

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 Project, South Dakota Agricultural Experiment Station. The equipment storage and processing facilities are located approximately 1 mile west of the village of Box Elder. The office facilities are located on the Central States Fairgrounds at 801 San Francisco Street, Rapid City. Telephone 394-2236.

This Research Project serves the entire western part of the state and does not have research plots at one central location. It is unique in that all experimental plots are cooperative with farmers, ranchers and county agents, are initiated at their request, and are conducted at one site for no longer than usually a three year period.

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 incomplete work nor 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
Richard Espenscheid	Newell 57760	Butte
Oliver Gerkin	Arpan	Butte
Fenton Brock	Nisland 57762	Butte
Maynard Britton	Oelrichs 57763	Fall River
Bill & Raymond Roghair	Okaton 57562	Jones
Dwaine Dodds	Spearfish 57783	Lawrence
Fred Beets	Spearfish 57783	Lawrence
Daniel Beug	Sturgis 57785	Meade
Charles Hawks	Plainview 57771	Meade
Joe Komes	Sturgis 57785	Meade
Rodney Renner	Wall 57790	Pennington
County Crop Impr Ass'n	Bison 57620	Perkins
Harry Nordby	Dupree 57623	Ziebach
Gerald Vrooman	Eagle Butte 57625	Ziebach

This is an annual report and results published herein are therefore neither complete nor conclusive. 2000 copies printed at an estimated cost of 15¢ each.

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The following County Extension Agents assisted in locating cooperators and conducting the research: Gary C. Mies-Martin, Ronald L. Stee-Belle Fourche, Floyd F. Wiedmaier-Hot Springs, Robert S. Edwards-Murdo, Ray Rezek-Spearfish, John C. Hansen & Tom Warren-Sturgis, Lyndell H. Petersen-Rapid City, Elbert Bentley-Bison, and Ron Schrampp-Dupree.

The results reported in this pamphlet were funded under Plant Science Projects 7110-971, 7110-725 and 7110-5093. Research was conducted by H. A. Geise-Project Leader, J. R. Johnson-Extension Agronomist, and V. K. Mosley-Assistant in Plant Science of Rapid City, and in conjunction with M. D. Rumbaugh, P. D. Carson, D. J. Reid, J. D. Colburn, W. S. Gardner, J. J. Bonnemann, E. P. Adams, E. J. Williamson, and Lee Tucker of Brookings.

Table 1. Weather Data - Average Temperature and Total Precipitation by Months, with Departures from Longtime Averages, or Normal, for Period 1931-1960. (Information presented is from nearest U.S. Climatological Reporting Station.)

Month & Year	Average Temperature*	Departure from Normal**	Total Precipitation*	Departure from Normal**
Martin (Bennett County Reporting Point)				
August 1975	72.9	0.6	1.49	-0.59
September 1975	60.7	-0.8	0.51	-0.91
October 1975	52.3	1.6	0.50	-0.54
November 1975	34.2	-1.4	0.48	0.13
December 1975	30.3	3.6	0.38	0.09
January 1976	23.6	1.1	0.58	0.29
February 1976	34.9	8.2	0.20	-0.21
March 1976	36.2	4.1	0.32	-0.35
April 1976	48.7	2.9	3.41	1.76
May 1976	57.5	1.4	2.63	-0.32
June 1976	68.4	3.2	1.50	-2.38
July 1976	76.6	3.3	1.62	-0.84
Belle Fourche (Butte County Reporting Point)				
November 1975	32.6	-1.9	0.40	-0.09
December 1975	30.5	4.9	1.03	0.74
January 1976	26.9	5.6	0.65	0.40
February 1976	37.9	12.4	0.85	0.54
March 1976	34.9	3.6	0.47	-0.07
April 1976	50.2	4.6	2.20	0.45
May 1976	58.4	2.8	2.31	-0.17
June 1976	66.6	2.5	9.36	5.73
July 1976	74.5	2.8	1.37	-0.09
August 1976	72.3	0.0	1.43	0.00
September 1976	64.4	4.9	0.15	-1.18
October 1976	46.6	-2.3	0.55	-0.27
Newell (Butte County Reporting Point)				
November 1975	32.5	-0.1	0.37	-0.20
December 1975	26.5	3.8	0.24	-0.05
January 1976	18.9	1.4	0.90	0.50
February 1976	32.6	10.7	0.81	0.44
March 1976	30.7	1.9	0.42	-0.22
April 1976	47.9	4.0	1.65	0.02
May 1976	56.0	1.5	1.53	-1.16
June 1976	65.8	2.4	4.63	1.11
July 1976	73.8	1.9	2.68	0.83
August 1976	71.3	0.3	1.29	0.04
September 1976	62.6	3.4	0.86	-0.40
October 1976	43.8	-4.3	0.39	-0.39

* Average temperatures and total precipitation obtained from NOAA climatological data.

** Departures from normal are based on long-time records (1931-1960).

Table 1. Continued.

Month & Year	Average Temperature*	Departure from Normal**	Total Precipitation*	Departure from Normal**
Vale (Butte County Reporting Point)				
November 1975	31.6	-2.0	0.65	0.00
December 1975	--	--	0.72	0.37
January 1976	22.3	2.9	0.00	-0.38
February 1976	32.7	8.6	0.97	0.52
March 1976	32.5	1.4	0.74	0.02
April 1976	49.3	3.5	2.32	0.32
May 1976	58.1	2.2	1.63	-1.31
June 1976	66.6	2.0	5.62	1.81
July 1976	74.1	1.7	3.14	1.24
August 1976	72.2	1.3	0.86	-0.42
September 1976	62.3	3.0	0.32	-1.07
October 1976	44.7	-3.7	0.58	-0.32
Oelrichs (Fall River County Reporting Point)				
August 1975	73.9	0.8	0.86	-0.42
September 1975	60.9	-0.9	0.15	-1.12
October 1975	51.2	0.6	1.01	0.20
November 1975	34.4	-1.5	0.21	0.28
December 1975	29.6	2.8	0.94	0.53
January 1976	23.4	0.5	0.61	0.23
February 1976	35.0	7.3	0.48	0.02
March 1976	35.5	2.0	0.84	-0.10
April 1976	48.8	2.4	2.97	1.12
May 1976	57.7	1.6	2.61	-0.54
June 1976	66.7	1.3	2.58	-0.67
July 1976	75.5	1.5	2.76	0.38
Murdo (Jones County Reporting Point)				
August 1975	74.6	--	3.27	1.26
September 1975	60.6	--	0.22	-1.13
October 1975	51.7	--	0.89	-0.19
November 1975	34.3	--	tr	-0.50
December 1975	28.1	--	0.74	0.38
January 1976	21.8	2.3	0.52	0.15
February 1976	35.8	11.7	0.37	-0.10
March 1976	34.5	2.6	0.34	-0.55
April 1976	51.6	4.1	1.39	-0.57
May 1976	58.1	0.1	1.90	-0.92
June 1976	70.5	3.2	0.65	-3.19
July 1976	78.5	3.3	0.77	-1.02
August 1976				
Spearfish (Lawrence County Reporting Point)				
August 1975	69.4	-0.9	0.37	-1.23
September 1975	58.9	-0.7	0.26	-1.65
October 1975	49.2	-0.8	0.96	-0.25
November 1975	34.9	-1.1	0.45	-0.87
December 1975	32.9	4.0	0.85	0.08
January 1976	27.0	2.5	0.39	-0.34
February 1976	36.3	8.5	1.07	0.30
March 1976	32.7	0.9	0.83	-0.63
April 1976	46.7	2.1	3.53	0.96
May 1976	54.9	0.5	2.77	-0.87
June 1976	62.7	0.0	14.01	9.41
July 1976	72.2	1.2	2.77	1.08

Table 1. Continued.

Month & Year	Average Temperature*	Departure from Normal**	Total Precipitation*	Departure from Normal**
Ft. Mead (Meade County Reporting Point)				
August 1975	71.0	---	0.48	-1.49
September 1975	58.7	---	0.01	-1.30
October 1975	50.0	---	0.62	-0.60
November 1975	34.3	---	0.35	-0.10
December 1975	32.2	---	0.25	-0.44
January 1976	27.8	---	0.42	-0.14
February 1976	37.0	---	1.30	0.59
March 1976	34.0	---	0.66	-0.88
April 1976	48.1	---	3.51	1.53
May 1976	57.2	---	2.62	-1.98
June 1976	64.7	---	11.45	7.87
July 1976	72.7	---	1.64	-1.35
Plainview (Meade County Reporting Point)				
January 1976	17.5	---	0.30	---
February 1976	32.5	---	0.98	---
March 1976	32.7	---	0.62	---
April 1976	49.8	---	1.09	---
May 1976	---	---	---	---
June 1976	68.0	---	7.34	---
July 1976	74.3	---	0.78	---
Bison (Perkins County Reporting Point)				
No records for 1975-76				
Dupree (Ziebach County Reporting Point)				
August 1975	71.3	-1.3	1.47	-0.11
September 1975	59.5	-1.3	0.60	-0.56
October 1975	49.5	-0.1	0.36	-0.51
November 1975	32.1	-0.8	0.25	-0.21
December 1975	24.3	2.8	0.70	0.37
January 1976	17.1	1.4	0.40	-0.04
February 1976	30.9	10.5	0.86	0.40
March 1976	32.4	3.5	0.68	-0.05
April 1976	49.8	4.7	1.53	-0.21
May 1976	57.9	1.8	1.79	-0.79
June 1976	69.0	3.9	6.09	2.56
July 1976	75.2	1.7	1.33	-0.50

* Average temperatures and total precipitation obtained from NOAA climatological data.

** Departures from normal are based on long-time records (1931-1960).

Table 2. Weather Data - Date of Critical Temperatures and Total Usable Precipitation in Counties with Experimental Plots, 1975-76.

Location	Date of Temperature*		Total Usable Moisture**	
	Fall-First	Spring-Last	Aug 75-Jul 76	Mar 76-Jul 76
Bennett County (Martin)	Oct 15, 75	Apr 4, 76	11.48	8.41
Butte County (Newell)	Oct 1, 75	Apr 22, 76	11.78	9.81
(Belle Fourche)	Sep 21, 75	Apr 20, 76	15.28	14.03
Fall River County (Oelrichs)	Sep 21, 75	Apr 5, 76	12.90	10.31
Jones County (Murdo)	Oct 15, 75	Apr 4, 76	9.03	4.38
Lawrence County (Spearfish)	Oct 24, 75	Apr 4, 76	21.30	20.18
Lawrence County (Vale)	Oct 1, 75	Apr 22, 76	12.98	12.17
Meade County (Ft. Meade)	Oct 1, 75	Apr 3, 76	20.83	18.16
(Plainview)	Oct 1, 75	Apr 18, 76	10.28	9.26
Ziebach County (Dupree)	Oct 10, 75	Apr 25, 76	11.94	10.47

* First 28° temperature in Fall or last 28° in Spring.

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

SMALL GRAIN VARIETY TRIALS

Objective: To observe and compare small grain varieties and experimental strains for winterhardness, grain yield, disease resistance, and other characteristics of area adaptability.

Hard Red Winter Wheat

Plots were located in Bennett, Fall River, Lawrence, Meade, and Ziebach counties. All trials were seeded in non-fertilized fallow with a deep-furrow drill. The seeding rate averaged 60 pounds per acre.

None of the five locations were damaged by hail, but only limited moisture was received at most points during the growing season. Yields were excellent to poor. The plots were harvested with a Massey-Ferguson Model 35 self-propelled combine. Machine harvested areas contained a minimum of 150 square feet per sample.

The yield results from the five trials conducted in 1976 are reported in Tables 3 through 7.

Table 3. Hard Red Winter Wheat Variety Performance Test - Bennett County (Martin Airport) - 1974-76.

Variety	Height (Inches)	Rust Reaction*		Wheat Streak* Mosaic	Straw Strength	Percent** Protein	Test Wt (Lbs/Bu)	Grain Yield-Bu/A	
		Leaf	Stem					1976	(3 yr av)
Winoka	32	S	R	S	Good	15.45	61.5	26.8	33.1
Lancer	33	S	R	MR	Good	14.42	60.5	24.1	34.0
Cloud	29	MS	R	MR	--	14.08	60.7	23.3	37.5
Sage	33	MS	R	Tol	Good	15.11	60.5	21.1	39.2
Agate (NR69442)	33	S	R	MR	--	12.43	61.7	20.5	--
Buckskin	33	S	R	MS	Good	14.22	61.0	20.4	37.1
Bronze	32	MR	R	S	Good	14.76	59.0	20.0	31.5
TA 101	28	S	S	S	--	17.27	60.2	19.9	35.1
Scout 66	34	S	MR	Tol	Fair	14.99	60.2	19.8	--
Kerwin	32	MR	S	--	--	15.45	62.3	18.6	--
Trison	32	S	S	--	--	16.13	60.3	18.3	--
Eagle	30	S	R	Tol	Good	14.36	61.3	17.9	30.9
Centurk	29	MR	R	MR	Stiff	17.33	59.8	17.8	36.9
Sentinel	27	S	R	S	Stiff	14.31	59.3	17.8	36.9
Co 701733	29	--	--	--	--	16.47	60.2	17.6	--
Synthetic	32	--	--	--	--	15.05	60.0	17.4	--
Gent	31	R	R	MR	Fair	13.34	60.8	16.8	--
Stud (66169)	34	S	R	--	Good	13.91	61.5	16.7	--
Baca	31	S	R	--	Fair	13.68	60.8	15.9	--
Homestead	27	S	R	S	Stiff	14.36	59.3	15.3	33.7
Scoutland	31	S	R	Tol	Fair	15.11	61.3	15.1	--
HiPlains	28	S	R	S	Stiff	13.74	60.7	14.2	33.8
Gage	32	MR	R	S	Stiff	15.50	59.7	13.4	33.7
Lancota	31	MR	R	--	Good	13.51	61.0	13.3	--

LSD (.05) - N.S.

Mean - 18.4

Note: Yield data presented within the table are an average of three replications; Plot size was 6' x 50'; Row space was 12 inches; Seeded on Sept. 11, 1975 and harvested on July 23, 1976. Seeding rate was 60 pounds per acre. Fallow soil dry due to below normal precipitation.

* Letter indicates reaction to disease: S-susceptible, MS-moderately susceptible, MR-moderately resistant, R-resistant, Tol-tolerant.

** Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven dry basis.

Table 4. Hard Red Winter Wheat Variety Performance Test - Fall River County (Oelrichs) - 1976.

Variety	X Stand 4-22-76	Rust Reaction*		Wheat Streak* Mosaic	Straw Strength	Percent** Protein	Test Weight (lbs/bu)	Grain Yield (bu/Acre)
		Leaf	Stem					
Winoka	43	S	R	S	Good	12.77	60.8	30.2
Co701733	30	--	--	--	--	12.88	61.3	29.0
Buckskin	19	S	R	MS	Good	10.60	60.5	28.8
Agate (NE69442)	52	S	R	MR	--	12.43	60.3	28.6
Scout 66	33	S	MR	Tol	Fair	11.63	60.2	27.3
HiPlains	22	S	R	S	Stiff	12.37	60.3	26.9
Eagle	23	S	R	Tol	Good	13.74	53.0	26.6
Sage	40	MS	R	Tol	Good	11.97	59.0	26.2
Kirwin	43	MR	S	--	--	14.14	60.5	26.2
Lancota	25	MR	R	--	Good	12.26	60.0	26.1
TAM 101	27	S	S	S	--	14.65	60.3	24.3
Trison	22	S	S	--	--	15.05	60.2	23.1
Centurk	24	MR	R	MR	Stiff	12.88	59.2	23.0
Gent	20	R	R	MR	Fair	12.65	58.7	22.6
Scoutland	27	S	R	Tol	Fair	12.94	60.2	21.7
Synthetic	18	--	--	--	--	13.17	59.0	20.8
Baca	18	S	R	--	Fair	12.94	59.3	20.4
Lancer	23	S	R	MR	Good	11.97	60.3	19.7
Homestead	25	S	R	S	Stiff	13.57	59.0	19.6
Sentinel	18	S	R	S	Stiff	13.22	58.8	19.5
Cloud	18	MS	R	MR	--	11.91	60.2	19.4
Stud	23	S	R	--	Good	12.26	59.8	19.3
Gage	7	MR	R	S	Stiff	14.99	58.5	18.3
Bronze	16	MR	R	S	Good	14.71	58.0	15.5

LED (6.05) - 8.6 bu/A

Mean - 23.5

Note: Yield data presented within the table are an average of three replications. Plot size was 6' x 50' with 12 inch spaced rows. Seeded on September 10, 1975 and harvested on July 27, 1976. Seeding rate was 60 pounds per acre. Fallowed soil was extremely dry, cloddy and hard from hail compaction.

* Letter indicates reaction to disease: S-susceptible, MS-moderately susceptible, MR-moderately resistant, R-resistant, Tol-tolerant.

** Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Table 5. Hard Red Winter Wheat Variety Performance Trial - Lawrence County (Spearfish) - 1974-76.

Variety	Rust Reaction*		Wheat Streak*	Straw	Percent**	Test Wt	Grain Yield-Bu/A	
	Leaf	Stem	Mosaic	Strength	Protein	(Lbs/Bu.)	1976	(3 yr Av)
Centurk	MR	R	MR	Stiff	11.97	61.2	54.4	57.9
Buckskin	S	R	MS	Good	12.09	61.2	51.3	54.7
Agate (NE69442)	S	R	MR	--	12.88	60.7	50.5	--
Cloud	MS	R	MR	--	12.71	57.5	48.8	52.1
Scout 66	S	R	Tol	Fair	13.91	59.5	48.0	54.4
Kirwin	MR	S	--	--	14.36	61.0	47.0	--
RiPlains	S	R	S	Stiff	12.37	60.5	46.6	53.5
Spearfish	--	--	--	--	12.31	58.2	45.0	--
Lancer	S	R	MR	Good	13.06	61.0	44.8	51.1
Winoka	S	R	S	Good	12.31	62.5	44.3	49.1
Lancota	MR	R	--	Good	13.74	61.0	42.5	--
Sage	MS	R	Tol	Good	13.79	59.5	42.2	55.0
Gent	R	R	MR	Fair	14.48	59.5	40.8	--
Sentinel	S	R	S	Stiff	14.42	58.8	40.6	52.5
Scoutland	S	R	Tol	Fair	14.19	60.9	40.5	--
Bronze	MR	R	S	Good	13.79	60.5	40.4	49.9
Eagle	S	R	Tol	Good	14.59	59.2	40.0	50.4
Weathermaster	--	--	--	--	13.45	60.5	39.4	--
Baca	S	R	--	Fair	12.46	59.2	38.6	--
Trison	S	S	--	--	15.62	60.2	37.1	--
Gage	MR	R	S	Stiff	14.99	59.0	34.8	47.3
TAM 101	S	S	S	--	15.42	59.5	32.9	47.0

LSD (.05) - 9.7 Bu/A

Mean - 43.2

Note: Yield data presented within the table are an average of two replications. Plot size 5' x 50' with 10 inch spaced rows. Seeded on September 11, 1975 and harvested on August 6, 1976. Seeding rate was 60 pounds per acre. Summer of 1975 very dry no residual soil moisture in fallow layer.

* Letter indicates reaction to disease: S-susceptible, MS-moderately susceptible, MR-moderately resistant, R-resistant, Tol-tolerance.

**Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Table 6. Hard Red Winter Wheat Variety Performance Trial - Meade County (Bear Butte Valley) - 1974-76.

Variety	Height (Inches)	Rust Reaction*		Wheat Streak*	Straw Strength	Percent** Protein	Test Wt (Lbs/Bu.)	Grain Yield-Bu/A	
		Leaf	Stem					1976	(3 yr Av)
Buckskin	39	S	R	MS	Good	14.02	62.5	64.2	52.4
Centurk	36	MR	R	MR	Stiff	14.19	62.2	62.2	58.1
Kirwin	37	MR	S	--	--	15.73	63.8	59.6	--
Lancer	36	S	R	MR	Good	13.85	62.8	59.0	54.9
Agate	37	S	R	MR	--	15.50	62.0	58.3	--
Winoka	36	S	R	S	Good	16.53	61.5	56.1	52.0
Sentinel	32	S	R	S	Stiff	16.13	61.2	55.0	54.9
Homestead	34	S	R	S	Stiff	16.76	62.0	54.9	52.4
TAM 101	29	S	S	S	--	16.87	60.8	52.0	50.3
Scout 66	32	S	MR	Tol	Fair	16.13	62.2	50.6	52.1
HiFlains	36	S	R	S	Stiff	16.19	60.2	50.4	50.0
Triadon	37	S	S	--	--	16.30	62.0	49.6	--
Cloud	34	MS	R	MR	--	16.70	61.5	49.4	46.3
Lancota	34	MR	R	--	Good	18.30	59.8	47.8	--
Bronze	35	MR	R	S	Good	17.90	60.5	47.5	45.8
Eagle	31	S	R	Tol	Good	16.59	61.8	47.5	51.2
Baca	34	S	R	--	Fair	14.88	62.8	46.3	--
Gent	32	R	R	MR	Fair	16.82	62.5	45.2	--
Scoutland	33	S	R	Tol	Fair	17.90	62.0	43.9	--
Gage	36	MR	R	S	Stiff	16.08	61.2	43.8	49.5
Sage	35	M	R	Tol	Good	16.33	61.5	42.0	51.6

LSI (.05) - 11.7 Bu/A

C.V. - 10.9%

Mean - 51.7

Note: Yield data presented within the table are an average of two replications. Plot size was 5' x 50' with 12 inch row spacing. Seeded on September 8, 1975 and harvested on July 19, 1976. Seeding rate was 60 pounds per acre. Seeded on fallow with limited residual soil moisture.

* Letter indicates reaction to disease: S-susceptible, MS-moderately susceptible, MR-moderately resistant, R-resistant, Tol-tolerance.

** Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Table 7. Hard Red Winter Wheat Variety Performance Trial - Ziebach County (Eagle Butte) - 1976.

Variety	Height (Inches)	Rust Reaction*		Wheat Streak* Mosaic	Straw Strength	Percent** Protein	Test Weight (Lbs/Bu.)	Grain Yield (Bu/Acre)
		Leaf	Stem					
Lancer	33	S	R	MR	Good	14.4	62.0	52.6
Scout 66	33	S	MR	Tol	Fair	11.5	62.0	50.6
Sage	34	MS	R	Tol	Good	13.6	62.0	50.0
Buckskin	27	S	R	MS	Good	13.0	61.3	49.8
Centurk	26	MR	R	MR	Stiff	11.9	59.5	49.2
Cloud	28	MS	R	MR	--	12.6	58.5	46.8
Winoka	30	S	R	S	Good	13.3	63.3	46.6
Nomeatead	31	S	R	S	Stiff	14.8	61.5	46.2
Sentinel	28	S	R	S	Stiff	14.2	60.5	46.2
Gent	35	R	R	MR	Fair	16.1	59.0	45.7
HiPlains	29	S	R	S	Stiff	15.0	59.8	44.7
Kirwin	32	MR	S	--	--	14.7	63.3	44.4
Scoutland	31	S	R	Tol	Fair	15.8	61.5	44.3
Lancota	30	MR	R	--	Good	15.4	61.0	44.2
Eagle	29	S	R	Tol	Good	14.2	61.0	43.9
TAM 101	27	S	S	S	--	16.4	59.5	43.2
Baca	30	S	R	--	Fair	11.9	60.8	42.8
Trison	32	S	S	--	--	17.3	60.3	42.7
Gage	29	MR	R	S	Stiff	14.1	59.3	41.7
Bronze	26	MR	R	S	Good	15.4	58.5	31.4

LSD (.03) - 3.9 Bu/A

C.V. - 4.1%

Mean - 45.3

Note: Yield data presented within the table are an average of two replications. Plot size was 7' x 50' with 12 inches between rows. Plots were seeded September 9, 1975 and harvested on July 20, 1976. Seeding rate was 60 pounds per acre. Fallowed soil was very dry and air temperatures above normal.

* Letter indicates reaction to disease: S-susceptible, MS-moderately susceptible, MR-moderately resistant, R-resistant, Tol-tolerance.

** Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

DISCUSSION:

Winter wheat plots in Bennett county produced less than half the grain one would expect in an average year. The precipitation in the fall of 1975 was below normal which resulted in slow germination and spotty emergence with only limited ground cover. Showers beginning in April made up for earlier shortages. Spring growth was good with anticipated high yields. Soil moisture was adequate in the spring for germination of wild annual bromes and as a result almost a solid stand grew in the winter wheat plots.

The variety trial conducted in Fall River County was seeded in very dry, cloddy soil. This condition was caused by a severe hail storm which compacted the soil and the lack of precipitation later in the season which would have mellowed the soil condition. The lack of soil moisture was also a factor in almost total absence of fall germination and emergence. The germination problem is reflected by the low emergence counts seen in Table 4. Stands improved as the spring progressed and all plants had vernalized and produced heads. The number of heads were few because of limited tillering.

The winter wheat trial in Lawrence County was seeded in early September in very dry soil. Appreciable moisture was not received until October. Near normal moisture during the spring and heavy rains in June contributed to the yield level. The lack of moisture at planting time led to delayed emergence, reduced crown size and plant vigor. An abundance of straw was produced but heads were short.

The yields of winter wheat at Bear Butte Valley, Meade County, were comparable to the 1975 level, and were well above the county average for the last five years. Although precipitation recorded at Fort Meade indicates a below normal pattern for almost the entire growing season, there was sufficient moisture early in the season to produce vigorous plants and a uniform stand. Heads were well filled with good quality seed as evidenced by the high bushel test weights.

The performance trial in Ziebach county was seeded early in September in dry fallow. Moisture was limited during the fall and following spring. In June heavy showers helped produce grain yields of average to good test weight. Protein contents ranged from a low of 11.5% to a high of 17.3%.

Hard Red Spring Wheat

The data reported in Table 8 for Bennett County is a summary of an experiment conducted in 1976 containing 12 measurements per variety. Soil moisture was adequate for germination and emergence. The stands were uniform on all plots. Precipitation was subnormal for most of the summer causing grain of lower than standard weights per bushel and shriveled kernels. Yields, although low, were higher than in 1975 as evidence by the average yield.

A Spring Wheat trial was conducted in Lawrence County in 1976. The results are reported in Table 9. Precipitation during the fall and winter was below

Table 8. Hard Red Spring Wheat Variety Trial - Bennett County (Martin)

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield-Bu/Acre	
			(1976)	(Av 1975-76)
Semidwarfs				
MP-25-8	23	60.7	29.6	18.6
Bounty 208	21	61.2	22.2	16.8
Bounty 309	22	59.5	22.2	16.2
Prodax	23	55.5	22.2	16.2
Kitt	24	51.0	22.2	13.4
Olaf	26	56.5	21.8	16.4
Profit 75	24	60.5	20.7	18.4
Era	23	53.5	18.8	17.4
Bonanza	20	59.0	17.4	13.0
WS 1809	22	59.0	15.2	13.0
Protor	21	59.5	12.8	15.1
Standard Height				
Waldron	28	57.0	19.6	15.2
Ellar	30	56.0	18.2	15.8
Fortuna	31	58.0	16.4	16.1
Nowesta	30	56.2	15.6	15.2
Tinga	29	56.5	13.8	14.8

Mean = 18.9

Note: Plots were seeded in fallow on April 14 at 60 lbs/acre. Row spacing was 8 inches. Soil moisture was adequate for germination and emergence. Harvesting was completed on July 28 with a MRF SP35 combine.

Table 9. Hard Red Spring Wheat Variety Trial - Lawrence County (Spearfish)

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Semidwarf			
WS 25	36	61.5	26.4
Bounty 309	34	60.5	26.1
Prodax	34	62.0	24.8
WS 1809	34	62.0	24.8
Profit 75	34	62.0	22.5
Olaf	34	60.5	19.8
Era	32	62.0	18.9
Kitt	33	61.0	18.7
Bounty 208	33	63.5	18.2
Protor	36	61.5	16.0
Standard Height			
Fortuna	38	61.0	21.5
Ellar	41	61.0	18.6
Nowesta	38	60.0	18.2
Waldron	40	61.0	17.2

LSD (.05) - 4.1 Bu/Acre

Mean = 20.4

Note: Plots were seeded on April 14 at 60 pounds per acre. Row spacing was 10 inches. Harvesting was completed on August 18, 1976.

normal. In April, at planting time, the area received several good showers which provided sufficient moisture for early growth. In early June the area received very heavy rains which saturated the soil. The plants were vigorous and produced good grain yields. Quality of the grain was excellent with high bushel weights.

One of the three spring wheat plots in Meade County was located in the Alkali area. It was seeded in conjunction with other studies and because of space limitations could not be replicated. Spring moisture was adequate for good stands. The area received hail on July 1. On that date heading was completed with kernel development progressing rapidly. The hailstones damaged the culms so that the heads broke over, but the kernels were able to complete development. The quality of the grain was poor but yields were good considering the hail damage. The plot data are reported in Table 10.

Table 10. Hard Red Spring Wheat Variety Trial - Meade County (Alkali) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Semidwarfs			
Olaf	27	55.0	30.5
Kitt	30	53.0	29.8
Proctor	27	60.0	28.3
Era	28	53.0	27.6
Bonanza	29	53.0	27.6
WS 6	27	55.0	25.4
			Mean - 28.2
Standard Height			
Fortuna	37	59.0	31.2
Tioga	36	57.0	28.3
Chris	37	57.0	26.9
Nowesta	28	55.0	26.9
Ellar	36	55.0	12.3
			Mean - 25.1

Note: Non-replicated. Plots received severe hail damage on July 1. Seeding was completed on April 21. Rate of seeding was 60 pounds per acre in a row spacing of 8 inches. Harvest was completed on August 2 with a MHF SP-35 self-propelled combine. The soil had been fallowed during the previous summer.

The second trial in Meade County was located in Bear Butte Valley. It consisted of 11 semidwarf and 4 standard height varieties of Hard Red Spring Wheat. Rainfall was sporadic being far below normal through January and alternating above and below normal during the spring and summer. The pattern was such that plants received adequate moisture during growth periods of tillering, jointing, and filling. The results, as shown in Table 11, were about 12 bushels per acre above the three year average.

Table 11. Hard Red Spring Wheat Variety Trial - Meade County (Bear Butte).

Variety	Height	Test Weight	Grain Yield-Bu/Acre	
	(Inches)	(Lbs/Bu)	(1976)	(Av 1974-76)
Semidwarf				
Bounty 208	25	60.0	53.7	36.3
Profit 75	28	59.0	50.4	—
Protor	30	57.0	49.9	39.3
Olaf	33	57.0	49.2	33.8
WS 25	27	58.2	48.3	—
Bounty 309	31	58.5	46.8	—
WS 1809	25	57.5	46.8	34.6
Era	34	55.5	45.4	34.9
Prodax	31	54.0	44.7	—
Bonanza	29	58.5	42.7	30.9
Kitt	32	53.0	40.0	27.1
Standard Height				
Ellar	38	59.0	51.9	—
Waldron	34	61.7	50.6	35.5
Nowesta	36	58.7	44.2	31.9
Fortuna	32	58.5	44.0	—

LSD (.05) - 5.2 Bu/A

C.V. - 5.1%

Mean - 47.2

Note: Varieties were seeded on April 2 at the rate of 60 pounds per acre. Drill rows were spaced 8 inches apart. Harvesting was completed on Aug. 4. Soil was fallowed during the previous summer.

Table 12. Hard Red Spring Wheat Variety Trial - Meade County (Plainview)

Variety	Height (Inches)	Percent Protein	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Semidwarf				
Era	28	13.0	60.2	38.9
Prodax	24	14.4	59.5	37.8
WS 25	24	14.0	60.0	34.4
Olaf	29	16.4	59.5	32.0
Bounty 309	26	14.4	60.0	31.8
Kitt	28	14.8	56.7	31.2
Profit 75	27	14.6	59.5	30.6
WS 1809	25	15.9	60.2	29.8
Protor	23	15.2	58.0	28.0
Bounty 208	26	15.4	60.5	27.4
Bonanza	23	15.4	58.0	19.6
Standard Height				
Ellar	32	16.2	59.0	40.5
Waldron	33	15.6	58.7	37.2
Novesta	32	14.6	60.0	35.4

LSD (.05) - 5.4 Bu/A

C.V. - 7.8%

Mean - 32.5

Note: Variety plots were seeded on April 13 with a deep furrow drill. Row spacing was 12 inches and seeding rate 60 pounds per acre. Harvesting was completed on August 4 with a self-propelled combine. Soil was fallowed in 1975.

The third trial was located in eastern Meade County near Plainville. It was similar in composition to the one in Bear Butte Valley. Precipitation was inadequate for the entire season except June. However soil moisture saved by conservation practices during 1975 provided enough stored water for the plants to grow until the heavy showers of June were received. Seed quality was good with weight per bushel near standard and protein quantity ranging from 13% to over 16%.

Hard Red Spring Wheat varieties compared in a trial in Ziebach County were subjected to severe moisture stress during the entire growing season. The lack of available moisture caused limited tillering, reduced plant height, and below normal weights per bushel.

Table 13. Hard Red Spring Wheat Variety Trial - Ziebach County (Dupree)

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Semidwarfs			
Bounty 208	19	60.3	15.7
MP-25-B	23	57.0	15.0
WS 1809	19	58.0	14.8
Bounty 309	21	56.3	13.5
Era	22	57.7	13.3
Profit 75	21	58.3	13.3
Prodax	21	58.0	13.0
NP-25	22	57.0	12.1
Olaf	23	57.3	12.1
Protor	20	58.3	11.9
WS 6	23	55.7	11.6
Bonanza	20	58.7	10.6
Kitt	22	55.0	10.4
Standard Height			
Tioga	23	58.0	12.8
Fortuna	25	55.7	11.9
Novesta	23	55.7	11.1
Waldron	24	57.3	10.6
Chris	27	56.7	10.6
Sheridan	26	56.7	9.9
Ellar	25	58.3	9.2

LSD (.05) - 1.8 Bu/A

C.V. - 8.7%

Mean = 12.2

Note: Variety plots were seeded on April 28 in 8 inch spaced rows at a rate of 60 pounds per acre. Soil had produced a spring wheat crop in previous growing season. Moisture stress was exhibited during the entire 1976 season. Plots were harvested on Aug. 5 with a self-propelled plot combine.

Durum Wheat

Durum wheats were compared in three separate trials in 1976. The results are reported in Tables 14 through 16. The discussions which pertain to the Hard Red Spring Wheat trials also describe the conditions which influenced the durum wheats at respective locations. Grain yields were equal for the two types. However durum varieties had higher weight per bushel tests than did the Hard Red Spring Wheats.

Table 14. Durum Wheat Variety Trial - Bennett County (Martin) - 1975-76.

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield-Bu/Acre	
			1976	(Av 1975-76)
Botno	27	60.0	16.0	13.8
Rollette	27	59.5	15.2	12.7
Leeds	29	60.5	18.9	14.0
Crosby	28	59.7	22.2	15.4
Ward	26	61.2	19.2	15.6
Rugby	27	60.0	22.1	25.8
Cando	20	58.5	17.8	—

Mean - 18.8

Note: Plots were seeded in fallow on April 14 at 60 pounds per acre. Row spacing was 8 inches. Soil moisture was adequate for germination and emergence. Harvesting was completed on July 28 with a self-propelled combine.

Table 15. Durum Wheat Variety Trial - Meade County (Alkali) - 1976.

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Ward	37	59.0	50.8
Rugby	37	59.0	48.6
Botno	35	59.0	44.3
Cando	27	61.0	39.2

Mean - 45.7

Note: Plots were non-replicated and received severe hail damage on July 1. Seeding was completed on April 21. Rate of seeding was 60 pounds per acre in a row spacing of 8 inches. Harvest was completed on August 2 with a self-propelled plot combine. The soil was fallowed the previous summer.

Table 16. Durum Wheat Variety Trial - Ziebach County (Dupree) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Botno	24	59.0	13.8
Rollette	26	61.3	12.3
Crosby	26	59.3	12.3
Leeds	26	61.3	11.8
Cando	20	59.0	11.6
Ward	26	59.7	10.5
Hercules	25	60.7	10.4
Rugby	25	60.7	9.7
<hr/>			
LSD (.05) - 2.2 Bu/Acre	C.V. - 10.4%	Mean - 12.4	

Note: Plots were seeded on April 28 in 8 inch spaced rows at a rate of 60 pounds per acre. Soil had produced a spring wheat crop in previous growing season. Moisture stress was exhibited during the entire 1976 season. Plots were harvested on August 5 with a self-propelled combine.

Oats

Oat variety trials were conducted on a cooperative basis at four locations in 1976. The results are reported in Tables 17-20. Three of the sites were in fallow and the fourth in spring wheat stubble. The average yields in 1976 varied considerably. Those in Bennett County were slightly below a previous 5 year average as reported by the Crops and Livestock Reporting Service.

Table 17. Oat Variety Trial - Bennett County (Martin Airport) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Trio	30	34.7	43.6
Nodaway 70	31	37.5	43.4
Spear	30	34.1	42.1
Stout	26	35.2	39.3
Burnett	33	35.3	38.1
Proker	33	31.8	37.9
Wright	33	37.1	37.4
Diana	30	33.8	36.7
Astro	25	33.9	36.5
Noble	28	35.2	35.9
Dal	32	34.6	35.4
Chief	29	33.8	33.6
Otee	28	36.8	31.0

Mean - 37.8

Note: Replicated plots were seeded in fallow on April 14 in 8 inch spaced rows at a rate of 2 bushel per acre. Soil moisture was adequate for germination and emergence. Harvesting was completed on July 28 with a self-propelled plot combine. Plot size was 4' x 25'.

Table 18. Oat Variety Trial - Meade County (Bear Butte) - 1974-76

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield-Bu/Acre	
			1974	(Av 1974-76)
Astro	32	33.5	87.6	69.7
Burnett	42	39.0	63.8	79.6
Chief	38	37.8	55.3	84.4
Dal	39	37.5	85.2	79.5
Diana	38	34.5	66.8	83.3
E 76	36	39.5	64.4	--
Froker	43	38.5	69.8	79.8
Holden	39	37.2	60.0	--
Lang (67-1514)	35	35.5	101.4	--
M 73	36	36.0	53.2	58.8
MN 71101	45	36.5	76.3	--
Noble	35	36.5	76.3	91.1
Nodaway 70	38	38.0	73.6	92.8
Otee	36	38.0	66.5	--
Spear	38	36.5	73.6	77.8
Stout	31	36.2	89.9	--
Trio	38	37.2	77.0	76.7
Wright	41	38.5	70.9	--

LSD (.05) - 13.6 Bu/A C.V. - 8.8% Mean - 72.9

Note: Replicated plots were seeded in fallow on April 2 at the rate of 64 pounds per acre. Drill rows were spaced 8 inches apart. Harvesting was completed on August 4 with a self-propelled combine. Plot size was 5' x 50'.

Table 19. Oat Variety Trial - Meade County (Plainview) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Noble	28	36.0	59.2
Trio	29	35.0	52.4
Nodaway 70	32	37.0	51.2
Burnett	34	37.2	50.0
Lang (67-1514)	30	33.5	50.0
Wright	34	38.5	49.0
Otee	27	36.5	49.0
Astro	28	32.2	48.6
Spear	30	35.0	46.8
Dal	30	34.7	45.8
E 76	26	35.7	44.0
Froker	35	36.7	43.6
MN 71101	35	33.5	42.6
Stout	25	35.5	42.0
Diana	29	36.2	38.5
Chief	31	35.0	38.0
M 73	30	35.5	34.2
Holden	30	37.0	33.8

LSD (.05) - 1.4 Bu/A C.V. - 6.7% Mean - 45.5

Note: Replicated plots were seeded in fallow on April 13 with a deep furrow drill. Row spacing was 12 inches and seeding rate 64 pounds per acre. Harvesting was completed on August 4 with a plot combine. Plot size was 7' x 50'.

The Bear Butte average was 160% of the Meade County average, whereas the Plainview yields were near the 5 year average. The Ziebach County average which was about a third of the 5 year average indicated an extreme moisture shortage existed because of the limited rainfall and low soil moisture. The soil moisture shortage resulted from utilization of the water by a previous crop.

Table 20. Oat Variety Trial - Ziebach County (Dupree) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Cayuse	26	30.3	26.8
Lang	26	35.3	22.7
Kelsey	28	34.7	20.4
Wright	25	33.3	20.0
Portal	29	34.0	19.1
Astro	24	31.3	18.1
Dal	27	31.0	16.3
Froker	28	33.7	15.9
Otee	26	35.7	15.4
Burnett	29	35.3	15.0
Noble	26	32.3	15.0
MN 71101	29	30.0	14.5
Grundy	27	33.0	14.1
Stout	24	34.0	14.0
Holden	29	32.7	13.6
Spear	26	30.3	13.6
M 73	28	32.0	13.2
Trio	27	32.7	13.1
Garland	27	33.3	12.9
Diana	27	34.7	12.7
Chief	27	33.0	12.7
E 76	26	35.0	11.3
Hodaway 70	27	33.3	11.3
E 74	27	32.7	10.4

LSD (.05) - 5.3 Bu/A

Mean - 15.5

Note: Replicated plots were seeded on April 28 in 8 inch spaced rows at a rate of 64 pounds per acre. Moisture stress was exhibited during the entire growing season because of utilization of soil moisture by a previous spring wheat crop as well as subnormal rainfall during 1976. Plots were harvested on August 5. Plot size was 4' x 25'.

Spring Barley

Spring barley varieties were compared at three locations in 1976. In Bennett County they were seeded in fallow but because of above normal temperatures and below normal rainfall produced yields (Table 21) which averaged about 7 bushels below the longterm records.

The trial in western Meade County was also seeded in fallow. In this location soil moisture was also limited. However extremely heavy showers in early June

Table 21. Spring Barley Variety Trial - Bennett County (Martin) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Beacon*	24	43.8	23.5
Larker*	25	46.5	27.1
Manker*	22	47.2	26.9
Prilar	24	45.2	22.8
Primus II	22	47.0	25.4

*Approved for malting

Mean - 25.1

Note: Replicated plots were seeded on April 14. Plots were 4' x 25' with 8 inch spaced rows. Seeding rate was 72 pounds per acre. They were harvested with a self-propelled plot combine on July 28.

Table 22. Spring Barley Variety Trial - Meade County (Bear Butte)

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield-Bu/Acre	
			1976	Av 1974 & 76
Steptoe	24	47.3	99.7	—
Larker*	35	49.5	74.8	60.1
Primus II	27	48.0	70.6	54.6
Beacon*	31	46.2	68.1	55.6
Prilar	32	47.5	63.6	53.7
Manker*	31	49.0	60.3	—
Bonanza*	35	49.5	52.9	—

LSD (.05) - 8.6 Bu/A

C.V. - 5.1%

Mean - 68.7

*Approved for malting.

Note: Plots were seeded in fallow on April 2 at the rate of 72 pounds per acre. Drill rows were spaced 8 inches apart. Harvesting was completed on August 4 with a plot combine. Plot size was 5' x 50'.

Table 23. Spring Barley Variety Trial - Ziebach County (Dupree) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Manker*	24	46.3	20.0
M-18	24	44.0	20.0
Bonanza*	28	43.0	20.0
Larker*	26	47.0	19.1
Cree	25	43.7	18.2
Primus II	24	47.0	17.5
Prilar	27	46.3	17.5
Beacon*	24	43.0	14.5

LSD - N.S.

C.V. - 16%

Mean - 18.3

*Approved for malting.

Note: Plots were seeded on April 28 in 8 inch spaced rows. Seeding rate was 72 pounds per acre. The 4' x 25' plots were harvested with a plot combine on August 5. Moisture stress was exhibited in the plots during the entire growing season.

resulted in sufficiently increased available moisture to produce grain yields (Table 22) double the longtime records.

In Ziebach County the trial was located in wheat stubble. The low soil moisture content aggravated by low rainfall resulted in poor stands, minimum tillering, and grain yields (Table 23) below long time records.

Flax

Only one flax variety trial was seeded in 1976. This was located in Ziebach County. The grain production as reported in Table 24 reflects an increase over longtime records, however, the lack of soil moisture and below normal precipitation restricted production to a level well below the yielding ability of the varieties tested.

Table 24. Flax Variety Trial - Ziebach County (Dupree) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Linott	19	55.0	11.9
Culbert	19	55.0	11.2
Foster	19	52.7	10.6

LSD (.05) - N.S.

C.V. - 10.9%

Mean - 11.2

Note: Replicated plots were seeded on April 28. The 4' x 25' plots were seeded in 8 inch rows at the rate of 56 pounds per acre. Harvesting was completed on August 5. Moisture stress was experienced during the entire season.

Triticales

Three variety trials were seeded in 1976. Two were seeded on fallow and the third on spring wheat stubble. The trial in Bennett County, grown on fallowed soil, produced near normal height plants with good weight per bushel grain. Yields are reported in Table 25.

Table 25. Triticales Variety Trial - Bennett County (Martin) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Triticales 419	32	40.5	23.5
Triticales 418	33	42.0	21.8
Triticales 204	34	42.0	20.8
Triticales 203	33	44.5	16.6

Mean - 20.7

Note: Plots were seeded on April 14. Seeding rate in the 4' x 25' plots was 45 pounds per acre. Row space was 8 inches. Harvesting was completed on July 28. Temperatures were above normal and precipitation below normal.

The trial in Meade County was seeded in fallow and although the season started with marginal soil moisture supply, there was adequate rainfall to produce good vigorous plants. Heavy rain in early June provided enough additional moisture to produce tall plants with large heads. Although weight per bushel was below standard, yields were high as reported in Table 26.

Table 26. Triticales Variety Trial - Meade County (Bear Butte) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Triticales 204	47	42.0	44.9
Triticales 418	51	41.5	37.1
Triticales 419	52	42.0	36.9
Triticales 203	47	40.7	36.2
			Mean - 38.8

Note: Plots were seeded on April 2. Plot size was 4' x 50' and row spacing 8 inches. Seeding rate was 45 pounds per acre. Harvested on August 4. Adequate moisture and favorable temperatures resulted in good grain yields.

In Ziebach County the yields were limited because of lack of soil moisture and rainfall. Plant heights were medium while weights per bushel were near standard. Yields were low and are reported in Table 27.

Table 27. Triticales Yield Trial - Ziebach County (Dupree) - 1976

Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Triticales 418	37	45.7	15.7
Triticales 419	35	44.0	15.7
Triticales 203	36	43.7	13.4
Triticales 204	34	44.7	11.3

LSD (.05) - 3.7 Bu/Acre

Mean - 14.0

Note: Varieties were seeded on April 28 in 4' x 25' plots with 8 inch spaced rows. Seeding rate was 45 pounds per acre. Plots were harvested on August 5 with a plot combine. Plants were under moisture stress during the entire growing season.

SORGHUM VARIETY TESTING

Grain Sorghum

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

A small trial of short-season grain sorghum varieties was seeded in Perkins County in 1976. The varieties were evaluated for plant height and grain yield. The soil had been fallowed the previous year. Excellent stands were obtained. Rail damage in late June reduced the yields because of stem damage. The results of the trial are reported in Table 28.

Table 28. Grain Sorghum Variety Trial - Perkins County (Bison) - 1976

Brand & Variety	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield	
			Lbs/Acre	Bu/Acre
Pride P500A	40	52.6	2323	41.5
RS 506	47	53.2	2287	40.8
Acco R920	40	53.2	2178	38.9
SD 7505	39	52.9	2142	38.2
NK M52	34	51.2	2142	38.2
Pioneer 894	32	53.6	2069	37.0
SD 7502	36	50.6	2069	37.0
NK 121	37	51.0	2015	36.0
SD 106	35	53.6	1742	31.1
SD 7506	34	52.4	1706	30.5
SD 104	36	52.5	1616	28.9

LSD (.05) - N.S.

Mean - 2026

36.2

Note: Variety plots were seeded on May 25 in 36 inch rows. Individual plots consisted of 2 rows 25 feet long. Severe hail damage was inflicted in late June. Harvesting was completed on September 20 by clipping heads from 10 foot length of row in each plot. The heads were threshed with a Chain plot thresher.

Sorghum Forage Trials

Objective: To compare the various forage sorghums, and sudangrasses, or their hybrids, as to their adaptability, their forage production, and their forage quality.

Replicated single row plots of forage sorghum, sorghum-sudans, and sudangrasses were seeded in Perkins County on May 25. The trial was seeded in fallow soil. The seedbed was excellent which resulted in a uniform stand. Hail damage in late June influenced forage yield levels as reported in Table 29.

Corn

Objective: To compare various corn hybrids as to their adaptability, and grain production.

Replicated two row plots of 11 hybrids of corn were planted in late May in central Perkins County. The varieties tested were based on availability of seed from local seed sources. All local dealers were contacted and invited to submit materials for testing. The planting rate was heavier than required but was thinned to desired populations. Severe hail damage was received in late June and most of the leaves were destroyed. However, with adequate soil moisture the plants recovered and produced exceptionally high yields. The plots were hand harvested on October 21, 1976, and the yields are reported in Table 30.

Table 29. Sorghum Forage Yields - Perkins County (Bison) - 1976

Brand & Variety	Height (Inches)	Percent Protein	Percent Dry Matter	Forage Yield T/A @ 17% H ₂ O
Forage Sorghum				
NK 367	76	8.8	43	6.81
Pioneer 931	82	8.1	34	5.74
Acco FS401R	82	4.7	38	5.47
Agrow Beefbuilder T	67	8.6	33	5.18
Taylor-Evans Raygrazer	85	8.1	37	5.05
NK 300	52	--	35	4.61
Frontier S209	78	8.5	43	4.50
Rudy-Patrick 22F	55	7.9	39	3.59
DeKalb PS1b	45	6.7	34	3.52
SD 275F	49	5.6	38	3.44
Waconia	64	10.0	30	3.23
Rudy-Patrick 55F	72	8.8	27	3.03
Rancher	68	12.1	37	1.76
LSD (.05) - 1.4 T/A				Mean - 4.31
Sorghum-Sudangrass				
NK Sordan 70	79	7.6	33	4.8
DeKalb SX-4	82	8.6	39	4.4
DeKalb Sudax SX-17	58	8.1	35	4.1
Dorman Suregraze	81	7.8	36	4.0
Frontier Hidan 37	81	6.7	36	3.9
Acco Sweet Sioux	79	8.4	37	3.3
LSD (.05) - 1.5 T/A				Mean - 4.1
Sudangrass				
NK Trudan 5	76	5.5	39	4.5
Cal/West Monarch	74	7.7	52	3.9
Acco HS-33	69	8.1	48	3.8
NK Trudan 6	76	7.6	43	3.7
Piper	77	8.2	57	2.7
LSD (.05) - 1.25 T/A				Mean - 3.7

Note: Replicated single row plots were seeded on May 25. A preemergence herbicide was applied with good results. Plots were hand harvested on September 20.

Table 30. Corn Variety Demonstration Trial - Perkins County (Bison) - 1976

Brand & Variety	Percent Dry Matter	Grain Yield-Bu/Acre @ 15.5% Moisture
Pioneer 3968	16.0	60.0
Cenex 4042	21.5	55.3
Weathermaster Prairie Mix I	16.5	54.3
Pioneer 3965	15.5	52.6
DeKalb XL12	19.0	52.4
Cenex 3 way	23.5	51.4
Cenex 4040	23.0	51.3
DeKalb XL21A	25.0	50.6
Pioneer 3955	21.5	45.3
Weathermaster CR40	14.5	45.0
Weathermaster CR50	15.0	37.0
LSD (.05) - 9.3 Bu/A		Mean - 50.5
C.V. - 12.6%		

Note: Seeding date-May 11, 1976. Plot size-2 rows 36 inches apart and 25 feet long. Population-9500 plants per acre. Planted on fallow, fertilizer not used.

IRRIGATED ALFALFA TRIALS

Objective: To compare brands and varieties of alfalfa for their ability to become established, resistance to diseases, stand survival, and forage production.

Variety Trial

An irrigated variety trial containing 20 entries was established near Nisland in Butte County in April 1974. Practices to maintain stands and maximize yields include annual top drasaing with 60 pounds of phosphate and additional water applied to maintain moiature levels, based on tensiometer levels at one and two foot depths. The study is located on a deep silt loam with $\frac{1}{2}\%$ slope. The forage yields are reported in Table 31.

Table 31. Irrigated Alfalfa Variety Trial - Butte County (Nisland) - 1974-76

Source	Variety	Tons of Hay per Acre - 12% Moisture				
		1974	1975	1976	Average	
		2 cuts	4 cuts	4 cuts	75-76	74-76
Tewalee	Americana*	3.78	6.75	7.69	7.19	6.06
Northrup King	Thor*	3.13	6.61	7.93	7.32	5.92
USDA	Team	3.15	6.92	7.75	7.28	5.91
NY	Saranac*	2.84	6.69	7.66	7.27	5.79
Northrup King	Warrior	3.14	6.52	7.69	7.10	5.77
Barzan	Flandria*	3.51	6.23	7.36	6.85	5.74
Tewalee	Superstan*	2.41	6.86	7.75	7.33	5.69
USDA-MN	Agate	2.57	6.56	7.94	7.20	5.66
USDA-NB	Ranger	2.48	6.47	7.83	7.21	5.64
USDA-NB	Dawson	3.89	5.76	7.41	6.51	5.63
FarmForRea	Weavilchak	3.49	6.03	7.23	6.58	5.54
Jacques	J-80*	2.49	6.58	7.57	7.07	5.53
DeKalb	131*	2.94	6.24	7.35	6.80	5.52
USDA	Cossack	3.00	5.83	7.26	6.52	5.35
King's	17AA*	3.03	5.95	7.00	6.51	5.35
MN	Grimm	2.39	5.67	7.39	6.52	5.26
MT	Ladak 65	2.82	5.18	6.98	6.07	5.00
NY	Iroquois	2.89	5.38	6.78	6.06	5.00
WI	Vernal	2.41	5.36	6.82	6.15	4.90
Foater's	Siberian	2.97	4.40	5.86	5.09	4.38
	Average	2.97	6.10	7.36	6.72	5.48
	LSD (.05)	N.S.**	0.67***	0.84***	0.88***	N.S.
	C.V. (%)	34	7	8	11	17

* Flemish varieties

** For yields in this column there is no significant difference among varieties. Apparent differences are due to field plot variation.

*** For yields in these columns, real variety differences exist only when there is more difference in yield than the value given.

Statistical analyses by Dr. Mel Rumbaugh, Alfalfa Breeder, SDSU, Brookings.

Yields during the first year, 1974, are shown in Table 31. Two cuttings were obtained. There was no statistical difference in yields among varieties for either cutting or for total yield. This was attributed to high plot-to-plot variation which appeared to be a result of differential weed control. An average of nearly 3 tons of hay was harvested during the first year.

Yields for 1975 are also shown in Table 31. The first cutting, taken June 11 was small due to the late spring and cool temperatures. The second and third cuttings, taken July 14 and August 25 produced very well. The fourth cutting, taken October 22 was somewhat reduced due to the late date. Normal recommendation would not advise harvest on such a date, very little regrowth occurred after the fourth cutting and consequently we would anticipate normal amounts of winter injury. For four cuttings, 6.5 tons were harvested from the higher yielding varieties.

Because of the high field plot variation in 1974, it is best to look at the 1975-76 average to get an idea of trends in production differences. Statistically, there are relatively small differences with the greatest being among the lower producing varieties. Siberian which is suffering stand losses is considerably lower than any other variety, followed by a group consisting of Iroquois, Ladak 65, Vernal, Dawson, King's 17AA, Grimm, Cossack, and Weevilchuk. Some of these, especially Iroquois and Vernal have been and continue to be standard varieties with good agronomic characteristics, including production. Their low yields are unexplainable and inconsistent with other trials.

Only one Flemish type is among the lowest producers. This can be attributed to quick regrowth for excellent second, third, and fourth harvest. However, winter hardiness in the Flemish varieties is questionable. Seven of the top eight varieties in the fourth cutting were Flemish varieties. This suggests that these varieties, under intensive management schemes, may be well adapted and might thereby offer greater variety selection than we currently recommend.

It is interesting to note that in 1976 there was no significant difference among varieties when looking at the variety production totals for the first three cuttings. In other words, there would not have been any differences among variety yields in 1976 if a fourth harvest had been obtained.

The variety plots are being managed to give maximum yields with four harvests per year in most years. One could speculate that in western South Dakota, with irrigation, the problems of poor winter hardiness, that are often associated with rapid growth recovery types, may be minimized. This may especially be true where alfalfa is used in short term rotations as contrasted to nearly permanent alfalfa fields. Early evidence also suggests that some of the varieties which have been top performers in the region may not now be the best.

The difficulty of obtaining four cuttings per year has been clearly illustrated during the last two years. Timing of harvest is a critical factor, and if harvest schedules begin to slip, the last harvest will not occur. The 1975 cutting dates were June 11, July 24, August 25, and October 22. In 1976 harvest dates were June 3, July 16, August 17, and October 5. By having some breaks in the weather and being able to maintain the cutting schedule, the fourth cutting was advanced by more than two weeks. The desirability, in fact the need, for

advancing the fourth cutting date is apparent as we look at dates of earliest low temperatures. Where ice sheets are not normally a problem, and producers are anxious to achieve peak production under irrigation, there is an opportunity to relax the standard of having no harvest later than mid-September.

Fertilizer and Water Management Trial - Nisland

The water management trial was located in the spring of 1975 on a sandy loam site and included fertilizer treatments. The field had been seeded to DeKalb 131 in the spring of 1974.

The purpose of the trial was to demonstrate the need for careful water and fertility management. The intent was not to irrigate the "casual" half more often than once between harvests, and the "intensive" half as often as necessary to keep adequate soil moisture for plant growth. The "intensive" half also receives an irrigation in late summer or early fall. Extremely favorable moisture in late spring 1976 as well as later in the season minimized the difference in production due to water management.

Several fertilizer treatments were included in the trial (Table 32) of which two were based on soil tests and yield goals for the water management portions. They were 0-30-30 treatment in the "casual" half and 0-60-60 treatment in the "intensive" half.

Table 32. Hay Production From Fertilizer and Water Management Trial - Butte County (Nisland)

Water Management	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Hay Production - Tons/Acre @ 12% Moisture		
		1975	1976	2 Yr Average
Casual (5 ton projection)	0- 0- 0	6.9	6.5	6.9
	0-30- 0	6.5**	6.8	6.7
	0-30-30*	7.1	7.0	7.1
	60-30-30	6.5**	6.6	6.6
	Average	6.8	6.8	6.8
Intensive (7 ton projection)	0- 0- 0	6.2**	7.8**	7.0
	0-60- 0	6.7	7.7**	7.2
	0-60-60*	6.9	7.8**	7.4
	60-60-60	6.3**	7.1	6.7
	Average	6.5	7.6	7.1

* Recommended fertilizer treatment for yield projection.

** Values are significantly different from casual 0-0-0.

During 1975, production differences due to water management and to fertility appeared extremely unusual and difficult or impossible to explain. For example, at the 0-0-0 level of fertilizer, the intensive water management portion produced less forage than the casual portion. Further, the recommended levels of fertility, 0-30-30 and 0-60-60, did not show an increase in forage over the control. This led us to suspect that the alfalfa was drawing on phosphorus reserves below our six inch soil sampling depth. The 60-30-30 treatment produced less than the control or the 0-30-30 treatment. Also, production from 60-60-60 appears less

than 0-60-60. The application of nitrogen fertilizer to alfalfa does not usually show a response, however, in this instance is caused a reduction in yield.

In 1976 as in the year earlier, there was not a response to phosphorus and potash further suggesting phosphorus and potassium are in low quantities only in the surface. Failure to get the expected responses may find deep soil sampling necessary in order to make realistic fertility recommendations. In both years, where nitrogen was added in the casual portion there was a "trend" for reduced yields when compared to the same levels of fertility without nitrogen. Also, in the intensive portion, the only fertility treatment that was not greater than the control is the treatment with nitrogen.

The trial began to show some response to water management in 1976. The unfertilized, intensive half, produced 0.9 ton more than the control (Table 33). It is noteworthy that the September 29, 1975 irrigation on the intensive half had a major impact on the first harvest production in 1976, resulting in a half ton (0.5) additional hay being produced in the first harvest.

Table 33. Hay Production for Four Cuttings - Fertilizer and Water Management Trial - Butte County (Nisland)

1976 Hay Production in Tons/Acre @ 12% Moisture						
Treatment	Cut	1	2	3	4	Total
Casual 0-0-0		2.51	1.82	1.71	0.90	6.93
Intensive 0-0-0		3.01	2.19	1.62	1.01	7.83
Increase from Water Mgt.		0.50*	0.37*	-0.09	0.11*	0.90*

* Increase in production is significantly different from the control, casual 0-0-0.

Note: Statistical analyses by Lee Tucker, Station Statistician, SDSU.

This accounts for 56% of the total 0.9 ton increase for the year. A substantial increase (0.37 T/A) occurred in the second harvest as well. This would have been a result of the May 24 irrigation prior to the first harvest and possibly the previous September irrigation as well. The fall 1976 irrigation (August 30) occurred just 10 days prior to the fourth harvest with a minor increase (0.11 T) in hay production. This final irrigation however, should have a desirable impact on spring vigor and first harvest production in 1977.

Protein determinations have been completed for the 1975 trial. The purpose was to learn whether fertility or water management has an impact on this important quality component. Virtually no differences (Table 34) exist among protein values for any harvest date, but more intensive water management shows a trend for lowered protein values. No consistent trends were evident for fertility treatments.

Conclusions

- (1) Lighter textured soils may have to be deep sampled in order to get a realistic index of fertility status.
- (2) Responses to water management alone appear substantial in 1976.
- (3) Protein changes due to either fertility or water management appear to be insignificant.

Table 34. Protein Values from Fertilizer and Water Management Trial - Butte County (Niiland) - 1975

Water Management	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Percent Protein*				Average	
		Cut	1	2	3		4
Casual	0- 0- 0		17.9	20.4	22.1	17.4	19.5
	0-30- 0		18.5	21.3	22.1	21.7	20.9
	0-30-30		18.8	20.3	21.2	20.0	20.1
	60-30-30		17.3	20.8	22.4	20.7	20.3
	Average		18.1	20.7	22.0	20.0	20.2
Intensive	0- 0- 0		18.3	19.0	20.5	19.6	19.2
	0-60- 0		18.3	18.4	21.0	19.0	19.6
	0-60-60		17.6	19.2	20.0**	19.5	18.8
	60-60-60		18.0	19.6	20.8	18.4	19.7
	Average		18.0	19.0	20.6	19.1	19.3

* Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

** Significantly different (P @ 5%) from the control (casual 0-0-0), by Dunnett's test.

Note: Statistical analyses by Les Tucker, Station Statistician, SDSU.

Variety, Fertilizer, and Water Management Trial - Newell

This trial was on heavy clay soil. Slope is about 2% with considerable side slope, and is typical of the district. The spring of 1975 was extremely cool and wet; as a result, seeding was late. Plots were established on June 6 with farm-size equipment giving plots 27 ft x 100 ft. Irrigation borders were required at 30 foot intervals to control lateral water movement. In August 1975 seedling counts on the plots confirmed some differences in seeding success, but they were not serious.

Water management was split into two components, "casual" and "intensive". Three varieties, Agate (Phytophthora root rot resistant), Thor (a popular Flemish variety), and Vernal (a recommended standard) were subjected to the two water management levels in addition to two levels of fertility, 0-0-0 versus soil test recommendation.

In the seeding year, 1975, irrigation and cutting management was the same for both halves. Early spring 1976 was quite dry so the intensive half was irrigated (May 25). The casual portion was not irrigated at this time. Between the first and second harvests considerable rain fell so neither portion was irrigated. As the third harvest approached, the intensive portion was irrigated (August 24) in order to get late summer regrowth. Both halves were fall irrigated (September 22) to decrease chances of winter kill.

First year results show no significant differences among the three distinctly different alfalfa varieties (Table 35). Phytophthora root rot being a problem in the district might require the trials to span several years in order to show a difference due to root rot resistance. The same might be true for winter hardiness; that is, several years might be required before winter losses are reflected in yield variation among varieties.

Differences exist among the fertility-water management components. Table 35 shows the most intensive management treatment (intensive, 0-90-0) produced more alfalfa than the control (casual, 0-0-0). The intermediate treatments, (casual 0-60-0 and intensive 0-0-0), although not statistically different from the control, show trends for production increases that over the years or even a better year would be different from the control. It is interesting to note that the two intermediate treatments are essentially identical at 3.8 ton/acre. Production differences would likely have been bigger for all treatments, especially the intensive portion, except for hard frost in May. Had it not been for the frost, the yield goal of 5 ton might have been realized.

Table 35. Hay Production from Alfalfa Variety, Fertility, and Water Management Trial on Clay Site - Butte County (Newell) - 1975 Seeding

Water Management	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Variety	Hay Production - 1976 T/A @ 12% Moisture
Casual (3.5 ton projection)	0-0-0	Agate	3.27
		Thor	3.81
		Vernal	3.65
			3.57
	0-60-0	Agate	3.77
		Thor	3.83
		Vernal	3.78
			3.79
Intensive (5.0 ton projection)	0-0-0	Agate	3.78
		Thor	3.68
		Vernal	3.82
			3.76
	0-90-0	Agate	4.25
		Thor	4.30
		Vernal	4.26
			4.27*

* Significantly different (P < 1%) Duncan's test, from the control (casual 0-0-0).

Note: Statistical analyses conducted by Lee Tucker, Station Statistician, SDSU.

Production by cuttings is given in Table 36. In each of the three cuttings, the fertilized portion of both water management halves produced more hay than the unfertilized portion. Also, the May 25 irrigation (intensive, 0-0-0) yielded 0.3 ton/acre increase over casual 0-0-0 in the first cutting. That same irrigation continued to show a yield advantage at the second cutting. For the two cuttings, the yield increase of intensive over casual was nearly 0.5 ton/acre from the single irrigation. The August 24 irrigation decreased yield for the 0-0-0 treatment and apparently prevented a response from the 0-90-0 treatment as well. The only explanation that appeared likely for the decrease was that irrigation lowered soil temperature sufficiently long to retard growth.

Table 36. Hay Production by Cuttings for Alfalfa Variety, Fertility, and Water Management Trial on Clay Site - Butte County (Newell)-1976

Water Management :	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Hay Production in Tons/Acre @ 12% Moisture				
		Cut	1	2	3	Total
Casual	0- 0-0		1.11	1.21	1.14	3.57
	0-60-0		1.23*	1.34	1.25*	3.79
Intensive	0- 0-0		1.42**	1.38*	0.96**	3.76
	0-90-0		1.51**	1.60**	1.16	4.27**

* Significantly different (P=5%) from control (casual 0-0-0) by Dunnett test.

** Significantly different (P=1%) from control (casual 0-0-0) by Dunnett test.

Note: Statistical analyses by Lee Tucker, Station Statistician, SDSU.

Conclusions

- (1) Total production was increased by the most intensive management (intensive 0-90-0) with strong trends for increases from the intermediate treatments.
- (2) First and second harvest production increased from early spring irrigation.
- (3) The August 24 irrigation was responsible for a decrease in production, possibly from lowered soil temperature.
- (4) Reasonably good responses resulted from fertilizer treatments but the 0-90-0 treatment was offset by adverse influence of August 24 irrigation.

Variety, Fertilizer, and Water Management Trial - Arpan and Newell

In the late and cool spring of 1975 two sets of variety-fertility-water management trials were initiated. Both were on clay soils. Plots were seeded on June 5 and 6 with a John Deere double disc press drill in six inch rows. To half of the plots the recommended level of starter fertilizer was applied with the seed. The other half was not fertilized. Rates of fertilizer are shown in Table 37. By late July stands were noticeably poor at Arpan, with differences apparently related to varieties and starter fertilizer treatments. Seedling counts were taken in early August, and for all varieties fertilizer decreased stands. The decrease in stand at Arpan was so severe that several of the plots had to be over-seeded. The overseeding failed and the plots were abandoned in the spring of 1976.

Table 37. Alfalfa Establishment in Variety-Fertility-Water Management Trials Butte County (Newell and Arpan) - Early August 1975

Treatment	Number of Plants per Square Foot			Vernal
	Agate	Cossack	Jacques-80	
<u>Arpen</u>				
No starter fertilizer	18.4	8.7	21.7	8.9
12# N* and 60# P ₂ O ₅	11.7	2.7	8.6	2.2
LSD (.05) - 1.5 plants/square foot				
<u>Newell</u>				
	<u>Agate</u>	<u>Thor</u>	<u>Vernal</u>	
No starter fertilizer	34.0	42.4	29.3	
12# N* and 60# P ₂ O ₅	21.1	16.5	16.8	
LSD (.05) - 1.3 plants/square foot				

* Nitrogen applied in the urea form.

Stand reductions were not as severe at Newell and the plots were maintained without overseeding. Salt levels approach toxic levels at Arpan, so it is reasonable that the additional salt from the fertilizer hurt the stands more than at Newell.

Alfalfa Establishment

In order to determine whether it was nitrogen or phosphorus fertilizer that was responsible for the reduced stands in 1975, a study was initiated in 1976. This study involved three varieties plus the nitrogen and phosphorus factors. The rate of fertilizer, its placement and the seeding rate of the varieties were all controlled. The results are reported in Table 38.

Table 38. Alfalfa Seedling Emergence Trial - Butte County (Arpan) - 1976

Fertilizer	Plants per square foot		
	Agate	Thor	Vernal
0- 0-0	21.2	45.1	33.1
15- 0-0	25.2	19.1	15.4
0- 30-0	41.3	22.4	31.8
15- 30-0	16.2	14.9	13.2
0-120-0	28.2	11.3	16.7
15-120-0	14.4	7.6	7.9

LSD (.05) - 16.4 plants per square foot

The results of the stand counts are quite variable but they indicate that small amounts of phosphorus may be beneficial whereas large amounts might reduce stands quite drastically. The application of nitrogen in the form of urea (46-0-0) in all cases for Thor and Vernal reduced the number of seedlings by 50% or more.

Although the symptoms were not noted in this study, it is known that under limited moisture, seedlings will exhibit a burning or stunted or semi-chlorotic appearance when grown in nitrogen fertilized soil. This situation is created by the ability of the fertilizer to attract the moisture from the soil particles thus also making it unavailable for plant use. As a result the seedlings die from dehydration and lack of light, due to their inability to penetrate the soil surface.

The conclusions at this point would indicate phosphorus fertilizer is of questionable benefit to alfalfa seedlings even if applied at low rates. Nitrogen in a urea form should not be used unless it can be placed away from the seed, is used in small amounts, and that adequate moisture is available during the early seedling stage. Further, Agate appeared to better tolerate high salt levels, followed by Thor and then Vernal.

MANAGEMENT, TILLAGE, AND CULTURAL PRACTICES

Rate of Seeding of Winter and Spring Wheat

Objective: To determine the optimum rate of seeding required for spring wheat in order to produce the highest yield of quality grain.

Two rate of seeding experiments with wheat were conducted in 1976. The experiments involved both spring wheat and winter wheat. The winter wheat plots were located in Fall River and Bennett counties. Only one variety of wheat was used. It was seeded at eight rates which ranged from one to eight pecks per acre. The results are reported in Tables 39 and 40.

Table 39. Winter Wheat Rate of Seeding - Bennett County (Martin) - 1976

Seeding Rate Pounds/Acre	Height (Inches)	Percent* Protein	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
15	33	15.9	58.8	17.4
30	32	15.8	59.2	17.1
45	33	14.2	59.5	16.6
60	33	13.8	56.2	22.2
75	33	12.5	59.7	18.0
90	31	14.0	59.7	26.9
105	31	14.1	59.0	21.4
120	33	13.6	59.5	22.8

LSD (.05) - 5.6 Bu/A

Mean - 19.9

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Experiment was seeded on Sept. 11, 1975. Variety was Scout 66. Row space was 12 inches. Harvested on July 23, 1976 with plot combine. Fallowed soil was dry due to subnormal rainfall.

Table 40. Winter Wheat Rate of Seeding - Fall River County (Oelrichs)-1976

Seeding Rate Pounds/Acre	Percent Stand 4/22/76	Percent* Protein	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
15	4	13.4	58.7	10.8
30	15	12.7	58.5	14.9
45	22	13.8	59.0	19.2
60	50	12.1	59.2	23.0
75	40	12.0	60.3	22.3
90	73	12.5	59.3	28.7
105	50	12.0	60.0	27.5
120	58	11.2	59.0	27.4

LSD (.05) - 8.3 Bu/Acre

Mean - 21.7

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Experiment was seeded on Sept. 10, 1975. Replicated plots (4'x25') were seeded in 12" rows. Harvested on July 27, 1976 with plot combine. Variety was Scout 66. Fallowed soil was extremely dry, cloddy and hard from hail compaction.

The spring wheat study was also conducted at two locations, but it involved both a standard height and a semidwarf variety. Both varieties were seeded at eight different rates. The results are reported in Tables 41 and 42.

Table 41. Hard Red Spring Wheat Rate of Seeding Trial - Bennett County-1976

Variety	Seeding Rate (Lbs/Acre)	Height (Inches)	Percent* Protein	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
WS 1809	15	22	20.4	56.5	10.7
	30	22	20.1	58.5	12.9
	45	21	20.2	58.5	15.0
	60	22	19.7	58.8	14.5
	75	22	20.3	59.2	14.7
	90	22	20.0	60.5	10.2
	105	22	20.2	59.9	12.9
	120	22	19.8	61.1	15.0
					Mean - 13.2
Waldron	15	29	21.3	49.6	16.2
	30	29	21.2	52.9	20.0
	45	22	20.9	56.6	20.7
	60	30	21.1	56.6	25.2
	75	29	21.1	57.6	21.1
	90	28	21.1	56.8	19.2
	105	28	20.9	58.1	20.3
	120	28	20.8	59.0	22.2
					Mean - 20.6

LSD (.05) - 4.2 Bu/Acre

Average - 16.9

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Plots were seeded in fallow on April 14, 1976. Row spacing-8 inches. Soil moisture was adequate in spring. Harvested-July 28, 1976 with plot combine.

Table 42. Hard Red Spring Wheat Rate of Seeding Trial - Meade County-1976

Variety	Seeding Rate (Lbs/Acre)	Height (Inches)	Percent* Protein	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
WS 1809	15	26	17.2	48.3	18.6
	30	26	17.4	50.5	24.0
	45	27	16.4	55.0	27.1
	60	26	16.2	55.3	26.6
	75	26	16.1	56.8	26.4
	90	25	16.1	57.0	29.8
	105	29	16.0	57.3	26.1
	120	26	15.4	58.8	30.2
					Mean - 26.1
Waldron	15	34	18.8	46.3	14.8
	30	34	18.9	47.3	17.9
	45	37	18.0	48.8	18.6
	60	36	16.5	49.7	16.0
	75	33	16.5	54.0	25.1
	90	32	16.5	53.3	21.3
	105	35	17.0	54.7	19.6
	120	37	17.2	53.7	19.8
					Mean - 19.2

LSD (.05) - 6.1 Bu/Acre

Average - 22.7

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Experiment was seeded in fallow on April 21. Row space was 8 inches. Harvested with a combine on Aug. 2. Severe hail damage received in late June.

The results of the winter wheat seeding rate study indicates there is a high point in yield, reached at the 60 pounds per acre level, and another at the 90 pound per acre level.

In Bennett county the yields were quite erratic because of the influence of annual brome grass in the plots. However, the trend indicated that a high point was reached at 60 pounds per acre. This seems to indicate that with the number of plants up to that level, it was possible for tillering to occur. At the next higher (75#/A) rate, a yield decrease occurred, indicating overpopulation from tillering, but a considerable increase occurred at the next (90#/A) level. This would seem to indicate that a heavy initial population had limited tillering but sufficient moisture was available to fill the heads which were present. The upper two levels were again reduced indicating an overpopulation without tillering and inadequate moisture.

In Fall River County the initial stands were very small because of the lack of soil moisture and the seedbed condition. It should be noted (Table 40) that emergence in late April was still much below the desired level. Final populations were much improved, as can be seen by yields in the table. The trend, however, was similar to that in Bennett County except the yield at the various seeding levels showed almost a continuous increase up to the 90 pounds per acre level. Above 90 pounds per acre the yield again decreased.

In the spring wheat studies a situation similar to the winter wheats existed except at the levels where yield was highest. For both varieties there appeared to be one high at 75 pounds per acre and a second somewhere near or above 120 pounds per acre. Both locations produced near similar patterns for WS 1809, the semidwarf variety, except at the 90 pound seeding rate. At that point the Bennett County yield dropped, and was assumed to be the result of annual brome competition. In Meade County, at the 90 pound rate, a high point was reached, followed by a drop at the 105 pound rate and another increase at 120 pounds per acre.

The yields of Waldron, a standard height variety, indicated a consistent pattern at low levels, but at the 60 pound rate, Meade County dropped, while Bennett County reached the top for yield. At the 75 pound level, Meade County reached the top yield while Bennett County showed a declining yield. The yield pattern cannot be explained at this time. However, with additional years of data, it should be possible to establish definite yield curves for the individual varieties tested.

Influence of Fertilizer on Yield of Hard Red Winter Wheat

Objective: To study winter wheat responses to various rates and ratios of fertilizer in a continuous cropping system.

A study was initiated in Jones County in September 1974, and continued in 1975 in which 16 fertilizer ratios under continuous cropping were studied. The treatments consisted of four rates of nitrogen and four rates of phosphorus fertilizers.

The fertilizer was applied as a broadcast application and was incorporated into the soil during tillage operations. Stands were thin with few tillers because

of limited rainfall. The yields reported in Table 43 include the two year average as well as the 1976 yields. It should be noted there was severe drought stress during the entire growing season.

Table 43. Influence of Fertilizer on Grain Yield of Winter Wheat - Jones County (Okaton)

Treatment	Height (Inches)	Percent Protein*	Test Weight (Lbs/Bu)	Grain Yield - Bu/Acre	
				1976	2 Yr Av (75-76)
0- 0-0	19	15.3	61.6	12.9	13.2
0-30-0	20	14.8	61.6	14.4	13.4
0-60-0	19	15.2	62.1	12.2	12.4
0-90-0	18	14.9	61.9	13.5	13.1
30- 0-0	22	16.5	62.2	12.7	13.2
30-30-0	19	16.7	61.9	13.4	14.0
30-60-0	20	16.5	61.4	14.0	14.0
30-90-0	19	17.0	61.5	12.6	14.0
60- 0-0	21	17.6	60.8	12.9	13.2
60-30-0	22	17.6	61.5	15.6	15.2
60-60-0	21	17.8	61.8	14.4	14.4
60-90-0	19	17.8	61.8	12.3	13.0
90- 0-0	21	17.6	61.1	15.3	14.8
90-30-0	22	18.4	60.4	13.2	13.9
90-60-0	21	17.9	61.6	14.5	14.8
90-90-0	21	18.2	61.2	13.8	14.4

LSD (.05) - N.S.

Mean - 13.6 13.8

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Soil test analysis shows O.M.-2.4%, P-13#/A, K-1000#/A, pH-7.6. Fertilizer recommendation for yield of 40 Bu/A - Apply 100#/A of 35-40-0. Seeded on Sept. 15, 1975, plot size-10'x43', harvested July 14, 1976. Extremely dry, thin stand with few tillers.

A statistical analysis of the 1976 data indicates there were no differences because of fertilizer application. None of the treatments have shown an economic increase in yield due to fertilizer application. However, in both years this study has been conducted, the area has received below normal rainfall. Consequently, the plants have not been able to utilize the fertilizer.

Winter Wheat Variety and Fertilizer Studies

Objective: To compare selected winter wheat varieties for their reactions to the addition of nitrogen and phosphorus fertilizers.

Studies were initiated in Bennett and Fall River counties in September 1975. They included five varieties and two levels of nitrogen and phosphorus fertilizer as well as their combination. The results are shown in Tables 44 and 45.

Table 44. Winter Wheat Variety-Fertilizer Study - Bennett County - 1976

Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Height (Inches)	Percent* Protein	Test Weight (lbs/Bu)	Grain Yield (Bu/Acre)
Sage	0- 0-0	33	15.11	60.5	21.1
	15- 0-0	34	15.56	58.8	30.8
	0-15-0	33	17.04	56.2	32.8
	15-15-0	33	17.84	58.0	30.5
Lancer	0- 0-0	33	14.42	60.5	24.1
	15- 0-0	35	17.04	59.2	27.0
	0-15-0	36	16.53	58.7	31.0
	15-15-0	36	16.87	58.8	29.5
Eagle	0- 0-0	30	14.36	61.3	17.9
	15- 0-0	32	17.67	58.2	29.0
	0-15-0	31	17.39	57.7	31.4
	15-15-0	32	17.84	57.7	29.5
Baca	0- 0-0	31	13.68	60.8	15.9
	15- 0-0	35	16.93	57.2	26.4
	0-15-0	35	16.47	57.2	31.1
	15-15-0	36	16.30	56.2	29.8
Gent	0- 0-0	31	13.34	60.8	16.8
	15- 0-0	36	17.24	57.5	30.3
	0-15-0	34	15.96	57.2	28.6
	15-15-0	34	17.16	56.8	27.3

LSD (.05) - 6.2 Bu/A

Mean - 27.0

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Yield data presented are an average of three replications. Fertilizer applied with seed when planted. Row space was 12 inches. Planted on September 11, 1975 and harvested on July 23, 1976.

The study conducted in Bennett County indicated a good response to fertilizer. When either element was added it produced a yield increase. However, when the two fertilizers were mixed the yield in most cases fell between that of a single element. The weights per bushel was greatest for the check plots while the protein content was least. When considering all three factors together (yield, test weight, and protein content) it would appear that fertilizer produced more vigorous plants but by the time the heads were developing they were under moisture stress and produced grain which was lower in bushel weight but higher in protein quantity.

In Fall River County the yield pattern was quite different. Because of the poor seedbed resulting from hail compaction and dry soil, the germination was very low. Evidently the limited soil moisture was absorbed by the fertilizer and restricted germination as indicated by stand counts in April. The small amount of moisture available early in the spring vernalized the seeds and as spring progressed and more moisture was received the stands increased. However, there still is a strong relationship between stands in April and yield at harvest.

Table 45. Winter Wheat Variety-Fertilizer Study - Fall River County - 1976

Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	% Stand 4-22-76	Percent Protein*	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Baca	0- 0-0	18	12.9	59.3	20.4
	15- 0-0	8	12.8	58.0	12.4
	0-15-0	15	11.5	59.0	17.9
	15-15-0	9	10.8	59.0	15.7
Centurk	0- 0-0	24	12.9	59.2	23.0
	15- 0-0	4	12.0	58.2	13.7
	0-15-0	43	11.6	59.7	29.4
	15-15-0	13	11.9	59.2	21.2
Gent	0- 0-0	20	12.6	58.7	22.6
	15- 0-0	9	12.5	57.3	13.4
	0-15-0	47	10.7	58.5	23.5
	15-15-0	12	13.8	57.8	18.5
Lancer	0- 0-0	23	12.0	60.3	19.7
	15- 0-0	4	13.0	58.5	12.9
	0-15-0	8	12.0	59.3	19.1
	15-15-0	4	12.8	57.0	12.5
Sage	0- 0-0	40	12.0	59.0	26.2
	15- 0-0	22	12.9	58.0	15.2
	0-15-0	43	11.9	58.5	27.0
	15-15-0	10	12.6	57.8	18.2

LSD (.05) - 5.6 Bu/Acre

Mean - 19.2

*Protein content was calculated from Kjeldahl analysis and is reported on an oven-dry basis.

Note: Yield data is an average of three replications. Seeded on Sept. 10, 1975 and harvested on July 27, 1976. Row space was 12 inches. Seeding rate was 60 pounds per acre. Soil was extremely dry, cloddy, and compacted due to hail and lack of additional rainfall.

Spring Barley Variety Fertilizer Demonstration

Objective: To determine the optimum rate of fertilizer necessary to obtain maximum yield of grain and change in protein quantity of the grain.

Bennett County

Five varieties of spring barley were seeded at Martin in Bennett County in replicated plots with three rates of nitrogen and two rates of phosphorus fertilizer. The fertilizer was applied as urea and treble superphosphate. Only 10 pounds of the nitrogen and all of the phosphorus was applied with the seed. The remainder of the nitrogen was broadcast on the soil surface after seeding. The results are shown in Tables 46 and 47.

Table 46. Spring Barley Variety Fertilizer Demonstration-Bennett County-1976

Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Height (Inches)	Percent Protein*	Test Weight (lbs/Bu)	Grain Yield (Bu/Acre)
Beacon	0-0-0	22	14.9	45	21.8
	30-30-0	26	14.7	43	25.4
	0-30-0	24	14.6	44	23.2
	60-30-0	22	14.6	44	24.5
	60-0-0	24	15.1	44	20.4
	30-0-0	24	15.4	43	25.8
Larker	0-0-0	26	15.3	47	29.0
	30-30-0	24	15.9	48	23.2
	0-30-0	26	15.9	46	30.4
	60-30-0	24	15.2	46	26.4
	60-0-0	26	16.5	44	28.2
	30-0-0	25	16.0	48	25.4
Larker	0-0-0	22	15.4	47	26.4
	30-30-0	22	14.5	47	25.4
	0-30-0	24	14.4	48	31.8
	60-30-0	22	14.3	48	24.0
	60-0-0	22	15.5	47	28.2
	30-0-0	22	15.4	46	25.9
Prilar	0-0-0	25	15.6	46	22.2
	30-30-0	24	15.8	46	24.5
	0-30-0	22	15.8	44	23.6
	60-30-0	24	16.2	44	24.6
	60-0-0	26	16.0	46	23.6
	30-0-0	22	15.6	45	18.2
Primus II	0-0-0	21	14.8	48	21.4
	30-30-0	22	13.8	49	27.7
	0-30-0	24	13.9	47	30.9
	60-30-0	24	14.6	47	25.9
	60-0-0	23	15.9	45	27.7
	30-0-0	20	13.6	46	13.6

LSD (.05) - N.S.

Mean - 25.1

*Protein quantity was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

The addition of fertilizer had very little effect on the height of the plants. The change was not consistent in all varieties and was undoubtedly restricted because of the shortage of moisture.

Protein content of the grain was increased by the addition of nitrogen. The increases were quite consistent although small. With the addition of phosphorus the content was decreased in three varieties and increased in two. The changes ranged from an increase of 1.7% to a decrease of 1.2%.

Grain yields were quite erratic with differences not large enough to be real. The only fertilizer application which increased yields over the check for all varieties was phosphorus at 30 pounds per acre.

Table 47. Yield Summary of Spring Barley Fertilizer Demonstration - Bennett County (Martin) - 1976

Variety	Fertilizer						Average
	0-0-0	30-0-0	60-0-0	0-30-0	30-30-0	60-30-0	
Beacon	21.8	25.8	20.4	23.2	25.4	24.5	23.5
Larker	29.0	25.4	28.2	30.4	23.2	26.4	27.1
Manker	26.4	25.9	28.2	31.8	25.4	24.0	26.9
Prilar	22.2	18.2	23.6	23.6	24.5	24.6	22.8
Primus II	21.4	18.6	27.7	30.9	27.7	25.9	25.4
Average	24.2	22.8	25.6	28.0	25.2	25.1	25.1

Note: Replicated plots were seeded on April 14 in 8 inch spaced rows. Seeding rate was 72 pounds per acre. All of the phosphorus and some of the nitrogen fertilizer was applied with the seed, the remainder of the nitrogen was broadcast on the surface. Harvesting was completed with a plot combine on July 28.

Ziebach County

Two varieties of spring barley, one acceptable for malting and one feed, were seeded at Dupree in Ziebach County in 1976. Each variety was subjected to two rates of nitrogen and two rates of phosphorus fertilizer, as well as the combination. Agronomic notes were taken, and at harvest samples were collected to determine grain quality. The data is reported in Tables 48 and 49.

Table 48. Spring Barley Variety Fertilizer Demonstration - Ziebach County (Dupree) - 1976

Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Height (Inches)	Percent Protein*	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Beacon	0- 0-0	25	12.1	42	12.7
	15- 0-0	26	12.4	42	12.7
	0-30-0	25	11.6	43	14.2
	15-30-0	26	12.1	44	14.5
Primus II	0- 0-0	23	10.7	47	16.3
	15- 0-0	25	11.7	44	18.2
	0-30-0	22	11.4	47	17.5
	15-30-0	24	11.4	47	22.1

LSD (.05) - 3.8 Bu/A

C.V. - 12%

Mean - 16.0

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

The two varieties responded differently to the fertilizer treatments. In the case of plant height both exhibited an increase for nitrogen but for phosphorus either no change or a slight decrease. A combination of fertilizer resulted in a value similar to nitrogen or between those of nitrogen and phosphorus when applied alone.

For protein content the results were similar to plant height except Primus II had a slight increase for phosphorus alone. The weight per bushel measurements indicated a response to phosphorus by Beacon and an additional response when nitrogen was applied with the phosphorus. Primus II responded only to phosphorus.

Table 49. Spring Barley Variety Fertilizer Demonstration - Ziebach County (Dupree) - 1976

Variety	Fertilizer Treatment				Average
	0-0-0	15-0-0	0-30-0	15-30-0	
Beacon	12.7	12.7	14.2	14.5	13.5
Primus II	16.3	18.2	17.5	22.1	18.5
Average	14.5	15.4	15.8	18.3	16.0

Note: Plots were seeded on April 28, 1976. Seeding rate was 72 pounds per acre. Fertilizer was placed with the seed in 8 inch spaced rows. Harvested on August 5, 1976. Plots were planted in soil which had been in wheat the previous year. Plants were under moisture stress during the entire growing season.

Grain yield increases, although small, indicated Beacon responded to phosphorus but not to nitrogen. Primus II yield was increased by both the addition of nitrogen and phosphorus. It also had a yield increase when the two fertilizers were applied in combination.

Oat Variety Fertilizer Demonstration

Bennett County

Thirteen varieties of oats were seeded in replicated trials in April 1976. Each variety received three levels of nitrogen fertilizer in combination with two levels of phosphate. The demonstration was seeded in fallow with a plot seeder having double disc openers. All phosphorus fertilizer but only 10 pounds of the urea form of nitrogen was applied with the seed. The remainder of the nitrogen, 20 pounds and 50 pounds, was broadcast on the surface after seeding. The yield and other data are reported in Tables 50 and 51.

The yields obtained as a result of the addition of fertilizer do not indicate any trends or patterns. The explanation for this was the lack of precipitation during the growing season. However, in those instances where there was an increase in yield of fertilized over the unfertilized plot, about half were large enough to pay for the fertilizer plus a profit. The other half were not large enough to pay the fertilizer costs. Those increases which seemed to be worth mention were the addition of 30 pounds of phosphorus per acre, and the combination of 30 pounds of phosphorus plus 30 pounds of nitrogen per acre.

Table 50. Oat Variety Fertilizer Demonstration - Bennett County (Martin) - 1976

Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Height Inches	Test Wt Lbs/Bu	Grain Yield Bu/Acre	Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Height Inches	Test Wt Lbs/Bu	Grain Yield Bu/Acre
Astro	0- 0-0	27	36.0	30.7	Froker	0- 0-0	32	38.0	45.6
	30-30-0	26	34.0	29.2		30-30-0	34	36.5	42.2
	0-30-0	26	34.0	49.0		0-30-0	34	36.0	47.6
	60-30-0	25	33.0	32.6		60-30-0	34	36.0	42.2
	60- 0-0	23	33.0	35.4		60- 0-0	34	36.5	23.2
	30- 0-0	24	33.5	42.2		30- 0-0	32	37.5	26.6
Burnett	0- 0-0	31	36.0	32.7	Noble	0- 0-0	28	36.5	36.1
	30-30-0	34	36.2	34.8		30-30-0	28	35.5	44.3
	0-30-0	32	35.5	38.2		0-30-0	24	35.0	36.1
	60-30-0	34	36.0	45.6		60-30-0	27	34.0	31.4
	60- 0-0	35	34.0	35.4		60- 0-0	28	34.5	34.7
	30- 0-0	32	34.0	42.2		30- 0-0	30	35.5	30.6
Chief	0- 0-0	30	35.5	47.0	Nodaway 70	0- 0-0	29	38.0	51.0
	30-30-0	30	35.0	29.3		30-30-0	32	37.0	47.0
	0-30-0	28	33.0	35.4		0-30-0	32	37.5	50.4
	60-30-0	30	33.0	30.6		60-30-0	34	37.5	30.0
	60- 0-0	28	33.0	26.6		60- 0-0	30	38.0	40.8
	30- 0-0	30	33.0	32.7		30- 0-0	30	37.0	40.8
Dal	0- 0-0	32	35.0	34.8	Otee	0- 0-0	28	37.5	38.2
	30-30-0	32	33.5	43.6		30-30-0	29	37.5	31.4
	0-30-0	32	34.5	38.8		0-30-0	27	35.5	35.4
	60-30-0	32	34.5	40.8		60-30-0	28	36.5	27.9
	60- 0-0	32	34.5	27.2		60- 0-0	28	36.0	28.6
	30- 0-0	30	35.5	27.2		30- 0-0	29	37.5	24.5
Diana	0- 0-0	30	36.0	33.4	Stout	0- 0-0	25	35.5	39.5
	30-30-0	30	32.5	47.0		30-30-0	26	33.5	46.4
	0-30-0	30	32.5	47.0		0-30-0	28	35.5	41.6
	60-30-0	28	34.0	45.0		60-30-0	26	34.5	42.2
	60- 0-0	30	33.5	27.9		60- 0-0	26	35.0	36.1
	30- 0-0	30	33.5	31.4		30- 0-0	25	37.0	30.0

(Continued)

(Table 50 Continued)

Spear	0- 0-0	30	34.5	44.2	Wright	0- 0-0	32	38.0	25.8
	30-30-0	30	35.0	40.8		30-30-0	33	38.0	40.2
	0-30-0	31	35.0	53.1		0-30-0	34	36.0	46.3
	60-30-0	28	33.5	34.7		60-30-0	36	38.0	40.2
	60- 0-0	28	34.2	34.8		60- 0-0	33	36.5	40.9
	30- 0-0	30	32.5	45.0		30- 0-0	32	36.0	30.6
Trio	0- 0-0	32	34.5	38.8					
	30-30-0	31	34.5	40.2					
	0-30-0	30	34.5	46.3					
	60-30-0	30	37.0	43.6					
	60- 0-0	27	34.2	35.4					
	30- 0-0	33	33.5	57.2					

LSD (.05) - 21.7 Bu/A

Mean - 38.0

Note: Plots were seeded in fallow on April 14 in 8 inch spaced rows at 64 pounds per acre. Soil moisture was adequate for germination and emergence. Harvesting was completed on July 28 with a self-propelled plot combine.

Table 51. Oat Variety Fertilizer Demonstration - Bennett County (Martin)-1976

Variety	Fertilizer						Average
	0-0-0	30-0-0	0-30-0	30-30-0	60-0-0	60-10-0	
Astro	30.7	42.2	49.0	29.2	35.4	32.6	36.5
Burnett	32.7	42.2	38.2	34.8	35.4	45.6	38.1
Chief	47.0	32.7	35.4	29.3	26.6	30.6	35.6
Dal	34.8	27.2	38.8	43.6	27.2	40.8	35.4
Diana	33.4	31.4	35.4	47.0	27.9	45.0	36.7
Froker	45.6	26.6	47.6	42.2	23.2	42.2	37.9
Noble	36.1	30.6	36.1	44.3	34.7	31.4	35.9
Nodaway 70	51.0	40.8	50.4	47.0	40.8	30.0	43.4
Otee	38.2	24.5	35.4	31.4	28.6	27.9	31.0
Stout	39.5	30.0	41.6	46.4	36.1	42.2	39.3
Spear	44.2	45.0	53.1	40.8	34.8	34.7	42.1
Trio	38.8	57.2	46.3	40.2	35.4	43.6	43.6
Wright	25.8	30.6	46.3	40.2	40.8	40.2	37.4
Average	38.3	36.9	42.6	39.7	32.8	37.4	
Bushels required to pay for fertilizer*		3.5	2.8	6.3	6.9	9.8	

*Estimated prices and costs: Oats per bushel - \$1.60; Nitrogen/pound - \$0.185; Phosphorus/pound - \$0.155.

Ziebach County

Five varieties of oats were seeded in replicated plots near Dupree to study the effects of fertilizer applied at time of seeding. The rate of fertilizer application was based on a soil analysis. The plots were seeded with a plot seeder having double disc openers and an 8 inch row spacing. The fertilizer which was placed with the seed was nitrogen in the urea form and treble superphosphate.

Precipitation was below normal for the entire growing season, except June which received 2.5 inches above the longtime average. However, since the soil had grown a wheat crop in the previous year the moisture was untimely and inadequate. The plants indicated moisture stress during the entire season by their lack of vigor and tillering.

The yield data presented in Tables 52 and 53 show little advantage due to fertilizer application. In this situation with extremely subnormal precipitation there were only two instances where yield increase paid the cost of the fertilizer, and neither increase was statistically significant.

Table 52. Oat Variety Fertilizer Demonstration - Ziebach County (Dupree)

Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Height (Inches)	Percent Protein*	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Burnett	0- 0-0	32	12.9	40	24.9
	15- 0-0	32	13.9	39	24.5
	0-30-0	32	13.0	40	21.3
	15-30-0	32	13.6	37	26.7
Noble	0- 0-0	30	15.2	37	24.0
	15- 0-0	31	13.8	38	26.7
	0-30-0	30	14.0	38	21.8
	15-30-0	30	13.4	37	26.3
Spear	0- 0-0	29	13.6	39	18.6
	15- 0-0	31	13.5	38	20.8
	0-30-0	30	14.4	39	21.3
	15-30-0	30	14.2	37	22.2
Stout	0- 0-0	27	14.5	37	22.2
	15- 0-0	27	14.4	37	21.3
	0-30-0	28	14.8	37	23.1
	15-30-0	31	14.9	39	23.1
Trio	0- 0-0	30	12.4	38	22.2
	15- 0-0	31	12.4	39	23.6
	0-30-0	31	12.6	38	23.1
	15-30-0	32	13.3	38	22.6

LSD (.05) - 4.4 Bu/A

C.V. - 6.9%

Mean - 23.0

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Plots were seeded on April 28, 1976. Seeding rate was 64 pounds per acre. Fertilizer was placed with the seed in 8 inch spaced rows. Harvested on August 5 with a plot combine. Plots were planted in soil which had been in wheat the previous year. Moisture stress was obvious during the entire growing season.

Table 53. Yield Summary of Oat Variety Fertilizer Study - Ziebach County

Variety	Fertilizer Treatment				Average
	0-0-0	15-0-0	0-30-0	15-30-0	
Burnett	24.9	24.5	21.3	26.7	24.4
Noble	24.0	26.7	21.8	26.3	24.7
Spear	18.6	20.8	21.3	22.2	20.7
Stout	22.2	21.3	23.1	23.1	22.4
Trio	22.2	23.6	23.1	22.6	22.9
Average	22.4	23.4	22.1	24.2	23.0

Spring Wheat Fertilizer Demonstrations

Bennett County

Sixteen varieties of hard red spring wheat were included in combination with six fertilizer ratios in a study to determine the optimum fertilizer ratio for the various wheat varieties. They were planted in mid-April on fallowed soil. All of the phosphorus fertilizer was placed with the seed but only 10 pounds per acre of the nitrogen. The remainder of the nitrogen was surface broadcast after seeding. Subnormal rainfall throughout the growing season did not provide adequate moisture so that plants could utilize the fertilizer.

Table 54. Hard Red Spring Wheat Variety Fertilizer Demonstration - Bennett County - 1976

Variety	Fertilizer						Average
	0-0-0	30-0-0	0-30-0	30-30-0	60-0-0	60-30-0	
Bonanza*	24.3	19.2	23.2	27.2	23.2	20.0	22.8
Bounty 208*	24.7	21.8	31.3	24.3	21.4	30.1	25.6
Bounty 309*	28.0	20.7	32.6	29.0	24.0	20.4	25.8
Ellar	29.4	22.2	30.8	21.2	21.4	23.2	26.4
Era*	27.6	32.3	29.4	29.8	23.6	27.6	28.4
Fortuna	23.6	22.5	25.8	25.0	24.0	27.1	24.7
Olaf*	23.2	25.0	21.4	22.2	21.0	19.6	22.1
MP 25*	29.4	23.2	23.5	25.8	30.2	25.4	26.3
Nowesta	21.0	24.4	26.9	21.4	26.5	24.4	24.1
Kitt*	23.2	20.6	27.6	28.0	22.2	27.2	24.8
Prodax*	39.0	28.3	34.1	27.6	22.1	23.6	29.1
Profit 75*	22.9	26.2	28.3	30.2	26.8	25.4	26.6
Protor*	20.0	16.3	25.4	22.5	19.6	21.0	20.8
Tloga	21.1	24.0	22.8	19.2	19.8	22.1	21.5
Waldron	22.1	23.6	28.0	24.4	25.4	19.2	23.8
WS 1809**	18.5	17.1	18.2	14.5	14.9	16.3	16.6
Average	24.9	23.0	26.8	25.1	22.9	23.3	24.3

*Semidwarf type.

The yields reported in Tables 54 and 55 do not indicate any strong trends or patterns. There appears to be some advantage in the use of 30 pounds of phosphorus. There also is indication the ratio 30-30-0 increased the grain yield. However, the yield differences are so small the increase benefit would not pay the fertilizer cost. In most instances the high rate of nitrogen decreased the yield which would indicate the plants ran out of moisture after they reached full growth but before their heads were filled.

Ziebach County

Six varieties of spring wheat were planted in combination with four fertilizer ratios. The varieties selected included three semidwarf and one standard height hard red spring wheats and one durum wheat. The varieties were selected on the basis of their inherent characteristics and adaptability. Fertilizer ratios were based on a soil analysis.

Table 55. Hard Red Spring Wheat Variety Fertilizer Demonstration - Bennett County (Martin) - 1976

Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Percent Protein*	Test Wt Lbs/Bu	Grain Yield Bu/Acre	Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Percent Protein*	Test Wt Lbs/Bu	Grain Yield Bu/Acre
Bonanza	0- 0-0	20.1	54.0	24.3	Nowesta	0- 0-0	19.1	56.5	21.0
	30-30-0	20.0	58.5	27.2		30-30-0	19.0	58.0	21.4
	0-30-0	19.6	58.2	23.2		0-30-0	18.7	56.5	26.9
	60-30-0	20.2	58.5	20.0		60-30-0	19.6	55.0	24.4
	60- 0-0	20.7	54.5	23.2		60- 0-0	19.7	52.2	26.5
	30- 0-0	20.3	55.2	19.2		30- 0-0	19.3	54.0	24.4
Bounty 208	0- 0-0	18.4	59.0	24.7	Kitt	0- 0-0	20.4	48.5	23.2
	30-30-0	18.6	61.0	24.3		30-30-0	20.8	51.5	28.0
	0-30-0	18.0	61.0	31.2		0-30-0	19.0	53.0	27.6
	60-30-0	19.0	59.5	30.1		60-30-0	20.4	53.7	27.2
	60- 0-0	19.0	60.0	21.4		60- 0-0	20.8	47.5	22.2
	30- 0-0	19.4	60.0	21.8		30- 0-0	20.5	51.5	20.6
Bounty 309	0- 0-0	18.9	56.5	28.0	Prodax	0- 0-0	19.4	54.5	39.0
	30-30-0	19.5	57.0	29.0		30-30-0	18.6	58.0	27.6
	0-30-0	17.6	57.5	32.6		0-30-0	17.8	57.7	34.1
	60-30-0	19.7	55.7	20.4		60-30-0	19.5	59.0	23.6
	60- 0-0	19.9	53.5	24.0		60- 0-0	19.8	56.0	22.1
	30- 0-0	19.6	56.0	20.7		30- 0-0	19.3	55.0	28.3
Eller	0- 0-0	19.6	52.0	29.4	Profit 75	0- 0-0	19.3	59.5	22.9
	30-30-0	19.6	54.5	31.2		30-30-0	18.3	59.2	30.2
	0-30-0	19.1	54.7	30.8		0-30-0	18.6	60.0	28.3
	60-30-0	20.5	56.5	23.2		60-30-0	18.8	61.0	25.4
	60- 0-0	20.4	53.0	21.4		60- 0-0	19.0	59.0	26.8
	30- 0-0	20.2	54.5	22.2		30- 0-0	18.9	59.0	26.2
Era	0- 0-0	16.6	52.5	27.6	Protor	0- 0-0	20.5	59.5	20.0
	30-30-0	18.5	54.0	29.8		30-30-0	20.5	59.5	22.5
	0-30-0	17.4	53.5	29.4		0-30-0	20.1	60.5	25.4
	60-30-0	19.3	56.5	27.6		60-30-0	20.1	59.5	21.0
	60- 0-0	19.8	53.0	23.6		60- 0-0	20.1	58.7	19.6
	30- 0-0	19.4	53.0	32.3		30- 0-0	20.5	59.0	16.3

(Continued)

(Table 55 Continued)

Fortuna	0- 0-0	17.3	57.0	23.6	Tioga	0- 0-0	19.2	57.5	21.1
	30-30-0	17.4	57.2	25.0		30-30-0	19.4	58.2	19.2
	0-30-0	17.6	58.5	25.8		0-30-0	17.9	58.5	22.8
	60-30-0	17.8	58.5	27.2		60-30-0	19.3	56.7	22.1
	60- 0-0	18.9	56.0	24.0		60- 0-0	19.7	56.0	19.8
	30- 0-0	18.7	57.5	22.5		30- 0-0	20.3	55.5	24.0
Olaf	0- 0-0	18.4	52.5	23.2	Waldron	0- 0-0	19.3	56.7	22.1
	30-30-0	18.9	55.5	22.2		30-30-0	19.2	57.0	24.4
	0-30-0	18.6	55.8	21.4		0-30-0	18.1	57.2	28.0
	60-30-0	19.4	54.0	19.6		60-30-0	19.9	58.0	19.2
	60- 0-0	20.6	52.0	21.0		60- 0-0	20.3	54.5	25.4
	30- 0-0	20.0	48.5	25.0		30- 0-0	20.9	55.0	23.6
MP 25	0- 0-0	17.7	60.2	29.4	WS 1809	0- 0-0	19.3	57.7	18.5
	30-30-0	19.2	60.5	25.8		30-30-0	19.0	59.0	14.5
	0-30-0	17.9	60.0	23.6		0-30-0	19.2	60.2	18.2
	60-30-0	19.0	58.2	25.4		60-30-0	19.2	59.0	16.3
	60- 0-0	18.5	59.0	30.2		60- 0-0	19.2	60.2	14.9
	30- 0-0	19.2	58.2	23.2		30- 0-0	19.0	60.2	17.1

LSD (.05) - 8.8 Bu/A

Mean - 24.2

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Plots were seeded in fallow on April 14 in 8 inch spaced rows at 60 pounds per acre. Soil moisture was adequate for germination and emergence. Harvesting was completed on July 28 with a self-propelled plot combine.

Table 56. Spring Wheat Variety Fertilizer Demonstration - Ziebach County - 1976

Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Height (Inches)	Percent Protein*	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Bounty 208	0- 0-0	20	15.4	60	14.8
	15- 0-0	22	15.0	58	13.8
	0-30-0	21	15.4	60	15.0
	15-30-0	22	15.2	60	16.9
Olaf	0- 0-0	25	16.1	58	14.0
	15- 0-0	24	17.2	54	11.8
	0-30-0	24	15.6	59	11.8
	15-30-0	25	16.5	57	13.5
Protor	0- 0-0	22	15.4	58	12.8
	15- 0-0	24	16.4	57	14.0
	0-30-0	23	15.8	58	14.5
	15-30-0	23	15.3	57	14.2
Waldron	0- 0-0	28	16.9	58	16.0
	15- 0-0	28	16.8	57	14.8
	0-30-0	29	16.4	58	15.0
	15-30-0	29	16.1	57	15.2
WS 1809	0- 0-0	22	14.7	57	13.3
	15- 0-0	22	14.7	57	14.5
	0-30-0	22	14.8	58	15.0
	15-30-0	22	15.6	58	15.4
Rolette	0- 0-0	28	14.8	60	15.0
	15- 0-0	28	15.8	60	15.5
	0-30-0	27	14.6	61	15.2
	15-30-0	29	16.2	60	15.2

LSD (.05) - 2.6 Bu/A

Mean - 14.5

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Plots were seeded on April 28, 1976. Seeding rate was 60 pounds per acre. Fertilizer was placed with the seed in 8 inch spaced rows. Harvested on August 5 with a plot combine. Soil had been in wheat the previous year. Moisture stress was visible during the entire growing season.

Table 57. Yield Summary of Spring Wheat Fertilizer Study-Ziebach County

Variety	Fertilizer Treatment				Average
	0-0-0	15-0-0	0-30-0	15-30-0	
Bounty 208	14.8	13.8	15.0	16.9	15.1
Olaf	14.0	11.8	11.8	13.5	12.8
Protor	12.8	14.0	14.5	14.2	13.9
Waldron	16.0	14.8	15.0	15.2	15.3
WS 1809	13.3	14.5	15.0	15.4	14.6
Rolette	15.0	15.5	15.2	15.2	15.2
Average	14.3	14.1	14.4	15.1	14.5

The data reported in Tables 56 and 57 indicate differences between varieties are greater than the differences between fertilizer treatments. Protein content was increased in three of the varieties by addition of nitrogen fertilizer, and in another by the combination of nitrogen and phosphorus, and in the case of the durum by both nitrogen, and nitrogen plus phosphorus.

Weight per bushel measurements indicated a decrease by the addition of nitrogen, and when compared with certain varieties had a direct relationship with lower test weight and higher protein content which is typical of drought stress. Yield differences were not significant but with three varieties the addition of fertilizer decreased yields which indicates larger plants that run out of water before they complete filling of their heads.

Durum Wheat Fertilizer Demonstration

Bennett County

Seven varieties of durum wheat with six fertilizer combinations containing various levels of nitrogen and phosphorus were compared to determine the optimum fertilizer ratio for each variety. The study was located on fallowed soil and seeded in mid-April with a double disc opener type plot seeder. All of the phosphorus fertilizer was placed with the seed but only 10 pounds per acre of the nitrogen fertilizer. The remainder of the nitrogen was surface broadcast after seeding. Subnormal rainfall throughout the growing season did not provide adequate moisture so that plants could utilize the fertilizer. The results are presented in Tables 58 and 59.

Table 58. Yield Summary of Durum Wheat Variety Fertilizer Study - Bennett County (Martin) - 1976

Variety	Fertilizer						Average
	0-0-0	30-0-0	0-30-0	30-30-0	60-0-0	60-30-0	
Botno	36.0	29.0	31.6	21.0	19.6	23.6	26.8
Crosby	17.4	20.0	27.9	24.3	27.2	21.4	23.0
Hondo	24.4	21.4	26.5	28.0	23.6	21.1	24.1
Leeds	24.7	23.6	30.1	24.2	20.0	26.8	25.4
Rolette	22.8	24.7	24.0	25.8	24.7	17.0	23.2
Rugby	23.6	19.2	28.3	25.0	21.0	29.4	24.4
Ward	32.0	30.4	26.5	24.3	23.2	27.6	27.3
Average	25.8	24.0	26.0	25.1	22.8	23.9	24.9

Addition of fertilizer to the durum wheat varieties did not alter plant height in a recognizable pattern. Slight increases in height were present when phosphorus alone was applied but it was not consistent for all varieties. When nitrogen was applied at 60 pounds per acre there was a noticeable decrease in test weight which was consistent for all varieties. There was an increase in test weight for certain varieties due to the addition of phosphorus.

Grain yields were increased by the addition of phosphorus fertilizer in five of the seven varieties. There was also an additional increase by two varieties when they were fertilized with 30-30-0. However, none of the yield increases were large enough to pay the fertilizer cost, nor were any differences statistically significant.

Table 59. Durum Wheat Variety Fertilizer Demonstration - Bennett County (Martin) - 1976

Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Height (Inches)	Test Wt Lbs/Bu	Grain Yield Bu/Acre	Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Height Inches	Test Wt Lbs/Bu	Grain Yield Bu/Acre
Hokna	0- 0-0	29	61.0	36.0	Rolette	0- 0-0	29	61.0	22.8
	30-30-0	26	59.0	21.0		30-30-0	29	61.7	25.8
	0-30-0	28	61.0	31.6		0-30-0	28	62.0	24.0
	60-30-0	30	60.0	23.6		60-30-0	24	60.0	17.0
	60- 0-0	30	59.0	19.6		60- 0-0	30	60.0	24.7
	30- 0-0	28	60.0	29.0		30- 0-0	26	61.5	24.7
Crosby	0- 0-0	28	61.0	17.4	Rugby	0- 0-0	30	57.5	23.6
	30-30-0	29	60.0	24.3		30-30-0	29	60.5	25.0
	0-30-0	27	60.0	27.9		0-30-0	30	59.5	28.3
	60-30-0	29	59.5	21.4		60-30-0	30	58.7	29.4
	60- 0-0	32	59.5	27.2		60- 0-0	30	55.7	21.0
	30- 0-0	30	60.0	20.0		30- 0-0	30	59.0	19.2
Hondo	0- 0-0	23	59.5	24.4	Ward	0- 0-0	28	61.5	32.0
	30-30-0	26	59.0	28.0		30-30-0	32	59.0	24.3
	0-30-0	23	60.5	26.5		0-30-0	28	61.0	26.5
	60-30-0	24	58.5	21.1		60-30-0	28	60.0	27.6
	60- 0-0	23	55.5	23.6		60- 0-0	30	58.0	23.2
	30- 0-0	24	58.2	21.4		30- 0-0	31	60.5	30.4
Leeds	0- 0-0	28	61.0	24.7					
	30-30-0	30	61.0	24.2					
	0-30-0	29	60.5	30.1					
	60-30-0	32	61.5	26.8					
	60- 0-0	30	58.0	20.0					
	30- 0-0	30	60.0	23.6					

LSD (.05) - U.S.

Mean - 24.9

Note: Plots were seeded in fallow on April 14 in 8 inch spaced rows at 60 pounds per acre. Soil moisture was adequate for germination and emergence. Harvesting was completed on July 28 with a self-propelled plot combine.

Flax Fertilizer Demonstration

Ziebach County

Only one variety of flax was used to study fertilizer effects. It was seeded on April 28 at the rate of 56 pounds per acre. Fertilizer was placed with the seed in 8 inch spaced rows. The study was harvested on August 5 with a self-propelled plot combine. The land had been in wheat the previous year which contributed to the moisture stress which was visible during the entire growing season.

Table 60. Flax Variety Fertilizer Demonstration - Ziebach County - 1976

Variety	Fert-Lbs/A N-P ₂ O ₅ -K ₂ O	Height (Inches)	Percent Protein*	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Culbert	0- 0-0	18	21.6	55	11.9
	15- 0-0	18	22.4	54	11.4
	0-30-0	19	21.6	55	10.1
	15-30-0	19	22.7	53	11.1

LSD (.05) - N.S.

Mean - 11.1

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Fertilizer application to flax caused very small changes. The addition of nitrogen did not alter plant height but the addition of phosphorus increased it by one inch. Protein content of the seed was increased by the addition of nitrogen but not by phosphorus. Test weights were decreased by the addition of nitrogen while phosphorus had no effect. Yield differences were small and with all treatments were less than the untreated plots. As with the other crops, lack of moisture was so critical the plants were not able to utilize the fertilizer properly.

CROP DISEASE CONTROL

Effects of a Seed Treatment on Hard Red Spring Wheat

Four varieties of spring wheat were grown at two locations after treating their seed with four levels of a biological organism, Beauveria uniflagellatus. The treatments within and between the varieties were compared for agronomic changes as well as incidence of disease.

The agronomic data (Tables 61 and 62) and statistical analysis indicate no significant effects were caused by the application of the organism as a seed treatment.

Table 61. Effect of a Biological Organism, Bacillus subtilis, on Yield and Other Agronomic Characteristics of Four Varieties of HRS Wheat Bennett County (Martin) - 1976

Variety	Treatment Rate	Height (Inches)	Percent Protein*	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Bounty 208	Check	20	18.0	61.0	21.7
	1 gm/kg	20	17.7	61.6	20.9
	2 gm/kg	20	18.0	64.4	22.0
	3 gm/kg	19	17.2	61.6	23.8
Profit 75	Check	23	17.4	59.7	23.0
	1 gm/kg	22	17.6	60.2	21.8
	2 gm/kg	22	17.5	60.3	21.5
	3 gm/kg	20	18.2	59.9	21.9
Protor	Check	21	18.3	60.0	18.8
	1 gm/kg	21	19.7	59.8	19.7
	2 gm/kg	21	19.7	59.9	19.4
	3 gm/kg	22	19.6	59.9	20.0
WS 1809	Check	22	18.9	59.6	19.0
	1 gm/kg	22	19.0	58.7	20.8
	2 gm/kg	22	18.6	59.0	19.4
	3 gm/kg	22	18.9	59.8	20.1

LSD (.05) - 5.2 Bu/A

Mean - 20.8

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Replicated plots were seeded in fallow on April 14. Plots were 4'x25' with 8 inch spaced rows. Seeding rate was 60 pounds per acre. They were harvested on July 28 with a plot combine. Precipitation was below normal for all months except April.

Only minor differences were found in the bacillus treated spring wheat plots in Bennett County. The changes in plant height were primarily decreases, but the changes were only an inch. In protein content three of the four varieties indicated an increase in the treated plots. The changes ranged from a decrease of 0.5% to an increase of 1.4%, and was not an additive increase. The increase appears as the presence of the bacillus and is not related to quantity of bacillus.

Weights per bushel were increased in only two of the varieties, and as with the protein quantity, the increase or decrease in weight was not a relation with the bacillus quantity but only as presence or absence. Grain yields were increased in three of the four varieties with no relationship with quantity of bacillus.

The relationship of the bacillus with the four varieties being studied indicate no definite changes occur. There are small alterations in a characteristic and may be positive or negative. However, the character which seems to be of major significance appears to be the increase in protein quantity.

Table 62. Effect of a Biological Organism, Bacillus uniflagellatus, on Yield and Other Agronomic Characteristics of Four Varieties of HRS Wheat - Meade County (Alkali) - 1976

Variety	Treatment Rate	Height (Inches)	Percent Protein*	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Bounty 208	Check	26	15.0	60.8	28.9
	1 gm/kg	25	15.0	60.6	27.0
	2 gm/kg	26	15.3	60.1	30.1
	3 gm/kg	26	15.6	62.0	29.9
Profit 75	Check	28	14.2	56.5	28.3
	1 gm/kg	29	15.2	57.8	29.3
	2 gm/kg	28	14.6	57.2	31.6
	3 gm/kg	28	14.5	57.4	30.5
Protor	Check	28	15.0	59.5	25.8
	1 gm/kg	28	14.4	59.8	28.7
	2 gm/kg	28	15.2	59.5	28.7
	3 gm/kg	27	15.0	60.2	28.3
WS 1809	Check	26	15.4	58.1	26.9
	1 gm/kg	26	15.2	58.8	31.6
	2 gm/kg	25	15.7	58.2	26.1
	3 gm/kg	28	16.1	58.0	29.8

LSD (.05) - N.S.

Mean - 28.8

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Replicated plots were seeded on April 21. Rate of seeding was 60 pounds per acre in 8 inch spaced rows. Severe hail damage was received on July 1 which resulted in culm damage and lodging. Harvest was completed on August 2.

In Meade County the four varieties reacted similar to the Bennett County study. Plant height differences were limited to one inch in nearly all plots without reason for the change. Protein quantity was increased in nearly all plots where treatment was applied to the seed. The changes were small with the maximum being 0.7%. In only one instance, Protor treated at 1 gm/kg, was the protein content below the untreated plot. Weights per bushel were increased by seed treatment in all cases except two; however, all differences were so small they could not be considered real. Grain yields were increased in all but two treatments. In this case the increases were much larger than the decreases. It would seem the changes that occurred in 1976, although small, indicate a trend which merit further investigation under more normal rainfall conditions.

Effects of Seed Treatment for Control of Wheat Streak Mosaic in Ten Varieties of Hard Red Winter Wheat

Ten varieties of hard red winter wheat were seeded in two locations in paired plots with two levels of seed treatment. The varieties had been selected on the basis of their resistance to the wheat streak mosaic virus. Because prior research indicated a possible control mechanism for the virus the seed was treated with a dust containing Bacillus uniflagellatus. The results of the experiment are reported in Tables 63 and 64.

Table 63. Effects of a Biological Organism, *Bacillus uniflagellatus*, on Yield and Other Agronomic Characteristics of Four Varieties of Hard Red Winter Wheat - Bennett County (Martin) - 1976

Variety	Seed Treatment	Height (Inches)	Test Weight (Lbs/Bu)	Grain Yield (Bu/Acre)
Centurk	Check	30	59.5	28.1
	Treated	29	59.3	29.4
Eagle	Check	28	59.7	23.0
	Treated	29	60.2	24.2
Gent	Check	34	60.0	25.7
	Treated	29	59.5	25.8
Homestead	Check	26	59.2	22.6
	Treated	26	59.2	22.2
Lancer	Check	31	60.7	25.6
	Treated	29	60.3	28.0
Sage	Check	29	59.8	24.0
	Treated	29	60.3	25.1
Scout 66	Check	29	60.3	28.0
	Treated	29	61.2	27.9
Scoutland	Check	30	60.7	24.2
	Treated	29	60.5	24.0
Synthetic	Check	30	60.0	26.4
	Treated	29	59.5	24.2
TAM 101	Check	26	60.2	27.4
	Treated	26	59.8	26.8

LSD (.05) - 2.4 Bu/A

Mean - 25.6

Note: Replicated plots were seeded on Sept. 11, 1975 and harvested on July 23, 1976. Seeding rate was 60 pounds per acre. Fallow soil was dry due to below normal precipitation.

The results of the two trials, Bennett and Meade counties, do not show reactions the same in both locations. There are no similar reactions in yield except for the variety Sage. At both locations there was a increase which was about the same magnitude.

The only positive results was for the stand counts made in April 1976. In all varieties there was a definite increase in stand. This indicates there was more vigorous seedlings established in the fall in the treated plots. However, later observations indicated stands much higher than shown in Table 64 but they were not documented.

Grain yields for individual varieties at Martin (Table 63) indicated if there was a positive effect the increase was larger than those where a negative effect was seen. At Alkali the differences (Table 64) were similar regardless whether they were positive or negative.

Table 64. Effects of a Biological Organism, Bacillus uniflagellatus, on Yield and Other Agronomic Characteristics of Four Varieties of Hard Red-Winter Wheat - Meade County (Alkali) - 1976

Variety	Seed Treatment	% Stand* (4-8-76)	Height (Inches)	Percent Protein**	Test Weight (Lbs/Bu)	Yield Bu/A
Centurk	Check	14.4	31	9.9	61.5	36.6
	Treated	16.9	31	11.5	61.5	34.7
Eagle	Check	9.2	39	11.5	61.9	29.3
	Treated	24.4	31	11.3	61.7	27.8
Gent	Check	19.6	33	12.8	60.3	28.1
	Treated	28.4	34	12.3	61.3	27.9
Homestead	Check	12.2	29	12.4	62.1	26.2
	Treated	16.0	28	12.5	61.6	26.9
Lancer	Check	13.7	32	11.2	62.6	29.4
	Treated	30.5	33	11.0	61.8	28.2
Sage	Check	24.3	33	11.6	61.4	25.4
	Treated	25.8	34	11.6	61.2	28.0
Scout 66	Check	7.6	34	10.9	61.5	30.4
	Treated	11.2	32	11.5	61.3	28.0
Scoutland	Check	9.4	30	11.6	61.8	24.6
	Treated	14.0	30	11.9	61.8	23.5
Synthetic	Check	3.5	33	11.9	62.5	28.0
	Treated	13.8	32	12.3	61.8	29.7
TAM 101	Check	12.1	26	12.9	61.7	30.1
	Treated	22.8	27	12.9	60.9	27.9

LSD (.05) - 2.9 Bu/A

Mean - 28.5

*Multiple counts per plot were made by farmer cooperator.

**Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Replicated plots were seeded on Sept. 17, 1975 in 12 inch spaced rows. Dry soil resulting in poor germination and emergence was subjected to wind erosion during the winter. Hail damage was inflicted on July 1 resulting in head loss and some lodging. Harvesting was completed on August 3, 1976.

Effects of Date of Seeding and Seed Treatment on Hard Red Winter Wheat

A study at two locations in western South Dakota was continued in 1976. It involved two varieties of winter wheat (Bronze and Winoka) planted at two dates (Aug. 20 and Sept. 20) in which comparison was made between plots which were treated at two rates with a non-pathogenic bacteria Bacillus uniflagellatus believed to influence the adverse effects of WSMV in wheat. The results of the study are shown in Tables 65 and 66.

Table 65. Effects of Seed Treatment, Bacillus ~~uniflagellatus~~, and Date of Planting on the Agronomic and Other Characteristics of Hard Red Winter Wheat - Bennett County (Martin) - 1976

Variety	Seeding Date	Seed Treatment	Height (Inches)	Percent Protein*	Test Wt (Lbs/Bu)	Yield Bu/A
Bronze	Early	Check	32	16.9	57.0	23.6
		Treated	30	16.9	57.6	24.2
	Late	Check	35	17.9	58.4	35.9
		Treated	35	16.5	58.5	35.5
Winoka	Early	Check	34	16.2	60.0	29.2
		Treated	34	16.3	60.4	29.9
	Late	Check	36	16.3	61.0	39.1
		Treated	34	16.3	61.3	37.4

LSD (.05) - 2.9 Bu/A

Mean - 31.8

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Replicated plots were seeded with a deep furrow seeder in 12 inch rows. Early seeded plots were slow to emerge because of shortage of soil moisture. Subnormal moisture was experienced during entire spring. Harvest was completed on July 23, 1976.

Table 66. Effects of Seed Treatment, Bacillus ~~uniflagellatus~~, and Date of Planting on the Agronomic and Other Characteristics of Hard Red Winter Wheat - Meade County (Alkali) - 1976

Variety	Seeding Date	Seed Treatment	% Stand 5-13-76	Height (Inches)	Percent Protein*	Test Wt Lbs/Bu	Yield Bu/A
Bronze	Early	Check	76.2	32	11.6	61.2	23.5
		Treated	80.0	32	11.7	61.1	23.8
	Late	Check	65.0	32	11.9	60.6	24.3
		Treated	60.3	32	11.6	60.8	22.9
Winoka	Early	Check	72.5	35	11.9	62.5	20.7
		Treated	73.3	35	11.9	62.2	22.9
	Late	Check	76.7	34	11.8	62.7	28.0
		Treated	63.3	35	12.0	62.5	27.8

LSD (.05) - 5.2 Bu/A

Mean - 24.5

*Protein content was calculated from Kjeldahl nitrogen analysis and is reported on an oven-dry basis.

Note: Plots were seeded with a deep furrow plot seeder into dry soil which resulted in spotty emergence. Lack of ground cover also resulted in soil erosion during the early spring. Plants were broken over by hail damage on July 1, 1976. Harvested on August 3, 1976.

In 1976 WSMV did not develop in sufficient amounts to give a valid test on the effects of the bacteria on WSMV development or on the yields of wheat.

Although treatment of winter wheat seed with Bacillus uniflagellatus did not cause large changes in grain yield, it did create a trend visible at both locations. In comparing yields between treated and untreated plots, one will note there was a small increase because of treatment in all of the early planted wheat. Conversely, in all late planted wheat, treatment resulted in a small decrease in yield. It should be noted that in Meade County wheat stands had a direct relationship on yield. Consequently, there appears to be a beneficial effect resulting in better stand of early planted wheat, which ultimately resulted in higher yield. The inverse effect on late planted wheat results in fewer plants or thinner stand and lower yields. The nature of this reaction will require additional study.



