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Plant Science Pamphlet #62-3 December 1991

WEST RIVER AGRICULTURAL RESEARCH AND EXTENSION CENTER
CROPS AND SOILS RESEARCH

Rapid City, South Dakota

Meade County

Introduction

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

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

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

FIELD PLOT COOPERATORS

Name	Address	County
Don Brown	Scenic 57780	Custer
Gary Hawks	Plainview 57771	Meade
Tim Komes	Sturgis 57785	Meade
Don Hackens	New Underwood 57761	Pennington
Martin Printz	New Underwood 57761	Pennington

This is an annual report and results published herein are therefore neither complete nor conclusive. 50 copies printed at an estimated cost of $1.17 each.

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Acknowledgements

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Research was conducted by H. A. Geise-Research Agronomist, C. E. Stymiest-Extension Agronomist, and in conjunction with F. A. Cholick, J. L. Gellner, D. L. Reeves, J. J. Bonnemann, R. J. Pollman, J. Ingemansen, and R. G. Hall.

This publication was written and edited by Harry A. Geise, Ass't Professor.

Weather Summary

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

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

Month & Year		Average Temperature*	Departure from Normal**	Total Precipitation*	Departure from Normal**
Bear Butte Valley (Ft. Meade-Meade County Reporting Station)***					
Aug.	1990	73.6	1.9	0.95	-0.77
Sept.	1990	66.9	5.3	0.63	-0.56
Oct.	1990	49.9	-1.0	0.61	-0.43
Nov.	1990	41.5	5.6	0.62	-0.08
Dec.	1990	30.3	-7.8	0.50	-0.06
Jan.	1991	20.2	-2.6	0.34	-0.13
Feb.	1991	37.9	10.0	1.22	0.50
Mar.	1991	38.8	5.2	1.31	0.29
Apr.	1991	46.6	-1.1	3.96	1.55
May	1991	57.6	1.2	6.78	3.47
June	1991	67.6	1.8	3.86	0.05
July	1991	73.6	0.6	1.58	-0.65

Table 1. (Continued)

Month & Year		Average Temperature*	Departure from Normal**	Total Precipitation*	Departure from Normal**
Plainview (Meade County Reporting Point)***					
Aug.	1990	75.0	1.6	0.32	-1.23
Sept.	1990	67.2	8.0	0.67	0.48
Oct.	1990	47.5	-0.2	0.34	-1.48
Nov.	1990	37.3	5.1	Tr	-0.50
Dec.	1990	14.2	-4.9	0.38	0.08
Jan.	1991	14.2	-3.0	0.17	0.02
Feb.	1991	32.0	7.7	0.94	0.46
Mar.	1991	37.3	3.6	0.70	-0.63
Apr.	1991	47.3	1.0	2.23	0.65
May	1991	58.0	-0.6	4.16	1.77
June	1991	69.2	1.4	3.13	0.51
July	1991	M	M	0.73	-1.41
Rapid City Airport (Pennington County Reporting Station)					
Aug.	1990	73.8	2.4	1.87	0.43
Sept.	1990	65.9	5.0	2.44	1.41
Oct.	1990	48.2	-1.5	0.61	-0.20
Nov.	1990	40.5	5.6	0.44	-0.07
Dec.	1990	17.8	-8.3	0.33	-0.12
Jan.	1991	18.4	-2.4	0.32	-0.10
Feb.	1991	36.0	10.0	0.77	0.15
Mar.	1991	38.5	5.9	0.63	-0.39
Apr.	1991	46.3	1.7	2.99	1.03
May	1991	56.6	1.0	4.40	1.77
June	1991	67.2	2.0	3.27	0.01
July	1991	72.9	0.3	1.97	-0.15

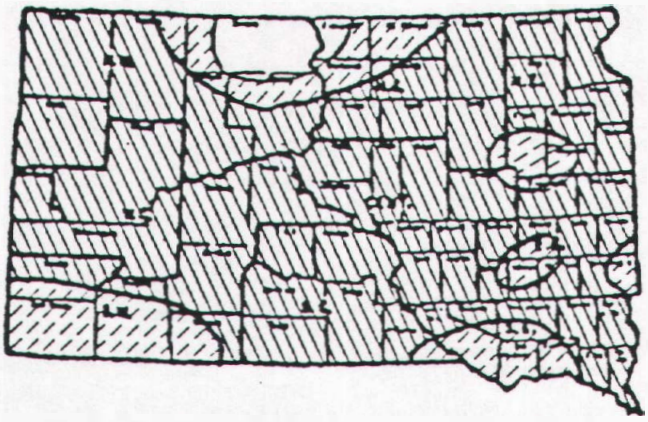
*Average temperatures and precipitation obtained from NOAA Climatological Data from reporting station nearest the experimental sites. Temperatures are reported in degrees Fahrenheit and precipitation in inches.

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

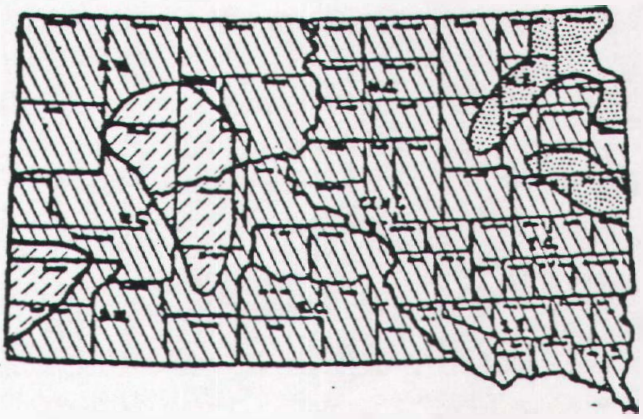
***Departures are based on records for 1977-1987 at specific location.

Table 2. Topsoil Moisture Conditions During Growing Season, May-September 1991. (Crop and Livestock Reporting Service-USDA)

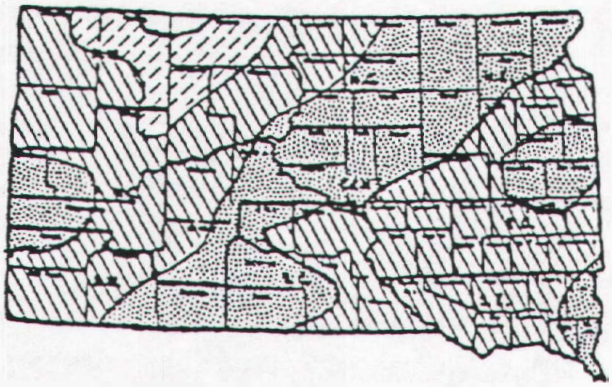
As of Friday April 12, 1991



As of Friday May 10, 1991



As of Friday June 14, 1991



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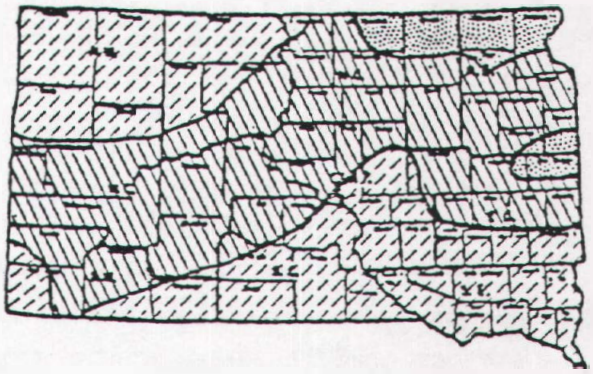
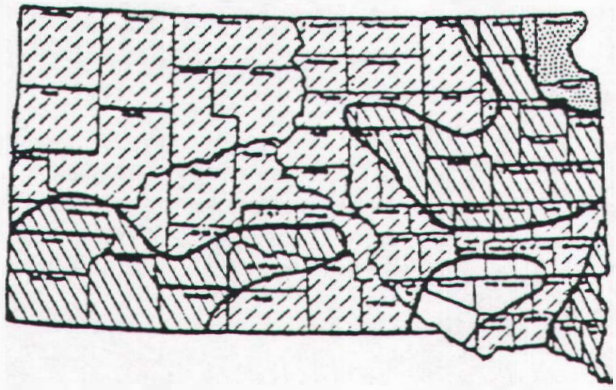


As of Friday August 16, 1991



As of Friday September 13, 1991

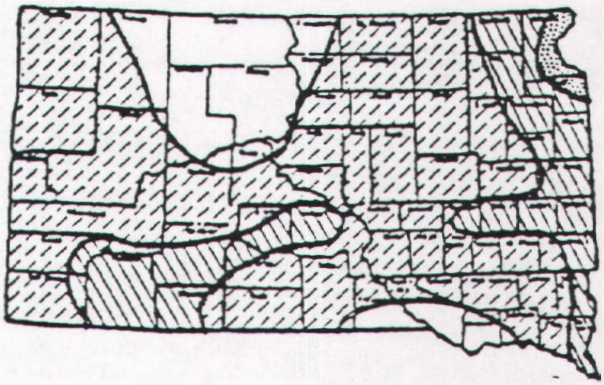


TABLE 3. Weather Data - Date of Critical Temperatures and Total Usable-Precipitation in Counties with Experimental Plots, (1990-1991).

Location	Date of Temperature*		Total Usable Moisture**	
	Fall-First	Spring-Last	Aug 90-July 91	April 91-July 91
Meade County (Ft. Meade)	Oct. 7 (27°)	May 3 (28°)	14.15	11.72
Meade County (Plainview)	Oct. 7 (27°)	May 6 (27°)	6.62	5.34
Pennington County (Rapid City AP)	Oct. 7 (26°)	May 6 (28°)	11.78	8.73

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

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

SMALL GRAIN VARIETY TRIALS

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

Hard Red Winter Wheat

Trials and demonstrations were located in Meade and Pennington Counties. The trial plots were seeded with a deep furrow seeder with fertilizer attachment. The seeding rate was 60 pounds per acre. The plots were harvested with a Hege, Model 125B, self-propelled plot combine. Machine harvested plots contained a minimum of 125 square feet per sample. All samples were weighed for plot yield and bushel weight at the harvest site.

TABLE 4. Hard Red Winter Wheat Variety Trial - Meade County(Bear Butte), 1989-91.

Variety	Percent Stand 11/90	Percent Stand 5/91	Height Inches	Date of Heading	Percent Protein*	Test Wt (Lbs/Bu)	Grain Yield-Bu/A 1991	Grain Yield-Bu/A (3 yr av)
Karl	50	68	36	June 2	12.7	61.3	51.2	--
Arapahoe	41	63	37	June 4	12.8	58.0	48.8	42.7
TAM 107	39	69	34	May 31	11.6	58.5	46.7	40.9
Sage	55	76	42	June 1	13.0	62.1	45.4	40.0
SD 88185	28	53	41	June 5	11.9	60.4	44.4	--
Bronco	31	53	34	June 4	12.0	57.8	43.9	--
Siouxland	60	66	40	June 4	11.5	56.5	43.8	39.6
SD 87143	50	66	40	June 5	11.9	59.8	43.2	--
SD 88191	35	48	33	June 7	12.7	56.3	42.8	--
Scout 66	53	63	44	June 1	--	61.4	42.5	36.4
Rio-Blanco	40	56	32	June 4	13.6	56.9	42.3	--
Rose	55	75	44	June 8	14.1	58.3	42.2	35.4
Thunderbird	55	73	38	June 4	14.6	58.8	41.7	37.4
TAM 200	36	45	33	June 4	11.7	61.0	41.6	39.3
Redland	30	59	36	June 7	14.1	55.4	41.6	36.5
Quantum 562	46	56	36	June 4	14.2	55.4	41.5	38.2
SD 88253	51	53	38	June 5	12.4	58.2	40.5	--
SD 87128	46	61	43	June 5	14.7	59.6	40.0	--
Quantum 549	18	48	36	June 5	12.5	57.2	39.8	--
Bennett	45	59	38	June 2	14.6	58.2	39.0	39.6
Abilene	32	54	32	June 4	12.9	56.5	38.6	37.3
Quantum 542	22	46	41	June 5	12,3	57.6	38.5	35.2
Rawhide	33	49	35	June 3	11.7	57.8	38.0	--
Brule	31	45	37	June 5	13.2	55.8	37.9	39.5
SD 87127	58	59	43	June 4	12.3	61.5	37.4	--
SD 88231	49	60	40	June 2	12.6	59.2	37.2	--
Siouxland 89	10	29	38	June 5	11.3	58.0	37.0	--
Lamar	38	62	39	June 6	13.2	60.0	36.8	--
Centura	35	41	38	June 4	12.4	58.6	36.8	39.7
Seward	26	56	42	June 10	12.4	57.3	35.0	33.8
Dawn	34	50	34	June 4	12.3	60.0	34.8	33.8
Carson	23	53	39	June 4	12.2	57.4	34.6	--
Agassiz	46	69	45	June 10	14.5	58.5	30.5	28.1
Roughrider	27	58	43	June 9	15.7	58.7	27.6	28.7
Norstar**	50	61	46	June 11	12.5	55.5	22.3	19.8
Tiber**	36	47	42	June 10	12.1	51.8	21.4	28.3

LSD(5%)- 11.7 Bu/Acre C.V.- 20.9% Mean - 39.1

*Percent protein determined with a Technicon 300 InfraAnalyzer.
**Variety susceptible to stem rust.

NOTE: Seeded September 18, 1990 and harvested July 19, 1991. Fertilizer was applied for an anticipated yield of forty bushels per acre. Weeds were controlled by Ally at 1/10 oz/A. and 2,4D at 8 oz/A. applied in mid-May.

Table 5. Hard Red Winter Wheat Variety Trial - Meade County(Plainview), 1989-91.

Variety	% Stand 7/91	Height Inches	Maturity (0-7)*	Percent Protein*	Test Wt (Lbs/Bu)	Grain Yield-Bu/A 1991	Grain Yield-Bu/A (3 yr av)
Arapahoe	89	29	Medium 2	16.6	55.6	31.2	37.5
Dawn	91	29	Medium 4	14.9	56.0	30.5	36.1
Karl	86	27	Early 0	16.1	58.0	29.5	--
TAM 200	87	27	Early 2	14.4	57.7	28.7	25.8
Bronco	90	29	Medium 3	15.2	54.5	28.6	--
Scout 66	86	26	Early 2	13.8	55.7	28.2	27.3
Siouxland	80	32	Early 1	14.8	51.9	26.7	30.2
Thunderbird	80	30	Medium 4	14.5	55.8	25.6	30.8
Sage	89	34	Early 2	14.8	56.2	25.2	29.6
Redland	87	33	Medium 3	15.1	53.0	25.0	38.7
Siouxland 89	79	32	Early 2	15.4	51.9	24.2	--
Quantum 542	85	29	Early 3	15.4	53.9	23.8	28.6
Centura	86	32	Early 3	16.3	54.1	23.8	33.9
TAM 107	90	28	Early 0	15.4	51.6	22.4	24.5
Abilene	80	25	Medium 2	15.5	53.1	20.8	36.3
Brule	73	32	Medium 3	15.5	50.9	19.8	32.4
Seward	84	35	Med-Late 5	15.9	52.3	19.6	30.8
Rose	84	33	Med-Late 5	15.8	52.5	19.6	32.7
Roughrider	85	34	Med-Late 6	16.1	54.3	17.3	27.3
Norstar	65	37	Late 7	15.2	48.4	13.5	26.4
Agassiz	76	39	Med-Late 6	14.4	55.8	12.5	25.8

LSD(5%) - 5.0 Bu/Acre C.V. - 14.7% Mean - 23.9

*Maturity rating and days headed after earliest variety has headed.
**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Seeded September 18, 1990 and harvested July 23, 1991.

Hard Red Spring Wheat

Plots were seeded at two locations in 1990. All trials were seeded on fallow with a six row plot seeder having eight inch row spacing. Individual plots contained a minimum of 120 square feet with four replications per variety.

Seeding rate was controlled by prepackaging all seed. Fertilizer requirements were predetermined by soil test. Harvesting was accomplished with a self-propelled plot combine. Machine harvested plots contained a minimum of 100 square feet per sample. Grain yields and other data are reported in Tables 6 and 7.

TABLE 6. Hard Red Spring Wheat Variety Trial - Meade County(Bear Butte Valley), 1989-91.

Variety	Height (Inches)	Relative Maturity*	Percent Moisture	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre 1991	Grain Yield-Bu/Acre (3 yr av)
2375	31	0	12.4	17.2	57.7	36.6	23.1
SD 3056	32	-1	10.7	17.3	55.4	36.4	--
SD 3055	31	0	10.6	17.8	55.1	35.2	--
SD 8073	34	-1	10.8	17.1	54.7	35.2	--
ND 655	33	3	11.8	12.3	55.4	34.8	--
SD 3080	34	-1	11.9	17.0	58.2	34.6	--
Sharp	35	-2	11.6	16.7	57.2	34.5	26.8
Prospect	32	2	10.5	17.6	52.8	34.5	22.6
SD 8072	34	-1	9.9	17.3	53.9	34.3	--
SD 8074	34	-1	11.1	16.9	56.2	34.1	--
Guard	31	1	10.7	17.4	54.2	33.7	21.0
Dalen	28	1	10.4	18.1	52.1	33.2	--
Butte 86	35	0	11.4	17.4	54.4	33.0	22.2
SD 8070	35	-1	11.2	17.1	56.4	32.9	--
Amidon	36	2	11.4	16.8	55.4	32.6	19.2
Bergen	28	2	10.3	17.4	52.9	32.2	--
NDWX371	30	3	9.8	17.8	50.2	31.3	--
Grandin	31	1	10.6	17.3	52.2	30.6	19.6
Fjeld	29	1	9.6	17.1	50.8	30.5	18.1
Telemark	26	2	9.6	17.8	49.3	30.1	17.3
Gus	32	3	10.8	18.4	53.6	29.8	18.3
Stoa	35	3	10.5	17.8	52.8	29.5	20.6
MN 85324	31	1	9.7	18.0	50.9	29.4	--
Celtic	33	4	9.9	17.8	49.5	29.3	21.3
N86-0542	28	4	8.7	18.3	48.2	28.5	--
Nordic	29	4	9.8	17.2	51.6	28.2	19.0
W2501	28	3	8.8	16.9	47.8	27.9	17.0
W2502	27	3	8.3	17.8	47.2	27.8	18.4
Vance	29	4	9.1	18.0	50.3	26.7	15.5
2369	29	3	10.8	17.7	52.1	26.4	19.1
Chris	38	3	10.3	17.5	53.2	23.6	17.2
Marshall	27	6	9.5	17.7	47.5	21.9	15.6

LSD(5%) - 2.4 Bu/A C.V. - 4.8% Mean - 31.2

*Indicates relative maturity based on 65 days from seeding to heading.
**Percent protein determined with a Technicon 300 infraanalyzer.

NOTE: Plots were seeded April 10 and harvested July 24, 1991.

Table 7. Hard Red Spring Wheat Variety Trial - Meade County(Plainview), 1989-91

Variety	Height (Inches)	Relative Maturity*	Percent Moisture	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/A 1991	Grain Yield-Bu/A (3 yr av)
Sharp	33	-2	11.0	14.9	62.3	33.6	18.3
Bergen	26	2	8.9	17.1	58.0	32.1	--
Fjeld	26	1	9.2	17.1	55.6	31.0	21.3
Grandin	32	1	10.9	14.1	59.4	31.0	17.2
Butte 86	32	0	11.1	14.2	61.0	30.9	22.2
Prospect	30	2	9.6	--	59.1	30.8	21.0
2375	30	0	--	--	59.6	30.2	22.6
Nordic	30	4	10.2	17.6	57.6	28.6	19.6
Amidon	36	2	9.5	15.8	58.3	27.3	19.2
Gus	30	3	9.3	17.6	57.7	25.9	18.1
2369	29	3	10.8	14.7	57.7	24.8	19.0
Stoa	34	3	9.1	17.1	56.4	24.7	15.6
Guard	26	1	9.2	17.1	56.6	23.5	8.3

LSD(5%) - 6.6 Bu/A C.V. - 13.5% Mean - 28.8

*Indicates relative maturity based on 60 days from seeding to heading.
**Percent protein determined with a Technicon 300 InfraAnalyzer.
NOTE: Plots were seeded April 18 and harvested July 30, 1991.

Durum Wheat

A durum wheat variety trial was seeded in 1991. The remarks and discussion pertinent to the trial was included in the Hard Red Spring Wheat section. The data are listed in Table 8.

TABLE 8. Durum Wheat Variety Trial - Meade County(Bear Butte), 1989 & 91.

Variety	Height (Inches)	Relative Maturity*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre 1991	Grain Yield-Bu/Acre (2 yr av)
Fjord	38	-1	17.1	58.8	34.2	30.5
Vic	39	0	18.2	58.7	33.0	29.7
Monroe	38	-3	17.6	56.8	32.9	27.3
Ward	37	0	18.1	56.8	32.7	26.6
Stockholm	28	1	17.9	55.9	31.3	26.5
Renville	36	0	18.9	55.8	31.2	27.3
Sceptre	35	-1	18.0	54.8	30.4	26.8

LSD(5%) - 3.6 Bu/A C.V. - 6.2% Mean - 32.2

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

NOTE: Plots were seeded April 10 and harvested July 24, 1991.

Winter Triticale

Plots were seeded at two locations in 1990. All trials were seeded in fallow soil with a six row plot seeder having a ten inch row spacing. Seeding rate was controlled by prepackaging all seed. Fertilizer requirements were predetermined by soil test. Harvesting was accomplished with a self-propelled plot combine. Grain yield and other data are reported in Tables 9 and 10.

TABLE 9. Winter Triticale Variety Trial - Meade County (Bear Butte), 1989-91.

Variety	Percent Stand 11/90	Percent Stand 5/91	Date of Heading	Height (Inches)	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/A 1991	Grain Yield-Bu/A (3 yr av)
Newcales	48	73	May 27	47	13.7	51.4	66.1	46.8
18249	38	72	May 30	53	13.6	51.6	52.2	37.7
Jenkins	43	82	June 8	57	14.3	44.4	42.9	27.1
Winteri	59	73	June 8	60	14.3	44.4	30.5	22.8
Thunderbird**	44	80	June 3	38	14.8	60.1	48.1	42.7

LSD(5%) - 10.1 Bu/A. C.V. - 13.1% Mean - 47.9

*Percent protein determined with a Technicon 300 InfraAnalyzer.
**HRW Wheat (var.) Thunderbird was used as a standard for comparison.
NOTE: Plots were seeded September 19, 1989 and harvested July 19, 1990.

TABLE 10. Winter Triticale Variety Trial - Pennington County (Wall), 1989-91.

Variety	Percent Stand 11/90	Percent Stand 6/91	Date of Heading	Height (Inches)	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/A 1991	Grain Yield-Bu/A (3 yr av)
Jenkins	80	95	June 8	59	10.3	52.6	59.7	50.8
18249	82	95	May 30	55	10.0	55.4	58.5	52.1
Newcales	85	95	May 27	43	10.3	53.9	54.6	60.7
Winteri	84	95	June 8	63	9.8	53.4	54.0	51.1
Thunderbird**	84	95	June 1	36	12.2	63.1	42.5	40.6

LSD(5%) - 7.7 Bu/A C. V. - 9.2% Mean - 56.7

*Percent protein was determined with a Technicon 300 InfraAnalyzer.
**HRW Wheat (var.- Thunderbird) was used as a standard for comparison.

NOTE: Plots were seeded September 19, 1990 and harvested July 17, 1991.

Winter survival of the triticales was equal to winter wheat classed as good for winter survival. Weights per bushel were exceptionally high and grain quality was excellent. Early heading varieties produced better quality grain with higher test weights. The conditions under which the tests were conducted are discussed under the hard red winter wheat trials.

Spring Triticale

Plots were seeded at two locations in 1991. All trials were seeded in fallow soil a six row plot seeder having an eight inch row spacing. Seeding rate was controlled by prepackaging all seed. Fertilizer requirements were predetermined by soil test. Harvesting was accomplished with a self-propelled plot combine. Grain yields and other data are reported in Tables 11 through 12.

TABLE 11. Spring Triticales Variety Trial - Meade County (Bear Butte), 1991.

Variety	Height (Inches)	Percent Moisture*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield (Bu/Acre)
Kramer	37	7.4	15.9	44.0	39.4
Trical Victoria	37	10.3	16.5	43.0	31.7
Marval	42	7.6	17.0	39.3	28.7
Trical Grace	38	14.3	18.7	38.1	25.7

LSD(5%) - 8.3 Bu/Acre C.V. - 13.2% Mean - 31.4

*Percent moisture in grain was determined in field at harvest.
**Percent protein was determined with a Technicon 300 InfraAnalyzer.
NOTE: Plots were seeded April 10 and harvested July 24, 1991.

TABLE 12. Spring Triticales Variety Trial - Pennington County (Wall), 1989-91.

Variety	Height (Inches)	Date of Heading	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre 1991	Grain Yield-Bu/Acre (3 yr av)
Kramer	33	June 23	13.0	43.0	31.2	21.3
Marval	37	June 25	13.7	39.9	25.0	15.4
Trical Grace	35	June 27	13.9	41.7	23.3	18.2
Trical Victoria	33	June 25	12.7	44.9	17.5	--

LSD(5%) - 0.6 Bu/Acre C.V. - 7.1% Mean - 23.7

*Percent protein was determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded April 30 and harvested August 2, 1991.

Spring triticale varieties grown under normal moisture conditions had grain yields equal to Hard Red Spring wheat and Durum. The conditions under which the trials were conducted are discussed under the hard red spring wheat trials. The present varieties have an inherent shrivelled kernel which has a standard weight of 48 pounds per bushel. It is best utilized as a grain feed for swine or poultry.

Oat Variety Trials

Oat variety trials were conducted on a cooperative basis at two locations in 1990. Seeding dates was April 10 and 18. All trials were seeded on fallow with a six row plot seeder having an eight inch row spacing. Seeding rates

were controlled by prepackaging all seed. Fertilizer requirements were predetermined by soil test. Harvesting was accomplished with a self-propelled plot combine. Grain yield and other data are reported in Tables 13 and 14.

TABLE 13. Oat Variety Trial - Meade County (Bear Butte), 1989-91.

Variety	Height (Inches)	Date of Heading	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre 1991	Grain Yield-Bu/Acre (3 yr av)
SD 87572	36	June 27	35.3	78.4	--
Riel	39	June 29	31.8	77.8	--
Robert	38	June 29	29.0	76.0	--
Moore	39	June 28	31.9	76.0	43.0
Troy	38	June 27	32.2	75.5	44.5
WIX5229-1	36	June 26	29.2	72.2	--
Monida	56	June 28	27.2	71.9	40.3
Newdak	36	June 25	31.8	71.3	44.6
Porter	35	June 27	29.6	69.4	39.8
Dumont	38	June 28	28.4	67.7	--
Webster	33	June 23	34.2	67.3	45.3
Ogle	35	June 25	30.6	66.5	49.5
Settler	37	June 27	32.2	66.4	43.6
Hamilton	34	June 23	32.8	65.7	47.3
Premier	35	June 24	36.7	64.2	--
Steele	37	June 27	31.7	63.3	38.4
SD 87063	36	June 22	29.1	62.5	--
Dane	34	June 22	33.1	60.3	--
Valley	33	June 22	33.8	60.3	38.7
Tibor	42	June 27	32.8	58.7	--
Y933-11-2	36	June 25	32.7	57.1	--
Hazel	31	June 25	33.6	57.1	44.6
Starter	34	June 23	35.4	56.8	47.4
Hytest	39	June 25	37.2	55.2	37.3
Burnett	38	June 25	33.3	54.9	40.4
Don	32	June 22	35.9	54.2	44.9
Kelly	36	June 25	34.6	53.2	42.1
SD 87675	35	June 27	31.6	53.1	--

LSD(5%) - 9.9 Bu/Acre C.V. - 9.3% Mean - 64.8
NOTE: Plots were seeded April 10 and harvested July 24, 1991.

TABLE 14. Oat Variety Trial - Meade County (Plainview), 1990-91.

Variety	Height (Inches)	Date of Heading	Seed Color	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre 1991	Grain Yield-Bu/Acre (2 yr ave)
Troy	38	June 23	White	32.2	68.5	51.0
Monida	35	June 21	Creamy White	27.2	65.2	48.5
Newdak	36	June 20	White	31.8	64.6	49.6
Porter	35	June 24	Lt Tan	29.6	62.9	--
Ogle	35	Juen 18	Yellow	30.6	60.2	--
Settler	37	June 20	White	32.2	60.2	47.4
Premier	35	June 20	Yellow	36.7	58.2	42.8
Valley	33	June 23	Ivory	33.8	54.6	44.2
Hazel	31	June 17	White	33.6	51.8	43.8
Hytest	39	June 18	Lt Cream	37.2	50.0	38.4
Burnett	38	June 18	Ivory	33.3	49.8	40.8
Don	32	June 18	White	35.9	49.1	40.0
Kelly	36	June 15	White	34.6	48.3	36.8

LSD(5%) - 10.6 Bu/Acre C.V. - 11.0% Mean - 57.2

NOTE: Plots were seeded April 18 and harvested July 30, 1991.

Spring Barley Trials

Spring barley variety trials were conducted on a cooperative basis at two locations in 1990. Soil moisture was adequate for germination and emergence at all sites. Seeding was accomplished with a six row plot seeder having an eight inch row spacing. Rate of seeding was controlled by prepackaging all seed. Fertilizer requirements were predetermined by soil test. The dates of seeding ranged from April 10 to April 18. Harvesting was completed with a self-propelled plot combine between July 24 and July 30. Trial data are reported in Tables 15 and 16.

TABLE 15. Spring Barley Variety Trial - Meade County(Bear Butte), 1989-91.

Variety	Height (Inches)	Date of Heading	Percent Protein*	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre 1991	Grain Yield-Bu/Acre (3 yr av)
Excel (M52)	35	June 21	13.1	43.4	57.8	34.8
Gallatin	35	June 18	13.0	48.5	57.2	41.6
Bowman	35	June 18	12.3	51.6	54.7	44.6
B1603	35	June 20	13.9	44.2	52.5	--
EX B1614	34	June 21	12.2	45.4	51.8	--
Hazen	36	June 20	13.6	42.2	48.4	35.1
Robust	37	June 19	12.6	46.1	46.7	30.5
Stark(ND 9866)	34	June 20	13.2	48.3	46.6	--
SD 71-672	35	June 17	14.1	51.3	46.5	--
Azure	36	June 18	12.4	48.5	44.7	34.5
B1602	37	June 19	13.7	42.2	44.4	30.4
Morex	36	June 19	13.8	43.5	41.9	33.0
Bearpaw	34	June 22	14.7	40.8	41.0	--

LSD(5%) - 5.0 Bu/A C.V. - 6.1% Mean - 48.8

*Percent protein determined with a Technicon 300 InfraAnalyzer.
NOTE: Plots were seeded April 10 and harvested July 24, 1991.

TABLE 16. Spring Barley Variety Trial - Meade County(Plainview), 1990-91.

Variety	Height (Inches)	Days to Heading*	Percent Protein**	Test Wt. (Lbs/Bu)	Grain Yield-Bu/Acre 1991	Grain Yield-Bu/Acre (2 yr av)
Bowman	30	65	12.5	51.5	57.7	40.1
Gallatin	32	65	13.3	48.3	53.3	37.1
Hazen	30	67	13.4	42.4	51.5	35.3
SD 71-672	31	64	13.5	52.5	48.7	--
Excel	32	68	14.1	46.5	48.7	33.3
Robust	32	66	13.5	46.4	41.6	29.3
B1603	31	67	14.2	41.8	40.1	--
Bearpaw	32	69	15.1	42.3	39.5	28.8
Morex	34	66	13.1	47.8	39.2	29.8
B1602	34	66	14.4	40.9	37.7	26.2

LSD(5%) - 7.9 Bu/A C.V. - 10.1% Mean - 45.8

*Days from seeding to 50% headed.
**Percent protein determined with a Technicon 300 InfraAnalyzer.
NOTE: Plots were seeded April 18 and harvested July 23, 1991.

Grain Sorghum

Objective: To compare the performance of various grain crops for yield and other agronomic characteristics.

Twenty nine grain sorghum hybrids were seeded near Wall in eastern Pennington county. Plant population was established at 1.3 plants per square foot, or

58,000 plants per acre. Stands were good as a result of rain immediately following seeding. During the month of July the area received timely showers and after the first week below normal temperatures. August was normal for both moisture and temperature. September and October were above normal for temperature. The combination of moisture and temperature was favorable for the growth of sorghum and it did not become dormant. The sorghum reached maturity prior to the first killing frost which did not occur until early October. The seed was of good quality and high weight per bushel. The yield and other data are listed in Table 17.

Table 17. Grain Sorghum Hybrid Variety Trial - Pennington County(Wall), 1989-91.

Brand and Variety	Date of Heading	Height (Inches)	Percent Lodged	Test Wt (Lbs/Bu)	Grain Yield-Bu/A 1991	Grain Yield-Bu/A (3 yr av)
Pioneer 8570	Aug 7	36	3	53.8	64.0	--
Northrup King 1210	Aug 6	38	3	53.1	63.8	--
Pioneer 8790	Aug 9	35	0	53.8	63.2	46.7
Dahlgren DG27B	Aug 10	38	1	52.5	62.2	--
Pioneer 894	Aug 4	36	2	55.4	60.6	41.4
Dekalb DK-18	Aug 7	38	7	53.1	60.5	46.3
Agripro ST3280	Aug 11	38	2	52.8	59.9	--
Golden Harvest H301	Aug 10	36	1	51.6	59.7	--
Pioneer 8855	Aug 9	38	2	54.6	58.9	41.2
Cargill 630	Aug 17	36	0	49.3	57.8	38.8
Wilson 512	Aug 13	35	1	50.8	57.0	--
Cargill X77010A	Aug 9	36	3	52.3	56.3	--
Jacques 111E	Aug 12	33	1	51.3	55.7	--
Northrup King X8803	Aug 8	35	1	52.8	55.0	--
Agripro ST1002	Aug 10	33	2	52.7	54.6	--
Wilson 514	Aug 17	36	1	51.0	52.4	--
Pioneer 8877	Aug 12	37	1	53.6	52.4	19.9
Jacques 101	Aug 10	36	2	52.8	52.0	--
Dekalb DK-28E	Aug 10	34	0	51.8	51.6	44.9
Pioneer XS902	Aug 12	38	1	52.6	48.9	--
Jacques 308	Aug 15	37	1	47.9	48.7	--
Asgrow Madera	Aug 13	34	0	53.4	48.3	33.5
Cargill 577	Aug 11	39	6	50.4	48.2	41.6
Cargill X70001	Aug 14	36	1	51.4	42.8	--
Jacques 311	Aug 19	35	0	47.2	41.0	--
Cargill 40	Aug 15	32	0	45.7	33.6	--
Dahlgren DG33B	Aug 21	36	0	44.5	29.6	33.4
Asgrow Seneca	Aug 15	35	0	47.4	27.8	25.0
Cargill X15645	Aug 30	65	4	30.2	8.2	--

LDS(5%) - 10.7 Bu/A C.V. - 14.6% Mean - 49.3

Note: Plots were seeded June 14, 1991 and harvested October 3, 1991. Dual was applied as a postplant preemergence herbicide. The plots received one cultivation. Liquid starter fertilizer (10-34-0) was applied with the seed, and liquid sidedress (28-0-0) when cultivated.

OILSEED CROPS

Canola

Objective: To evaluate Canola for adaptation to western South Dakota.

Meade County

Location: Tim Komes farm in Bear Butte Valley in Western Meade county.

Procedure: The variety Westar was seeded in 8 inch rows June 10, 1991. The soil was in winter wheat during the previous summer. Treflan was applied for weed control at the rate of 1 pound per acre and incorporated with a disc harrow. The plots were harvested with a Wintersteiger plot combine on October 10, 1991. The yield was 158 pounds per acre with a test weight of 50.0 pounds per bushel.

Pennington County

Location: Rod Renner farm near Wall in eastern Pennington county.

Procedure: The variety Westar was seeded in 8 inch rows on April 30, 1991. The soil had been fallowed during the previous summer. Treflan was applied for weed control at the rate of 1 pound per acre and incorporated with a disc harrow. Flowering was initiated in mid-June. The plots were harvested with a Hege plot combine on August 2. Harvesting was completed while the pods were still immature and before shattering had occurred. The seed was seived from the empty pods, and dried before weighing. The yield was ~~64~~ 640 pounds per acre with a test weight of 50.3 pounds per bushel.

Safflower Varieties

Objective: To evaluate the adaptation of safflower varieties in western South Dakota.

Meade County

Procedure: The field had a good winter wheat crop in 1990 and the stubble had not been worked. The field was disked in the spring and had 1 quart per acre of Treflan applied and incorporated with a tandem disk. The plots were seeded on June 10, 1991. The stand was spotty with few weeds. Because of the late planting the plots were not harvested until October 8, 1991. The data are reported in Table 18.

Results:

Table 18. Safflower Variety Trial - Meade County(Bear Butte), 1991.

Variety	Percent Stand	Height (Inches)	% Oil Content	Test Wt. (Lbs/Bu)	Seed Yield (Lbs/Acre)
S-317*	80	17	40.3	39.2	823
Finch	80	17	38.2	40.2	758
Girard	81	18	41.9	38.0	745
Montola 2000*	76	13	40.7	38.2	719
Centennial*	79	17	41.1	39.2	718
S-541	70	18	44.7	37.5	677
S-208	74	16	39.7	36.3	663
Oker	68	16	39.3	35.0	578

LSD(5%) - 187 Lbs/Acre C.V. - 17.9% Mean - 635

*High Oleic acid oil.

NOTE: Plots were seeded June 10 and harvested October 8, 1991.

Pennington County

Procedure: The field was fallowed in 1990. The field was disked in the early spring and had 1 pound per acre of Treflan applied and incorporated. The plots were seeded on April 30, 1991. Seeding was done with a plot seeder having disc openers and an 8 inch row spacing. Plot size was 4 feet by 25 feet. The stand was excellent with few weeds. Harvesting was completed on September 6, 1991.

Results:

Table 19. Safflower Variety Trial - Pennington County (Wall), 1990-91.

Variety	Date of Flower	Height (Inches)	% Oil Content	Test Wt. (Lbs/Bu)	Seed Yield-Lbs/A 1991	Seed Yield-Lbs/A (2 yr av)
S-317*	June 24	29	41.1	39.5	1476	1450
Girard	June 28	30	41.6	41.9	1424	1344
Finch	June 25	29	38.8	43.1	1404	1378
Montola 2000*	June 24	24	41.5	40.2	1387	--
S-208	June 28	30	41.6	40.9	1358	1359
S-541	June 27	31	46.1	40.8	1271	1298
Centennial*	June 28	28	39.2	41.8	1127	1204
Oker	June 25	29	42.8	40.2	1108	1114

LSD(5%) - 200 Lbs/A C.V. - 10.2% Mean - 1319

*High Oleic acid oil

Discussion: The two studies were grown under quite different conditions. The trial in Meade county was on recrop soil, while the Pennington county study was on fallow soil. The shortage of soil moisture under recrop conditions resulted in low yield of seed. Weed control of all trials was good, however, some hand weeding was required. The crop is adapted to the area and can be grown with normal small grain planting and harvesting equipment. Weed control is very important, therefore it is necessary to select a clean field and use a herbicide.

Soybean Varities

Pennington County

Objective: To evaluate the adaptation of soybean varieties to western South Dakota.

Location: Rod Renner farm north of Wall, South Dakota.

Procedure:The soybeans were planted in 8 inch rows, with 6 rows in each plot. The field had been fallowed in 1990 and was relatively weed free. One quart of Treflan herbicide was applied and incorporated with a disk prior to planting. The crop was not cultivated during the summer. The plots were harvested with a small plot combine. The experimental data are given in Table 20.

Results:

Table 20. Soybean Variety Trial - Pennington County (Wall), 1991.

Varieties	Maturity Group	Height (Inches)	Plants per Acre	Percent Stand	Test Wt (Lbs/A)	Yield (Bu/A)
Glenwood	0	21	191,000	75	56.0	15.6
Simpson	0	23	145,000	90	55.9	14.0
Hardin	I	24	65,000	88	56.6	13.7
Sibley	I	24	135,000	90	56.7	13.1

LSD(5%) - 3.5 Bu/A C.V. - 15.4% Mean - 14.1

Discussion: The soybean yields were consistent with yields obtained in past research trials. The seed pods were from 3 to 4 inches above the soil surface making harvest easy. The location of the seed pod on the plant was higher from the soil surface than when the beans were planted in 12 inch rows. The narrow rows did not allow cultivation but weed control by the herbicide was excellent.

Sunflower Varieties

Objective: To evaluate the adaptation of sunflower varieties to western South Dakota.

Meade County

Procedure: The sunflowers were seeded in 30 inch rows, with 2 rows in each plot. The field produced a crop of winter wheat in 1990 and had not been tilled. The herbicide Roundup was applied after seeding to kill any growing plants. No further weed control was used. End of season conditions indicated a heavy infestation of wild lettuce and a sunflower population of 7 thousand plants per acre. The plots were harvested with a small plot combine. The sunflowers produced 325 pounds of seed per acre with a test weight of 28 pounds.

Pennington County

Procedure:The sunflowers were seeded in 30 inch rows, with 2 rows in each plot. The field was fallowed in 1990. Treflan herbicide was applied at the rate of one pound per acre and incorporated with a disk prior to seeding. The plots were harvested with a plot combine.

Results:

Table 21. Sunflower Variety Trial - Pennington County (Wall), 1991.

Varieties	Height (Inches)	Plants per Acre	Date of Flowering	Test Wt (Lb/Bu)	Yield (Lbs/A)
Dahlgen DO855	64	14,250	August 6	24.5	1383
Dahlgren DO704XL	63	13,300	August 9	25.0	1301
LSD(5%) - 320 lbs/A		C.V. - 14.5%			Mean - 1342

OILSEED CROP PRODUCTION-MANAGEMENT STUDIES

Objective: (1) To determine the optimum row spacing for Safflower and Soybeans and Sunflowers utilizing a minimum tillage site in conjunction with labelled pesticides. (2) To compare a number of Safflower varieties for yield, disease resistance, oil content, and oil content. (3) To determine the efficiency of labelled hebicides under reduced tillage management practices. (4) To compare Safflower and Soybeans for economic returns.

Procedure: A series of experiments were established on soils which had not received tillage after harvesting a wheat crop in 1990. The replicated experiments were designed to utilize farm sized equipment, and to minimize travel across the undisturbed stubble, thus retaining maximum standing straw. The experiments were blocked so that herbicides which required soil incorporation were located adjacent to each other. This design procedure facilitated tillage by permitting the use of farm size tillage equipment. Herbicides were applied as required by using a small plot sprayer.

The experiment located in Bear Butte Valley-Meade county contained three Safflower varieties in three row spacings, and three Soybean varieties in two row spacings. These plots were overlain with four herbicide treatments.

Results:

Table 22. Safflower Variety-Row Space-Herbicide, Bear Butte Valley, 1991.

Treatment	Herbicide Rate	Percent Stand	Height Inches	Test Wt. (Lbs/Bu)	Seed yield (Lbs/Acre)
Variety					
S-208		44	21.5	34.2	431
Centennial		46	21.2	33.5	328
S-541		34	20.7	29.7	273
Row Space-Inches					
6		27	22.2	32.5	349
12		44	22.2	34.0	400
24		57	22.0	33.5	323
Herbicide Applied					
Roundup	0.5#/A	57	22.3	32.2	292
Dual	1.5#/A	36	22.7	32.6	338
Dual + Tillage	1.5#/A	55	21.7	35.2	400
Treflan + Tillage	1.0#/A	43	22.0	34.1	395
LSD(5%) - 119 Lbs/A		C.V. - 23.5%		Mean - 356	

NOTE: The plots were seeded on June 18 and harvested on October 8, 1991. Seedine was delayed because of heavy rain which flooded the plotsite.

Discussion: Although there was not a significant difference between the stands, there was a significant difference between the yield of S-208 and S-541. Damage to seed as it was expelled from the drill box resulted in fewer plants in the six inch spaced rows but still resulted in higher seed yield than from the 24 inch spaced row with better stand. The 12 inch row spacing produced better seed yield than either the 6 or the 24 inch rows. Where tillage was used to incorporate the herbicide the seed quality and yield were better than seeding without tillage, however, the stand was not increased.

Table 23. Soybean Variety-Row Space-Herbicide, Bear Butte Valley, 1991.

Treatment	Herbicide Rate	Percent Stand	Height Inches	Test Wt. (Lbs/Bu)	Seed yield (Bu/Acre)
Variety					
Simpson		31	18	54.1	5.35
Hardin		34	18	52.9	4.32
Glenwood		16	24	53.2	3.86
Row Space-Inches					
12		24	18	53.4	3.89
24		38	25	53.4	4.43
Herbicide Applied					
Roundup	0.5#/A	8	17	--	--
Dual	1.5#/A	4	22	52.0	2.64
Dual + Tillage	1.5#/A	52	18	53.9	4.45
Treflan + Tillage	1.0#/A	58	18	53.8	5.33

LSD(5%) - 1.1 Bu/A C.V. - 26.5% Mean - 4.28

NOTE: Plots were seeded on June 10 and harvested on October 8, 1991.

Discussion:
The seed produced on the soybean plants had low weight per bushel and was of poor quality. The yield difference between the varieties was due to seedling vigor and resultant stand rather than yielding ability. The higher yield was produced from 24 inch row spacing. This appeared to be the result of less seed damage by the drill cup as the seed was expelled from the seedbox. Weeds were not a serious problem. The primary weeds in the plots were wild lettuce, with a few rough pigweed and kochia. The major problems with stand establishment was penetration of the hard soil by the double disc drill openers and damage to the seed by the drillbox.

FORAGE PRODUCTION RESEARCH

Objective: To compare various annual crops for forage production, forage quality, and the relationship of grain to forage production.

Spring Seeded Small Grain Forage Trial

Fifteen varieties of spring seeded small grain including Barley, Oats, Hard Red Wheat, and Triticales were seeded in replicated plots at Bison in Perkins county in April of 1991. The rate of seeding in pounds per acre was: Barley - 72 lbs, Oats - 64 lbs, Spring Wheat - 60 lbs, and Triticales - 75 lbs. Plots were located in proximity of variety trials so that grain yields would be comparable. Soil moisture was adequate for germination and emergence.

The forage plots were havested 21 days after heading when the oat seeds were in the dough stage. The seed plots were harvested for grain on July 31.

The overall results indicated that dollar returns for forage production from barley was nearly double that of grain, Oats forage returns were more than double grain returns, and wheat forage returns were nearly triple that of grain.

Table 24. Small Grain Forage Trial - Perkins County(Bison), 1991.

Crop & Variety	Height (Inches)	Forage Production % Dry Matter	Forage Production Percent Protein*	Forage Production Yield-T/A (@ 12% H2O)	Grain Production Test Wt. (Lbs/Bu)	Grain Production Yield (Bu/A)
Spring Barley						
Gallatin	30	42.0	8.8	3.45	51.5	75.6
Hazen	29	46.0	9.1	3.41	48.6	71.4
SD 71-672	31	43.0	10.1	3.38	51.2	56.4
Robust	31	43.0	10.2	3.30	50.5	71.3
Bowman	28	43.0	10.8	3.01	53.2	78.9
				Mean - 3.31		70.7
Oats						
Newdak	31	42.0	8.0	3.44	32.3	105.5
Steele	34	42.0	8.1	3.12	31.4	96.7
Burnett	35	35.0	10.3	2.58	36.3	79.7
Moore	35	31.0	9.9	2.33	32.5	93.5
				Mean - 2.87		93.8
Triticales						
Winter Triticale	9	24.0	15.5	0.9	--	--
Marval	42	36.0	9.5	2.74	41.6	45.0
Grace	39	38.0	10.4	2.70	42.4	47.8
				Mean - 2.10		46.4
Spring Wheat						
Butte 86	34	43.0	8.6	3.43	58.8	39.4
Nordic	31	38.0	9.8	3.43	57.2	42.0
Guard	31	43.0	10.2	3.16	56.8	40.1
Stoa	36	41.0	11.5	3.11	54.0	39.8
				Mean - 3.28		40.3
LSD(5%) - .66 T/A		C.V. - 16.3%		Mean - 2.9		62.8

NOTE: Plots were seeded on April 23 and harvested July 31, 1991.

Fall Seeded Small Grain Forage Trials

Eleven varieties of Fall seeded small grain including Winter wheat and Winter Triticales were seeded in replicated plots in the fall of 1990. The rate of seeding in pounds per acre was: Winter Wheat - 60 lbs, and Triticales - 75 lbs. Plots were located in proximity of variety trials so that grain yields would be comparable.

Table 25. Fall Seeded Small Grain Forage Trial - Meade County(Bear Butte), 1991.

Crop & Variety	Height (Inches)	Forage Production: % Dry Matter	Forage Production: Percent Protein	Forage Production: Yield-T/A (@ 12% H2O)	Grain Production: Test Wt. (Lbs/Bu)	Grain Production: Yield (Bu/A)
Winter Triticales						
Winteri	48	46.0	6.9	3.5	44.4	30.5
Jenkins	49	36.0	9.1	2.7	44.4	42.9
Newcales	36	40.0	9.2	2.2	51.4	66.1
				Mean - 2.8		46.5
Winter Wheat						
Arapahoe	32	42.0	9.7	3.0	59.0	48.8
Sage	33	61.0	7.1	2.8	62.1	45.4
TAM 107	27	63.0	7.2	2.7	58.5	46.7
Abilene	23	56.0	8.8	2.7	56.5	38.6
Agassiz	38	44.0	9.2	2.6	58.5	30.5
Rose	31	44.0	8.4	2.4	58.3	42.2
Thunderbird	29	51.0	6.9	2.4	58.8	41.7
Norstar	39	41.0	7.5	2.2	55.5	22.3
				Mean - 2.6		39.5
Least Significant Difference(5%)				T/A - 0.5		Bu/A - 11.7
Average Yield				2.7		43.0

Pennington County

Fall seeded grain for forage production were seeded near Wall in November 1990. Soil moisture was adequate for germination and emergence. The forage was harvested on July 3 when the seeds were in the milk stage. The adjacent plots for grain production were harvested for grain on July 17.

Table 26. Fall Seeded Small Grain Forage Trial - Pennington County(Wall), 1991.

Crop & Variety	Height (Inches)	Forage Production: % Dry Matter	Forage Production: Percent Protein	Forage Production: Yield-T/A (@ 12% H2O)	Grain Production: Test Wt. (Lbs/Bu)	Grain Production: Yield (Bu/A)
Winter Triticales						
18249	55	43.1	7.4	4.4	51.6	41.6
Jenkins	59	37.8	6.9	3.3	46.0	32.8
Winteri	63	39.4	8.2	3.1	45.9	30.6
Newcales	43	42.5	9.9	2.9	50.2	35.6
				Mean - 3.4		35.2
Winter Wheat						
Sage	40	55.4	10.1	3.6	56.9	20.4
Thunderbird	36	55.8	10.2	3.3	57.7	23.3
TAM 107	31	68.9	9.8	3.2	51.3	16.0
Rose	40	52.2	9.0	3.0	56.2	22.0
Agassiz	49	48.8	9.9	1.7	53.6	12.9
				Mean - 3.0		18.9
Least Significant Difference(5%)				T/A - 0.3		Bu/A - 5.4
Average Yield				3.2		27.1

Millet Forage Trials

Procedure: Millets for grain and forage production were seeded near Wall in June 1991. Soil moisture was adequate for germination and emergence. The forage was harvested on August 29 when the seeds were in the dough stage. The adjacent plots for grain production were harvested for grain on September 6.

Table 27. Millet Grain and Forage Trial - Pennington County(Wall), 1991.

Crop & Variety	Height (Inches)	Forage Production: % Dry Matter	Forage Production: Percent Protein	Forage Production: Yield-T/A (@ 12% H2O)	Grain Production: Test Wt. (Lbs/Bu)	Grain Production: Yield (Bu/A)
Proso Millet						
Cerise	34	68.0	7.9	3.3	58.3	35.7
Rise	35	61.0	7.1	3.6	56.2	52.5
Minsum	38	67.0	8.4	3.3	56.0	44.3
Minco	38	72.0	6.2	3.8	56.9	43.2
Dawn	29	74.0	6.9	2.7	56.8	48.6
				Mean - 3.3		Mean - 44.9
Foxtail Millet						
Siberian	32	69.0	8.4	3.6	54.7	32.2
Manta	32	67.0	9.4	3.7	54.8	34.7
German	33	45.0	7.0	4.1	50.5	6.5
				Mean - 3.8		Mean - 24.5
Pearl Millet						
Hypro	47	32.0	6.6	4.0	51.3	4.2
Least Significant Difference(5%)				T/A - 0.6		Bu/A - 7.8
Average Yield				3.7		33.5

Winter Wheat Starter Fertilizer Studies

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

Introduction: The use of fertilizer to increase and stabilize production, by maintaining soil nutrient level, has been practiced since the beginning of plant cultivation. The method of application, time of application, and source of nutrients have all been studied, each with a specific objective. These studies were initiated to determine (1) the effect of starter fertilizer on winter survival, (2) the effect on yield as a result of winter survival, and (3) the effect on grain quality.

Procedure: The studies were located near area winter wheat variety trials. The liquid fertilizer (Analysis 10-34-0) was applied at the rate indicated in the tables. The granular fertilizer was applied at a level required to produce a response without damaging germination.

Seeding was completed during the period September 18-19, 1990. Seeding rate was established at 60 pounds per acre and was controlled by prepackaging the

seed. The seeded areas were 5 feet wide by 30 feet long. They were trimmed to a 25 foot length prior to harvest. The experiment contained four replications. Harvesting was completed with a Hege 125B self-propelled plot combine.

Meade County
(Bear Butte Valley)

The hard red winter wheat variety, Thunderbird, was seeded in fallow soil at Bear Butte on September 18, 1990. All nitrogen and phosphorus was applied in liquid form. The potash and sulfur was applied as granules, at the rate specified in Table 28. The nutrient content of the soil was above that required for a 40 bushel yield.

TABLE 28. Starter Fertilizer Demonstration with Hard Red Winter Wheat - Meade County (Bear Butte Valley), 1990-1991.

Treatment	Percent Stand* 11/90	5/91	Date of Heading	Percent Protein**	Test Wt (Lbs/Bu)	Grain Yield-Bu/A 1991	(2 yr av)
0- 0- 0	15	58	June 9	13.0	59.7	25.4	30.4
12-41- 0	14	48	June 8	13.5	60.2	31.4	32.2
12-41-20	16	41	June 8	11.8	60.0	27.4	31.4
0-41- 0	14	33	June 7	13.5	59.5	29.4	--
12-41- 0 +S	20	51	June 7	12.4	60.4	31.2	32.1
12-41-20 +S	24	60	June 7	13.3	60.0	35.6	33.9

LSD(5%) - 5.4 Bu/A C.V. - 11.9% Mean - 30.1

*Percent stand determined by visual observation.
**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded September 18, 1990 and harvested July 19, 1991.

(Table 28 Continued)
Soil Analysis Data:

Nutrient	Pounds per Acre Nitrogen	Phosphorus	Potash	Sulfur
In Soil	153	88	1760	104
Pounds Added*	12	41	20	20
Required for 40 Bu Yield	96	40	275	10

*Added pounds of nutrient indicated only to those plots receiving a specific treatment.

Results
Soil nutrient levels at this site were sufficient to produce the anticipated yield goal under normal moisture conditions. Moisture during the fall was very limited, resulting in thin stands and limited growth. Spring rains were above normal and temperatures were below normal resulting in good plant growth and good quality grain. The data are reported in Table 28.

Meade County
(Plainview)

The hard red winter wheat variety Thunderbird was seeded in fallow soil at Plainview on September 18, 1990. The experiment contained four replications. All nitrogen and phosphorus was applied in liquid form. The potash and sulfur was applied as granules, at the rate specified in Table 29. The nitrogen fertilizer in the soil was sufficient nutrient for the wheat to produce a grain yield of 40 bushels per acre.

TABLE 29. Starter Fertilizer Demonstration with Hard Red Winter Wheat - Meade County (Plainview), 1991.

Treatment	Percent Stand* 11/90	7/91	Height (Inches)	Percent Protein**	Test Wt (Lbs/Bu)	Grain Yield (Bu/Acre)
0- 0- 0	8	68	31	16.5	53.9	18.0
12-41- 0	1	83	31	17.1	51.1	19.3
12-41-20	4	73	31	16.5	54.5	23.4
0-41- 0	0	76	31	16.8	51.5	20.4
12-41- 0 +S	1	74	32	16.2	51.2	20.4
12-41-20 +S	0	74	31	16.5	51.4	18.5

LSD(5%) - 5.4 Bu/A C.V. - 17.8% Mean - 20.0

*Percent stand determined by visual observation.
**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded on September 18, 1990 and harvested July 23, 1991.

(Table 29 Continued)
Soil Analysis Data:

Nutrient	Pounds per Acre Nitrogen	Phosphorus	Potash
In Soil	102	60	990
Pounds Added*	12	41	0
Required for 40 Bu Yield	96	40	275

*Added pounds of nutrient indicated only to those plots receiving a specific treatment.

Discussion:

Soil nutrient levels at this site were sufficient to produce the anticipated yield goal without additional fertilizer. Rainfall was below normal resulting in poor fall emergence and reduced stands. The lower yields received at this location were due to droughty conditions. However, the application of starter fertilizer resulted in increased yield in all cases. The plots were harvested on July 30, 1991. Data are reported in Table 29.

Pennington County

The hard red winter wheat variety, Thunderbird, was seeded in fallow soil near Wall in eastern Pennington county on September 19, 1990. All nitrogen and phosphorus was applied in liquid form. The potash and sulfur was applied as granules, at the rate specified in Table 30. The total fertilizer applied raised the nutrient content in the soil to the yield goal level required for a yield of 45 bushel per acre.

TABLE 30. Starter Fertilizer Demonstration with Hard Red Winter Wheat - Pennington County(Wall), 1990-91.

Treatment	Percent Stand* 11/90	Percent Stand* 5/91	Height (Inches)	Percent Protein**	Test Wt (Lbs/Bu)	Grain Yield-Bu/A 1991	Grain Yield-Bu/A (2 yr av)
0- 0- 0	84	92	31	10.8	59.5	39.5	44.0
12-41- 0	87	93	31	10.9	60.6	51.4	52.8
12-41-20	85	93	32	11.5	61.4	51.1	52.5
0-41- 0	81	92	31	10.9	61.2	51.2	--
12-41- 0 +S	88	93	31	11.3	61.3	52.7	53.0
12-41-20 +S	85	94	31	10.8	60.8	52.9	52.8

LSD(5%) - 4.8 Bu/Acre C.V. - 6.4% Mean - 49.8

*Percent stand determined visually.
**Percent protein determined with a Technicon 300 InfraAnalyzer.

NOTE: Plots were seeded September 19, 1990 and harvested July 17, 1991.

(Table 30 Continued)
Soil Analysis Data:

Nutrient	Pounds per Acre Nitrogen	Phosphorus	Potash	Sulfur
In Soil	115	66	1870	98
Pounds Added*	12	41	20	20
Required for 45 Bu Yield	108	45	350	12

*Added pounds of nutrient indicated only to those plots receiving a specific treatment.

Results:

The site of this experiment had soil moisture to a depth of 36 inches at seeding time in September. Germination and emergence were good but below normal fall moisture stressed the seedlings. Good moisture was received from

April through June resulting in high yield of high quality grain. Protein content was low because of the high content of starch in the grain. There was a positive response to the addition of all starter fertilizer at this location.

Summary:

The use of starter fertilizer generally resulted in better fall emergence and winter survival. The increase in survival was associated with the addition of phosphorus which favors root growth. Larger root masses would permit more water intake resulting in less plant dehydration and eventual death. Increase in yield was also associated with phosphorus application. The difference in yield of unfertilized and fertilized was very small as should be expected when the nutrient levels in the soil are high enough so as to be readily available. However, longtime yield increases favor the use of starter fertilizer. Test weights were increased by application of starter fertilizer. The increase appears to have been the result of delayed drying thus favoring further kernel development and normal maturity.

WEED CONTROL RESEARCH

Control of Weeds With Roundup, Herbicide Combinations, and Sulfate Additives

Objective: To evaluate the control of weeds with Roundup in combination with other herbicides and various sulfate additives on fallow.

Table 31. Percent Control of Weeds with Roundup, Herbicide Combinations, and Sulphate Additives. Pennington County(New Underwood), 1991.

Herbicide Treatment	Product (Oz/Acre)	Sulfate Source	Volunteer Wheat 5/21	Volunteer Wheat 6/14	Pennycress 5/21	Pennycress 6/14	Wild Buckwheat 5/21	Wild Buckwheat 6/14
Roundup	4	None	35	53	71	86	20	40
Roundup 2,4-D Amine	4 16	Am-Sul	86	86	90	95	43	66
Roundup 2,4-d Ester	4	Am-Sul	86	89	94	95	55	60
Roundup DF	4	Am-Sul	75	86	90	94	38	48
Roundup DF 2,4-D Amine	4 16	Am-Sul	85	89	85	95	43	68
Roundup DF 2,4-D Ester	4 8	Am-Sul	74	83	88	94	35	55
Control			1	1	1	1	1	1
Roundup	4	Acid	79	76	86	94	33	55
Roundup 2,4-D Amine	4 16	Acid (Gelled)	1	1	1	1	1	1
Roundup 2,4-D Ester	4 11	Acid	80	93	90	93	35	65
Roundup	4	Am-Sul	86	75	85	93	23	50
Roundup 2,4-D Ester	4 11	Alone	43	63	83	94	18	58
Roundup 2,4-D Amine	4 8	Alone	59	74	86	94	35	60
Roundup	4	Na-Sul	69	78	85	93	28	50
Roundup Banvel	4 8	Am-Sul	95	86	98	95	91	84
		LSD(5%) =	13	12	11	4	17	16
		SD =	9	9	7	3	12	11
		CV(%) =	14	13	10	3	36	22

Summary: Treatments of Roundup alone and Roundup plus other herbicides with sulfate additives had significantly better control of volunteer wheat. Control of Pennycress was excellent with all formulations that contained a sulfate additive. Wild Buckwheat was sparsely populated in this trial so the assessment probably isn't valid.

Control of Weeds with Roundup and Various Combinations of Herbicides

Ojective: To assess control of Volunteer Wheat, Pennycress, and Wild Buckwheat using Roundup alone and various combinations of herbicides with various sulfate additives.

Table 32. Control of Weeds with Roundup in Combination with Other Herbicides. Pennington County (New Underwood), 1991.

Herbicide Treatment	Product (Oz/Acre)	Sulfate Source	Volunteer Wheat 5/21	Volunteer Wheat 6/14	Pennycress 5/21	Pennycress 6/14	Wild Buckwheat 5/21	Wild Buckwheat 6/14
Roundup	6		76	79	78	94	25	43
Roundup	6	Am-Sul	90	90	91	95	40	35
Roundup DF	6	Am-Sul	79	86	75	94	28	48
Roundup	6	H2SO4	90	90	91	95	30	40
Control			1	1	1	1	1	1
Roundup 2,4-D ester	6 8	Am-Sul	83	88	92	94	38	55
Roundup DF 2,4-D ester	6	Am-Sul	85	83	93	94	45	76
Roundup Banvel SGF	6 4	Am-Sul	84	88	88	95	86	84
Roundup Banvel SGF	6 4	Am-Sul	89	91	96	95	93	88
Roundup Banvel SGF	6 4	H2SO4	73	84	89	95	91	78
Roundup 2,4-D ester	6	H2SO4	83	88	94	95	65	68
Roundup 2,4-D Amine	6	Am-Sul	89	93	93	95	51	69
Roundup Atrazine	6 16	Am-Sul	71	88	96	95	85	88
		LSD(5%) -	10	7	14	2	20	13
		SD -	7	5	10	1	14	9
		CV(%) -	9	6	12	2	27	15

Summary: Test results indicate Roundup is more effective when used with a sulfate additive when controlling volunteer wheat. Due to the caustic nature of H2SO4, Am-Sul (Ammonium Sulfate) is the better choice as a sulfate additive. Ammonium sulfate indicates a slight advantage over H2SO4 in the table as well.

Efficiency of Surfactants with Roundup and Monsanto 35085

Objective: To assess the efficiency of various surfactants when used with Roundup and Montasnto 35085 at various rates.

Table 33. Efficiency of Surfactants When Used With Roundup and Monsanto 35085. Pennington County (New Underwood), 1991.

Herbicide Treatment	Product (Oz/Acre)	Surfactant	Volunteer Wheat 5/21	Volunteer Wheat 6/14	Pennycress 5/21	Pennycress 6/14	Wild Buckwheat 5/21	Wild Buckwheat 6/14
Roundup	6		82	83	92	95	25	56
Roundup	12		88	69	97	84	40	55
Control			1	1	1	1	1	1
Mon 35085	6		59	71	91	94	25	43
Mon 35085	6	LI 700	44	64	88	91	25	58
Mon 35085	6	SP-BO	28	58	74	88	25	53
Mon 35085	6	R-11	33	59	75	89	25	48
Mon 35085	6	Act 90	41	74	84	94	23	60
Mon 35085	6	Adwet	28	55	84	70	25	39
Mon 35085	6	Kenet	15	54	80	88	18	63
Mon 35085	12	LI 700	78	88	93	94	23	61
Mon 35085	12	SP-BO	88	89	96	94	33	63
Mon 35085	12	R-11	91	90	96	95	33	75
Mon 35085	12	Act 90	93	90	98	95	36	58
Mon 35085	12	Adwet	88	88	95	95	35	59
Mon 35085	12	Kenet	69	80	90	95	25	58
Mon 35085	12	Alone	86	89	96	95	30	68
Mon 35085	6	Am-Sul	64	80	92	95	23	50
Roundup	6	Am-Sul	84	81	94	95	30	61
Mon 35085	12	Am-Sul	92	86	98	94	48	68
		LSD(5%) -	18	17	8	17	17	20
		SD -	12	12	6	12	12	14
		CV -	20	16	7	14	43	26

Summary: In most trials, heavier rates of herbicides exhibited better control of volunteer wheat and pennycress. Surfactant type had little effect on degree of control. Wild Buckwheat was too sparsely populated to get a good measure of control.

Resistance of Kochia to Sulfonylurea Herbicides

Objective: To determine if kochia in this trial has a genetic resistance to Sulfonylurea herbicides (Ally, Amber, Glean).

Table 34. Effect of Sulfonylurea Herbicides in Combinations on Growth of Kochia and on Winter Wheat. Custer County(Scenic), 1991.

Herbicide Treatment	Formulation	Product (Oz/A ai)	Injury (Hgt-In)	Kochia % Control	Kochia (1-5)*	Wheat** Maturity	Wheat** Yield
Control			34	1	5.0	5.0	59.5
Amber	WG71.4	0.15	32	89	1.0	4.8	57.1
2,4-D ester	Lq 4.0	4.0					
Ally	DF 60%	0.6	32	93	1.0	4.5	56.0
Starane	Lq	1.5					
Ally	DF 60%	0.4	33	89	1.0	5.0	55.9
Starane	Lq 34.9	1.5					
Amber	WG71.4	0.21	33	93	1.0	4.8	55.2
2,4-D ester	Lq 4.0	4.0					
Ally	DF 60%	0.06	32	95	1.0	4.8	55.2
2,4-D ester	Lq 4.0	6.0					
Ally	DF 60%	0.60+Sur	31	93	1.0	5.0	55.0
Banvel	Lq 2.0	0.75+Sur					
2,4-D ester	Lq 4.0	4.00+Sur					
Ally	DF 60%	0.04+Sur	29	93	1.0	4.8	54.7
Banvel-SGF	Lq 2.0	0.75+Sur					
2,4-D ester	Lq 4.0	4.00+Sur					
Amber	WG71.4	0.15	31	88	1.0	4.5	54.7
Banvel-SGF	LQ 2.0	1.5					
Amber	WG71.4	0.21	28	89	1.0	5.0	53.6
Banvel-SGF	Lq 2.0	1.5					
Ally	DF 60%	0.06+Sur	32	90	1.3	4.8	53.0
Ally	DF 60%	0.60	30	94	1.0	4.8	52.4
Banvel-SGF	Lq 2.0	1.5					
Ally	DF 60%	0.06+Sur	28	94	1.0	4.5	52.3
2,4-D ester	Lq 4.0	4.00+Sur					
Banvel-SGF	Lq 2.0	1.50+Sur					
Ally	DF 60%	0.04+Sur	28	94	1.0	4.3	51.6
Banvel-SGF	Lq 2.0	1.50+Sur					
2,4-D ester	Lq 4.0	4.00+Sur					
2,4-D ester	Lq 4.0	6.0	28	94	1.0	4.5	51.1
Banvel	Lq 2.0	1.0					
		LSD(5%) -	2	6	.2	.7	3.5
		SD -	1	4	.1	.5	2.4
		CV(%) -	5	5	10.1	10.6	4.4

Footnotes for table on following page.

NOTE: Injury as noted in Height in inches was as of June 14, 1991.
Percent Control of Kochia was as of May 25, 1991.
Kochia Population (1-5), Wheat Yield and Maturity,were as of July 15.
Surfactant was X-77.

*Kochia Population: 1-No kochia, 5-Heavy kochia population.
**Maturity of Wheat: 1-Very Green Heads, 5-Fully Matured. Yield in Bu/acre.

Summary: No resistant strains of Kochia were found in this trial. Applying herbicides indicated a minimum yield loss of 2.4 bushels per acre.

DISEASE CONTROL

Control of Tan Spot on Winter Wheat

Objective: To control Tan Spot on winter wheat using fungicides at various rates. To assess yield potential of the crop when these fungicides are used.

Table 35. Control of Tan Spot on Winter Wheat With Fungicides. Pennington County (New Underwood), 1991.

Fungicide Treatment	Rate of Application (Oz of ai/acre)	Time of Application	Percent Moisture*	Test Wt (Lbs/Bu)	Grain Yield Bu/Acre
Tilt 41.8%	4.0	Flag Leaf	13.5	63.3	77.8
H6573 25%	2.0	Flag Leaf	13.8	63.3	75.8
H6573 25%	1.0	Flag Leaf	13.0	63.3	74.5
H6573 25%	1.0	Heading	13.3	63.5	73.8
H6573 25%	2.0	Heading	13.8	63.8	73.8
Control			13.0	63.3	66.0
		LSD(5%) -	1.5	1.2	4.0
		SD -	1.0	0.8	2.6
		CV(%) -	7.3	1.3	3.6

Summary: Use of fungicides indicated a very positive response in this trial. The effectiveness and need for fungicides, however, hinges on the amount of moisture received during the spring and the amount of tan-spot innoculum found on the wheat.

Control of Tan Spot on Spring Wheat with Various Rates of Fungicides

Objective: To control Tan Spot on Spring Wheat by using fungicides at various rates. To assess yield potential of the crop when these fungicides are used.

Table 36. Control of Tan Spot on Spring Wheat with Various Rates of Fungicide. Pennington County (New Underwood), 1991.

Fungicide Treatment	Application Rate (Oz of ai/A)	Time of Application	Test Wt (Lb/Bu)	Grain Yield (Bu/Acre)
H6573 25%	2.0	Flag Leaf	60.0	23.8
H6573 25%	1.0	Heading	59.8	21.7
Control			60.5	21.2
H6573 25%	1.0	Flag Leaf	60.5	20.6
Tilt 41.8%	4.0	Flag Leaf	60.8	18.7
H6573 25%	2.0	Heading	60.8	18.3
		LSD(5%) -	0.7	6.8
		SD -	0.5	4.5
		CV(%) -	0.8	21.7

Summary: Fungicides were not effective on the Spring Wheat in this trial. The weather turned hot and the rains stopped after the heading time treatment was applied. These weather conditions blocked further development of the tan-spot disease and also reduced the yield of the wheat crop because proper filling of the heads could not take place.