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An Analysis of 1999 Gross Returns for Small Grains in North Dakota

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Abstract

North Dakota gross returns from HRS wheat, durum wheat, and barley declined in 1999, relative to the expected gross returns, due to adverse weather conditions and low prices. The total gross return reductions in 1999 was estimated to be \$361 million, which was divided into \$51 million from weather and disease and \$329 million from lower-than-average prices. Gross return reductions were largest in Region 1 (Northwest), followed by Regions 3 (Northeast) and 6 (East Central). HRS wheat accounted for the largest income loss, followed by durum and barley. However, total net farm income increased in 1999 relative to 1998, because of government payments and crop insurance.

Key Words: net farm income, crop losses, weather conditions

Highlights

The North Dakota agricultural economy has experienced severe financial stress since 1995, while the overall U.S. agricultural economy has been relatively healthy. Stress has been especially acute since 1997 due to poor weather conditions during the growing season, disease, and low prices for crops produced in North Dakota.

According to annual reports of the North Dakota Farm and Ranch Business Management Program, average net farm income (NFI) dropped by 59 percent in 1997, relative to 1996, excluding the Red River Valley, but NFI has increased since 1997 to an average of \$51 thousand in 1999. Much of the increase in NFI is due to government and other cash payments. North Dakota farmers received \$860 million in 1998 from government and other cash payments and \$1,390 million in 1999. About 7 percent of farms enrolled in the North Dakota Farm and Ranch Business Management system experienced negative NFI in 1999, compared to 24 percent in 1998.

Prices received by producers for spring wheat, durum wheat, and barley have been on a downward trend in real terms for the last 20 years, and prices in 1999 were lower than their five-year moving averages.

In 1999, North Dakota gross returns from HRS wheat, durum wheat, and barley declined by about \$380 million due to adverse weather conditions and low prices. Of this reduction, \$51 million was due to weather and disease and \$329 million was due to lower-than-average prices. Gross return reductions were largest in Region 3 (Northeast), followed by Regions 6 (East Central) and 5 (Central). Spring wheat accounted for the largest gross return reduction, followed by durum wheat and barley.

The study shows the need for additional governmental support, whether it is in the form of subsidized revenue crop insurance, higher support prices for commodities, or additional and flexible government payments in the form of the transition payments which producers receive under the FAIR Act. Traditional crop insurance provides protection from crop loss due to weather conditions but provides no support for price loss. Likewise, transition payment provide no price protection.

An Analysis of 1999 Gross Returns for Small Grains in North Dakota

Won W. Koo, Richard D. Taylor, Andrew L. Swenson*

Introduction

The North Dakota agricultural economy has experienced severe financial stress since 1995. Stress has been especially acute since 1997 due to poor weather conditions during the growing season, disease, and low prices for crops produced in North Dakota.

According to annual reports of the North Dakota Farm and Ranch Business Management Program, average net farm income (NFI) dropped by 59 percent in 1997 (to \$15,190), relative to 1996, excluding the Red River Valley, but has increased since 1997. When farms are grouped by profit category, the same trend emerges: NFI dropped in 1997 for high-, medium-, and low-profit farms but has recovered recently. Low-profit farms have experienced negative NFI in most years since 1989. Even with the improvement in NFI in the past two years, the NFI for the low-profit farms is still negative.

NFI for middle- and high-profit farms is the highest in 1999 due to government and other cash payments in the year. North Dakota farmers received \$860 million in 1998 from government and other cash payments and \$1,390 million in 1999.

Farms with negative NFI in 1999 were almost evenly distributed across size categories. About 6 percent of large-size farms enrolled in the North Dakota Farm and Ranch Business Management system experienced negative NFI in 1999: 8 percent of small-size farms and 7 percent of medium-size farms. The percentage of negative NFI in 1999 is much smaller than those in 1997 and 1998 because government payments and crop insurance proceeds in 1999 are much larger than in the other years.

The purpose of this study was to estimate the differences between expected gross returns and actual gross returns for spring wheat, durum wheat, and barley for North Dakota in 1999 and to analyze factors contributing to these differences. Special attention was given to effects of yield reductions due to weather and crop disease and effects of low prices on gross returns by crop reporting districts (CRDs).

In 1999, yields for spring wheat, durum, and barley were below both the actual 1998 and the trendline yield because many areas of the state were forced into late planting due to excessive moisture during the 1999 spring planting season and large areas in the northern sectors were never planted (Figure 1).

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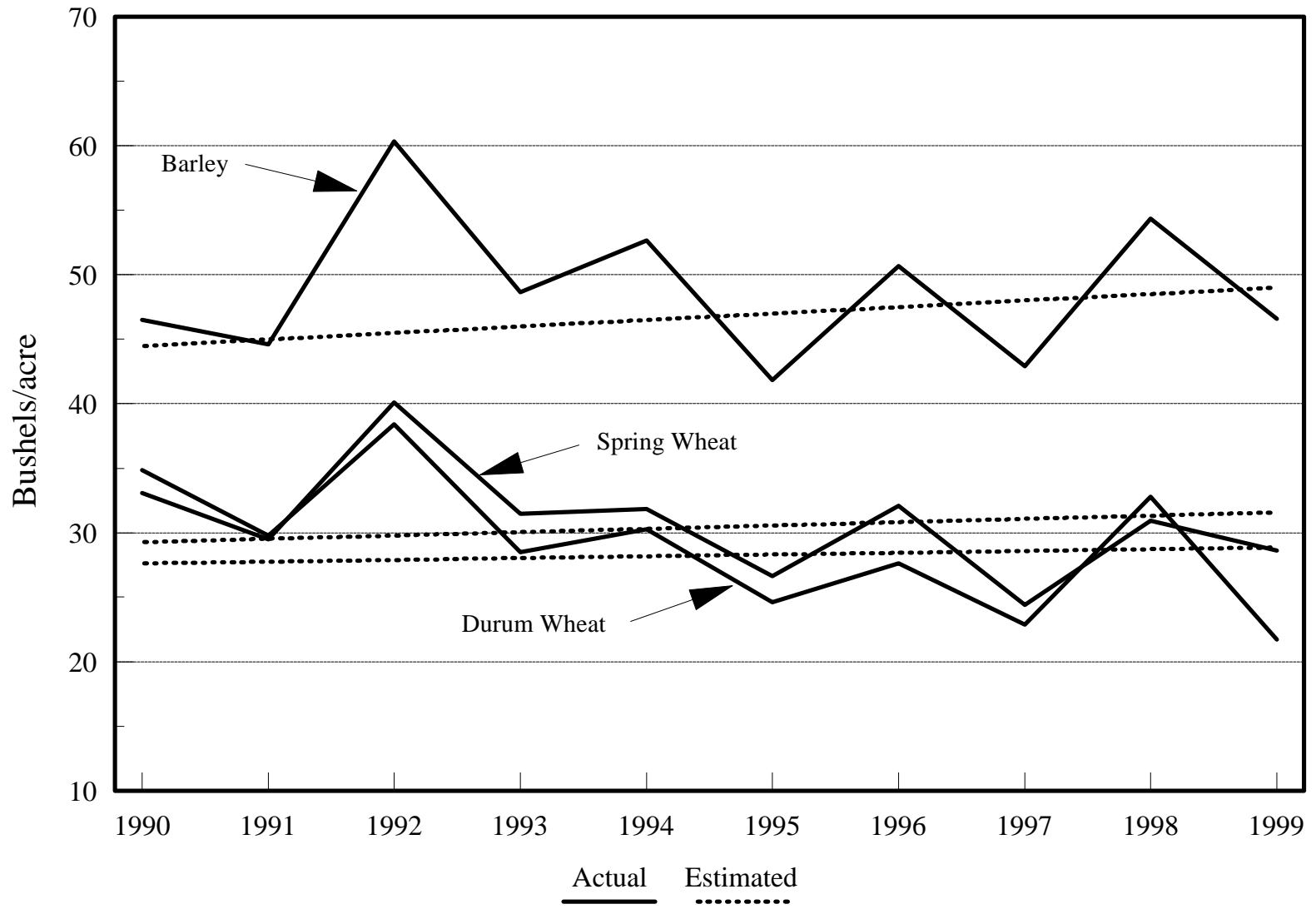


Figure 1. Actual and Expected Yields for North Dakota Barley, Spring Wheat, and Durum Wheat

Prices received by producers for spring wheat, durum wheat, and barley have been on a downward trend in real terms for the last 20 years (Figure 2). In real terms, durum wheat prices have fallen from over \$6/bushel in 1980 to \$1.65/bushel in 1999. Commodity prices received by farmers, for the most part, have been lower than their 5-year moving averages since 1997 (Figure 3). Meanwhile, most farm expenses have increased substantially until the past two years (Figure 4 and Table 1).

Table 1. North Dakota Cost of Production for Spring Wheat, Durum Wheat, and Barley for 1990 to 1998, Excluding the Red River Valley

	1990	1991	1992	1993	1994	1995	1996	1997	1998	% Increase
	-----dollars-----									
<u>Spring Wheat</u>										
seed	5.93	4.92	6.64	7.19	8.79	8.43	10.69	8.93	8.43	42
fertilizer	6.71	8.26	9.32	11.73	14.96	18.20	19.27	19.41	15.76	135
chemicals	4.66	5.45	4.70	6.28	6.87	8.11	9.56	9.52	10.38	123
fuel	4.86	5.45	5.21	5.37	5.69	5.88	6.42	6.22	4.92	1
repairs	7.32	7.31	7.85	8.93	9.45	9.50	9.58	9.36	8.49	16
land rent	24.11	25.18	26.58	25.87	27.27	29.21	28.81	29.61	29.35	22
others	9.79	9.28	9.14	11.42	11.90	14.30	15.34	13.83	12.87	31
total direct	63.38	65.85	69.44	76.79	84.93	93.63	99.67	96.88	90.20	42
total overhead	12.90	14.52	13.92	15.95	17.94	19.62	20.27	20.60	19.66	52
total cost	76.28	80.37	83.36	92.74	102.87	113.25	119.94	117.48	109.86	44
<u>Durum Wheat</u>										
seed	6.95	5.64	7.01	7.24	11.95	11.97	12.88	11.43	10.83	56
fertilizer	5.94	6.90	8.65	10.09	14.27	18.74	17.96	17.31	12.55	111
chemicals	5.76	5.85	5.08	6.53	8.39	9.30	10.98	10.51	9.28	61
fuel	5.64	5.44	5.44	5.66	5.58	5.91	6.18	5.17	5.12	-9
repairs	6.89	7.19	7.88	8.73	10.08	9.99	9.76	9.64	8.23	19
land rent	23.65	25.46	24.76	26.31	26.56	28.49	26.81	27.71	26.69	13
others	9.62	8.19	9.87	9.60	9.95	12.66	13.32	14.10	12.02	25
total direct	64.45	64.67	68.69	74.16	86.78	97.06	97.89	95.87	84.72	31
total overhead	12.15	12.25	12.13	13.86	16.29	18.60	22.60	18.99	17.15	41
total cost	76.60	76.92	80.82	88.02	103.07	115.66	120.49	114.86	101.86	33
<u>Barley</u>										
seed	5.06	4.47	4.74	5.21	5.18	6.25	8.73	6.23	5.86	16
fertilizer	6.21	7.55	9.02	11.21	14.03	17.59	18.66	17.99	14.33	131
chemicals	5.15	5.60	4.63	5.48	6.95	7.01	8.45	9.36	8.86	72
fuel	6.46	5.30	5.58	5.62	5.65	6.09	6.83	6.35	5.09	-21
repairs	7.37	7.28	7.86	9.19	9.43	9.82	9.92	9.23	8.65	17
land rent	24.81	24.10	25.57	25.37	26.40	28.31	27.77	28.52	29.29	18
others	9.43	8.49	7.88	8.57	9.28	11.29	13.30	13.87	12.38	31
total direct	64.49	62.79	65.28	70.65	76.92	86.36	93.66	91.55	84.46	31
total overhead	14.31	14.25	15.37	16.09	17.50	19.40	21.92	18.77	19.40	36
total cost	78.80	77.04	80.65	86.74	94.42	105.76	115.58	110.32	103.85	32

Source: North Dakota Farm and Ranch Business Management Program.

1983-1984 Dollars

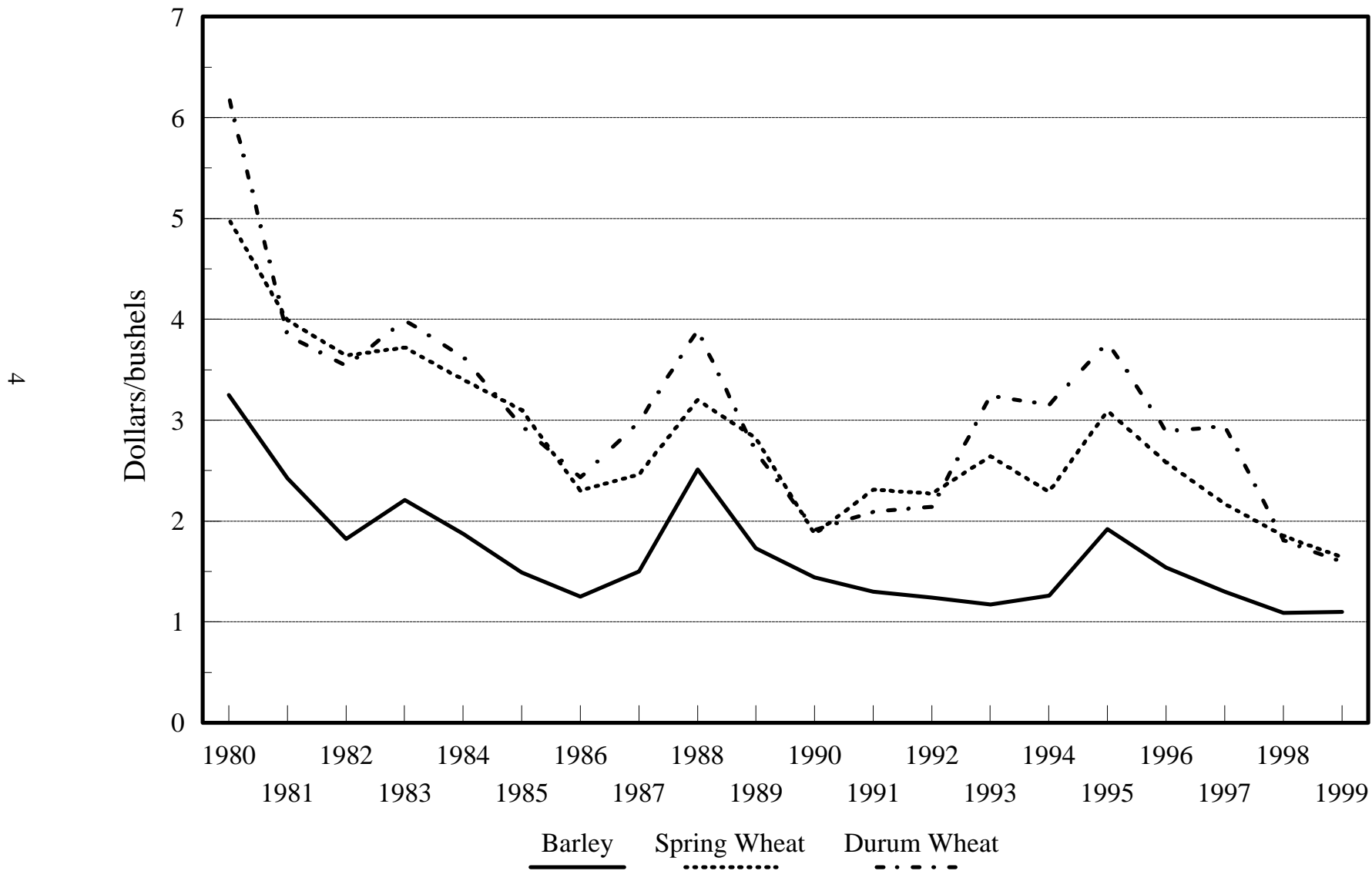


Figure 2. Real Prices of North Dakota Barley, Spring Wheat, and Durum Wheat

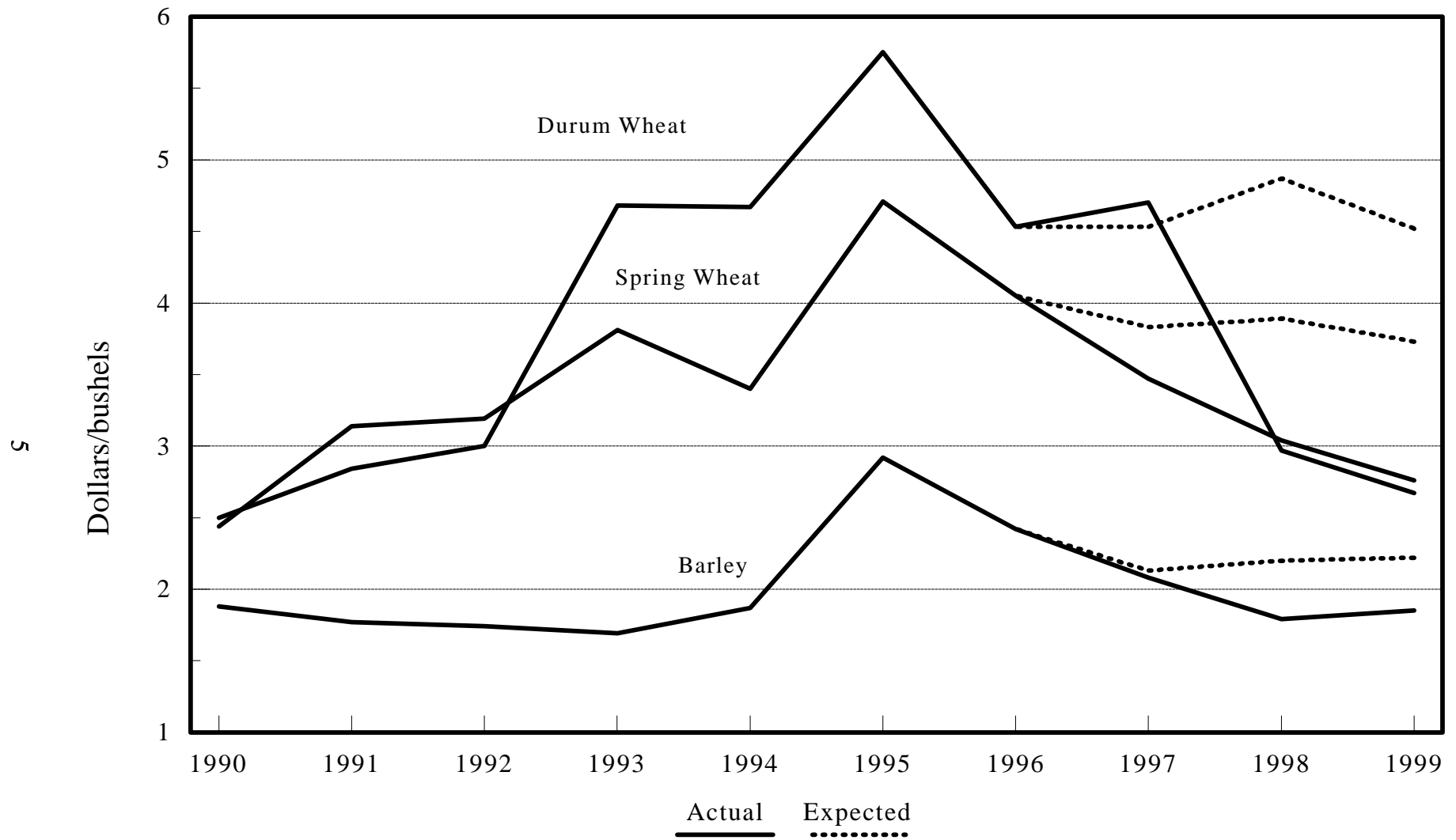


Figure 3. Actual and Expected Prices for North Dakota Durum Wheat, Spring Wheat, and Barley

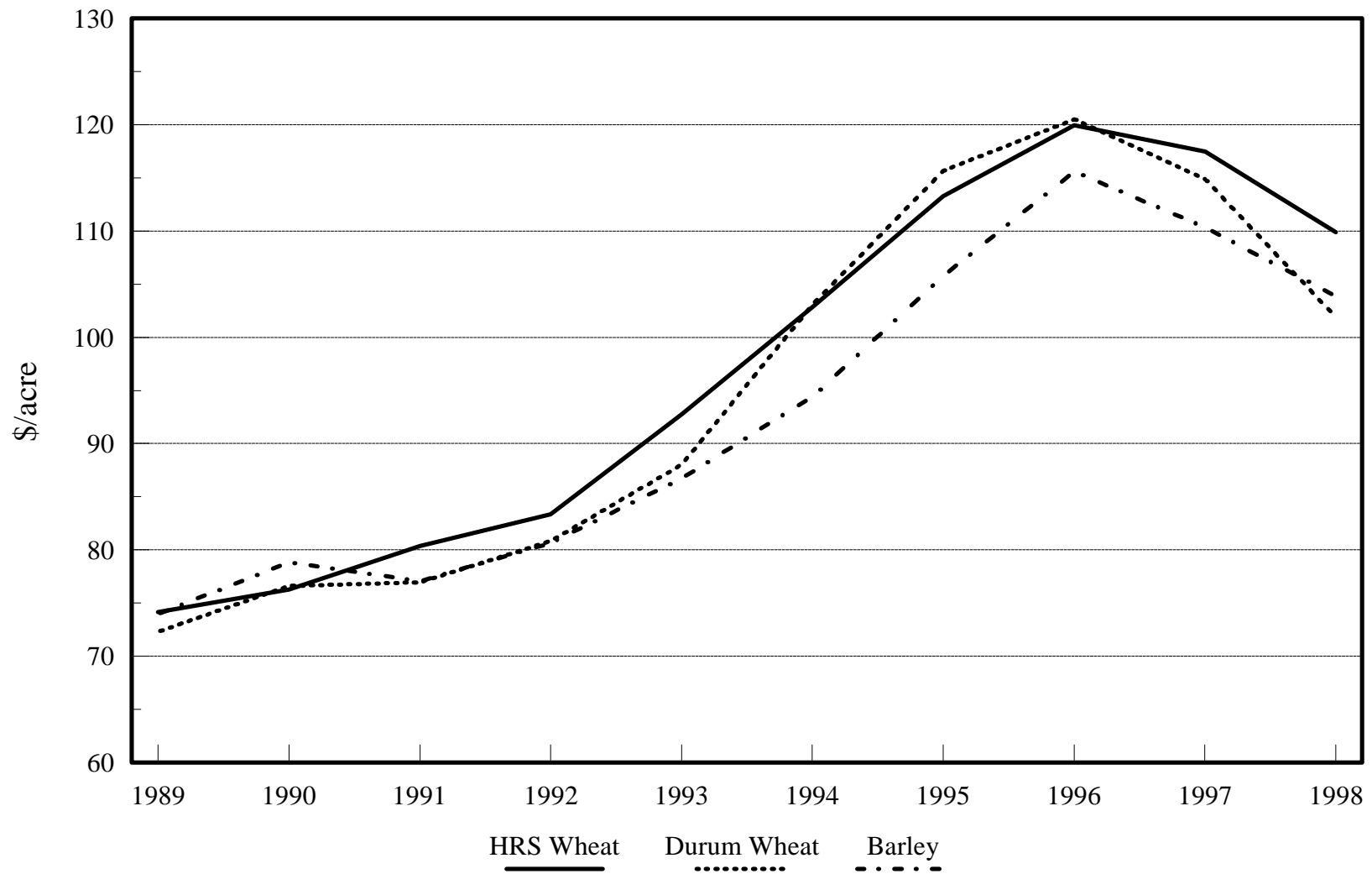


Figure 4. Total Production Costs on Cash Rented Land for HRS Wheat, Durum Wheat, and Barley in North Dakota, Excluding the Red River Valley, 1989-1998

Source: North Dakota Farm and Ranch Business Management Program

Method

Gross return reductions due to weather, disease, and price changes are calculated for nine crop reporting districts of North Dakota (see Figure 5). Since North Dakota produces mainly spring wheat, durum wheat, and barley, gross return reductions are calculated for these three crops.

The total gross return reductions due to adverse weather (and associated disease) and price conditions are calculated by multiplying the difference between expected and actual yields by the total harvested acres in a region, as follows:

$$L_{it} = (y_{it}^e p_{it}^e - y_{it} p_{it}) A_{it}^h \quad (1)$$

where L_{it} is the reduction in gross return in region i in time t
 y_{it}^e is the expected long-run trend yield for region i in time t
 y_{it} is the actual yield for region i in time t
 p_{it}^e is the expected five-year moving average price for region i in time t
 p_{it} is the actual price received by farmers for region i in time t
 A_{it}^h is harvested acres for region i in time t .

The first term in the parenthesis of Equation 1 represents normal average revenue per acre and the second term represents the actual revenue per acre. The gross reduction is calculated by multiplying the difference between these two terms by total harvested acres.

Total gross return reductions in a given year consist of gross return reductions due to adverse weather and disease, those due to changes in crop prices received by farmers, and those due to the interaction of production and price. Gross return reductions per acre due to weather and disease are calculated by multiplying the estimated yield shortfall (expected trend yield minus actual yield) by the net price received. Similarly, the gross return reductions per acre due to low prices are calculated by multiplying the actual price reduction (relative to the expected five-year average) by the long-run trend yield. The gross return reductions due to the interaction of production and price are the product of deviations of yield and price from their average values. To separate the total gross return reductions into ‘production’ and ‘price’ components, Equation 1 is rewritten as

$$L_{it} = [(y_{it}^e - y_{it}) p_{it} + (p_{it}^e - p_{it}) y_{it} + (y_{it}^e - y_{it}) (p_{it}^e - p_{it})] A_{it}^h \quad (2)$$

The last term of Equation 2 represents the interaction of yield and price deviations. This term can be allocated equally to ‘production’ and ‘price’ components, as follows:

$$L_{it} = [(y_{it}^e - y_{it}) p_{it} + \frac{1}{2} (y_{it}^e - y_{it}) (p_{it}^e - p_{it})] A_{it}^h + [(p_{it}^e - p_{it}) y_{it} + \frac{1}{2} (y_{it}^e - y_{it}) (p_{it}^e - p_{it})] A_{it}^h \quad (3)$$

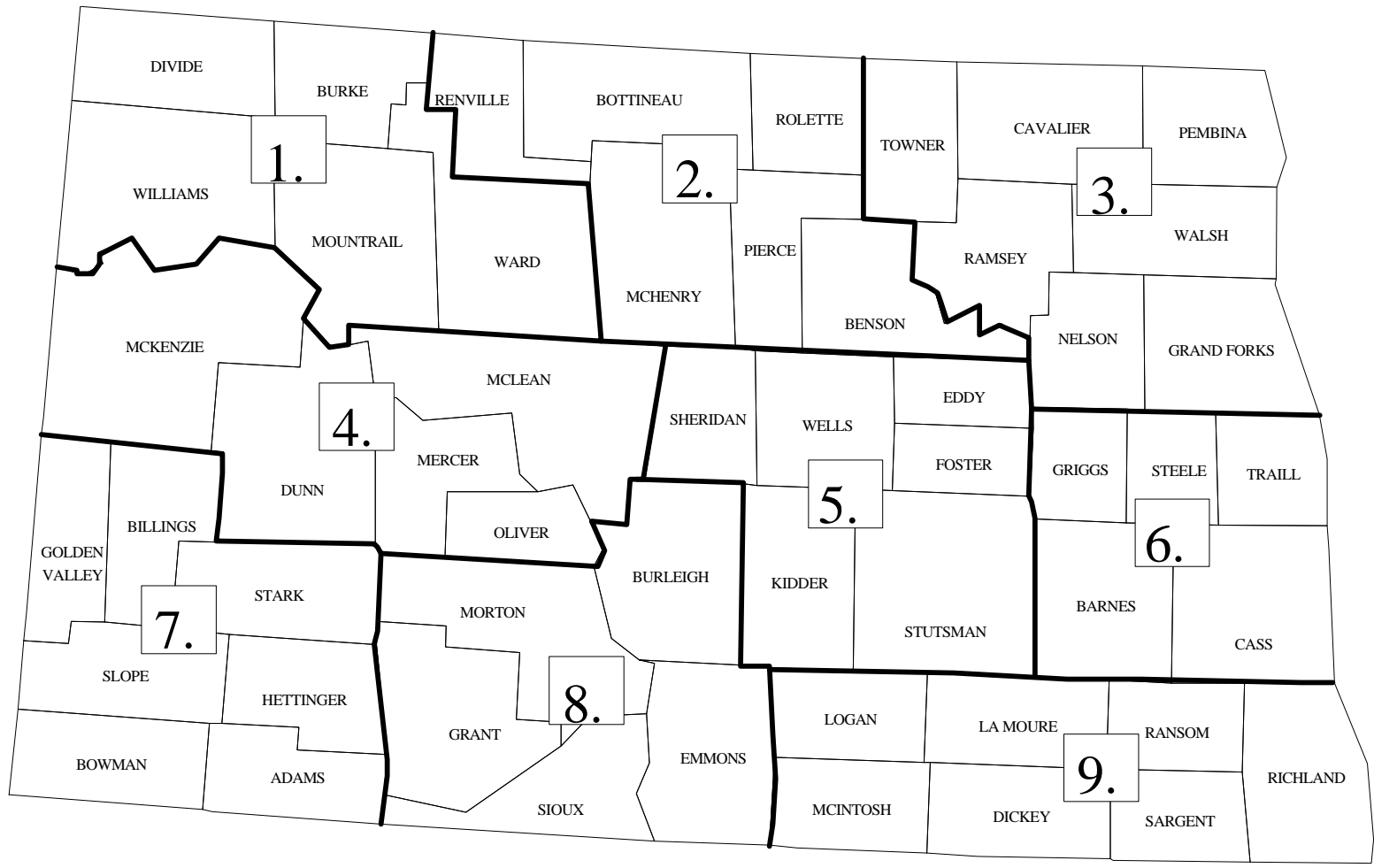


Figure 5. North Dakota Crop Reporting Districts (CRDs)

The first term of Equation 3 represents the contribution of adverse yields to gross return reductions, and the second term represents the contribution of lower-than-average prices. When the actual prices are higher than the long-run average price, and actual yields are lower than the long-run trend yields, the total gross return reductions are calculated as:

$$L_{it} = [(y_{it}^e - y_{it}) p_{it}^e + (p_{it}^e - p_{it}) y_{it}] A_{it}^h \quad (4)$$

Conversely, when the actual yields are higher than the long-run trend yield, and actual prices are lower than the long-run price, total gross return reductions are calculated as:

$$L_{it} = [(y_{it}^e - y_{it}) p_{it} + (p_{it}^e - p_{it}) y_{it}^e] A_{it}^h \quad (5)$$

Equations 3, 4, or 5 are used to calculate gross return reductions due to production and those due to prices, depending on the relationship of actual prices and yields to their expected long-run average values.

The expected long-run trend yield of a crop is estimated by regressing actual yields against a linear trend as follows:

$$y_{it}^e = a_0 + a_1 \text{ trend} + e_{it}$$

where e_{it} represents deviations of yields from the expected long-run trend yield. These deviations are due to weather, crop disease, and other factors.

Yield equations for spring wheat, durum wheat, and barley were estimated for each crop reporting district, using data from 1970 to 1999 obtained from the North Dakota Agricultural Statistics Service. Estimated yield shortfalls for 1999 are shown in Table 2. Table 3 shows deviations of actual prices received in 1999 from their five-year moving averages.

Results

Adverse weather conditions, late planting, and disease caused an average yield reduction of about 4 percent for spring wheat relative to the trend yield (Table 2). Average yield reductions were about 22 percent for durum wheat and 2 percent for barley. Yield losses were greatest in Region 6 (East Central), followed by Regions 2 (North Central) and 3 (Northeast).

Prices received for spring wheat and barley were lower than their five-year average in all CRDs (Table 3). In several regions, HRS wheat was more than \$1.00 less than the five-year average, and durum wheat was more than \$2.00 less than the five-year average.

Table 2. Estimated Trend Yields, Actual Yields, and Differences by Regions of North Dakota, 1999

CRD	Estimated			Actual			Difference		
	Spring	Durum	Barley	Spring	Durum	Barley	Spring	Durum	Barley
	-----bu/acre-----								
1	23.7	23.7	40.1	26.1	28.0	43.0	2.4	4.3	2.9
2	31.1	29.8	51.8	25.2	19.6	43.8	- 5.9	-10.2	-8.0
3	35.2	27.6	59.4	37.7	20.8	52.6	2.5	- 6.8	-6.8
4	27.5	27.1	40.9	26.8	24.9	45.4	- 0.7	- 2.2	4.5
5	30.5	29.8	54.2	28.5	17.6	50.6	- 2.4	-12.2	- 3.6
6	36.6	34.4	61.2	34.5	20.9	50.7	- 2.1	-13.5	-10.5
7	27.1	28.6	37.1	24.1	27.8	46.4	- 3.0	-0.8	9.3
8	22.8	24.3	37.0	22.0	17.8	35.0	- 0.8	- 6.5	- 2.0
9	33.4	30.9	54.1	32.4	18.2	51.9	- 1.0	-12.7	- 2.2

Table 3. Deviations of the 1999 Actual Prices From Five-year Moving Average, North Dakota

CRD	Region		
	Spring	Durum	Barley
	-----\$/bu-----		
1	-0.93	-2.00	-0.46
2	-0.92	-1.66	-0.37
3	-0.93	-1.50	-0.20
4	-0.99	-2.12	-0.26
5	-1.01	-1.92	-0.34
6	-1.04	-1.43	-0.36
7	-0.92	-2.04	-0.16
8	-0.94	-1.79	-0.17
9	-1.09	-1.65	-0.32

Table 4 shows the expected gross returns for small grains in North Dakota using the five-year moving average price and trend line yields. Expected gross returns for spring wheat were calculated at \$647 million, followed by \$361 million for durum wheat and \$136 million for barley.

Table 5 shows the actual gross returns for small grains in North Dakota, actual prices received by farmers and actual yields. Actual gross returns for spring wheat were calculated at \$463 million, followed by \$192 million for durum wheat and \$109 million for barley.

Table 4. Expected Total Gross Returns for Small Grains for North Dakota Farmers

CRD Region	Spring Wheat	Durum	Barley	Total Gross Returns
-----\$1,000-----				
1	36,293	131,263	16,876	184,432
2	34,372	30,208	21,944	86,524
3	137,180	59,301	31,659	228,140
4	46,922	48,958	9,208	105,088
5	67,054	31,747	21,741	120,543
6	120,936	22,577	15,391	158,904
7	73,839	18,574	3,620	96,033
8	43,047	7,803	5,205	56,055
9	87,396	11,346	9,861	108,604
State	647,039	361,778	135,506	1,144,324

Table 5. Actual Total Gross Returns for Small Grains for North Dakota Farmers

CRD Region	Spring Wheat	Durum	Barley	Total Gross Returns
-----\$1,000-----				
1	29,895	88,740	14,518	133,153
2	20,866	12,246	15,477	48,588
3	109,775	28,601	25,349	163,725
4	33,655	25,064	8,945	67,664
5	45,229	10,902	17,177	73,309
6	82,841	8,928	10,693	102,462
7	49,222	10,243	4,163	63,628
8	30,967	3,422	4,500	38,889
9	60,808	4,130	8,065	73,004
State	463,259	192,277	108,887	764,424

The total reductions in gross returns from spring wheat, durum wheat, and barley for North Dakota CRDs are divided into reductions due to weather and disease and reductions due to lower-than-average prices (Figure 6). Table 6 shows estimated reductions in gross returns that were due to weather conditions in 1997-99. In 1997, the largest reductions in gross returns are due to weather and crop disease (\$285.5 million). In 1998, reductions due to weather and crop disease fell 43 percent to \$160.2 million. In 1999, reductions due to weather and crop disease fell to \$51.1 million. All regions except for Region 1 experienced some weather and disease problems during the year. Region 2 experienced excess moisture in the spring of 1999 which delayed much of the planting and prevented some acres from being planted. The unused acres are not used to calculate gross returns which are calculated from harvested acres and yields.

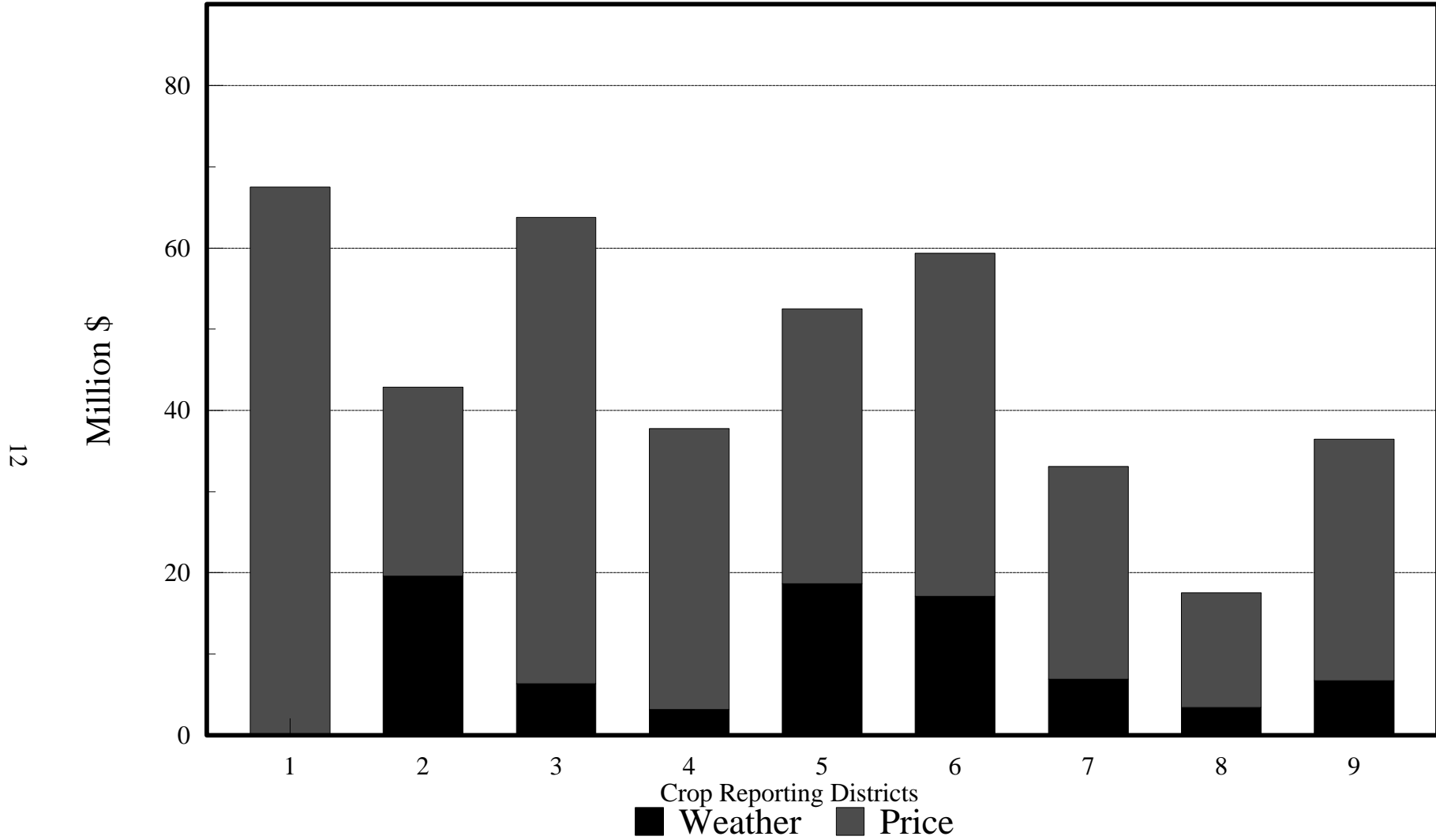


Figure 6. Total Reductions in Gross Returns by Crop Reporting Districts for North Dakota in 1999

Table 6. Estimated Reductions in Gross Returns, Due to Weather Conditions, for North Dakota Farmers

CRD Region	Spring Wheat	Durum	Barley	Total Weather Reductions
-----\$1,000-----				
<u>1997</u>				
Total	172,961	83,417	29,116	285,494
<u>1998</u>				
Total	47,052	95,092	8,061	160,205
<u>1999</u>				
1	(4,064)	(25,325)	(1,397)	(30,786)
2	6,249	10,146	3,208	19,604
3	(11,173)	14,175	3,351	6,353
4	749	3,536	(1,113)	3,173
5	4,606	12,815	1,246	18,667
6	5,829	8,727	2,516	17,072
7	7,535	344	(951)	6,927
8	1,106	2,032	233	3,371
9	1,791	4,598	309	6,698
Total	12,628	31,048	7,404	51,080

The reductions in gross returns due to price changes are shown in Table 7. Region 1 had the largest reduction due to price (\$67.5 million), followed by Region 3 (\$57.4 million). The total price-related reductions were highest for HRS wheat (\$165 million), followed by durum wheat (\$145 million). The estimated reductions due to price were substantially less in 1999 than the reductions that occurred in 1998 in spite of lower commodity prices. There are several reasons for this. First, harvested acres for HRS wheat and barley in 1999 were 15.2 percent and 35.8 percent less than in 1998, and durum wheat acres were about the same. Second, the five-year moving average of crop prices was lower in 1999 than in 1998. In 1998, the five-year average HRS price was \$3.89 compared to \$3.73 in 1999. For durum, the five-year average price was \$4.87 in 1998 and \$4.52 in 1999. Third, yields were higher in 1998 than in 1999 for all crops. Therefore, with production being down in 1999 due to lower yields and fewer harvested acres, the reductions due to price effect were less than in 1998.

In general, yield reductions due to weather and disease might be expected to raise domestic crop prices. However, Canada is a large surplus producer of small grains and any production shortfall in the United States is likely to be met in part by imports from Canada. This negates much of the (positive) effect of a poor crop on U.S. wheat and barley prices.

Table 7. Estimated Reductions in Gross Returns, Due to Prices, for North Dakota Farmers

CRD Region	Spring Wheat	Durum	Barley	Total Price Reductions
-----\$1,000-----				
<u>1997</u>				
Total	66,872	(21,073)	16,933	62,732
<u>1998</u>				
Total	169,738	185,507	53,369	408,614
<u>1999</u>				
1	8,883	55,420	3,205	67,508
2	8,370	11,408	3,463	23,241
3	33,687	20,980	2,754	57,421
4	12,051	21,414	1,071	34,537
5	17,539	13,108	3,163	33,810
6	32,196	7,739	2,358	42,293
7	17,951	7,933	259	26,143
8	10,641	3,086	401	14,128
9	24,100	4,265	1,372	29,738
Total	165,419	145,354	18,047	328,820

Table 8 shows the total estimated reductions in total gross return for 1997-99 (sum of 'production' and 'price' components). Total reductions were also less in 1999 than in 1998 by 33 percent, \$379.9 million in 1999 compared to \$586.8 million in 1998. Region 3 had the largest reduction in total gross returns (\$63.8 million), followed by Region 6 (\$59.4 million). The total reductions are almost evenly distributed between spring wheat and durum wheat.

Table 8. Estimated Reductions in Total Gross Returns for North Dakota Farmers

CRD Region	Spring Wheat	Durum	Barley	Total Reductions
-----\$1,000-----				
<u>1997</u>				
Total	239,833	62,344	46,050	348,226
<u>1998</u>				
Total	216,790	280,599	71,430	568,819
<u>1999</u>				
1	4,818	30,094	1,809	36,721
2	14,620	21,554	6,671	42,845
3	22,514	35,155	6,105	63,774
4	12,800	24,951	(41)	37,710
5	22,145	25,923	4,409	52,477
6	38,025	16,465	4,874	59,365
7	25,486	8,277	(692)	33,070
8	11,747	5,118	634	17,500
9	25,892	8,864	1,681	36,437
Total	178,047	176,402	25,451	379,900

Over the last several years, North Dakota farmers have received substantial income from government payments such as AMTA payments, crop loss disasters payments, market loss payments, loan deficiency payments, and crop insurance proceeds. Table 9 show the payments for the years 1998 and 1999. In 1998, producers received \$859.7 million in payments compared to \$1,380 million in 1999.

Table 9. Government Payments, Crop Insurance Proceeds, and Other Payments to North Dakota Farmers, 1998 and 1999

Program	1998	1999
-----million \$-----		
Production Flexibility Contract Payments	238.9	245.0
Market Loss Payments (supplemental AMTA)	123.0	245.0
Crop Loss Disaster Assistance Payments	109.2	50.0
Crop Insurance Indemnity Payments	91.6	444.5*
Loan Deficiency Payments and Marketing Loan Gains	182.1	223.0
Conservation Reserve Program	112.8	104.0
Miscellaneous	<u>2.1</u>	<u>73.0</u>
Total	859.7	1,389.5

Source: North Dakota Farmers Union

*USDA-RMA Web Site

Over the past five years (1994-1998), cash receipts for North Dakota farmers from farm marketings for all crop and livestock averaged \$3,159 million. Government payments and other assistance have averaged 12-14 percent over the past five years but if gross returns for 1999 are similar to the past, assistance will be 44 percent of gross revenue.

Figure 7 shows the direct government payments to North Dakota farmers between 1982 and 1999. Between 1983 and 1997 payments ranged between \$300 and \$700 million. The trend since 1988 until 1998 has been downward, \$715 million in 1988 to \$296 million in 1995.

Concluding Remarks

Excluding government payments, in 1999 North Dakota gross returns from HRS wheat, durum wheat, and barley declined by about \$380 million due to adverse weather conditions and low prices. Of this reduction, \$51 million was due to weather and disease and \$329 million was due to lower-than-average prices. Reductions in gross returns were largest in Region 3 (Northeast), followed by Regions 6 (East Central) and 5 (Central). Spring wheat accounted for the largest reduction in gross returns, followed by durum wheat and barley. However, total net farm income from all sources improved in 1999, but the improvement was due to government payments, crop insurance proceeds, and improved beef cattle prices. This implies that governmental support has been a significant portion of farm income and is needed to stabilize farm income. The subsidy is in the form of subsidized revenue crop insurance, higher support prices for commodities, or additional and flexible government payments in the form of the transition payments which producers receive under the FAIR Act but are based on commodity prices. Traditional crop insurance provides protection from crop loss due to weather losses but provides no support for price loss. Likewise, transition payments provide no price protection.

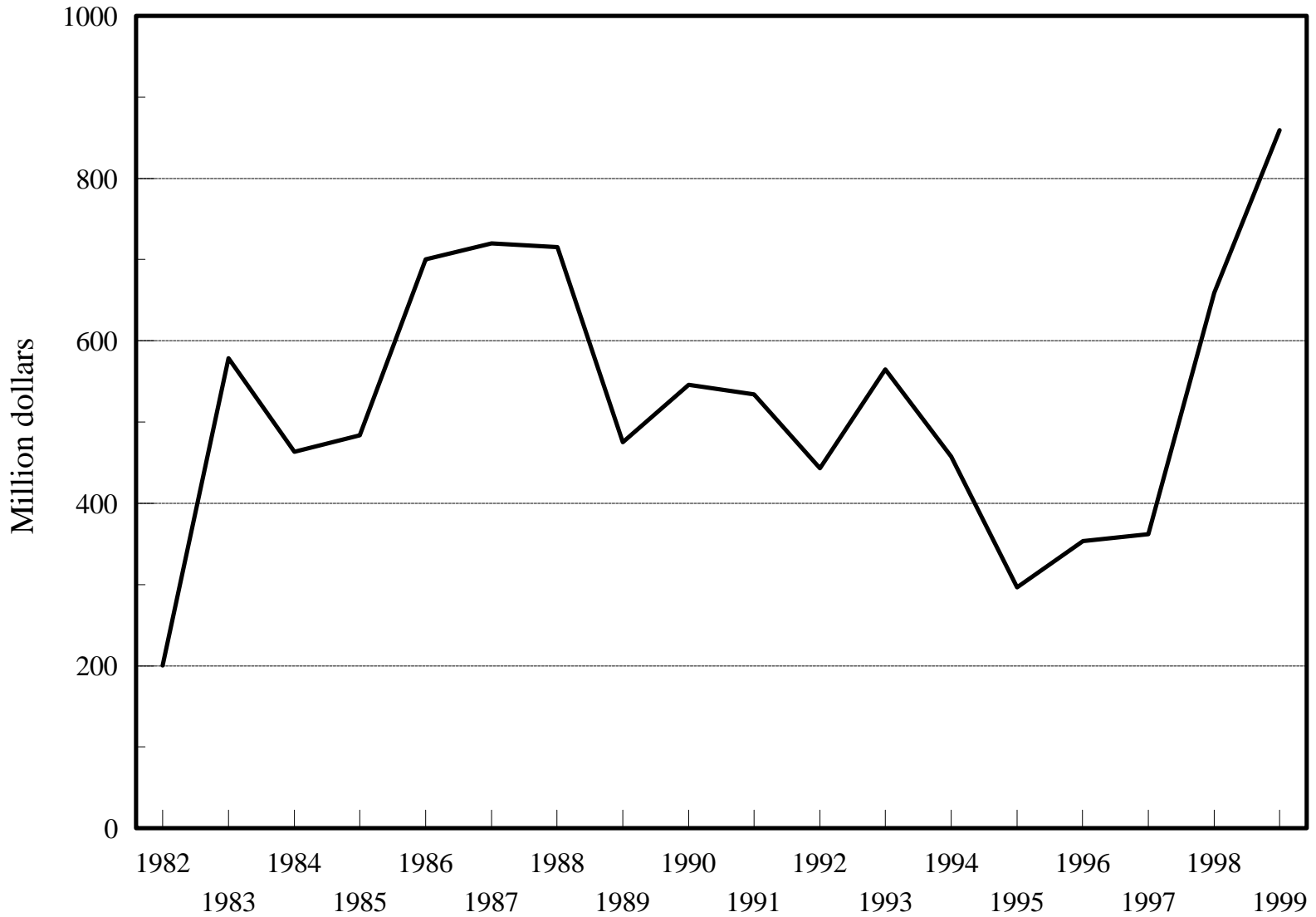


Figure 7. Government Payments to North Dakota Farmers*

*Conservation Reserve Program, Feed Grain Program, Wheat Program, and Miscellaneous

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