early 1950s were approximately 60,000. The number of acres peaked in the early 1950s at just under 71,000 and then began a downward trend until the early 1960s. For the next 10 years, production was relatively stable, with about 50,000 acres planted. Then a sharp downward trend occurred to its early 1990s level of just under 500 acres planted to flax in Codington County.

Wheat has been relatively important in Codington County over the years. The number of acres planted to wheat in the early 1950s was just short of 50,000 acres. By the mid-1950s, the number of acres

[1] Data for Figure 2 came from the National Agricultural Statistics Service (NASS), U.S Department of Agriculture.

Figure 2. Major Crops:
Eastern South Dakota

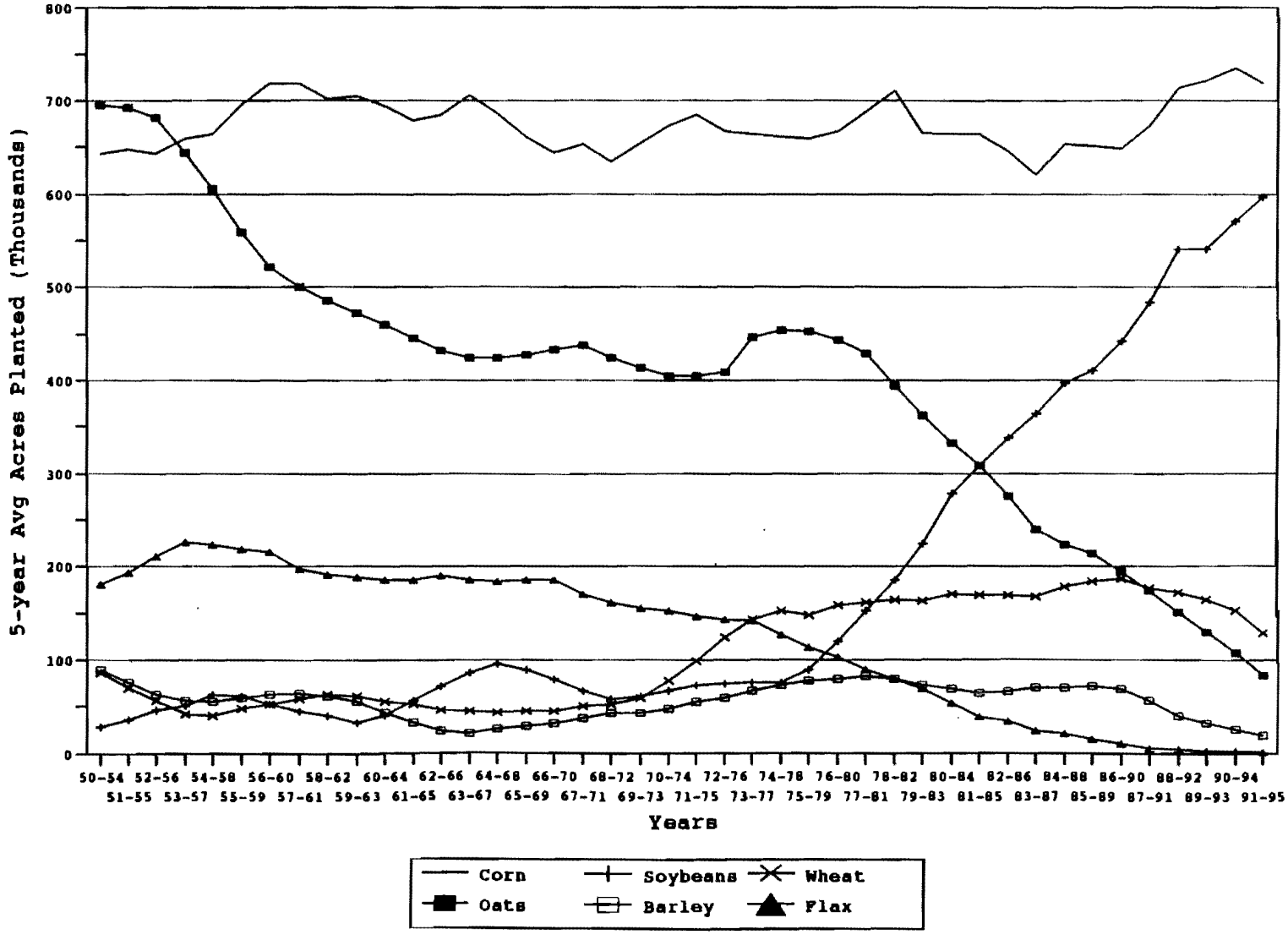
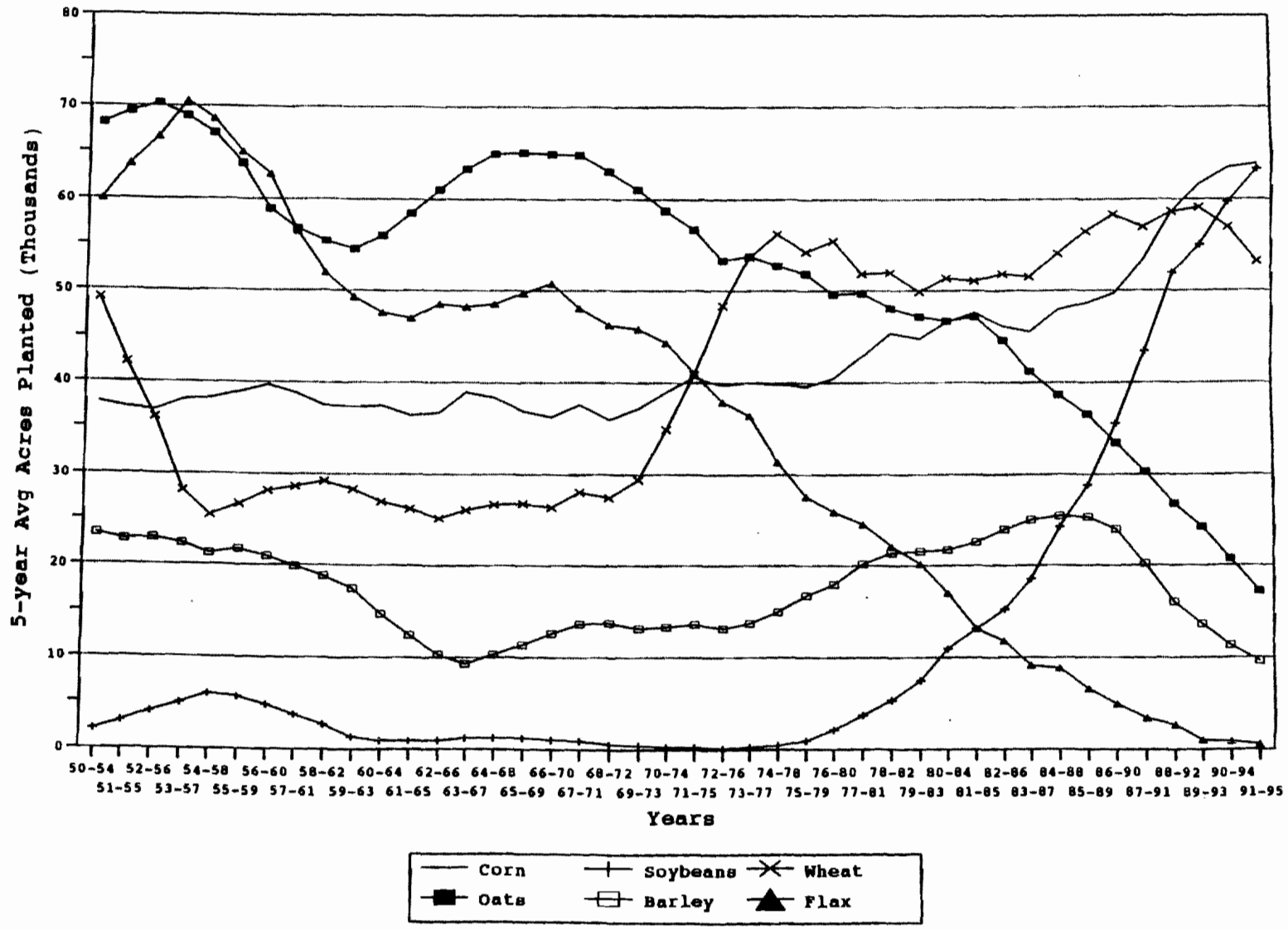


Figure 3. Major Crops:
Codington County



declined to roughly 25,000 acres, and remained relatively stable until the early 1970s, when the number of acres rose sharply to approximately 55,000 acres planted. The number of acres planted to wheat has remained between 50,000 and 60,000 since the early 1970s, with an early 1990s level of just over 53,000 acres planted in Codington County.

Corn production in Codington County remained stable from the early 1950s to the mid-1970s. The number of acres planted during that time was between 35,000 and 40,000 acres. Acres planted then began an upward trend to its early 1990s level of approximately 64,000 acres.

Barley played a minor role in Codington County in the early 1950s, with acres planted just over 23,000. Production steadily declined to a low of 9,200 acres planted in the mid-1960s. Then an upward trend occurred until a peak in the mid-1980s of just over 25,000 acres planted. A downward trend occurred after that, to an early 1990s level of about 9,500 acres planted in Codington County.

Soybeans played a very small role in the early 1950s, with a minor peak in the mid-1950s of just under 6,000 acres planted. Acres planted to soybeans declined to a level of 128 to 1,000 acres for the next 15 years. In the mid-1970s, soybean production soared. The number of acres planted to soybeans rose from a few thousand acres in the early 1970s to its early 1990s level of approximately 63,000 acres. Presently, Codington County has three major crops grown (in addition to alfalfa): corn, soybeans, and wheat.

The pie charts in Figure 4 also show how crop systems have changed over time (information obtained from the Agricultural Census).[2] To show how the percentages of the major crops harvested have changed over the years, four time periods were selected from the Agricultural Census. The percentages are calculated from the cropland harvested for the specific crops in the graph, alfalfa hay acres harvested, and "other" acres harvested. The "other" category includes minor small grains such as rye, emmer, and spelt, along with miscellaneous crops such as barley, edible beans, and sunflowers.

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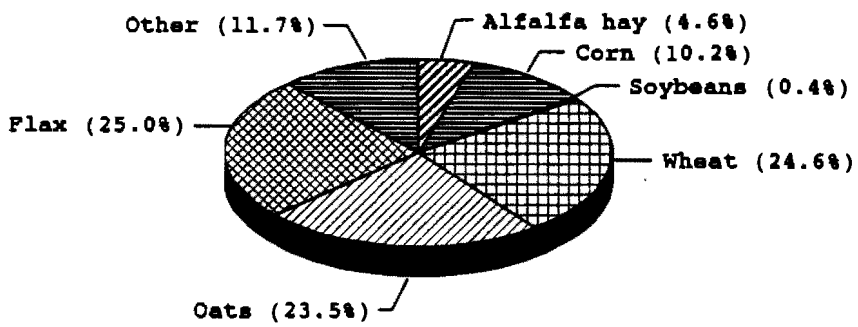
[2] Pie charts for all nine Agricultural Census years running from 1954 through 1992 are shown for both Codington and Moody Counties, as well as the other five counties in the study area, in Dobbs and Carr (1997). Data for those charts came from a different source, however, so the charts are not directly comparable to the ones in this report.

Figure 4. Acres Harvested: Codington County

1949



1964

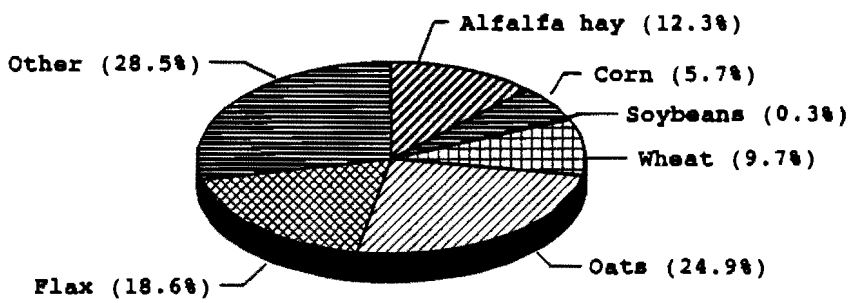
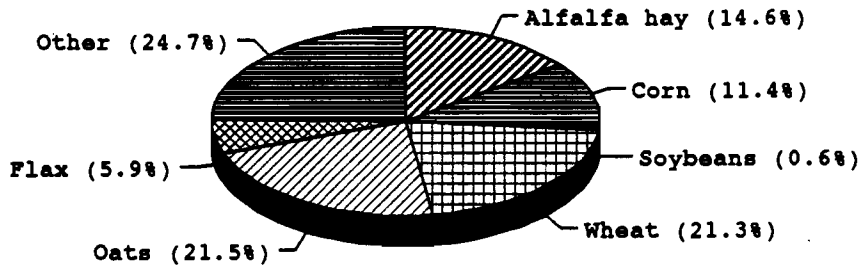
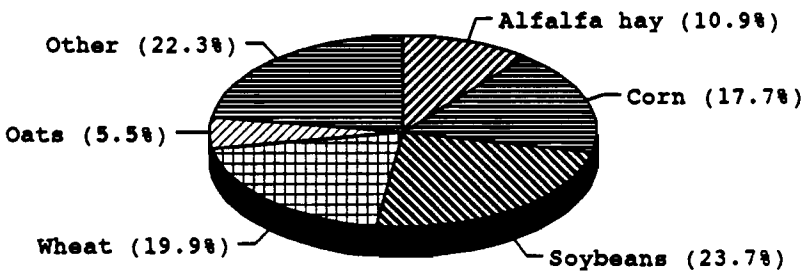


Figure 4. Acres Harvested: Codington County (continued)

1978



1992



The pie charts reveal three significant changes that have occurred in the last 45 years: both flax and oats acreage plummeted, and soybeans grew from a new crop to a major crop. In 1949, flax was 25 percent, soybeans were 0.4 percent, and oats were 23.5 percent of harvested cropland. Approximately 40 years later, flax was at 0 percent, soybeans were 23.7 percent, and oats were 5.5 percent. The percentage of wheat acres harvested dropped considerably in the 1964 reporting period; however, it increased in the following years to 19.9 percent in 1992. Alfalfa hay increased from 4.6 percent in 1949 to 12.3 percent in 1964 and to 14.6 percent in 1978. In 1992, alfalfa hay acres harvested declined to 10.9 percent of acres harvested.

Another significant change is the "other" category, which has increased its percent of acres harvested over the years. In 1949, the "other" category was 11.7 percent of acres harvested; it jumped to 28.5 percent in 1964 and then declined to 22.3 percent in 1992. This suggests that farmers were looking for alternatives to their traditional crop rotations. In the mid-1970s, farmers began to plant buckwheat and sunflowers. Edible beans began showing up in crop systems in the early 1980s.

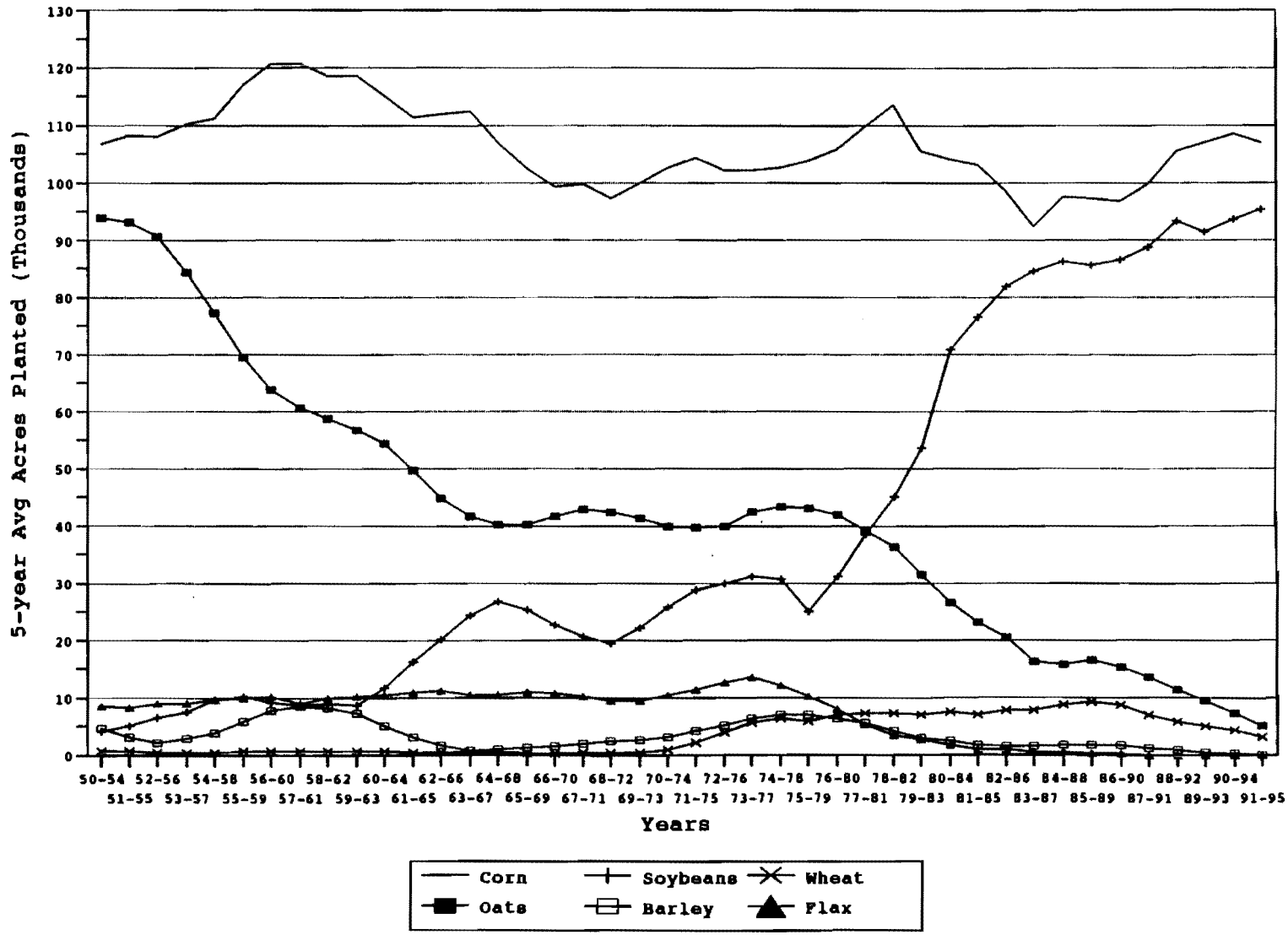
The pie charts indicate that farmers in Codington County have had moderate diversity in their crop systems. In the early part of the period examined, wheat, oats, flax, corn, and alfalfa were important in Codington County; in later years, wheat, soybeans, corn, and alfalfa were important.

Moody County

The major crops grown in Moody County are shown in Figure 5 (information obtained from NASS). The major crops grown in Moody County show a trend similar to that for eastern South Dakota, shown in Figure 2. One slight difference is that of corn—it was the most important crop for Moody County in the early 1950s, whereas oats was the most important crop for the eastern South Dakota region. In Moody County, corn acres planted in the early 1950s were just under 107,000. Corn production peaked in the late 1950s at just over 120,000 acres planted. Another peak occurred in the late 1970s, with approximately 113,000 acres planted. Another downward trend occurred until there was a 45-year low of just over 92,000 acres planted in the mid-1980s. Since then, corn production was on an upward trend, to its early 1990s level of just under 107,000 acres planted.

Oats also was a major crop in Moody County in the early 1950s, with approximately 94,000 acres planted. Oats underwent a sharp downward trend until the mid-1960s. Acres planted for the next 10 years

Figure 5. Major Crops:
Moody County



hovered around 40,000 acres. Then, in the late 1970s, another downward trend occurred, resulting in an early 1990s level of approximately 5,000 acres planted.

Soybeans had limited significance in Moody County in the 1950s, with acres planted ranging from 5,000 to 10,000 acres. In the early 1960s, soybean acres started an upward trend to just under 27,000 acres in the mid-1960s. The number of acres planted oscillated between 19,000 and 31,000 for the next 10 years. Then, in the mid-1970s, soybeans began a sharp upward trend, tapering off in the early 1980s. In the early 1990s, acres planted to soybeans in Moody County were approximately 95,000.

Flax was of limited importance in Moody County. Production was relatively stable from the 1950s to the early 1970s. The number of acres planted held relatively steady at 10,000. Acres peaked in the mid-1970s at just over 13,000 acres and then began a downward trend. In the early 1990s, there were few or no acres planted to flax in Moody County.

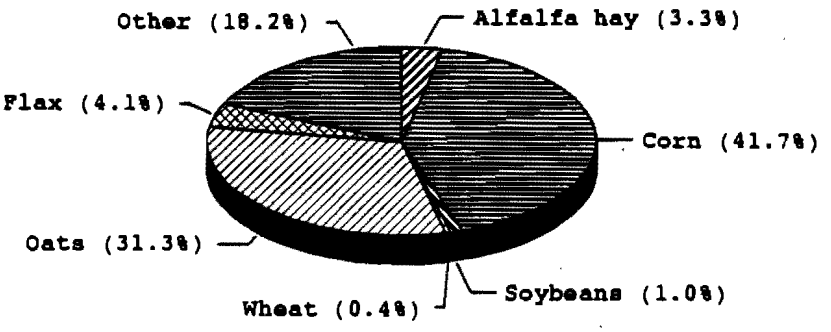
Wheat production was almost nonexistent in Moody County until the early 1970s. The number of acres planted to wheat then increased for the next 15 years, to a high of approximately 9,200 acres in the late 1980s; acres then declined to an early 1990s level of approximately 3,000.

Barley also is of little importance in Moody County. Acres planted have fluctuated between 1,000 and 10,000 acres for the last 45 years. In the early 1990s, there were few to no acres planted to barley.

Pie charts for crop acres harvested in Moody County are shown in Figure 6 (information obtained from the Agricultural Census). The major changes that occurred from 1949 to 1992 were for oats and soybeans—oats decreased from 31.3 percent in 1949 to 1.6 percent in 1992. Soybeans, however, increased from a low of 1.0 percent in 1949 to 35.8 percent of acres harvested in 1992. Flax also decreased from 4.1 percent of acres harvested in 1949 to a negligible amount in 1992. Alfalfa hay acres harvested increased from 3.3 percent in 1949 to 8.2 percent in 1964. Alfalfa hay then declined to 6.5 percent in 1978 and 4.7 percent in 1992. Corn, as a percent of acres harvested, has not changed significantly over the years—41.7 percent in 1949 and 37.9 percent in 1992. The "other" category has remained relatively stable. Its percent of acres harvested was 18.2 percent in 1949; the percent increased in reporting years 1964 and 1978, and then declined to 18.7 percent of acres harvested in 1992.

Figure 6. Acres Harvested: Moody County

1949



1964

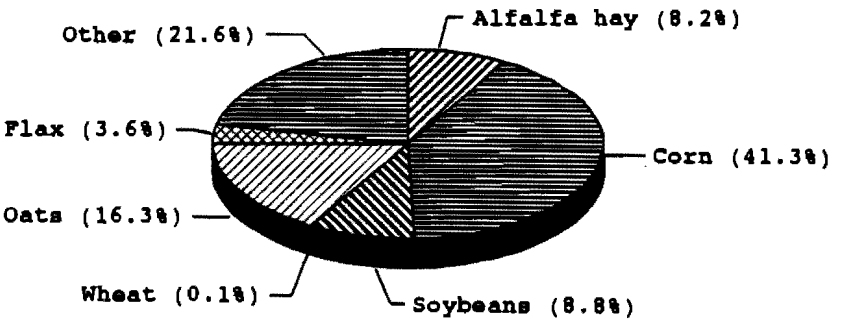
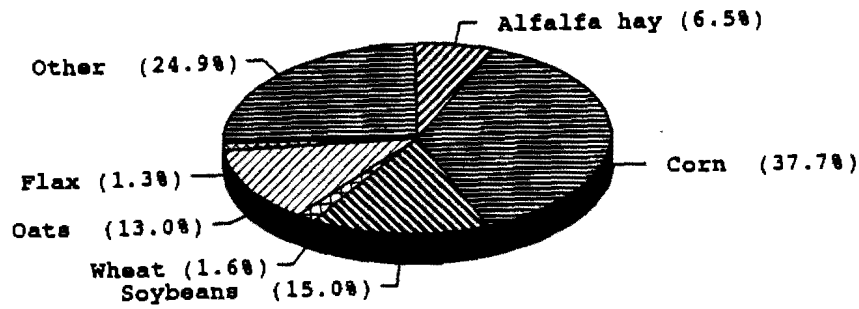
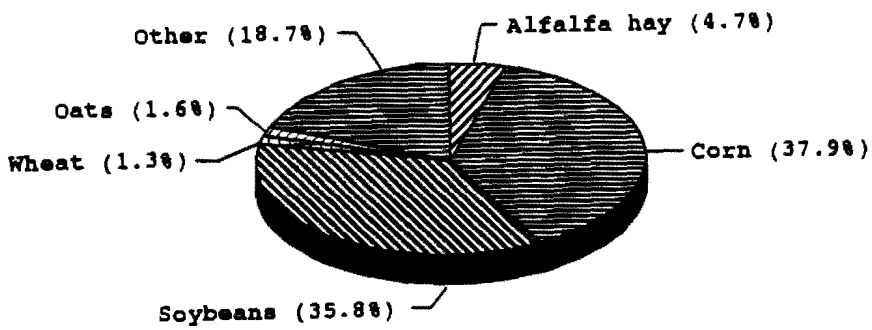


Figure 6. Acres Harvested: Moody County (continued)

1978



1992



The pie charts also reveal that farmers in Moody County have somewhat narrow cropping systems. In 1949, corn and oats were 73 percent of acres harvested, and in 1992, corn and soybeans were 73.7 percent of acres harvested.

Economic influences

The following sets of potential economic influences on crop system decisions are examined in this report: (1) crop price relationships and access to markets; (2) technological change and other supply factors; (3) changes in the structure of agriculture; and (4) Federal farm programs.

Crop prices play an important role in farmers' decisions about what crops to plant. Prices affect both profits and risks.

Technology also plays an important role in farmers' crop system decisions. For example, the introduction of synthetic chemicals and fertilizers after World War II has increased production substantially, particularly for corn. Another example is that of farm equipment, where there have been many changes over time, particularly in size.

With respect to changes in the structure of agriculture, the number of farms continues to decline while average farm size continues to increase. Larger farms require larger equipment in order to limit risks of not getting crops planted and harvested in a timely manner. Due to the expense of equipment and repairs, farmers tend to plant fewer crops in order to limit the number of pieces of equipment needed.

Over the years, Federal farm policies have played a major role in farmers' crop system decisions. The origin of "modern" agricultural policies was the agricultural depression of the 1920s and 1930s, when a substantial portion of the population made its living from the land, commodity prices were extremely low, and production was high. Thus, the first price and income supports came about with the Agricultural Adjustment Act (AAA) of 1933. Included in the AAA was the first attempt to reduce or control production through acreage reduction. To implement the acreage reduction, "base acres" were established. Farmers were allowed to plant crops on their "base acres", but were required to idle their remaining acres in return for a payment. However, farmers found ways to turn this to their advantage by farming the best land and idling their poorest land. Consequently, farm production declined only slightly. Incomes of farmers, however, did increase with the government payments, helping farmers to purchase the required inputs and make loan payments. (Cochrane and Runge, 1992)

Over the next 30 years, agricultural policies were revamped to meet the changing situations found in the agricultural economy. Government payments were increased or decreased, depending on commodity prices and production levels. Also, continued efforts were made to improve environmental protection.

Since the inception of the first agricultural commodity policy, acreage reduction and base acres have played an important role in farmers' crop system decisions. Support payments were tied, or "coupled", to the basic commodity crops, which could be planted only on base acres, while remaining land had to be idled. There were time periods when farmers were able to increase their base acres by foregoing support payments and planting previously idled acres to corn and wheat, for example (Cochrane and Runge, 1992). This "coupling" of payments to certain commodities encouraged the production of these crops; therefore, farmers were financially penalized if they planted a nonprogram crop (Faeth, 1995).

The 1996 Farm Bill "decoupled" the payments from specific commodities. Farmers can still receive the payments and plant any crops, with minor exceptions for fruits and vegetables, on their acres. The payments received are based on previously established bases and yields (Economic Research Service, 1996).

Data and information sources

Our analysis drew on both quantitative and qualitative information. Quantitative data was obtained from Agricultural Census and National Agricultural Statistics Service sources. Focus groups provided qualitative information on farmers' views about the crop system changes that have taken place in eastern South Dakota since World War II. Qualitative analysis also was conducted, in part, on the basis of interviews with plant scientists at South Dakota State University and other sources to gain a better understanding of the role of technological change. A review of past Federal farm policies helped us to understand the potential influences of such policies on crop system patterns since the early 1950s. This complemented the descriptive and statistical analyses based on Agricultural Census and NASS data.

Two focus groups were formed from both Codington and Moody Counties, for a total of four focus groups. We attempted to have five to eight farm units in each focus group. Also, we designed one group for each county with smaller (sometimes part-time) farms and another group with larger farms. The size criteria differed for each county, as the average farm size (determined from Agricultural Census data) differed substantially. Codington County has considerably more pasture than Moody County, causing

average farm size to be larger in the former. For each group, we attempted to have at least two farmers with livestock, at least two growing crops over the Big Sioux Aquifer, and at least one using irrigation.

With the aid of the Extension Agents in Codington and Moody Counties, farmers were selected for each group, given the desired criteria. To ensure attendance of 5 to 8 farm units per group, we selected more than 8 farms per group, realizing that not all farmers would be able to attend. In Codington County, 11 farm units were selected for Group I and 10 for Group II. In Moody County, 9 farm units were selected from Group I and 11 for Group II.

Invitational letters, RSVP slips, background information forms, and some historical county background information were mailed approximately 3 to 4 weeks in advance of the meetings. Farmers were allowed 2 weeks to return their RSVPs and the background information sheet. Follow-up calls were made to the farmers who did not respond, to get an indication whether they would be attending the meetings. Two days before each meeting, reminder calls were made to those who indicated they would be attending the upcoming meeting.

The focus group meetings were held in the latter part of November and the first part of December 1997, after harvest was finished. The meetings were located in the meeting rooms of the local Extension offices. Luncheons, catered by local people, were provided in appreciation of the farmers' participation.

In Codington County, Group I had five farm units, or six farmers (including one woman), in attendance. Group II also had five farm units, or eight farmers (including one woman), in attendance.

Group I of Moody County had five farm units, or seven farmers (including two women), present. Unfortunately, Group II had only two farm units, or three farmers (including one woman), present.

The Extension Agents for each county were also invited to participate in the discussion. The Agent in Codington County was able to attend one of the two meetings, and the Agent in Moody County attended both meetings.

The focus groups started with casual noon luncheons, providing an opportunity for everyone to get acquainted. One of us (Dobbs) served as facilitator for the focus group meetings. After lunch, the facilitator gave a historical overview (with the aid of overhead graphs) of the applicable counties with respect to crops grown, livestock enterprises, sizes of farms, and farm numbers. There was also a graph showing historical crop prices for South Dakota.

After the overview, we both asked various questions of the groups regarding the overheads, past farm bills, and the 1996 Farm Bill. Ample time was given for each question to allow for good discussion; however, the facilitator kept the discussion on track to ensure that the meetings could officially adjourn at 2:00 p.m. However, farmers were encouraged to stay longer and continue the discussion, if their time permitted. The final question asked of each group provided for good discussion, with many of the farmers staying beyond 2:00 p.m.

The focus group sessions were recorded on audiotapes, with the permission of the participants. We also took notes and, when possible, individual viewpoints were recorded—not to quote individuals, but, rather, to get a feeling of the attitudes of farmers with different backgrounds.

Organization of report

The remainder of this report is organized on the basis of the four sets of economic forces previously described—dealing with price relationships, technological change, the structure of agriculture, and Federal farm programs. Conclusions are presented at the end of the report.

Price Relationships and Access to Markets

Economic logic would lead us to expect that as the price increases (decreases) for a commodity, the number of acres planted will increase (decrease); this assumes that prices of particular commodities are positively related to net returns per acre for the crops associated with those commodities. Logic also suggests that the number of acres planted to a commodity depends on the prices of substitute and complementary commodities. In this section, we report results of our examination of price influences, based on descriptive statistics and focus group feedback.[3]

Statistical description

The prices received by farmers in South Dakota, for the major crops and hay, are shown in Figures 7 and 8, respectively. Prices were obtained from NASS. The graphs show the 5-year average prices for the 45-year time period. To smooth out the year-to-year fluctuations in prices, 5-year averages were used. The first time period along the x-axis, 50-54, is the 5-year average for years 1950 to 1954.

[3] Dumke's M.S. thesis (1999) also contains results of some multivariate regression analyses. However, limitations of the data and modeling approaches were such that we place more trust in our descriptive statistics and focus group interview findings than in the regression findings.

Figure 7. Commodity Prices:
South Dakota

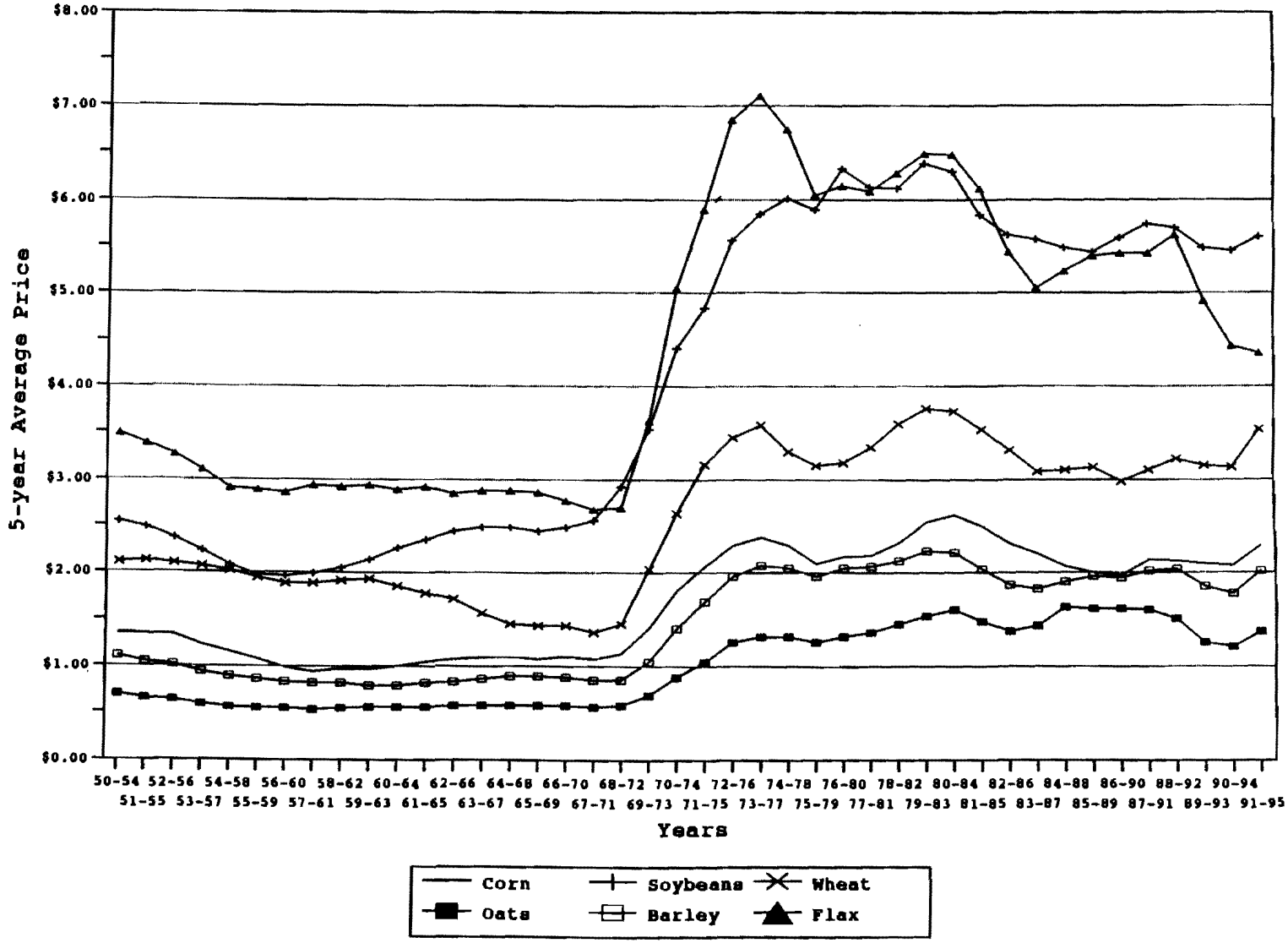
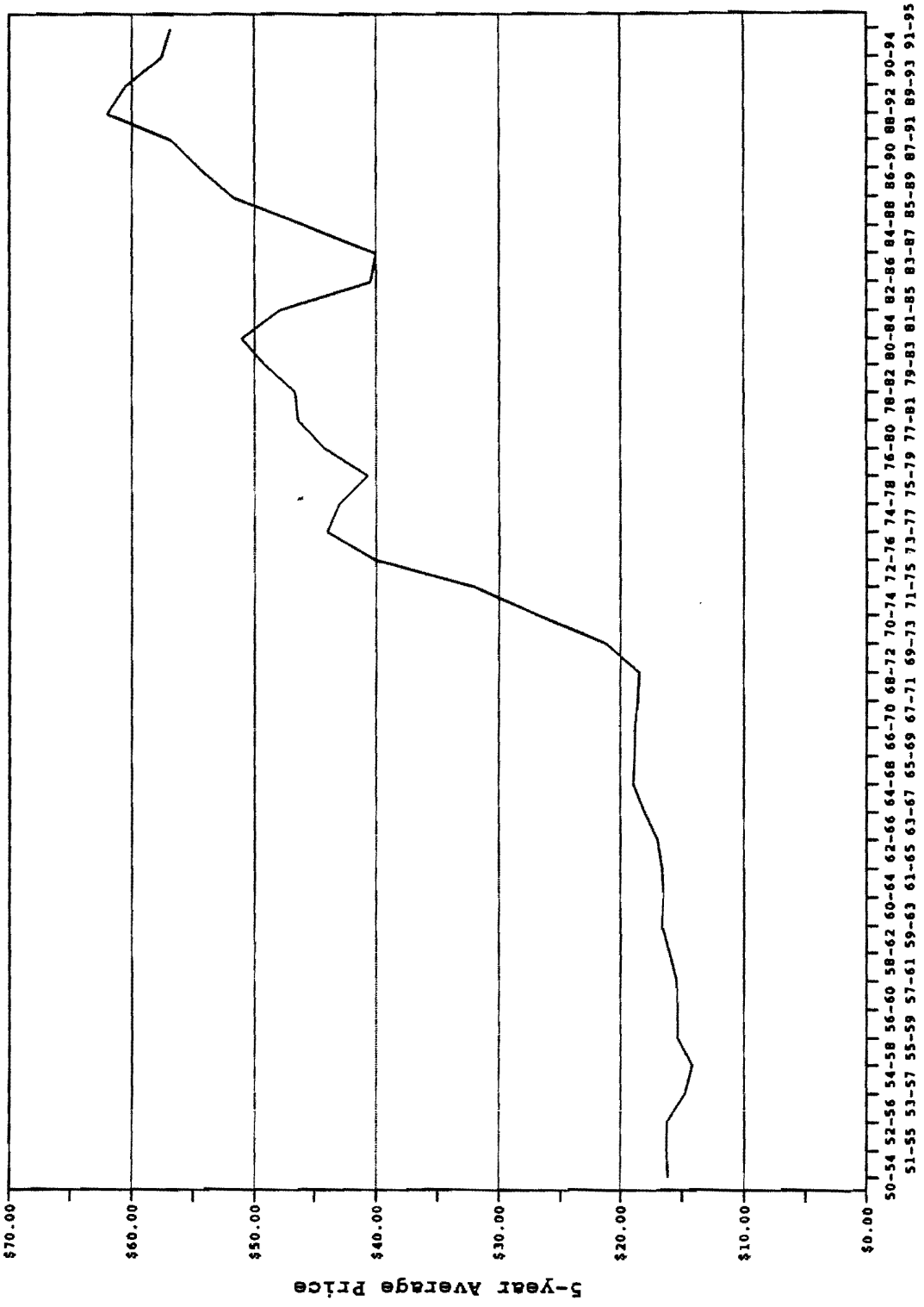


Figure 8. Hay Prices:
South Dakota



The undeflated prices show relatively stable to slightly downward trends until the late 1960s, when a sharp upward trend occurred. All prices peaked in the mid-1970s, followed by a decline. For the next 10 years, prices fluctuated moderately. In the early 1990s, all prices started another upward trend, except for the flax price, which showed a sharp decline into the early 1990s.

Hay prices fluctuated moderately between $14 and $22 per ton from the early 1950s to the early 1970s. Then, a strong upward trend occurred until prices peaked in the mid-1970s, with prices hitting $44 per ton. Prices tapered off for the next few years, followed by another upward trend and prices peaked again in the early 1980s at $51 per ton. Again, prices dropped off until they hit a low of $40 per ton in the mid-1980s. Another upward trend occurred until prices peaked at an all-time high in the late 1980s of just under $66 per ton. Prices, again, tapered off in the early 1990s, to just under $57 per ton.

Figures 9 through 12 show the relationships between deflated prices and acres planted for corn, soybeans, wheat, and oats, respectively. Figure 13 shows the relationship between deflated prices and the number of alfalfa hay acres harvested. The prices and acres "planted" were obtained from NASS. The Agricultural Census, reported approximately every 5 years, provided the information for alfalfa hay acres "harvested".

Prices reflect 5-year averages, deflated by the "total production items" cost index. Total production items include agricultural inputs, except labor, that go into the production of crops. Deflated prices were used to show what prices were relative to inputs, or the purchasing power relative to cost of the inputs. Hay prices for Figure 13 also reflect deflated 5-year averages; prices corresponding to each Agricultural Census reporting year were averages for 5-year periods surrounding that year. We did not attempt to construct a time series of deflated production costs for each crop, to combine with prices and yields for measurement of crop-specific net returns. Therefore, the following observations are based on price (rather than net return) and acreage relationships.

The deflated prices for all graphs show a general downward trend, particularly for wheat, which shows an approximate two-fold decrease in price from the early 1950s to the late 1960s. A strong spike occurred for all crops in the mid-1970s. The graphs show generally positive relationships between the

Figure 9. SD Corn Prices and
Acres Planted: Eastern South Dakota

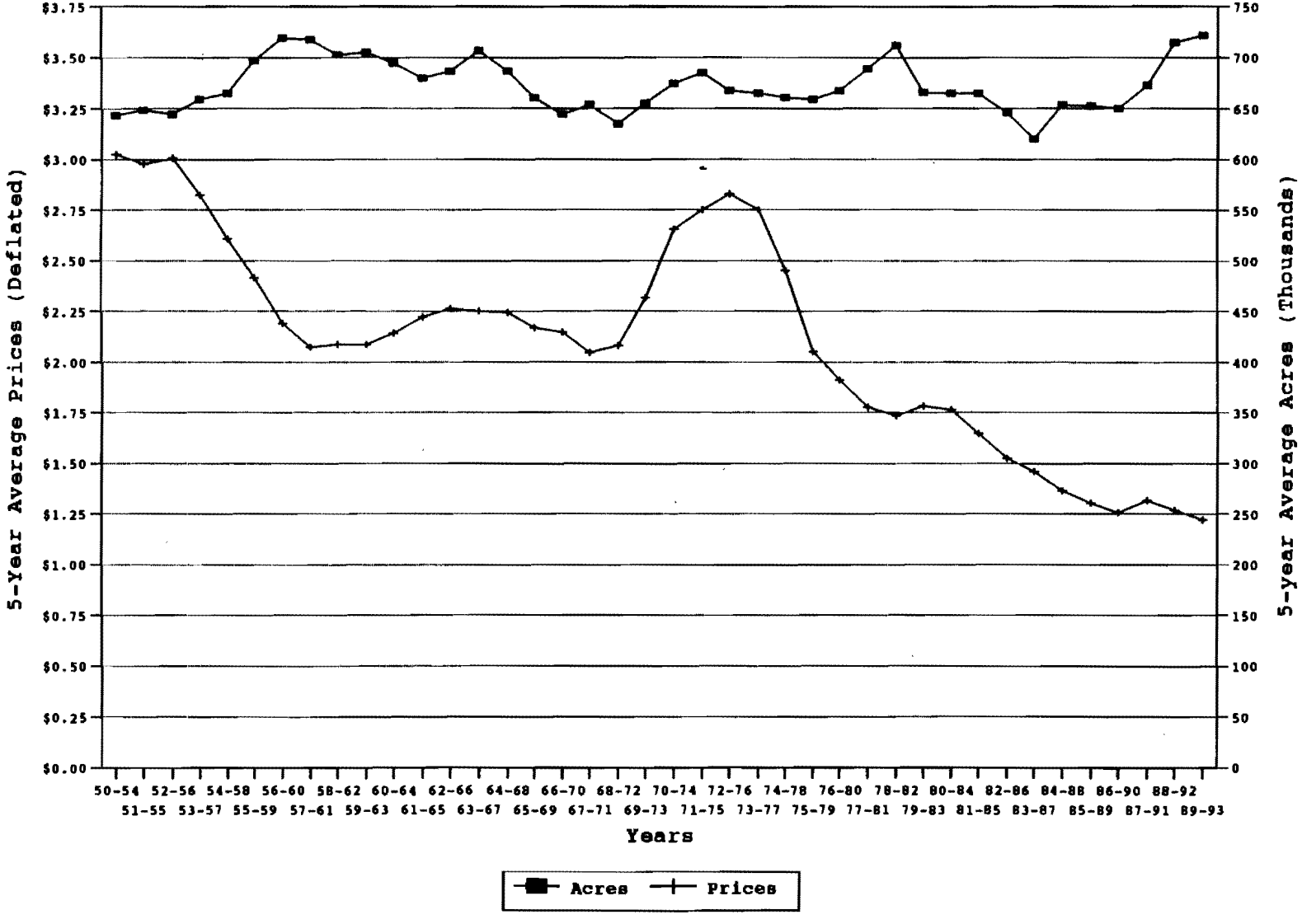


Figure 10. SD Soybean Prices and and Acres Planted: Eastern South Dakota

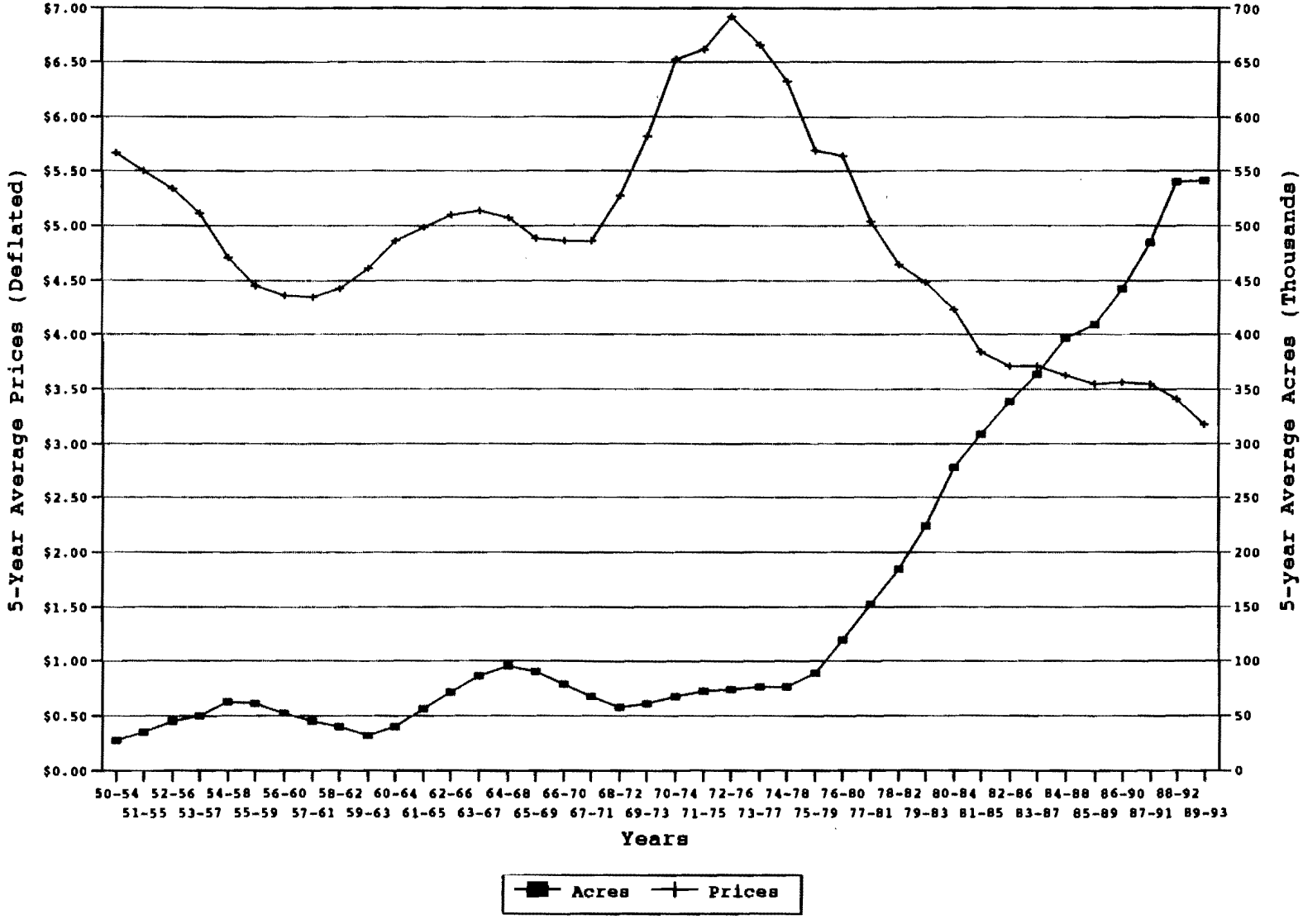


Figure 11. SD Wheat Prices and
Acres Planted: Eastern South Dakota

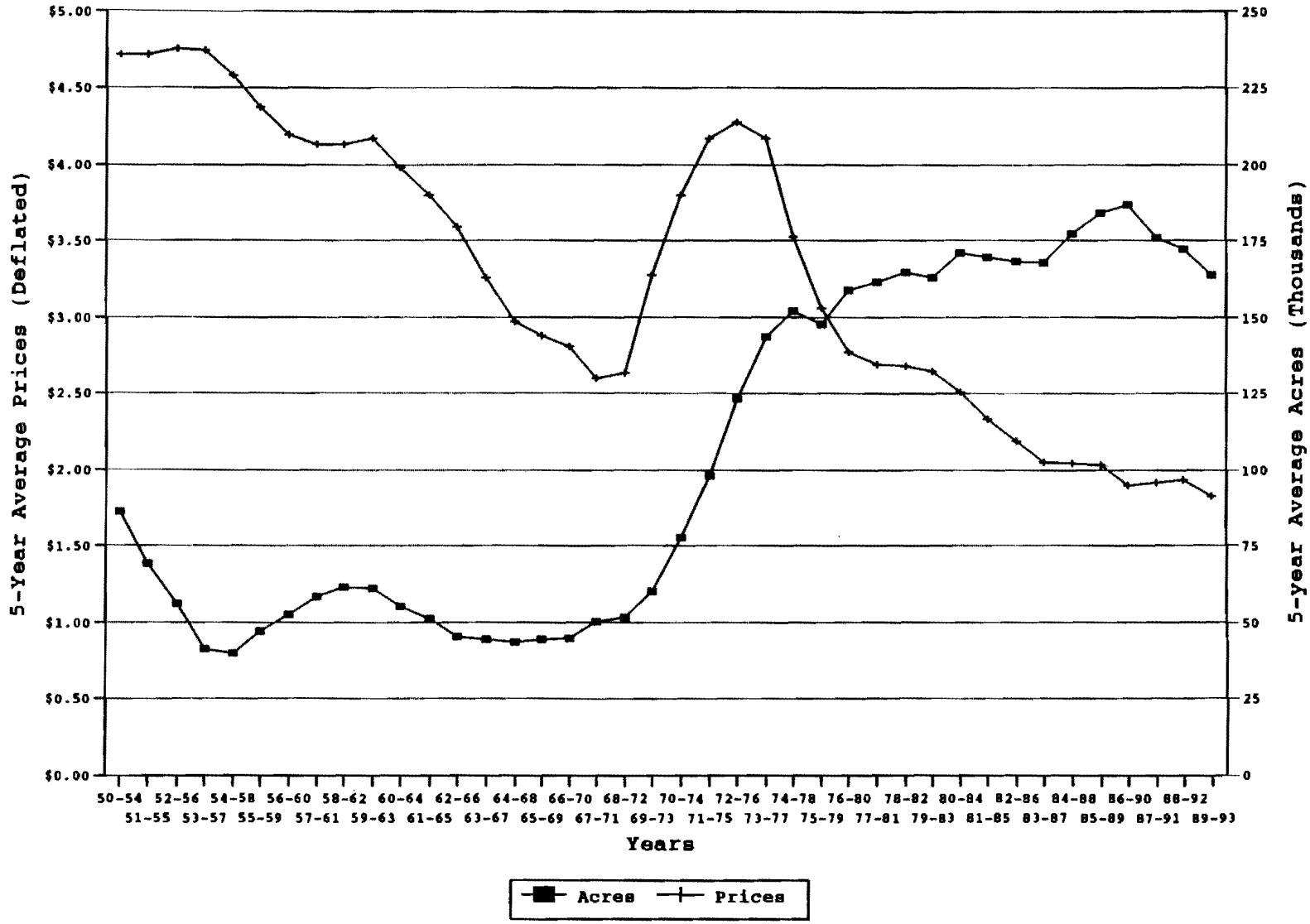


Figure 12. SD Oat Prices and Acres Planted: Eastern South Dakota

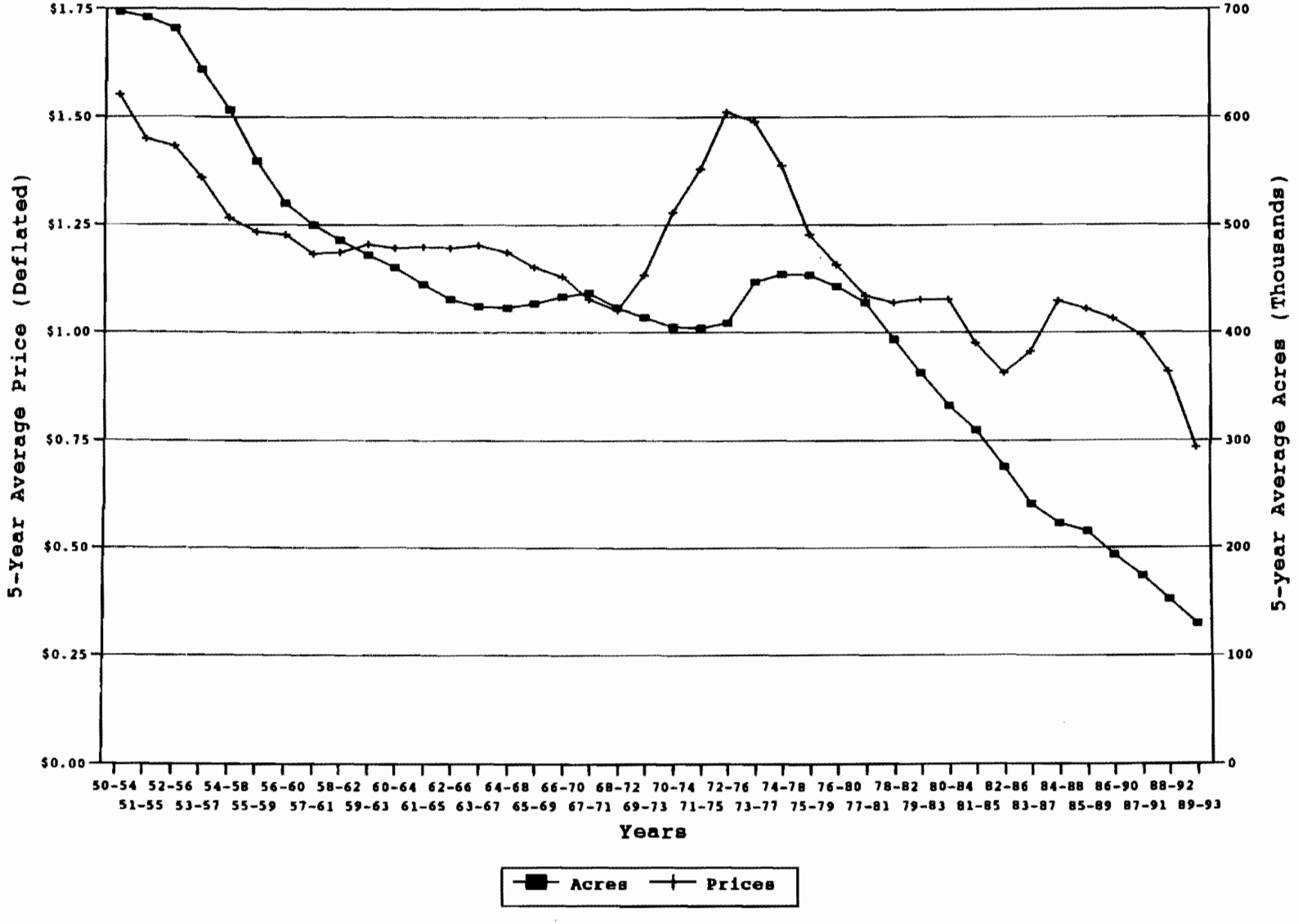
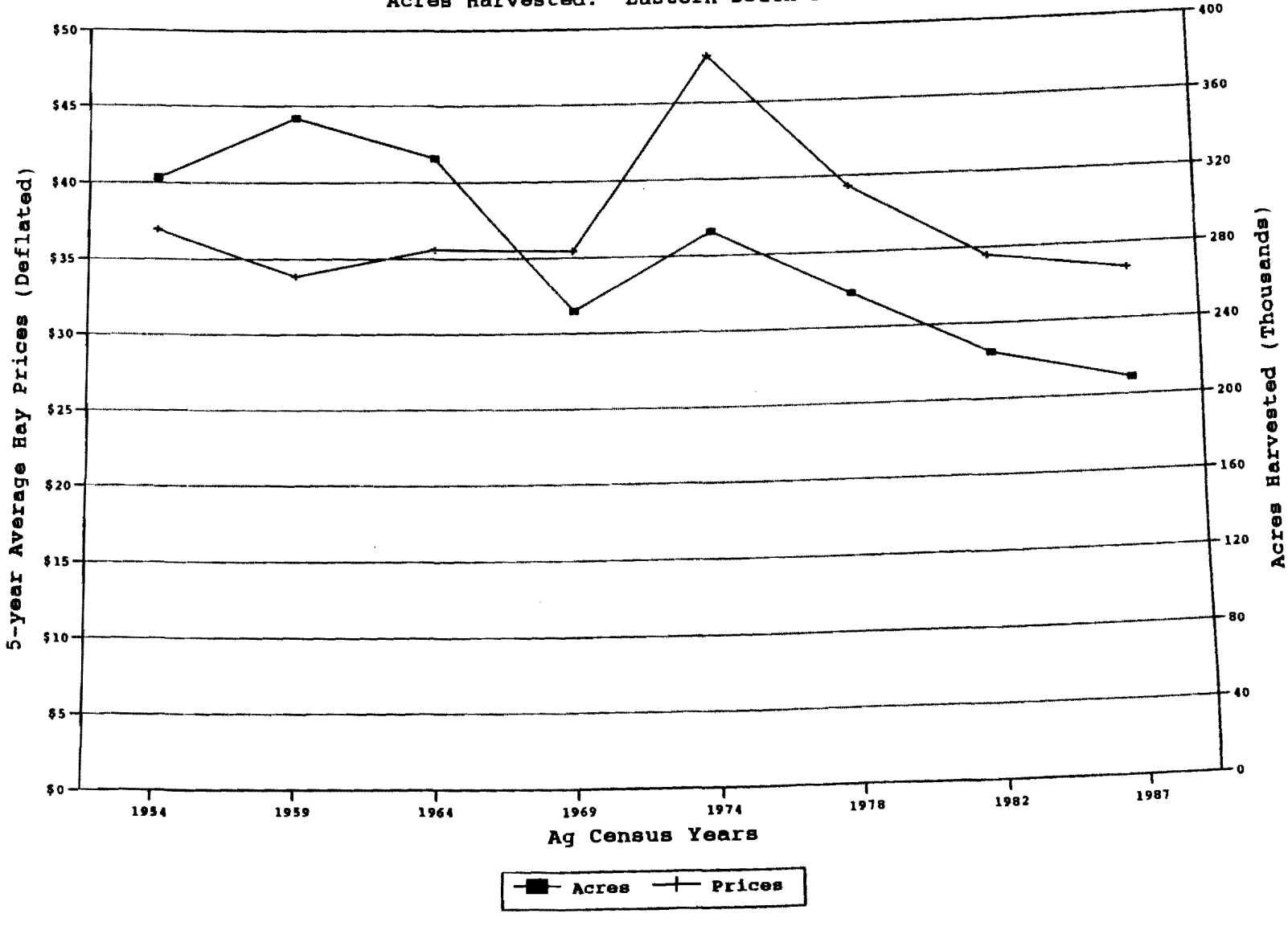


Figure 13. SD Hay Prices and
Acres Harvested: Eastern South Dakota



deflated price and the number of acres planted to the individual crops from the 1960s through the mid-1970s.[4]

In the late 1970s and early 1980s, there is an inverse relationship between the number of acres planted and prices for corn and soybeans. This indicates that factors other than price caused farmers to continue or increase the number of acres planted to corn and soybeans. For example, technological changes—discussed in a subsequent section of this report—could have led to changes in per unit production costs and in the *relative* profitability of different crops.

Wheat acres show a trend similar to those for corn and soybeans until the mid-1980s, when acres planted and prices both decline.

Oats and alfalfa are two crops that, for most years, show a strong relationship between the number of acres planted and prices. Except for reporting periods 1959 and 1969, the number of alfalfa hay acres planted is strongly linked to prices. Oats follow a pattern similar to alfalfa hay; except for the late 1950s, late 1960s, and the early 1980s, oat acres planted are strongly correlated with prices.

Focus group responses

The first focus group question, "What are the major factors that have influenced this evolution of crop systems since the early 1950s?", pertained to the major crops grown in Codington and Moody Counties (Figures 3 and 5).

Many farmers felt that the reason for the decline in flax acres was the decreased demand for flax products. In the early 1970s, there was a strong demand for linen, paper, and linseed oil, all made from flax. However, due to high prices for these products, synthetic fabrics replaced linen and latex paints replaced paints made from linseed oil. Some farmers commented that the soybean market replaced the flax market.

Some of the farmers indicated that the number of oats acres declined, in part, due to low prices for both oats and livestock. As farmers decreased or eliminated their livestock operations, the need for oat straw diminished.

Many reasons were cited by the focus group farmers for the sharp increase in soybean acres

[4] Average prices and acres are for the periods indicated, and are not plotted in a lagged fashion (i.e., acreage data points are not lagged behind price data points).

planted. Soybean meal began to replace oats in livestock rations—farmers can more efficiently raise protein intake with soybean meal than with oats. Also, there has been an increase in other products made from soybeans, such as soybean oil replacing linseed oil. Some farmers also reported that the high prices of the mid-1970s conditioned farmers to make a living with just corn and soybeans.

The ability to use hedging tools for corn, soybeans, and wheat has helped lock in higher prices, some farmers reported. Therefore, more acres are planted to those crops.

Farmers in Moody County commented on the lack of markets for wheat. Even though prices at times are high, there presently are no local markets for wheat.

Hay prices for the last few years have been good, but the number of alfalfa hay acres harvested remains relatively low, particularly in Moody County. One of the plant scientists commented on a survey of farmers put out by the University of Minnesota regarding alfalfa. The report revealed that farmers with alfalfa in their rotation reported that alfalfa consistently outperformed, profit-wise, their corn and soybean rotations. Despite this report, many farmers still do not include alfalfa hay in their rotations. Farmers and plant scientists commented that the main reason for not including alfalfa hay in the rotation is the expense of another line of equipment that is needed to put up hay. Also noted was the "window of time" for putting up hay. Once alfalfa hay is cut, ideal weather conditions—warm, sunny, and low humidity—are needed to put up quality hay.

Technological Change and Other Supply Factors

Changes in technology during the last half of this century have resulted in crop yield increases, particularly for corn and soybeans in the Corn Belt. This has been helpful in increasing production; however, it also has caused less diversity in crop systems and, at times, created a surplus of some commodities.

Statistical analysis

Simple regression models were developed to show changes in yields over time. Of particular interest were wheat and soybean yields—a small grain and (until recently) a row crop. Wheat is one of the three major crops grown in Codington County, and soybeans is one of the two major crops in Moody County.

Figures 14 and 15 show the results of the models for wheat, in Codington County, and soybeans, in Moody County. The dependent variable, represented by 'Y', denotes wheat or soybean yields. The letter 't' represents trend, or time. The trend variable is meant to encompass those variables that cannot easily be quantified individually. Trend explains factors which change gradually over time, such as technology in the form of new seed varieties, chemical pesticides, fertilizers, and machinery.

One model was run for wheat yield in Codington County. Results show that as time increases by one year, yields increase by 0.553 bushels. This equates to an approximate 25 bushels per acre increase from 1950 to 1995.

There were two models run for soybean yields in Moody County—one for the 1950 to 1995 time period and one for 1970 to 1995. As previously mentioned, the number of acres planted to soybeans in Moody County started its sharp upward trend in the early 1970s; therefore, there was interest in determining if yields increased at a greater rate in the later time period. The intercepts correspond to the beginning time period for each model. Results for the time period 1950 to 1995 reveal that as time increases by one year, yields increase by 0.474 bushels per acre—approximately a 22 bushel per acre increase from 1950 to 1995. The model for years 1970 to 1995 reveals only a 0.357-bushel annual increase. However, as shown in the graph, there were two years in the 1970 to 1995 time period when yields were unusually low, which could account for the reason that yields did not increase more during that time period. Also, technology may be increasing the yield potential at a decreasing rate. Technology, such as commercial fertilizers and new seed varieties, soared after World War II, which also could help explain yields increasing at a faster rate in the earlier years.

The R-square (R^2) measures the coefficient of determination, or the "goodness of fit". The closer R^2 is to 1.0, the better the fit of the model. The R^2 indicates the proportion or percentage of the total variation in Y that is explained by the regression model (Studenmund, 1997). The model for wheat yield has an R^2 of 0.6062; 61 percent of the variation in yield is explained by the trend variable. For soybean yield, the R^2 for the 1950 to 1995 time period is 0.6036 and it is 0.1849 for time period 1970 to 1995. Therefore, 60 and 18 percent, respectively, of the variation in the yield is explained by the trend variable. The soybean trend model for the 1950 to 1995 time period is much more meaningful than is the model for the later period.

Figure 14. Wheat Yield Trend:
Codington County

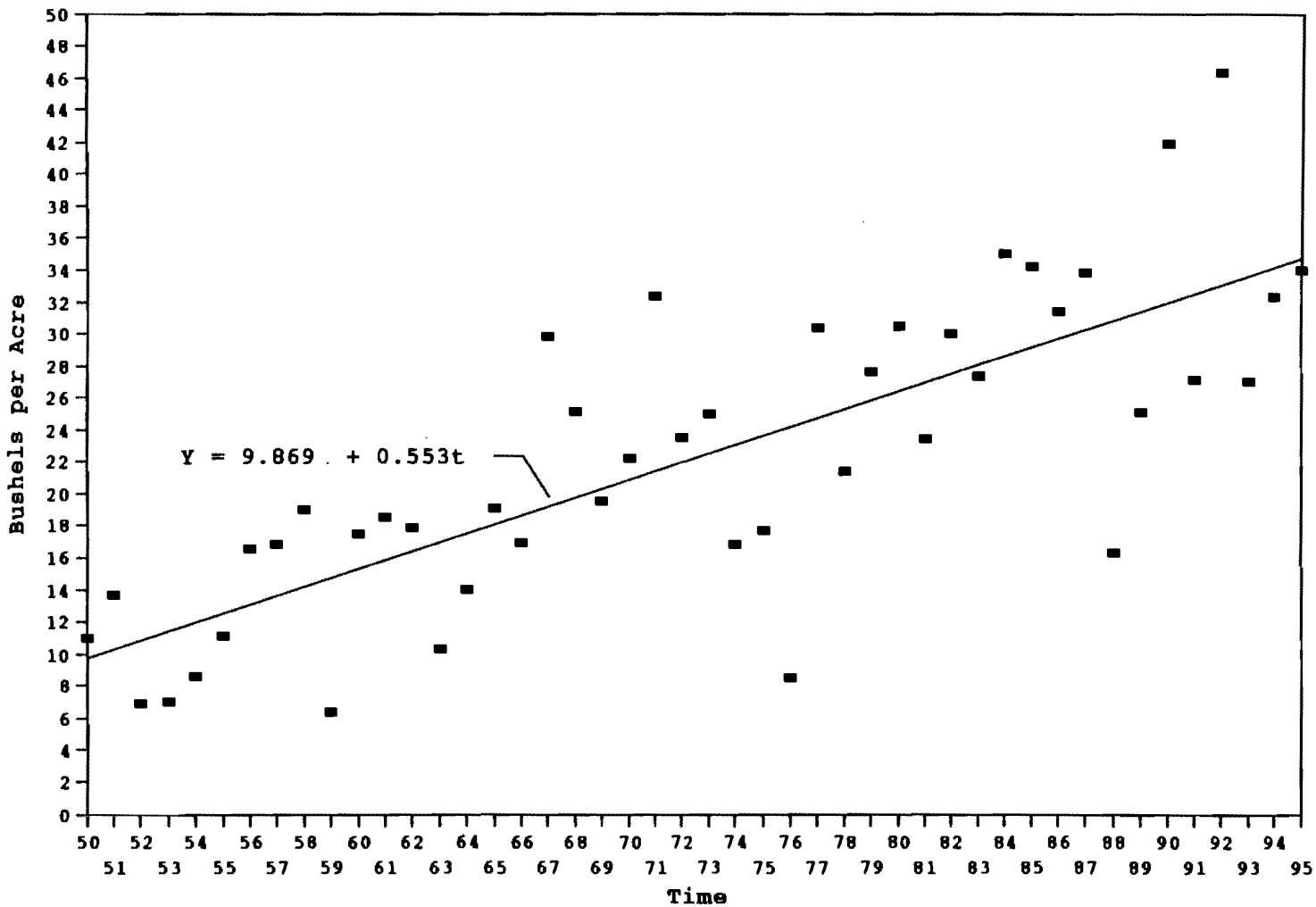
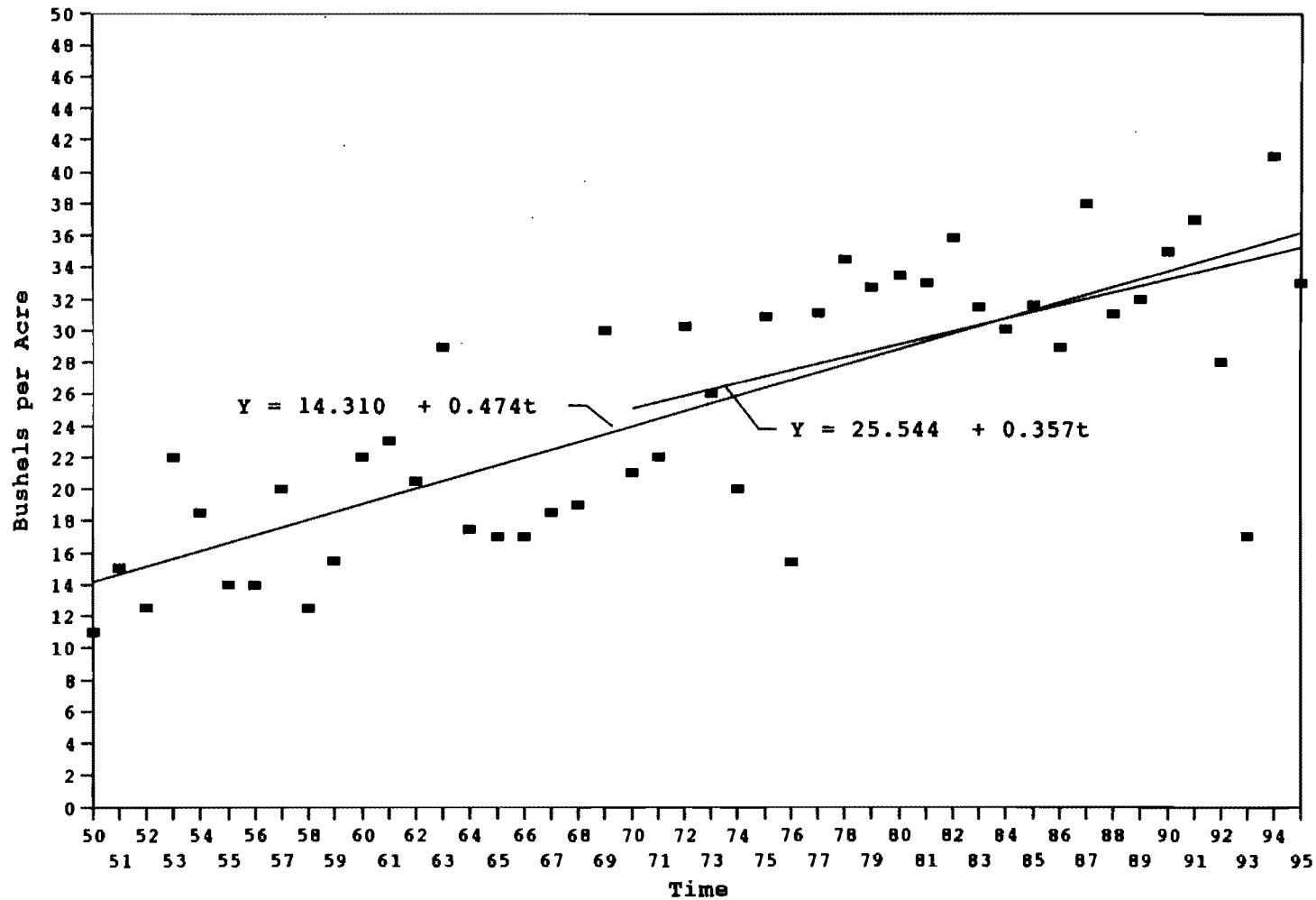


Figure 15. Soybean Yield Trend:
Moody County



Use of fertilizers

The previous section indicates how such technologies as fertilizers, represented by the trend variable, impact yields. Figures 16 and 17 are 2-Y graphs showing the 5-year average acres planted to wheat in Codington County and corn in Moody County, respectively, and the dollars (constant) spent on fertilizers. Fertilizer expenditure data were obtained from the Agricultural Census; such data were not reported for 1959, however.

In Codington County, the amount of (constant) dollars spent on fertilizers is directly related to the amount of acres planted to wheat, beginning in reporting year 1969. This may indicate that farmers realized the impacts fertilizer has on yields and on profits. In comparing Figures 14, Wheat Yield Trend, and Figure 16, the amount spent on fertilizer, we see an apparently strong positive relationship between fertilizer use and yields.

In Moody County, however, reporting years 1974, 1978, and 1992 are the only years where there appears to be a strong correlation between the number of acres planted to corn and total dollars spent on fertilizers. In the mid-1980s, there was an economic crisis in the agricultural sector, which may account for the decline of fertilizer use during this period.

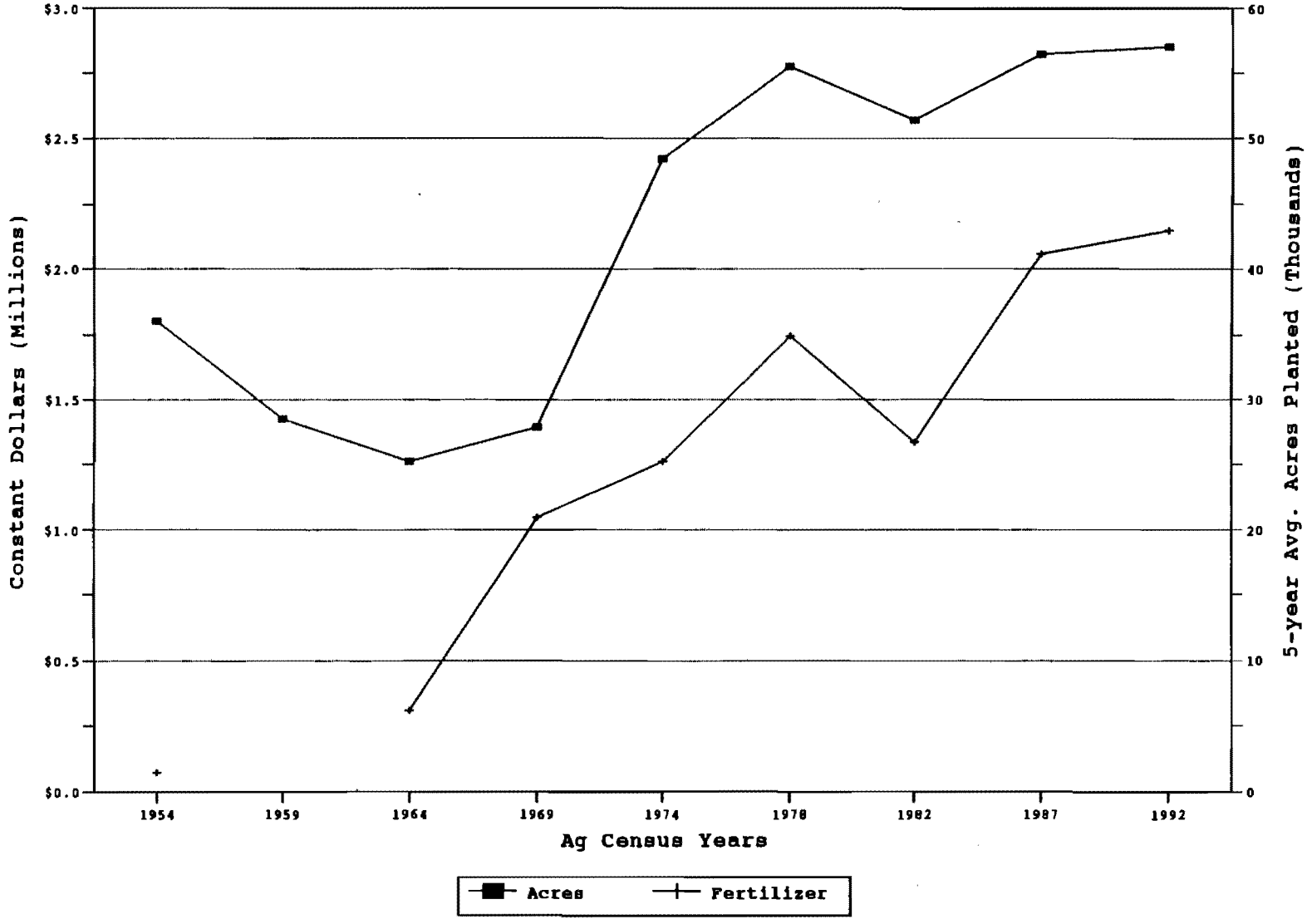
Irrigation

Irrigation has not had a large impact in the seven-county study area. Acres under irrigation are shown in Figures 18 and 19 for Codington and Moody Counties, respectively. Soybeans and corn are the primary crops under irrigation in eastern South Dakota. As shown in the graphs, a surge in irrigation occurred in the late 1970s in Codington County and in the late 1960s in Moody County.

In reference to Figures 3 and 5, the number of acres under irrigation follows the upward trend for the number of acres planted to soybeans in the mid- to late 1970s in Codington County and in the late 1960s in Moody County.

Technology, in the form of irrigation, also plays a role in the narrowing of crop systems. Many of the sandier soils in eastern South Dakota were found to be quite productive when irrigation systems were installed, particularly for corn and soybeans. Evidence of less diverse crop systems is particularly true for Codington County, as shown in Figure 3. The number of acres under irrigation in the late 1970s soared and, at the same time, crop systems narrowed.

Figure 16. Fertilizer and
Wheat Acres Planted: Codington County



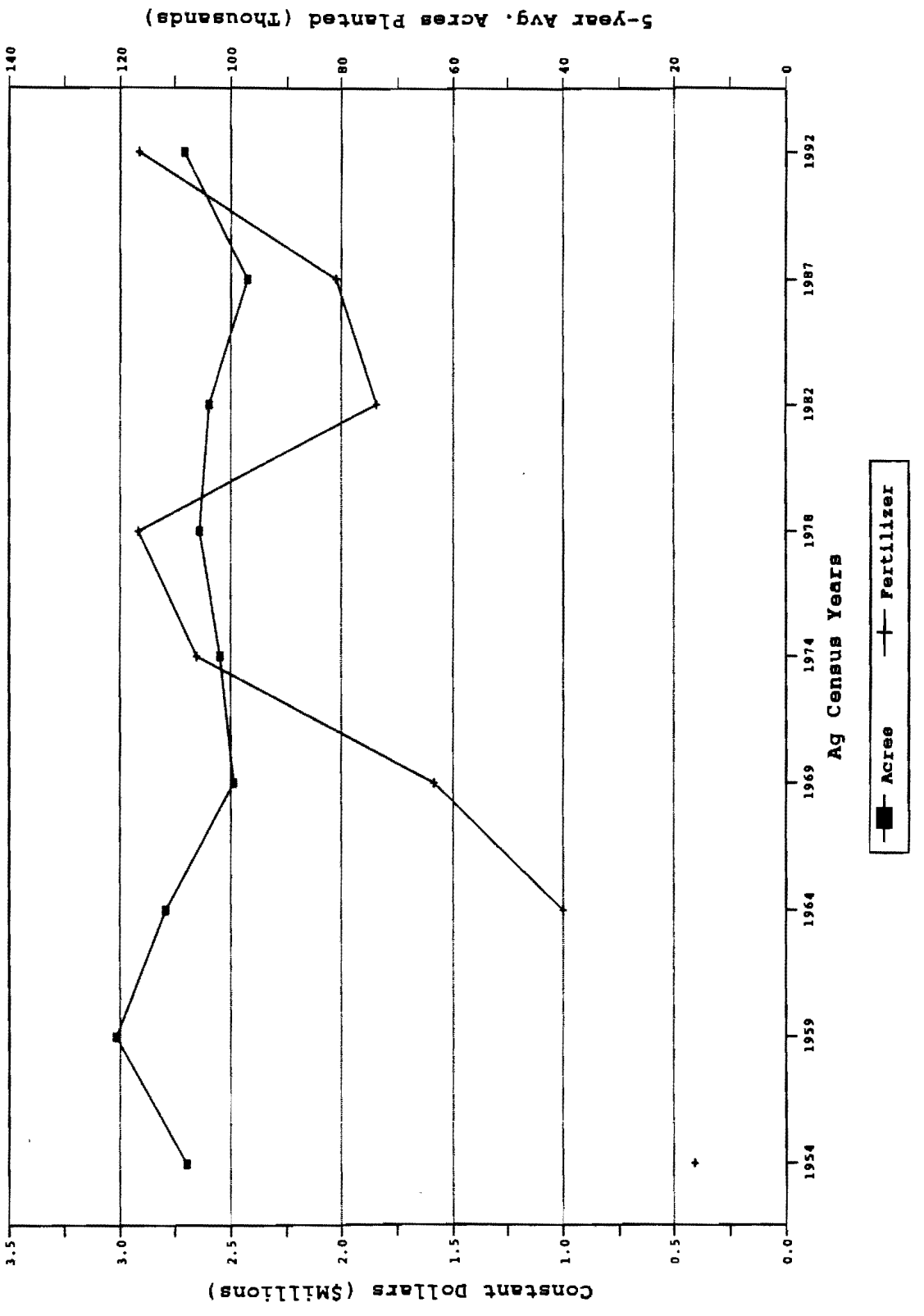


Figure 17. Fertilizer and
Corn Acres Planted: Moody County

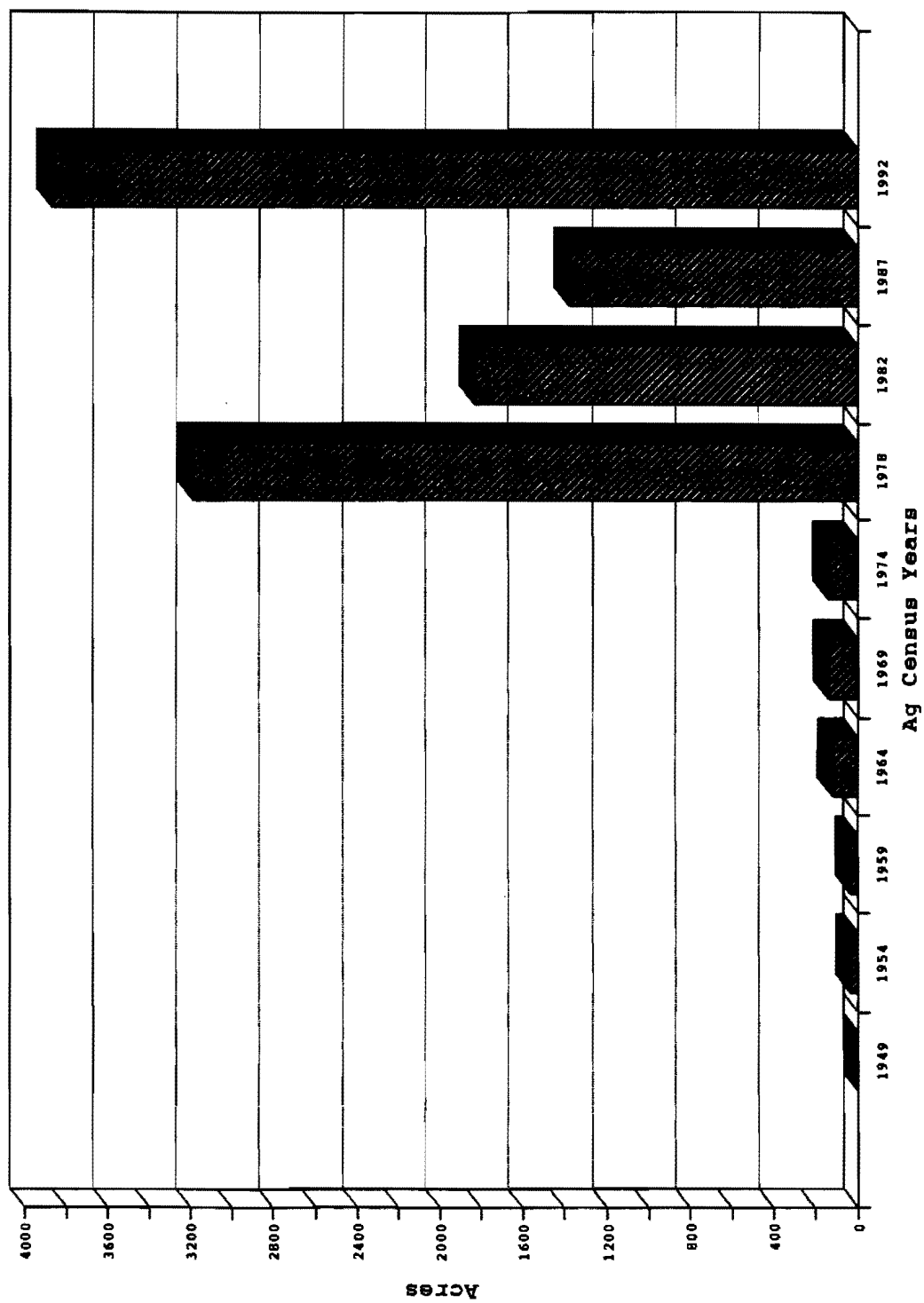


Figure 18. Land in Irrigation: Codington County

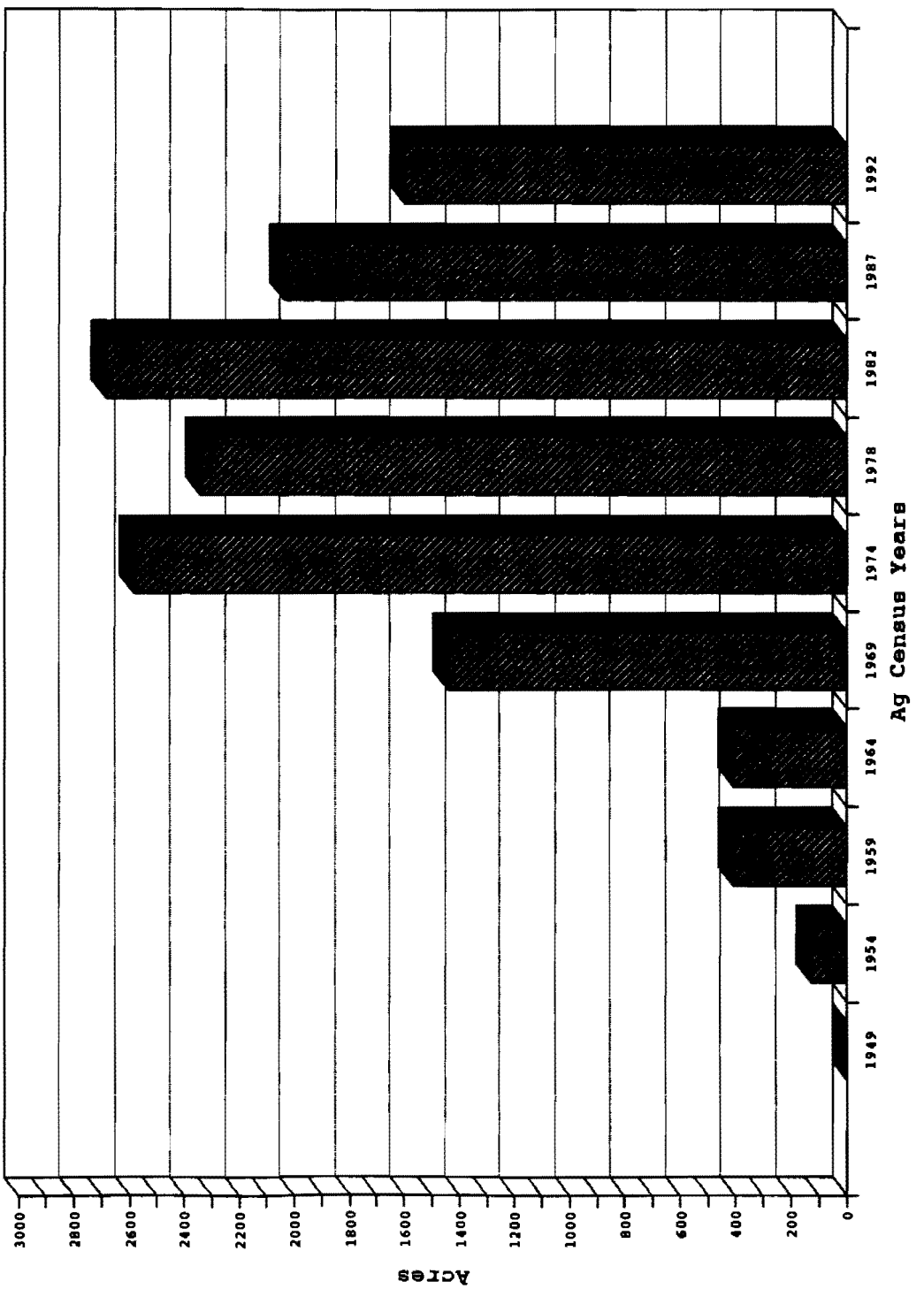


Figure 19. Land in Irrigation:
Moody County

Focus group responses

Focus group farmers commented on several technological factors contributing to changes in crop system diversity. The decline in oats, they felt, was due in part to the decline in prices as shown in Figure 12. Also, chemical carryover from applications to crops preceding oats hinder oat yields. However, some farmers also felt that with Round-up Ready crops, the time may come when small grains will yield well again.

The decline in flax acres, farmers commented, was in part due to the lack of chemicals for flax. Therefore, flax fields had a tendency to be weedy, causing yields to decline. Some farmers commented that flax was not always the primary crop; therefore, it was often the last crop to be planted, also a cause for low yields. One farmer said that flax declined as the moldboard plow went out, making it more difficult to keep flax fields "clean", or free of weeds.

Plant breeding has created different seed varieties, such as earlier maturing corn and soybeans and Round-up Ready soybeans. Better genetics allow for more soybeans to be grown on different ground (due to regional weather differences; e.g., rainfall, temperatures). Also, the development of chemical pesticides that are adapted to soybeans has increased soybean production.

Some of the focus group plant scientists mentioned that one of the reasons for less diversity is the convenience for farmers to grow only a few crops, such as corn and soybeans. Plant breeding, such as in the development of Round-up Ready soybeans, has re-enforced this—there is now less need for crop diversity. However, the scientists also noted that diseases are beginning to show up in more narrow rotations, which may force farmers to put other crops back into their rotations.

Some of the newer equipment, such as the no-till drill, has helped to conserve soil moisture—allowing for expansion of crops such as soybeans into lower rainfall areas. Improved technology for harvesting has helped corn and soybeans. Newer and larger combines decrease harvesting time and dryer systems allow farmers to harvest corn and soybeans at higher moisture levels.

Many of the farmers talked about the decline in the number of pieces of equipment farmers own. Due to expensive equipment and repairs, farmers have become more specialized in order to curb costs. The more crops a farmer has, the more pieces of equipment are needed; therefore, expensive technology has

narrowed crop system diversity. Some farmers felt there was a transition from corn, wheat, and soybeans to corn and soybeans in the late1970s due to specialization.

Farmers also noted that recent years have been relatively wet, causing delayed planting. Excess moisture at the time when small grains are typically planted has caused many farmers to plant corn and soybeans, instead, as these crops are planted at later dates. This increase in moisture, particularly in drier counties, has increased yields for corn and soybeans. Therefore, some farmers feel that when this wet weather pattern ends and the more typical, drier weather returns, small grain acreage may expand.

Diseases, such as scab in wheat, have been surfacing, causing many farmers to switch to row crops. Diseases are typically found where there has been a continuous crop or narrow rotations. One of the plant scientists suggested that the cyst nematode problem in soybeans might force farmers to plant more than two crops.

Changes in the Structure of Agriculture

Structural changes that have occurred over the years in agriculture have had a major impact on crop system diversity. The transition from animal power to tractors has decreased the need for small grains. Larger equipment has replaced labor. Irrigation systems, for some operations, have replaced mother nature for moisture. New seed hybrids and synthetic chemicals and fertilizers have dramatically increased yields.

Structural changes, however, come at a price. Farmers are buying up their neighbors' land to increase their size and spread out costs (Hallam, 1993). Therefore, the number of farms has decreased while the size of farms has increased, resulting in large commercial and more specialized farms.

Statistical description

Figures 20 and 21 show the number and size of farms for Codington and Moody Counties, respectively. This information was obtained from the Agricultural Census.

In 1949 there were 1,160 farms in Codington County. By 1992 (the last Ag Census year prior to the 1996 Farm Bill), that number had decreased to 658, about a 43 percent decrease. The average size of a farm in Codington County increased from 360 acres in 1949 to 597 acres in 1992.

Moody County had 1,332 farms in 1949. The number had declined to 640 by 1992, about a 50 percent decrease in 43 years. The average farm almost doubled in size over that 43-year period—from 236

Figure 20. Number and Size of Farms:
Codington County

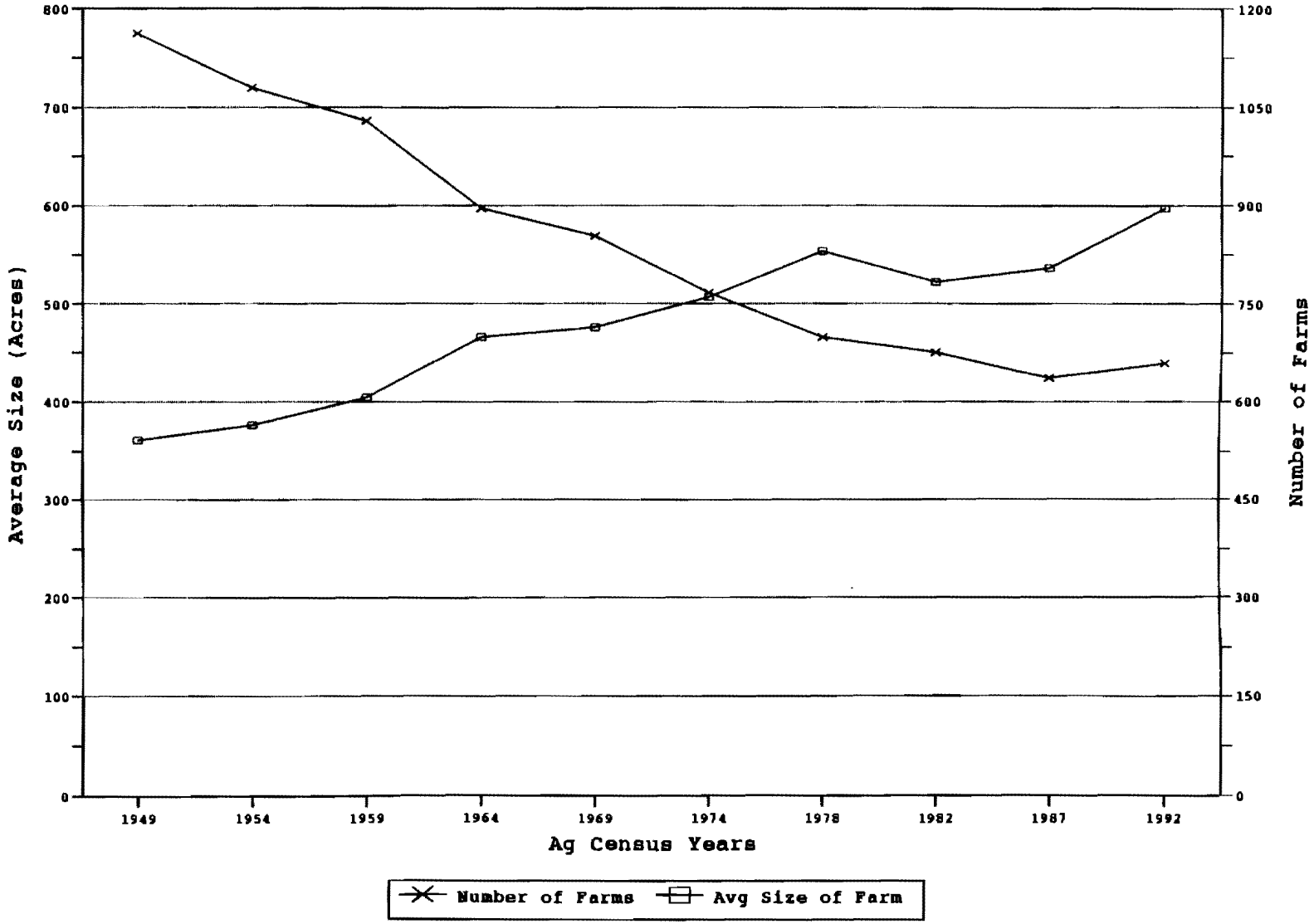
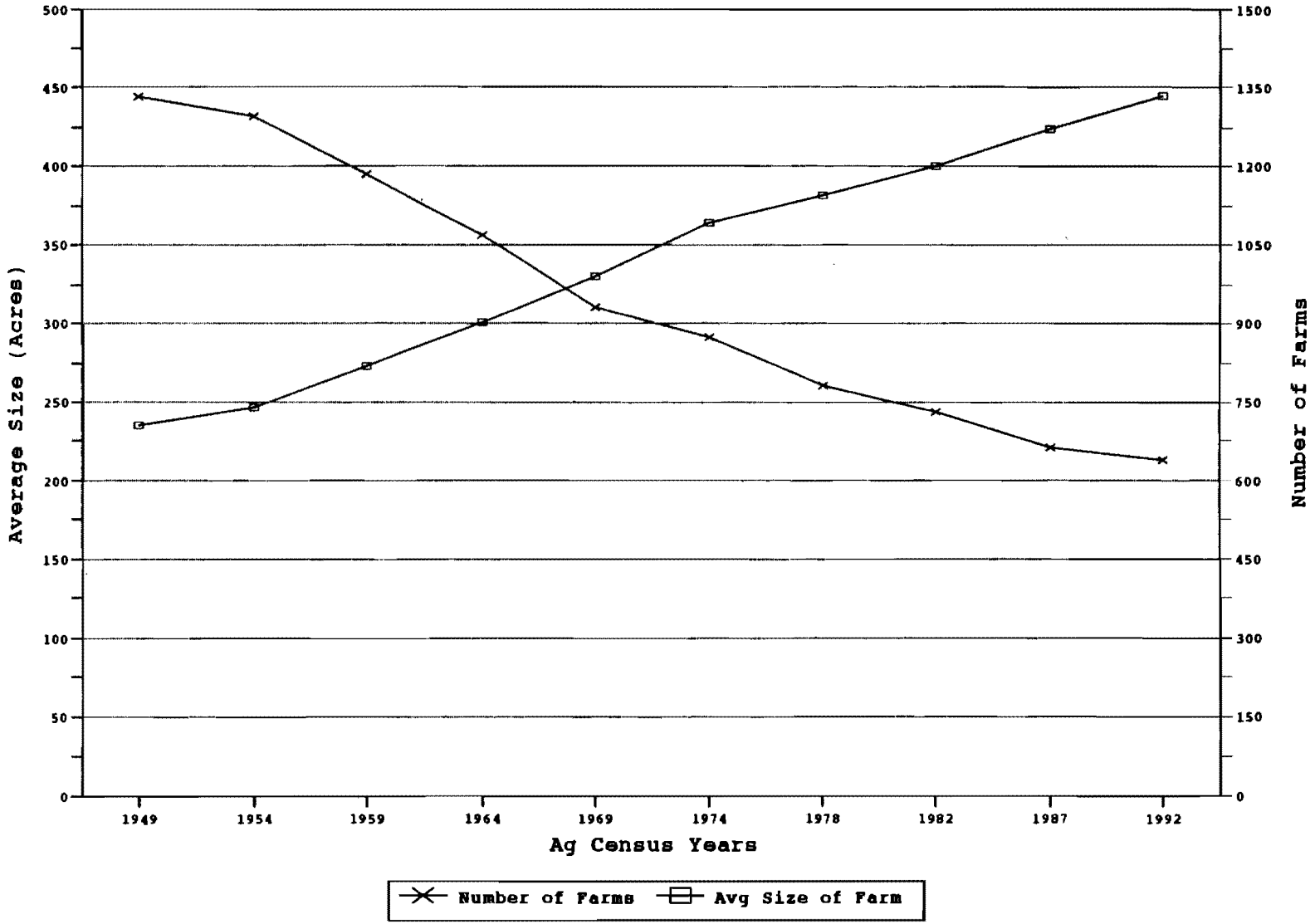


Figure 21. Number and Size of Farms:
Moody County



acres in 1949 to 445 acres in 1992. The average size for full-time farmers may be even greater, since small, part-time farmers were included in these data.

Many changes have occurred in livestock enterprises over the years. Figures 22 and 23 show the livestock inventories for Codington and Moody Counties, respectively.

In Codington County, cattle and calves show an overall upward trend. In 1949, inventory numbers were just under 27,000. A peak occurred in 1964, with inventories of about 48,200. The numbers leveled off for the next four reporting periods. By 1992, numbers had soared to a level of just over 52,200, almost a two-fold increase in 43 years.

Hogs and pigs have not been a very significant enterprise for Codington County. Inventory numbers have fluctuated moderately over the years. In reporting year 1974, inventory numbers were at their lowest in the last half century, about 8,300. The highest inventory number, approximately 20,000, was reported in 1982. In 1992, the hogs and pigs inventory was just under 18,000.

Sheep and lambs constituted a significant livestock enterprise in Codington County during the 1950s. The graph shows an upward trend in numbers during the 1950s, with a peak in the 1959-reporting year of approximately 30,000. This was followed by a downward trend when inventory numbers fell to a 43-year low of 8,400 in reporting year 1978. Sheep and lamb inventories then fluctuated slightly in subsequent reporting years, with 11,800 reported in 1992.

In Moody County (Figure 23), hogs and pigs showed an upward trend until the late 1950s, when numbers reached a 43-year high of approximately 66,300. A downward trend occurred over the next three reporting periods, with a low in 1974 of approximately 42,200. The last three reporting years have been relatively stable, with hog and pig numbers hovering around 50,000. The inventory number in reporting year 1992 was just over 52,000.

The cattle and calves inventory was just under 33,300 in reporting year 1949. An upward trend occurred for the next five reporting periods until inventories peaked in 1974 at 65,244. Since then, inventories have shown a general downward trend, with 36,776 in 1992.

Sheep and lamb inventories in Moody County have seen some drastic changes over the years. Inventories in 1949 were about 13,600. An upward trend occurred in the next two reporting periods and they peaked in 1959 at just over 54,000. A downward trend followed until they hit a low in 1978 when

Figure 22. Livestock Inventory:
Codington County

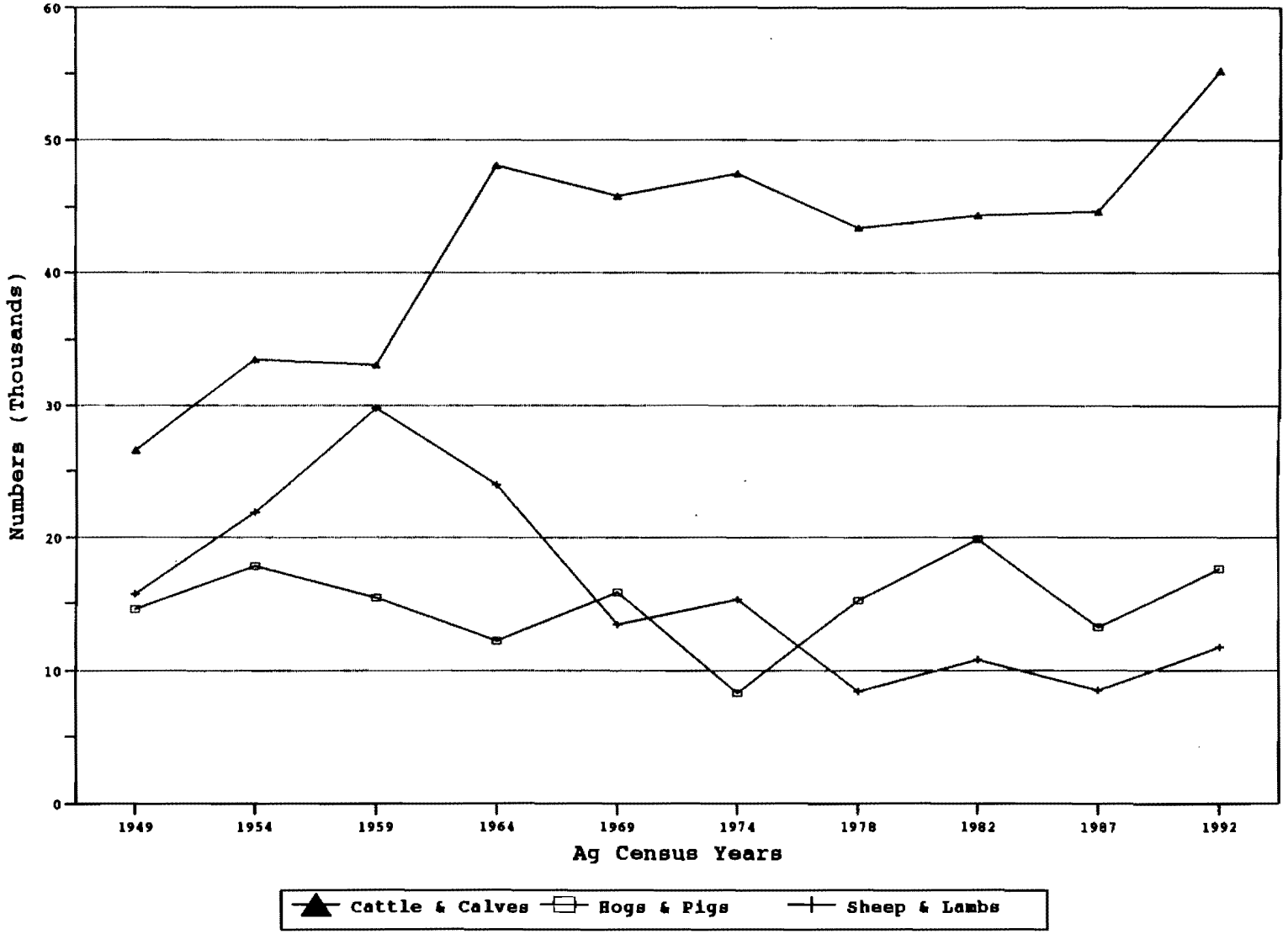
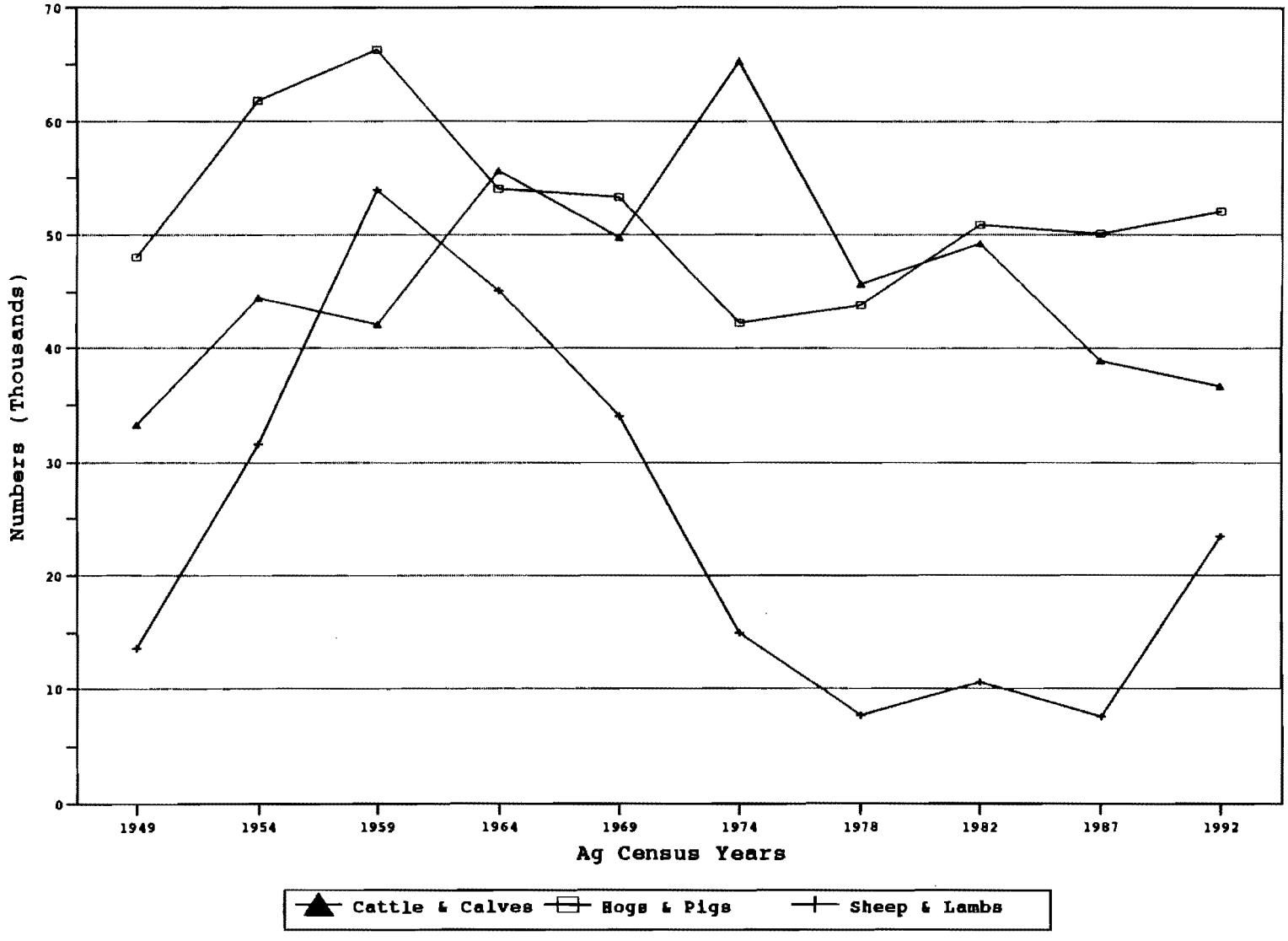


Figure 23. Livestock Inventory:
Moody County



inventory numbers were approximately 7,600. Sheep and lamb inventories fluctuated slightly for the next two reporting periods, followed by another sharp upward trend. In 1992, numbers were at 23,411.

Focus group responses

One of the structural changes farmers have experienced is their increase in acreage. As fixed expenses for machinery have increased, they have had to increase the number of acres in order to spread costs over more land. Also, expensive equipment and repairs have steered more farmers toward specialization, decreasing diversity. Corn and soybeans, typically, can be planted and harvested with the same equipment.

Some farmers felt that less livestock means farmers will plant less hay or small grains (for the straw). However, some farmers felt that the large, concentrated operations now emerging will need to buy hay, which may increase the number of hay acres.

The structural changes in livestock, some farmers felt, are related to low prices. Many smaller farmers have quit their livestock operations due to low prices. Also, it is difficult to find labor. Increased school activities have decreased the labor available from farm and town children.

Federal Farm Programs

Federal farm programs took on new forms in the 1930s. Since that time, crop system diversity gradually diminished over the years. Following is a brief account of policies since 1950 that have contributed to the current cropping systems.

Historical review

The farm programs of today have their roots in the Agriculture Adjustment Acts of 1933 and 1938. As current policies come up for renewal, legislation must be passed to either continue with the current program or make revisions. Otherwise, agriculture policy reverts back to the costly "permanent provisions" of the Agriculture Adjustment Act of 1938 and the Agricultural Act of 1949 (Economic Research Service, 1996).

Coming into 1950, market prices were strong. In place was the Agricultural Act of 1948, which contained two parts, Title I and Title II. Title I was a continuance of price supports at 90 percent of parity for the 1949 marketing year. Title II introduced flexible price supports for the basic commodities starting in 1950 and for subsequent years at 75 percent of parity for a "normal" supply—support levels increased in

years when inventory levels fell below the normal supply and decreased in years when inventory was above the normal supply (Cochrane and Runge, 1992). However, at the end of 1949, legislation was passed to increase the support levels to 90 percent of parity for the marketing year 1950. This support level for the basic commodities continued through marketing year 1954.

Farm prices declined in 1952 and even more in 1953. At the same time, production was rapidly increasing. President Eisenhower was now in office and appointed a new Secretary of Agriculture, Ezra Taft Benson, who strongly opposed government intervention. Once again, the idea of a flexible, more market-oriented policy surfaced in the Agricultural Act of 1954.

> The Act authorized the use of flexible price supports for the basic commodities ranging from 82.5 percent of parity to 90 percent in 1955, and from 75 percent of parity to 90 percent in 1956 and thereafter (Cochrane and Runge, 1992, p.45).

However, in spite of the lower support levels, production of wheat, feed grains, and cotton continued to increase for the remainder of the 1950s, while farm incomes continued to decline.

Attempts to control surpluses of wheat and feed grains came into effect with the "soil bank" in the Agricultural Act of 1956. This Act also had two main parts: the Acreage Reduction Program (ARP) and the Conservation Reserve Program (CRP). Under the Acreage Reduction Program, farmers were paid to take land out of production. In return, farmers were not allowed to harvest a crop or pasture these acres. The Conservation Reserve Program paid farmers to take marginal land out of production and plant resource conserving crops on these acres (Cochrane and Runge, 1992).

These two programs, designed to decrease production, were short-lived; the Acreage Reduction Program was in existence from 1956 to 1958, and the Conservation Reserve Program was not pushed after 1959. Exorbitant costs to the government, dissatisfaction of rural residents due to whole farms being taken out of production, and the inability to greatly reduce production were the main reasons for their short lives (Cochrane and Runge, 1992).

When President Kennedy came into office in the early 1960s, surpluses continued and farm incomes were still falling. Orville L. Freeman was appointed Secretary of Agriculture. Emergency production control programs evolved to aid in reducing surpluses.

> The emergency feed grain program of 1961 became the prototype. This program held the level of price support at approximately the 1960 level, and paid farmers on a voluntary basis to take from 20 up to 50 percent of their feed grain base acreage out of production (Cochrane and Runge, 1992, p. 47).

The land taken out of production had to be put in cover crops that were soil-conserving and nonproductive, with no exceptions. Output declined modestly as a result of this program. Wheat farmers participating in the acreage control program, under the Agricultural Act of 1964, were given "a support price of $2.00 per bushel... and a voluntary acreage control program in which farmers were paid to retire their wheat base acres from production" (Cochrane and Runge, 1992, p. 48).

The Food and Agricultural Act of 1965 lowered price supports and "income deficiency and/or land retirement payments" were used to increase incomes. However, farmers received these payments only if they participated in the production control program for that crop year (Cochrane and Runge, 1992). This Act ran through 1970, with only minor changes made for the 1970s. One change in 1970, though, was a payment limitation per farm; it was set at $55,000 per commodity per farmer. The Agricultural and Consumer Protection Act of 1973 lowered this level to $20,000 per farmer; however, farmers created ways to get around this limitation.

In 1972, the Soviet grain deal came about, greatly reducing inventories and causing grain prices to soar in 1973 to 1974. However, there were no provisions in the 1973 Act to deal with this situation. One new feature of the 1973 Act was the "target price", which was used to measure the size of income supports.

In 1976, Jimmy Carter was elected President and appointed Bob Bergland as Secretary of Agriculture. A year later, the Food and Agricultural Act of 1977 was passed, which raised target and loan rates slightly. Payment limitations were raised from $20,000 per farmer to $40,000 per farmer in 1978, and "farmer owned reserves" were reintroduced (Cochrane and Runge, 1992).

In 1980, there was a grain embargo on the former Soviet Union, which caused adverse effects on farmers. Also, macroeconomic policies and other forces of the early 1980s caused U.S. agricultural exports to decline. Farmers' incomes declined as prices plummeted. This is revealed in Figures 7 to 13, which show crop prices received by South Dakota farmers.

When President Reagan took office in 1981, there were surpluses of wheat and corn. The Agriculture and Food Act of 1981 was a continuation of the programs of the 1970s; however, there were modest increases in the income supports. In 1982, attempts were made, with the aid of acreage reduction programs, to reduce surpluses; however, good weather provided a record-breaking harvest, adding to the

surplus problem. Inventories and outstanding loans with the Commodity Credit Corporation (CCC) reached all-time highs in 1982 to 1983.

In 1983, the Payment-In-Kind (PIK) program was introduced to help curb the mounting surpluses and the costs associated with them.

> Under this approach, the Office of Management and Budget hoped to keep farm program payments 'off-budget' by paying for massive land retirements with stocks already owned by the U.S. Department of Agriculture. At the same time, surplus stocks in government hands would be reduced (Cochrane and Runge, 1992, p. 52).

The PIK program was partly successful; it helped reduce, in conjunction with the drought of 1983, carryover stocks of corn and wheat. The program was quite costly, however. Total agricultural program costs to the Federal government were between $28 and $30 billion in the 1983 fiscal year.

High interest rates and declining land values contributed to the demise of many farmers in the early 1980s. This prompted many of the components of the 1985 Farm Bill. Target prices were held steady to help farm incomes; however, due to budget concerns, base yields were frozen. The Acreage Reduction and Conservation Reserve Programs reemerged. The ARP helped reduce the number of acres on which subsidies were paid, and the CRP had a goal of taking 45 million acres out of production. Both the ARP and the CRP were intended to help fight the mounting surpluses.

Due to increasing environmental concerns, the 1985 Farm Bill introduced the "sod- and swamp-buster programs". To remain eligible for deficiency payments, farmers could not farm their "designated" wetlands or break up grassland or woodland areas that are considered highly erodible.

Other programs new in the 1985 Farm Bill prompted by environmental concerns were the optional "0-92" and "50-92" programs. Producers of wheat and feed grains were allowed to plant soil-conserving crops on all or a portion of their base acreage, less their set-aside acres, and still receive deficiency payments. The payments were set at a maximum of 92 percent of their base acres (Cochrane and Runge, 1992).

The main theme of the 1990 Farm Bill was "flexibility". The flexibility provision was simply an extension of the 1985 "0-92" and the "50-92" programs allowing farmers to include other acreage "bases". Another feature was the "zero certification", which allowed farmers to plant any nonprogram crop, other than a fruit or vegetable crop, on their base acres without a reduction of their base (Cochrane and Runge, 1992). The new "triple-base plan" also was included in the 1990 bill. Under this plan, farmers' base acres

were divided into three parts: (1) program acres, (2) flexible acres, and (3) conserving-use acres. Program crops had to be planted on the program acres in order to receive the deficiency payments. The flexible acres could be planted to any crop, except fruits and vegetables. The normal restrictions of acreage reduction program acres applied to the conserving-use acres (Hallberg, 1992).

Statistical review

Effects of agriculture policies on program crop acres can be seen in Figures 24 and 25. These graphs show the "yearly" planted wheat acres in Codington County and yearly planted corn acres in Moody County, respectively.

The early 1950s show an increase for both corn and wheat, due in part to high support levels at that time. The rapid decline in wheat acres for Codington County is offset by the increase in flax and corn acres, as shown in Figure 3. In 1956, the Soil Bank was introduced to take acres out of production. However, the number of acres planted continued to increase, particularly for corn, until the peak in 1959. The Acreage Reduction Program took acres out of production for years 1956 to 1958. The Conservation Reserve Program retired acres on 10- and 20-year bases through 1959. The program was not pushed after 1959 due to the many criticisms of the program. The graphs appear to show that the Conservation Reserve Program had more of an impact than the Acreage Reduction Program. After 1959, there was a considerable decrease in the amount of corn acres and a moderate decrease in wheat acres. The Food and Agriculture Act of 1962 continued the feed grain acreage reduction program and had price support payments in addition to nonrecourse loans. Both corn and wheat acres continued to decline slightly.

A new low occurred in 1968 for corn and in 1970 for wheat, followed by an upward trend, possibly prompted by the increase in payment limitations in 1971. In 1972 the Soviet grain deal occurred, causing stocks to decrease and prices to soar. As a result of price increases, acres planted to wheat in Codington County dramatically increased for the next four years. In Moody County, corn acres increased slightly from 1972 to 1974. Payment limitations were lowered in 1973, possibly contributing to a reduction in corn acres planted after 1974. However, wheat acres planted continued to increase until 1976, due to high prices. From 1976 to 1979, the number of wheat acres decreased substantially. In 1978 the payment limitations were increased, which may have contributed to the increase in corn acres.

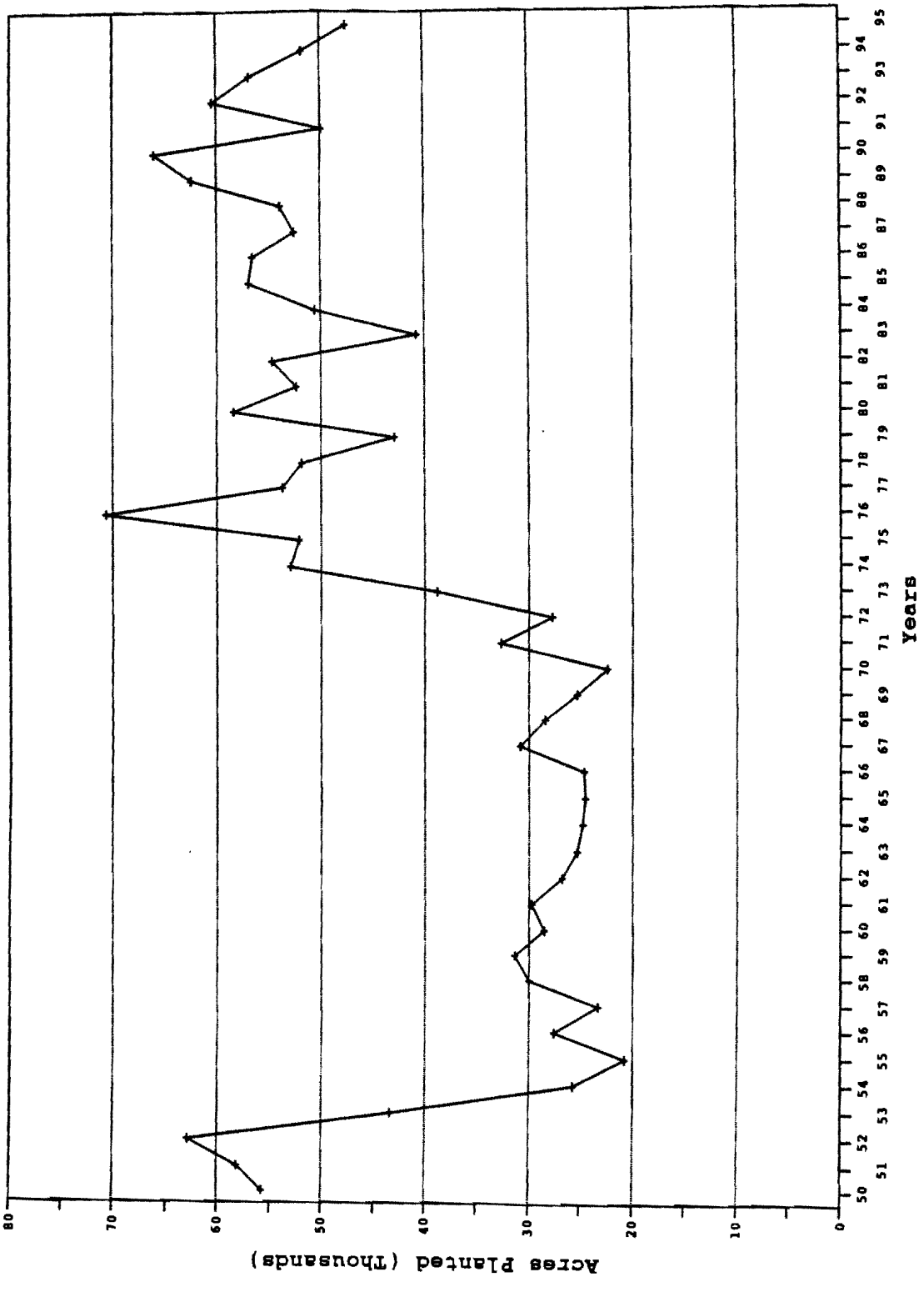


Figure 24. Wheat Acres Planted:
Codington County

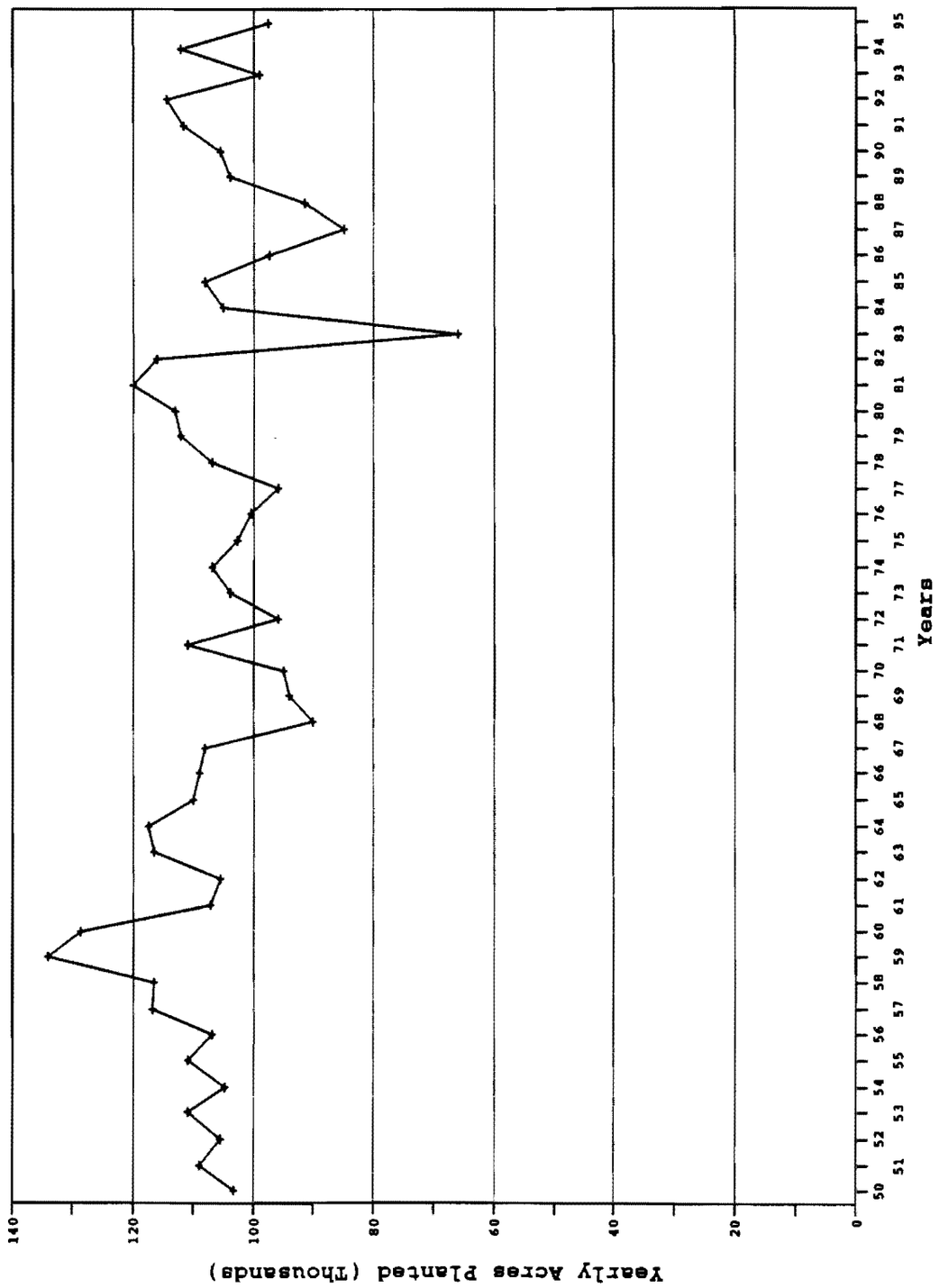


Figure 25. Corn Acres Planted:
Moody County

commodity programs decreased substantially for

4,515 acres in Moody County.

In 1980 and 1981, production increased for corn and wheat, causing surpluses. To add to this problem, the grain embargo of 1980 occurred, creating even more surpluses. The drought of 1983, coupled with the PIK program, helped to decrease surpluses. The number of corn acres planted in Moody County in 1983 decreased approximately 50 percent from the previous year. Wheat acres declined in Codington County as well.

Production of corn and wheat increased again in 1984 and 1985, with another high for acres planted. The 1985 Farm Bill brought back the Acreage Reduction and Conservation Reserve Programs. This is evident by the decrease in the number of acres planted to corn and wheat over the next two years. However, production again increased after 1987 to yet another high in 1990 for wheat and in 1992 for corn.

In 1990, target prices were frozen and the CRP continued, focusing on water quality. Wheat acres responded with a substantial decline in 1992; however, acres increased again in 1993 and then continued to decline the following two years. The 1990 policies did not seem to have much of an effect on corn in Moody County. The number of acres increased to a high in 1992 and fluctuated moderately over the next three years.

Tables 1 and 2 give the total number of cropland acres, the number of acres taken out of production for some of the farm programs, and the acres harvested for two of the former program crops—corn and wheat—in Codington and Moody Counties. Due to reporting inconsistencies, reporting periods 1949, 1954,1959, 1969 and 1974 are omitted.

Under the Federal acreage reduction programs, the number of cropland acres diverted under annual commodity programs was similar for Codington and Moody Counties in the 1964 reporting year, with 784 acres and 656 acres, respectively. In 1978, the number of acres increased substantially for both counties, with 15,438 acres in Codington County and 9,815 acres in Moody County. In 1982, the number of acres decreased considerably for both counties, to 6,118 acres in Codington County and 1,615 acres in Moody County. This was followed by another substantial increase in 1987, to 35,153 acres in Codington County and 30,775 acres in Moody County. In 1992, the number of acres diverted under annual commodity programs decreased substantially for both counties—to 5,103 acres in Codington County and 4,515 acres in Moody County.

Table 1. Acres Enrolled in Various Farm Programs: Codington County

REPORTING YEAR	1964	1978	1982	1987	1992
Total Cropland	309117	285107	273452	267297	304627
Cropland Diverted	784	15438	6118	35153	5103
Wetlands/CRP Reserve				1448	10038
Corn for Grain	13776	26204	27232	33835	45516
All Wheat	23539	48718	47225	39929	48555

Source: Agricultural Census

Table 2. Acres Enrolled in Various Farm Programs: Moody County

REPORTING YEAR	1964	1978	1982	1987	1992
Total Cropland	256665	251635	245324	242231	248696
Cropland Diverted	656	9815	1615	30775	4515
Wetlands/CRP Reserve				1339	4557
Corn for Grain	100425	94915	91421	75791	94298
All Wheat	352	4015	5388	7218	3202

Source: Agricultural Census

The 1985 Farm Bill stressed conservation; therefore, the Conservation Reserve program (CRP) was reintroduced and the Wetlands Reserve Program (WRP) was created. In 1987, there were minimal acres enrolled in these programs for both counties, with 1,448 acres in Codington County and 1,339 acres in Moody County. By 1992, the number of acres enrolled in conservation programs in Codington had increased substantially, to 10,038 acres. In Moody County, the number of acres enrolled in conservation programs also had increased—to 4,557 acres—but not as much as in Codington County.

In 1964, the number of acres of corn harvested for grain was 13,776 acres in Codington County and 100,425 acres in Moody County. In 1978, corn acres harvested almost doubled from the 1964-reporting year in Codington County, to 26,204. In Moody County, corn acres harvested decreased slightly from 1964, to 94,915. In 1982, corn acres harvested rose slightly in Codington County and decreased moderately in Moody County. By 1987, acres harvested had increased moderately in Codington County but had decreased about 20 percent from 1982 in Moody County. In 1992, corn acres harvested increased substantially in both counties—to 45,516 in Codington County and 94,298 in Moody County.

Wheat is more important in Codington County than in Moody County. In 1964, there were 13,776 wheat acres harvested in Codington County versus 352 acres harvested in Moody County. Wheat acres harvested more than doubled from 1964 to 1978 in Codington County, with 48,718 acres harvested. In Moody County, there was more than a ten-fold increase, to 4,015 acres of wheat harvested, but this was still substantially less than in Codington County. For the next two reporting years, wheat acres harvested decreased slightly in Codington County but increased in Moody County. By 1992, wheat acres harvested in Codington County had again increased to 48,555. In Moody County, wheat acres harvested had decreased by more than 50 percent from 1987, to 3,202.

Conclusions

We conclude from this historical analysis that the narrowing of crop systems in eastern South Dakota over the past half-century has been due to interactions of several economic forces, including Federal farm policy. Farm price support policies prior to the 1996 Farm Bill tended to disproportionately support particular crops, such as corn and wheat. Research and technology development—in both public and private sectors—also has focused heavily on a few major crops, especially corn, wheat, and soybeans in the Western Corn Belt and Northern Great Plains. Due to equipment costs, larger farm sizes, spouses and

children spending less time in farm work, and the amount of management attention needed to effectively produce and market different products, farmers have increasingly specialized in just a few crop and livestock enterprises. Moreover, markets gradually disappeared in some areas for certain crops such as flax.

Thus, we see many forces at work that influence farmers' decisions about the mix of crops to grow. Were prices alone what mattered, we probably already would see more diverse rotations that include alfalfa in the eastern South Dakota crop mix. And, while past Federal farm policies have contributed to the narrowing of crop systems, changes in farm policies alone are unlikely to cause substantial crop system diversity. However, potential impacts of the 1996 Farm Bill on crop rotation systems deserve detailed attention. That attention will be provided in a companion report, in the SDSU Economics Department's Staff Paper series.

The historical experience in the Western Corn Belt/Northern Plains region reviewed in this report reveals the immensity of the challenge in "re-diversifying" crop systems. The relatively high profitability of corn and soybeans, in combination with the forces of specialization we have discussed, provide major disincentives to diversification. If policy makers are truly concerned about the difficulties farmers face in choosing between diversity and specialization, concerted action will be required on at least three fronts: Federal farm policy, research policy, and markets.

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