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SOUTH DAKOTA STATE UNIVERSITY

WEST RIVER AG CENTER

CROPS AND SOILS RESEARCH

PLANT SCIENCE PAMPHLET #44

MARCH 2011

SDSU

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 one mile southwest of Box Elder, SD at 22735 Radar Hill Road. The office facilities are located at 1905 North Plaza Boulevard; Rapid City, SD 57702-9302. Telephone (605)394-2236, Fax (605)394-6607
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The Research Projects serve the western part of South Dakota. They are unique in that all experimental plots are cooperatively located with farmers. All the studies are located on farmer fields rather than at a particular experiment station. This allows for more mobility and localized data collection. This system is very dependent upon farmer cooperators and local extension agronomy educators.

This research tests the adaptability of new crops, varieties and farming methods. This report does not include results of work conducted by SDSU Plant Science Staff headquartered on campus at Brookings, South Dakota.

FIELD PLOT COOPERATORS

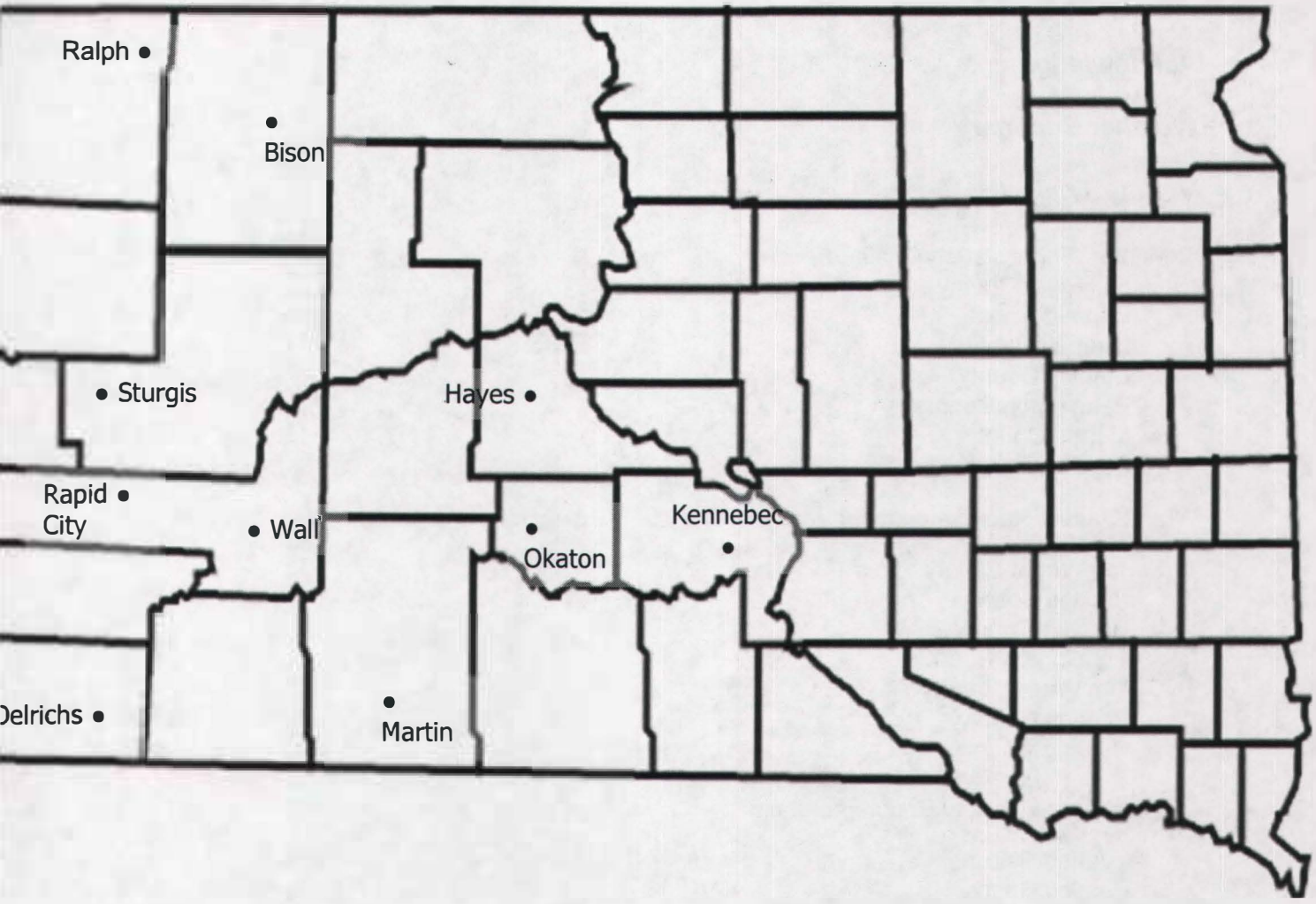
Name	Address	County
Larry Novotny	Martin 57551	Bennett
Bill Greenough	Oelrichs 57763	Fall River
Rex Haskins	Hayes 57537	Stanley
Henry Roghair	Okaton 57562	Jones
Merle Aamot	Kennebec 57544	Lyman
Steve Halverson	Kennebec 57544	Lyman
Merritt Patterson & Sons	Wall 57790	Pennington
Crown Partnership	Wall 57790	Pennington
Dave Wilson	Sturgis 57785	Meade
Ron Seidel	Bison 57620	Perkins
Duane Shea	Bison 57620	Perkins
Lennis Erickson	Ralph 57650	Harding

This is an annual report, some trials are ongoing and will require additional testing before final conclusions can be reported.

250 copies printed at an estimated cost of $5.25 each. March 2011.

South Dakota State University, South Dakota Counties, and U.S. Department of Agriculture Cooperating.

TESTING LOCATIONS



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ACKNOWLEDGMENTS

The following County Extension Educators assisted in locating cooperators and conducting the research: TJ Swan-Belle Fourche, Mike Huber-Timber Lake, Robert Fanning-Kennebec, Ruth Beck-Ft. Pierre, Valerie Mitchell-Murdo, Justin Keyser –Burke, Dave Vander Vliet –Mound City, Bob Drown - Bison and Robin Salverson – Buffalo.

The results reported in this pamphlet were funded under Plant Science Projects SD-00956 Research Substation, H-284 Diversified Cropping Systems in Western South Dakota USDA NIFA - NRI and USDA-NFIA Consortium for Alternative Crops. Additional financial support was received from The South Dakota Crop Improvement Association, The South Dakota Wheat Commission, South Dakota Oilseeds Council, United Sorghum Checkoff Program, Gylling Data Management, Inc., EMD Crop BioScience and Warne Chemical Co.

Research was conducted by Thandiwe Nleya-Associate Professor, John R. Rickertsen-Research Associate II, and Bruce A. Swan-Senior Ag Research Technician, in conjunction with Thomas Cheesbrough – Director Ag Experiment Station, Sue Blodgett – Dept. Head Plant Science, Robert Hall, Neal Foster, Jack Ingemansen, Bill Berzonsky, Kathy Grady, Michael Moechnig, and Karl Glover.

A special thank you is extended to Charlie Ellis and Michael Swan for their help during 2010.

This publication was written and edited by Thandiwe Nleya, John R. Rickertsen and Bruce A. Swan.

WEATHER SUMMARY

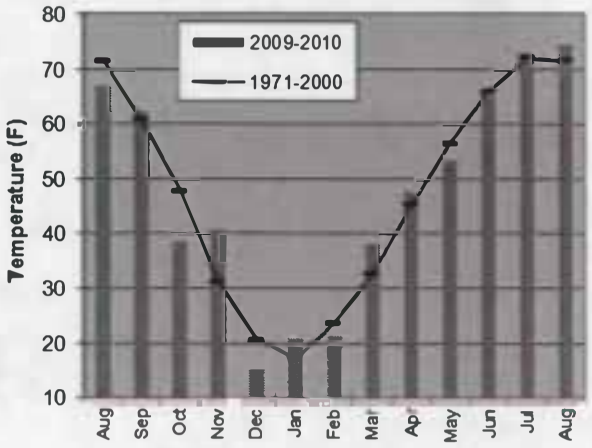
The data in the weather summaries presented in the following charts and table were obtained from the National Oceanic and Atmospheric Administration (NOAA) publication, Climatological Data – South Dakota; from Dennis Todey, State Climatologist at South Dakota State University and the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS). Weather data was also collected from the weather station located at the Wall Rotation Study near Wall, South Dakota. For more information about South Dakota's climate, visit the South Dakota climate website *climate.sdstate.edu*

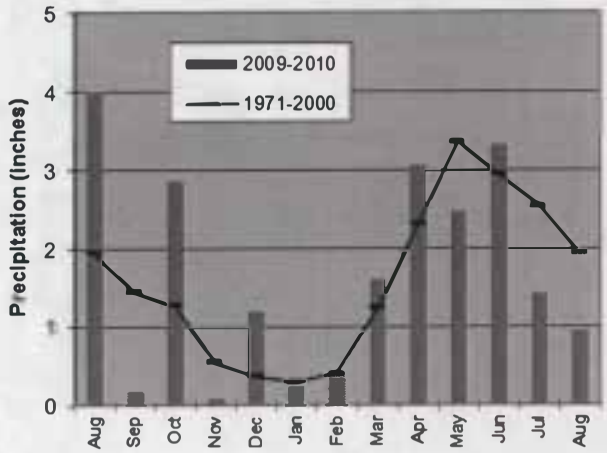
September was dry with most locations receiving ½ to 1" of rain. October turned wetter with most of western South Dakota receiving 3-4" of precipitation. Through the winter, November and January were dry and December and February were near the average. March was average to somewhat below average with April being average to somewhat above average. May was wet in the northwest and average in west central South Dakota. June had good moisture with average to above average rain; July was drier with most locations below the average. August was also dry everywhere but the northwest part of the state.

Temperatures in September were average to 3^{O}F warmer than normal. October was very cold with temperatures 9-10^{O}F lower than average, November went the other direction with readings 9-10^{O}F higher than normal. December was 6-10^{O}F colder than average with January average to slightly below and February 6-10^{O}F colder than average. March was average to above average and April had temperatures near the 30-year normal. May was 2 - 4^{O}F below average. June and July were near the average and August was warm with temperatures 1½ to 3^{O}F warmer than average.

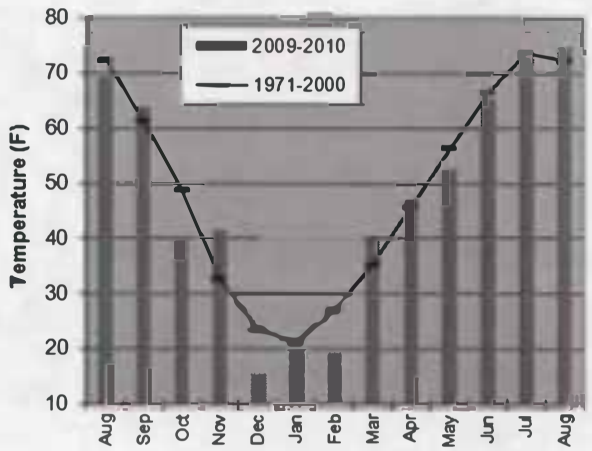
The winter wheat got off to a slow start with the dry September and cold October, but fortunately the very warm November allowed decent growth before going into dormancy. Even though temperatures in December and February were very cold the snow cover allowed most of the wheat to make it through the winter in good condition. The plentiful moisture in the spring and early summer allowed for decent wheat yields. The lack of very hot weather in the summer combined with the above average growing season precipitation provided for excellent yields of summer crops like corn, sunflower and milo.

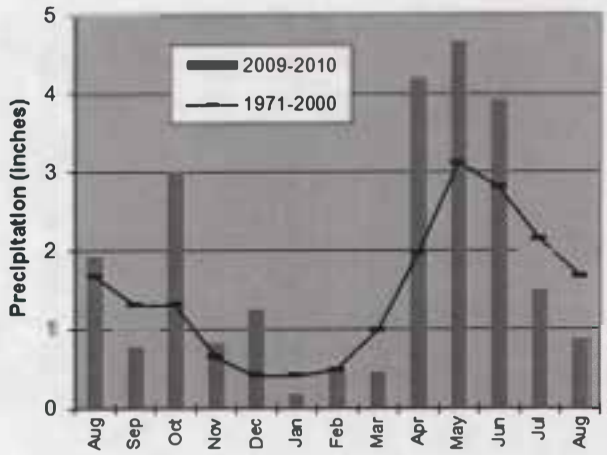
Temperature and Precipitation Charts for Martin (Bennett County Reporting Station).



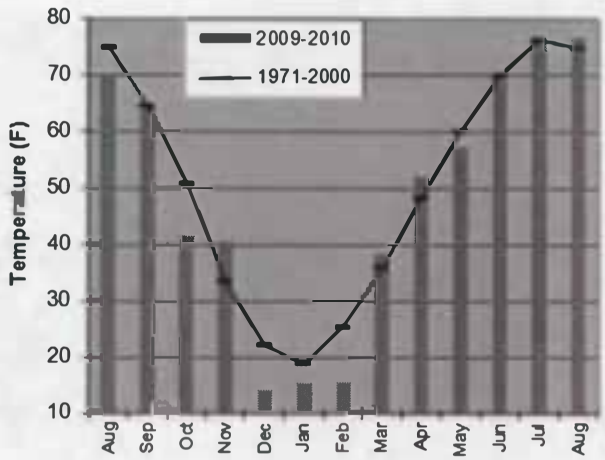


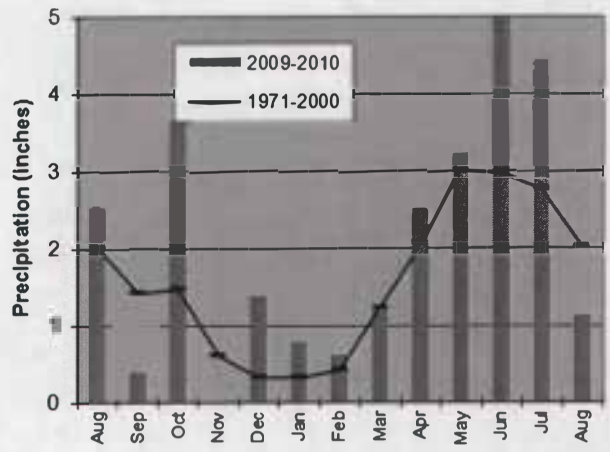
Temperature and Precipitation Charts for Oelrichs (Fall River County Reporting Station).





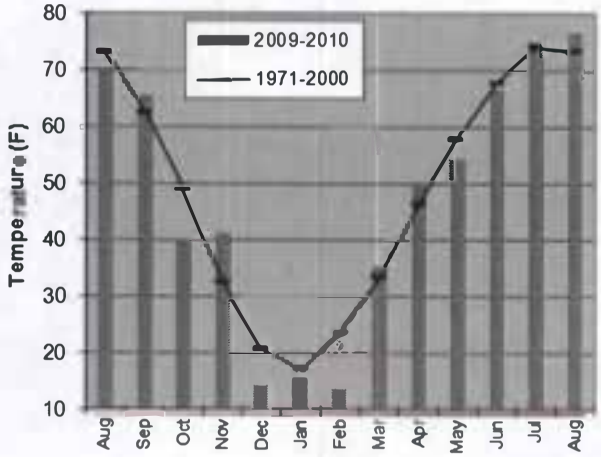
Temperature and Precipitation Charts for Kennebec (Lyman County Reporting Station).

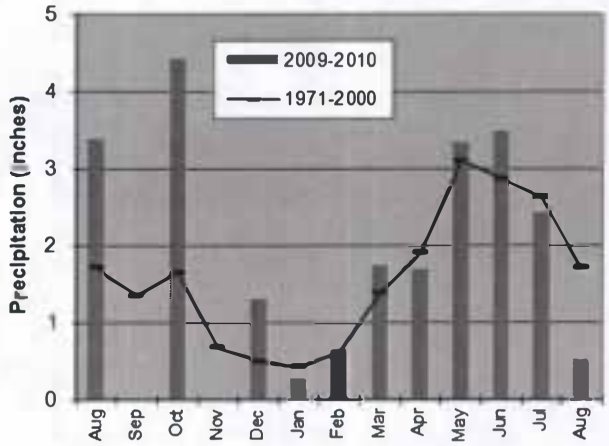




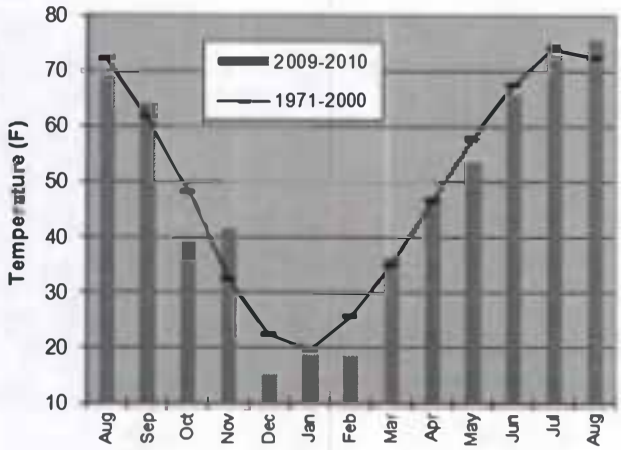
Average temperatures and precipitation obtained from NOAA Climatological Data. Weather data is collected from the reporting station nearest the experimental sites.

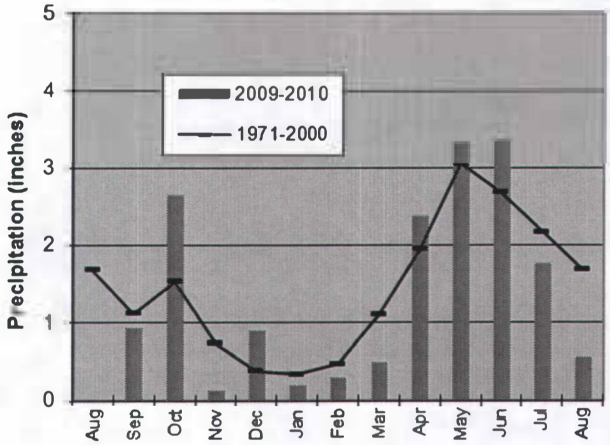
Temperature and Precipitation Charts for Kirley (Haakon County Reporting Station).



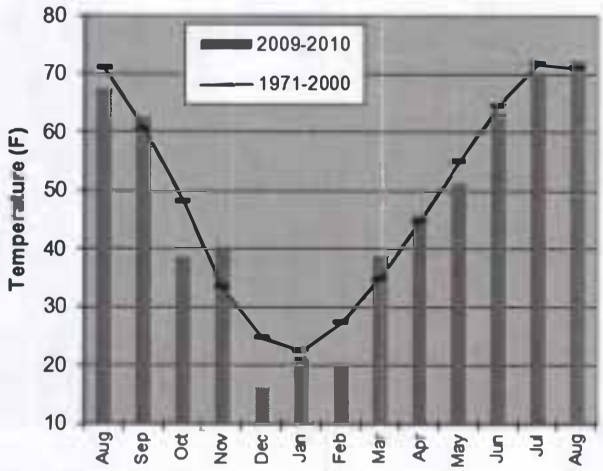


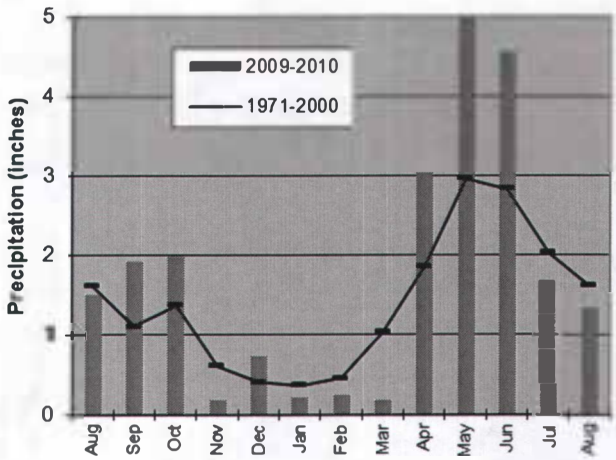
Temperature and Precipitation Charts for Wall (Rotation Study Site).





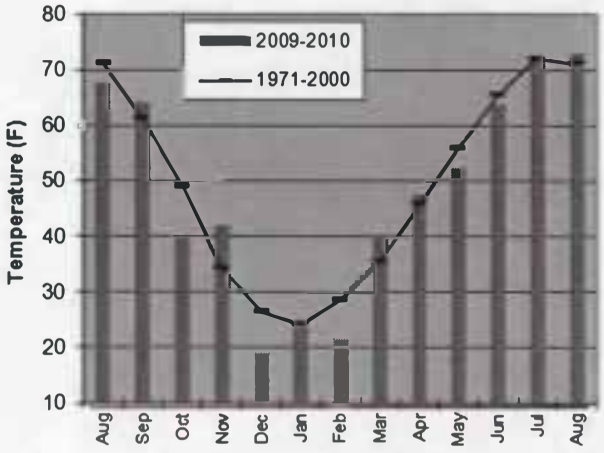
Temperature and Precipitation Charts for Rapid City Airport (Pennington County Reporting Station).

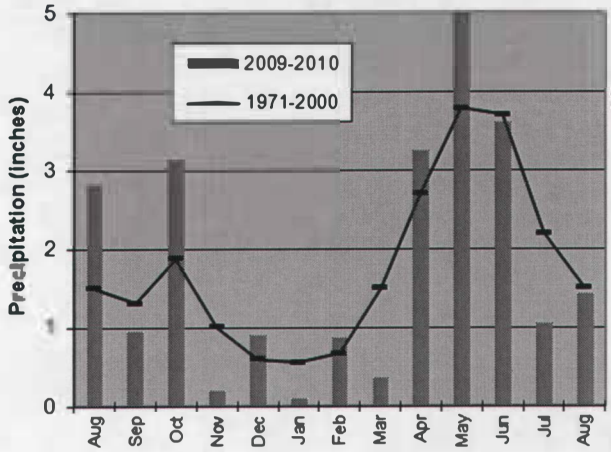




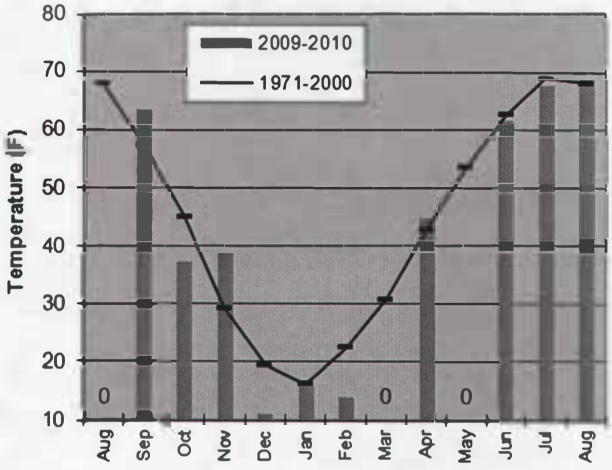
Average temperatures and precipitation obtained from NOAA Climatological Data. Weather data is collected from the reporting station nearest the experimental sites.

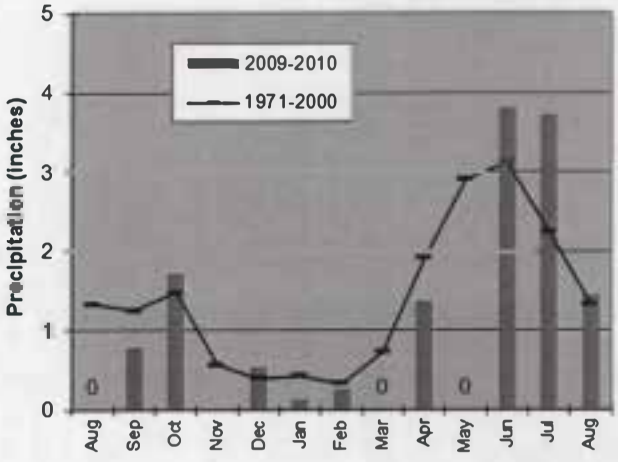
Temperature and Precipitation Charts for Fort Meade *(Sturgis)* (Meade County Reporting Station).





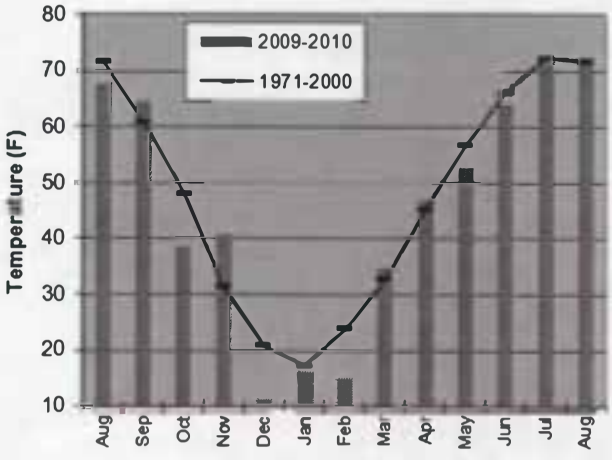
Temperature and Precipitation Charts for Ludlow (Harding County Reporting Station).

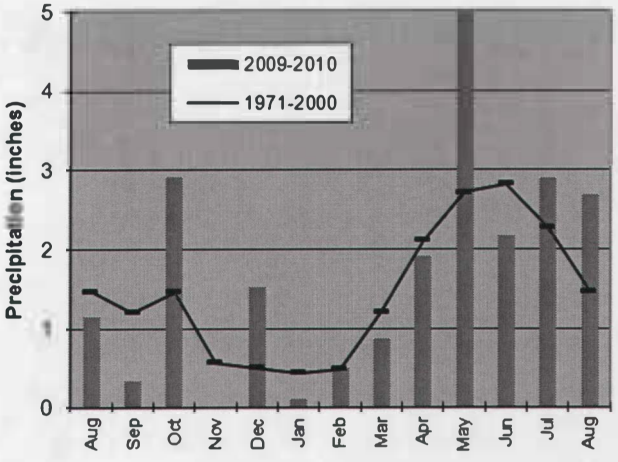




0 = Missing Data

Temperature and Precipitation Charts for Bison (Perkins County Reporting Station).





Average temperatures and precipitation obtained from NOAA Climatological Data. Weather data is collected from the reporting station nearest the experimental sites

Table 1. Weather Data – Date of Critical Temperatures and Total Precipitation in Counties with Experimental Plots (2009-2010).

Location	Date of Freeze* 2010		Total Moisture (inches)		
	Last in Spring	First in Fall	Aug. 09 - July 10	Sept. 09 - Aug 10	April 09 - Aug 10
Bennett County (Martin)	May 8	Oct 28	20.9	17.8	12.8
Harding County (Ludlow)	Missing data	Oct 27	Missing data	Missing data	Missing data
Fall River County (Oelrichs)	May 9	Oct 13	23.1	22.0	15.6
Jones County (Murdo)	May 8	Oct 28	26.7	23.1	16.5
Meade County (Ft. Meade)	May 8	Nov 5	22.5	21.1	15.0
Lyman County (Kennebec)	May 8	Oct 17	26.9	25.5	18.6
Pennington County (Rapid City AP)	April 27	Oct 13	21.3	21.1	16.0
Pennington County (Wall)	May 8	Oct 28	16.4	17.0	11.9
Perkins County (Bison)	May 8	Cot 18	20.0	21.5	16.1
Stanley County (Kirley)	May 8	Oct 28	22.7	19.8	13.2

* = Last 28° temperature in Spring or first 28° temperature in Fall.

WINTER WHEAT VARIETY TRIALS

Objective: To evaluate standard and experimental hard red and hard white winter wheat varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Plots were seeded at seven locations in September 2009 with a John Deere 610 double disk (conventional fallow) or John Deere 750 (no-till) plot drills with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 960,000 seeds per acre (60 - 80 Lb/A).The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Herbicides were applied in either the fall or spring and varied according to weeds present. Visual stand ratings were taken in October 2009 and April 2010. The plots were trimmed to 5' x 25' after heading. The wheat was harvested in July and August with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest. Protein content was determined with a Near Infrared Spectrophotometer (Technicon InfraAlyzer 400).

Location Summaries:

Fall River County – Oelrichs

Planted: September 24, 2009 Herbicide: Widematch (1.33 pt/A)
Harvested: July 27, 2010 Additional Nitrogen: 80 Lb/A
Previous crop: Conventional fallow

Yields at Oelrichs were excellent in 2010 averaging 61 Bu/A. The top yielding varieties in 2010 were Lyman, Wahoo, Millennium and Overland. The best varieties over the past two years are Wahoo, Millennium, Harding, Infinity CL and Alliance. Results are presented in Table 2.

Bennett County – Martin

Planted: September 29, 2009 Herbicide: None
Harvested: August 6, 2010 Additional Nitrogen: 80 Lb/A
Previous crop: Millet stubble, no-till planted

Martin had poor yields in 2010 because of light stands and root rot pressure. Yields at Martin averaged only 22 Bu/A. Because of the variability in the trial (CV = 25.5%) no yields are being reported in 2010.

Lyman County – Kennebec

Planted: September 23, 2009 Herbicide: None
Harvested: July 20, 2010 Additional Nitrogen:
Previous crop: Winter Wheat

Yields were mediocre at Kennebec averaging 32 Bu/A mainly due to heavy downy bromegrass pressure. Because of the weed pressure, the 2010 trial was somewhat variable with a CV of 17.2. Therefore no yield comparisons should be made on the 2010 results. The top varieties over the last three years were Lyman, Millennium, Darrell, Smoky Hill, Wahoo, Arapahoe, Overland and Wesley. Results are presented in Table 3.

Table 2. Hard Winter Wheat Variety Trial – Fall River County (Oelrichs), 2009 - 2010.

Variety	Height	Lodging	Test Wt	Protein	Yield Bu/A	
	Inches	0-9*	Lb/Bu	Percent	2009	2-Year
Hard Red						
ALLIANCE	32	0	59.1	10.0	64.8	**41.4**
ARAPAHOE	36	0	59.9	10.7	65.6	39.1
LYMAN	37	0	60.6	11.3	**74.1**	
WAHOO	34	0	58.9	10.3	**68.0**	**44.2**
MILLENNIUM	36	0	61.8	10.2	**67.8**	**43.4**
OVERLAND	36	0	61.1	10.2	**67.4**	**42.2**
WESLEY	30	0	59.6	11.1	63.5	38.9
FULLER	30	0	58.3	10.9	54.1	34.5
SMOKY HILL	34	0	57.8	9.8	52.7	35.4
HAWKEN	30	0	58.5	11.4	54.8	35.8
HARDING	38	0	61.2	10.7	62.9	**42.8**
CRIMSON	39	0	61.0	11.8	65.7	
EXPEDITION	32	0	59.6	10.8	58.4	36.8
INFINITY CL	36	0	61.0	10.8	64.4	**42.5**
AP502CL2	31	0	60.2	10.8	55.6	38.8
Hard White						
ALICE	30	0	59.7	11.9	49.6	31.8
NUDAKOTA	29	0	61.4	12.6	55.7	36.9
WENDY	33	0	59.3	11.9	59.7	**39.9**
Average	33.5	0.0	59.9	11.0	61.4	39.0
LSD (P=.05)	2.9	0.0	1.4		7.2	4.8
CV	6.1		1.6		8.3	12.4

* 0=No lodging, 9 = 100% lodged.

Table 3. Hard Winter Wheat Variety Trial - Lyman County (Kennebec), 2008 - 2010.

Variety	Height	Lodging	Test Wt	Protein	Yield Bu/A	
	Inches	0-9*	Lb/Bu	Percent	2010	3 Year
Hard Red						
ARAPAHOE	38	0	52.6	11.2	35.6	**59.8**
ART	32	0	54.9	11.0	35.1	.
BOOMER	33	0	51.3	11.9	24.7	.
CAMELOT	34	0	51.0	10.7	31.9	.
DARRELL	36	0	55.1	10.3	42.5	**60.7**
EXPEDITION	33	0	49.6	11.1	27.3	54.8
FULLER	30	0	51.2	10.9	31.9	52.8
HARDING	39	0	54.5	11.2	33.0	**60.0**
HATCHER	32	0	50.1	10.8	35.8	51.3
HAWKEN	31	0	53.6	10.9	39.7	56.5
JAGALENE	35	0	51.4	11.4	34.0	49.2
JERRY	40	0	52.6	12.0	33.6	55.3
LYMAN	35	0	55.0	12.6	44.6	**63.8**
MILLENNIUM	38	0	55.0	12.1	38.6	**61.5**
OVERLAND	34	0	55.2	12.1	28.1	**59.1**
RADIANT	36	0	49.6	12.6	19.2	.
SETTLER CL	32	0	50.7	12.1	24.8	52.7
SMOKY HILL	33	0	54.4	10.7	37.6	**60.3**
STRIKER	32	0	50.6	13.3	21.2	.
WAHOO	36	0	51.0	11.8	30.7	**60.3**
WESLEY	32	0	52.5	11.7	40.6	**58.0**
SD06069	33		52.1	11.6	34.9	.
SD06158	33		52.1	12.4	31.2	.
SD051181	34		53.1	11.5	34.3	**62.9**
SD07056	39	0	55.8	10.4	36.7	.
SD07126	36	0	53.5	11.2	31.2	.
SD07165	35	0	49.2	11.6	30.7	.
Hard White						
ALICE	31	0	51.0	11.8	31.9	53.5
WENDY	29	0	51.0	12.5	25.4	49.6
SD05W030	35	0	51.8	11.1	26.1	.
Average	34	0.0	52.4	11.6	32.4	56.9
LSD (P=.05)	2.6	0.0	3.6	.	8.0	5.9
CV	5.5	0.0	4.9	.	**17.4**	12.7

* 0=No lodging, 9 = 100% lodged.

Stanley County - Hayes

Planted: September 22, 2009 Herbicide: Olympus (0.9 oz/A)
Harvested: July 26, 2010 Additional Nitrogen: 120 lb/A
Previous crop: Wheat, no-till planted

Hayes had excellent yields averaging 72 Bu/A with the varieties Expedition, Lyman, Hawken, Wendy, Settler CL and Smoky Hill showing top yields in 2010. The varieties with the best three year averages were Expedition, Settler CL, Wendy, Smoky Hill, Darrell, and Overland. Results are presented in Table 4.

Pennington County - Wall

Planted: September 29, 2009 Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Buctril (1 pt/A)
Harvested: July 28, 2010 Additional Nitrogen: 80 lb/A
Previous crop: Chemical fallow, no-till planted

The Wall location averaged 38 Bu/A in 2010. The best yielding varieties at Wall were Hatcher, Camelot, Expedition, Hawken, Overland and Wesley. Over the past three years the varieties Overland, Millennium, Striker, Hatcher and Wahoo had the best yields. The results are presented in Table 5.

Meade County - Sturgis

Planted: September 28, 2009 Herbicide: Amber (0.5 oz/A)
Harvested: July 30, 2010 Additional Nitrogen: 80 lb/A
Previous crop: Chemical fallow, no-till planted

The Sturgis location had good yields in 2010 averaging 55 Bu/A. The varieties with the best yields in 2010 were Wahoo, Overland, Hatcher, Expedition, Wesley and Millennium. The varieties in the top yield group over the past three years were Hatcher, Overland, Wahoo, Wesley, Darrell and Millennium. The results are presented in Table 6.

Perkins County - Bison

Planted: September 28, 2009 Herbicide: Fall - Maverick (.66 oz/A)
Harvested: August 5, 2010 Additional Nitrogen: 60 Lb/A
Previous crop: Wheat, no-till planted.

The Bison location suffered from poor fall growth due to very dry conditions and spring freeze injury, which limited yields to 28 Bu/A. The top yield group in 2010 consisted of Wahoo, Lyman, Hatcher, Camelot, Arapahoe, Overland and Camelot. There are no three year averages for Bison. Results are presented in Table 7.

Table 4. Hard Winter Wheat Variety Trial - Stanley County (Hayes), 2008 - 2010.

Variety	Height	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	Percent	2010	3 Year
Hard Red						
ARAPAHOE	42	0	57.8	12.5	68.3	63.7
ART	34	0	58.2	12.5	72.1	.
BOOMER	39	0	57.4	13.3	66.2	.
CAMELOT	36	0	58.5	12.6	**74.4**	.
DARRELL	39	0	59.6	12.1	**75.5**	**69.2**
EXPEDITION	35	0	59.0	11.7	**79.0**	**71.1**
FULLER	34	0	58.3	11.6	70.0	63.6
HARDING	42	0	60.3	12.9	70.3	63.5
HATCHER	34	0	58.9	11.6	71.8	62.4
HAWKEN	31	0	58.7	12.7	**77.5**	65.5
JAGALENE	36	0	58.7	12.6	64.7	59.8
JERRY	43	0	58.3	13.2	65.4	60.4
LYMAN	37	0	58.9	13.1	**78.1**	**67.2**
MILLENNIUM	41	0	59.9	12.5	**74.8**	**66.7**
OVERLAND	37	0	59.4	12.0	**74.5**	**67.4**
RADIANT	42	0	56.4	12.6	63.2	.
SETTLER CL	34	0	58.5	10.7	**77.5**	**70.6**
SMOKY HILL	35	0	58.6	11.1	**76.9**	**70.2**
STRIKER	37	0	58.5	11.8	68.3	.
WAHOO	40	0	55.6	10.4	**76.3**	66.2
WESLEY	33	0	57.0	11.0	**76.0**	65.8
SD06069	35	0	59.0	10.9	70.8	.
SD06158	34	0	59.1	10.9	72.4	.
SD051181	38	0	59.5	11.0	**74.1**	**67.3**
SD07056	44	0	60.0	12.0	61.3	.
SD07126	41	0	59.5	12.6	70.3	.
SD07165	37	0	56.9	10.8	71.8	.
Hard White						
ALICE	32	0	58.4	12.1	71.2	63.7
WENDY	30	0	60.7	11.2	**77.5**	**70.4**
SD05W030	37	0	60.7	11.4	**72.9**	.
Average	37	0	58.7	11.9	72.1	66.0
LSD (P=.05)	3.9	0.0	1.6	.	5.6	4.5
CV	2.0	.	1.4	.	5.8	8.4

* 0=No lodging, 9 = 100% lodged.

Table 5. Hard Winter Wheat Variety Trial - Pennington County (Wall), 2008-2010.

Variety	Height	Lodging	Test Wt	Protein	Yield Bu/A	
	Inches	0-9*	Lb/Bu	Percent	2010	3 Year
Hard Red						
ARAPAHOE	32.3	0	60.4	11.9	33.4	50.1
ART	28.3	0	59.1	14.4	30.0	.
BOOMER	30.8	0	59.4	11.8	37.3	.
CAMELOT	30.8	0	59.6	10.8	**47.7**	.
DARRELL	33.5	0	60.4	12.0	37.8	52.3
EXPEDITION	28.5	0	59.6	11.0	45.8	54.9
FULLER	27.5	0	58.7	13.5	27.5	47.8
HARDING	34.3	0	60.2	12.5	28.2	48.7
HATCHER	28.8	0	59.4	10.3	**50.9**	55.0
HAWKEN	27	0	60.5	10.7	44.5	54.1
JAGALENE	28.3	0	61.5	10.7	39.7	51.1
JERRY	35.8	0	59.5	11.5	33.1	49.9
LYMAN	30.8	0	58.5	12.2	31.0	48.5
MILLENNIUM	33.8	0	61.7	10.9	39.8	55.1
OVERLAND	30.8	0	59.5	10.5	43.0	**59.6**
RADIANT	35	0	62.7	11.2	38.9	.
SETTLER CL	27.8	0	60.5	11.0	41.0	53.6
SMOKY HILL	28	0	60.4	11.9	35.6	53.2
STRIKER	27.8	0	61.2	11.7	35.9	55.1
WAHOO	30.8	0	60.5	10.9	37.6	54.5
WESLEY	27.3	0	60.5	11.5	42.0	.
SD06069	30.3	0	60.5	10.8	41.4	.
SD06158	31.8	0	61.2	10.6	42.7	.
SD051181	29.3	0	60.8	11.9	35.4	52.9
SD07056	35.8	0	61.3	11.7	35.4	.
SD07126	32.8	0	61.5	12.4	35.1	.
SD07165	29	0	60.5	10.7	41.9	.
Hard White						
ALICE	27.8	0	59.3	11.6	41.9	52.4
WENDY	26.5	0	58.1	13.6	28.2	51.3
SD05W030	29.8	0	61.5	13.0	26.1	.
Average	30	0	60.3	11.6	37.6	52.6
LSD (P=.05)	2.4	0.0	1.8	.	3.2	3.0
CV	5.6	.	2.1	.	6.0	7.6

* 0=No lodging, 9 = 100% lodged.

Table 6. Hard Winter Wheat Variety Trial - Meade County (Sturgis), 2008 - 2010.

Variety	Height	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	Percent	2010	3 Year
Hard Red						
ARAPAHOE	38	0	60.7	10.4	66.9	53.2
ART	35	0	61.7	10.6	**72.1**	.
BOOMER	34	0	60.6	11.3	60.1	.
CAMELOT	38	0	60.6	10.8	**71.8**	.
DARRELL	38	0	60.3	11.1	69.9	**57.4**
EXPEDITION	36	0	59.9	10.3	**72.7**	56.8
FULLER	34	0	60.8	10.2	68.6	53.2
HARDING	43	0	61.6	11.3	61.7	52.0
HATCHER	34	0	60.6	10.2	**73.0**	**61.2**
HAWKEN	33	0	59.0	10.4	64.4	51.2
JAGALENE	36	0	60.2	10.1	62.1	51.4
JERRY	43	0	60.6	10.7	64.7	51.8
LYMAN	39	0	60.8	10.9	**72.1**	56.7
MILLENNIUM	39	0	61.1	11.1	**72.1**	**57.1**
OVERLAND	37	0	60.8	9.8	**74.1**	**59.2**
RADIANT	38	0	61.1	10.6	66.5	.
SETTLER CL	35	0	61.4	9.9	69.6	49.7
SMOKY HILL	34	0	59.9	9.5	65.7	52.7
STRIKER	33	0	61.2	10.8	60.7	.
WAHOO	37	0	59.5	9.5	**74.2**	**59.2**
WESLEY	33	0	59.0	10.5	**72.7**	**58.1**
SD06069	33	0	62.1	10.9	66.9	.
SD06158	34	0	61.9	11.1	69.6	.
SD051181	36	0	61.5	10.9	**71.8**	55.4
SD07056	46	0	61.8	10.5	69.8	.
SD07126	41	0	61.7	11.3	66.6	.
SD07165	36	0	59.9	10.9	68.9	.
Hard White						
ALICE	33	0	60.9	10.8	69.9	55.2
WENDY	32	0	62.1	10.6	**70.6**	49.5
SD05W030	37	0	61.9	10.1	67.5	.
Average	36	0	60.8	10.6	68.6	54.8
LSD (P=.05)	1.5	0.0	1.1	.	4.2	4.2
CV	3.0	.	1.3	.	4.3	9.6

*0=No lodging, 9 = 100% lodged.

Table 7. Hard Winter Wheat Variety Trial - Perkins County (Bison), 2010.

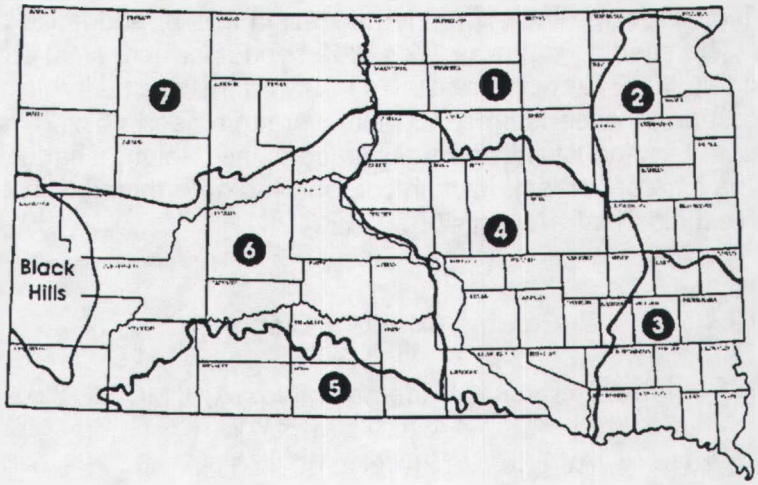
Variety	Height	Lodging	Test Wt	Protein	Yield
	Inches	0-9*	Lb/Bu	Percent	Bu/A
Hard Red					
ARAPAHOE	28	0	59.4	13.6	**29.5**
ART	26	0	59.5	13.5	27.6
BOOMER	26	0	57.9	12.2	**31.1**
CAMELOT	26	0	58.2	12.5	**28.5**
DARRELL	26	0	59.5	13.5	26.3
EXPEDITION	25	0	59.0	13.0	26.6
FULLER	24	0	59.7	14.2	22.9
HARDING	25	0	60.4	14.2	20.2
HATCHER	24	0	61.5	12.6	**31.2**
HAWKEN	24	0	61.4	13.9	24.5
JAGALENE	23	0	60.4	14.5	24.8
JERRY	26	0	59.0	13.7	25.7
LYMAN	26	0	60.0	14.9	**33.7**
MILLENNIUM	26	0	61.1	13.4	28.2
OVERLAND	26	0	58.4	13.0	**28.5**
RADIANT	28	0	61.6	14.1	27.7
SETTLER CL	23	0	61.1	13.2	24.0
SMOKY HILL	23	0	59.6	14.4	24.7
STRIKER	23	0	60.2	13.7	27.9
WAHOO	26	0	60.0	13.5	**34.1**
WESLEY	23	0	59.2	14.1	**29.0**
SD06069	23	0	60.4	12.7	**29.5**
SD06158	25	0	59.1	13.6	**32.7**
SD051181	26	0	58.5	12.5	**33.1**
SD07056	29	0	62.0	12.5	**30.6**
SD07126	28	0	59.7	12.8	**31.7**
SD07165	27	0	60.0	12.7	**33.5**
Hard White					
ALICE	24	0	59.3	13.2	**29.5**
WENDY	22	0	61.9	14.8	25.7
SD05W030	26	0	61.4	12.7	**31.2**
Average	25	0.0	60.0	13.4	28.5
LSD (P=.05)	3.1	0.0	2.3	.	5.73
CV	8.6	0.0	2.7	.	14.2

* 0=No lodging, 9 = 100% lodged.

WHEAT VARIETY RECOMMENDATIONS FOR 2011

Crop Adaptation Areas for South Dakota

(Revised 1992)



WINTER WHEAT

Recommended:

Variety	*Crop Adaptation Area*
Alice (white) [PVP]	1 [pc],4 [pc],5,6,7 [pc]
Expedition [PVP]	1 [pc],4 [pc],5,6,7 [pc]
Harding [PVP]	1 [pc],2 [pc],4,7
Millennium [PVP]	1 [pc],4 [pc],5,6,7 [pc]
Overland [PVP]	1[pc],3,4[pc],5,6,7[pc]
Wendy (white) [PVP]	5,6,7 [pc]

Acceptable/Promising:

Variety	*Crop Adaptation Area*
Arapahoe [PVP]	1 [pc],3,4 [pc],5,6,7 [pc]
Darrell [PVP]	1 [pc],4 [pc],5,6,7 [pc]
Hatcher [PVP]	5,6,7 [pc]
Hawken [PVP]	3,4 [pc],5,6
Lyman [PVP]	1 [pc],3,4 [pc],5,6,7 [pc]
Smoky Hill	5,6,7 [pc]
Wesley	5,6,7 [pc]

SPRING WHEAT

Recommended:

Variety	*Crop Adaptation Area*
Albany [PVP]	Statewide
Brick [PVP]	Statewide
Faller [PVP]	Statewide
RB07 [PVP]	All except 3
Steele-ND [PVP]	All except 3
Traverse [PVP]	Statewide
Select [PVP]	Statewide

Acceptable/Promising:

Variety	*Crop Adaptation Area*
Barlow [PVP]	Statewide
Granger [PVP]	All except 3
Howard [PVP]	Statewide
Sampson [PVP]	5,6,7

DURUM WHEAT

Durum wheat is not part of the statewide variety testing (CPT) program, so no recommendations are made. There were trials planted at Bison and Ralph with the results presented on page 19.

[PVP] U.S. Plant Variety Protection applied for and/or issued; seed sales of these varieties are restricted to classes of certified seed.

[pc] Plant into protective cover.

Source - Small Grains, 2011 Variety Recommendations, EC774, South Dakota State University. (http://www.sdstate.edu/ps/extension/crop-mgmt/variety-trials-results.cfm)

SPRING WHEAT VARIETY TRIALS

Objective: To evaluate standard and experimental hard red spring wheat varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Plots were seeded at three locations in March and April 2010 with a John Deere 750 plot drill with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 1,220,000 seeds per acre (~90 Lb/A). The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Herbicides were applied in May and varied according to weeds present. Plots were trimmed to 5' x 25' after heading. The wheat was harvested in August with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest. Protein content was determined with a Near Infrared Spectrophotometer (Technicon InfraAlyzer 400).

Location Summaries:

Perkins County – Bison

Planted: April 21, 2010
Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: August 17, 2010
Additional Nitrogen: 60 lb/A
Previous crop: Wheat, no-till planted

The trial at Bison averaged 32 Bu/A with test weights averaging 59.2 Lb/Bu. The top yielding varieties in 2010 were Breaker, Barlow, Faller, Albany, RB07, Briggs and Brogan. There was too much variation in the plot for valid yield comparisons to be made for the three year data (CV = 19.2). Results are shown in Table 8.

Harding County – Ralph

Planted: April 21, 2010
Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: August 18, 2010
Additional Nitrogen: 50 lb/A
Previous crop: Conventional Fallow

Ralph averaged 29 Bu/A with test weights averaging 55.3 Lb/Bu. There was a large amount of stripe rust at this location and those ratings are listed in Table 9. The top yielding varieties in 2010 were Sabin, Traverse, Granger, Select, Reeder and Barlow. The best varieties over the last two years were Sabin, Traverse, Select, Breaker and RB07. The variety Mott is a semi-solid stemmed variety that would be a good choice if wheat stem sawfly is a concern. Results are shown in Table 9.

Pennington County - Wall

Planted: March 31, 2010
Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Buctril (1 pt/A)
Harvested: August 2, 2010
Additional Nitrogen: 80 lb/A
Previous crop: Chemical fallow

Wall had disappointing results in 2010 with the plot only averaging 15 Bu/A . With yields this low, there was not enough sample to get an accurate test weight with the combine weigh system. The top yield group in 2010 consisted of Samson, Mott, Albany, Vantage and Sabin. The top yield group over the past three years consisted of Samson, Traverse, Sabin, Faller and Granger. Results are shown in Table 10.

Table 8. Hard Red Spring Wheat Variety Trial – Harding County (Bison), 2008 - 2010.

Variety	Height	Lodging	Test Wt.	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	%	2010	3-Year
ALBANY	23	0	58.7	12.9	**36.3**	31.9
BARLOW	27	0	60.6	14.4	**38.4**	31.8
BREAKER	27	0	60.1	13.8	**39.2**	.
BRENNAN	23	0	58.4	14.1	32.2	28.1
BRICK	28	0	59.4	13.1	31.8	31.8
BRIGGS	30	0	58.9	12.7	**35.7**	30.4
BROGAN	25	0	60.1	13.8	**35.6**	.
CHRIS	33	0	57.3	15.2	28.2	23.5
DIGGER	26	0	58.3	13.8	28.9	.
FALLER	26	0	57.9	12.1	**38.1**	30.6
GLENN	25	0	60.3	13.9	28.4	27.9
GRANGER	28	0	61.1	12.4	**33.0**	31.8
HAT TRICK	23	0	59.6	12.1	23.1	.
HOWARD	26	0	57.3	13.1	29.6	27.7
MOTT	28	0	59.4	14	**35.1**	27.3
RB07	26	0	59.7	13.6	**36.3**	32.6
REEDER	24	0	59.8	14.4	31.9	26.1
SABIN	25	0	58.9	13.6	28.2	27.9
SAMSON	24	0	57.8	13.3	**35.0**	32.7
SELECT	27	0	62.5	13.5	31.7	29.9
STEELE-ND	26	0	59.0	13.7	29.8	29.0
TOM	25	0	59.2	14.2	28.4	24.6
TRAVERSE	27	0	57.4	13.9	**33.9**	32.3
VANTAGE	25	0	61.1	15.8	**34.4**	.
MN 05214-3	24	0	60.5	13.5	32.3	.
ND 808	27	0	59.5	13.3	**37.7**	.
ND 810	28	0	58.2	13.9	30.4	
ND 811	23	0	57.5	13.9	27.6	.
SD 3997	28	0	58.3	13.7	26.4	27.2
SD 4011	26	0	59.6	14	**32.9**	.
SD 4023	24	0	59.6	13.1	30.0	.
SD 4046	28	0	59.2	13.1	29.2	.
SD 4076	23	0	60.1	13.1	28.4	.
SD 4105	26	0	59.8	13.1	28.7	.
SD 4112	27	0	58.7	13.6	29.1	.
SD 4159	25	0	58.5	14.8	26.8	.
SD 4181	26	0	59.6	14.7	26.7	.
SD 4189	27	0	59.0	14.6	29.2	.
Average	26	0.0	59.2	13.7	31.5	29.3
LSD (P=.05)	2.1	0.0	2.1	.	6.7	4.1
CV	5.8	0.0	2.2	.	13.0	**19.2**

* 0=No lodging, 9 = 100% lodged.

Table 9. Hard Red Spring Wheat Variety Trial – Perkins County (Ralph), 2009 - 2010.

Variety	Stripe Rust 0-9*	Height Inches	Lodging 0-9**	Test Wt. Lb/Bu	Protein %	Yield 2010	Bu/A 2-Year
ALBANY	4	27	0	54.4	13.8	25.9	40.1
BARLOW	5	30	0	55.6	16.0	33.2	41.7
BREAKER	4	28	0	56.6	15.8	31.1	42.2
BRENNAN	3	27	0	59.3	14.7	28.9	35.5
BRICK	2	32	0	57.0	15.0	28.7	37.5
BRIGGS	5	33	0	55.4	14.6	32.8	42.0
BROGAN	7	27	0	53.9	14.9	18.7	31.5
CHRIS	4	36	0	55.1	15.6	26.9	35.0
DIGGER	2	31	0	53.8	14.5	28.2	.
FALLER	7	32	0	48.6	14.6	18.2	37.7
GLENN	1	31	0	53.5	15.8	31.7	38.4
GRANGER	5	33	0	57.0	14.4	35.0	43.6
HAT TRICK	9	28	0	55.5	13.0	19.3	.
HOWARD	6	31	0	52.6	15.4	26.3	37.2
MOTT	1	32	0	56.2	15.1	25.1	39.5
RB07	4	29	0	55.2	14.4	29.6	42.1
REEDER	1	28	0	54.1	14.9	33.5	41.6
SABIN	0	30	0	55.6	16.6	**38.6**	**47.8**
SAMSON	7	28	0	52.2	14.3	23.0	29.7
SELECT	6	32	0	57.2	13.3	34.7	43.2
STEELE-ND	3	31	0	55.4	15.2	31.0	38.9
TOM	1	31	0	56.0	15.4	29.1	37.2
TRAVERSE	2	30	0	55.1	13.9	**35.5**	43.5
VANTAGE	1	28	0	56.8	16.3	27.6	34.7
MN 05214-3	2	27	0	55.5	15.3	30.6	.
ND 808	6	31	0	50.3	13.4	21.2	36.4
ND 810	2	32	0	55.7	14.3	31.1	.
ND 811	7	28	0	52.9	13.7	24.6	.
SD 3997	7	33	0	57.0	14.6	32.9	35.6
SD 4011	6	29	0	54.9	14.5	31.2	38.8
SD 4023	3	29	0	56.7	13.7	33.7	**44.8**
SD 4046	5	32	0	57.7	13.6	27.2	35.7
SD 4076	5	29	0	57.6	13.6	31.1	37.4
SD 4105	7	31	0	56.4	14.2	28.6	.
SD 4112	3	30	0	54.9	15.1	27.9	.
SD 4159	1	28	0	57.0	15.0	**36.7**	.
SD 4181	3	32	0	56.7	15.4	27.7	.
SD 4189	4	32	0	56.1	13.7	**39.7**	.
Average	4.0	30	0.0	55.3	14.7	29.4	38.9
LSD (P=.05)	.	2.0	0.0	1.9	.	4.6	3.9
CV	.	4.7	0.0	2.5	.	11.1	10.2

* 0 = No rust, 9 = Leaf gone. ** 0 = No lodging, 9 = 100% lodged.

Table 10. Hard Red Spring Wheat Variety Trial – Pennington County (Wall),2008 - 2010.

Variety	Height Inches	Lodging 0-9*	Test Wt. Lb/Bu	Protein %	Yield 2010	Bu/A 3-Year
ALBANY	26	0	**	14.2	19.1	34.6
BARLOW	31	0		16.0	14.6	33.2
BREAKER	27	0		15.6	14.8	.
BRENNAN	26	0		15.6	15.9	35.4
BRICK	31	0		16.5	7.6	32.2
BRIGGS	30	0		16.2	13.9	34.9
BROGAN	26	0		15.3	16.7	.
CHRIS	32	0		15.8	12.4	26.6
DIGGER	28	0		15.1	15.4	.
FALLER	26	0		15.4	15.8	**36.8**
GLENN	29	0		16.4	10.3	28.1
GRANGER	29	0		16.2	10.1	**36.1**
HAT TRICK	26	0		18.1	11.5	
HOWARD	30	0		16.0	15.9	33.7
MOTT	29	0		15.0	20.0	29.8
RB07	26	0		17.2	12.4	35.4
REEDER	29	0		15.3	17.7	30.7
SABIN	26	0		16.2	18.5	**37.9**
SAMSON	25	0		15.1	**24.0**	**38.8**
SELECT	30	0		16.2	11.8	35.1
STEELE-ND	30	0		15.8	16.2	33.0
TOM	28	0		17.3	7.9	33.5
TRAVERSE	30	0		14.5	16.4	**37.9**
VANTAGE	25	0		15.3	18.8	.
MN 05214-3	26	0		16.7	11.5	.
ND 808	27	0		15.3	15.9	.
ND 810	30	0		16.3	10.1	.
ND 811	28	0		15.4	19.7	.
SD 3997	32	0		15.4	**23.0**	**37.6**
SD 4011	28	0		16.1	13.1	.
SD 4023	27	0		15.5	17.6	.
SD 4046	29	0		15.5	13.3	.
SD 4076	26	0		16.3	8.9	.
SD 4105	30	0		15.4	16.1	.
SD 4112	26	0		16.3	11.0	.
SD 4159	28	0		16.1	16.1	.
SD 4181	29	0		17.2	6.4	.
SD 4189	30	0		13.8	21.6	.
Average	28	0.0		15.8	14.8	34.1
LSD (P=.05)	1.9	0.0		.	2.3	3.0
CV	4.9	0.0		.	11.0	11.1

* 0=No lodging, 9 = 100% lodged.

** Not enough sample for a test weight.

DURUM WHEAT VARIETY TRIALS

Objective: To evaluate standard and experimental durum wheat varieties for yield, agronomic characteristics and adaptation to northwestern South Dakota.

Procedure: Plots were seeded at two locations in April 2010 with a John Deere 750 plot drill with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 1,220,000 seeds per acre (90 - 115 Lb/A).The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Herbicides were applied in late May and varied according to weeds present. Plots were trimmed to 5' x 25' after heading. The wheat was harvested in August with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest. Protein content was determined with a Near Infrared Spectrophotometer (Technicon InfraAlyzer 400).

Location Summaries:

Perkins County – Bison

Planted: April 21, 2010 Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: August 17, 2010 Additional Nitrogen: 60 lb/A
Previous crop: Wheat, no-till planted

Durum wheat yields averaged 36 Bu/A at Bison with test weights averaging 59.6 Lb/Bu. There was no significant yield differences among the varieties tested in 2010. There are no three year averages at Bison. Results are shown in Table 11.

Harding County – Ralph

Planted: April 21, 2010 Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: August 18, 2010 Additional Nitrogen: 50 lb/A
Previous crop: Conventional Fallow

The Ralph trial looked good in 2010 averaging 47 Bu/A with test weights averaging 57.4 Lb/Bu. The top yielding varieties in 2010 were Divide and Tioga. There are no significant yield differences among the varieties with four year averages for Ralph. Results are shown in Table 12.

Table 11. Durum Wheat Variety Trial – Perkins County (Bison), 2010.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Protein %	Yield Bu/Ac
AC AVONLEA	30	0	58.5	16.8	36.4
ALKABO	30	0	59.4	13.2	36.4
DIVIDE	30	0	60.3	13.2	33.9
GRENORA	29	0	59.6	12.6	39.6
LEBSOCK	30	0	60.6	12.2	30.7
TIOGA	34	0	59.1	13.2	38.2
Average	30.2	0.0	59.6	13.5	35.9
LSD (P=.05)	1.5	0.0	1.8	.	**NS**
CV	3.4	0.0	1.9	.	11.4

* 0 = no lodging, 9 = 100% lodged.

Table 12. Durum Wheat Variety Trial – Harding County (Ralph), 2010.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Protein %	Yield 2010	Bu/Ac 4-year
AC AVONLEA	33	0	56.7	15.6	50.1	.
ALKABO	31	0	57.1	13.4	38.3	39.9
DIVIDE	35	0	58.4	15.0	**53.8**	.
GRENORA	30	0	55.5	15.2	46.1	41.1
LEBSOCK	32	0	58.0	15.2	39.9	38.9
TIOGA	36	0	58.9	15.0	**52.2**	.
Average	33	0.0	57.4	14.9	46.8	2.9
LSD (P=.05)	1.2	0.0	1.2	.	3.1	**NS**
CV	2.4	0.0	1.4	.	4.4	10.5

* 0 = no lodging, 9 = 100% lodged.

OAT AND BARLEY VARIETY RECOMMENDATIONS FOR 2011

Crop Adaptation Areas for South Dakota

(Revised 1992)

OATS

Recommended:

Variety	*Crop Adaptation Area*
Beach [PVP]	5,6,7
Colt [PVP]	Statewide
Shelby427 [PVP]	Statewide
Souris [PVP]	Statewide
Stallion [PVP]	All except 3

Acceptable/Promising:

Variety	*Crop Adaptation Area*
HiFi [PVP (non-title V status)]	All except 3
Jerry [PVP (non-title V status)]	5,6,7
Rockford	All except 3
Buff (hull-less)	Statewide
Streaker [PVP] (hull-less)	Statewide

SPRING BARLEY

Recommended:

Variety	*Crop Adaptation Area*
6 Row	
Lacey [PVP]	Statewide
Stellar-ND [PVP]	Statewide
2 Row	
Conlon [PVP]	1,4,6,7
Eslick [PVP] (feed)	6,7
Pinnacle	1,2,7
Rawson (feed)	1,2,7

Acceptable/Promising:

Variety	*Crop Adaptation Area*
6 Row	
Tradition [PVP]	Statewide
2 Row	

[PVP] U.S. Plant Variety Protection applied for and/or issued; seed sales of these varieties are restricted to classes of certified seed.

Source - Small Grains, 2011 Variety Recommendations, EC774, South Dakota State University. (http://www.sdstate.edu/ps/extension/crop-mgmt/variety-trials-results.cfm)

OAT VARIETY TRIALS

Objective: To evaluate standard and experimental oat varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Plots were seeded at three locations in March and April 2010 with a John Deere 750 plot drill with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 1,220,000 seeds per acre (64 Lb/A). The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Herbicides were applied in May and varied according to weeds present. Plots were trimmed to 5' x 25' after heading. The oats were harvested in August with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest.

Location Summaries:

Perkins County – Bison

Planted: April 21, 2010
Harvested: August 17, 2010
Previous crop: Wheat, no-till planted

Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A)
Additional Nitrogen: 60 lb/A

The trial at Bison averaged 50 Bu/A with test weights averaging 37.0 Lb/Bu. This trial was heavily infested with wild oats, which contributed to a high CV of 18.1, so no yield comparisons should be made in 2010. The varieties with the best three year averages are Souris, Shelby427, HiFi and Beach. Results are presented in Table 13.

Jones County - Okaton

Planted: April 12, 2010
Harvested: August 3, 2010
Previous crop: Sunflower

Herbicide: None
Additional Nitrogen: 80 lb/A

Oat yields averaged 58 Bu/A with average test weights of 37.0 Lb/Bu. The best yielding varieties in 2010 were Rockford, HiFi, Souris, Stallion, Colt and Shelby427. The varieties Souris, Stallion, HiFi, Beach, Shelby427 and Jerry make up the top yield group over the past three years. Results are presented in Table 14.

Pennington County - Wall

Planted March 31, 2010
Harvested: August 2, 2010
Previous crop: Chemical fallow

Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Buctril (1 pt/A)
Additional Nitrogen: 80 lb/A

The yields at Wall were poor averaging 34 Bu/A with average test weights of 37.0 Lb/Bu. There was a fair amount of grasshopper pressure and their feeding on the oat heads caused some varieties to seed shatter. The best yielding varieties in 2010 were Shelby427, Rockford, Souris and HiFi. The varieties with the best yields over the past three years were Shelby427, Souris and HiFI.

Table 13. Oat Variety Trial - Perkins County (Bison), 2008 - 2010.

Variety	Heading Date*	Height Inches	Lodging 0-9**	Test Wt Lb/Bu	Yield 2010	Bu/A 3 -Year
BUFF (hull-less)	3	29	0	39.3	26.1	41.0
STREAKER (hull-less)	3	32	0	40.5	37.3	39.5
BEACH	7	35	0	38.7	57.2	**61.6**
COLT	0	30	0	37.1	45.5	54.5
DON	1	28	0	35.2	44.4	50.8
HIFI	8	35	0	36.9	52.8	**64.2**
JERRY	5	31	0	35.2	39.5	59.7
REEVES	2	35	0	38.6	45.5	44.1
ROCKFORD	8	31	0	37.0	52.8	.
SHELBY427	2	33	0	39.2	66.7	**66.5**
SOURIS	7	28	0	36.9	61.5	**66.6**
STALLION	9	33	0	36.7	57.4	56.7
MN 07210	.	34	0	36.0	55.8	.
SD 081563	.	30	0	37.2	47.4	.
SD 081577	.	29	0	35.7	50.6	.
SD 081629	.	32	0	39.2	55.3	.
SD 081644	.	31	0	36.4	52.0	.
SD 081936	.	27	0	36.0	57.2	.
SD 081949	.	31	0	36.0	48.5	.
SD 082192	.	28	0	37.7	43.0	.
Average	.	31	0.0	37.0	49.8	55.0
LSD (P=.05)	.	4.1	0	2.8	12.8	6.6
CV	.	6.3	0	5.4	**18.1**	15.6

* Heading Date, relative difference in days compared to Colt.

** 0 = No Lodging, 9 = 100% lodged.

Table 14. Oat Variety Trial – Jones County (Okaton), 2008 - 2010.

Variety	Height	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	Percent	2010	3 -Year
BUFF (hull-less)	30	0	41.0	15.9	43.3	64.6
STREAKER (hull-less)	33	0	42.2	16.4	34.6	58.1
BEACH	35	0	36.5	13.5	58.5	**90.1**
COLT	30	0	37.0	13.8	**59.9**	82.4
DON	29	0	34.0	13.1	56.6	84.1
HIFI	33	0	35.2	12.5	**64.5**	**90.7**
JERRY	34	0	36.3	14.8	56.9	**86.8**
REEVES	36	0	37.2	12.6	52.8	75.9
ROCKFORD	34	0	36.1	12.1	**64.5**	.
SHELBY427	34	0	38.7	12.3	**59.1**	**87.2**
SOURIS	29	0	35.1	13.6	**64.0**	**93.8**
STALLION	34	0	36.0	12.9	**62.1**	**91.9**
MN 07210	32	0	35.1	13.2	50.6	.
SD 081563	31	0	37.1	12.8	**63.4**	.
SD 081577	30	0	35.9	12.8	**59.6**	.
SD 081629	30	0	38.1	13.0	**65.1**	.
SD 081644	31	0	37.2	12.8	**64.5**	.
SD 081936	27	0	36.8	12.7	**63.4**	.
SD 081949	30	0	36.8	13.5	**59.9**	.
SD 082192	27	0	38.0	13.5	**64.3**	.
Average	31	0.0	37.0	13.4	58.4	82.3
LSD (P=.05)	2.3	0	1.5	.	6.3	6.8
CV	5.2	0	2.8	.	7.6	10.2

** 0 = No Lodging, 9 = 100% lodged.

Table 15. Oat Variety Trial – Pennington County (Wall), 2008 - 2010.

Variety	Height	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	Percent	2010	3 -Year
BUFF (hull-less)	30	0	37.9	17.3	27.2	49.5
STREAKER (hull-less)	31	0	38.0	17.0	10.9	45.4
BEACH	36	0	32.3	14.3	13.1	55.9
COLT	32	0	31.4	15.5	33.5	54.6
DON	29	0	29.9	14.4	35.1	54.1
HIFI	35	0	31.1	13.2	43.3	65.1
JERRY	33	0	26.9	15.4	15.5	53.5
REEVES	34	0	33.1	14.3	9.3	45.9
ROCKFORD	34	0	34.1	12.8	48.7	.
SHELBY427	36	0	35.7	13.5	**67.0**	**76.1**
SOURIS	32	0	30.8	14.7	46.0	68.3
STALLION	30	0	27.7	14.9	14.7	55.2
MN 07210	34	0	31.7	13.5	23.4	.
SD 081563	31	0	34.7	14.4	51.2	.
SD 081577	32	0	32.8	13.8	44.9	.
SD 081629	33	0	33.4	14.8	55.3	.
SD 081644	34	0	28.7	14.1	22.1	.
SD 081936	30	0	32.8	14.4	39.7	.
SD 081949	31	0	32.5	14.9	45.2	.
SD 082192	30	0	35.8	15.1	44.6	.
Average	32	0.0	32.2	14.6	34.5	56.7
LSD (P=.05)	2.4	0	1.9	.	7.3	5.5
CV	5.2	0	4.2	.	14.9	12.0

* 0 = No Lodging, 9 = 100% lodged.

SPRING BARLEY VARIETY TRIALS

Objective: To evaluate standard and experimental spring barley varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Plots were seeded at three locations in April and May 2010 with a John Deere 750 plot drill with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 1,220,000 seeds per acre (117 Lb/A for two row, 83 Lb/A for six-row). The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Herbicides were applied in June and varied according to weeds present. Plots were trimmed to 5' x 25' after heading. The barley was harvested in August with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest.

Location Summaries:

Perkins County – Bison

Planted: April 21, 2010 Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: August 5, 2010 Additional Nitrogen: 60 lb/A
Previous crop: Wheat, no-till planted

At Bison, yields averaged 35 Bu/A and test weights averaged 47.0 Lb/Bu. The best performing varieties in 2010 were Eslick, Pinnacle and Rawson. The variety Conlon suffered from wildlife damage which greatly reduced its yields. There are no three year averages for Bison. Results are shown in Table 16.

Harding County – Ralph

Planted: April 21, 2010 Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: August 18, 2010 Additional Nitrogen: 50 lb/A
Previous crop: Conventional Fallow

At Ralph, yields averaged 54 Bu/A and test weights averaged 45.7 Lb/Bu. The top performing variety in 2010 was Eslick, with all the other varieties yielding 15 - 25 Bu/A less than Eslick. Eslick is a variety from Montana State University that was bred and selected for its feeding qualities for beef production with feed values similar to corn. Also the variety Conlon suffered from wildlife damage which greatly reduced its yields. Eslick was also 20 Bu/A higher yielding than all the other varieties when averaged over the last two years. Results are shown in Table 18.

Table 16. Spring Barley Variety Trial - Perkins County (Bison), 2010.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Protein Percent	Yield 2010
TWO ROW					
CONLON +	22	0	**	12.4	9.3
ESLICK	21	0	46.5	12.2	**47.4**
PINNACLE	25	0	48.1	11.8	**45.4**
RAWSON	28	0	47.2	12.1	**42.5**
SIX ROW					
CELEBRATION	26	0	46.6	13.7	29.6
LACEY	25	0	47.7	12.9	35.4
STELLAR-ND	25	0	45.6	12.6	37.9
TRADITION	25	0	47.2	11.9	36.5
Average	24.6	0.0	47.0	12.5	35.5
LSD (P=.05)	1.8	0.0	1.9	.	8.0
CV	5.1	0.0	2.7	.	15.4

+ Conlon yields were adversely affected by wildlife damage.
* 0 = no lodging, 9 = 100% lodged.
** Not enough sample for a test weight.

Table 17. Spring Barley Variety Trial – Harding County (Ralph), 2010.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Protein Percent	Yield 2010	Bu/A 2-Year
TWO ROW						
CONLON +	30	0	**	13.9	7.7	8.6
ESLICK	26	0	46.8	12.3	**77.4**	**83.8**
PINNACLE	32	0	43.4	11.9	55.0	64.2
RAWSON	32	0	46.7	12.4	56.0	63.0
SIX ROW						
CELEBRATION	32	0	43.5	13.6	50.1	.
LACEY	32	0	48.0	13.5	62.0	62.8
STELLAR-ND	33	0	43.8	13.5	60.3	60.6
TRADITION	33	0	47.5	12.9	63.3	.
Average	31.2	0.0	45.7	13.0	54.0	57.1
LSD (P=.05)	1.8	0.0	1.3	.	7.9	4.5
CV	3.8	0.0	1.9	.	9.9	11.1

+ Conlon yields were adversely affected by wildlife damage.
* 0 = no lodging, 9 = 100% lodged.
** Not enough sample for a test weight.

SAFFLOWER VARIETY TRIAL

Objective: To evaluate safflower varieties for yield and adaptation to western South Dakota.

Procedure: Safflower varieties were planted at 18 Lb/A in a randomized complete block experiment with four replications near Wall, South Dakota. The trial was planted on April 12th, 2010 with a John Deere 750 drill set to 10-inch row spacing. The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed and received 50 Lb/Ac top dressed nitrogen. Plots were trimmed to 5' x 25' before harvest.

Pennington County - Wall

Planted: April 12, 2010
Harvested: Not harvested
Previous crop: Field peas

Herbicide: Prowl H_20 (2 pt/A)
Additional Nitrogen: 50 Lb/Ac

Discussion: The safflower trial suffered from hail damage and severe grasshopper pressure, this led to very poor grain production and the trial was abandoned.

SUNFLOWER HYBRID TRIAL

Objective: To evaluate sunflower hybrids for yield and adaptation to western South Dakota.

Procedure: Oilseed hybrid sunflower trials were planted at four locations in South Dakota (Bison, Eureka, Onida, and Presho). Entries in the oilseed sunflower trials included traditional linoleic oil hybrids, NuSun (mid-oleic) hybrids, and high oleic hybrids. At Bison, plots of four rows, 30 feet long, spaced 30 inches apart were planted on June 10, 2010 with a Kinze 2100 two row no-till plot planter into wheat stubble. The plot layout was in a randomized complete block design with four replications. The experiment was randomized for a nearest neighbors statistical analysis, which removes effects of field trends. Seed of most of the hybrids entered in the trials were pre-treated with Cruiser® insecticide and at least one fungicide. Plots were over seeded and thinned to a plant population of 17,000 plants/acre. Spartan herbicide was applied prior to planting. The center two rows of each plot were harvested with a Wintersteiger Delta small plot combine on November 1, 2010. Oil content was determined by NMR analysis. Oil values for NuSun® and high oleic hybrids were adjusted for oleic acid content.

Discussion: Yields at Bison averaged 1762 lbs/acre with 29.1 lbs/bu test weights and oil content averaged 44.9%. Information on the statewide trials that this location was part of can be found in the publication "Sunflower, South Dakota Hybrid Performance Trials, EC909", which can be found at the following website http://www.sdstate.edu/ps/extension/crop-mgmt/cpt/alt-oilseeds-variety-trials-results.cfm Results are presented in Table 18.

Table 18. Oilseed Sunflower Hybrid Trial - Perkins County (Bison), 2008 - 2010.

Company/ Brand	Hybrid	Hybrid Type*	Seed Yield 2010	Seed Yield 2-yr Avg.	Seed Yield 3-yr Avg.	Oil Content	Plant Height	Lodge	Test Wt.	Pop. x1000
			---Lb/A---			(%)	(in)	(%)	(lb/bu)	(Plt/a)
Advanta	NutriSun HS03	HS,HO	1322	–	–	41.6	61	3	31.7	16.1
Croplan Genetics	306 DMR NS	NS,DM	1703	1323	1505	46.2	62	1	28.5	16.2
Croplan Genetics	3080 DMR NS	NS,DM	1899	1464	**1645**	46.6	62	3	28.1	16.4
Croplan Genetics	356A NS	NS	2019	1464	–	45.5	59	0	32.0	16.4
Croplan Genetics	378 DMR HO	HO,DM	1579	–	–	42.7	67	3	27.7	17.1
Croplan Genetics	460 E NS	NS,Ex	1444	1041	–	48.1	65	3	30.0	17.1
Croplan Genetics	555 CL DMR NS	NS,CL,DM	1280	995	–	43.4	63	3	27.6	17.1
Croplan Genetics	559 CL DMR NS	NS,CL,DM	1573	–	–	47.2	67	1	29.6	14.5
King Seed Inc.	SunKing 3909 NSCL	NS,CL	1395	–	–	43.1	63	3	28.4	16.5
King Seed Inc.	SunKing 4404 NSCL	NS,CL	1686	1259	1588	42.8	64	1	29.0	17.5
Mycogen Seeds	8D481	NS	1836	–	–	43.8	67	0	29.0	16.7
Mycogen Seeds	8N358CLDM	NS,CL,DM	1502	1280	1480	46.8	64	2	30.4	16.8
Mycogen Seeds	8N453DM	NS,DM	**2145**	–	–	49.0	64	1	31.3	15.9
Mycogen Seeds	8N510	NS	1682	1474	1512	46.0	60	1	27.7	14.8
Pioneer Hi-Bred	Pioneer Brand 63ME70	NS,Ex	1640	–	–	44.9	62	1	25.3	16.4
Pioneer Hi-Bred	Pioneer Brand 63N82	NS,Ex	1613	1298	–	46.1	64	0	29.2	17.2
Pioneer Hi-Bred	Pioneer Brand 64HE01	HO,Ex	1637	–	–	45.3	59	2	30.5	15.6
ProSun	SK-4510	NS,CL	1549	–	–	43.1	62	2	29.4	17.3
ProSun	SK-4610	NS,CL	1904	–	–	45.4	64	0	31.8	16.3
ProSun	SK-4810	NS,CL	1868	–	–	43.5	59	1	30.2	16.4
ProSun	SK-4910	NS,CL	1691	–	–	43.0	64	0	29.8	15.2
Seeds 2000	Badger	ConOil,CL	1503	–	–	40.3	68	2	28.9	15.6
Seeds 2000	Blazer CL	NS,CL	1784	–	–	45.4	64	3	27.8	17.0
Seeds 2000	Firebird	NS,Ex	1751	–	–	45.1	61	0	29.0	16.9
Seeds 2000	Sierra	HO	1665	–	–	44.5	62	0	27.8	15.8
Seeds 2000	X9464	HO,CL	1101	–	–	44.5	65	3	28.9	16.7
Seeds 2000	X9866	NS,CL	1603	–	–	43.6	64	0	26.5	15.6
Syngenta	3732 NS	NS	1996	1408	–	46.0	59	0	31.9	17.6
Syngenta	3845 HO	HO	1899	1385	1578	47.4	59	2	29.7	16.6
Syngenta	3875 NS	NS	**2115**	1471	**1651**	44.7	57	4	30.0	15.9
Syngenta	3980 NS/CL	NS,CL	1937	1290	1415	43.8	68	0	28.7	16.1
Syngenta	4596 HO/DM	HO,DM	1492	–	–	44.2	68	5	28.1	17.9
Syngenta	4651 NS/DM	NS,DM	1719	–	–	44.6	69	1	28.1	15.4
Technology Crops	OL535	HO	1571	–	–	44.4	64	2	28.1	15.9
Technology Crops	OL555	HO	1792	–	–	44.0	65	4	26.9	16.5
Triumph Seed Co.	s655	NS,SS	1731	1321	–	46.4	38	0	31.4	16.7
Triumph Seed Co.	s668	NS,SS	**2401**	–	–	45.5	48	0	29.0	15.1
Triumph Seed Co.	s671	NS,SS	**2405**	**1795**	**1856**	45.4	46	0	28.7	15.9
Triumph Seed Co.	s674	NS,SS	**2086**	**1694**	–	46.5	44	0	28.5	14.9
Triumph Seed Co.	s678	NS,SS	**2405**	**1745**	**1758**	46.2	57	0	29.1	15.1
Triumph Seed Co.	s870HCL	HO,CL,SS	**2038**	–	–	44.4	44	0	28.3	14.2
Triumph Seed Co.	s673	NS,SS	**2125**	–	–	42.1	54	0	28.9	15.5
Triumph Seed Co.	TRXs9422	NS,SS	**2076**	1402	–	47.3	45	0	29.0	15.8
USDA	USDA 894 (check)	Trad.	1351	985	1021	46.5	59	0	31.2	15.6
Grand Mean			1762	1373	1546	44.9	60	1	29.1	16.2
LSD 5%			348	235	229	2	4	3	1.8	1.7
C.V. %			14.1	16.1	17.5	3.3	4.8	149	4.4	7.7

* NS=NuSun, HO=High Oleic, Trad.=Traditional (linoleic), CL=Clearfield, Ex=ExpressSun, DM=Downy Mildew Resistant, SS=Short Stature, HS=High Stearic..

Yield is reported at 10% moisture. Oil % is adjusted for oleic acid content.

FIELD PEA VARIETY TRIALS

Objective: To evaluate field pea varieties for yield and adaptation to western South Dakota.

Procedure: Field peas were planted in a randomized complete block experiment with four replications near Wall and Bison, South Dakota. The seeding rate was 300,000 seeds/A (90 - 220 Lb/A) and the peas were inoculated with a granular pea inoculum (*Rhizobium leguminosarium* biovar *viceae)* prior to planting. A John Deere 750 drill with 10-inch spacing was used to plant the trials in April 2010. The peas were harvested for grain with a small plot combine equipped with vine lifters and a pickup reel.

Location Information:

Pennington County – Wall

Planted: April 12, 2010 — Herbicide: Prowl H_2O (3.5 pint/A)
Harvested: Not harvested — Additional Nitrogen: Inoculated
Previous crop: Soybeans, no-till planted

Perkins County - Bison

Planted: April 21, 2010 — Herbicide: Prowl H_2O (3.5 pint/A) *pre*; Poast (1 pint/A) *post*
Harvested: August 5, 2010 — Additional Nitrogen: Inoculated
Previous crop: Wheat, no-till planted

Summary: The Wall location suffered from hail injury on June 20th , because of the hail injury the plants failed to produce much seed and the trial was abandoned. The Bison trial was excellent averaging 42 Bu/A with test weights averaging 60.2 Lb/Bu. There was no significant difference in yields among the varieties tested in 2010.

Table 19. Field Pea Variety Trial - Perkins County (Bison), 2010.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Yield Bu/Ac
CDC MOZART (yellow)	26	0	58.6	41.2
CDC GOLDEN (yellow)	27	0	60.6	43.6
DS ADMIRAL (yellow)	26	0	60.2	40.5
COOPER (green)	28	0	61.6	41.8
Average	27	0.0	60.2	41.8
LSD (P=.05)	3.0	0	1.7	**NS**
CV	7.0	0	1.7	9.5

* 0 = no lodging, 9 = 100% lodged.

GRAIN SORGHUM YIELD TRIAL

Funding: United Sorghum Checkoff Program

Objective: To evaluate standard and experimental grain sorghum hybrids for yield, agronomic characteristics and adaptation to west central South Dakota.

Procedure: The trial was no-till planted with a Kinze 2100 two row plot planter with 30 inch spacing. The plots were two rows wide and 30 feet long and the experimental design was a randomized complete block with four replications. The sorghum was planted at 60,000 seeds per acre. The trial was harvested with a Wintersteiger Delta plot combine equipped with a GrainGage weigh system. Height, shatter, and lodging notes were taken just prior to harvest.

Location Summary:

Lyman County –Kennebec

Planted: June 17, 2010 Herbicide: Dual (pre) Paramount (post)
Harvested: Nov. 2, 2010

This trial was initiated to restart the grain sorghum testing program in South Dakota, which was last done in 1994. The trial was planted later than ideal because of wet conditions in early June. Fortunately fall conditions were warm through the end of October, so all the entries did fully ripen before harvest. Some of the plots had less than ideal stands due to pheasants digging the seeds out of the ground after planting. The variable stands certainly led to a higher than ideal CV of 14.9. Otherwise growing conditions were excellent throughout the season with adequate moisture and heat units which resulted in an average yield of 77 bu/ac. We plan on continuing and expanding grain sorghum testing in 2011. Results are presented in Table 20.

Table 20. Grain Sorghum Yield Trial - Lyman County (Kennebec), 2010.

Variety	Height Inches	Lodging Percent	Moisture Percent	Test Wt Lb/Bu	Yield Bu/A
Syngenta H-307	50	0	16.9	50.6	82
Syngenta 5745	48	0	16.7	50.5	**96***
Syngenta 5875	37	0	16.7	53.6	71
Pioneer Brand 8925	45	0	15.5	54.2	**86**
Pioneer Brand 88P68	50	0	15.5	54.8	**92**
Sorghum Partners 251	41	0	15.5	55.3	66
Sorghum Partners SP3303	45	0	15.5	52.5	80
Sorghum Partners K35-Y5	44	0	16.0	52.6	81
Sorghum Partners KS310	43	0	16.3	49.0	**101**
DeKalb DKS28-05	49	0	16.3	49.2	68
DeKalb DKS29-28	39	0	15.5	52.4	83
Channel 5B27	47	0	14.8	50.1	**86**
Channel 5C35	45	0	15.9	54.2	71
Triumph TR420	44	0	16.2	55.9	76
Triumph TR424	43	0	15.5	49.2	63
Triumph TRX00464	42	0	16.5	48.8	80
Legend LGS5001	45	0	16.1	52.8	51
Legend LGS5009	47	0	16.4	54.7	61
Average	45	0	16.0	52.2	77
LSD (P=.05)	3	0		2.5	16
CV	5.2	0.0		3.3	14.9

* Bolded yields are in the top yield group.

EVALUATION OF COOL AND WARM SEASON ANNUAL FORAGES

Objectives: To evaluate warm and cool season crops for forage yield and quality.

Background: Perennial forages provide most of the supplemental livestock feed in western South Dakota, a major livestock producing region. The frequent occurrence of drought in the past few years has resulted in shortage of livestock feed, driving a high demand for alternative sources of forages. Annual crops can be of great value in developing a year round forage system. They can be used to provide early grazing before perennials are available, extend the grazing period or increase hay and silage production. Annual crops differ in growth habit and in forage quality. The selection of a particular crop for forage should be based on intended end use. There is a lack of detailed information on yield and quality of some of the forage species for our region.

Procedures:
Cool Season Annual Forages: The study had ten entries which are listed in the table below. The experimental design was a randomized complete block with four replications. The study was conducted at three locations, Ralph, Oelrichs and Wall, South Dakota. The oats, barley and spring triticale were also grown in mixtures with Arvika pea at a seeding rate of 60% of recommended seeding rate for the cereal crop and 40% of the recommended seeding rate for the forage pea at each location. Entries were planted in six-row plots, 5 ft. wide by 25 ft. long using a John Deere 750 drill with 10-inch row spacing. Glyphosate herbicide was applied as a burn down just prior to planting; otherwise no other herbicides were applied to the plots. Nitrogen fertilizer as 28-0-0 was applied at 50 Lb/A actual N to all locations. The Ralph location was harvested at five dates to evaluate forage maturity vs. yield and feed value. At each harvest date, a quadrant of four center rows (3.3 feet) by five feet long was harvested with a Jari Mower for forage yield determination. At the Wall and Oelrichs locations, the entire trial was harvested on the same day with a small plot forage harvester. Forage samples were collected for ADF, NDF, protein and moisture content determination at each harvest date.

Cool Season Annual Forage Seeding Rates

Crop (Variety)	*Seeding Rate (lbs / acre)*
Pea (Arvika)	96
Pea (Mozart)	150
Hairy Vetch	20
Oat (Troy)	75
Oat/Pea (60% Troy / 40%Arvika)	45 / 38
Barley (Haybet)	119
Barley/Pea (60% Haybet / 40% Arvika)	71 / 38
Spring Triticale (Common)	84
Spring Triticale / Pea (60%s.trit/40%Arvika)	50 / 38
Spring Wheat (Traverse)	97

Warm-Season Annual Forages : This study had ten entries planted in a randomized complete block design with four replications at Wall, Oelrichs and Ralph, South Dakota. The entries and seeding rates are listed in the table below. Entries were planted in six-row plots, 5 ft. wide by 25 ft. long using a John Deere 750 drill with 10-inch row spacing. Glyphosate herbicide was applied as a burn down just prior to planting, otherwise no other herbicides were applied to the plots. Nitrogen fertilizer as 28-0-0 was applied at 50 Lb/A actual N to all locations. The Ralph location was harvested at five dates to evaluate forage maturity vs. yield and feed value. At each harvest date a quadrant of four center rows (3.3 feet) by five feet long was harvested with a Jari Mower for forage yield determination. At Oelrichs, the entire trial was harvested on the same day with a small plot forage harvester. The Wall location was devastated by grasshoppers and was not harvested. Forage samples were collected for ADF, NDF, protein and moisture content determination at each harvest date.

Warm Season Annual Forage Seeding Rates

Crop (Variety)	*Seeding Rate (lbs / acre)*
Teff Grass (Tiffany)	8
Foxtail Millet (Manta)	12
Foxtail Millet (Golden German)	12
Foxtail Millet (White Wonder)	12
Proso Millet (Sunup)	15
Pearl Millet (Producers Pro Millet)	12
Sorghum Sudan (Honey Sweet)	20
Sorghum Sudan (Honey Sweet 2)	20
Sorghum Sudan (Honey Sweet BMR)	20
Cowpea (Red Ripper)	35

Planting and Harvest Dates - 2010

Trial	Planting Date	Harvest Date
Wall Cool Season	April 12	July 8
Oelrichs Cool Season	April 13	July 6
Ralph Cool Season	April 21	July 7, 14, 28, Aug 4
Wall Warm Season	June 7	Not harvested
Oelrichs Warm Season	June 8	Aug 31
Ralph Warm Season	June 9	Aug 4, 11, 18, 25, Sept 1

Definition of Forage Quality Values: *Crude Protein (CP):* Laboratories measure the nitrogen (N) content of the forage and calculate crude protein using the formula: CP = % N x 6.25. Crude protein will include both true protein and non-protein nitrogen. Cattle can use both types to some varying degree. Crude protein values give no indication if heat damage has occurred, which may alter protein availability.

Neutral Detergent Fiber (NDF): Structural components of the plant, specifically cell wall. NDF is a predictor of voluntary intake because it provides bulk or fill. In general, low NDF values are desired because NDF increases as forages mature.

Acid Detergent Fiber (ADF): The least digestible plant components, including cellulose and lignin. ADF values are inversely related to digestibility, so forages with low ADF concentrations are usually higher in energy.

Relative Feed Value (RFV): A prediction of feeding value that combines estimated intake (NDF) and estimated digestibility (ADF) into a single index. The RFV system was developed using legume forages and intake responses of lactating dairy cows, it works best when applied to that situation. RFV is often used as a benchmark of quality when buying or selling alfalfa hay. While RFV works to some extent with alfalfa, it is absolutely useless for comparing alfalfa with either alfalfa-grass or pure grass. If RFV is used to compare forages, then 150 RFV alfalfa (optimum quality) is approximately equivalent to 115 RFV grass (optimum quality).

Results and Discussion

Cool Season Forages: Cool Season Forages: The results from the cool season study at Ralph showed greater forage yield as harvesting date was delayed to later maturity stages of the crops. The first harvesting was done at anthesis to milk stage for the cereal grains and flowering to early podding for legume crops. The latest harvesting was conducted at late milk to hard dough stage for the cereal grains and late podding to hard dough for the legume crops (Table 27). On average, forage yield (Table 24) increased from 1.6 ton/acre at the first harvesting date to 2.5 tons/acres at the forth harvesting date on July 28 and showed a slight decrease as harvesting was delayed to first week of August. When individual entries were compared, barley and oats had the greatest yield for the first and second harvesting dates while the later maturing spring triticale yielded the same as oats for the fifth harvesting date. The two pea entries performed similarly and had lower forage yield than oat, barley and spring triticale. The other legume crop in the study, hairy vetch, had a slow start in spring and had barely covered the ground during the first harvesting date. Even though hairy vetch yields increased greatly by the fifth date, overall forage yield for the hairy vetch was the lowest among all the entries. The cereal-pea mixes yielded the same as or slightly less than cereals alone for all harvesting dates. At Wall, barley and oats sole crops had the greatest forage yield and hairy vetch the lowest. Forage mixtures yield significantly lower than cereal sole crops. At Oelrichs, oats yielded the highest and hairy vetch the lowest.

Relative feed value generally increased with addition of legume portion in the cereal forage (Table 28). This increase in relative feed value with addition of legume component was greater early in growing season but less pronounced later in the season as the crops matured. At time of printing this report crude protein values were not yet available. The online version of the annual report will be updated when the crude protein values are available. The web site is www.sdstate.edu/wrac

Warm Season Forages: The diversity of crops used in the warm season study made it difficult to match individual harvesting dates to the same maturity stage for all crops. The proso and foxtail millets mature much quicker than the sorghum/sudangrass and pearl millet. On average at Ralph, forage yield increased as harvesting date was delayed to later maturity stages for all crops with the lowest forage yield of 1.6 tons/acre recorded for the August 4 harvesting date and the highest forage yield of 2.9 tons/acre recorded for the September 1 harvest date. When individual crops were compared, the foxtail millets had higher yields early in the growing season while sorghum hybrids had a slow start but gave similar yield to foxtail millets later in the

growing season. Cowpea had the lowest forage yield for all harvesting dates. Teff grass yielded lower than other cereal grasses. At Oelrichs, sorghum hybrids yielded slightly higher than the millets. Cowpea and teff grass performed poorly.

On average, relative feed values for most cereals grasses were close to 100 with Tiffany teff grass having slightly higher relative feed values early in the growing season (Table 31). Cowpea relative feed values were relatively higher than those for cereal crops at all harvest dates. At time of printing this report crude protein values were not yet available. The online version of the Annual Report will be updated when the crude protein values are available. The web site is www.sdstate.edu/wrac

Table 24. Forage Yield (Tons/Acre @ 13% moisture) of Cool Season Crops at Ralph, Wall and Oelrichs, SD.

	Ralph (2009 – 2010)					Wall (2010)	Oelrichs (2008-10)	Average
Crop (Variety)	July 7	July 14	July 21	July 28	Aug 4	July 8	July 6	
Pea (Arvika)	1.4	2.1	**Rained Out**	2.4	1.7	1.2	1.9	1.8
Pea (Mozart)	1.5	2.1		1.9	1.2	1.0	1.9	1.6
Hairy Vetch	0.6	1.1		1.8	1.8	0.9	0.3	1.0
Oat (Troy)	2.2	2.6		3.0	2.9	2.3	3.1	2.8
Oat/Pea (60% Troy / 40% Arvika)	2.0	2.4		2.9	2.3	1.9	2.8	2.5
Barley (Haybet)	1.9	2.3		2.5	2.0	2.4	2.6	2.5
Barley/Pea (60% Haybet / 40% Arvika)	1.7	2.2		2.4	1.9	1.8	2.5	2.2
Spring Triticale (Common)	1.7	2.2		2.8	2.9	1.9	2.5	2.4
Spring Triticale / Pea (60%s.trit/40% Arvika)	1.7	2.2		3.0	3.0	1.8	2.2	2.3
Spring Wheat (Traverse)	1.4	1.6		2.2	2.3	1.6	2.2	2.0
Mean	1.6	2.1		2.5	2.2	1.7	2.2	2.1
LSD (.05)	0.2	0.3		0.4	0.4	0.5	0.2	
CV	15.1	15.6		16.4	16.9	18.5	15.3	

Table 25. Forage Yield (Tons/Acre @ 13% moisture) of Warm Season Crops at Ralph and Oelrichs, SD in 2008 - 2010.

Crop (Variety)	Ralph (2009 – 2010) Aug 4	Aug 11	Aug 18	Aug 25	Sept 1	Oelrichs (2008 -10) Aug 31	Average
Teff Grass (Tiffany)	1.2	2.1	2.3	2.6	2.0	0.9	1.8
Foxtail Millet (Manta)	1.9	2.9	3.2	3.5	3.7	2.1	2.8
Foxtail Millet (Golden German)	1.9	2.5	3.2	3.4	3.6	2.4	2.9
Foxtail Millet (White Wonder)	1.7	2.4	2.6	3.2	3.3	2.4	2.8
Proso Millet (Sunup)	1.9	2.5	3.0	3.3	3.4	2.3	2.8
Pearl Millet (Producers Pro Millet)	1.7	1.9	2.6	3.0	3.1	1.9	2.5
Sorghum Sudan (Honey Sweet)	1.6	2.5	2.9	3.3	3.5	2.6	2.9
Sorghum Sudan (Honey Sweet 2)	1.6	2.3	2.4	2.8	2.7	2.3	2.5
Sorghum Sudan (Honey Sweet BMR)	1.6	2.4	2.7	2.9	3.2	2.8	2.9
Cowpea (Red Ripper)	0.8	1.0	0.8	0.9	0.7	0.4	0.6
Mean	1.6	2.2	2.6	2.9	2.9	2.0	2.4
LSD (.05)	0.2	0.3	0.4	0.5	0.6	0.3	-
CV	14.0	15.5	15.8	16.0	22.0	21.0	-

* Average is the mean of Ralph August 25th and Oelrichs yields.

Table 26. Moisture Content and Crop Stage at Harvest of Cool Season Crops at Oelrichs and Wall, SD in 2010.

Crop (Variety)	Oelrichs (July 6) Mois (%)	Oelrichs (July 6) Crop Stage	Wall (July 8) Mois (%)	Wall (July 8) Crop Stage
Pea (Arvika)	80	Bloom/pod fill	78	Early podding
Pea (Mozart)	81	Pod fill	78	Mid-podding
Hairy Vetch	84	Vegetative	82	Anthesis
Oat (Troy)	73	Milk	68	Milk stage
Oat/Pea (60% Troy / 40% Arvika)	73	Milk/pod fill	71	Milk stage / early podding
Barley (Haybet)	63	Soft dough	63	Soft dough
Barley/Pea (60% Haybet / 40% Arvika)	67	Soft dough/pod fill	67	Soft dough / early podding
Spring Triticale (Common)	71	Late anthesis	68	Late anthesis
Spring Triticale / Pea (60%s.trit/40% Arvika)	74	Late anthesis / pod fill	70	Late anthesis / early podding
Spring Wheat (Traverse)	68	Late milk	65	Late anthesis
Mean	73		71	
LSD	3		2	
CV (%)	2.4		1.9	

Oelrichs was planted on April 13th and Wall on April 12th.

Table 27: Moisture Content and Crop Stage at Harvest of Cool Season Crops at Ralph, SD in 2010.

Crop (Variety)	July 7		July 14		July 21		July 28		August 4	
	Mois (%)	Crop Stage	Mois (%)	Crop Stage	Mois (%)	Crop Stage	Mois (%)	Crop Stage	Mois (%)	Crop Stage
Pea (Arvika)	77	Late flower / early podding	74	Podding		**Missing Rained out**	48	Late podding	43	Mature pods
Pea (Mozart)	79	Early pod filling	74	Late pod filling			40	Pods mature	41	Mature pods
Hairy Vetch	80	Flowering	78	Flowering			76	Flower / early podding	71	50% flowered / 50% pods
Oat (Troy)	71	Milk stage	64	Milk stage			48	Dough stage	33	Ripe
Oat/Pea (60% Troy / 40% Arvika)	72	Milk stage / late flower to early pod	68	Milk stage / podding			48	Dough stage / late podding	44	Ripe / mature pods
Barley (Haybet)	66	Anthesis	58	Soft dough			38	Mature	33	Ripe
Barley/Pea (60% Haybet / 40% Arvika)	69	Anthesis / late flower to early pod	60	Soft dough / podding			40	Mature / late podding	33	Ripe / mature pods
Spring Triticale (Common)	72	Anthesis	65	Late anthesis			59	Soft dough	80	Milk to soft dough
Spring Triticale / Pea (60%s.trit/40% Arvika)	73	Anthesis / late flowering to early pod	66	Late anthesis / podding			59	Soft dough / late podding	51	Milk to soft dough / mature pods
Spring Wheat (Traverse)	67	Anthesis	62	Soft dough			52	Soft dough	36	Ripe
Mean	72.6		66.9				50.8		46.5	
LSD (P=.05)	2		2				7		10	
CV	2.1		2.1				9.5		15.9	

Ralph was planted on April 1st.

Table 28. Forage Quality Analysis of Cool Season Crops by Harvest Date at Ralph, SD in 2009 - 2010.

	July 7				July 14				July 21				July 28				August 4			
rop (Variety)	*CP (%)	NDF (%)	ADF (%)	RFV	*CP (%)	NDF (%)	ADF (%)	RFV	CP (%)	NDF (%)	ADF (%)	RFV	*CP (%)	NDF (%)	ADF (%)	RFV	*CP (%)	NDF (%)	ADF (%)	RFV
a rvika)	-	39	28	161	-	38	29	162	**Missing Rained out**				-	45	34	136	-	53	34	111
a ozart)	-	33	24	202	-	36	26	178					-	44	31	141	-	50	32	120
iry Vetch	-	42	28	151	-	44	29	143					-	51	33	119	-	51	30	121
t roy)	-	56	31	109	-	56	32	110					-	61	36	94	-	64	30	97
t/Pea 0% / 40%)	-	52	30	118	-	51	31	119					-	59	35	98	-	57	31	106
rley aybet)	-	56	32	108	-	61	33	97					-	62	35	95	-	63	33	93
rley/Pea 0% / 40%)	-	53	30	116	-	55	32	109					-	59	36	98	-	62	33	95
ring Triticale ommon)	-	53	30	115	-	58	33	102					-	62	36	93	-	63	33	95
ring Triticale / a (60% /40%)	-	47	29	131	-	54	32	110					-	59	35	99	-	60	33	99
ring Wheat raverse)	-	55	30	113	-	60	34	98					-	59	35	100	-	62	33	96
ean	-	48	29	132	-	51	31	123					-	56	34	107	-	59	32	103
D	-	3	1	12	-	3	2	14					-	4	2	11	-	2	6	9
/ (%)	-	5.4	4.4	8.4	-	6.2	5.9	10.6					-	6.7	5.3	10.2	-	3.9	18.9	8.7

*CP = Crude protein -data were not available at time of printing.
NDF = Neutral detergent fiber.
ADF = Acid detergent fiber.
RFV = Relative feed value

Table 29. Forage Quality of Cool Season Crops at Oelrichs and Wall, SD in 2008 -2010.

Crop (Variety)	Oelrichs (2008 -2010)				Wall (2010)			
	*CP (%)	NDF (%)	ADF (%)	RFV	*CP (%)	NDF (%)	ADF (%)	RFV
Pea (Arvika)	-	32	24	184	-	39	27	166
Pea (Mozart)	-	29	21	208	-	37	24	180
Hairy Vetch	-	36	24	163	-	46	32	131
Oat (Troy)	-	52	29	107	-	55	32	108
Oat/Pea (60% Troy / 40%Arvika)	-	50	28	114	-	55	32	111
Barley (Haybet)	-	56	30	100	-	61	33	97
Barley/Pea (60% Haybet / 40% Arvika)	-	53	29	107	-	54	30	115
Spring Triticale (Common)	-	56	31	99	-	59	33	102
Spring Triticale / Pea (60%s.Trit/40%Arvika)	-	47	28	131	-	54	31	112
Spring Wheat (Traverse)	-	54	29	106	-	61	35	96
Mean	-	46	27	132	-	52	31	122
LSD	-	2	1	9	-	6	4	28
CV (%)	-	7.6	7.7	10.9	-	5.2	5.1	10.3

*CP = Crude protein – data were not available at time of printing
NDF = Neutral detergent fiber.
ADF= Acid detergent fiber.
RFV = Relative feed value

Table 30: Moisture Content and Crop Stage at Harvest of Warm Season Crops at Ralph, SD in 2010.

Crop (Variety)	August 4		August 11		August 18		August 25		Sept 1	
	Mois (%)	Crop Stage	Mois (%)	Crop Stage	Mois (%)	Crop Stage	Mois (%)	Crop Stage	Mois (%)	Crop Stage
Teff Grass (Tiffany)	75	Early headed	66	Headed	67	Mature headed	57	Ripe seed	61	Ripe seed
Foxtail Millet (Manta)	77	Early headed	68	Headed	68	Mature headed	51	Ripe seed	49	Ripe seed
Foxtail Millet (Golden German)	82	Vegetative	75	10% Headed	75	Clear liquid headed	64	Hard dough	67	Hard dough
Foxtail Millet (White Wonder)	83	Vegetative	75	Vegetative	76	50% Headed	64	Clear liquid	71	Milk stage
Proso Millet (Sunup)	79	Early headed	73	Headed	70	Soft dough	61	Hard dough to ripe	62	Hard dough to ripe
Pearl Millet (Producers Pro Millet)	80	Vegetative	75	Vegetative	77	Vegetative	73	Vegetative	77	5% Headed
Sorghum Sudan (Honey Sweet)	82	Vegetative	75	10% headed	75	Anthesis	71	Anthesis	73	Milk stage
Sorghum Sudan (Honey Sweet 2)	82	Vegetative	75	Vegetative	76	Vegetative	74	Anthesis	76	Anthesis
Sorghum Sudan (Honey Sweet BMR)	82	Vegetative	73	Vegetative	78	Vegetative	74	Anthesis	76	Anthesis
Cowpea (Red Ripper)	85	Vegetative	78	Vegetative	78	Vegetative	80	Vegetative	81	Vegetative
Mean	80.7		73.3		74.0		66.9		69.3	
LSD (P=.05)	2		4		3		3		2	
CV	1.5		3.3		2.6		3.5		2.3	

Ralph was planted on June 9th.

Table 31. Forage Quality Analysis of Warm Season Crops by Harvest Date at Ralph, SD in 2009 - 2010.

rop (Variety)	August 4				August 11				August 18				August 25				Sept 1			
	*CP (%)	NDF (%)	ADF (%)	RFV	*CP (%)	NDF (%)	ADF (%)	RFV	*CP (%)	NDF (%)	ADF (%)	RFV	*CP (%)	NDF (%)	ADF (%)	RFV	*CP (%)	NDF (%)	ADF (%)	RFV
ff Grass iffany)	-	55	29	116	-	61	31	99	-	66	33	90	-	60	32	102	-	66	34	88
xtail Millet lanta)	-	59	34	99	-	59	32	101	-	59	31	102	-	63	34	93	-	65	36	87
xtail Millet olden rman)	-	58	35	100	-	59	32	102	-	59	32	101	-	57	30	107	-	60	32	101
xtail Millet /hite Wonder)	-	59	32	101	-	59	31	103	-	59	31	104	-	60	31	102	-	61	32	99
oso Millet unup)	-	57	33	104	-	57	29	110	-	57	29	109	-	62	32	97	-	62	33	95
arl Millet roducers Pro let)	-	56	32	107	-	60	30	103	-	59	30	104	-	60	31	100	-	62	32	97
rghum Sudan oney Sweet)	-	57	34	101	-	57	30	107	-	58	29	107	-	57	29	110	-	58	30	106
rghum Sudan oney eet 2)	-	58	33	102	-	57	29	110	-	58	29	106	-	58	29	108	-	58	29	108
rghum Sudan oney eet BMR)	-	58	33	102	-	58	30	106	-	58	30	105	-	57	29	108	-	58	30	106
wpea ed Ripper)	-	49	34	122	-	55	30	112	-	52	28	127	-	54	30	118	-	52	33	117
ean	-	57	33	105	-	58	30	105	-	58	30	105	-	59	31	104	-	60	32	100
D	-	4	6	14	-	2	2	7	-	2	2	6	-	6	2	14	-	3	1	8
/ (%)	-	6.7	16.6	12.8	-	3.8	5.3	6.0	-	2.8	5.4	5.3	-	9.6	7.0	13.2	-	5.1	4.1	7.8

*CP = Crude protein – data were not available at time of printing.
NDF = Neutral detergent fiber.
ADF= Acid detergent fiber.
RFV = Relative feed value.

Table 32. Moisture Content and Crop Stage at Harvest of Warm Season Crops at Oelrichs, SD in 2010.

Crop (Variety)	Oelrichs (August 31) Height (inches)	Mois (%)	Crop Stage
Teff Grass (Tiffany)	12	61	Vegetative
Foxtail Millet (Manta)	35	64	Ripe
Foxtail Millet (Golden German)	45	65	Soft dough
Foxtail Millet (White Wonder)	46	66	Soft dough
Proso Millet (Sunup)	42	61	50% ripe / 50% green
Pearl Millet (Producers Pro Millet)	40	74	5% headed
Sorghum Sudan (Honey Sweet)	55	69	50% ripe / 50% green
Sorghum Sudan (Honey Sweet 2)	68	73	10% headed
Sorghum Sudan (Honey Sweet BMR)	61	73	Milk stage
Red Ripper (Cowpea)	22	84	Flowering
Mean		69	
LSD		2	
CV (%)		2.4	

Oelrichs was planted on June 8th.

Table 33. Forage Quality Analysis of Warm Season Crops at Oelrichs, SD in 2008 - 2010.

Crop (Variety)	Oelrichs *CP (%)	NDF (%)	ADF (%)	RFV
Teff Grass (Tiffany)	-	58	27	98
Foxtail Millet (Manta)	-	53	26	108
Foxtail Millet (Golden German)	-	51	25	115
Foxtail Millet (White Wonder)	-	52	24	113
Proso Millet (Sunup)	-	53	25	109
Pearl Millet (Producers Pro Millet)	-	55	25	106
Sorghum Sudan (Honey Sweet)	-	49	24	125
Sorghum Sudan (Honey Sweet 2)	-	52	23	113
Sorghum Sudan (Honey Sweet BMR)	-	55	26	106
Cowpea (Red Ripper)	-	39	23	164
Mean	-	52	25	116
LSD	-	3	2	11
CV (%)	-	10.6	10.6	15.5

*CP = Crude protein were not available at time of printing.
NDF = Neutral detergent fiber.
ADF= Acid detergent fiber.
RFV = Relative feed value.

SAFFLOWER TOLERANCE TO ALTERNATIVE HERBICIDES - 2010

Objective: To evaluate various herbicides for weed control and crop injury in safflower.

Procedure: A spray treatment of ½ lb/A Atrazine was applied in the fall of 2009 by the cooperator.

All herbicide treatments plus a control for the trial were established on May 17, 2010. The herbicides were applied with a Yamaha 4-wheeler research sprayer with10 foot boom. Spray tips used were TeeJet Yellow 8002 XR using 50 mesh screens. The herbicides were sprayed on at 30 psi @ 3.5 mph (10 gallon per acre spray rate). Soil temperature was 72 degrees F. Air temperature was 79 degrees F. Wind was out of the south east at 7 1/2 to 9 1/2 mph.

Observations on July 2, 2010: At this time, the safflower was 4-12" tall and was still totally vegetative. The crop injury ratings (VCRR) were not measurable by treatment. Barnyard grass was the predominant weed in the trial. There were traces of red root pigweed and witch grass but not enough to use as a rating. It was observed that the red root pigweed was stunted in the atrazine plots but it was still growing. The pigweed in the atrazine plots were about 40-50% the size of the pigweed in the controls. The barnyard grass was 6-24" tall with about 1% or less that was starting to head out. The barnyard grass in the control and the atrazine plots were solid stands. The redroot pigweed was 4-8" tall as of July 2, 2010. There were approximately 6-10 plants in each control plot. Pigweed populations were very hard to rate in terms of control. The witch grass was very sparse in the plots with about one plant per plot in the controls. There was some stunting of the safflower in the control plots due to very heavy weed pressure.

Summary: Labeled herbicides that do a good job of controlling all weeds in no-till safflower are not currently available. This trial looked at non-labeled herbicide options for weed control. Treatments that performed well included: Valor/Prowl H2O, Valor/KIH 485, Spartan 4F/Prowl H2O, and Spartan 4F/Dual II Magnum. There is concern that we will be selecting for tolerant strains of red root pigweed using the lower rates of atrazine. Plans are underway to rerun this trial at two locations in 2011.

Note: For more information regarding conventional and no-till herbicides used in Safflower Production, refer to FS5250S publication (Weed Control in Oilseed Crops: 2010).

Table 34. Safflower Herbicide Tolerance and Weed Control - 2010.

Herbicide	Timing Of Application	Rate Per acre	Crop Injury (VCRR)	Weed Control % Barnyard grass	Safflower Height (inches)	Test Wt. (lbs/bu)	Yield (Lbs / Acre)
	5-17-2010		7-2-10	7-2-10	10-21-10	10-21-10	10-21-10
Check		none	0	0.0	21.5	40.7	286
Atrazine	pre	.5 pint	0	5.2	17.8	Missing*	137
Spartan 4F	pre	3 fl oz	0	75.0	23.5	40.4	548
Spartan 4F Prowl H2O	pre pre	2 fl oz 2.5 pts	0	88.8	23.5	42.7	**977**
Spartan 4F KIH-485	pre pre	2 fl oz 3 oz	0	83.5	22.3	42.1	616
Spartan 4F Dual II Mag.	pre pre	2 fl oz 1 pint	0	76.3	23.8	42.3	**741**
Valor	pre	2 oz	0	77.5	24.3	42.8	685
Valor Prowl H2O	pre pre	1.5 oz 2.5 pints	0	88.8	24.0	42.4	**996**
Valor KIH-485	pre pre	1.5 oz 3 oz	0	90.0	24.0	41.9	**989**
LSD (P=.05)			0	9	3	2	307
CV			0	9	9	3	31

* Not enough sample for a test weight.

SDSU REDUCED TILLAGE AND NO-TILL CROP ROTATION STUDY
WALL, SOUTH DAKOTA

OBJECTIVES

1. To determine crop productivity in varied rotations with different crop intensities.
2. To determine economic returns from various rotation systems with varied levels of crop intensification and diversity.

PROCEDURES

The study with nine different rotations was established in the spring of 1994. The rotations are two to six years in duration and we have completed at least one full cycle in all of the rotation sequences. All phases in each rotation are grown each year. No-till production practices are used to grow all crops except for the winter wheat conventional fallow treatment of Rotation 1. Proso millet, dry peas, hairy vetch/winter triticale, hay millet, spring barley and winter wheat were planted with a JD 750 no-till drill at 10 inch row spacing. The fallow winter wheat (Rotation 1) is planted with a JD 610 deep furrow drill at 10 inch row spacing. The safflower and sunflower are planted with a JD 7100 corn planter in 20 inch rows. The corn is planted with a JD 7100 corn planter in 40 inch rows. Nitrogen and phosphorus fertilizer are injected in the fall using strip tillage preparing the zone for planting by the JD 7100 corn planter the following spring.

The experimental design is a randomized complete block with all treatments replicated four times. Plots are 25' x 80' in size; the small size allows all the plots to be located on the same soil type (Nunn Type A) and reduces variability due to soil characteristics. The crop yields are measured from each plot and analyzed to compute the average yields for each rotation. Detailed records of all of the cultural practices including planting, fertilizing, weed control, and harvesting are kept and cost of each practice assessed. These cultural practices are listed in Appendix 1. This allows for yield and economic comparisons to be made each year.

RESULTS AND DISCUSSION

Long Term Trends

Long term results have shown that the inclusion of broadleaf crops such as sunflower, safflower and peas; along with warm season grass crops like corn helps to break weed and disease cycles and can improve wheat yields and profitability. It should be noted that we do not include any farm program payments except loan deficiency payments (LDP) when applicable, in our economic analysis.

Note: Due to extensive hail and grasshopper pressure in 2010, this year's yields were not included in the long term averages listed below.

The eleven year (1999-2009) average yield of winter wheat following millet in a rotation where a broadleaf crop or corn was grown prior to the millet was 42.3 Bu/A (average of rotations 3 and 11). The winter wheat grown in a continuous winter wheat-millet rotation (rotation 4) had an eleven year average yield of 35.4 Bu/A. This indicates a 6.9 bushels per acre difference due to introducing a broadleaf or warm season crop into the rotation as similar management practices were applied in both rotations over the eleven year period. These results indicate the importance of crop diversity in a rotation system. For comparison, the winter wheat-fallow rotation (rotation 1) had an eleven year average yield of 48.7 Bu/A while wheat following fallow in the diversified rotation (rotation 2a) yielded 57.2 bushels per acre over the same period. The two warm season grass crops (corn and millet) have high demand for soil moisture late in summer while winter wheat has high demand for soil moisture early in spring. Diverse rotations make full use of all the rainfall received during the growing season. The winter wheat diversified rotations seem to benefit from the diverse soil moisture use pattern of the crops. The diversity of crops in rotation 2a also makes for easier weed management.

Introduction of safflower, sunflower and pea crops into the winter wheat-millet rotation would be expected to increase demand for soil moisture and thus decrease winter wheat yield compared to the winter wheat-millet rotation. The winter wheat in rotations with safflower, sunflower and pea, however, yielded more than the winter wheat-millet rotation, indicating the increasing problem with root diseases in the undiversified winter wheat-millet rotation (Table 37). The increased income from the higher yields of winter wheat along with the opportunity to produce a profitable broad-leaf crop like sunflower or safflower can increase the net income of these rotations, particularly in the wetter years.

We continue to use a strip tillage system for corn, sunflowers and safflower. The fertilizer is injected in the fall using a narrow point opener which leaves about a four inch area strip tilled. We have added some reverse mounted closing disks to fill the trench formed by the injector, but still having minimal soil disturbance. In the spring; corn, safflower and sunflowers are planted over the injected strips. Since going to this system in 1999, crop stands of corn and sunflowers have improved. The fertilizer injector has the added bonus of putting the fertilizer right where the new planted crop will utilize it. The next step would be to add a fertilizer injector to the planter so it can all be done in one pass.

Recent Cropping Changes in this study include:

1) For Rotation 2a, in 2007 we substituted Golden German hay millet in where proso millet was. Proso millet yields in this rotation have been historically the lowest in the entire trial. The hay millet stands were good in 2007, 2008, and 2009 and can be harvested earlier than proso millet. As of 2010, forage millet continues to be a good crop. The grasshoppers seemed to leave the hay millet alone.

Another cultural practice change in 2a that we implemented in the spring of 2008 was change from mechanical tillage during the fallow period to chemical fallow. We had no protective cover for winter wheat after planting so the crop often winter-killed. In the spring of 2009, we planted a 4-way mix cover crop consisting of lentils, flax, camelina, and canola. The cover crop mix was sprayed off in June to allow for dry down before fall planting of wheat in the fall. By comparing winter wheat yields in rotation 1 and rotation 2a we can determine if mechanical tillage is necessary during the fallow period for higher yields. For the 2010 green fallow year, we had 5 crops in the mix. They included: chickling vetch, lentils, flax, radish, and turnip. The flax straw is long standing and serves as a good snow catch in the winter time. The turnips were consumed by the grasshoppers this summer. The grasshoppers also ate the radish tops. The chickling vetch and lentils are legumes and serve to fix nitrogen for the following wheat crop.

2) For Rotation 5a, in 2005 we substituted feed barley for spring wheat. The feed barley has excellent seedling vigor and early season growth and has yielded better than spring wheat.

3) For Rotation 6a, in 2005 we started growing dry peas for grain rather than spraying them off as a green manure crop.

4) In 2009; Rotation 9a has been adjusted to include winter triticale planted with the hairy vetch in the fall. The winter triticale is planted at 10 lbs/acre and the hairy vetch is at 15 pounds per acre. The mixture will give better ground cover. The hairy vetch stubble holds better to the soil surface than the field pea stubble that we used prior to 2005.

5) in 2007; Rotation 10 was changed to winter wheat / proso millet / chickpea. This placed the chickpea ahead of the wheat crop. This would give nitrogen credit towards the wheat crop and allow more time between chickpea harvest and wheat planting time. In 2008 ascochyta blight disease decimated the chickpea crop. It was decided to readjust this rotation again in 2009 by substituting dry pea for chickpeas. The next sequence was winter wheat / proso millet / dry peas. A down side to this sequence is that the winter wheat being planted into dry pea residue did not have

very much protective cover. In September of 2010 we changed this rotation to Winter Wheat / Dry Pea / Proso Millet. This will allow better protective cover for planting the wheat into. We have found from previous data that the nitrogen release from the legume often takes two years to be released back into the soil. This will be more beneficial for the later planted wheat crop.
Table 38 shows the estimated yield goals used for fertilizer recommendations of each crop and rotation since 2000. Thus, all crops have been adequately fertilized with nitrogen since the beginning of the study in 1994. However, our long term results (Table 37) show that attained yields for some crops have been below yield goals (Table 38). For economic reasons, we decided starting in 2006, to adjust yield goals to match long-term average yields for each crop and rotation.

Wall Rotation - Total Precip. by Month (inches) – September 2009 to August 2010

September 2009	0.93"	January 2010	0.20"	May 2010	3.32"
October 2009	2.65"	February 2010	0.30"	June 2010	3.35"
November 2009	0.13"	March 2010	0.50"	July 2010	1.76"
December 2009	0.90"	April 2010	2.37"	August 2010	0.56"

2010 YIELD RESULTS AND DISCUSSION BY ROTATION

Rotation 1: Winter Wheat / Fallow:
This is the base rotation that all other rotations in the study are compared to. This rotation has had 2 to 3 mechanical tillage's each year during the fallow period since we started the rotation study in 1994. We spray in the fall and spring as needed during the cooler months for weed control.

Winter wheat stands were marginal in the fall due to limited soil moisture conditions. October was wetter at 2.65" but by then we were running out of heat units for fall. Spring rainfall was adequate with 2.37 inches in April, 3.32 inches in May and 3.35 inches in June. In 2010, winter wheat yields were at 34.9 Bu/A of winter wheat. The hail on June 20, 2010 was devastating to the wheat crop. The 11-year average yield (1999-09) on winter/spring wheat in Rotation 1 is 48.7 Bu/A. This rotation had a net return of $ - 75.46 / acre in 2009. This rotation has had the same cropping sequence since 1994.

Rotation 2: Winter Wheat-a / Sunflower / Hay Millet / Winter Wheat-b / Corn / Chem. Fallow:
This is a very diverse rotation that provides many opportunities for weed control and disease suppression. On the long term, yields from this rotation have been above average even in the dry years. The best winter wheat yields from this entire rotation study have come from winter wheat following fallow (Winter wheat –a) that has consistently out-yielded the fallow wheat in Rotation 1 by an additional 8.5 Bu/Acre over the last eleven years. Sunflower yields have averaged 1373 Lb/Acre (Table 37) with extremely low yields in 2002, 2003, and 2007 due to drought stress. Sunflower is deep rooted and tends to dry out the soil profile considerably, thus millet grown after the sunflower crop is very dependent upon spring and summer rains to recharge the top two feet of soil. Proso millet seed yields in this rotation have averaged 909 Lb/Acre over an 8 year period (1999-06). Proso millet yields were lower in this rotation than any other in the trial. It was decided to plant Golden German hay millet and cut it for hay in 2007. Hay millet yields were at 1.57 tons per acre in 2007, 2.5 tons per acre in 2008, 2.5 tons per acre in 2009 and 2.2 tons per acre in 2010. (Table 37). The recrop winter wheat following millet on average, yielded 71.3% the yield of the fallow wheat that is in this rotation.

This six-year rotation requires nitrogen applications on every crop so there are no fertilizer savings as is observed in rotations with legumes. The diversity of warm and cool season crops in this six - year rotation spreads the work-load out for the producer. This rotation requires more equipment than most other rotations. The fallow segment was chemical fallowed in 2008. The absence of protective cover and limited growth in the fall of 2008 brought on winter-kill so these plots were replanted to spring wheat in April of 2009. We are now looking at a green cover crop during the fallow period to provide additional cover and protection for the following crop. This rotation had a net return of $ - 46.91 / acre in 2009. This rotation has a 3 year net return (2007-2009) of $+11.98 / acre. See Table 39.

This rotation will be changed for 2011. The new sequence will be: **Winter Wheat-a / Safflower / Hay Millet / Winter Wheat-b / Corn / (Cover crop) Fallow.** The safflower was substituted in to provide us better yield numbers. Bird and deer pressure can be very heavy with the sunflowers, particularly in small test plots. We have found that in dryer years, sunflower and safflower will yield about the same. On a wetter year the sunflower will out yield the safflower.

Rotation 3: Winter Wheat / Safflower / Proso Millet:
Winter wheat in this rotation yielded 42.6 Bu/A in 2009 and has averaged 41.3 Bu/A long term. Safflower yields were 1744 Lb/A in 2009 and averaged 968 Lb/A in the eleven-year period of 1999-2009. (Table 37). Millet yields were 540 Lb/A in 2009 with a eleven-year average of 1071 Lbs/A. The safflower crop is deep-rooted and dries out the ground for the upcoming millet crop. During dry years, a summer fallow could be used to replace the millet crop. In 2009, safflower yields were good and prices were at $ .18 per pound. Yields of proso millet have been variable in this rotation depending upon amount of snow catch in the safflower stubble and the amount of rainfall before and during the millet crop.
This rotation provides the diversity of a broadleaf crop along with cool season and warm season grass crops. The two warm season crops are relatively drought tolerant, and the winter wheat makes most of its growth during the cool portion of the summer. This rotation will make full use of all precipitation received. The rotation can be planted with small grain equipment and therefore does not require any additional investment in equipment. This rotation had a net return of $ - 62.28 / acre in 2009. This rotation has had the same cropping sequence since 1994.

Rotation 4: Winter Wheat / Proso Millet:
This rotation alternates between winter wheat and proso (grain) millet. We continue to see declining yields on the winter wheat side of this rotation. The proso millet crop is a good replacement for summer fallow for a short-term basis. Winter wheat yields in this rotation have averaged 35.4 Bu/A over an eleven-year period. Millet yields, on the other hand, have averaged 1402 Lb/A over the last eleven years. In 2009, the winter wheat yields (25.9 Bu/A) were well below the eleven-year average. This rotation is not well diversified and will harbor crown and root rot diseases over time. In some years, large amounts of residue on the soil surface after the winter wheat crop has caused some difficulty in establishing a good stand of millet. On average (1999-2009), winter wheat in this rotation has yielded 73 percent of the fallow winter wheat yields from Rotation 1. In comparison, our better more diverse rotations of winter wheat (Rot 6a-a, 9a-a, and 11) will yield over 88% of what wheat will do in Rotation 1. Due to the heavy crown and root rot damage to the wheat root system, wheat of Rotation 4 does not utilize soil moisture very well. This rotation had a net return in 2009 of $ - 157.35 per acre. This rotation has had the same cropping sequence since 1994.

It was decided in late summer of 2010 to combine Rotation 4 and Rotation 9a to make a new Rotation 8a.The sequence for 2011 will be:(Winter Wheat-a / Dry Pea / Spring Wheat / Winter Wheat-b / Safflower / Forage Millet) We are excited about this new six year rotation and feel with the profit potential of the wheat's and safflower and the beneficial aspects of the dry peas and forage millet will make this a sound rotation that will perform well in western South Dakota.

Rotation 5a: Winter Wheat / Corn / Sunflower / Spring Barley:
This is a very intensive rotation with high moisture demand. Winter wheat yields have averaged 36.5 Bu/A over the eleven-year period. Corn yields averaged 45.8 Bu/A over the last eleven years although corn failed completely in 2002, 2003, and 2006 due to drought/heat stress. Sunflower yields from this rotation have been the lowest yielding in the study over the eleven-year period (1999-2009). Sunflower is harvested late in the fall, and will leave limited stubble to catch snow. Spring wheat did not perform well after sunflower in wet years and did even worse in drier years. Spring barley replaced spring wheat in 2005. Barley is more drought tolerant than spring wheat and matures before spring wheat. Barley yields in 2009 were at 56.6 Bu/A. The Barley has a 5 year average (2005-2009) of 44.9 bushels per acre. This rotation had a net return of $ - 59.46 / acre in 2009.

Changes in this rotation for the 2011 year include substituting a grain soybean in where the sunflower has been. The new rotation 5a sequence will be: Winter Wheat / Corn / Soybean / Spring Barley. The soybean will use less moisture and will be harvested earlier than the sunflower. This rotation will be changed for 2011. This new rotation will allow us to revisit what kind of yields we can get from soybean grain in western South Dakota. We will plant in 20" rows using our JD 7100 planter. A non-glyphosate variety of soybean will be used. Using too many glyphosate tolerant crops sequentially will allow resistant types of weeds to develop.

Rotation 6a: Winter Wheat-a / Winter Wheat-b/ Safflower / Dry Pea:
This rotation was changed in 2005. The original rotation had peas grown as a green-fallow crop. The pea green-fallow in this rotation was intended to lower the demand for fertilizer nitrogen in the rotation. The peas were grown only until early bloom and then killed by a herbicide spray. By bloom, peas have accumulated a good amount of biomass to benefit the following crop and at the same time killing the crop at this stage allowed for potential soil moisture recharge before the winter wheat crop.

The first winter wheat (WW-a) in Rotation 6a has an eleven year average of 43.2 bu / acre. The second winter wheat (WW-b) has a 33.7 bu / acre average over the eleven year period (Table 37). Safflower yields averaged 990 lbs/acre for the last 5 years. Safflower and sunflower yields are very comparable in dry years but the sunflower will out yield safflower in wetter years. Growing the field peas for grain is a better option in most years although in the winter of 2008, spring of 2009 we had winter-kill of the winter wheat crop due to dry conditions at planting thus slow development and lack of protective cover. Peas have proven to be too expensive to grow as a green-fallow crop. The field pea grain yields have an average yield of 1410 Lb/A (23.5 bu/A) over the last five years. Planting dry peas eliminates the need to add nitrogen fertilizer during that year and reduces the nitrogen needs of the following wheat crop. Downy brome/Japanese Chess continues to be a problem in this rotation. Olympus was again sprayed on both wheat crops in October of 2008. This particular year saw very strong winds shortly after spraying on the Olympus. Winds blew most of the detached pea stubble away. Limited stubble opened the door for winter-kill in the first year of winter wheat. The 2nd year of wheat had good wheat stands but had so much downy brome that it was necessary to spray off the winter wheat crop and start over. Spring wheat (Traverse) was planted back in both winter wheat segments of this rotation in the spring of 2009.

In most years, the Olympus program works OK. There is concern of downy brome/Japanese Chess developing resistant strains if Olympus is used for several years in a row. Although Olympus has some winter annual activity, it was necessary to spray for weed control using Starane NXT (27 oz/A) + Penetrate II on both wheat crops in May of 2009.

The safflower is deep rooted and although it was fertilized for a 1200 pound crop; adequate moisture, good weed control and deep rooting pushed the crop to an excellent yield of 1825 pounds per acre in 2009. The dry peas are a legume so they were inoculated at seeding time and no additional nitrogen was applied to them. The dry peas yielded 1164 pounds in 2009 and have a five year average (2005-2009) yield of 1410 pounds(23.5 bushels) per acre.

This rotation has looked good over the years. It had many challenges in 2009 with winter-kill (Wheat-a) elevated weed pressure (Wheat-b), and reduced yields (wheat-b, dry peas). Advantage of this rotation include: no additional Nitrogen needed during the pea crop, no need for additional equipment for planting or harvest, and a wide diversity of crops. This rotation had a net return of $ - 73.12 / acre in 2009.This rotation has a 4 year net return (2006-2009) of $21.97 / acre. See Table 39.

Rotation 9a: Winter Wheat-a / Winter Wheat-b / Safflower / Hairy Vetch:
The winter wheat grown after the legume-fallow (winter wheat-a) has averaged 43.3 Bu/A over a eleven-year period. The second winter wheat crop (winter wheat-b) has averaged 34.0 Bu/A in the same time frame (1999-2009). Safflower in this rotation has the highest yield in the study with a eleven-year average of 1070 Lb/A. This rotation saw changes in 2005 with the addition of hairy vetch to replace pea green fallow. Hairy vetch produces more biomass, is more vegetative and the stubble tends to cling to the ground better than the pea stubble. The better ground cover of the hairy vetch provides better snow catch which will benefit the following winter wheat crop. The hairy

vetch is planted into the safflower stalks in late September. The hairy vetch seems to establish very well in the fall and winter hardiness is typically good. Although, in the winter of 2008-09, the hairy vetch winter-killed. Planting in the fall allows the crop to initiate growth sooner in the spring and gives the ground plenty of cover until the wheat is planted in the fall. Olympus was sprayed on both wheat crops in October of 2008. This was done to suppress downy brome/Japanese Chess. Downy brome/Japanese Chess continues to be a problem in this rotation. This particular year saw very strong winds shortly after spraying on the Olympus. Winds blew most of the detached pea stubble away. Limited stubble opened the door for winter-kill in the first year of winter wheat. The 2nd year of wheat had good wheat stands but had so much downy brome that it was necessary to spray off the winter wheat crop and start over. Spring wheat was planted back in both winter wheat segments of this rotation in the spring of 2009.

In most years, the Olympus program works OK. There is concern of downy brome/Japanese Chess developing resistant strains if Olympus is used for several years in a row. Although Olympus has some winter annual activity, it was necessary to spray for weed control using Starane NXT (27 oz/A) + Penetrate II on both wheat crops in May of 2008. This rotation had a net return of $ - 117.53 / acre in 2009. This rotation has a 4 year net return (2006-2009) of $ - 2.68 / acre. See Table 39.

Although, this rotation is the most weed free rotation in the study, the winter wheat yields of the second year drop nearly 10 bushels per acre less than the first year of wheat over an eleven year period (1999-09).

Rotation 9a is being reconfigured for 2011. A benefit of the new rotation is that both winter wheat's are planted into protective cover. This will help insure good wheat stands in the spring. Combining Rotation 4 and Rotation 9a will result in a six year rotation that will be called Rotation 8a for the 2011 growing season. The sequence will be: **(Winter Wheat-a / Dry Pea / Spring Wheat / Winter Wheat-b / Safflower / Forage Millet)** We are excited about this new six year rotation and feel with the profit potential of the wheat's and safflower and the beneficial aspects of the dry peas and forage millet will make this a sound rotation that will perform well in western South Dakota.

Table 35. Hard Red Winter Wheat Protein Content, Test Weights and Yields from The Nine Rotation Sequences at Wall in 2010 and Long Term (11 year) data (1999-2009).

Rotation	Crop Sequence	Protein 2010 (%)	Test Wt 2010 (Lb/Bu)	Yield 2010 (Bu/A)	Ave Yield* 1999-09 (Bu/A)
1	**WW** / F	11.7	59.3	34.9	48.7
2a	WW / C / F/ **WW** / Su / HM	12.8	58.7	42.4	57.2
2a	**WW** / C / F/ WW / Su / HM	11.1	58.7	29.2	40.8
3	**WW** / Sa / PM	10.8	59.3	20.8	41.3
4	**WW** / PM	12.3	59.9	17.5	35.4
5a	**WW** / C / Su / S Bar	12.1	59.0	34.3	36.5
6a	**WW** / WW / Sa / DP	13.0	59.9	32.4	43.2
6a	WW / **WW** / Sa / DP	13.0	59.6	31.5	33.7
9a	***WW*** / WW / Sa / HV	13.0	60.8	38.7	43.3
9a	WW / **WW** / Sa / HV	13.2	59.8	32.6	34.0
10	**WW** / PM / DP	12.3	60.0	25.0	40.6
11	**WW** / C / PM	12.2	59.5	36.9	43.4
	Mean	12.3	59.5	31.4	41.5
	LSD (.05)	.6	.8	11.1	
	CV	3.2	1.0	**24.5**	

WW = winter wheat, F=fallow, C=corn, Su=sunflower, HM=hay millet, PM=proso millet, Sa=safflower, DP=dry peas, HV=hairy vetch, S Bar=spring barley

(*) = Average yields 1999-09 do not include the 2010 crop due to heavy hail damage.

Table 36. Rotation Sequences in the Study

Rotation #	Crops
1	Winter Wheat / Fallow
2a	Winter Wheat-A / Sunflower / Hay Millet / Winter Wheat-B / Corn / Fallow
3	Winter Wheat / Safflower / Proso Millet
4	Winter Wheat / Proso Millet
5a	Winter Wheat / Corn / Sunflower / Spring Barley
6a	Winter Wheat-B / Safflower / Dry Pea / Winter Wheat-A
9a	Winter Wheat-B / Safflower / Hairy Vetch / Winter Wheat–A
10	Winter Wheat / Proso Millet / Dry Pea
11	Winter Wheat / Corn / Proso Millet

Rotation 10: Winter Wheat / Proso Millet / Dry pea:
This is a diversified rotation that has seen lots of changes in the last few years.

Starting in 2001 and going through 2006, this rotation was: Winter Wheat / Chickpea / Proso Millet. Over the 6 year period of 2001-06 the three crops in this rotation performed as follows: winter wheat averaged 35.6 bushels / acre, chickpeas averaged 736 pounds / acre and proso millet averaged 1274 pounds /acre. We learned that chickpeas should be in a longer rotation than one out of three years. Ascochyta blight became more of a problem as we continued to have chickpeas in this close rotation. One year of chickpeas out of 5 or 6 years in a crop rotation would be better. The winter wheat did very well after the millet crop. The protective stubble of the millet worked well for the following winter wheat crop. Proso millet typically did well after the chickpeas because there was less stubble to contend with after the chickpea crop. The chickpeas also provided some nitrogen credit for the following millet crop.

In 2007, we changed the rotation sequence to: Winter Wheat / Proso Millet / Chickpea. This rotation sequence was used through the 2008 growing season. The reason for changing the sequence was to provide the nitrogen credit of the chickpea to the following winter wheat crop. A concern about this change was the limited amount of cover that the chickpea crop provided. This may or may not be a problem, depending upon how tough of a winter we have. Planting and establishment of stands of proso millet into the winter wheat stubble was difficult at times especially when wheat yields were high and there were large amounts of wheat straw.

In 2009, we changed the Rotation 10a sequence to: Winter Wheat / Proso Millet / Dry peas. The intent of the cropping change was to get away from chickpeas and the Ascochyta blight problem. We want to evaluate the benefits of planting winter wheat after dry peas. A down side to this rotation in some years is that the dry peas when harvested for grain do not have much protective cover to plant the winter wheat in to. This rotation had a net return of $ - 135.66 per acre in 2009.

In the late summer of 2010 we reconfigured this rotation again. The 2011 rotation is: **Winter Wheat / Dry Pea / Proso Millet**. This will provide good protective cover for the wheat crop planted into millet stubble. The dry peas will provide a disease break between the wheat and millet crops. The dry pea legume credit will be beneficial to the following Proso millet and wheat crop.

Rotation 11: Winter Wheat / Corn / Proso Millet:
This is an intensive but well balanced continuous crop rotation. Inclusion of glyphosate tolerant corn in the rotation allows us to manage weeds much better. The injection of fertilizer in the fall allows us to plant corn into a tilled strip that is 2 to 4 degrees warmer than the non-tilled area between the rows. Corn plant populations were reduced to14,200 seeds/acre in 2004 and 2005 in an effort to reduce seed costs and to optimize plant competition for soil moisture. In 2006, 07, and 08, corn population was further reduced to12,500 seeds/acre. In 2009 we moved from our

traditional 20 inch row spacing to a 40 inch row spacing with a seeding rate of 15,450 seeds per acre with a theoretical final stand of 13,900 plants per acre.

The winter wheat has averaged 43.4 Bu/A over the last eleven years (1999-2009) Long-term averages on winter wheat are at 89.1 % of what yields are in Rotation 1. (Table 37).The eleven-year average yield for corn is 52.4 Bu/A and this includes 2002 and 2006 that were total crop failures. Proso millet yields have averaged 1140 Lbs/A over the last eleven years (1999-09). Winter Wheat yields in 2009 were 48.3 bushels per acre. Corn yields were at 75.0 bu / acre in 2009. Proso Millet yields in 2009 were decent at 952 pounds per acre. This rotation had a net return of $ - 73.90 per acre in 2009. As of 2010, this rotation continues to be one of the best recrop winter wheat rotations at the Wall Rotation Study. The combination of Atrazine sprayed in the fall before planting to corn and weed control with Roundup Ready does an excellent job of keeping this rotation clean. Downy brome is held in check in this rotation. No downy brome herbicides have been needed in this rotation. This rotation has had the same cropping sequence since 1994.

GENERAL OVERVIEW OF THE 2010 CROPPING YEAR AT THE WALL ROTATION

The fall of 2009 and spring and summer of 2010 returned to stable prices on fertilizer costs. Starter fertilizer was at $390.00 per ton ($2.28 / gallon) and Nitrogen (28-0-0) was at $265.00 / Ton or ($.47) per pound of N.

September of 2009 rained 0.93". The winter wheat was slow to establish because the soil was dry at planting time. October was a wet month at 2.65". The wheat got established in October but didn't have much time for growth in the fall. Winter survival ratings taken on March 24, 2010 indicated that we had very minimal winter kill this year. Overall, crop stands were very good this year. The problems came later, starting on June 20, 2010 (Father's Day). The Rotation Study received 30 minutes of one inch hail on that evening between 7:30 and 8:00pm. The hail was devastating to the wheat, barley and peas. The peas didn't look severely damaged right away but it turned out that they were ruined. The corn got shredded but was at V-7 to V-9 growth stage so it recovered from the hail. The safflower was set up pre-hail time for excellent yields this year. The hail broke over the safflower plants about ten inches below the top. The safflower wasn't blooming yet at that time. Although stems were twisted and broken from the hail, the safflower did rebound. Grasshoppers later consumed the leaves and destroyed the safflower crop. The sunflowers were planted on June 3, 2010. They were getting established at the time of the storm and mostly recovered from the hail. The Proso millet and hay millet weren't planted yet. The spring and summer of 2010 had adequate moisture to produce excellent yields on all of the crops.

Grasshopper pressure was massive in the summer of 2010. The most damaging two species were the two stripe and the differential grasshoppers. Several other species were also observed. The entire study was sprayed twice this summer. On June 25th, the entire study was aerially sprayed with Asana (6 oz/A rate). Control was good immediately following the spray application but grasshoppers kept coming back in to the area.

The entire study was again aerially sprayed on August 6, 2010 with lambda star (Generic Warrior). Control was temporary and by 3 days after spraying (August 9, 2010), grasshopper populations had fully returned from adjoining areas to continue feeding. Grasshoppers destroyed four crops at the Wall Rotation Study this year. They included: safflower, corn, sunflowers, and Proso millet.

The grasshoppers consumed the leaves of the safflower. Harvest test weights were at 32 pounds per bushel and yields were very poor at about 350 pounds per acre. The grasshoppers were drawn to eat the silks first on the corn. Next, they ate the tassels. This prevented pollination of the ears and many of the ears only had 20-30 kernels per ear. Later, the grasshoppers consumed the leaves of the corn plant, leaving bare corn stalks down the row. Sunflower damage started shortly after the florets started to bloom. Grasshoppers consumed the florets and continued eating the sunflower kernels and eventually ate through the sunflower heads and stalks. Many of the heads were chewed off and fell to the ground. The sunflowers were a total loss. The Proso millet had some grasshopper feeding of the leaves earlier on and heavy feeding on the millet heads. The Proso millet was a total loss. Forage millet (Golden German) had some grasshopper feeding but was not affected nearly as much as the other summer crops. The forage millet was

harvested when headed out but was taken a few days early before the grasshoppers had a chance to destroy the crop. Grasshopper counts from the fall of 2010 indicate that pressure may be bad again in 2011.

SUMMARY TO DATE

Our long term Economic Trends (Table 39) tell us that there are two crops that have been economically sustainable at the Wall Rotation going back to at least 1999. They are **winter wheat** and **safflower**. We have 12 wheat entries in our rotation study. Seven of those 12 are making money when evaluated in a 3 year and / or 11 year summary. The safflower entries in the Wall Rotation are 3 for 3 at turning a profit in the 3 year and / or 11 year summary. In the Wall area, safflower was again a profitable crop. Safflower prices were good and yields were decent this year in the Wall area.

Corn has produced 70 bushel / acre or better seven years out of the last 16. However, the corn has failed nearly one out of six years or 17% of the time over the last 16 years. Corn will out yield in terms of pounds of production per acre, anything else that we grow but it has to have the 9 inches of initial moisture before it can produce the first bushel. Some years, we don't get that or get hot weather that affects pollen shed. Corn yields were good in the Wall area this year (2010). Timely rains were very beneficial to the local corn crop in the Wall area.

Sunflowers yield well most years if we get adequate moisture but high input costs can destroy their economics.

Proso millet is a beneficial crop planted before winter wheat. Millet stubble provides great protection for the young wheat crop and does a good job of capturing snow in the winter time. It has been very difficult to grow Proso millet profitably in the rotation study.

Growing of **hay millet** in a rotation provides several opportunities for cleaning up weeds. First, we can plant hay millet in late June, waiting for the weed flush (green and yellow foxtails, stink grass) to occur. Once the weed flush takes place, weeds can be sprayed off before planting of the crop. Another advantage is that when we hay the millet crop off, any escapee weeds are removed with the hayed crop. Usually the weeds are not mature yet at that time so they will not produce viable seed. Hay millet stubble provides good winter protection for a wheat crop and wheat performs well after the hay millet (42.9 bu / acre winter wheat average over a three year period 2007-2009). See Table 37.

Spring Barley has yielded 45 bushel per acre average over a 5 year period (2005-2009). See Table 37. This is in a continuous crop rotation. The barley is grown after corn and sunflowers which are both heavy moisture users. Barley has excellent vigor in the spring and establishes very quickly. We plant barley as soon as we can get in the field in the spring, preferably to plant in late March to early April.

Dry Peas have averaged 1410 pounds (23.5 bu) per acre over a 5 year period (2005-2009). See Table 37. Dry peas can be planted early (late March to early April) because of their hypogeal emergence. The growth point of dry peas stays underground until later development of the plant, allowing the plant to start growth without getting frozen off in the early spring. Dry peas require cool growing conditions through bloom and pod set to get good yields.

Table 37. Long-Term Yield Trends at The Wall Rotation Study (2000-2010).

Rotation & Crop	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010(&)	Ave Yield (Bu/A) or (Lb/A) (2007-09)	Ave Yield (Bu/A) or (Lb/A) (1999-09)
Rotation 1#													
Winter Wheat	58.3	38.6	28.6	77.1	17.7	60.0	31.0	52.2	56.2	44.5*	34.9	**50.9**	**48.7 bu**
Fallow	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Rotation 2a													
Winter Wheat-a	66.9	51.1	30.9	72.8	34.3	70.0	49.8	60.4	69.3	56.2*	42.4	**61.9**	**57.2 bu**
Sunflower	2602	2082	400	584	1093	860	1030	382	1690	2294	missing	**1455**	**1373 lb**
Proso Millet (99-06) Hay Millet (07-10)	1300	2000	326	0	449	1405	300	Hay millet 1.57T	Hay millet 2.5 T	Hay millet 2.5 T	Hay millet 2.3 T	**Hay millet 2.19 T**	**n/a**
Winter Wheat-b	46.0	40.2	10.7	46.3	27.1	50.0	38.1	43.7	47.6	37.5	29.2	**42.9**	**40.8 bu**
Corn	65.8	97.5	0	0	70.3	55.0	0	30.0	33.0	88.8	missing	**50.6**	**49.8 bu**
Fallow	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Rotation 3#													
Winter Wheat	45.4	38.1	9.8	47.8	24.2	50.0	40.3	43.3	51.0	42.6	20.8	**45.6**	**41.3 bu**
Safflower	1391	1575	360	614	957	685	489	375	1483	1744	missing	**1200**	**968 lb**
Millet	1266	2000	783	0	867	1906	400	1307	1224	540	missing	**1023**	**1071 lb**
Rotation 4#													
Winter Wheat	32.6	33.7	14.7	57.4	28.9	35.0	37.8	39.2	36.8	25.9	17.5	**33.9**	**35.4 bu**
Millet	1370	1800	1182	1500	1888	1848	1000	1241	949	1149	missing	**1113**	**1402 lb**
Rotation 5a													
Winter Wheat	47.6	33.1	3.4	34.9	34.1	49.7	37.0	37.6	45.9	42.3	34.3	**41.9**	**36.5 bu**
Corn	50.2	101.6	0	0	54.9	50.0	0	30.0	33.0	78.7	missing	**47.2**	**45.8 bu**
Sunflower	1958	1443	250	722	455	680	N/A	63.0	1494	1708	missing	**1088**	**1026 lb**
S Wheat (99-04) Barley (05-10)	31.8	28.4	1.6	26.2	0	41.6	15.8	37.0	73.7	56.6	32.0	**55.7**	**n/a**
Rotation 6a													
Winter Wheat-a	60.8	48.0	10.8	35.9	34.5	55.6	25.5	45.6	43.6	51.7*	32.4	**46.9**	**43.2 bu**
Winter Wheat-b	48.9	33.0	5.2	35.4	24.7	52.5	26.5	35.5	50.0	25.2*	31.5	**36.9**	**33.7 bu**
Sunflower (99-04) Safflower(05-10)	2468 sunf	2011 sunf	200 sunf	1132 sunf	818 sunf	651 saff	548 saff	278 saff	1650 saff	1825 saff	missing	**1251**	**n/a**
Pea Fallow (99-04) Field Pea (05-10)	0-pf	0-pf	0-pf	0-pf	0-pf	1405 fp	1308 fp	1170 fp	2004 fp	1164 fp	missing	**1446 fp**	**n/a**
Rotation 9a													
Winter Wheat-a	57.1	50.0	9.2	44.0	0	64.8	34.4	44.7	59.2	44.5*	38.7	**49.4**	**43.3 bu**
Winter Wheat-b	43.0	38.2	4.9	31.7	27.5	56.8	35.2	36.4	48.5	23.0*	32.6	**35.9**	**34.0 bu**
Safflower	1546	1624	230	1106	617	885	516	539	1559	1873	missing	**1323**	**1070 lb**
Pea Fallow (99-04) H. Vetch (05-10)	0-pf	0-pf	0-pf	0-pf	0-pf	0 - hv	0-hv	0-hv	0-hv	0-hv	missing	**0-hv**	**n/a**
Rotation 10a													
Winter Wheat	48.9	40.8	13.1	58.7	22.5	45.0	33.5	45.8	29.9	34.9*	25.0	**36.8**	**40.6 bu**
Chickpea(99-06) *to millet (07-10)*		1585	95	667	976	292	800	*1420*	*764*	517	missing	**900**	**n/a**
Millet (99-06) *Chickpea (07-08) Field Pea (09-10)*	1524	2000	622	925	1197	2000	900	*700*	*0*	1110 fp	missing	**n/a**	**n/a**
Rotation 11#													
Winter Wheat	37.8	42.2	13.5	59.4	28.2	53.0	41.7	45.0	54.8	48.3	36.9	**49.3**	**43.4 bu**
Corn	60.2	106.4	0	39.7	76.6	55.0	0	35	29.7	75.0	missing	**46.5**	**52.4 bu**
Millet	1300	2000	829	0	1017	1634	600	1483	1228	952	missing	**1221**	**1140 lb**
Rainfall(Apr-Aug)	**8.20 "**	**12.29 "**	**5.59 "**	**5.24 "**	**9.20 "**	**10.89"**	**5.72"**	**9.08"**	**14.57"**	**8.74"**	**11.36"**		

Rotations unchanged since 1994. N / A = Sunflowers were destroyed by deer In 2009; some winter wheat plots were replanted to spring wheat due to winter kill. They have an '*' to denote replanting to spring wheat.
(&) = 2010 had heavy hail on June 20, 2010 and heavy grasshopper pressure later in the summer.

Table 38. Estimated Yield Goals of The Wall Rotation Study (2000-2011).

Crop	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Rotation 1												
Winter Wheat	60	60	60	60	60	60	55	55	55	55	55	60 bu
Fallow	0	0	0	0	0	0	0	0	0	0	0	0
Rotation 2a												
Winter Wheat-a	60	60	60	60	60	60	60	60	60	60	60	65 bu
Sunflower(2000-2010) Safflower (2011)	2000	2000	2000	2000	2000	2000	1600	1600	1600	1600	1600	1200 lb
Proso Millet (99-06) Hay Millet (07-11)	2000	2000	2000	2000	2000	1500	1200	2 tons/a	2 tons/a	2 tons/a	2 tons/a	2 tons/a
Winter Wheat-b	45	45	45	45	45	45	45	45	45	45	45	50 bu
Corn	80	80	80	80	80	80	80	80	80	80	60	80 bu
Fallow	0	0	0	0	0	0	0	0	0	0	0	0
Rotation 3												
Winter Wheat	45	45	45	45	45	45	45	45	45	45	45	50 bu
Safflower	1500	2000	2000	2000	1500	1200	1200	1200	1200	1200	1200	1200 lb
Millet	2000	2000	2000	2000	2000	1500	1500	1500	1500	1500	1500	1500 lb
Rotation 5a												
Winter Wheat	45	45	45	45	45	40	40	40	40	40	40	45 bu
Corn	80	80	80	80	80	70	80	80	80	80	60	80 bu
Sunflower(2000-2010) Soybean (2011)	2000	2000	2000	2000	2000	1500	1300	1300	1300	1300	1300	20 bu
Spring Barley	n/a	n/a	n/a	n/a	n/a	50	60	60	60	60	60	60 bu
Rotation 6a												
Winter Wheat-a	60	60	60	60	60	60	45	45	45	45	45	50 bu
Winter Wheat-b	45	45	45	45	45	45	45	45	45	45	45	40 bu
Safflower	n/a	n/a	n/a	n/a	n/a	1500	1200	1200	1200	1200	1200	1200 lb
Dry Peas	n/a	n/a	n/a	n/a	n/a	1800	1800	1800	1800	1800	1800	1800 lb
Rotation 8a (new)												
Winter Wheat-a												50 bu
Dry Peas												1800 lb
Spring Wheat												40 bu
Winter Wheat-b												45 bu
Safflower												1200 lb
Hay Millet												2 tons/a
Rotation 10a												
Winter Wheat	45	45	45	45	45	45	45	45	45	45	45	50 bu
Millet (2007-10) Dry pea (2011)	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1800 lb
Dry pea (2009-10) Proso Millet (2011)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1800	1800	1500 lb
Rotation 11												
Winter Wheat	45	45	45	45	45	45	45	45	45	45	45	50 bu
Corn	80	80	80	80	80	80	80	80	80	80	60	80 bu
Millet	2000	2000	2000	2000	2000	1500	1500	1500	1500	1500	1500	1500 lb
Rainfall (Apr-Aug)	8.20 "	12.29 "	5.59 "	5.24 "	9.20 "	10.89"	5.72"	9.08"	14.57"	8.74"	11.36"	

Table 39. Long-Term Economic Trends of The Wall Rotation Study (1999-2010) (Net Income - $ per Acre)

Rot	Crop	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Ave Net Ret. ($) 2007-09	Ave Net Ret. ($) 1999-09
1	W. Wht	$90.54	$70.94	$10.04	$25.01	$116.40	$-30.23	$46.30	$21.88	$236.39	$215.13	-37.84	*67.76*	*137.89*	*$69.51*
	Fallow	-59.62	-61.35	-57.03	-72.57	-66.64	-56.29	- 73.72	-59.50	-86.26	-118.19	-113.07	*-95.96*	*-105.84*	*-74.92*
	Ave Inc.	15.46	$4.79	-23.49	-23.78	24.88	-43.26	- 13.71	-18.81	75.06	48.47	-75.46	*-14.10*	*16.02*	*-2.71*
2a	W. Wht-a	82.99	95.54	40.94	42.76	107.49	21.04	96.03	102.54	309.85	285.42	3.02	*121.28*	*197.41*	*107.41*
	Sunflower	40.45	84.65	39.43	-109.29	-92.02	3.19	-80.10	-29.44	-113.89	69.54	-5.27	*missing*	*-16.54*	*-17.52*
	G Millet(99-06) HayMil (07-10)	-27.28	4.37	-19.28	-57.29	-77.58	-73.57	-22.11	-76.21	-9.97	41.70	-84.55	*-101.50*	*-17.60*	*-36.52*
	W. Wht-b	24.74	19.17	9.61	-69.50	39.15	-19.59	21.67	21.64	170.92	82.39	-114.30	*6.29*	*46.33*	*16.90*
	Corn	36.30	-25.08	56.84	-160.22	-125.56	-14.84	-51.30	-133.25	-68.70	-88.64	32.15	*missing*	*-41.73*	*-49.30*
	Fallow	-47.40	-52.47	-62.28	-58.69	-52.82	-44.25	-63.08	-49.25	-86.26	-95.10	-106.83	*-128.94*	*-96.06*	*-65.31*
	Ave Inc.	18.30	21.03	10.87	-68.70	-33.55	-21.33	-16.48	-27.32	33.65	49.21	-45.96	*missing*	*+11.96*	*-7.39*
3	W. Wht	20.18	14.85	4.42	-72.08	34.93	-34.58	3.41	31.09	157.74	82.57	-81.31	*-61.42*	*53.00*	*14.65*
	Safflower	-23.86	17.92	51.48	-84.25	-46.52	23.70	-33.35	-57.25	-72.94	238.61	63.65	*missing*	*76.44*	*7.02*
	Grain Millet	-27.28	11.01	-19.28	-1.81	-77.58	-45.38	7.12	-56.00	-5.90	-61.65	-169.18	*missing*	*-78.91*	*-40.54*
	Ave Inc.	-10.32	14.59	12.20	-52.71	-29.72	-18.75	-7.60	-27.38	26.30	86.51	-62.28	*missing*	*+16.84*	*-6.28*
4	W Wht	4.41	- 9.30	-11.92	-58.02	57.89	-15.32	-41.08	40.01	114.40	20.46	-155.33	*-57.56*	*-6.82*	*-4.89*
	Grain Millet	-28.73	9.27	-35.90	49.06	-48.44	0.25	3.96	-30.94	-11.50	-110.45	-159.38	*missing*	*-93.77*	*-32.98*
	Ave Inc.	-12.16	-.01	-23.91	-4.48	4.72	-7.53	-18.56	4.53	51.45	-44.99	-157.35	*missing*	*-50.29*	*-18.94*
5a	W Wht								41.07	143.54	51.14	-82.05	*55.64*	*37.54*	*n/a*
	Corn								-133.25	-68.70	-103.45	-21.55	*missing*	*-64.56*	*n/a*
	Sunflower								-80.50	-150.76	49.36	-56.20	*missing*	*-52.53*	*n/a*
	S. Barley								-77.88	-16.10	110.31	-78.07	*-19.80*	*5.38*	*n/a*
	Ave Inc.								-62.64	-23.00	26.84	-59.46	*missing*	*-18.54*	*n/a*
6a	W Wht-a								21.44	194.41	83.14	-70.45	*38.40*	*69.03*	*n/a*
	W Wht-b								-8.47	93.98	69.06	-239.82	*21.81*	*-25.59*	*n/a*
	Safflower								-48.60	-93.95	287.37	78.23	*missing*	*90.55*	*n/a*
	Dry Pea								-20.98	15.15	51.52	-60.44	*missing*	*2.07*	*n/a*
	Ave Inc.								-14.15	52.39	122.77	-73.12		*+34.01*	*n/a*
9a	W Wht-a								36.47	185.73	176.51	-106.74	*71.57*	*85.16*	*n/a*
	W Wht-b								22.31	118.36	68.49	-238.94	*50.17*	*-17.36*	*n/a*
	Safflower								-53.29	-37.39	261.11	86.87	*missing*	*103.53*	*n/a*
	Hairy Vetch								-96.51	-108.38	-146.20	-211.33	*-113.14*	*-155.30*	*n/a*
	Ave Inc.								-22.75	39.58	89.97	-117.53	*missing*	*+4.01*	*n/a*
10	WWht (07-10)									174.58	-15.21	-162.87	*6.54*	*-1.16*	*n/a*
	Grain *Mil(07-10)*									*-19.53*	*-118.60*	-179.39	*missing*	*- 105.84*	*n/a*
	CP (07-08)									-22.84	-171.63				
	DP (09-10)											-64.72	*missing*	*- 86.39*	*n/a*
	Ave Inc.									44.07	-101.81	-135.66	*missing*	*- 64.46*	*n/a*
11	W. Wht	23.06	-1.29	16.24	-61.47	65.64	-15.14	7.31	37.08	179.68	101.19	-57.43	*69.12*	*74.48*	*26.81*
	Corn	15.42	-34.38	73.76	-160.22	-62.72	-3.44	-51.30	-133.25	-53.00	-99.96	-34.87	*missing*	*-62.61*	*-49.45*
	Grain Millet	-27.85	13.60	-19.28	16.85	-87.98	-35.30	-9.53	-52.99	8.40	-50.06	-129.42	*missing*	*-57.02*	*-33.96*
	Ave Inc.	3.54	-7.35	23.57	-68.28	-28.35	-17.96	-17.84	-49.72	45.02	-16.27	-73.90	*missing*	*-15.05*	*-18.86*
	Rainfall(Apr-Aug)	**13.44 "**	**8.20 "**	**12.29 "**	**5.59 "**	**5.24 "**	**9.20 "**	**10.89"**	**5.72"**	**9.08"**	**14.57"**	**8.74"**	**11.36"**		

Note: No Federal Government farm payments or crop insurance are calculated into these values. LDP is included where applicable.
Note: Winter wheat and spring barley received extensive hail on June 20, 2010. Warm season crops other than hay millet were destroyed by grasshoppers.

2010 CROP CONDITIONS AND COMMENTS

Fallow Winter Wheat –was planted to **"Overland"** a hard red winter wheat variety with a JD 610 notched deep-furrow opener drill plus liquid starter fertilizer (10-34-0) at 6 gallons per acre rate on September 23, 2009. Soil conditions at planting time were dry. Precipitation in October was 2.65" for the month. Winter wheat stands got established in October but we were late enough in the fall that we had limited growth. Winter-kill ratings were done on March 24, 2010. All of the wheat rotations survived the winter and stands were good in the spring of 2010. April had 2.37" rainfall for the month. May received 3.32" and June was at 3.35". The relatively higher rainfall received from April to June helped the winter wheat crop along. Hail reduced the yields of the fallow wheat.

Recrop Winter Wheat- was planted to **"Overland"** Hard Red Winter Wheat with a JD 750 no-till drill plus liquid starter fertilizer (10-34-0) at 6 gallons per acre rate on October 7, 2009. Most of the seeding of the recrop wheat was done with a light misting of rain. The recrop wheat had time to establish although it was planted later in the fall. Winter-kill was not an issue this year. Hail reduced the yields of the recrop wheat.

Hairy Vetch / Winter Triticale – The hairy vetch is a nitrogen fixing cover crop. Hairy Vetch **(Common)** (15 lb/a) / Winter Triticale **"Boreal"** (10 lb/a) were planted into safflower stubble in Rotation 9a with a JD 750 no-till drill on October 7, 2009. Soil conditions were dry but it was misting the day we planted the hairy vetch / winter triticale mix. Stands in the fall were poor due to dry soil conditions. The mixture winter-killed and weed pressure (prickly lettuce, downy brome) was a problem in the spring so the plots were sprayed off on May 21, 2010. The downy brome was headed out but still green so the germ was destroyed at spraying time. These plots were sprayed again on June 15, 2010 to control weeds.

Spring Barley-A feed barley **"Eslick"** was seeded into sunflower stalks of Rotation 5a with a JD 750 no-till drill plus liquid starter fertilizer (10-34-0) at 6 gallons per acre rate on April 12, 2010. Soil moisture levels were good at planting time. Barley stands were excellent this year. After the set back from hail, the grain yield was at 32.0 bushels per acre in 2010.

Dry Peas-were planted in rotations 6a and 10a. **"Admiral"** Peas were planted with a JD 750 drill on April 12, 2010. Rhizobium inoculants were applied to the seed at planting. Pea stands were beautiful before the hail storm hit. The peas were actively blooming when the hail storm came through. Growing conditions were good in the early growing season. Early hail assessment didn't look too bad but in actuality, the hail (June 20, 2010) destroyed the pea crop.

Five Way Cover Crop Mix on Fallow of Rotation 2a - was planted on April 12, 2010 with a JD 750 drill. Cover crops have a wide range of contributions to the rotation. Among these, lentils and Chickling vetch serve as nitrogen fixers. The turnips **"Purple Top"** and radishes **"Amigos"** serve to break up restrictive layers in the soil and to bring beneficial nutrients up to the surface. The flax has tough straw and will help with snow catch in the coming winter after the wheat crop is planted. Breakdown of the plant material also helps to feed microbes in the soil during the fallow period. Grasshoppers consumed most of the turnips (tops and tubers), and radishes (tops and tubers).

Safflower- Nitrogen and phosphorus fertilizer (60 lb N/a + 20 lb P_2O_5/a) is injected the fall before planting. The variety **"Finch"** was planted on April 29, 2010 with a JD 7100 planter at 20" row spacing using soybean plates and brushes. We plant at a seeding rate of approximately 20 pounds per acre. Soil temperatures should be at least 60 degrees at planting time to insure quick water absorption through the seed coat and thus a speedy germination. No seed treatments, insecticides, or fungicides were used during this year's crop. The safflower was a total loss due to grasshopper feeding.

Corn- Nitrogen and phosphorus fertilizer (60 lb N/a + 20 lb P2O5/a) was injected the fall before planting. Atrazine was applied in October of 2009. It did an excellent job of controlling broadleaf weeds. **"Econo-Brand Dekalb RR/YG"** a 90 day maturity corn was planted in 40 inch rows on April 29, 2010. Seeding rate was at 15,450 with a theoretical final stand of 13,900 plants per acre. Seeding conditions were good and we had decent subsoil moisture recharge. Roundup was sprayed twice during the cropping season June 15 and again on July 15, 2010. The predominant weed species on July 15, 2010 was stink grass. Although, stink grass is a warm season grass, the roundup did a nice job of controlling the weeds. The corn was a total loss due to grasshopper feeding.

Sunflowers- Nitrogen and phosphorus (80 lb N/a + 20 lb P2O5/a) is injected the fall before planting. **"Pannar 8560 NS/CL/Cruiser"** seed was planted on June 3, 2010 with a JD 7100 planter at 20" row spacing. Seeding conditions were good at planting time. Soil temp was at 85 degrees F. at 1:30pm. A year ago we updated to a size 4 seed which is larger than we have had in previous years. Seedling vigor is better with the larger seed size. The sunflowers were a total loss due to grasshopper feeding.

Proso Millet- "Horizon" Proso Millet was seeded at 18 pounds per acre plus liquid starter fertilizer (10-34-0) at 6 gallons per acre rate with a JD 750 no-till drill on June 24, 2010. Planting date was intentionally delayed to allow time for foxtail and stink grass flush to take place so they could be sprayed off. All of the proso millet plots were sprayed with Roundup on June 15, 2010. Proso Millet stands were very good this year. Proso Millet was attacked by grasshoppers on the developing heads first and later on the leaves. The proso millet was a total loss due to grasshopper feeding.

Hay Millet- "Golden German" Hay Millet was planted at a seeding rate of 12 pounds per acre with a JD 750 no-till drill plus liquid starter fertilizer (10-34-0) at 6 gallons per acre rate on June 24, 2010. We delayed planting of the forage millet until the same time we seeded the Proso millet. This gave ample time for weed flushes and we still had plenty of time to get the hay millet to maturity. The Golden German Millet was about 10% headed on August 23, 2010 and although grasshopper populations were heavy, damage was tolerable in the forage millet. The hay millet was harvested on August 26, 2010. The crop was 20% headed at that time. The forage millet was harvested a bit early as a rescue effort against grasshoppers. The hay crop had nice growth and stand at harvest time.

Appendix 1 Detailed Cultural Practices for Each Rotation in 2010

Rotation 1
WINTER WHEAT / SUMMER FALLOW

Cost / A.	2010 Winter Wheat
$7.50	-Pre-plant preparation work plots with 12" sweeps and harrow – September 17, 2009
28.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on September 23, 2009.
29.50	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 50 lb N / Acre rate (16.7 gal/Acre). – March 29, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 34.9 bu/A winter wheat – July 28, 2010 Test weight – 59.3 lb / bu (Protein Content – 11.7%)
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$153.50	Total Cost of Winter Wheat Production

Rotation 1
WINTER WHEAT / *SUMMER FALLOW*

Cost / A.	2010 Summer Fallow
$ 14.31	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate. 8 gpA rate. – August 25, 2009.
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate 8 gpA –April 16, 2010
15.72	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate + 32-0-0 @ 1 gal/acre.(7gal water + 1 gal 32-0-0/a) 8 gpA – June 15, 2010.
7.50	-Work w / 24" sweeps. – July 6, 2010.
46.00	-Land Charges 2010
$95.96	Cost of Summer Fallow

Rotation 1 SUMMARY 2010

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$221.26	-	$153.50	=	$ 67.76	
Fallow	$ 0.00	-	$95.96	=	$- 95.96	
	$ 221.26	-	$249.46	=	$- 28.20	÷ 2 = **$ - 14.10**

$ - 14.10 Average Income / acre for Rotation 1 - 2010

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Rotation 2a

WINTER WHEAT-A / SUNFLOWER /HAY MILLET / WINTER WHEAT-B / CORN / *COVER CROP FALLOW*

Cost / A.	2010 Winter Wheat-A
$32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on October 7, 2009.
38.90	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 70 lb N / Acre rate (23.3 gal/ Acre). – March 30, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 42.4 bu/A spring wheat – July 28, 2010 Test weight – 58.7 lb / bu (Protein Content – 12.8 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$159.40	Total Cost of Winter Wheat-A Production

Rotation 2a

WINTER WHEAT-A / *SUNFLOWER* / HAY MILLET / WINTER WHEAT -B / CORN / *COVER CROP FALLOW*

Cost / A.	2010 Sunflowers
$14.31	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate. 8 gpA rate. – August 25, 2009.
51.17	-Inject 28-0-0 + 10-34-0 (80 lb N / 20 lb P2O5) with injector implement set @ 20" row spacing. – October 27, 2009.
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate 8 gpA – April 16, 2010
24.37	-Spray w / 24 oz Roundup Original Max + liquid ammonium Sulfate @ 50 ml / gal + 4 oz / acre Spartan75 df +28-0-0 @ 10% of the carrier to help minimize drift. 10 gpA spray rate. – June 2, 2010.
30.41	-Plant to Pannar 8560 NS/CL @ 16,600 seeds / acre, 20" rows, w / JD 7100 planter. Note: Seed was treated w / Cruiser for wireworm control. – June 3, 2010.
25.00	-Harvest **n/a** lb / Acre Sunflowers Test weight – **n/a** – October 6, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$204.19	Total Cost of Sunflower Production

Rotation 2a

WINTER WHEAT-A / SUNFLOWER / *HAY MILLET* /WINTER WHEAT-B / CORN / *COVER CROP FALLOW*

Cost / A.	2010 Hay Millet
$20.10	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 30 lb N / Acre rate (10 gal/Acre). – March 29, 2010.
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –May 21, 2010.
15.90	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate. + 28-0-0 @ 1 gal / acre rate to heat up the mix and reduce drift. 8 gpa rate. – June 15, 2010
33.84	-Planted to Golden German Hay millet w / JD750 drill. w/ starter fertilizer(10-34-0) at 6 gal / Acre. Row spacing was at 10". Seeding rate was at 12 lb/A. – June 24, 2010.
64.73	-Swath & bale 2.3 Tons / Acre Hay Millet @ 13.5% Moisture – August 26, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$193.50	Total Cost of Hay Millet Production

Hay Millet Quality and Yield - 2010.

NDF %	ADF %	RFV	Crude Protein %	Yield (Tons/A)
57.2	30.5	106		2.3

Rotation 2a

WINTER WHEAT-A / SUNFLOWER / HAY MILLET / *WINTER WHEAT-B* / CORN / *COVER CROP FALLOW*

Cost / A.	2010 Winter Wheat –B
$12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –October 6, 2009.
32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on October 7, 2009.
38.90	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 70 lb N / Acre rate (23.3 gal/Acre). – March 30, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 29.2 bu/A winter wheat – July 28, 2010 Test weight – 58.7 lb / bu (Protein Content – 11.1 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$171.83	Total Cost of Winter Wheat-B Production

Rotation 2a

WINTER WHEAT-A / SUNFLOWER /HAY MILLET / WINTER WHEAT-B / *CORN* / *COVER CROP FALLOW*

Cost / A.	2010 Corn
$12.98	-Spray w / 16 oz Roundup Original Max + liquid ammonium sulfate @ 50 ml / gallon + 12 oz LV6. 8 gpa rate. – August 1, 2009
20.34	- Spray w / Atrazine 90df@ 2 lbs ai/acre + 16 oz Roundup Original Max + Liquid Ammonium Sulfate. 10 gpA spray rate. – October 15, 2009.
41.73	-Injected 28-0-0 + 10-34-0 (60 lb N / acre plus 20 lb P2O5 per acre). 20 inch row spacing. –October 27, 2009.
40.20	-Plant to Econo Brand Dekalb RR/YG 90 day @ 15,450 seeds / acre w / 10% stand loss. Final stand of 13,900. Planted w / JD 7100 Corn planter. 40 inch row spacing. - April 29, 2010.
15.90	- Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal + 28-0-0 @ 1 gal / acre rate. 8 gpA spray rate. – June 15, 2010.
25.00	-Harvest **n/a** bushels / acre corn – October 6, 2010. Test weight – **n/a** lbs/bu.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$202.65	-Total Cost of Corn Production

Rotation 2a

WINTER WHEAT-A / SUNFLOWER / HAY MILLET /WINTER WHEAT-B / CORN / *COVER CROP FALLOW*

Cost / A.	2010 Summer Fallow
$53.78	-Planted w / JD 750 drill w/ 10" row spacing to 5 way mix of: flax (8 lbs/a rate), Lentil (10 lbs/a rate) + innoculum, Chickling Vetch (15 lbs/a rate), Purple Top Turnip (.5 lb/a rate), Adios Radish (.5 lb/a rate). – April 12, 2010
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate. 8 gpA –April 16, 2010
16.73	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate + 12 oz LV6. 8 gpA spray rate –July 7, 2010.
46.00	-Land Charges 2010
$128.94	Cost of Cover Crop Summer Fallow

Rotation 2a SUMMARY 2010

Crop	Income		Expense		Net Income Per Acre
Winter Wheat-A	$280.68	-	$ 262.55 ($159.40 + $103.15)	=	$18.13
Sunflower	$ missing	-	$ 229.98 ($204.19 + $ 25.79)	=	$ missing
Hay Millet	$92.00	-	$ 193.50	=	$ - 101.50
Winter Wheat-B	$178.12	-	$ 171.83	=	$ 6.29
Corn	$ missing	-	$ 202.65	=	$ missing
Cover Crop Fallow	$ 0.00	-	$ 0.00*	=	$ 0.00*
	$ missing	-	$1060.51	=	$ missing ÷ 6 = **$ missing**

*The expense of the fallow ($128.94) was split 80% to the Winter Wheat-A ($103.15) and 20% to the Sunflowers ($25.79).

$ missing Average Income / acre for Rotation 2a – 2010

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Rotation 3
WINTER WHEAT / SAFFLOWER / PROSO MILLET

Cost / A.	2010 Winter Wheat
$12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –October 6, 2009.
32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on October 7, 2009.
53.70	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 90 lb N / Acre rate (30.0 gal/Acre). – March 30, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 20.8 bu/A winter wheat – July 28, 2010 Test weight – 59.3 lb / bu (Protein Content – 10.8 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$186.63	Total Cost of Winter Wheat Production

Rotation 3
WINTER WHEAT / *SAFFLOWER* / PROSO MILLET

Cost / A.	2010 Safflower
$12.98	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml / gallon + 12 oz LV6 / acre. 8 gpA spray rate. – August 1, 2009.
41.73	-Injected 28-0-0 +10-34-0 (60 lb N/acre + 20 lb P2O5 / acre) - October 27, 2009.
26.34	-Spray w / 24 oz Roundup Original Max + liquid ammonium sulfate @ 50 ml / gal + 3 pints Prowl H2O. 8 gpA spray rate. – April 16, 2010.
14.90	-Plant to Finch w / JD 7100 planter @ 210,000 seeds/acre rate. (20 lbs/acre). – April 29, 2010.
25.00	-Harvest **n/a** lb / Acre Safflowers –Test weight – 32.0 lb / bushel. - September 7, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$167.45	Total Cost of Safflower Production

Rotation 3

WINTER WHEAT / SAFFLOWER / PROSO *MILLET*

Cost / A.	2010 Proso Millet
$21.90	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 30 lb N / Acre rate (10 gal/Acre). – March 29, 2010.
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –April 16, 2010.
15.90	- Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal + 28-0-0 @ 1 gal / acre rate. 8 gpA spray rate. – June 15, 2010.
30.12	-Planted to Horizon Proso millet w / JD750 drill. w/ starter fertilizer(10-34-0) at 6 gal / Acre. Row spacing was at 10". Seeding rate was at 18 lb/A. – June 24, 2010.
25.00	-Harvest **n/a** lb / acre Test weight- **n/a** lbs/bushel – September 7, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$151.85	Total Cost of Millet Production

Rotation 3 SUMMARY 2010

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$125.21	-	$186.63	=	$ - 61.42	
Safflower	$ missing	-	$167.45	=	$ missing	
Proso Millet	$ missing	-	$151.85	=	$ missing	
	$ missing	-	$505.93	=	$ missing	÷ 3 = **$ missing**

$ missing Average Income / acre for Rotation 3 – 2010

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Rotation 4

WINTER WHEAT / PROSO MILLET

Cost / A.	2010 Winter Wheat
$12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate. 8 gpA --October 6, 2009.
32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on October 7, 2009.
38.90	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 70 lb N / Acre rate (23.3 gal/Acre). – March 30, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 17.5 bu/A winter wheat – July 28, 2010 Test weight – 59.9 lb / bu (Protein content – 12.3 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$171.83	Total Cost of Winter Wheat Production

Rotation 4

WINTER WHEAT / *PROSO MILLET*

Cost / A.	2010 Proso Millet
$12.98	-Spray w / 16 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate + 12 oz LV6 . 8 gpA – August 1, 2009.
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –April 16, 2010.
15.90	- Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal + 28-0-0 @ 1 gal / acre rate. 8 gpA spray rate. – June 15, 2010.
30.12	-Planted to Horizon Proso millet w / JD750 drill. w/ starter fertilizer(10-34-0) at 6 gal / Acre. Row spacing was at 10". Seeding rate was at 18 lb/A. – June 24, 2010.
25.00	-Harvest **n/a** lb / acre Test weight- **n/a** lbs/bushel – September 7, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$142.93	Total Cost of Millet Production

Rotation 4 SUMMARY 2010

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$114.27	-	$171.83	=	$ - 57.56	
Proso Millet	$ missing	-	$142.93	=	$ missing	
	$ missing	-	$314.76	=	$ missing	÷ 2 = **$ missing**

$ ___ Average Income / acre for Rotation 4 – 2010

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Rotation 5a

WINTER WHEAT / CORN / SUNFLOWER / SPRING BARLEY

Cost / A.	2010 Winter Wheat
$14.31	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –August 25, 2009.
32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. - October 7, 2009.
32.50	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 50 lb N / Acre rate (16.7 gal/Acre). – March 29, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 34.3 bu/A winter wheat – July 28, 2010 Test weight – 59.0 lb / bu (Protein content – 12.1 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$167.31	Total Cost of Winter Wheat Production

Rotation 5a

WINTER WHEAT / *CORN* / SUNFLOWER / SPRING BARLEY

Cost / A.	2010 Corn
$12.98	-Spray w / 16 oz Roundup Original Max + liquid ammonium sulfate @ 50 ml / gallon + 12 oz LV6. 8 gpa rate. – August 1, 2009
17.94	- Spray w / Atrazine 90df@ 1 1/2 lbs ai/acre + 16 oz Roundup Original Max + Liquid Ammonium Sulfate. 10 gpA spray rate. – October 15, 2009.
41.73	-Injected 28-0-0 + 10-34-0 (60 lb N / acre plus 20 lb P2O5 per acre). 20 inch row spacing. –October 27, 2009.
40.20	-Plant to Econo Brand Dekalb RR/YG 90 day @ 15,450 seeds / acre w / 10% stand loss. Final stand of 13,900. Planted w / JD 7100 Corn planter. 40 inch row spacing. - April 29, 2010.
15.90	- Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal + 28-0-0 @ 1 gal / acre rate. 8 gpA spray rate. – June 15, 2010.
25.00	-Harvest **n/a** bushels / acre corn – October 6, 2010. Test weight – **n/a** lbs/bu.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$200.25	-Total Cost of Corn Production

Rotation 5a

WINTER WHEAT / CORN / *SUNFLOWER* / SPRING BARLEY

Cost / A.	2010 Sunflower
$51.17	-Inject 28-0-0 + 10-34-0 (80 lb N / 20 lb P2O5) with injector implement set @ 20" row spacing. – October 27, 2009.
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate 8 gpA – April 16, 2010
24.37	-Spray w / 24 oz Roundup Original Max + liquid ammonium Sulfate @ 50 ml / gal + 4 oz / acre Spartan 75 df +28-0-0 @ 10% of the carrier to help minimize drift. 10 gpA spray rate. – June 2, 2010.
30.41	-Plant to Pannar 8560 NS/CL @ 16,600 seeds / acre, 20" rows, w / JD 7100 planter. Note: Seed was treated w / Cruiser for wireworm control. – June 3, 2010.
25.00	-Harvest **n/a** lb / Acre Sunflowers Test weight – **n/a** lb / bushel – October 6, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$189.88	Total Cost of Sunflower Production

Rotation 5a

WINTER WHEAT / CORN / SUNFLOWER / *SPRING BARLEY*

Cost / A.	2010 Spring Barley
$31.75	-Plant to Eslick Barley @ 119.7 lb or 1,220,000 seeds (2.49 bushels) / acre rate. Seeded w / JD 750 drill. No starter fertilizer applied (soil tests indicated that starter fertilizer wasn't needed) – April 12, 2010.
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate 8 gpA – April 16, 2010
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 32.0 bu/A Barley Test weight – 46.5 lb / bu (Protein content - 11.7%) – July 28, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$131.80	Total Cost of Spring Barley Production

Rotation 5a SUMMARY 2010

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$222.95	-	$167.31	=	$55.64	
Corn	$ missing	-	$200.25	=	$ missing	
Sunflower	$ missing	-	$189.88	=	$ missing	
Spring Barley	$112.00	-	$131.80	=	$ - 19.80	
	$ missing	-	$689.24	=	$ missing	÷ 4 = **$ missing**

$ missing Average Income / acre for Rotation 5a - 2010

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Rotation 6a

WINTER WHEAT-B / SAFFLOWER / DRY PEA / WINTER WHEAT-A

Cost / A.	2010 Winter Wheat – B
$14.31	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –August 25, 2009.
32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on October 7, 2009.
20.35	-Spray w / Olympus WG @ .9 oz (25.56 grams) / acre rate plus Penetrate II @ 18 ml / gallon + 28-0-0 @ 10% of the carrier to enhance efficiency of Olympus. 10 gpA spray rate. – November 16, 2009.
32.50	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 50 lb N / Acre rate (16.7 gal/Acre). – March 29, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 31.5 bu/A Winter Wheat Test weight – 59.6 lb / bu (Protein content -13.0 %) – July 28, 2010
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$187.66	Total Cost of Winter Wheat–B Production

Rotation 6a

WINTER WHEAT-B / *SAFFLOWER* / DRY PEA / WINTER WHEAT-A

Cost / A.	2010 Safflower
$14.31	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –August 25, 2009.
41.73	-Injected 28-0-0 +10-34-0 (60 lb N/acre + 20 lb P2O5 / acre) - October 27, 2009.
26.34	-Spray w / 24 oz Roundup Original Max + liquid ammonium sulfate @ 50 ml / gal + 3 pints Prowl H2O. 8 gpA spray rate. – April 16, 2010.
14.90	-Plant to Finch w / JD 7100 planter @ 210,000 seeds/acre rate. (20 lbs/acre). – April 29, 2010.
25.00	-Harvest **n/a** lb / Acre Safflowers –Test weight – 32.0 lb / bushel. - September 7, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$168.78	Total Cost of Safflower Production

Rotation 6a

WINTER WHEAT-B / SAFFLOWER / *DRY PEA* / WINTER WHEAT-A

Cost / A.	2010 Dry Pea
$54.16	-Plant to Admiral Peas @ 330,000 seeds per acre (178 lbs/A) (1850 seeds/lb)+ 5 lb / acre granular innoculum w / JD 750 drill. No starter fertilizer added. – April 12, 2010.
22.96	-Spray w / 24 oz / acre Roundup Original Max + 50 ml / gal liquid Ammonium Sulfate + Spartan 75 df @ 4 ounces per acre. 10 gpA spray rate. – April 16, 2010.
28.00	-Harvest **n/a** lb or bushels / Acre Admiral peas (yellow seed) – August 9, 2010. Test weight – lb / bushel
46.00	-Land Charges 2010
$151.12	Total Cost of Dry Pea Production

Rotation 6a

WINTER WHEAT-B / SAFFLOWER / DRY PEA / *WINTER WHEAT-A*

Cost / A.	2010 Winter Wheat – A
$14.31	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –August 25, 2009.
32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on October 7, 2009.
20.35	-Spray w / Olympus WG @ .9 oz (25.56 grams) / acre rate plus Penetrate II @ 18 ml / gallon + 28-0-0 @ 10% of the carrier to enhance efficiency of Olympus. 10 gpA spray rate. – November 16, 2009.
21.90	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 30 lb N / Acre rate (10.0 gal/Acre). – March 29, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 32.4 bu/A Winter Wheat Test weight – 59.9 lb / bu (Protein content -13.0 %) – July 28, 2010
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$177.06	Total Cost of Winter Wheat-A Production

Rotation 6a SUMMARY 2010

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat-B	$209.47	-	$187.66	=	$21.81	
Safflower	$ missing	-	$168.78	=	$ missing	
Dry pea	$ missing	-	$151.12	=	$ missing	
Winter Wheat-A	$215.46	-	$177.06	=	$38.40	
	$ missing	-	$684.62	=	$ missing	÷ 4 = **$ missing**

$ missing Average Income / acre for Rotation 6a - 2010

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Rotation 7

The plots from rotation #7 (WW-Corn-Fallow) were combined with rotation #2 (WW-Sunflower-Millet) to make a longer six year rotation (2a) in 1999.

Rotation 8

The plots from rotation #8 were added to rotations 5, 6 and 9 to make longer 4 year rotations in 1998

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Rotation 9a

WINTER WHEAT-B / SAFFLOWER / Hairy Vetch / WINTER WHEAT-A

Cost / A.	2010 Winter Wheat –B
$14.31	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –August 25, 2009.
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate 8 gpA – October 6, 2009
32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on October 7, 2009.
20.35	-Spray w / Olympus WG @ .9 oz (25.56 grams) / acre rate plus Penetrate II @ 18 ml / gallon + 28-0-0 @ 10% of the carrier to enhance efficiency of Olympus. 10 gpA spray rate. – November 16, 2009.
00.00	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 0 lb N / Acre rate (0.0 gal/Acre). – March 29, 2010 (none needed).
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 32.6 bu/A Winter Wheat Test weight – 59.8 lb / bu (Protein content -13.2 %) – July 28, 2010
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$167.59	Total Cost of Winter Wheat–B

Rotation 9a

WINTER WHEAT-B / *SAFFLOWER* / Hairy Vetch / WINTER WHEAT-A

Cost / A.	2010 Safflower
$14.31	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –August 25, 2009.
41.73	-Injected 28-0-0 +10-34-0 (60 lb N/acre + 20 lb P2O5 / acre) - October 27, 2009.
26.34	-Spray w / 24 oz Roundup Original Max + liquid ammonium sulfate @ 50 ml / gal + 3 pints Prowl H2O. 8 gpA spray rate. – April 16, 2010.
14.90	-Plant to Finch w / JD 7100 planter @ 210,000 seeds/acre rate. (20 lbs/acre). – April 29, 2010.
25.00	-Harvest **n/a** lb / Acre Safflowers –Test weight – 32.0 lb / bushel. - September 7, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$168.78	Total Cost of Safflower Production

Rotation 9a

WINTER WHEAT-B / SAFFLOWER / *Hairy Vetch* / WINTER WHEAT-A

Cost / A.	2010 Hairy Vetch / Winter Triticale
$38.81	- Plant to Hairy Vetch (15 lb/A) + innoculum + Winter Triticale @ 10 lbs / acre w / JD 750 drill. – October 7, 2009.
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate 8 gpA (Note: The crop was terminated early due to winter-kill and weed pressure) – May 21, 2010
15.90	- Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal + 28-0-0 @ 1 gal / acre rate. 8 gpA spray rate. – June 15, 2010.
46.00	-Land Charges 2010
$113.14	Total Cost of Hairy Vetch / Winter Triticale Cover Crop Production

Rotation 9a

WINTER WHEAT-B / SAFFLOWER / HAIRY VETCH / *WINTER WHEAT-A*

Cost / A.	2010 Winter Wheat-A
$12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate 8 gpA – October 6, 2009
32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on October 7, 2009.
20.35	-Spray w / Olympus WG @ .9 oz (25.56 grams) / acre rate plus Penetrate II @ 18 ml / gallon + 28-0-0 @ 10% of the carrier to enhance efficiency of Olympus. 10 gpA spray rate. – November 16, 2009.
32.50	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 50 lb N / Acre rate (16.7 gal/Acre). – March 29, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 38.7 bu/A Winter Wheat Test weight – 60.8 lb / bu (Protein content -13.0 %) – July 28, 2010
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$185.78	Total Cost of Winter Wheat-A Production

Rotation 9a SUMMARY 2010

Crop	Income	-	Expense	=	Net Income Per Acre	
Winter Wheat-B	$217.76	-	$167.59	=	$50.17	
Safflower	$ missing	-	$168.78	=	$ missing	
Hairy Vetch	$ 0.00	-	$113.14	=	$ - 113.14	
Winter Wheat-A	$257.35	-	$185.78	=	$71.57	
	$ missing	-	$635.29	=	$ missing	÷ 4 = **$ missing**

$ missing Average Income / acre for Rotation 9a – 2010

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Rotation 10

WINTER WHEAT / PROSO MILLET / DRY PEA

Cost / A.	2010 Winter Wheat
$14.31	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –August 25, 2009.
32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on October 7, 2009.
21.90	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 30 lb N / Acre rate (10.0 gal/Acre). – March 29, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 25.0 bu/A Winter Wheat Test weight – 60.0 lb / bu (Protein content -12.3 %) – July 28, 2010
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$156.71	Total Cost of Wheat Production

Rotation 10
WINTER WHEAT / *PROSO MILLET* / DRY PEA

Cost / A.	2010 Proso Millet
$14.31	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –August 25, 2009.
12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –April 16, 2010.
15.90	- Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal + 28-0-0 @ 1 gal / acre rate. 8 gpA spray rate. – June 15, 2010.
30.12	-Planted to Horizon Proso millet w / JD750 drill. w/ starter fertilizer(10-34-0) at 6 gal / Acre. Row spacing was at 10". Seeding rate was at 18 lb/A. – June 24, 2010.
25.00	-Harvest **n/a** lb / acre Test weight- **n/a** lbs/bushel – September 7, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$144.26	Total Cost of Proso Millet Production

Rotation 10
WINTER WHEAT / PROSO MILLET / *DRY PEA*

	2010 Dry Peas
$54.16	-Plant to Admiral Peas @ 330,000 seeds per acre (178 lbs/A) (1850 seeds/lb)+ 5 lb / acre granular innoculum w / JD 750 drill. No starter fertilizer added. – April 12, 2010.
22.96	-Spray w / 24 oz / acre Roundup Original Max + 50 ml / gal liquid Ammonium Sulfate + Spartan 75 df @ 4 ounces per acre. 10 gpA spray rate. – April 16, 2010.
28.00	-Harvest **n/a** lb or bushels / Acre Admiral peas (yellow seed) Test weight – lb / bushel – August 9, 2010.
46.00	-Land Charges 2010
$151.12	Total Cost of Dry Pea Production

Rotation 10 SUMMARY 2010

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$163.25	-	$156.71	=	$6.54	
Proso Millet	$ missing	-	$144.26	=	$ missing	
Dry Pea	$ missing	-	$151.12	=	$ missing	
	$ missing	-	$452.09	=	$ missing	÷ 3 = **$ missing**

$ missing Average Income / acre for Rotation 10 - 2010

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Rotation 11
WINTER WHEAT / CORN / PROSO MILLET

Cost / A.	2010 Winter Wheat
$12.43	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate 8 gpA – October 6, 2009
32.88	-Plant to Overland @ 72.5 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on October 7, 2009.
38.90	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 70 lb N / Acre rate (23.3 gal/Acre). – March 30, 2010.
16.12	-Spray wheat with 1 pint (16 oz) / acre Wide Match + LV6 @ 5 oz / acre. 8 gpA spray rate. – May 21, 2010.
25.00	-Harvest 36.9 bu/A Winter Wheat Test weight – 59.5 lb / bu (Protein content -12.2 %) – July 28, 2010
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$ 171.83	Total Cost of Winter Wheat Production

Rotation 11
WINTER WHEAT / *CORN* / PROSO MILLET

Cost / A.	2010 Corn
$12.98	-Spray w / 16 oz Roundup Original Max + liquid ammonium sulfate @ 50 ml / gallon + 12 oz LV6. 8 gpa rate. – August 1, 2009
20.34	- Spray w / Atrazine 90df@ 2 lbs ai/acre + 16 oz Roundup Original Max + Liquid Ammonium Sulfate. 10 gpA spray rate. – October 15, 2009.
41.73	-Injected 28-0-0 + 10-34-0 (60 lb N / acre plus 20 lb P2O5 per acre). 20 inch row spacing. –October 27, 2009.
40.20	-Plant to Econo Brand Dekalb RR/YG 90 day @ 15,450 seeds / acre w / 10% stand loss. Final stand of 13,900. Planted w / JD 7100 Corn planter. 40 inch row spacing. - April 29, 2010.
15.90	- Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal + 28-0-0 @ 1 gal / acre rate. 8 gpA spray rate. – June 15, 2010.
25.00	-Harvest **n/a** bushels / acre corn – October 6, 2010. Test weight – **n/a** lbs / bu.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$202.65	-Total Cost of Corn Production

Rotation 11
WINTER WHEAT / CORN / PROSO *MILLET*

Cost / A.	2010 Proso Millet
21.90	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 30 lb N / Acre rate (10.0 gal/Acre). – March 29, 2010.
15.90	- Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal + 28-0-0 @ 1 gal / acre rate. 8 gpA spray rate. – June 15, 2010.
30.12	-Planted to Horizon Proso millet w / JD750 drill. w/ starter fertilizer(10-34-0) at 6 gal / Acre. Row spacing was at 10". Seeding rate was at 18 lb/A. – June 24, 2010.
25.00	-Harvest **n/a** lb / acre Test weight- **n/a** lbs/bushel – September 7, 2010.
.50	-Soil Sampling / acre
46.00	-Land Charges 2010
$139.42	Total Cost of Proso Millet Production

Rotation 11 SUMMARY 2010

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$240.95	-	$171.83	=	$69.12	
Corn	$ missing	-	$202.65	=	$ missing	
Proso Millet	$ missing	-	$139.42	=	$ missing	
	$ missing	-	$513.90	=	$ missing	÷ 3 = **$ missing**

$ missing Average Income / acre for Rotation 11 - 2010

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COST OF INPUTS – 2010 CROP

SEED

Overland Winter Wheat.....$ 7.50 / Bu
Hairy Vetch.....$1.50 / lb
Radish Seed (Adios)...$3.70/lb(Warne Chemical)
Turnip (Purple Top)...$1.55 / lb(Warne Chemical)
Eslick Barley.....$ 7.00 / 50 lb bag
Finch Safflower.....$13.50 / 50 lbs
Dekalb Corn RR (EB90RR) (80,000 kernels)
(4-20-10 Warne Chemical).....$159.00 / bag
Pannar 8560 NS / CL + Cruiser Sunflower – Size 4
(200,000 seeds).....$ 252.00 / bag
Golden German Hay Millet .....$ .43 / lb
**Horizon Millet.....$ .35 / lb
Winter Triticale.....$ 7.00 / bu
Lentil.....$ .55 / lb
Flax.....$12 / bu or $ .22 / lb
Chickling Vetch.....$1.91 / lb
Canola.....$.55 / lb
Admiral peas.....$12.50 / bu or $.21/lb
*** from Foundation seed stocks January 2010*

HERBICIDES

(From Warne Chemical, Rapid City, SD – Dec, 2009)

Assure II.....$144.95 / gal
Beyond 1L.....$611.34 / gal
Bronate (Brox M).....$50.40 / gal
Roundup Original Max.....$30.00 / gal
Atrazine 90df.....$ 4.79 / lb
Harmony SG.....$29.40 / oz
Harmony Extra.(Affinity TM) .....$ 8.17 / oz
Ally.....$13.63 / oz
Treflan 10% granules.....$ 0.84 / lb
2,4D Ester LV6.....$25.87 / gal
Clarity (dicamba).....$53.85 / gal
Poast.....$80.41 / gal
Spartan 75df.....$41.32 / lb ($2.58 /oz)
Spartan 4F.....$405.76 / gal($3.17/oz)
Starane .....$111.36 / gal
Starane NXT.....$88.50/gal
Maverick.....$16.04 / oz
Olympus WG.....$13.14 / oz
Olympus Flex.....$ 4.47 / oz
Aim.....$212.37 / quart ($5.66 / oz)
Wide Match.....$72.90 / gal
Crop Oil.....$11.21 / gal
Penetrate II.....$20.10 / gal
Induce.....$20 /gal ($.16/oz)
Ammonium Sulfate.....$ 7.73 / gal
Prowl H2O.....$37.10 / gal
Buctril(Brox 2EC).....$169.25 / 2½ gal
MCPA ester.....$86.10 / 2 ½ gal

FUNGICIDES

Tilt.....$438.00 / gallon
Headline.....$373.63 / gallon

FERTILIZER

(Warne Chemical, Rapid City, SD – Sept 23, 2009)
10-34-0.....$250.95 / Ton ($1.47 / gallon)
(Johnson's Ranchers Supply, Wall, SD – March 29, 2010)
28-0-0.....$ 265.00 / Ton ($1.41 / gallon)($.47 / lb N)

(Warne Chemical, Rapid City, SD – April 2010)
10-34-0.....$390.00 / Ton ($2.28 / gallon)
(Warne Chemical, Rapid City, SD – March 29, 2010)
28-0-0.....$ 297.50 / Ton ($1.59/gallon) ($.53/lb N)

SEED TREATMENTS

Vitavax/Thiram/RTU.....$50.50 / gal
Raxil MDW.....$91.90 / gal
Seed treatment fee.....$ 0.25 / acre
Field Pea/Vetch innoculum (peat base)..$ 0.60 / bu

EQUIPMENT CHARGES

Row Crop Planting.....$ 9.50 / acre
No-till Planting.....$15.00 / acre
Conventional Planting.....$11.00 / acre
Mechanical Tillage.....$ 7.50 / acre
Swathing hay.....$19.50 / acre
Baling hay.....$14.75 / 1500 lb bale

APPLICATION RATES

Herbicide.....$ 6.00 / acre
Top dress Fertilizing.....$ 6.00 / acre
Injection Fertilizing.....$ 9.00 / acre

HARVEST RATES

All crops but peas.....$25.00 / acre
Dry peas.....$28.00 / acre

Soil Sampling & Analysis $ .50 / acre

LAND CHARGES

$600 / A x .07=$42.00 + $4 land tax=$46.00/Acre

GRAIN SALE VALUES

(Grain Prices for 2010 crop from Dakota Mill & Grain, Rapid City, SD - December 15, 2010)

Winter Wheat.....See chart on next page.
Sunflower (oil-type).....$ 18.00 / cwt.
Corn #2 yellow.....$ 3.50 / bu
Safflower.....$ 20.50 / cwt
Proso Millet.....$ 8.00 / cwt
Barley.....$ 3.50 / bu
Field peas (yellow).....$ 6.00 / bu *
Field peas (green).....$ 7.00 / bu *
*(*price quote from Sunbird, Inc Huron, SD (Dec 15, 2010)*

HAY SALE VALUE

Golden German millet hay.....$ 40.00 / ton

2010 Winter Wheat Protein Content by Rotation

Rot 1 – 11.7% WW	Rot 3 – 10.8% WW	Rot 6a-a -13.0% WW	Rot 9a-b –13.2% WW
Rot 2a-a – 12.8% WW	Rot 4 – 12.3% WW	Rot 6a-b–13.0% WW	Rot 10a – 12.3% WW
Rot 2a-b – 11.1% WW	Rot 5a –12.1% WW	Rot 9a-a–13.0% WW	Rot 11 – 12.2% WW

2010 average protein across all rotations - 12.3%

Winter Wheat Value Per Bushel with Protein Adjustment.
(Prices from Dakota Mill and Grain, Rapid City as of December 15, 2010)
(Average sale value for fall of 2010)

Protein Content	Winter Wheat $ / Bushel	Spring Wheat $ / Bushel
8.8%	$5.70	
9.0	$5.70	
9.2	$5.70	
9.4	$5.70	
9.6	$5.70	
9.8	$5.70	
10.0%	$5.70	$4.25
10.2	$5.78	$4.40
10.4	$5.86	$4.55
10.6	$5.94	$4.70
10.8	$6.02	$4.85
11.0%	$6.10	$5.00
11.2	$6.18	$5.15
11.4	$6.26	$5.30
11.6	$6.34	$5.45
11.8	$6.42	$5.60
12.0%	**$6.50**	**$5.75**
12.2	$6.53	$5.90
12.4	$6.56	$6.05
12.6	$6.59	$6.20
12.8	$6.62	$6.35
13.0%	$6.65	$6.50
13.2	$6.68	$6.65
13.4	$6.71	$6.80
13.6	$6.74	$6.95
13.8	$6.77	$7.10
14.0%	$6.80	**$7.25**
14.2	$6.83	$7.40
14.4	$6.86	$7.55
14.6	$6.89	$7.70
14.8	$6.92	$7.85
15.0%	$6.95	$8.00
15.2	$6.98	
15.4	$7.01	
15.6	$7.04	
15.8	$7.07	
16.0%	$7.10	
16.2	$7.13	

Precipitation for September 2005 through August 2010

Wall Rotation Rainfall Data - 2005-06 (inches)

Month	Total Precip.	Month	Total Precip.	Month	Total Precip.
September 05..	0.39"	January 06...	0.17"	*May*.....	1.21"
October.....	0.63"	February.....	Missing	*June*.....	1.08"
November.....	0.24"	March.....	Missing	*July*.....	0.89"
December.....	0.28"	*April*.....	1.36"	*August*.....	1.18"

(Accumulative total precipitation from Sept.1, 2005 to Aug. 31, 2006 is 7.43" + missing data in Feb and Mar.) (Accumulative total precipitation from Apr.1 to Aug. 31, 2006 is 5.72")

Wall Rotation Rainfall Data - 2006-07 (inches)

Month	Total Precip.	Month	Total Precip.	Month	Total Precip.
September 06..	2.59"	January 07...	0.02"	*May*.....	1.81"
October.	0.31"	February.....	0.29"	*June*.....	3.23"
November.....	0.29"	March.....	1.51"	*July*.....	1.56"
December.....	0.02"	*April*.....	0.56"	*August*.....	1.92"

(Accumulative total precipitation from Sept.1, 2006 to Aug. 31, 2007 is 14.11")
(Accumulative total precipitation from Apr.1 to Aug. 31, 2007 is 9.08")

Wall Rotation Rainfall Data – 2007-08 (inches)

Month	Total Precip.	Month	Total Precip.	Month	Total Precip.
September 07..	1.19 "	January 08...	0.00"	*May*.....	4.96"
October.....	1.92"	February.....	0.26"	*June*.....	4.41"
November.....	0.16"	March.....	0.43 "	*July*.....	3.13"
December.....	0.03"	*April*.....	1.13"	*August*.....	0.94"

(Accumulative total precipitation from Sept.1, 2007 to Aug. 31, 2008 is 18.56")
(Accumulative total precipitation from Apr.1 to Aug. 31, 2008 is 14.57")

Wall Rotation Rainfall Data - 2008-09 (inches)

Month	Total Precip.	Month	Total Precip.	Month	Total Precip.
September 08..	0.37"	January 09...	0.08"	*May*.....	0.90"
October.....	1.12"	February.....	0.38"	*June*.....	1.91"
November.....	0.23"	March.....	0.60"	*July*.....	2.50"
December.....	0.15"	*April*.....	1.62"	*August*.....	1.81"

(Accumulative total precipitation from Sept.1, 2008 to Aug. 31, 2009 is 11.67 ")
(Accumulative total precipitation from Apr.1 to Aug. 31, 2009 is 8.74 ")

Wall Rotation Rainfall Data - 2009-10 (inches)

Month	Total Precip.	Month	Total Precip.	Month	Total Precip.
September 09..	0.93"	January 10...	0.20"	*May*.....	3.32"
October.....	2.65"	February.....	0.30"	*June*.....	3.35"
November.....	0.13"	March.....	0.50"	*July*.....	1.76"
December.....	0.90"	*April*.....	2.37"	*August*.....	0.56"

(Accumulative total precipitation from Sept.1, 2009 to Aug. 31, 2010 is 16.97 ")
(Accumulative total precipitation from Apr.1 to Aug. 31, 2010 is 11.36 ")

1971-2000 (30 year average) Total Precipitation from September 1 – August 31 is 17.24"
1971-2000 (30 year average) Total Precipitation from April 1 – August 31 is 11.53"

Wall Rotation Study Soil Analysis - As of December 6, 2010 for the 2011 Season.

Plot No.	2011 Crop and estimated yield goal	Soil Texture	Soil pH	Soluble Salts	Organic Matter %	NO3-N lbs / acre 0-6" top	NO3-N lbs / acre 0-24" total	P ppm (olsen)	K ppm	**Add N lbs/A**	**Add P205 lbs/A**	**Add K2O lbs/A**	2010 Yield (Bushels, tons, Lbs / acre)
101-1	Fallow	Medium	6.8	0.4	1.8	12	28	9	361	**0**	**0**	**0**	34.9 bu HRW (H)
102-1	HRW-60bu	Medium	6.4	0.4	1.8	40	68	9	400	**80**	**30**	**0**	Fallow
117-2a	Fal (5 way mix)	Medium	6.5	0.3	1.8	36	56	21	685	**0**	**0**	**0**	0 bu Corn (H) (G)
118-2a	HRW-65bu	Medium	6.8	0.4	1.7	21	37	9	515	**125**	**30**	**0**	Fallow (5 way mix) (G)
119-2a	Saff -1200 lb	Medium	7.1	0.4	1.8	31	46	11	498	**35**	**10**	**0**	42.4 bu HRW-a (H)
103-2a	Mil Hay- 2 Ton/a	Medium	6.5	0.4	1.8	44	58	17	531	**0**	**0**	**0**	0 lb Sunflower (G)
104-2a	HRW-50bu	Medium	6.4	0.4	2.0	36	49	13	675	**75**	**10**	**0**	2.0 T/a Millet Hay
105-2a	Corn-80bu	Medium	6.3	0.3	1.9	14	24	15	425	**70**	**5**	**0**	29.2 bu HRW-b (H)
106-3	Mil-1500 lb	Medium	6.6	0.4	1.4	19	38	19	430	**15**	**0**	**0**	0 lb Safflower (H) (G)
107-3	HRW-50bu	Medium	6.6	0.3	1.7	24	36	8	396	**90**	**25**	**0**	0 lb Millet (G)
108-3	Saff-1200 lb	Medium	6.9	0.3	1.8	15	31	14	501	**30**	**5**	**0**	20.8 bu HRW (H)
111-5a	Soybean – 20 bu	Medium	6.4	0.4	2.0	45	69	24	450	**0**	**0**	**0**	0 bu Corn (H) (G)
122-5a	Barley 60bu	Medium	6.4	0.3	2.2	30	46	16	655	**55**	**0**	**0**	0 lb Sunflower (G)
112-5a	HRW-45bu	Medium	6.9	0.4	1.9	30	45	15	525	**70**	**5**	**0**	32.0 bu Barley (H)
113-5a	Corn-80bu	Medium	6.7	0.5	1.9	24	38	13	595	**60**	**10**	**0**	34.3 bu HRW (H)
114-6a	Dry Pea-1800 lb	Medium	6.7	0.4	1.9	22	38	6	461	**0**	**20**	**0**	0 lb Safflower (H) (G)
115-6a	HRW-a 50bu	Medium	6.5	0.4	1.8	42	60	6	605	**65**	**35**	**0**	108 lb Dry peas (H)
121-6a	HRW-b 40bu	Medium	6.3	0.3	2.1	19	28	14	620	**70**	**5**	**0**	32.4 bu HRW-a (H)
116-6a	Saff-1200 lb	Medium	6.4	0.3	1.6	30	50	11	635	**10**	**10**	**0**	31.5 bu HRW-b (H)
110-8a	HRW-a 50bu	Medium	6.8	0.3	2.0	27	40	15	356	**85**	**5**	**0**	0 lb Millet (G)
123-8a	Dry Pea-1500 lb	Medium	6.4	0.3	1.9	26	42	10	406	**0**	**10**	**0**	0 lb Safflower (H) (G)
124-8a	S. Wheat-40 bu	Medium	6.4	0.3	2.0	37	51	8	451	**50**	**20**	**0**	H.Vch/ W trt (g.manure)
125-8a	HRW-b45bu	Medium	6.6	0.4	2.0	26	38	9	558	**75**	**20**	**0**	38.7 bu HRW-a (H)
120-8a	Saff-1200 lb	Medium	6.3	0.3	2.0	30	45	10	630	**15**	**10**	**0**	32.6 bu HRW-b (H)
109-8a	Mil Hay-2 Tons/a	Medium	7.4	0.4	1.7	6	12	9	332	**40**	**10**	**0**	17.5 bu HRW (H)
126-10	HRW-50bu	Medium	6.7	0.3	2.0	16	25	12	519	**100**	**15**	**0**	0 lb Millet (G)
127-10	Dry Pea-1800 lb	Medium	6.6	0.3	1.5	26	39	6	492	**0**	**20**	**0**	96 lb Dry peas (H)
128-10	Mil-1500 lb	Medium	6.8	0.2	1.9	14	22	6	404	**30**	**15**	**0**	25.0 bu HRW (H)
129-11	Mil-1500 lb	Medium	6.6	0.3	2.0	29	51	17	527	**0**	**0**	**0**	36.9 bu HRW (H)
130-11	HRW-50bu	Medium	6.3	0.3	1.9	24	36	9	517	**90**	**25**	**0**	0 bu Corn(H) (G)
131-11	Corn-80bu	Medium	6.2	0.3	2.0	28	38	18	479	**60**	**0**	**0**	0 lb Millet (G)

(H) = Hail. The Wall Rotation received 1" hail for 30 minutes on June 20, 2010.
(G) = Heavy grasshopper feeding that destroyed the crop

Note: All nitrogen levels other than millet were adjusted back to not compensate for additional 30 lbs N / acre for no-till.

Note: to convert P & K values to lb/A take ppm value x 2. Example: 500 ppm is equal to 1000 lb/Acre.

2010 Wall Rotation Yields, Expense/Acre, Break-Even Costs & Break-Even Yields

Rotation (Net return/A)	Crop	(A) Yield/Acre	(B) Expense of Crop/Acre	(C)=(B)/(A) Cost of Production	(D)=(B)/(E) Break-Even Yield	(1999-09) Yield AVG
1	W Wheat	34.9 bu	$153.50 + $95.96	$7.14 / bu	39.3 bu	48.7 bu
($-14.10)	Fallow at $95.96 / acre.					
2a	**W Wheat-A**	**42.4 bu**	**$159.40 + *$103.15***	**$ 6.19 / bu**	**39.6 bu**	57.2 bu
($ missing)	Sunflower	n/a lb	$204.19 + *$25.79*	$ n/a / lb	1277 lb	1373 lb
	Hay Millet	2.3 Tons	$193.50	$84.13 / ton	4.8 tons	2.2T (4yr)
	W Wheat-B	**29.2 bu**	**$171.83**	**$ 5.88 / bu**	**28.1 bu**	40.8 bu
	Corn	n/a bu	$202.65	$ n/a / bu	57.9 bu	49.8 bu
	Cover Crop Fallow at *$128.94* / acre. *($103.15 + $25.79)**					
3	W Wheat	20.8 bu	$186.63	$ 8.97 / bu	31.0 bu	41.3 bu
($ missing)	Safflower	n/a lb	$167.45	$ n/a / lb	816 lb	968 lb
	Millet	n/a lb	$151.85	$ n/a / lb	1898 lb	1071 lb
4	W Wheat	17.5 bu	$171.83	$ 9.81 / bu	26.3 bu	35.4 bu
($ missing)	Millet	n/a lb	$142.93	$ n/a / lb	1786 lb	1402 lb
5a	**W Wheat**	**34.3 bu**	**$167.31**	**$ 4.87 / bu**	**25.7 bu**	36.5 bu
($ missing)	Corn	n/a bu	$200.25	$ n/a / bu	57.2 bu	45.8 bu
	Sunflower	n/a lb	$189.88	$ n/a / lb	1054 lb	1026 lb
	Barley	32.0 bu	$131.80	$ 4.11 / bu	37.6 bu	42.7 bu (6yr)
6a	**W Wheat-B**	**31.5 bu**	**$187.66**	**$ 5.95 / bu**	**28.2 bu**	33.7 bu
($ missing)	Safflower	n/a lb	$168.78	$ n/a / lb	823 lb	990 lb (5yr)
	Dry Pea	n/a bu	$151.12	$ n/a / bu	25.1 bu	23.5 bu (5yr)
	W Wheat-A	**32.4 bu**	**$177.06**	**$ 5.46 / bu**	**26.6 bu**	43.2 bu
9a	**W Wheat-B**	**32.6 bu**	**$167.59 + $22.63**	**$ 5.83 / bu**	**28.4 bu**	34.0 bu
($ missing)	Safflower	n/a lb	$168.78	$ n/a / lb	823 lb	1070 lb
	Hairy Vetch (green fallow)*$113.14 / acre ($90.51+$22.63)*					
	W Wheat-A	38.7 bu	$185.78 + *$90.51*	$ 7.13 / bu	41.5 bu	43.3 bu
10	**W Wheat**	**25.0 bu**	**$156.71**	**$ 6.26 / bu**	**23.9 bu**	40.6 bu
($ missing)	Millet	n/a lb	$144.26	$ n/a / lb	1803 lb	
	Dry pea	n/a lb	$151.12	$ n/a / bu	25.1 bu	
11	**W Wheat**	**36.9 bu**	**$171.83**	**$ 4.65 / bu**	**26.3 bu**	43.4 bu
($ missing)	Corn	n/a bu	$202.65	$ n/a / bu	57.9 bu	52.4 bu
	Millet	n/a lb	$139.42	$ n/a / lb	1742 lb	1140 lb

Grain Sale Values for determining Yield to Break-Even Point (E)

Winter Wheat	See Chart Below	Corn	$ 3.50 / bu
Hay Millet	$ 40 / ton	Proso Millet	$ .08 / lb
Sunflower	$ .18 / lb	Safflower	$ .205 / lb
Barley	$ 3.50 / bu	Field Pea (yellow)	$ 6.00 / bu

Winter Wheat Chart (values adjusted for protein content) (E)

Rot 1 - $6.34 / bu WW	Rot 3 - $6.02 / bu WW	Rot 6a-a -$6.65 / bu WW	Rot 9a-b - $6.68 / bu WW
Rot 2a-a - $6.62/ bu WW	Rot 4 - $6.53 / bu WW	Rot 6a-b - $6.65 / bu WW	Rot 10a - $6.53 / bu WW
Rot 2a-b - $6.10 / bu WW	Rot 5a - $6.50 / bu WW	Rot 9a-a - $6.65 / bu WW	Rot 11 - $6.53 / bu WW

*The fallow expense is separated at 80% for the first crop year and 20% to the second crop year.

Note: WW = winter wheat Note: "**bolded**" rows above made money in 2010.

n/a = yields not available due to heavy grasshopper feeding. $ missing = not able to calculate due to missing yields.

Note: The entire Rotation Study was severely damaged with hail on June 20, 2010.

WALL ROTATION STUDY WEED RATINGS

Objectives: 1) To determine weed species and weed intensity in each rotation.
2) To evaluate the effects of crop rotations on weed control.

Procedures: All 124 plots of the Wall Rotation Study were evaluated (visually rated) for weed species presence and weed density on April 15, July 15, and October 15, 2010. A rating of zero (**0**) means that the plot was completely weed free. A rating of five (**5**) indicates that the plot was totally covered with weeds. The **Weed Rating Score** is derived from adding up the weed scores in the four plots of one rotation with the same cropping treatment and dividing by 4. The **Rotation Weed Mean** is derived from adding up weed scores for each crop in the rotation and dividing by the number of cropping treatments in each rotation. The lower the **Weed Rating** score and **Rotation Weed Mean**, the lower the incidence of weeds.

Challenges of the 2010 growing season: The Wall Rotation received 1" hail for 30 minutes on June 20, 2010 between 7:30 and 8:00 pm. Crops heavily injured included: dry peas, safflower, spring barley, winter wheat. The corn was extensively damaged but was in V-7 to V-9 stage so it could still recover.

Grasshoppers (Two Stripe, Differential) were devastating to the Proso Millet, Safflower, Sunflower, and Corn. The entire study was aerially sprayed with Asana (6 oz/A)(June 25, 2010) and with Lambda Star (Generic Warrior)(3 oz/A) (August 6, 2010).

Discussion:

Weed Control of Winter Wheat & Barley:

Soil conditions at Wall, SD were dry at planting time in mid-September of 2009, so planting was delayed. Overland winter wheat was planted on September 23, 2009 (fallow) with a JD 610 drill, and October 7, 2009 (recrop) with a JD 750 no-till drill. Wheat stands were slow to establish in the fall. Downy brome flushes did not start very well in the fall. Downy Brome stand ratings were taken on November 13, 2009. Wheat stands were downy brome free in mid-November for rotations 1, 2a, 3, 4, 5a, 10a, and 11.

In rotation 6a, and 9a, first and second year wheat had downy brome pressure at that time so they were sprayed with Olympus WG at .9 oz/acre plus surfactant. 28-0-0 was used at 10% of the spray carrier mix to enhance efficiency of the Olympus. Downy brome control was good throughout the spring of 2010 in the sprayed plots. Downy brome flushes came in some of the other rotations in the spring of 2010 (See Table 40). So far, Olympus has worked well to control downy brome. It should be cautioned that repeated use of Olympus will in time, allow resistant strains of weeds to develop.

Table 40. Wall Rotation Downy Brome Ratings (2010).

Winter Wheat Rotation	Emerged Downy Brome as of November 13, 2009 Rating 0 - 5	Emerged Downy Brome as of June 2, 2010 Rating 0 - 5
Rot 1 **Wheat** / fallow	0	2.1
Rot 2a **Wheat**/corn/fal/**Wht**/sunf/hay millet	0	0.8 2.2
Rot 3 **Wheat**/safflower/ proso millet	0	3.5
Rot 4 **Wheat** / proso millet	0	3.1
Rot 5a **Wheat**/corn/sunf/barley	0	3.0
Rot 6a **Wheat/Wheat**/saff/dry pea	0.2* 0.5*	0.6 1.1
Rot 9a **Wheat/Wheat**/saff/ h. vetch	0.1* 1.2*	0.0 0.5
Rot 10a **Wheat** / millet / dry pea	0	1.1
Rot 11 **Wheat** / corn / millet	0	0.3

* = sprayed with Olympus WG on November 16, 2009.

Winter survival ratings were taken on March 24, 2010. Other than 3 weaker plots in the fourth range, all wheat plots looked good. These weaker plots recovered later in the growing season. Winter-kill was not an issue this year.

Wide Match plus 5 oz/acre of LV6 / acre were applied to every winter wheat and barley plot at the Wall Rotation in the spring of 2010. The Starane portion of the Wide Match controls all Kochia types. The LV6 was added to control prickly lettuce.

Overall, the most weed free (cleanest) rotation in 2010 was Rotation 11 (Wheat/Corn/Proso Millet) followed closely by Rotations 2A and 5A.

Weed Control of Hairy Vetch and Winter Triticale: The hairy vetch and winter triticale were planted on October 7, 2009 with a JD 750 no-till drill. This crop winter-killed. The plots were loaded with prickly lettuce and downy brome as of May 21, 2010. The plots were sprayed with Roundup at that time to clean things up. These plots were again sprayed on June 15, 2010 with Roundup.

Weed Control of Dry Peas: Admiral peas were planted with a JD 750 no-till drill on April 12, 2010. The peas were sprayed with Roundup and Spartan the day after they were planted. The dry peas stayed very clean through the growing season. Dry pea stands were excellent.

Weed Control of Safflower: The safflower plots were sprayed with Roundup and Prowl H2O on April 16, 2010. The safflower was planted in 20 inch rows on April 29,2010 with a JD 7100 planter. No post-emerge herbicides were applied. Mare's Tail was a problem in 2010. Safflower stands were excellent.

Weed Control of Field Corn: Roundup plus Atrazine applied at a 1 ½ or 2 pound per acre rate was sprayed on October 15, 2009; depending upon what the following crop would be. The corn was planted in 40 inch rows on April 29, 2010 with a JD 7100 planter. Roundup was sprayed on post-emerge of the corn crop on June 15, 2010. The primary weed in late July was stink grass. The corn was very clean this summer. Corn stands were excellent.

Weed Control of Sunflowers: The sunflower plots were sprayed pre-plant on April 16, 2010 with Roundup. The plots were again sprayed on June 2, 2010 with Roundup plus 4 oz Spartan 75 df / acre. 28-0-0 was used at 10% of the carrier to help minimize drift. The sunflowers were planted in 20 inch rows on June 3, 2010 with a JD 7100 planter. Sunflower stands were good.

Weed Control of Proso Millet: Proso Millet plots were sprayed with Roundup and 32-0-0 to heat up the mixture and reduce spray drift on June 15, 2010. The proso millet was planted with a JD 750 no-till drill on June 24, 2010. Stands were very good.

Weed Control of Hay Millet: The Hay Millet plots were sprayed with Roundup and 32-0-0 to heat up the mixture and reduce spray drift on June 15, 2010. The hay millet was planted with a JD 750 no-till drill on June 24, 2010. Stands were very good.

The rotation in 2010 with the most overall weed pressure was Rotation 3 (Winter Wheat / Safflower / Proso Millet). Rotation 4 is historically (2004-10) the weediest rotation in the study especially in April and July. Rotation 4 has about 11 months of fallow period between harvest of the wheat crop to planting of the millet crop. This non-crop period has in the past, proven to be problematic. Proso Millet in Rotation 4 requires more sprayings per summer than the other millet plots in this study. Crown rot disease and weed problems are an ongoing problem in rotation 4 and subsequently soil moisture is not being properly utilized. Rotation 4 will be combined with Rotation 9a to make a new rotation in 2011. It will be called Rotation 8a and the sequence will be: (Winter Wheat-a / Dry Pea / Spring Wheat / Winter Wheat-b / Safflower / Forage Millet) We are excited about this rotation because it has good windows of opportunity for weed control and has four profitable crops with the three wheat's and the safflower. The dry

peas and forage millet are good beneficial crops that will help provide positive attributes for the other crops. We chose to dismantle Rotation 9a to form this rotation because the stacked winter wheat's back to back do not complement each other. We see high levels of downy brome in the wheat crops when they are stacked. We will continue to look at Rotation 6a as a stacked wheat rotation.(wheat / wheat / safflower / dry pea)

Table 41 The growing season of 2010 had good moisture for the main part. Along with good moisture came more weed flush which was indicated in the 2010 weed ratings. It was interesting to note that the July ratings for weeds were lower than those of April or October. It is not usually this way. This was due to the Wall Rotation being a hot spot for grasshoppers that fed heavily on the crops and also on the weed populations this summer. Attempts at spraying the grasshoppers did not control them this year.

Table 42 is a combined average of April, July, and October weed pressure over a 7 year period (2004-2010). It indicates that Rotation 9a is the over-all cleanest rotation with a rating of 2.02. There are five rotations that are in the middle with ratings of 2.10 to 2.59. Rotations 3, 4, and 10a are definitely the weediest in the trial at 3.14, 3.76, and 3.48 respectively.

Table 43 shows what weeds are present at the 3 rating dates of April 15, July 15, and October 15 in 2010. Weeds are listed from highest count to least in each of the crops or fallow listed.

Table 44 lists the weeds at the Wall Rotation, their life span, origin and characteristics. Approximately half of these weeds are of major economic importance and are directly competing with the crops at some point for valuable moisture, nutrients and sunlight. The **bolded weeds** are the most prevalent at the study, followed by the non-bolded weeds that are present but not in high numbers.

Weed pressure in the rotations will vary from year to year depending upon crop planting sequence, soil and air temperature, rainfall, canopy cover, mechanical tillage, and types of herbicides used and timing of planting. Ultimately, it is important to get a thorough weed cleansing at least one time during the crop season and/or during the fallow periods. Every crop in this rotation has a fallow period of at least a few months where there is no crop growing. It is critical to get good weed control during these opportunity windows of the fallow periods. The planting of diverse crops in a rotation sequence helps to ensure good crop health. Spraying pre-plant of the crops and also in the late fall are excellent times to keep weed populations in check. It is important to be versatile on herbicide options during the cropping period so resistant species of weeds do not develop.

Table 41. Wall Rotation Weed Rating Scores and Rankings - 2010.

Rotation	Rank as of 4-15-10	Apr 15, 2010 rating	Rank as of 7-15-10	July 15, 2010 rating	Rank as of 10-15-10	Oct 15, 2010 rating	**Overall Rank Apr,Jul, Oct 2010**	**Total Weed Pressure (Apr 15, July 15, Oct 15) 2010**
1	5th	1.6	3rd	0.6	8th	2.2	4th	1.5
2a	3rd	0.8	2nd	0.5	2nd	0.9	2nd	0.8
3	9th	3.6	9th	2.4	9th	2.3	9th	2.8
4	4th	1.2	8th	2.1	7th	2.1	8th	1.8
5a	2nd	0.6	4th	0.7	4th	1.3	3rd	0.9
6a	6th	2.2	5th	0.7	6th	1.9	6th	1.6
9a	7th	2.6	7th	1.2	3rd	1.2	7th	1.
10a	8th	2.8	1st	0.5	5th	1.4	5th	1.6
11	1st	0.3	6th	0.9	1st	0.5	1st	0.6
Total		15.7		9.6		13.8		12.9

Table 42. Wall Rotation Weed Rating Scores and Rankings, Seven Year Averages – (2004 - 2010).

Rotation	Average for April 15th	Average for July 15th	Average for October 15th	Total Weed Pressure 4-15,7-15,10-15	Overall Ranking
1	0.7	0.8	1.0	2.6	6th
2a	0.7	0.6	0.7	2.1	2nd
3	1.4	1.0	0.6	3.1	7th
4	1.4	1.5	0.8	3.8	9th
5a	0.6	0.7	1.0	2.3	3rd
6a	0.9	0.8	0.6	2.4	5th
9a	0.8	0.6	0.5	2.0	1st
10a	1.4	1.3	0.7	3.5	8th
11	0.6	0.8	0.9	2.4	4th
Total	8.5	8.1	6.8	2.7 (*Mean*)	

Table 43. Wall Rotation Weed Ratings, 2010.

Rotation Number & Crop	April 15, 2010		July 15, 2010		October 15, 2010	
	Weed Rating	Weeds Present	Weed Rating	Weeds Present	Weed Rating	Weeds Present
Rotation 1						
W. Wheat	0.000	Traces of Pl	1.250	Db, jc	0.000	None
Fallow	3.250	Db, pl	0.000		4.500	Db, vw, sg
Rot Mean	**1.625**		**0.625**		**2.250**	
Rotation 2a						
Corn	0.250	Tg, pl	1.000	Sg, ps, pur, byg	1.750	Sg, wg, vw, db
Fal (5 way mix)	1.000	Pl, db	0.000	None	0.000	None
W. Wheat-a	0.500	Pl,,db, tg	0.625	Db, tg	0.000	Traces of Tg
Sunflower	3.250	Vw, db, pl	0.500	Gft, sg, pl, fm	3.500	Db, vw
Forage Millet	0.250	Db, pl	0.500	Ps, ko, byg, sg, pur	0.500	Tan, sg
W. Wheat-b	0.000	Traces of tg, pl, ko	0.625	Db, jc, tg	0.000	Traces of Db
Rot Mean	**0.875**		**0.541**		**0.958**	
Rotation 3						
Safflower	4.500	Db, pl	2.750	Mt, tm, jc, db, fm, sal	4.000	Db
Proso Millet	4.000	Db, pl	0.500	Ps, rt, pl, pur, ko	1.875	Db, vw, lls
W. Wheat	2.500	Pl, db	4.000	Jc, db	1.250	Db
Rot Mean	**3.666**		**2.416**		**2.375**	
Rotation 4						
W. Wheat	1.750	Pl, db	3.750	Jc, db	0.000	None
Proso Millet	3.250	Db, pl	0.500	Ps, rrp, pl	4.750	Db, sg, vw, s bur
Rot Mean	**1.250**		**2.125**		**2.375**	
Rotation 5a						
Corn	0.250	Tg, vw	1.000	Sg, ps, pur, byg	3.750	Db
Sunflower	0.750	Db, pl	1.125	Sg, fm, pl	0.000	None
Spring Barley	1.125	Pl, db	0.000	None	1.500	Sg, lls, ko
W. Wheat	0.500	Pl, db	0.875	Db, jc	0.125	Barley, sg
Rot Mean	**0.656**		**0.750**		**1.343**	
Rotation 6a						
Safflower	4.750	Db, pl	2.000	Mt, pl, db, sal, tm	3.000	Db, sg, vw
Dry Pea	2.500	Db, pl, mt, sp	0.500	Mt, pl, hv, fxt	2.500	Db
W. Wheat-a	0.000	Pl, db	0.250	Db, sg, tg	0.375	Db, pta
W. Wheat-b	1.625	Db, pl	0.375	sg	2.000	Db, sg, vw
Rot Mean	**2.218**		**0.781**		**1.968**	
Rotation 9a						
Safflower	5.000	Db, pl	2.000	Mt, pl, db, sal, tm	0.250	Vw, db, hv, tg
H.Vet/W.trit	3.750	Db, pl, sp	2.250	Hv, ps, pl, byg, pur	1.750	Db, vw
W. Wheat-a	0.000	Pl, hv	0.500	tg	2.500	Db, sg
W. Wheat-b	1.750	Db, pl	0.375	db	1.750	Db, hv, tg
Rot Mean	**2.625**		**1.281**		**1.562**	
Rotation 10a						
Proso Millet	4.500	Db, pl, vw, dan	0.500	Byg, pur, rrp,	3.500	Db, sg, vw,s bur
Dry pea	3.750	Db, pl	0.250	Mt, sg, pl, fm	0.625	Tg, lls, sg
W. Wheat	0.375	Pl, db,	0.750	Jc, db, fxb, gft	0.125	Db, tan, sg
Rot Mean	**2.875**		**0.500**		**1.416**	
Rotation 11						
Corn	0.125	Vw, tg	1.000	Sg, ps, pur, byg	1.750	Vw, db, sg
Proso Millet	0.500	Pl, db	1.500	Pur, rrp, ps, rt	0.000	None
W. Wheat	0.500	Pl	0.375	jc	0.000	None
Rot Mean	**0.375**		**0.958**		**0.583**	

Note: Weeds listed above are listed from most to least prevalent.

Legend: db-downy brome, jc – Japanese chess, vw-volunteer wheat, ko-kochia (ALS & non – ALS strains), pl-prickly lettuce, dan – dandelion, bl-blue lettuce, fxt – green or yellow foxtail, rt – Russian thistle, sg – stinkgrass, lq – lambs quarters, byg – barnyard grass, rrp – red root pigweed, saf – volunteer safflower, vol millet – volunteer millet, an sun – annual sunflower, pov – poverty weed, f mar – fetid marigold, ps – prostrate spurge, tg – tumble grass, lls – lance-leaf sage, pc – pennycress, barley-volunteer barley, wg – witchgrass, pl – prickly lettuce, tm – tansy mustard, sal-salsify. Pta-Prairie Three awn.

Note: Rotations 4 and 9a were combined in late October to form Rotation 8a for the 2011 season.

Table 44. Weeds at the Wall Rotation Study and their Characteristics - 2010.

Common Name	Growth Form	Life Span	Origin	Season or flowering dates	Reproduction
Downy Brome	Grass	Winter Annual	Europe	Cool	Seeds
Japanese Chess	Grass	Winter Annual	Europe	Cool	Seeds
Prickly Lettuce	Forb	Annual	Europe	July-Sept	Seeds
Stink grass	Grass	Annual	Europe	Warm	Seeds
Volunteer Wheat	Grass	Winter Annual		Cool	Seeds
Tumble grass	Grass	Perennial	Native	Warm	Seeds
Prostrate Spurge	Forb	Annual	Native	June-October	Seeds
Common Purslane	Forb	Annual	Eurasia	May-Nov	Seed/stem fragments
Mare's Tail	Forb	Annual	Native	June-Sept	Seeds
Barnyard Grass	Grass	Annual	Europe	Warm	Seeds
Hairy Vetch	Forb	Annual / Winter Annual	Europe	Cool	Seeds
Tansy Mustard	Forb	Annual	Native	March-Aug	Seeds
ALS Kochia	Forb	Annual	Eurasia	July-October	Seeds
Non-ALS Kochia	Forb	Annual	Eurasia	July-October	Seeds
Fetid Marigold	Forb	Annual	Native	July-Sept	Seeds
Western Salsify	Forb	Biennial / sl per.	Eurasia	May-July	Seeds
Lance-leaf Sage	Forb	Annual	Native	June-October	Seeds
Redroot Pigweed	Forb	Annual	Native	July-October	Seeds
Green Foxtail	Grass	Annual	Eurasia	Warm	Seeds
Yellow Foxtail	Grass	Annual	Europe	Warm	Seeds
Shepherds-purse	Forb	Annual / Winter Annual	Europe	March-November	Seeds
Sand bur	Grass	Annual / sl per.	Native	Warm	Seeds
Prairie Three Awn	Grass	Annual	Native	Cool	Seeds
Dandelion	Forb	Perennial	Eurasia	Apr-October	Seeds
Russian Thistle	Forb	Annual	Europe	Aug-October	Seeds
Foxtail Barley	Grass	Perennial	Native	Cool	Seeds
Witch grass	Grass	Annual	Native	Warm	Seeds
Sedge	Sedge	Perennial	Eurasia	July-Sept	Seed, rootstocks, tubers
Blue Lettuce	Forb	Perennial	Native	June-Sept	Rhizomes / seed
Wild Buckwheat	Forb	Annual	Europe	June-Sept	Seeds
Common Sunflower	Forb	Annual	Native	July-Sept	Seeds
Curly cup gumweed	Forb	Biennial / sl per.	Native	July-October	Seeds
Black Nightshade	Forb	Annual	Native	May-October	Seeds
Lambsquarters	Forb	Annual	Europe	June-Sept	Seeds
Buffalo bur	Forb	Annual	Native	May-October	Seeds
Pennycress	Forb	Annual / Winter Annual	Europe	April-June	Seeds
Field Bindweed	Forb	Perennial	Eurasia	June-Sept	Rhizomes / seed
Canada Thistle	Forb	Perennial	Eurasia/N. Africa	June-August	Rhizomes / seed

Note: The **bolded weeds** above are listed from the most to least prevalent in the Wall Rotation Study in the 2010 growing season.

ALS Kochia = Acetolactate Synthase (ALS) resistant Kochia has a less sulfonylurea-sensitive ALS enzyme.

Legend: sl per. = short lived perennial.

Information in the above table is from "*Weeds of Nebraska and the Great Plains*" Published by Nebraska Department of Agriculture.

2011 PREVIEW

The following is a partial listing of experiments that are either ongoing or will be initiated this coming spring. Data will be collected throughout the following year and results presented in next year's Annual Report.

SDSU Crop Rotation Study at Wall, SD

This 11-acre trial was initiated in the spring of 1994. There are eight cropping sequences from three to six years in length that are currently being evaluated. This rotation study looks at the economics, sustainability, and conservation compliance of wheat when grown in combination with safflower, sunflower, corn, millet, hay millet, barley, field peas and cover crops. This research is funded by the South Dakota Wheat Commission and the South Dakota Oilseeds Council.

Variety Testing of Winter Wheat and Spring Grains (8 locations)

There are currently seven Crop Performance Testing (CPT) sites in western South Dakota for evaluation of winter wheat varieties. The CPT's are located at Bison, McLaughlin, Hayes, Kennebec, Sturgis, Wall, and Martin. Spring grain variety testing sites are at Bison, Ralph, Okaton, and Wall.

Cover Crops as a Replacement for Fallow before Winter Wheat – New Underwood

In this trial, several combinations of cover crops and a chemical fallow check were grown in 2010. Winter wheat was seeded into all the plots in September. Winter wheat crop responses to the various cover crops will be evaluated in 2011. We are comparing cover crops to chemical fallow prior to winter wheat.

Safflower Herbicide Study

Experimental herbicides for safflower will again be evaluated in 2011. Continued research will evaluate for crop injury, weed control, and safflower yields at studies near Wall and Scenic, SD.

Sunflower Hybrid Trial

A trial near Bison, South Dakota, will be planted to evaluate sunflower hybrids for lodging, height, test weight, oil content, and yield.

Grain Sorghum Hybrid Trial

In this trial near Kennebec, South Dakota, and Dakota Lakes Research Farm in 2011, commercial milo hybrids will be evaluated for agronomic traits and yield.

Safflower and Dry Pea Variety Trials

Variety testing of safflower will be continued at Wall, SD. Dry pea trials will be conducted at Wall, Bison, and Dakota Lakes Research Farm.

Warm Season Annual Forage Trial

Annual warm season crops including millet, pearl millet, sorghum/sedan and forage soybeans will be evaluated over five weekly harvest dates at Wall, SD. The crops will be harvested for yield and analyzed or forage quality.