

WEST RIVER AGRICULTURAL RESEARCH AND EXTENSION CENTER
CROPS AND SOILS RESEARCH

Rapid City, South Dakota

Introduction

This is an annual progress report of the West River Crops and Soils Research Projects, South Dakota Agricultural Experiment Station. The equipment storage and processing facilities are located approximately 1 mile southwest of the village of Box Elder. The office facilities are located on the Central States Fairgrounds at 801 San Francisco Street, Rapid City. Telephone 605/394-2236.

The Research Projects serve the western part of the state. They are unique in that all experimental plots are cooperatively located with Farmers, Ranchers, or Crop Improvement Associations, through Extension Agents.

The research conducted is not restricted to a specific area, crop, or soil, but by necessity of workload, investigates only those problems which are pertinent to general areas. This report contains results of selected research. It does not include results of work conducted by projects headquartered from the campus at Brookings.

FIELD PLOT COOPERATORS

<u>Name</u>	<u>Address</u>	<u>County</u>
County Crop Impr. Ass'n	Martin 57551	Bennett
Roger Rosenow	Ralph 57650	Harding
Paul Patterson	Draper 57531	Jones
Clifford Halverson	Kennebec 57544	Lyman
Jim Madsen	New Underwood 57790	Meade
Gary Hawks	Plainview 57771	Meade
Tim Komes	Sturgis 57785	Meade
Brian Barber	Hermosa 57744	Pennington
Rodney Renner	Wall 57790	Pennington
Gary Wunder	Bison 57620	Perkins
Sivage Farms	Hayes 57537	Stanley

This is an annual report and results published herein are therefore neither complete nor conclusive. 300 copies printed at an estimated cost of \$1.95 each.

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PLANT SCIENCE DEPARTMENT
South Dakota State University

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Weather Summary

The weather summaries presented in Tables 1 through 3 were obtained from the National Oceanic and Atmospheric Administration publication, Climatological Data - South Dakota, and from South Dakota Crop-Weather Summary published by the South Dakota Statistical Reporting Service-USDA.

Average air temperatures in Western South Dakota were normal in September, but were two degrees below normal during August and October. During November and December temperatures were more than five degrees above normal. January and February were near normal, while March through July monthly averages varied from 2.2 degrees to 9.7 degrees above normal.

Precipitation patterns varied but rainfall was generally below normal for the year. The entire area was short or critically short of both topsoil and sub-soil moisture during the growing season. Only portions of the southwest and south central areas of the state had sufficient moisture for normal crop growth. Timely snow and rain showers provided much needed moisture resulting in good yields of winter grain. Spring grain yields reflected the extreme shortage of moisture.

The total useable moisture (Table 3) for the entire crop year varied from 15.2 inches at Long Valley in southern Jackson County to 4.5 inches at Rapid City in Pennington county. The Spring season useable moisture ranged from 10.2 inches at Long Valley down to 2.4 inches at Bison in Perkins county.

TABLE 1. Weather Data - Average Temperatures and Total Precipitation by Months, with Departures from Normal.

Month & Year	Average Temperature*	Departure from Normal**	Total Precipitation*	Departure from Normal**
<u>Martin</u> (Bennett County Reporting Station)***				
Aug. 1987	69.7	-2.4	1.72	-0.37
Sept. 1987	60.3	-1.9	1.42	0.16
Oct. 1987	47.8	-2.9	0.56	-0.33
Nov. 1987	38.9	3.6	0.13	-0.25
Dec. 1987	27.4	1.1	0.85	0.50
Jan. 1988	18.1	-3.3	0.23	-0.03
Feb. 1988	26.3	-0.7	0.67	0.25
Mar. 1988	35.8	2.7	0.48	-0.45
Apr. 1988	48.1	2.4	0.94	-1.02
May 1988	60.8	4.1	4.81	1.86
June 1988	73.7	7.1	3.49	0.12
July 1988	73.6	-0.2	1.70	-0.66

*Average temperatures and precipitation obtained from NOAA Climatological Data from reporting station nearest the experimental sites. Temperatures are reported in degrees Fahrenheit and precipitation in inches.

**Departures from normal are based on records for the period 1951-1980.

***Departures based on records for 1977-1987 at specific locations.

TABLE 1. Continued

Month & Year	Average Temperature*	Departure from Normal**	Total Precipitation*	Departure from Normal**
<u>Ralph</u> (Harding County Reporting Station)				
Aug. 1987	64.7	-3.2	1.70	0.07
Sept. 1987	58.2	1.7	1.74	0.53
Oct. 1987	43.9	-1.5	0.22	-0.61
Nov. 1987	37.0	7.2	0.20	-0.14
Dec. 1987	25.8	6.1	0.21	-0.07
Jan. 1988	15.2	1.9	0.56	0.19
Feb. 1988	20.3	0.3	0.55	0.23
Mar. 1988	32.5	4.1	0.79	0.33
Apr. 1988	46.5	4.3	0.20	-1.34
May 1988	59.5	5.7	3.18	0.57
June 1988	74.4	11.7	5.04	1.56
July 1988	73.0	3.4	0.19	-1.73
<u>Long Valley</u> (Jackson County Reporting Station)				
Aug. 1987	69.5	-4.1	2.47	0.42
Sept. 1987	63.0	-0.3	1.63	0.49
Oct. 1987	47.9	-3.8	0.61	-0.32
Nov. 1987	39.7	3.2	0.20	-0.17
Dec. 1987	29.7	2.6	0.57	0.25
Jan. 1988	20.4	-1.3	0.45	0.21
Feb. 1988	26.4	-0.8	0.98	0.56
Mar. 1988	35.9	2.2	1.67	0.58
Apr. 1988	48.0	1.4	0.82	-1.35
May 1988	60.3	2.8	4.45	1.68
June 1988	75.4	7.7	7.09	3.91
July 1988	74.7	-0.5	0.99	-1.33
<u>Murdo</u> (Jones County Reporting Station)				
Aug. 1987	72.1	-1.5	1.96	0.11
Sept. 1987	64.6	1.5	0.63	-0.48
Oct. 1987	49.9	-1.4	0.35	-0.80
Nov. 1987	40.0	4.8	0.15	-0.34
Dec. 1987	29.1	5.4	0.99	0.56
Jan. 1988	17.3	-0.6	0.36	0.05
Feb. 1988	24.7	0.9	0.34	-0.12
Mar. 1988	38.0	6.0	0.39	-0.69
Apr. 1988	49.4	2.8	1.12	-1.08
May 1988	61.6	3.5	3.02	0.35
June 1988	76.2	8.2	5.19	1.91
July 1988	76.1	0.9	0.36	-1.73

*Average temperatures and precipitation obtained from NOAA Climatological Data from reporting station nearest the experimental sites. Temperatures are reported in degrees Fahrenheit and precipitation in inches.

**Departures from normal are based on records for the period 1951-1980.

***Departures based on records for 1977-1987 at specific locations.

TABLE 1. Continued

Month & Year	Average Temperature*	Departure from Normal**	Total Precipitation*	Departure from Normal**
<u>Kennebec</u> (Lyman County Reporting Station)				
Aug. 1987	71.4	-3.0	2.19	-0.04
Sept. 1987	63.9	0.2	0.48	-0.73
Oct. 1987	47.5	-3.6	0.44	-0.62
Nov. 1987	38.9	4.7	0.48	-0.03
Dec. 1987	26.1	4.0	0.79	0.41
Jan. 1988	12.1	-3.5	0.30	0.05
Feb. 1988	21.2	-1.3	0.13	-0.35
Mar. 1988	37.2	5.2	0.98	0.09
Apr. 1988	49.2	1.9	1.52	-0.61
May 1988	63.6	4.7	4.21	1.69
June 1988	78.0	8.9	2.64	-0.37
July 1988	77.9	2.1	0.98	-1.31
<u>Bear Butte Valley</u> (Ft. Meade-Meade County Reporting Station)***				
Aug. 1987	68.0	-3.1	3.67	1.95
Sept. 1987	61.5	0.1	0.85	-0.34
Oct. 1987	48.6	-0.8	0.25	-0.79
Nov. 1987	40.8	6.3	0.48	-0.22
Dec. 1987	30.5	4.7	0.18	-0.38
Jan. 1988	25.4	2.0	0.14	-0.33
Feb. 1988	27.9	-0.5	0.28	-0.44
Mar. 1988	36.3	-0.1	4.22	3.20
Apr. 1988	49.1	1.5	0.63	-1.78
May 1988	61.3	4.1	3.88	0.57
June 1988	76.5	10.3	2.97	-0.84
July 1988	76.3	2.6	0.60	-1.63
<u>Plainview</u> (Meade County Reporting Point)***				
Aug. 1987	72.9	-0.5	0.60	-0.95
Sept. 1987	62.4	1.4	0.33	-0.85
Oct. 1987	47.3	-0.4	0.11	-1.71
Nov. 1987	M	M	M	M
Dec. 1987	28.0	8.9	0.08	-0.26
Jan. 1988	17.9	0.7	0.08	-0.07
Feb. 1988	M	M	M	M
Mar. 1988	35.3	1.7	0.84	-0.49
Apr. 1988	46.7	0.4	0.36	-1.22
May 1988	61.4	2.8	2.10	-0.29
June 1988	77.9	10.1	6.18	3.56
July 1988	75.9	11.2	0.16	-1.98

*Average temperatures and precipitation obtained from NOAA Climatological Data from reporting station nearest the experimental sites. Temperatures are reported in degrees Fahrenheit and precipitation in inches.

**Departures from normal are based on records for the period 1951-1980.

***Departures based on records for 1977-1987 at specific locations.

TABLe 1. Continued

Month & Year	Average Temperature*	Departure from Normal**	Total Precipitation*	Departure from Normal**
Rapid City Airport (Pennington County Reporting Station)				
Aug. 1987	68.1	-3.3	2.37	0.93
Sept. 1987	61.4	0.5	0.68	-0.35
Oct. 1987	47.1	-2.6	0.26	-0.55
Nov. 1987	40.3	5.4	0.30	-0.21
Dec. 1987	28.9	2.8	0.31	-0.14
Jan. 1988	21.7	0.9	0.17	-0.25
Feb. 1988	26.9	0.9	0.34	-0.28
Mar. 1988	35.6	3.0	0.52	-0.50
Apr. 1988	47.1	2.5	0.60	-1.36
May 1988	60.0	4.4	3.25	0.62
June 1988	75.6	10.4	1.09	-2.17
July 1988	76.1	3.5	0.38	-1.74
Wasta (Pennington County Reporting Station)				
Aug. 1987	70.6	-2.7	1.91	0.40
Sept. 1987	61.8	-0.4	0.38	-0.68
Oct. 1987	47.4	-3.0	0.21	-0.71
Nov. 1987	39.0	3.9	0.32	-0.17
Dec. 1987	27.8	3.1	0.25	-0.13
Jan. 1988	19.2	-0.6	0.17	-0.18
Feb. 1988	25.9	-0.1	0.80	0.36
Mar. 1988	35.2	1.1	2.10	1.25
Apr. 1988	49.0	2.0	0.65	-1.26
May 1988	62.3	4.2	3.22	0.71
June 1988	76.5	8.8	1.93	-1.20
July 1988	77.2	2.3	0.80	-1.25
Bison (Perkins County Reporting Station)				
Aug. 1987	66.4	0.4	1.36	-0.39
Sept. 1987	M	M	M	M
Oct. 1987	45.6	-5.1	0.11	-0.71
Nov. 1987	38.7	6.7	0.22	-0.29
Dec. 1987	28.0	10.0	0.11	-0.28
Jan. 1988	16.9	1.1	0.18	-0.18
Feb. 1988	21.4	-2.8	0.59	0.07
Mar. 1988	32.9	2.9	1.65	0.82
Apr. 1988	47.5	4.1	0.98	-0.87
May 1988	59.8	2.8	1.03	-1.53
June 1988	75.6	—	2.46	-0.82
July 1988	74.0	0.1	0.43	-1.77

*Average temperatures and precipitation obtained from NOAA Climatological Data from reporting station nearest the experimental sites. Temperatures are reported in degrees Fahrenheit and precipitation in inches.

**Departures from normal are based on records for the period 1951-1980.

***Departures based on records for 1977-1987 at specific locations.

TABLE 1. Continued

Month & Year	Average Temperature*	Departure from Normal**	Total Precipitation*	Departure from Normal**
<u>Kirley</u> (Stanley County Reporting Station)****				
Aug. 1987	68.2	-3.5	3.14	1.29
Sept. 1987	61.6	-0.2	0.42	-0.94
Oct. 1987	46.5	-2.1	0.14	-0.85
Nov. 1987	39.0	6.7	0.44	0.01
Dec. 1987	27.5	7.0	0.37	-0.13
Jan. 1988	15.4	-1.3	0.26	-0.09
Feb. 1988	21.0	-2.0	0.25	-0.33
Mar. 1988	35.5	2.1	0.43	-0.58
Apr. 1988	47.2	-0.4	0.86	-0.86
May 1988	62.1	3.5	2.86	0.24
June 1988	78.6	11.5	1.73	-1.27
July 1988	76.4	1.8	1.86	-0.11

*Average temperatures and precipitation obtained from NOAA Climatological Data from reporting station nearest the experimental sites. Temperatures are reported in degrees Fahrenheit and precipitation in inches.

**Departures from normal are based on records for the period 1951-1980.

***Departures are based on records for 1977-1987 at specific locations.

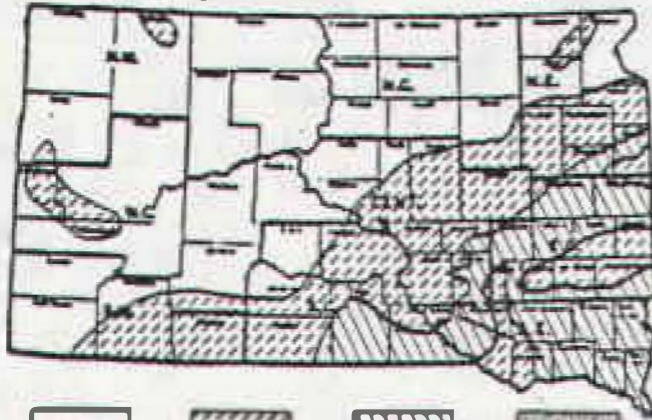
****Departures are based on records of 14 years (1971-1984).

Topsoil moisture (Table 2) was short or critically short up to late April 1988 in all of South Dakota except the southeast quarter of the state. At that time precipitation was received changing the classification to short, except in those counties which bordered North Dakota. Those counties bordering Nebraska and in the south central area were classed as adequate until June. Precipitation continued to be spotted and by the end of the fall 1988 growing season most of the state was critically short of both topsoil and subsoil moisture. The moisture shortage in 1988 was intensified by low precipitation in the previous year.

The useable moisture (Table 3) for the entire crop year varied from 4.5 inches in western Pennington county to over 15 inches at Long Valley in Jackson county. The spring season useable moisture ranged from 2.4 inches at Bison in central Perkins county to over 10 inches at Long Valley in Jackson county.

TABLE 2. Topsoil Moisture Conditions During Growing Season, May-September 1988. (Crop and Livestock Reporting Service-USDA)

As of Friday, April 15, 1988



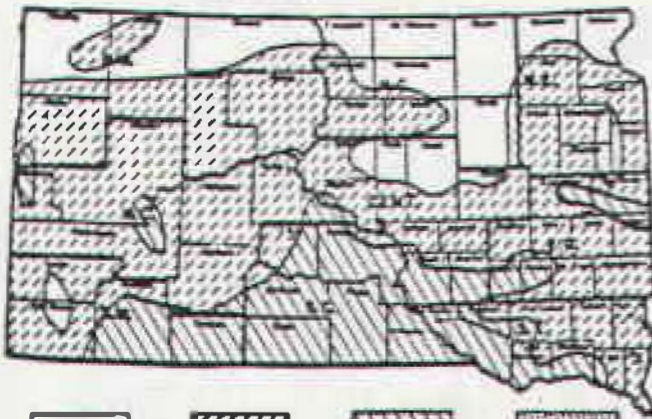
 **CRITICALLY SHORT**
 **SHORT**
 **ADEQUATE**
 **SURPLUS**

As of Friday, July 15, 1988



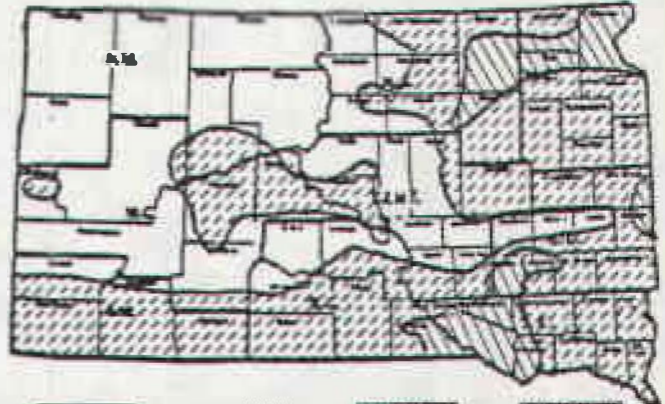
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 **SHORT**
 **ADEQUATE**
 **SURPLUS**

As of Friday, May 13, 1988



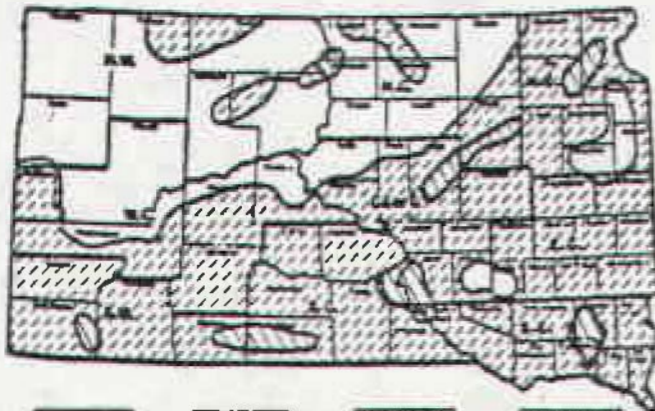
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 **SHORT**
 **ADEQUATE**
 **SURPLUS**

As of Friday, August 12, 1988



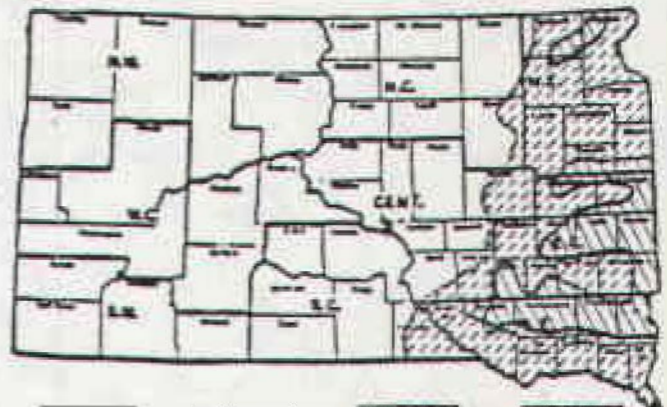
 **CRITICALLY SHORT**
 **SHORT**
 **ADEQUATE**
 **SURPLUS**

As of Friday, June 17, 1988



 **CRITICALLY SHORT**
 **SHORT**
 **ADEQUATE**
 **SURPLUS**

As of Friday, September 16, 1988



 **CRITICALLY SHORT**
 **SHORT**
 **ADEQUATE**
 **SURPLUS**

TABLE 3. Weather Data - Date of Critical Temperatures and Total Useable Precipitation in Counties with Experimental Plots, (1987-1988).

<u>Location</u>	<u>Date of Temperature*</u>		<u>Total Useable Moisture**</u>	
	<u>Fall-First</u>	<u>Spring-Last</u>	<u>Aug. 87-July 88</u>	<u>April 88-July 88</u>
Bennett County (Martin)	Sep. 12 (28°)	Apr 28 (27°)	10.46	8.22
Harding County (Ralph)	Oct. 2 (24°)	Apr 28 (24°)	9.53	6.95
Jackson County (Long Valley)	Oct. 2 (27°)	Apr 27 (26°)	15.24	15.24
Jones County (Murdo)	Oct. 2 (27°)	Apr 23 (25°)	8.53	6.88
Lyman County (Kennebec)	Oct. 7 (22°)	Apr 28 (28°)	8.20	6.25
Fall River County (Oelrichs)	Oct. 7 (24°)	Apr 28 (26°)	6.73	6.16
Meade County (Ft. Meade)	Oct. 9 (27°)	Apr 27 (28°)	11.52	5.15
Meade County (Plainview)	Oct. 2 (25°)	Apr 27 (27°)	7.15	6.48
Pennington County (Rapid City AP)	Oct. 10 (22°)	Apr 27 (23°)	4.53	2.91
Pennington County (Wasta)	Oct. 2 (27°)	Apr 28 (28°)	7.10	3.70
Perkins County (Bison)	Oct. 2 (27°)	Apr 27 (28°)	5.29	2.37
Stanley County (Kirley)	Oct. 10 (19°)	Apr 27 (27°)	6.58	4.53

*First 28 degree temperature in Fall or last 28 degree temperature in Spring reported in degrees Fahrenheit.

**Sum of all precipitation where amounts were greater than 0.25 inch or totaled 0.25 inches in two contiguous days.

SMALL GRAIN VARIETY TRIALS

Objective: To observe and compare standard small grain varieties and experimental lines for winter hardiness, grain yield, grain quality, disease resistance, insect resistance, and other characteristics for area adaptability.

Hard Red Winter Wheat

Trials and demonstrations were located in Bennett, Harding, Jackson, Lyman, Meade, Pennington, Perkins, and Stanley Counties. The trial plots were seeded with a deep furrow seeder with fertilizer attachment. The demonstration plots were seeded by the Cooperators. The seeding rate for the trials was 60 pounds per acre.

The plots were harvested with a Hege Model 125B self-propelled plot combine. Machine harvested plots contained a minimum of 125 square feet per sample. All samples were weighed for plot yield and bushel weight at the harvest site.

Bennett County

The winter wheat variety trial in Bennett county was seeded into fallow soil with a deep furrow seeder on September 11. Soil moisture was adequate for germination, but was soon limited because of subnormal precipitation which began in August and lasted through the following April. Grain yield was dependent upon moisture stored in the subsoil the previous summer and late spring. Table 2 illustrates the unfavorable topsoil moisture situation.

Subnormal air temperatures (Table 1) were experienced during August through September. In November they were above normal by 3.6 degrees, and in December by 1.1 degrees. During the period March through June the air temperatures were above normal by 2.7, 2.4, 4.1, and 7.1 degrees, respectively. During July the temperatures were near normal.

The plots were fertilized for an anticipated yield of 40 bushel per acre. Weeds were controlled by an application of Glean at one-half ounce per acre. The results are listed in Table 4.

Harding County

The Harding County trial was seeded on September 15. Soil moisture, adequate for germination and emergence, was present to a depth of 36 inches. Rainfall was normal for the year, with some months above and some months below normal.

Air temperatures were above normal during all months of the year except August and October. The months of November and December were six degrees or more above, March and April were over four degrees, May over five degrees, and June nearly twelve degrees above the normal.

Winterkill was not serious. Over 90% of the varieties survived in excess of 80%. Fertilizer was applied for an anticipated yield of forty bushels per acre. The herbicide Glean was used to control the weeds. The trial data are published in Table 5.

TABLE 4. Hard Red Winter Wheat Variety Trial - Bennett County (Martin), 1986-88.

Variety	% Stand Apr 88	Height (Inches)	Date of Heading	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/A 1988 (3 yr av)	
Quantum 562	88	34	May 31	14.6	60.3	72.1	—
Quantum 568	87	36	June 1	15.1	60.8	71.7	—
Quantum XH896	92	34	May 30	13.9	61.0	71.1	—
Quantum 542	88	38	May 30	13.6	60.3	68.7	—
Rodeo	84	36	May 30	14.0	62.5	64.4	—
Abilene	87	33	May 31	15.2	61.8	63.9	—
WH180001 XP	80	35	June 1	14.3	61.8	63.9	—
Redland	87	37	June 1	13.9	60.5	63.5	—
Norkan	81	36	May 31	14.6	62.5	63.4	—
Thunderbird	84	36	June 1	14.8	62.0	62.8	56.7
Brule	87	36	May 31	14.0	59.3	62.0	49.0
SD 82102	89	39	May 30	14.7	60.0	61.4	54.7
Dawn	76	35	May 31	14.3	62.0	60.1	53.4
Scout 66	84	39	May 31	14.6	61.8	59.7	52.2
Arapahoe	84	38	May 29	14.4	60.3	59.4	—
SD 76598-7	85	38	June 2	14.3	60.8	59.3	47.9
Cody	87	37	May 31	15.1	60.3	58.9	—
Centura	81	34	May 31	14.8	61.0	58.5	50.4
Sage	80	41	June 1	15.2	62.8	58.4	53.2
Dodge	86	36	May 30	14.1	62.8	58.3	—
Colt	88	34	June 2	14.8	59.8	58.2	54.1
Centurk 78	86	37	May 30	14.9	60.0	57.9	48.9
TAM 107	84	30	May 31	13.2	60.5	57.8	48.7
Siouxland	86	36	May 30	14.4	61.5	56.6	55.7
Bennett	86	35	June 1	14.5	60.8	55.5	48.1
Bounty 205	58	38	June 1	14.9	62.5	55.3	56.4
SD 82118	89	36	May 30	14.8	62.0	55.1	—
SD 82144	88	37	June 1	15.8	61.5	55.1	—
Rose	88	37	June 1	15.1	60.0	54.8	46.2
Roughrider	91	40	May 31	15.9	61.0	54.0	43.6
Lancota	84	38	May 31	16.2	61.0	54.0	—
Seward	92	40	June 1	14.7	58.5	51.4	—
Bounty 301	68	36	May 31	15.6	59.8	50.8	50.1
SD 78207-4	88	38	May 31	15.7	61.3	50.5	—
Agassiz	89	40	May 30	16.1	58.5	46.3	41.7
Norwin	88	30	May 31	14.2	59.8	43.1	38.8
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LSD (.05) - 7.5 Bu/A			C.V. - 8.9 %		Mean - 58.8		

*Protein content determined with a Technicon 300 InfraAnalyzer.

NOTE: Seeded September 11, 1987 and harvested July 8, 1988.

TABLE 5. Hard Red Winter Wheat Variety Trial - Harding County(Ralph), 1986-88.

Variety	% Stand May 1988	Height (Inches)	Date of Heading	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/A 1988	(3 yr av)
Quantum 542	88	25	June 4	14.4	54.5	26.5	---
Redland	87	24	June 3	14.3	58.0	24.5	---
Colt	88	21	June 3	14.8	56.8	24.5	31.7
Quantum XH696	93	23	June 2	14.4	57.0	23.7	---
Abilene	87	20	June 3	15.2	61.5	23.5	---
Siouxland	86	25	June 3	15.5	58.3	23.3	31.9
TAM 107	84	22	June 1	14.0	57.8	22.7	28.3
Seward	92	23	June 7	15.3	55.3	22.4	---
SD 82118	89	22	June 4	16.1	57.3	22.1	---
Bennett	86	22	June 2	15.1	55.0	22.0	27.5
Brule	87	24	June 3	14.9	56.3	21.7	31.4
Quantum 568	87	22	June 2	15.7	57.3	21.5	---
Centurk 78	87	22	June 5	14.6	57.8	20.3	27.9
Quantum 562	88	22	June 3	15.1	56.0	20.1	---
Scout 66	84	25	June 1	15.3	59.0	20.0	31.1
Agassiz	89	23	June 7	16.2	56.5	19.9	34.5
Rodeo	84	23	June 2	16.0	57.8	19.1	---
Sage	80	25	June 1	15.7	58.5	19.0	31.5
Thunderbird	84	21	June 2	16.0	59.8	18.9	28.9
Arapahoe	86	22	June 2	15.3	57.3	18.8	---
Cody	87	21	June 5	15.4	53.5	18.8	---
Centura	81	23	June 4	15.1	56.8	18.2	30.6
SD 82102	89	22	June 3	15.5	57.3	18.0	34.5
SD 82144	88	23	June 4	16.0	56.5	17.6	---
SD 76598-7	85	23	June 4	16.0	56.8	17.3	33.5
SD 78207-4	88	22	June 5	16.1	54.5	17.0	---
Roughrider	90	25	June 5	16.1	56.0	16.7	32.4
Dodge	86	21	June 2	16.1	56.5	16.3	---
Rose	88	21	June 6	16.2	50.0	15.9	34.0
Dawn	76	23	June 4	15.9	58.0	15.8	23.1
Lancota	84	21	June 4	17.4	55.0	15.2	---
Norkan	81	21	June 3	16.0	56.5	15.2	---
Norwin	88	19	June 6	15.9	53.5	14.9	33.7
WH180001 XP	81	23	June 3	16.7	56.0	11.0	---
Bounty 301	68	22	June 5	16.6	51.0	10.4	21.4
Bounty 205	58	23	June 3	16.3	54.5	5.8	16.6
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LSD(.05) - 4.4 Bu/A			C.V. - 16.4%		Mean - 18.4		

* Percent protein determined with a Technicon 300 InfraAnalyzer.

Note: Seeded September 15, 1987 and harvested July 15, 1988.

Jackson County

The winter wheat variety demonstration plots near Wanblee were seeded with a farm size deep furrow drill. Each variety was seeded in a single strip several hundred feet long. The strips were subdivided into shorter sections to provide uniform and multiple harvest samples. Management practices such as seeding rate, seeding date, soil fertility, and weed control were at the discretion of the cooperator. Air temperatures were above normal from March through June. Annual precipitation was slightly above normal for the period August 1987 through July 1988. However, rainfall during April was below normal resulting in topsoil moisture being critically short during that period. The plants developed to a normal height indicating drought had not affected their growth. Weight per bushel was near normal and protein content ranged from 11.1% to 13.8%. The level of protein in the seed indicated adequate moisture during the period when the grain was maturing. The trial data are reported in Table 6.

Lyman County

The winter wheat variety demonstration near Kennebec was seeded in early September with a farm sized deep furrow drill. Varieties were seeded in single strips that were several hundred feet long. The strips were subdivided into shorter sections to provide uniform and multiple harvest samples. Management practices such as seeding rate, seeding date, soil fertility, and weed control were at the discretion of the cooperator. Average air temperatures were above normal by several degrees during the spring growing season. Annual Precipitation was near normal for the period August 1987 through July 1988, but was in short supply during the critical period of June and July when the wheat was in the final stage of kernel development. Lower weights per bushel for the later maturing varieties indicate moisture stress at maturity. Trial data are reported in Table 7.

Meade County (Bear Butte Valley)

Winter wheat varieties in Bear Butte Valley were seeded on September 9, 1987. The soil was moist at seeding depth. Germination and emergence were good. Air temperatures were near normal during September and October, but much above normal during November, December, May, and June. Fall growth lacked vigor which resulted from lack of fall precipitation. Spring growth was also lacking in vigor because of moisture shortage and above normal temperatures. Heavy precipitation was received in March but was not sufficient to compensate for the above normal temperatures and shortage of rainfall during the remainder of the growing season. The trial results are reported in Table 8.

Meade County
(Plainview)

The Winter wheat trial at Plainview was seeded on September 9, 1987. The soil had a firm layer at 3 inches with little moisture in the seed bed area. Germination and emergence was slow with little growth visible in late October. Precipitation was almost non-existent until March. Stands were evaluated in early April and very few living plants were found. The trial was abandoned at that time.

TABLE 6. Hard Red Winter Wheat Variety Demonstration - Jackson County (Wanblee), 1988.

Variety	Height (Inches)	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield Bushel/Acre
Quantum 564	40	13.7	59.5	57.8
Quantum 562	34	12.7	58.3	55.0
Scout 66	39	13.6	59.5	52.8
Ram	33	13.3	57.0	48.4
Centurk 78	38	12.3	58.0	46.6
Abilene	32	12.4	60.5	45.4
Redland	36	11.1	54.7	44.9
Thunderbird	33	12.2	58.6	44.4
Colt	32	12.9	58.1	44.1
Lancota	38	12.8	58.7	43.3
Brule	34	11.1	55.4	42.8
Sage	37	11.9	58.2	41.7
Siouxland	36	12.5	59.5	39.5
Seward	37	11.6	56.8	38.4
Roughrider	39	12.6	58.4	38.1
Agassiz	39	13.1	59.0	36.0
Norstar	39	12.3	59.3	35.4
Dawn	35	12.1	58.5	32.3
Rose	32	13.8	57.1	32.1
LSD (.05) - 7.2 Bu/A		C.V. - 11.5 %		Mean - 43.1

*Protein content determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seed September 14, 1987 and harvested July 8, 1988.

TABLE 7. Hard Red Winter Wheat Variety Demonstration - Lyman County (Kennebec), 1987-88.

<u>Variety</u>	<u>Days to Heading*</u>	<u>Percent Protein**</u>	<u>Test Wt. (Lbs/Bu)</u>	<u>Grain Yield-Bu/Acre</u>	
				<u>1988</u>	<u>(2 yr av)</u>
Redland	153	13.8	58.7	55.6	---
Quantum 562	151	14.7	57.3	54.7	---
Abilene	152	15.9	59.6	54.1	---
Redland	153	13.6	55.3	52.9	---
Brule	152	13.7	54.7	50.6	61.0
Thunderbird	150	15.7	59.3	49.5	55.0
Quantum 554	151	14.6	56.9	49.4	49.3
Centurk 78	152	14.4	57.9	48.7	54.4
Dawn #2	152	14.6	58.4	48.3	---
Lancota	153	15.5	58.5	46.9	59.6
Siouxland	150	14.8	56.7	46.1	61.6
Sage	150	14.2	59.6	45.1	55.1
Dawn #4	152	14.7	58.0	44.9	---
Dawn #3	152	14.9	56.8	44.5	---
Dawn #1	152	14.6	59.2	44.3	---
Rose	153	14.9	56.4	43.6	50.7
Dawn #5	152	14.8	58.2	43.3	---
Scout 66	151	13.7	58.8	43.2	50.9
Ram	---	14.6	52.3	43.1	48.9
Agate	---	14.4	56.9	42.0	---
Colt	152	14.3	55.0	42.0	59.5
Dawn	152	14.5	57.0	40.8	56.1
Seward	---	14.5	53.5	39.9	---
Agassiz	154	15.9	53.4	32.7	43.4
Roughrider	154	15.3	55.4	32.4	43.7
Norster	---	15.5	53.6	28.5	---
LSD(.05) - 3.7 Bu/A		C.V. - 5.0%		Mean - 43.2	

*Indicates days from January 1 to date of Reading.

**Protein content determined with a Technicon 300 InfraAnalyzer.

NOTE: Harvested July 13, 1988.

TABLE 8. Hard Red Winter Wheat Trial - Meade County(Bear Butte Valley), 1986-88.

Variety	% Stand May 1988	Height (Inches)	Date of Heading	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/A 1988	(3 yr av)
Dodge	88	26	May 29	16.5	48.0	29.8	---
TAM 107	87	25	May 28	14.9	48.0	28.0	---
Abilene	90	24	May 28	16.0	47.0	27.0	---
Centura	88	28	May 28	17.5	46.0	24.3	47.9
Scout 66	90	29	May 29	16.3	48.3	24.0	46.5
Redland	91	26	May 29	15.1	45.0	23.5	---
Siouxland	86	27	May 28	15.0	46.8	22.8	50.6
Brule	90	26	May 29	15.4	44.3	22.5	45.4
SD 82102	89	28	May 28	15.5	42.8	22.5	---
Arapahoe	87	26	May 28	15.4	46.0	22.3	---
Quantum XH696	87	27	May 28	15.8	44.5	22.0	---
Colt	88	24	May 28	15.5	45.5	21.3	46.8
Quantum 562	91	24	May 29	16.4	44.3	20.5	---
Bennett	79	25	May 29	15.8	46.0	20.0	41.9
Cody	84	25	May 30	16.7	41.8	20.0	---
WH180001 XP	86	25	May 29	16.9	45.8	19.5	---
Norkan	89	25	May 29	16.3	46.5	19.3	---
Thunderbird	88	25	May 29	15.5	46.5	19.0	46.4
Quantum 542	85	27	May 27	15.7	45.8	19.0	---
Sage	86	27	May 29	16.2	46.8	18.8	46.8
SD 82118	88	26	May 28	17.3	46.0	18.5	---
Quantum 568	84	26	May 29	16.6	44.0	18.0	---
Rose	89	27	May 30	16.4	42.0	17.5	44.8
Dawn	83	26	May 28	15.8	46.3	17.3	40.6
Centurk 78	87	26	May 29	17.3	41.8	17.3	43.6
Rodeo	89	25	May 29	16.2	46.8	16.8	---
SD 82144	86	28	May 29	16.9	44.0	16.5	---
SD 76598-7	84	26	May 30	16.6	43.5	16.3	---
Lancota	89	26	May 29	16.3	46.3	15.5	---
Roughrider	88	28	May 29	16.1	45.5	15.5	41.8
SD 78207-4	84	27	May 30	17.8	43.5	14.8	---
Bounty 205	83	25	May 28	16.6	45.3	14.5	---
Norwin	88	22	June 1	15.3	44.5	14.3	---
Agassiz	88	25	June 2	16.5	43.5	13.5	37.8
Seward	87	27	May 31	17.3	40.5	12.8	---
Bounty 301	81	24	May 28	17.2	43.8	12.0	---
LSD(.05) - 5.8 BU/A				C.V. - 20.9%		Mean - 19.4	

*Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Seeded September 9, 1987 and harvested July 6, 1988.

Pennington County

The winter wheat trial in Pennington County was seeded in fallow soil on September 10, 1987. The soil surface was dry and cloddy. Subsoil moisture was thought to be adequate for germination and emergence. Precipitation was below normal from September through January, but was above normal in March and May. Air temperatures which were below normal from August through October, were almost four degrees above normal in November and December. In March, temperatures were near normal. During the remainder of the growing season air temperatures averaged from 2 degrees above normal in April to 8.8 degrees above normal in June. Many new seedlings emerged in April bringing stands to 80%. Rainfall received in May and June provided the moisture necessary for spring growth. The average yield for the trial was over 45 bushels per acre. Weights per bushel were slightly below normal because of droughty conditions at maturity. The data from the trial are listed in Table 9.

Perkins County

The winter wheat trial in Perkins County was seeded on September 14, 1987. Stored soil moisture was limited and no appreciable moisture was received until March when 10 inches of snow was reported. Germination was spotted and occurred only where the seed could be placed deep enough to be in moist soil. Soil moisture in the spring was measured to a depth of 36 inches. However, precipitation during the spring months was below normal for all months but May.

Air temperatures, averaging over 5 degrees below normal in October, were from 6 to 10 degrees above normal during November and December. From March through May they averaged from two to four degrees below normal. Data from Bison for June was not available but at surrounding points the temperatures were over 11 degrees above normal.

The combination of below normal precipitation and above normal temperatures resulted in low grain yield, low test weights, and high protein content. The trial data are reported in table 10.

Stanley County

The winter wheat varieties in Stanley County were seeded in fallow soil on September 8, 1987. There was limited moisture for germination and emergence in the fall. Below normal precipitation was received during the entire crop year, beginning in September 1987, except during May 1988.

Air temperatures were below normal from August through October, but were above normal, by almost seven degrees, during November and December. From January through April, they were within two degrees of normal. May through July were all above normal, especially June which averaged 11.1 degrees above normal. In addition to the unfavorable climatic conditions, there was also a heavy infestation of aphids during the fall of 1987. Data are reported in table 11.

TABLE 9. Hard Red Winter Wheat Variety Trial - Pennington County(Wall), 1986-88.

<u>Variety</u>	<u>% Stand May 1988</u>	<u>Height (Inches)</u>	<u>Date of Heading</u>	<u>Percent Protein*</u>	<u>Test Wt. (Lbs/Bu)</u>	<u>Grain Yield-Bu/A 1988</u>	<u>(3 yr av)</u>
Siouxland	90	35	May 29	12.8	57.8	56.5	65.6
Quantum 542	89	34	May 29	12.1	58.5	54.6	---
Rodeo	90	34	May 29	14.0	59.5	53.7	---
Bennett	84	32	May 28	13.2	59.0	51.8	58.2
Thunderbird	88	33	May 28	12.9	58.0	51.5	57.6
Arapahoe	89	32	May 28	14.2	57.0	51.5	---
Abilene	86	28	May 27	12.8	59.5	50.6	---
Centura	84	34	May 28	13.3	57.3	49.5	58.5
Cody	84	33	May 30	13.2	56.3	49.2	---
Norkan	84	28	May 27	14.9	58.5	48.8	56.6
WR180001 XP	86	32	May 27	---	57.8	48.4	---
TAM 107	89	33	May 28	12.6	58.5	48.1	56.6
Bounty 205	79	32	May 28	13.3	56.5	48.1	55.5
Redland	82	31	May 28	13.6	55.3	48.0	---
Quantum 562	84	31	May 28	13.1	56.3	46.9	---
Quantum 568	79	31	May 29	---	55.8	46.8	---
Quantum XH696	85	33	May 28	12.8	56.0	46.7	---
Sage	80	31	May 28	12.2	58.0	45.5	56.2
Brule	79	34	May 29	13.9	56.3	44.9	59.7
SD 76598-7	85	33	May 30	14.4	56.0	44.9	56.3
Seward	88	33	May 31	13.7	55.0	44.9	---
Dodge	87	32	May 27	14.3	57.8	44.8	---
Centurk 78	81	32	May 28	13.6	57.3	44.5	57.2
Colt	83	30	May 28	12.3	56.8	44.1	59.4
Lancota	85	34	May 28	13.9	58.8	43.1	---
Scout 66	81	33	May 28	12.8	56.8	43.1	55.3
Bounty 301	80	32	May 27	13.6	57.8	42.7	52.5
Norwin	89	27	June 2	12.6	57.5	42.5	50.0
Agassiz	86	34	June 2	13.0	56.0	40.9	50.6
SD 82118	81	33	May 27	15.5	57.3	39.8	---
Dawn	83	31	May 28	13.9	56.5	39.6	53.5
Rose	86	33	May 31	14.7	56.3	39.2	54.1
SD 82102	86	33	May 27	12.9	54.8	39.1	55.2
Roughrider	89	39	June 1	12.6	57.8	38.5	51.2
SD 78207-4	83	34	May 29	14.6	67.0	38.4	---
SD 82144	81	33	May 28	15.0	67.5	34.5	---

LSD(.05) - 10.1 Bu/A

C.V. - 15.2%

Mean - 45.7

*Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Seeded September 10, 1987 and harvested July 5, 1988.

TABLE 10. Hard Red Winter Wheat Variety Trial - Perkins County(Bison), 1986-88.

Variety	% Stand May 1988	Height (Inches)	Date of Heading	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/A 1988 (3 yr av)	
SD 76598-7	82	23	June 2	16.8	55.0	22.3	34.1
Thunderbird	84	23	June 1	16.5	57.3	22.0	35.6
Quantum 568	80	23	June 1	15.6	53.8	21.8	--
Scout 66	83	24	June 1	16.0	55.3	19.5	35.4
Quantum XH696	87	22	June 2	17.7	53.0	19.3	--
Sage	85	24	May 31	--	54.8	19.0	33.7
Cody	78	21	June 1	16.0	52.0	18.8	--
TAM 107	79	21	May 31	16.2	53.0	18.5	31.7
Bennett	73	20	June 2	16.3	55.0	18.3	30.9
SD 82118	76	22	June 2	17.9	57.8	17.8	--
Quantum 542	82	23	June 2	16.4	53.3	17.5	--
Brule	78	22	May 31	15.5	54.5	17.0	35.0
SD 78207-4	83	22	June 4	17.3	54.8	16.8	--
Agassiz	81	25	June 5	16.3	54.0	16.8	31.0
Arapahoe	82	21	June 1	17.7	53.5	16.3	--
Rodeo	84	22	June 2	18.6	54.8	16.0	--
Siouxland	80	22	June 2	17.2	52.8	16.0	37.2
Dawn	80	21	June 1	16.5	55.3	15.5	33.1
Quantum 562	72	19	June 3	16.6	53.5	15.0	--
Lancota	77	23	June 1	17.3	53.3	15.0	--
Abilene	77	19	June 1	16.9	56.3	15.0	--
Colt	80	20	June 2	17.4	54.8	14.8	34.1
Dodge	81	19	May 31	16.5	53.8	14.3	--
Roughrider	64	23	June 5	18.7	54.5	14.2	31.0
Redland	78	22	June 1	16.0	52.8	14.0	--
Rose	78	21	June 5	17.5	54.3	14.0	34.3
Centura	79	22	June 2	18.5	53.3	14.0	32.2
Norkan	80	21	June 1	17.7	54.3	13.8	--
Seward	82	22	June 6	17.0	49.8	13.5	--
Centurk 78	76	21	June 3	16.0	53.8	14.0	34.3
Norwin	78	18	June 6	17.0	53.8	12.1	32.9
SD 82102	78	21	June 1	18.0	52.0	12.0	34.6
WH180001 XP	77	22	May 31	16.5	51.8	11.5	--
SD 82144	76	22	June 3	17.4	53.5	11.4	--
Bounty 205	82	22	June 1	17.7	51.8	11.5	26.7
Bounty 301	82	22	June 1	18.4	52.3	10.4	26.9
ISD(.05) - 6.2 Bu/A		C.V. - 27.1%		Mean - 15.8			

*Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Seeded September 14, 1987 and harvested July 14, 1988.

TABLE 11. Hard Red Winter Wheat Variety Trial - Stanley County (Hayes), 1988.

<u>Variety</u>	<u>Maturity</u>	<u>Percent Protein*</u>	<u>Test Wt. (Lbs/Bu)</u>	<u>Grain Yield Bushel/Acre</u>
Abilene	Med-Late	--	55.0	14.5
Siouxland	Early	15.8	48.3	13.6
Thunderbird	Medium	15.9	53.8	12.0
Quantum 562	—	16.0	47.5	11.1
Quantum 554	Medium	—	39.0	9.9
Sage	Early	16.1	46.8	9.8
Scout 66	Early	15.2	39.3	8.2
Centura	Early	16.4	51.0	8.2
Colt	Medium	16.7	48.3	8.2
Brule	Medium	15.8	50.3	7.5
Ram	Medium	17.8	37.5	7.3
Dawn	Medium	17.3	48.8	7.1
Lancota	Medium	17.9	49.3	6.9
Redland	Medium	15.5	47.3	6.2
Centurk 78	Medium	16.6	50.3	6.1
Rose	Med-Late	--	39.8	5.4
Agassiz	Med-Late	17.7	44.3	3.4
Seward	Med-Late	17.6	32.3	2.2
Norstar	Med-Late	18.7	43.3	2.0
Roughrider	Med-Late	17.7	37.0	1.3
LSD(.05) - 3.1 Bu/Acre		C.V. - 28.5%	Mean - 7.4	

*Percent protein determined with a Technicon 300 InfraAnalyzer.

Note: Plots were seeded September 8, 1987 and harvested on July 12, 1988.

Hard Red Spring Wheat

Plots were seeded at five locations in 1987. All trials were seeded on fallow with a six row plot seeder having eight inch row spacing. Seeded areas contain a minimum of 120 square feet per variety and a minimum of four replications.

Seeding rate was controlled by prepackaging all seed. Fertilizer requirements were predetermined by soil test. Harvesting was accomplished with a self-propelled plot combine. Machine harvested plots contained a minimum of 100 square feet per sample. Grain yields and other data are reported in Tables 12 through 21.

Bennett County

Spring wheat plots at Martin were seeded on April 12 in soil fallowed in 1987. Soil moisture was adequate for germination at time of seeding. Rainfall received during March and April was only half of normal. In May and June good showers were received at regular intervals. This pattern provided the moisture necessary for growth through June. Topsoil moisture was classed as short throughout the growing season. Air temperatures were above normal from March through June. The trial results are shown in Table 12.

Harding County

Spring wheat variety trials at Ralph were seeded in fallow soil on April 18. The area did not receive any useable precipitation during April but did receive good rainshowers during early May. Topsoil moisture was critically short during the entire growing season.

Air temperatures varied during late summer and early fall but were much above normal during November and December. Late winter temperatures were near normal but starting in March the temperatures increased until by the end of June the average was 11.7 degrees over the normal. The effect of limited moisture and excessive temperature during the growing season was few tillers, reduced grain yields, and high protein content. Weight per bushel varied with earlier maturing varieties having the higher weights. The trial data for Hard Spring Wheat are reported in Tables 13-14 and the data for Durum Wheat in Table 19.

Meade County (Bear Butte Valley)

The variety trial in Bear Butte Valley was seeded on April 6. The surface soil was mellow and moist. Wet snow had fallen in mid-March and all moisture had soaked into the soil. Further moisture was received in May and June but because of below normal precipitation during the previous year was not sufficient to meet the needs of the growing plants.

Air temperatures were above normal during late fall and early winter months. They were also above normal during the spring and increased with time until by June they were over 10 degrees above normal. The drought conditions resulted in grain with low weight per bushel and high protein content. The data for the Hard Red Spring Wheat trial are listed in Table 15.

Pennington County

Variety plots of spring wheat were seeded in fallow near Wall on April 13, 1988. The topsoil was cloddy with moisture at 3 inches. Soil moisture was adequate for germination and emergence. However, topsoil moisture was in short supply during all months except May. Useable rainfall moisture during the same period was only 3.70 inches.

Air temperatures were above normal during November and December. They were also above normal throughout the spring growing season. The droughty conditions resulted in low grain yields, low test weight, and high protein content. The results of the Hard Red Spring Wheat trial are presented in Table 16 and the Durum Trial results in Table 20.

TABLE 12. Hard Red Spring Wheat Variety Trial-Bennett County(Martin), 1986-88.

Variety	Height (Inches)	Date of Heading	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
SD 2980	33	June 18	17.8	50.8	19.5	36.1
2385	30	June 17	16.4	47.6	18.0	---
Prospect	29	June 18	17.5	44.9	17.0	34.7
2375 (X)	30	June 17	18.8	48.4	16.8	---
Shield	31	June 17	17.7	47.7	15.6	29.8
Challenger	28	June 18	17.2	46.8	15.2	31.1
SD 3005	34	June 17	18.3	49.9	14.2	---
Guard	28	June 18	17.8	48.2	14.0	31.8
SD 2999	32	June 17	18.2	46.8	14.0	---
SD 3000	31	June 20	16.8	45.2	13.2	---
Fjeld(HS84-873)	27	June 20	17.4	43.8	13.2	---
Butte 86	31	June 17	18.0	45.9	13.0	33.6
W2501	26	June 19	18.3	38.6	12.9	---
W2502	25	June 18	18.6	38.9	12.6	---
2369	28	June 19	18.6	46.9	12.5	27.6
Leo 747	26	June 17	17.3	45.4	12.4	28.5
SD 3010	29	June 19	17.0	48.6	12.3	---
Westbred 926 (X)	28	June 18	18.0	44.3	12.2	---
SD 3014	32	June 18	18.4	44.8	10.9	---
Nordic	26	June 21	17.2	44.2	10.7	31.3
Len	28	June 21	18.0	44.8	10.4	27.7
Wheaton	25	June 19	19.0	40.6	10.3	29.4
Stoa	29	June 21	18.3	44.1	10.3	33.1
Minnpro(MN81110)	26	June 19	19.6	41.0	10.2	---
Marshall	23	June 21	18.3	40.1	10.1	28.6
Celtic	28	June 19	17.9	45.4	9.6	28.6
Telemark	24	June 21	18.8	46.8	9.4	29.0
ND 626	30	June 19	18.5	42.8	8.6	---
Norseman	24	June 22	19.0	42.3	8.4	27.1
Leif	28	June 21	19.4	44.1	8.1	---
Chris	31	June 20	18.6	41.8	8.0	23.2
Angus	25	June 21	19.1	43.6	7.7	25.3
Amidon	31	June 21	18.3	43.4	7.6	---
Vance(MN82354)	27	June 21	18.0	42.0	7.4	---
Alex	28	June 21	19.7	44.2	6.9	24.6
Coteau	26	June 22	19.5	40.7	5.1	---
<hr/>						
LSD(.05) - 2.8 Bu/A		C.V. - 17.6%		Mean - 11.6		

*Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 12 and harvested July 21, 1988.

TABLE 13. Hard Red Spring Wheat Variety Trial - Harding County(Ralph), 1986-88.

Variety	Height (Inches)	Maturity (Days)*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
SD 2980	20	-2	17.5	58.7	19.5	25.1
Amidon	25	2	18.7	53.1	19.2	---
Stoa	22	3	18.0	56.3	19.1	27.3
SD 3000	22	0	18.1	53.0	18.8	---
SD 3014	20	0	16.8	55.0	18.3	---
Marshall	19	6	17.5	48.4	18.1	24.2
Butte 86	22	0	18.5	58.0	18.0	25.6
Nordic	21	4	16.2	53.9	17.6	24.5
Prospect	20	2	18.7	54.5	17.6	26.2
Guard	20	0	17.8	53.2	17.6	23.8
Len	20	3	20.1	55.0	16.2	24.4
W2501	18	4	17.4	48.4	15.9	---
Alex	22	4	19.3	52.7	15.8	25.6
Challenger	20	1	18.0	55.6	15.5	22.4
Vance(MN82354)	22	5	17.1	56.1	15.4	---
Leif	21	6	16.9	51.7	15.4	---
SD 3005	21	-4	18.9	55.3	15.3	---
Telemark	20	3	17.9	52.0	15.1	23.6
ND 626	20	0	18.6	54.1	15.0	---
2375 (X)	20	-1	19.4	54.3	14.9	---
Angus	22	3	18.7	52.1	14.6	23.0
Chris	22	3	17.8	54.6	14.6	20.2
Norseman	18	4	18.3	51.8	14.5	22.5
Minnpro(MN81110)	21	4	18.9	50.9	14.3	---
SD 2999	22	-3	17.8	51.3	14.2	---
W2502	20	4	17.8	50.6	14.1	---
2385	18	0	18.5	58.8	13.8	---
Wheaton	19	5	18.9	52.3	13.7	21.7
SD 3010	22	1	17.1	53.4	13.7	---
Celtic	21	4	17.4	53.4	13.6	24.4
2369	21	3	19.0	60.0	13.2	22.4
Shield	22	-2	18.2	53.9	13.1	24.0
Fjeld(HS84-873)	21	1	16.6	61.4	12.7	---
Coteau	21	6	18.2	48.6	12.7	---
Leo 747	20	-1	19.4	51.8	12.3	---
Westbred 926 (X)	18	1	19.0	48.1	10.3	---
LSD(05) - 3.0 Bu/A				C.V. -14.1%		Mean - 15.4

*Indicates relative maturity of varieties in days.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 18 and harvested August 25, 1988.

TABLE 14. Hard Red Spring Wheat Advanced Line Yield Trial - Harding County
(Ralph), 1986-88.

Variety	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
			1988	(3 yr av)
SD 3047	17.0	58.9	24.0	---
SD 3036	18.2	60.1	23.3	---
SD 3044	17.3	58.7	21.8	---
SD 3041	18.3	60.9	21.7	---
SD 3054	19.5	58.4	21.2	---
SD 3000	18.1	57.5	20.5	29.1
SD 3033	18.3	57.5	20.3	---
Stoa	17.7	57.8	19.8	27.6
SD 3014	16.7	58.7	19.8	24.6
SD 3038	18.6	57.2	19.4	---
SD 3055	18.5	60.3	19.2	---
ND 626	20.1	59.8	18.9	---
Len	18.6	57.8	18.8	23.6
SD 3052	19.5	60.3	18.8	---
SD 3026	18.6	55.6	18.8	---
SD 8061	18.0	60.3	18.7	---
Butte-86	18.3	57.2	18.5	24.1
Prospect	17.8	58.9	18.3	27.6
Shield	18.7	56.1	18.2	24.9
SD 3060	18.6	59.2	18.1	---
SD 3037	17.5	58.7	18.1	---
Vance (MN82354)	17.3	57.5	18.1	---
Marshall	17.6	54.4	17.6	25.3
SD 3056	20.3	60.3	17.5	---
SD 3049	18.0	58.7	17.5	---
SD 8063	18.6	58.4	17.4	---
SD 3059	18.0	57.8	17.4	---
SD 2999	17.0	56.7	17.4	25.2
SD 3032	21.2	59.2	17.4	---
SD 3053	19.5	58.1	17.3	---
SD 8064	19.4	58.7	17.1	---
SD 2980	17.8	61.2	16.9	24.5
SD 8066	18.7	57.5	16.8	---
SD 3058	18.7	53.0	16.7	---
SD 3061	19.0	58.4	16.3	---
SD 3057	19.1	60.9	16.3	---
Chris	19.8	54.1	16.2	21.6
SD 8062	16.8	55.8	16.2	---
Amidon	18.6	50.2	15.9	---
SD 3051	20.0	53.0	15.9	---
SD 8065	18.7	53.9	15.4	---
SD 3010	20.2	59.2	15.2	23.6
SD 3048	18.6	60.1	15.1	---
SD 3027	18.4	55.6	15.0	---
SD 8059	17.8	55.0	14.6	---
SD 3050	18.7	52.7	14.3	---
SD 3005	19.0	56.7	14.1	23.5
SD 8060	18.2	55.0	13.8	---
Guard	18.4	51.9	13.2	24.3
LSD(.05) - 5.0 Bu/A	C.V. - 16.2%	Mean - 17.7		

*Percent protein determined with a Technicon 300 InfraAnalyzer.
NOTE: Plots were seeded April 18 and harvested August 27, 1988.

TABLE 15. Hard Red Spring Wheat Variety Trial - Meade County(Bear Butte Valley), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
2385	21	0	17.3	46.2	7.8	—
Challenger	18	1	18.6	47.2	7.8	26.8
SD 2980	21	-2	18.9	47.9	7.7	31.1
SD 3005	21	-4	19.3	45.3	7.1	—
SD 2999	20	-3	18.9	43.3	6.6	—
W2502	18	4	18.2	41.0	6.0	—
W2501	17	4	19.3	37.7	5.8	—
Butte 86	20	0	19.1	39.9	5.2	26.0
SD 3010	20	1	18.7	42.6	5.0	—
Prospect	18	2	18.6	44.0	5.0	24.6
Guard	18	0	18.8	39.8	5.0	25.1
Fjeld(HS84-873)	18	1	19.2	42.7	5.0	—
SD 3014	20	0	19.0	41.7	4.8	—
Leo 747	18	-1	18.0	42.9	4.6	26.9
SD 3000	21	0	19.5	41.0	4.6	—
ND 626	20	0	19.6	40.7	4.4	—
Wheaton	19	5	20.2	39.8	4.4	24.7
2375 (X)	19	-1	19.5	36.1	4.2	—
Shield	18	-2	19.2	44.6	4.2	31.4
Minnpro(MN81110)	19	4	20.5	38.6	4.0	—
Stoa	20	3	19.6	42.0	4.0	25.9
Westbred 926(X)	19	1	18.1	37.2	3.8	—
Len	16	3	—	36.1	3.6	22.2
Amidon	19	2	19.4	41.4	3.5	—
Celtic	18	4	20.2	44.3	3.5	27.5
2369	18	3	19.8	34.8	3.4	26.1
Chris	19	3	19.8	40.6	2.9	21.0
Telemark	16	3	20.0	41.2	2.8	20.4
Marshall	16	6	19.2	39.5	2.8	22.5
Leif	18	6	21.7	30.2	2.5	—
Norseman	16	4	19.8	39.2	2.3	23.6
Vance(MN82354)	17	5	19.0	36.9	2.1	—
Nordic	14	4	19.4	36.4	2.0	28.9
Angus	17	3	19.5	38.7	1.7	22.5
Alex	18	4	20.0	34.1	1.3	11.4
Coteau	17	6	20.5	24.8	1.2	—
LSD(.05) - 1.4 Bu/A		C.V. - 24.5%		Mean - 4.2		

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent protein determined with Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 6 and harvested July 18, 1988.

TABLE 16. Hard Red Spring Wheat Variety Trial - Pennington Co.(Wall), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
SD 3005	29	-4	17.7	51.0	24.9	---
SD 2980	29	-2	17.9	51.6	24.2	29.6
SD 2999	27	-3	18.4	48.3	23.2	---
Butte 86	29	0	17.5	47.2	23.0	28.8
2385	27	0	18.2	49.8	22.6	---
Shield	28	-2	18.4	48.0	20.9	28.0
Prospect	26	2	19.1	46.4	20.8	24.1
2375 (X)	24	-1	19.5	50.8	20.8	---
Challenger	24	1	16.9	47.9	20.7	25.2
SD 3014	30	0	17.5	47.4	20.6	---
Guard	24	0	18.3	48.9	20.2	25.4
SD 3000	28	0	18.7	47.9	20.2	---
SD 3010	26	1	19.5	49.6	20.1	---
W2502	24	4	17.5	41.7	19.9	---
Wheaton	24	5	18.1	42.2	19.7	21.2
Stoa	28	3	17.5	46.9	19.4	24.7
Amidon	28	2	18.1	45.2	19.4	---
W2501	23	4	17.6	40.7	19.3	---
Leo 747	23	-1	18.5	46.4	19.1	25.5
Westbred 926 (X)	25	1	19.0	50.0	18.9	---
Fjeld(HS 84-873)	25	1	17.8	45.3	18.8	---
Marshall	22	6	18.1	43.2	18.5	22.3
ND 626	27	0	18.2	42.9	17.9	---
2369	25	3	19.3	48.9	16.8	21.3
Norseman	20	4	19.0	46.4	16.5	18.5
Minnpro(MN81110)	26	4	19.9	42.9	16.5	---
Celtic	26	4	17.8	47.9	16.2	21.4
Nordic	26	4	18.7	47.0	15.9	21.0
Vance(MN 82354)	27	5	19.7	47.1	15.9	---
Chris	25	3	18.1	44.6	15.3	18.8
Leif	24	6	18.5	45.7	14.6	---
Len	24	3	19.0	47.8	14.3	18.4
Alex	28	4	18.3	48.1	14.0	18.7
Telemark	22	3	18.4	42.3	11.9	19.0
Angus	24	3	18.4	44.8	11.9	18.9
Coteau	24	6	18.2	43.4	11.6	---
LSD(.05) - 4.3 Bu/A		C.V. - 16.8%		Mean - 18.5		

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 13 and harvested July 19, 1988.

Perkins County

Spring wheat variety trials were seeded near Bison on April 14. The soil was loose and dry at the surface. Heavy snow was received in mid-March and subsoil moisture was measured to 36 inches. Further rainfall during the spring was below normal with only 2.37 inches of useable moisture received.

Air temperatures were above normal for all months except October and February. The result of the droughty conditions were high protein content, low test weights and poor yields. The data for the Hard Red Spring Wheat are reported in Table 17 and for the Durum wheat in Table 21.

TABLE 17. Hard Red Spring Wheat Variety Trial - Perkins County(Bison), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
Guard	18	0	17.5	56.5	15.9	29.2
Prospect	19	2	17.2	57.2	14.7	27.8
Challenger	16	1	—	55.2	13.6	28.0
ND 626	22	0	18.9	56.0	13.3	—
SD 3014	20	0	19.0	54.8	13.2	—
2375 (X)	16	-1	20.0	56.3	13.1	—
2385	18	0	18.5	54.2	13.0	—
2369	19	3	18.8	56.8	12.7	25.1
Angus	20	3	19.4	55.4	12.5	20.0
SD 3000	20	0	18.2	52.1	12.4	—
Fjeld(HS84-873)	18	1	17.8	55.4	12.0	—
Shield	18	-2	18.0	52.4	11.9	27.5
Leo 747	19	-1	18.5	55.3	11.6	25.8
Len	18	3	20.1	55.9	11.2	21.4
W2501	17	4	18.7	53.0	11.0	—
SD 2980	17	-2	18.4	54.9	11.0	29.2
Telemark	17	3	19.7	53.9	10.4	23.2
Amidon	20	2	18.6	53.9	10.3	—
Norseman	16	4	19.2	53.6	9.3	23.1
Butte 86	16	0	18.8	53.0	9.2	28.2
Westbred 926 (X)	18	1	18.8	55.3	9.0	—
Chris	21	3	19.0	52.2	8.7	20.0
SD 2999	15	-3	19.3	52.0	8.5	—
SD 3005	16	-4	20.4	54.5	8.5	—
Leif	19	6	20.7	51.4	8.4	—
Wheaton	15	5	17.8	52.4	8.4	22.9
SD 3010	16	1	17.1	56.5	8.1	—
Minnpro(MN81110)	18	4	20.9	53.8	7.6	—
Stoa	17	3	19.7	54.1	7.2	22.6
W2502	12	4	18.9	54.4	6.7	—
Alex	18	4	20.1	53.6	6.6	21.4
Marshall	16	6	20.2	53.3	6.5	21.7
Nordic	16	4	19.6	51.8	6.6	19.8
Celtic	16	4	19.1	53.3	4.8	18.8
Coteau	16	6	20.8	52.4	4.3	—
Vance(MN82354)	13	5	18.8	52.4	4.0	—
LSD(.05) - 4.8 Bu/A		C.V. - 35.0%		Mean - 9.9		

*Indicates maturity based on 58 day interval between seeding and heading.
 **Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 14 and harvested July 26, 1988.

Durum Wheat

Durum wheat variety trials were seeded at four locations in 1988. The remarks and discussion pertinent to these trials were included in the Hard Red Spring Wheat section and can be found on pages 21, 22 and 26. The yields and other data are listed in Tables 18 through 21.

TABLE 18. Durum Wheat Variety Trial - Bennett County (Martin), 1988.

Variety	Height (Inches)	Relative Maturity*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield Bu/Acre
Monroe	30	-2	20.1	47.4	15.4
Rugby	30	1	18.9	47.2	13.5
Fjord	30	0	18.7	46.7	13.5
Ward	30	0	20.0	46.2	13.1
Vic	30	1	19.5	43.8	12.7
Crosby	31	-1	19.1	45.8	12.4
Stockholm	23	0	19.6	42.0	11.3
Laker	26	1	18.9	44.2	10.9
D81154	27	1	19.6	42.4	10.8
Renville	30	2	20.4	43.8	10.7
WPB 883-323	29	1	18.3	39.5	7.9
LSD(.05) - 2.5 Bu/A		C.V. - 14.8%		Mean - 12.0	

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 12 and harvested July 21, 1988.

TABLE 19. Durum Wheat Variety Trial - Harding County (Ralph), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre 1988	(3 yr av)
Ward	23	0	17.9	58.2	18.5	27.5
Renville	23	2	17.5	56.9	18.3	—
D81154	22	1	18.7	57.2	17.6	—
Rugby	22	1	17.2	59.2	17.4	27.7
Laker	22	1	17.2	58.4	16.6	25.8
Fjord	22	0	16.4	57.8	16.5	—
Monroe	22	-2	16.3	57.7	16.3	27.9
WPB 883-323	24	1	16.9	55.2	15.5	—
Crosby	22	-1	16.9	56.1	15.2	27.0
Vic	22	1	17.7	56.9	14.0	24.8
Stockholm	21	0	16.3	57.8	13.8	—
LSD(.05) - 4.5 Bu/A		C.V. - 19.3%		Mean - 16.3		

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 18 and harvested July 27, 1988.

TABLE 20. Durum Wheat Variety Trial - Pennington County (Wall), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
Monroe	31	-2	20.1	47.2	22.0	22.5
Rugby	30	1	19.9	48.6	18.4	20.3
Ward	31	0	19.7	49.2	17.7	19.9
DB1154	26	1	19.2	48.1	17.7	—
Crosby	30	-1	20.8	49.5	17.3	19.5
Fjord	30	0	19.3	49.1	16.3	—
Vic	31	1	20.0	47.3	16.1	18.6
WPB883-323	30	1	19.0	47.2	16.0	—
Renville	29	2	20.0	48.6	16.0	—
Stockholm	24	0	20.3	47.4	15.9	—
Laker	28	1	19.6	42.4	13.4	16.0
LSD(.05) - 2.9 Bu/A					C.V. - 11.8%	
					Mean - 17.0	

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 13 and harvested July 19, 1988.

TABLE 21. Durum Wheat Variety Trial - Perkins County (Bison), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
WPB 883-323	20	1	18.9	53.6	14.3	—
Rugby	20	1	19.9	55.1	11.4	22.1
Ward	19	0	19.3	54.3	11.1	20.8
DB1154	16	1	19.8	54.0	11.1	—
Monroe	18	-2	19.3	53.9	10.7	23.4
Vic	20	1	19.9	58.6	9.8	18.1
Renville	19	2	20.5	53.2	9.7	—
Fjord	20	0	19.7	54.4	9.5	—
Stockholm	18	0	19.4	53.8	9.4	—
Laker	21	1	19.1	52.4	8.6	16.4
Crosby	20	-1	20.0	53.0	8.4	21.0
LSD(.05) - 2.3 Bu/A					C.V. - 15.9%	
					Mean - 10.4	

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 14 and harvested July 26, 1988.

Winter Triticale

Plots were seeded at two locations in 1987. All trials were seeded in fallowed soil with a six row plot seeder having a ten inch row spacing. Seeding rate was controlled by prepackaging all seed. Fertilizer requirements were predetermined by soil test. Harvesting was accomplished with a self-propelled plot combine. Grain yields and other data are reported in Tables 22 and 23.

TABLE 22. Winter Triticale Variety Trial - Harding County (Ralph), 1988.

Variety	Percent Stand*	Day of Heading**	Height (Inches)	Test Wt. (Lbs/Bu)	Grain Yield (Lbs/Acre)
Jenkins	93	156	35	54.0	2424
Il8+249	88	154	34	52.5	1488
LSD(05) - 547 lbs/A.		C.V. -12.5%		Mean - 1956	

*Stand based on visual observation in May 1988.

**Indicates days from January 1 to day of heading.

NOTE: Plots were seeded September 15, 1987 and harvested July 15, 1988.

TABLE 23. Winter Triticale Variety Trial - Perkins County (Bison), 1988.

Variety	Percent Stand*	Day of Heading**	Height (Inches)	Test Wt. (Lbs/Bu)	Grain Yield (Lbs/Acre)
Jenkins	78	156	34	51.0	1152
Il8+249	81	154	31	50.5	1022
LSD(.05) - 130 lbs/A.		C.V. -5.3%		Mean - 1087	

*Stand based on visual observation in May 1988.

**Indicates days from January 1 to day of heading.

NOTE: Plots were seeded September 14, 1987 and harvested July 14, 1988.

Winter triticale varieties had yields somewhat higher than adjacent winter wheat varieties. Winter survival was equal to the most winter hardy wheats. Weights per bushel were above the standard 48 pounds. The conditions under which the tests were conducted are discussed under the hard red winter wheat trials. The present varieties have an inherent shrivelled kernel which is best utilized as a grain feed for swine or poultry.

Spring Triticale

Plots were seeded at four locations in 1988. All trials were seeded in fallow soil a six row plot seeder having an eight inch row spacing. Seeding rate was controlled by prepackaging all seed. Fertilizer requirements were predetermined by soil test. Harvesting was accomplished with a self-propelled plot combine. Grain yields and other data are reported in Tables 24 through 27.

TABLE 24. Spring Triticale Variety Trial - Bennett County (Martin), 1988.

Variety	Height (Inches)	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield (Lbs/Acre)
Karl	28	16.6	42.0	1205
Trical Victoria	34	16.5	41.0	1061
Kramer	32	17.1	42.7	1056
Grace	33	18.6	37.7	950
Marval	33	17.4	36.0	782
LSD(05) - 187 lbs/A.		C.V. -12.6%		Mean - 1013

*Percent protein was determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 18 and harvested July 27, 1988.

TABLE 25. Spring Triticales Variety Trial - Harding County (Ralph), 1986-88.

Variety	Height (Inches)	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Lbs/Acre	
				1988	(3 yr av)
Grace	26	15.7	43.6	1238	---
Trical Victoria	25	15.5	45.5	922	---
Marval	24	15.3	41.5	869	1515
Kramer	23	16.4	41.8	547	1350
Karl	20	17.0	40.5	523	1384
LSD(05) - 326 lbs/A.		C.V. -26.7%		Mean - 821	

*Percent protein was determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 18 and harvested July 27, 1988.

TABLE 26. Spring Triticales Variety Trial - Pennington County (Wall), 1986-88.

Variety	Height (Inches)	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Lbs/Acre	
				1988	(3 yr av)
Trical Victoria	34	15.7	46.1	1800	---
Karl	32	16.2	45.2	1632	1450
Grace	32	16.3	43.8	1483	---
Kramer	35	16.1	43.0	1454	1479
Marval	38	16.7	38.8	989	1149
LSD(05) - 298 Lbs/Acre		C.V. - 13.8%		Mean - 1469	

*Percent protein was determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 13 and harvested July 19, 1988.

TABLE 27. Spring Triticale Variety Trial - Perkins County (Bison), 1986-88.

Variety	Height (Inches)	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Lbs/Acre	
				1988	(3 yr av)
Trical Victoria	23	16.4	47.9	797	---
Grace	22	17.9	47.3	763	---
Marval	22	17.3	42.4	533	1102
Kramer	20	17.8	44.8	302	1055
Karl	19	17.7	44.6	240	1098
LSD(05) - 106 Lbs/A		C.V. - 13.5%		Mean - 528	

*Percent protein was determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 14 and harvested July 26, 1988.

Spring triticale varieties had yields somewhat higher than adjacent spring wheat varieties. The weights per bushel were low due to drought stress prior to maturity. However, at Bison the plants were smaller and produced less grain but it was of better quality. The conditions under which the trials were conducted are discussed under the hard red spring wheat trials. The present varieties have an inherent shrivelled kernel which has a standard weight of 48 pounds per bushel. It is best utilized as a grain feed for swine or poultry.

Oat Variety Trials

Oat variety trials were conducted on a cooperative basis at four locations in 1988. Seeding dates ranged from April 6 to April 18. All trials were seeded on fallow with a six row plot seeder having an eight inch row spacing. Seeding rates were controlled by prepackaging all seed. Fertilizer requirements were predetermined by soil test. Harvesting was accomplished with a self-propelled plot combine. Grain yields and other data are reported in Tables 28 through 31.

Bennett County

Oat variety plots at Martin were seeded on April 12 into fallowed soil. Soil moisture at seeding time was adequate for germination and emergence. Precipitation during the spring was only half of normal. Topsoil moisture was classed as short throughout the growing season. Air temperatures were above normal from March through June. Although moisture was short and temperatures were above normal, grain yields were high. Weights per bushel were higher for the earlier maturing varieties and lower for the later maturing varieties. The data are listed in Table 28.

Meade County

The Meade County trial in Bear Butte Valley was seeded into fallow soil on April 6. Soil moisture was sufficient for germination and emergence. Wet snow had fallen in mid-March and all moisture had soaked into the soil. Further moisture was received in May and June, but because of below normal precipitation the previous year, was not sufficient to meet the needs of the growing plants.

Air temperatures were above normal during late fall and early winter months. They were also above normal during the spring and increased with time until by June they were over 10 degrees above normal. The drought conditions resulted in grain with low weight per bushel. Trial data are reported in Table 29.

Pennington County

The oat variety trial near Wall was seeded into fallow soil on April 12, 1988. The topsoil was cloddy with moisture at 3 inches. Soil moisture was adequate for germination and emergence. However, topsoil moisture was short during all months except May. Useable rainfall moisture during the same period was only 3.70 inches.

Air temperatures were above normal during November and December. They were also above normal throughout the spring growing season. The droughty conditions resulted in low grain yields, low test weight, and high protein content. The results of the trial are listed in Table 30.

Perkins County

Oat varieties in Perkins County were seeded near Bison on April 14. The soil had been recently tilled and was in a good state of tilth. Heavy snow had been received in mid-March and subsoil moisture was present to a depth of 36 inches. Further rainfall during the spring was below normal with only 2.37 inches of useable moisture received during the April-July growing season.

Air temperatures were above normal for all months except October and February. The result of the droughty conditions were high protein, low test weights and poor yields. The data for the trial can be found in Table 31.

TABLE 28. Oat Variety Trial - Bennett County (Martin), 1986-88.

Variety	Height (Inches)	Date of Heading	Percent Oil*	Percent Protein*	Test Wt (Lbs/Bu)	Grain Yield-Bu/Acre	
						1988	(3 yr av)
Hazel	30	June 17	7.4	22.1	27.8	75.4	98.8
SD 820045	34	June 19	5.5	24.3	28.1	73.5	95.7
Don	29	June 16	6.6	20.8	29.5	72.8	99.3
Ogle	30	June 18	5.5	21.3	26.6	72.1	91.8
WI X4872-2	33	June 18	6.4	22.9	26.0	72.0	—
SD 840104	32	June 21	5.4	24.1	25.5	67.1	—
Hamilton	30	June 16	5.7	22.5	24.6	66.5	—
Nodaway 70	34	June 16	5.2	22.7	27.9	65.4	80.4
Webster	30	June 16	6.2	22.8	24.8	63.8	84.1
Porter	31	June 22	6.7	24.2	23.6	60.7	101.5
ND 810104	31	June 21	5.5	22.9	23.4	60.4	—
SD 830095	32	June 18	7.4	26.6	25.9	60.2	—
Kelly	34	June 16	6.1	24.4	28.6	58.8	81.7
Starter	32	June 18	6.1	24.7	27.6	58.1	85.2
Otee	34	June 17	6.5	26.4	26.2	57.9	78.5
Valley	28	June 21	5.7	23.5	24.8	57.8	—
Benson	34	June 20	5.6	23.9	23.1	56.8	86.4
Lancer	32	June 17	5.9	23.5	24.2	56.6	84.3
Burnett	33	June 17	5.0	23.8	24.8	54.6	85.3
Preston	32	June 17	7.5	26.0	25.4	53.6	73.9
Wright	34	June 21	7.0	25.3	24.2	52.8	83.3
Hyttest	35	June 20	6.0	23.6	28.8	52.8	80.5
Proat	33	June 22	6.6	26.1	23.7	52.3	84.3
Otana	32	June 22	5.3	23.2	23.8	52.2	—
Monida	30	June 22	6.3	23.4	23.0	49.2	99.2
Steele	34	June 21	5.7	26.4	21.8	48.8	85.6
Moore	34	June 21	7.0	25.9	24.0	47.5	84.0
SD 830188	35	June 20	6.3	25.2	22.9	43.4	—
Trucker	34	June 21	6.5	25.2	24.8	42.8	79.5
Sandy	34	June 21	5.7	23.6	19.5	41.4	82.7
Lyon	34	June 21	6.1	27.1	18.8	36.1	71.4

LSD(.05) - 8.0 Bu/A

C.V. - 10.0%

Mean - 57.5

*Percent oil and protein determined on oat groats with a Technicon 300 Infra-analyzer.

NOTE: Plots were seeded April 12 and harvested July 21, 1988.

TABLE 29. Oat Variety Trial - Meade County(Bear Butte Valley), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
				1988	(3 yr av)
Hazel	24	2	25.9	25.0	72.0
Don	23	3	28.4	24.6	72.7
Starter	24	1	28.4	19.4	69.9
Hamilton	23	1	22.1	18.9	—
Webster	24	0	22.8	18.7	69.4
Nodaway 70	26	1	27.5	16.9	68.0
SD 830095	24	3	25.0	16.4	—
Otee	25	3	24.6	16.3	68.2
Ogle	24	3	21.6	15.9	73.7
WI X4872-2	23	4	22.1	15.9	—
Burnett	26	3	23.6	14.3	57.9
Benson	28	5	22.7	14.2	60.1
Lancer	24	3	21.7	14.1	64.8
Kelly	25	0	25.1	13.6	61.4
SD 820045	24	5	24.8	11.6	64.9
Trucker	28	5	22.8	11.3	58.6
Wright	27	6	17.1	10.9	59.8
Otana	28	5	16.1	10.3	—
Hytest	29	3	22.4	10.0	56.8
Valley	24	8	16.8	9.4	—
SD 840104	24	8	15.0	9.3	—
Lyon	29	6	16.8	8.7	56.5
Preston	25	0	20.4	8.6	53.9
Porter	25	9	15.9	8.6	58.2
SD 830188	25	3	19.4	8.4	—
ND 810104	25	5	14.9	8.3	—
Monida	24	4	15.7	8.2	62.0
Steele	26	7	16.1	8.1	55.4
Moore	27	7	14.0	7.1	59.5
Sandy	28	7	12.7	6.5	52.2
Proat	28	6	12.6	5.2	51.4
LSD(.05) - 3.9 Bu/Acre			C.V. - 22.0%		Mean - 12.7

*Indicates maturity based on 58 day Interval between seeding and heading.

NOTE: Plots were seeded April 6 and harvested July 22, 1988.

TABLE 30. Oat Variety Trial - Pennington County (Wall), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Percent oil**	Percent Protein**	Test Wt (Lbs/Bu)	Grain Yield-Bu/Acre	
						1988	(3 yr av)
Hazel	28	2	7.1	22.8	27.6	57.1	75.0
Don	27	3	6.6	22.2	28.3	57.1	74.6
Starter	29	1	6.1	24.1	29.1	56.5	71.0
SD 820045	31	5	5.1	25.9	24.2	56.1	76.0
Monida	28	4	5.9	21.8	23.0	55.4	84.6
SD 840104	32	8	5.2	24.2	21.4	54.9	—
Hamilton	28	1	5.5	22.7	23.0	53.0	—
Nodaway 70	33	1	5.1	22.8	28.6	52.6	67.0
Kelly	32	0	5.8	24.4	27.4	52.5	65.5
WI X4872-2	29	4	6.2	23.2	21.5	51.4	—
Webster	28	0	6.3	23.8	25.0	50.7	69.6
Lancer	29	3	5.8	24.6	24.8	50.5	71.6
Ogle	28	3	5.5	23.7	22.8	50.1	75.9
Valley	28	8	5.6	23.8	24.0	50.0	—
Trucker	32	5	5.9	25.1	26.4	49.7	69.8
Burnett	32	3	5.0	23.4	22.1	49.3	75.9
SD 830095	29	3	7.5	24.7	24.5	47.5	—
Otee	31	3	6.1	26.6	22.6	47.1	62.3
Hytest	32	3	5.7	23.1	26.2	45.1	71.2
Otana	30	5	4.8	23.2	21.8	43.9	—
Benson	29	5	5.8	23.2	17.5	42.4	70.2
Porter	29	9	6.4	25.0	22.2	42.2	78.0
Wright	33	6	6.6	26.7	23.0	41.8	69.3
Proat	32	6	6.3	25.7	23.6	41.4	71.9
Preston	29	0	7.0	27.1	22.9	40.5	64.0
Moore	31	7	6.6	25.0	20.0	38.7	68.1
Lyon	34	6	6.1	25.7	19.0	37.5	65.6
ND 810104	28	5	5.3	22.9	18.5	37.3	—
Steele	30	7	5.7	24.7	20.2	36.5	67.7
SD 830188	33	3	6.2	24.3	20.5	33.3	—
Sandy	32	7	5.5	24.7	16.0	31.3	64.3
<hr/>							
LSD(.05) - 9.9 Bu/A			C.V. - 15.0%		Mean - 46.9		

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent oil and protein determined on oat groats with a Technicon 300 Infraanalyzer.

NOTE: Plots were seeded April 13 and harvested July 19, 1988.

TABLE 31. Oat Variety Trial - Perkins County (Bison), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Percent Oil**	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre 1988	(3 yr av)
SD 840104	19	8	5.7	25.5	20.3	33.6	—
Otana	21	5	5.8	24.3	19.8	30.0	—
Valley	20	8	5.5	22.1	23.2	27.7	—
Monida	19	4	5.8	22.7	21.4	26.1	70.3
ND 810104	21	5	5.5	22.0	23.6	23.5	—
Lyon	24	6	7.0	24.2	26.7	23.4	58.9
Otee	21	3	6.5	26.0	31.1	23.3	52.3
Webster	19	0	6.3	23.2	23.8	23.3	66.1
Lancer	21	3	5.9	24.7	29.5	22.6	57.7
Porter	19	9	6.2	25.7	25.9	22.6	62.3
Burnett	20	3	5.0	25.0	27.4	22.5	60.0
SD 830095	20	3	7.3	24.6	26.3	22.0	—
Steele	19	7	6.2	24.3	19.5	20.3	57.1
Preston	21	0	7.2	26.0	26.3	20.2	54.3
Trucker	22	6	6.5	22.8	23.8	19.9	59.4
Wright	21	6	6.7	25.9	22.4	19.8	55.2
Hamilton	19	1	5.6	22.0	20.6	19.4	—
WI X4872-2	20	4	6.4	22.3	23.8	18.9	—
Moore	20	7	6.9	24.7	24.3	18.2	59.7
Sandy	20	7	5.7	25.0	16.4	18.1	57.1
Starter	18	1	6.0	24.4	34.9	18.1	63.0
Hyttest	23	3	5.8	24.0	30.3	17.8	54.4
Kelly	20	0	5.8	25.8	26.0	17.6	52.7
SD 820045	21	5	5.4	22.8	22.8	17.6	55.6
Hazel	15	2	6.6	24.0	19.8	17.2	57.6
Don	18	3	6.4	21.8	24.0	17.1	57.1
Ogle	18	3	5.8	22.2	30.1	16.3	63.1
Benson	20	5	5.5	24.9	21.1	15.3	54.1
SD 830188	21	3	6.5	27.4	33.1	14.9	—
Nodaway 70	19	1	5.4	22.9	29.5	12.7	52.2
Proat	20	6		26.1	15.9	12.0	55.9
LSD(.05) - 11.8 Bu/A		C.V. - 41.4%		Mean - 20.4			

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent oil & protein determined on oat groats with a Technicon 300 Infra-Analyzer.

NOTE: Plots were seeded April 14 and harvested July 26, 1988.

Spring Barley Trials

Spring barley variety trials were conducted on a cooperative basis at five locations in 1988. Soil moisture was adequate for germination and emergence at all sites. Seeding was accomplished with a six row plot seeder having an eight inch row spacing. Rate of seeding was controlled by prepackaging all seed. Fertilizer requirements were predetermined by soil test. The dates of seeding ranged from April 6 to April 18. Harvesting was completed with a self-propelled plot combine between July 15 and July 25. Trial data are reported in Tables 31 through 35.

Bennett County

The spring barley variety trial at Martin was seeded on April 12 into fallowed soil. Soil moisture was satisfactory at seeding. Precipitation during the growing season was below normal with topsoil moisture classed as short, except from early May through June.

Air temperatures were above normal from March through June. The residual soil moisture and intermittent showers were sufficient, despite the above normal temperatures, to produce a fair yield of grain. The low weights per bushel appear to have resulted from excessive heat more than from moisture shortage. Trial data are presented in Table 31.

TABLE 31. Spring Barley Variety Trial - Bennett County (Martin), 1986-88.

Variety	Height (Inches)	Date of Heading	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
Bowman	31	June 17	14.7	43.1	53.6	73.9
Glenn	32	June 18	15.3	32.4	50.5	64.5
Hazen	30	June 19	17.1	34.5	49.1	68.5
Gallatin	29	June 19	16.5	40.8	48.1	---
ND 8671	32	June 19	16.8	40.4	47.1	---
Primus II	31	June 16	15.1	36.8	47.0	59.5
SD 71-672	31	June 16	16.1	44.2	44.8	---
ND 7691	29	June 18	16.1	41.2	41.9	---
Azure	33	June 19	15.9	34.8	41.7	63.4
B1603	30	June 18	16.2	33.8	41.5	---
Robust	30	June 18	16.0	37.6	40.9	61.6
B1602	31	June 19	16.9	32.6	39.4	---
Morex	31	June 18	16.2	32.9	35.5	58.8
LSD(.05) - 8.1 Bu/A C.V. - 12.7% Mean - 44.7						

*Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 12 and harvested July 21, 1988.

Harding County

Experimental plots containing 13 varieties of spring barley were seeded near Ralph on April 18. Soil moisture was adequate for germination and emergence. Precipitation during April was very limited and only slightly above normal in May. Rainshowers, in June, of 5.04 inches were 1.56 inches above normal. However, The pattern in which the rain fell did not provide a continuous supply of water for the plants.

Air temperatures were above normal from November through July. They ranged from 7.2 degrees above normal in November, to near normal in February, to 11.7 degrees above normal in June. Weight per bushel was near the normal of 48 pounds. However, grain yield was only 40% of the previous 2 year average. The trial results are reported in Table 32.

TABLE 32. Spring Barley Variety Trial - Harding County (Ralph), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
Gallatin	18	5	15.4	49.0	39.7	—
Bowman	19	1	14.9	48.9	38.0	48.3
ND 8671	19	—	15.7	48.0	33.4	—
B1602	19	—	13.5	46.7	30.7	—
ND 7691	17	—	15.5	46.7	30.6	—
B1603	17	—	15.5	44.3	29.8	—
Morex	18	1	15.3	44.3	29.3	42.2
Glenn	19	0	15.8	44.5	28.3	37.6
Robust	18	3	15.1	46.9	28.0	41.8
Primus II	18	0	15.1	47.4	28.0	36.8
Hazen	18	2	15.3	47.6	27.5	42.4
Azure	19	3	14.3	44.5	26.1	29.6
LSD(.05) - 3.6 Bu/A		C.V. - 8.2%		Mean - 30.8		

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 18 and harvested July 25, 1988.

Meade County (Bear Butte Valley)

Spring barley varieties were seeded in Bear Butte Valley on April 6. The seed-bed was in good condition as a result of recent snow melt and tillage. Precipitation received in March, May, and June were the only months when appreciable moisture was received. With the exception of March 1987 the area has received subnormal precipitation since November 1986. The lack of moisture and high temperatures resulted in extremely low grain yields and poor test weights. The trial data are reported in Table 33.

TABLE 33. Spring Barley Variety Trial - Meade County(Bear Butte Valley), 1986-88

Variety	Height (Inches)	Relative Maturity*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
Bowman	20	1	16.8	38.7	14.7	49.3
Primus II	19	0	--	38.8	9.4	46.3
Glenn	19	0	16.9	32.8	7.3	40.0
Bl603	19	-	17.5	36.7	5.9	--
Robust	18	3	16.8	36.1	5.5	41.6
Morex	21	1	--	39.2	5.2	37.5
Gallatin	20	5	18.7	30.5	5.2	--
SD 71-672	18	-	16.6	40.0	5.2	--
Bl602	19	-	15.4	36.1	3.4	--
Azure	19	3	16.5	33.7	3.3	39.1
Hazen	18	2	16.1	39.1	3.1	42.2
ND 7691	19	-	17.4	33.8	3.1	--
ND 8671	22	-	17.5	32.7	2.4	--

LSD(.05) - 3.3 Bu/A

C.V. - 40.8%

Mean - 5.7

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 6 and harvested July 18, 1988.

Pennington County

Spring barley was seeded near Wall on April 13 into fallowed soil. The top-soil was cloddy with moisture available at 3 inches. There was sufficient moisture available for germination and emergence. Additional precipitation was received in May. Topsoil moisture was short during most of the spring season. The droughty conditions resulted in high protein, low test weights, and reduced grain yields. The trial data are reported in Table 34.

TABLE 34. Spring Barley Variety Trial - Pennington County (Wall), 1986-88.

Variety	Height (Inches)	Date of Heading	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
Bowman	25	June 19	--	41.2	44.2	57.3
Gallatin	26	June 19	16.5	37.6	35.9	--
Primus II	27	June 16	16.6	39.3	35.1	47.3
ND 8671	26	June 19	18.0	37.9	33.4	--
Bl603	24	June 18	17.2	34.0	31.5	--
SD 71-672	26	June 18	16.6	40.0	31.5	--
Robust	25	June 18	17.3	32.7	31.4	46.6
Bl602	27	June 18	15.5	32.3	30.2	--
Glenn	24	June 18	17.8	29.6	30.1	43.7
Hazen	27	June 18	16.4	30.9	29.1	50.8
ND 7691	23	June 19	16.9	38.2	27.7	--
Morex	26	June 18	16.1	34.3	26.8	41.5
Azure	25	June 18	16.4	32.6	26.2	48.4

LSD(05) - 7.7 Bu/A

C.V. - 17.2%

Mean - 31.7

*Percent protein determined with a Technicon 300 InfraAnalyzer

NOTE: Plots were seeded April 13 and harvested July 19, 1988.

Perkins County

Spring barley plots in Perkins county were seeded on April 14. The soil had been fallowed in 1987. It contained adequate topsoil moisture for germination and emergence. Subsoil moisture was measured to a depth of thirty six inches. Snowfall in March and rain in May provided moisture to compensate for below normal precipitation during April, June, and July. Topsoil moisture was short from May through July. Yield and other data are reported in Table 35.

TABLE 35. Spring Barley Variety Trial - Perkins County (Bison), 1986-88.

Variety	Height (Inches)	Relative Maturity*	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre	
					1988	(3 yr av)
Gallatin	20	5	17.5	45.7	27.7	--
ND 8671	20	--	15.5	41.3	23.9	--
Bowman	17	1	15.2	46.7	23.7	48.3
ND 7691	18	--	15.9	44.9	21.6	--
Primus II	15	0	14.3	47.7	21.3	36.8
Robust	17	3	15.3	43.1	20.6	41.8
B1602	19	--	14.7	42.9	20.3	--
Morex	20	1	15.6	41.9	20.1	42.2
Azure	18	3	15.6	42.6	20.1	29.6
Hazen	18	2	15.2	42.4	19.8	42.4
B1603	17	--	15.8	42.2	19.5	--
Glenn	18	0	15.3	41.8	18.8	37.6
SD 71672	16	--	17.1	42.3	17.8	--
LSD(.05) - 4.1 Bu/A		C.V. - 13.6%		Mean - 21.2		

*Indicates maturity based on 58 day interval between seeding and heading.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 14 and harvested July 15, 1988.

Winter Barley

Objective: To observe and compare growth characteristics, grain quality, and grain yield of varieties and composites of winter barley.

Fourteen entries of winter barley were seeded in fallow on September 10, 1987. The entries consisted of five varieties from Nebraska, eight composites from South Dakota, and one unadapted variety of unknown origin. Each composite was composed of plants which were selected for deep setting crowns. Crown depth is associated with winter survival because those genotypes with naturally buried crowns most frequently survive winter conditions.

At seeding time the surface soil was dry and cloddy, but contained sufficient subsurface moisture for germination and emergence. Rainfall was below normal from September through January, but was above normal in March and May. Air temperatures, which were below normal from August through October, were above normal during the Spring. The yield data are presented in Table 27.

during the year averaged near normal although it was limited during the months of April, June, and July. Air temperatures were above normal for all months except March. The barley entries varied in their ability to survive the winter. Grain yields were greatly reduced because of severe winterkill. The yield data are presented in Table 36.

Table 36. Winter Barley Variety Trial - Pennington County (Wall), 1984-88.

Variety	% Stand	Height	Test Wt.	Grain Yield-Bu/A	
	May 1988	(Inches)	(Lbs/Bu)	1988	(4 yr av)
Kearney	78	33	48.5	66.7	52.1
Composite 142	89	32	45.3	63.8	54.9
Dundy	74	24	46.5	61.2	56.6
Composite 10	65	32	44.3	58.0	52.8
Hitchcock	81	28	47.3	56.2	—
Composite 129	77	32	45.5	55.6	55.6
Herb	70	30	43.8	53.2	56.8
Composite 250	73	33	44.0	49.4	38.3
Composite 295	71	29	44.8	48.9	46.4
Composite 307	64	30	44.3	45.8	42.4
Composite 223	74	30	45.0	47.8	32.8
Nebar	55	28	44.8	42.0	44.1
Composite 308	58	28	43.3	37.6	33.0
Sprinter	41	19	38.3	23.1	—
<hr/>					
LSD(.05) - 9.8 Bu/A		C.V. - 12.7%		Mean - 50.7	

NOTE: Plots were seeded September 10, 1987 and harvested July 5, 1988.

SORGHUM VARIETY TESTING

Grain Sorghum

Objective: To compare the performance of grain sorghum hybrids and varieties for yield and other agronomic characteristics.

A grain sorghum variety trial was seeded in Pennington County on June 3, 1988. Included were commercial varieties which varied in maturity from short-season to medium season.

Fifty nine grain sorghum hybrids were seeded near Wall in eastern Pennington county on June 3. Plant populations were established at 3.6 plants per square foot. Stands were good and plants were healthy. The area received heavy showers in early July. The stored subsoil moisture from the previous fallow year plus the moisture received in July resulted in excellent yields of good quality grain. The plants did not exhibit moisture stress at any time. Harvest was completed on October 20. The results of the trial are listed in Table 40.

Table 40. Grain Sorghum Hybrid Variety Trial - Pennington County(Wall), 1988.

Brand and Variety	Height	Heading	Maturity	Test Weight	Grain Yield-Bu/A	
	(Inches)	(1-5)	(1-5)	(Lbs/Bu)	1988	(2 yr av)
Dekalb X-638	36	3.8	1.0	57.3	102.0	—
Northrup King 1410	34	4.3	1.0	58.8	96.3	—
Seedtec ST3101	36	3.3	1.0	57.0	93.3	51.6
Dekalb DK-18	36	2.5	1.0	58.3	92.3	77.4
Dekalb X-828	32	2.8	1.0	58.0	87.0	—
McCurdy M450	34	3.3	1.0	59.5	86.8	75.4
Dekalb P-818	33	2.5	1.0	57.5	85.3	—
McCurdy M410	31	3.0	1.0	57.0	84.5	82.2
Pioneer 8790	34	3.0	1.0	58.3	84.3	—
Asgrow XP257	33	3.5	1.0	59.3	84.0	—
Cargill 630	32	3.8	1.3	58.5	83.5	—
Seedtec W5203	35	3.0	1.0	59.8	82.5	85.0
Interstate 856	32	3.0	1.0	58.8	82.0	—
Seedtec 652G	35	3.5	1.0	59.5	81.8	—
Sigco 1070	34	3.0	1.0	58.5	81.5	81.8
Cargill X77001	34	3.5	1.0	59.5	81.3	—
Garst 5517	33	4.0	1.0	59.8	80.8	90.6
Garst R5681	35	3.3	1.0	59.0	80.8	—
NC+ Hybrid 155	30	3.5	1.0	59.3	80.5	—
Contiseed Hasty	37	3.5	1.0	58.8	80.5	—
Cargill 1022	31	3.8	1.0	58.5	80.0	64.2
Sigco X1061	31	3.0	1.0	58.5	79.5	—
Seedtec ST3103	36	3.5	1.0	58.0	79.0	—
NC+ Hybrid 55X	33	3.5	1.0	59.3	78.3	83.8
Interstate 665	34	3.3	1.0	56.3	78.0	83.4
Contiseed Pronto	34	4.5	1.3	57.5	77.8	—
Warner W-523T	33	2.8	1.0	59.3	77.3	76.6
Seedtec ST3308	37	4.5	1.0	57.0	77.3	—
Dahlgren DG-27B	35	3.5	1.0	59.0	77.0	—
Garst 5613	36	4.5	1.0	57.0	76.8	—
Pioneer 8791	31	3.3	1.0	58.0	76.3	—
AgriPro AP925G	32	3.3	1.0	57.5	76.0	—
Interstate 663	31	3.0	1.0	59.3	75.8	75.4
Asgrow XP3137	32	3.8	1.0	58.0	74.3	—
Dekalb DK-28	32	2.8	1.0	58.0	73.5	71.4
AgriPro AP910G	33	2.8	1.0	56.0	73.5	55.5
Asgrow XP4147	30	4.3	1.0	60.0	73.0	—
Warner WX88103	30	3.3	1.0	57.8	72.8	—
Dahlgren DG-33B	35	4.0	1.0	57.5	72.8	—
Warner W-545T	31	3.3	1.0	59.8	72.3	71.6

(Continued on following page)

Table 40 (Continuation). Grain Sorghum Hybrid Variety Trial

Brand and Variety	Height (Inches)	Heading (1-5)	Maturity (1-5)	Test Weight (Lbs/Bu)	Grain Yield-Bu/A	
					1988	(2 yr av)
Cargill 3385	31	4.3	1.0	57.0	71.8	50.6
Cargill 2285	30	3.3	1.0	59.3	71.3	71.4
Pioneer 8855	33	3.5	1.0	59.3	70.5	67.2
AgriPro AP940G	33	3.5	1.0	59.3	70.5	—
Contiseed 8105	31	3.5	1.0	59.3	69.3	—
Pioneer 894	30	3.5	1.0	58.3	69.3	65.1
Warner WX88101	30	3.0	1.0	58.5	69.0	—
Garst 5715	31	5.0	1.3	56.0	67.5	—
Dekalb DK39Y	32	3.5	1.0	57.3	67.3	—
Contiseed 8201	33	3.8	1.0	59.0	66.3	—
Cargill 22	30	3.3	1.0	59.8	65.3	62.2
Warner WX88102	29	3.5	1.0	57.8	64.3	—
Warner WX881044	31	3.3	1.0	58.5	62.0	—
Pioneer 8728	33	3.8	1.0	58.3	60.3	—
Cargill 40	33	4.8	1.8	53.3	60.0	53.4
Seedtec ST3258	35	5.3	1.5	54.0	55.5	—
McCurdy M689	32	4.8	2.3	55.5	53.8	—
Interstate 668	30	3.8	1.0	57.8	48.8	59.0
Contiseed Silverado	36	5.0	2.8	46.5	22.0	—

LSD(.05) - 17.8 Bu/A

C.V. - 16.4%

Mean - 74.9

Note: Plots were seeded June 3, 1988 and harvested October 20, 1988.

MANAGEMENT, TILLAGE, AND CULTURAL PRACTICES

Rate of Seeding-Spring Triticales Harding County (Ralph), 1988

Objective: Evaluate the Effects of Rate of Seeding of Triticales on Grain Yield, Grain Quality, and other Agronomic Characteristics in Relation to Hard Red Spring Wheat.

Three cultivars and 2 lines of spring grown triticales were seeded at rates ranging from the equivalent of five to ten pecks of spring wheat per acre. Five varieties of spring wheat were also seeded as checks at the rate of five pecks or seventy five pounds per acre. All seeding rates are based on a standard count of twenty eight seeds per square foot.

TABLE 43. Effect of Rate of Seeding on the Yield, Weight per Bushel, and Plant Height of Triticales - Harding County (Ralph), 1988.

<u>Cultivar</u>	<u>Rate of Seeding</u>	<u>Percent Protein*</u>	<u>Test Weight (Lbs/Bu)</u>	<u>Grain Yield (Bu/Acre)**</u>
Marval	150#/A	15.3	45.1	22.9
Marval	100#/A	15.4	40.9	18.6
Marshall (HRS)	75#/A	19.5	53.6	16.4
M-82	75#/A	15.8	43.4	15.5
Era (HRS)	75#/A	17.9	52.5	15.2
Marval	125#/A	15.6	45.4	14.6
Kramer	75#/A	16.8	44.6	14.2
James (HRS)	75#/A	18.5	53.3	13.8
BL-53	75#/A	15.6	46.8	13.6
Marval	75#/A	17.0	44.3	13.3
Guard (HRS)	75#/A	18.2	54.4	13.0
Kramer	125#/A	16.7	46.5	12.5
Stoa (HRS)	75#/A	18.4	55.3	12.2
Kramer	150#/A	17.3	44.3	11.7
Karl	75#/A	17.7	46.8	11.5
Kramer	100#/A	18.2	45.4	9.9
Butte (HRS)	75#/A	18.0	54.7	9.0
Karl	150#/A	16.5	45.1	8.2
Karl	125#/A	16.7	45.7	7.0
Karl	100#/A	17.4	44.6	5.7
LSD(.05) - 3.6 Bu/A		C.V. - 29.6%	Mean - 12.9	

*Percent protein determined with a Technicon 300 InfraAnalyzer.

**Yield was calculated on standard bushel weight: Wheat - 60#, Triticales - 48#.

NOTE: Plots were seeded April 18 and harvested July 27, 1988.

The yield data indicate certain cultivars reach a top yield level at a lower seeding rate than other cultivars. The cultivar Marval will produce more grain at 75#/A seeding rate as the cultivar Kramer at 125#/A seeding rate. The cultivar Marval, which reaches a yield plateau at a seeding rate of 100#/A will not produce a larger yield until the seeding rate is increased by another 50% or raised to a rate of 150#/A.

Winter Wheat Fertilizer Demonstration

Objective: Evaluate the effect of starter fertilizer on winter survival, plant height, grain quality, and yield of hard red winter wheat.

Introduction: The use of fertilizer to increase and stabilize production by maintaining soil nutrient level, has been practiced since the beginning of plant cultivation. The method, time, and rate of application, as well as the source of nutrients have each been studied. The present studies were initiated to determine the effect of starter fertilizer on winter survival, the effect on yield as a result of winter survival, and the effect on grain quality.

Procedure: Five sites representing major areas of winter wheat production in western South Dakota were selected. These sites were in conjunction with area winter wheat variety trials. The treatments consisted of the application of liquid or granular fertilizer with the seed at time of seeding. Application rates were restricted to prevent damage to germinating and emerging seedlings.

Seeding was completed between 10-15 September 1987. Seeding rate at 60 pounds per acre was controlled by prepackaging the seed. The plot areas contained 100 square feet and were harvested with a self-propelled plot combine.

Bennett County

The variety Rose was seeded in fallow soil at Martin on September 11, 1987. The granular fertilizer, specified in Table 44, was applied with the seed. Additional nitrogen fertilizer was applied as a liquid with a herbicide at a later date. The total fertilizer applied raised the amount of nutrient in the soil to a level sufficient for the wheat to produce a grain yield of 49 bushels per acre. The experiment contained four replications.

TABLE 44. Starter Fertilizer Demonstration with Hard Red Winter Wheat - Bennett County (Martin), 1988.

<u>Treatment</u>	<u>Percent Stand*</u>	<u>Height (Inches)</u>	<u>Percent Protein**</u>	<u>Test Weight (Lbs/Bu)</u>	<u>Grain Yield (Bu/Acre)</u>
0- 0- 0	93	39	14.7	59.5	59.8
20- 0- 0	93	38	15.7	59.0	60.3
20- 0-10	92	39	15.2	59.8	58.3
0-20-10	93	39	15.7	58.5	57.8
20-20-10	92	38	15.7	58.8	57.8
LSD(.05) - 3.6 Bu/A			C.V. - 4.0%		Mean - 58.8

*Percent stand determined by visual observation on May 17, 1988.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded on September 11, 1987 and harvested July 8, 1988.

(Table 44 Continued)

Soil Analysis Data:

Nutrient	Pounds per Acre		
	Nitrogen	Phosphorus	Potash
In Soil	70	86	1650
Pounds Added	25*	0**	0
Required for 49 Bu Yield	118	40	275

*Add 20 pounds of nitrogen for those plots receiving nitrogen fertilizer.

**Add 20 pounds of phosphorus for those plots receiving phosphorus fertilizer.

Results: Total rainfall for the year was near normal. However, precipitation was sporadic and topsoil moisture was classed as short during all months except May. Although moisture was limited, it was sufficient to produce wheat yields of 59 bushels per acre in adjacent wheat plots. The yields received in this experiment were slightly higher than the yield of Rose in the adjacent variety trial. Due to the mild winter there were no difference in winter survival. All measurement differences were negligible except the reduction in yield due to the addition of phosphorus fertilizer. The results are listed in Table 44.

Harding County

The hard red winter wheat variety Rose was seeded in fallow soil at Ralph on September 15, 1987. The experiment contained four replications. The starter fertilizer was applied with the seed as granules at the rates indicated in Table 45. Additional nitrogen fertilizer was applied as a liquid topdressing at a later date. Soil moisture was good at the surface and was available to a depth of 36 inches at the time of seeding. Emergence was fair for an average stand of 76%.

TABLE 45. Starter Fertilizer Demonstration with Hard Red Winter Wheat - Harding County (Ralph), 1988.

Treatment	Percent Stand*	Date of Heading	Height Inches	Percent Protein**	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
0- 0- 0	78	June 8	19	17.8	52.0	6.6
20- 0- 0	73	June 8	17	18.1	49.5	6.4
20- 0-10	68	June 6	18	16.8	53.4	5.4
0-20-10	83	June 5	19	16.2	55.2	10.6
20-20-10	78	June 5	20	17.0	54.5	10.3

LSD(05) - 2.6 Bu/A

Mean - 7.9

*Percent stand determined by visual observation on May 16, 1988.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded on September 15, 1987 and harvested July 15, 1988.

(Table 45 Continued)
Soil Analysis Data:

Nutrient	Pounds per Acre		
	Nitrogen	Phosphorus	Potash
In Soil	30	32	810
Pounds Added	25*	0**	0
Required for 37 Bu Yield	89	40	275

*Add 20 pounds of nitrogen for those plots receiving nitrogen fertilizer.

**Add 20 pounds of phosphorus for those plots receiving phosphorus fertilizer.

Results: Total annual rainfall was near normal. However, it was received as showers to small to do much good, or heavy rainstorms which ran off. The top-soil moisture was short or critically short during the growing season. The stand estimates averaged ten percent less for the fertilizer study than for the adjacent variety trial. That difference was due to slope, wind effect, and moisture availability. Within the experiment the higher plant populations were found in plots which had received phosphorus. The addition of phosphorus also hastened maturity, increased test weight, and produced higher yields. The data are reported in Table 45.

Meade County

The hard red winter wheat variety Rose was seeded in fallow soil at Bear Butte on September 9, 1987. The experiment consisted of four replications. The fertilizer was applied with the seed as liquid at a rate of 10 pounds of nitrogen plus 34 pounds of phosphorus per acre. Additional nitrogen fertilizer was applied as a topdressing at a later date. The nutrients added plus that available in the soil was sufficient to produce a wheat grain yield of 60 bushels per acre.

TABLE 46. Starter Fertilizer Demonstration with Hard Red Winter Wheat - Meade County (Bear Butte Valley), 1986, 1988.

Treatment	Percent Stand*	Date of Heading	Height (Inches)	Percent Protein**	Test Weight (Lbs/Bu)	Grain Yield-Bu/A 1988	(2 yr av)
0- 0-0	88	June 3	25	17.4	40.0	10.4	24.6
12-41-0	90	June 1	25	17.2	41.2	12.8	25.6
LSD(.05) - 1.7 Bu/A			C.V. - 9.3%		Mean - 11.5		

*Percent stand determined by visual observation on May 12, 1988.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded September 9, 1987 and harvested July 6, 1988.

(Table 46 Continued)
Soil Analysis Data:

Nutrient	Pounds per Acre		
	Nitrogen	Phosphorus	Potash
In Soil	80	64	860
Pounds Added	35	34	0
Required for 60 Bu Yield	144	40	300

Results: Soil nutrient levels at this site were insufficient to produce the anticipated yield goal under normal moisture conditions. However, total annual rainfall, near normal for the year, was below normal for all months except August, March, and May. Useable rainfall for the period of April through July was five inches. Average air temperatures during the spring growing season ranged from 1.5 to 10.3 degrees above normal. The combination of high temperature and limited precipitation resulted in topsoil moisture being critically short during most of the season. The low test weights are indicative of drought stress resulting in early maturity. The low yields were the result of fewer tillers, shorter heads, and less kernels developed. The advantages of the fertilizer under the adverse conditions were better winter survival, earlier maturity, higher test weight and better grain yield. Data are reported in Table 46.

Pennington County

The hard red winter wheat variety Rose was seeded in fallow soil near Wall in eastern Pennington county on September 10, 1987. The experiment consisted of four replications each of fertilized and unfertilized plots. The fertilizer was applied as a liquid with the seed at a rate of 12 pounds of nitrogen plus 41 pounds of phosphorus per acre. Additional nitrogen fertilizer was applied as topdressing at a later date. The total fertilizer applied raised the amount of nutrient in the soil near the level required by the wheat to produce a grain yield of 45 bushel per acre.

TABLE 47. Starter Fertilizer Demonstration with Hard Red Winter Wheat - Pennington County(Wall), 1986-88.

Treatment	Percent Stand*	Height (Inches)	Percent Protein**	Test Weight (Lbs/Bu)	Grain Yield-Bu/A	
					1988	(3 yr av)
0- 0-0	90	34	15.7	54.0	32.6	37.9
12-41-0	94	36	15.4	54.9	44.2	54.1

*Percent stand determined visually on May 31, 1988.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded September 10, 1987 and harvested July 5, 1988.

(Table 47 Continued)

Soil Analysis Data:

Nutrient	Pounds per Acre		
	Nitrogen	Phosphorus	Potash
In Soil	75	50	780
Pounds Added	35	34	0
Required for 60 Bu/A Yield	144	40	300

Results: The site of this experiment had soil moisture to a depth of 30 inches at time of seeding. Precipitation was limited during the winter months but the area received heavy snow during March. The Climatological station reported 17 inches of snow on the ground on March 11. Additional heavy showers were received in early May and again three weeks later. The timely moisture resulted in yields higher than anticipated. The useable precipitation during the period April through July was only 3.70 inches. The results of this experiment indicated that adequate nutrients together with adequate soil moisture will increase yields under very adverse conditions. In 1988 the increase was over 30%. There was also a slight increase in test weight. The data are reported in Table 47.

Perkins County

The hard red winter wheat variety Rose was seeded in fallow soil at Bison on September 14, 1987. The experiment consisted of four replications each of fertilized and unfertilized plots. The fertilizer was applied with the seed as a liquid at a rate of 12 pounds of nitrogen plus 41 pounds of phosphorus per acre. Additional nitrogen fertilizer was applied as a topdressing at a later date. The total fertilizer applied raised the amount of nutrient in the soil to the level required by the wheat to produce a grain yield of 35 bushels per acre.

TABLE 48. Starter Fertilizer Demonstration with Hard Red Winter Wheat - Perkins County(Bison), 1988.

Treatment	Percent Stand*	Height (Inches)	Percent Protein**	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
0- 0-0	82	22	17.0	56.9	18.7
12-41-0	81	22	17.9	57.2	21.5
LSD(.05) - 3.5 Bu/A		C.V. - 11.0%			Mean - 20.1

*Percent stand determined visually on May 16, 1988.

**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded September 14, 1987 and harvested July 14, 1988.

(Table 48 Continued)
Soil Analysis Data:

<u>Nutrient</u>	<u>Pounds per Acre</u>		
	<u>Nitrogen</u>	<u>Phosphorus</u>	<u>Potash</u>
In Soil	47	42	1000
Pounds Added	27	41	0
Required for 52 Bu/A Yield	125	40	300

Results: Soil nutrient levels at this site were sufficient to produce an anticipated yield goal of 35 bushels of wheat per acre. Rainfall from August 1987 until August 1988 was over 6 inches below normal. The total useable moisture during the same period was only 4 inches. Useable spring moisture, April through July, was 2.37 inches. With very limited moisture the unfertilized wheat was able to produce over 18 bushels of grain per acre. The application of the starter fertilizer resulted in a yield increase per acre of 2.8 bushels of grain. There was an additional benefit from a slight increase in test weight. Data are reported in Table 48.

Summary: The use of starter fertilizer generally resulted in better winter survival. The increase in survival was associated with the addition of phosphorus which favors root growth. Larger root masses would permit more water intake resulting in less plant dehydration and eventual death. Increase in yield was also associated with phosphorus application. The difference in yield of unfertilized and fertilized was greater where more moisture was available.

Test weights were increased by application of starter fertilizer. The increase appears to have been an effect of earlier maturity. Protein content was slightly lower and is an inverse relationship to weight per bushel. The earlier maturation resulted in plumper kernels and higher test weight. Plumper kernels have higher starch content and lower protein content.

ECOFALLOW ROTATION STUDY
(Stanley County)

Ojective: To determine the cost of producing a bushel of winter wheat, barley, oats, and grain sorghum under 5 reduced tillage rotational systems.

Experimental Design: The study was designed as a Randomized Complete Block, with four replications. The rotations include five cropping sequences which vary from two to five years per cycle. Plot size was 24 ft x 75 ft. The study will terminate after the fifth cropping year.

Rotations:

A: Winter Wheat - Summer Fallow.

A combination of herbicides and tillage are to be used to manage the crop residue so that a 30% ground cover will be maintained after planting of the winter wheat crop.

b: Winter Wheat - Spring Barley.

A continuous cropping rotation in which winter wheat and spring barley are alternated. The crops are planted with limited tillage. Non-residual herbicides are used to control weeds and volunteer crop growth.

C: Winter Wheat - Grain Sorghum - Grain Sorghum - Spring Barley.

A continuous cropping system designed to maintain residue cover. It includes two years of row crop. The crop residues will be destroyed by disking prior to seeding of Spring Barley.

D: Winter Wheat - Grain Sorghum - Oats - Winter Wheat - Fallow.

The longest and most complex rotation. It includes a winter annual cereal, a spring cereal, a row crop, and fallow.

E: Winter Wheat - Grain Sorghum - Fallow.

The classic or standard Ecofallow rotation which has shown significant yield increases over conventionally planted grain sorghum in past research. The winter wheat yields in past Ecofallow research plots have been similar to those obtained in a winter wheat fallow rotation.

Discussion: The first cropping season for this study was 1987. It is located on the Sivage Farm at the junction of highways US 14 and SD 34. The study has a duration of five years and is funded by the South Dakota Wheat Commission. It is supported by the SDSU Experiment Station, SDSU Extension Service, Stanley County Crop Improvement Association, E.I. du Pont de Nemours & Co., and Monsanto Agricultural Company.

The crop yields expressed in Table 49 are second year rotation yields, and represent the effects of previous cropping as well as below normal precipitation beginning in June 1987. The field produced a winter wheat yield of 50 bushel per acre in 1986. Future yields will reflect the influence of the rotational systems.

TABLE 49. Grain Yields from the Second Season of the Reduced Tillage Ecofallow Study - Stanley County(Hayes), 1988.

Rot:	Crop	Yield*	Crop	Yield*	Crop	Yield*	Crop	Yield*	Crop
A:	W.Wheat	- 6.8	Fallow						
B:	W.Wheat	- 1.7	Sp. Barley	- 0.8					
C:	W.Wheat	- 1.0	Sp. Barley	- 2.6	G.Sorghum	- 18.5	G.Sorghum	- 1.4	
D:	W.Wheat	- 7.0	G.Sorghum	- 28.5	Oats	- 0	W.Wheat	- 0	Fallow
E:	W.Wheat	- 6.6	G.Sorghum	- 29.5	Fallow				

*Grain yield is reported in bushels per acre

Discussion: The growing season of 1988 was dry and complicated by a heavy infestation of Wheat Streak Mosaic virus disease. It was so dry in April and May that winter wheat did not develop a secondary root system with which to get additional moisture for the plants. The extremely low small grain yields were a result of the poor growing season. The highest yield for grain sorghum was harvested where the sorghum followed winter wheat. Lower yields were harvested where sorghum followed Spring barley and sorghum followed sorghum.

No-Till Grain Sorghum Variety Demonstration

A grain sorghum variety demonstration was seeded near Draper in Jones county on June 1, 1988. The varieties were seeded in 30 inches rows with a Buffalo Till planter. a liquid starter fertilizer (8-20-0) was applied with the seed. Weeds and other volunteer plants were controlled by an application of Atrazine (1#/A) and Paraquat (2 pints/A) in April. Lasso was applied as a postplant-pre-emerge treatment at time of seeding. Harvesting was completed on October 4, 1988. The data are reported in Table 50.

Table 50. Grain Yield of No-Till Seeded Grain Sorghum Variety Demonstration Jones county(Draper), 1988.

Brand & Variety	Percent Moisture at Harvest	Test Weight (Lbs/Bu)	Grain Yield (Bushel/Acre)
Pioneer 894 (Ck 1)	21.0	55	29.9
Dekalb DK28	29.5	54	40.1
Jacques 8832	22.8	55	53.5
Pioneer 894 (Ck 2)	21.0	55	30.6
Sigco X-1061	24.0	56	34.6
Pioneer 8945	24.5	56	33.3
Pioneer 894 (Ck 3)	20.5	56	31.9
Pioneer 8790	21.9	56	15.0
Cargill X77002	25.4	54	31.9
Pioneer 894 (Ck 4)	24.5	55	33.3
Jacques 8830	24.3	54	17.9
Funks G-251	29.7	50	22.6
McCurdy 410	34.3	54	26.7
Jacques 111	30.0	54	18.6
Pioneer 894 (Ck 6)	23.3	55	26.0
Cargill 22	31.5	54	20.5
SeedTec WS-203	31.5	53	44.3
Pioneer 894 (Ck 7)	23.5	55	28.3
NK 1210	31.0	54	27.2
Pioneer 8855	30.5	53	13.7
Pioneer 8791	22.0	55	36.2
AgriPro 916	24.0	56	39.4
			Mean - 29.8

NOTE: Table sequence is the same as the field sequence.

No-Till Stand Establishment of Alfalfa and Grasses

In the semi-arid climates of western South Dakota the establishment of alfalfa and grasses is difficult. Producers may make several seeding attempts before obtaining a satisfactory stand. The use of nurse crops, such as oats or other small grains, provide shade for the seedling alfalfa and grasses but tends to compete for available moisture. The results of using oats as a nurse crop in many cases has been less than satisfactory. Planting alfalfa alone or with the use of soil incorporated herbicides generally does not leave adequate residue on the soil surface to protect against wind erosion or provide any shade for the small alfalfa seedling. The use of non-residual herbicides to control weeds in standing small grain stubble provides a dead nurse crop. The standing dead stubble provides wind erosion protection and shade while not using soil moisture. The concept is new with limited amounts of research information available. The concept needed to be researched in western South Dakota where the need for plant available moisture is critical during the establishment period for alfalfa and grasses.

Research: During 1984 and 1985, research experiments using No-till establishment of alfalfa were conducted. The 1984 treatment methods of stand establishments were quite successful (Table 50). Both Paraquat and Roundup herbicides were effective in controlling volunteer winter wheat and broadleaf weeds. The only treatment that did not appear to be successful was applying the alfalfa seed to the surface without the use of a drill. After stand counts were made in July grasshoppers seriously damaged the alfalfa. The plants had grown to a height of approximately eight inches before grasshopper damage occurred.

The spring of 1985 was very dry. No rain fell during April, and May had very limited precipitation. The 1985 No-till seeding attempt was unsuccessful. The alfalfa seed in the dry soil did not germinate until August.

In 1986 No-till plots of alfalfa and grasses were established near Rapid City. The spring of 1986 was very wet and spraying of herbicides was delayed (Table 51) until April 21. Plots were seeded to Intermediate Wheatgrass and Alfalfa using a press drill with disc openers on April 25, 1986. The plots had alternating six inch spaced rows of wheatgrass and alfalfa. Post planting spraying was accomplished on April 29, 1986. The weed growth on April 29 were Pennycress-2 leaf to 8 inches tall, Tansy Mustard-3 to 8 inches tall, and volunteer winter wheat-6 inches tall. The weeds were growing rapidly because of early season rains. The residue from the previous year, 30 plus bushel per acre winter wheat crop, was standing undisturbed at the time of seeding. There was no problem with the residue plugging the disc press drill. The evaluation of weed control and stands were made visually on May 21, 1986.

The Roundup, Landmaster, and tillage controlled weeds and volunteer winter wheat very effectively. The Paraquat did not control the volunteer winter wheat and the regrowth had competitive effect on the alfalfa and wheatgrass (Table 51). Stand counts were made in July 1986 and yield samples were taken August 4-5, 1986. The yield samples were separated into four major components (alfalfa, wheatgrass, volunteer wheat and weeds). The yields at 12.5% moisture are expressed in Table 52. The alfalfa and wheatgrass components were reduced when volunteer winter wheat and weeds were not controlled. The plots that received cultivation prior to planting had excellent stands as well as the Roundup treated plots.

The 1986 plots were maintained through 1987 and were again sampled for yield. The yields of alfalfa and wheatgrass were higher in plots that had better control of volunteer winter wheat and weeds the first season (Table 53).

In April 1987, two experiments were established. The soil was very dry at seeding time, and there was limited moisture at planting depth. Ten days after seeding the site received 1\3 inch of rain. The experiments evaluated herbicides as replacements for tillage in the establishment of an alfalfa and crested wheatgrass mixture, and in a planting of cool and warm season grasses. The alfalfa and crested wheatgrass were drilled in alternately spaced six inch rows into tilled and untilled winter wheat stubble. The alfalfa germinated and established a satisfactory stand by mid-May. The crested wheatgrass had limited germination and there were not enough plants to evaluate the stand by mid-May. All plots were mowed in late May to control larger weeds. The experiment in planting cool and warm season grasses used Western wheatgrass and Sideoats grama planted in alternately spaced six inch rows. No early summer germination was detected for either grass. By mid-summer, limited numbers of sideoats grama plants appeared to be established. The seedlings were not large enough to evaluate in 1987 so evaluation was delayed until 1988 to determine if there were stand differences due to methods of establishment.

In 1988, another nearly identical trial was established in stubble from the 1987 winter wheat crop. This trial, in Meade county, on the Jim Madsen farm, 10 miles Northeast of New Underwood, also confirmed that no-till establishment of grass and alfalfa has genuine potential.

Crested wheatgrass plus alfalfa were used in 1/2 of a fifty foot long plot, and Western wheatgrass plus Sideoats grama were used in the other 1/2 of the plot. All 4 species appeared to be well established (Table 54), but accidental overspraying with Landmaster killed small seedlings. Late germinating sideoats grama escaped most of the damage. The plots will be inspected in 1989 to determine if there are any treatment differences. Production and stand sampling is anticipated for 1989.

TABLE 50. No-Till Alfalfa Establishment in Stubble - Meade County(Elm Springs) 1984.

Seeder	Double Disc		Plants/square foot	
	Hoes	Incorporation	Roundup	Paraquat
John Deere-Double Disc	In		27	34
John Deere-Double Disc	Out	Rotary Hoe	35	31
John Deere-Double Disc	Out		35	37
Whirly Bird		Rotary Hoe	35	29
Whirly Bird			22	27

NOTE: Date of Seeding - May 30, 1984, Stand counts were made on July 2-3, 1984

TABLE 51. Summary of Weed Control and Stand Establishment for No-Till Alfalfa and Grass Study - Pennington County (Spring Creek Area), 1986.

Herbicide Treatment	Rate of Product (Oz/A)	Percent Weed Control*		Percent Stand**	
		Tansy-Mustard	Volunteer HRW Wheat	Alfalfa	Grass
<u>Preplant</u>					
Roundup	8	99	99	99	100
Roundup	12	99	97	86	65
Landmaster	40	99	99	54	79
Paraquat	16	83	45	81	71
Paraquat	24	86	53	100	72
Cultivated	Check	99	86	53	62
Uncultivated	check	0	0	45	26
<u>Post Plant</u>					
Roundup	8	92	97	87	69
Roundup	12	99	97	84	58
Landmaster	40	99	99	70	33
Paraquat	16	75	25	75	68
Paraquat	24	79	50	76	63
Least Significant Difference @ 5%		4	11		
Coefficient of Variability (%)		4	11		

*Weed Control estimates were made on May 21, 1986.

**Notes are based on top yielding plot=100%. Notes taken on May 21, June 16-17, and July 1, 1986.

TABLE 52. Summary of Production: No-Till Alfalfa and Grass Seeding Study - Pennington County(Spring Creek), 1986.

Herbicide Treatment	Rate of Product (Oz/A)	Pounds per Acre				Alfalfa and Grass
		Alfalfa*	Grass	Volunteer HRW Wheat	Weeds	
<u>PrePlant</u>						
Roundup	8	1078	197	0	1121	1275
Roundup	12	1145	209	0	1123	1354
Landmaster	40	1041	168	0	1551	1209
Paraquat	16	413	68	1809	668	481
Paraquat	24	496	79	2147	724	575
Cultivated	Check	1034	354	702	581	1388
Uncultivated	Check	214	123	547	607	337
<u>Post Plant</u>						
Roundup	8	700	72	36	1415	772
Roundup	12	995	215	15	840	1210
Landmaster	40	719	58	490	1208	777
Paraquat	16	143	13	4626	320	156
Paraquat	24	351	154	2241	430	505
LSD(.05)		464	168	1073	719	535
C.V. (%)		4.6	8.2	7.1	5.6	4.4

*Plots were harvested on August 4-5, 1986.

TABLE 53. Summary of Production: No-Till Alfalfa and Grass Seeding Study - Pennington County(Spring Creek), 1987.

Herbicide Treatment	Rate of Product (Oz/A)	Pounds per Acre				
		Alfalfa*	Grass	Volunteer HRW Wheat	Weeds	Alfalfa and Grass
<u>Preplant</u>						
Roundup	8	1360	3464	284	262	4824
Roundup	16	1301	4707	577	257	6008
Landmaster	40	815	3019	1472	193	3834
Paraquat	16	502	2133	1133	324	2635
Paraquat	24	903	2920	1060	550	3823
Cultivated	Check	680	3188	1178	283	3868
Uncultivated	Check	530	2837	1571	791	3367
<u>Post Plant</u>						
Roundup	8	1226	4261	337	272	5487
Roundup	16	1042	4411	761	477	5453
Landmaster	40	905	3975	472	334	4880
Paraquat	16	959	4251	671	80	5210
Paraquat	24	1063	3633	1425	457	4696
LSD(.05) - Lbs/Acre		529	1859	1148	—	—
C.V. - (%)		39	36	87	—	—

*Plots were harvested on June 24-29, 1987.

Summary: It would appear that spring no-till establishment of alfalfa and cool season grasses is somewhat variable. Herbicides improve the chance of success but there are no guarantees. In 1985, because of extreme drought, the alfalfa stand was not satisfactory. During 1984, 1986, and 1987, when volunteer winter wheat, downy brome grass, and other winter annual weeds were controlled, the no-till stand establishment of alfalfa was excellent. The no-till establishment of cool season grasses is very moisture dependent. More research into no-till establishment of cool and warm season grasses is needed to determine best planting times and methods of seeding. South Dakota producers have tried the no-till springtime method of alfalfa and grass establishment. In general, it has worked well when 12 fluid ounces of Roundup, a wetting agent, and Ammonium Sulphate(2% by weight) have been applied in a 5 gallon per acre spray solution prior to planting. The volunteer wheat or downy brome grass must be actively growing and completely out of winter dormancy. Herbicides are generally most effective when applied after April 15. A word of caution to producers considering the no-till option. Insects, particularly grasshoppers, are also favored by no-till. A producer in the Rapid City area lost a no-till planting to grasshoppers when the alfalfa plants were less than 3 inches tall.

Table 54. Summary of Stand: No-Till Alfalfa, Introduced, and Native Grasses. Pennington County (New Underwood), Seeded - 14 April 1987.

Treatment	Percent Stand		Comment
	All Replications		
<u>Alfalfa/Crested wheatgrass</u>			
	<u>Alfalfa</u>	<u>Grass</u>	
Roundup - 8 oz., Preseeding	91	64	Uniform
Roundup - 12 oz., Preseeding	90	75	Uniform
Roundup - 8 oz., Postseeding	91	68	Uniform
Roundup - 12 oz., Postseeding	84	62	Variable
Touchdown - 16 oz., Postseeding	92	61	F. Uniform
Cultivated - No Herbicide	87	65	Variable
Direct Drill - No Herbicide	60	22	Variable

Western wheatgrass/Side-oats grama

		All Replications		Rep IV only***	
		W.Wht*	SGr**	W.Wht*	SGr*
Roundup	- 12 oz., Postseeding	15	25	5	60
Roundup	- 12 oz., Postseeding (plus mowing)	14	30	25	65
Roundup	- 12 oz., Postseeding	11	29	10	50
Glean	1/4 oz., Postseeding				
Roundup	- 12 oz., Postseeding	24	30	30	35
Ally	1/10 oz., Postseeding				
Roundup	- 12 oz., Postseeding	25	30	35	25
Glean	1/3 oz., Postseeding				
Cultivated	- No-Herbicide	14	17	30	15
Direct Drill	- No Herbicide	9	30	10	65

* Western wheatgrass

** Side-oats Grama

*** Rep. IV exhibited significant difference from the other replications.

Weed Control in Dormant Alfalfa

Objective: To evaluate the use of Roundup herbicide for the control of winter annual weeds in dormant alfalfa.

The first treatment of herbicide was applied on April 2, 1988. The alfalfa was just starting to show new leaves down in the crown, and the intermediate wheatgrass had 1 to 3 leaves of new growth. The pennycress was in the cotyledon or rosette stage of growth and downy brome grass had 1 to 3 leaves of new growth. The spring had been very warm and dry. All treatments had ammonium sulphate added to the spray mixture at the rate of 2% by weight and .25% X-77 wetting agent.

The second treatment of herbicide was applied on April 18, 1988. The air temperature was 65 degrees and the soil temperature was 58 degrees. The alfalfa had 3 to 5 inches of growth and was fully out of dormancy. The weather was still dry with the top soil remaining dry.

Table 55. Effects of Herbicide Application to Dormant Alfalfa. 1988.

Application Date					
April 2, 1988			April 18, 1988		
Herbicide	Rate Oz/A	Alfalfa Hgt in inches	Herbicide	Rate Oz/A	Alfalfa Hg in inches
Roundup	8	14.75	Roundup	8	7.00
Roundup	12	15.50	Roundup	12	6.00
Roundup	16	13.25	Roundup	16	3.75
Control	00	14.75			
LSD(.05) - 1.41 inches			Coefficient of Variability - 6.09%		

The early treatments did not appear to cause injury to the alfalfa, but April 2 is generally too early to obtain good weed control. There were very few weeds present but the treatments did not appear to do a good job of controlling Pennycress. More work is needed to determine if the timing of this treatment was the best and if crop injury will always result from late spring applications. Additional treatments were applied in October and November of 1988 and spring treatments are planned in the spring of 1989.