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SOUTH DAKOTA STATE UNIVERSITY

WEST RIVER AG CENTER

CROPS AND SOILS RESEARCH

PLANT SCIENCE PAMPHLET # 40 FEBRUARY 2010

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.
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This publication can be found on the internet at: http://wrac.sdstate.edu/pubs/plant/plant.html

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
Lennis Erickson	Ralph 57650	Harding
Henry Roghair	Okaton 57562	Jones
Merle Aamot	Kennebec 57544	Lyman
Dave Wilson	Sturgis 57785	Meade
Pat Brown	Scenic 57780	Pennington
Merritt Patterson & Sons	Wall 57790	Pennington
Crown Partnership	Wall 57790	Pennington
Ron Seidel	Bison 57620	Perkins
Duane Shea	Bison 57620	Perkins
Rex Haskins	Hayes 57537	Stanley
Mark Stiegelmeier	Selby 57472	Walworth

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

250 copies printed at an estimated cost of $5.25 each. February 2010.

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.

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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 John D Kirby – Director Ag Experiment Station, Sue Blodgett – Dept. Head Plant Science, Robert Hall, Neal Foster, Jack Ingemansen, Bill Berzonsky, Ron Gelderman, Michael Moechnig, and Karl Glover.

A special thank you is extended to Charlie Ellis, Michael Swan and Pascal Bedard for their help during 2009.

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

WEATHER SUMMARY

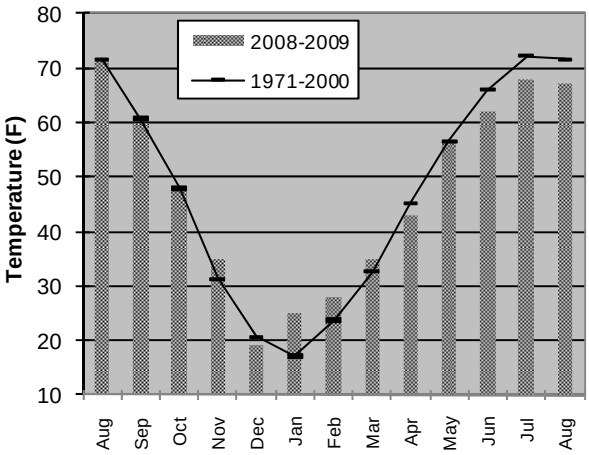
The data in the weather summaries presented in the following charts and table were obtained from the National Oceanic and Atmospheric Administration (NOAA) publication, Climatological Data – South Dakota; from Dennis Todey, State Climatologist at South Dakota State University and the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS). Weather data were 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*

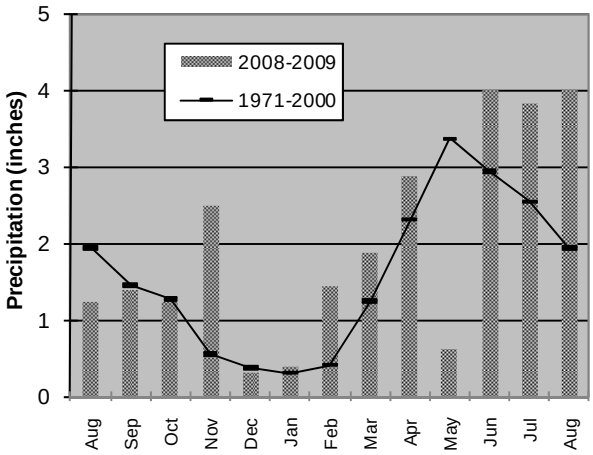
Precipitation was near average for September and October in western South Dakota. November was quite variable with Wall and Oelrichs receiving almost no moisture and other locations getting average to 1 ½" above average. December and January were near the average. February and March were near the average in the southwest and northwest, and above average in the west central areas. May was dry with most locations 1 ½ - 2 ½" below the average. June was average to 2" above the average, July average to 1 ½" above and in August most locations were above the 30 year average.

Temperatures in September and October were near the average, November 2 - 3 ½^{O} F above average and December was cold with readings 4 - 6^{O}F below average. January and February were average to slightly above with March being cooler at 2 - 7 ^{O}F below average. The trend continued with April temperatures below average and May warmed up with near normal temperatures. Summer was cool throughout western South Dakota with June, July and August mean temperatures 3 - 5 ^{O}F below the average.

The very cold temperatures in December and January caused winter kill on winter wheat planted into low residue fields in areas of west central South Dakota. For the winter wheat that survived, and the spring and summer crops, the cooler and more humid summer allowed for excellent growing conditions. The summer annual crops performed especially well with corn, sunflower and safflower yields being some of the best we have seen for at least a decade.

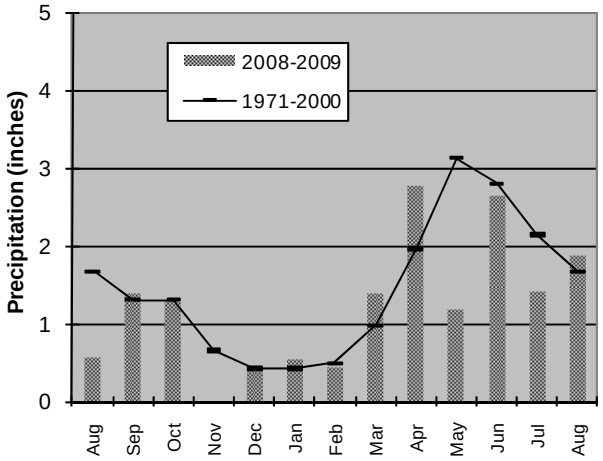
Temperature and Precipitation Charts for Martin (Bennett County Reporting Station).



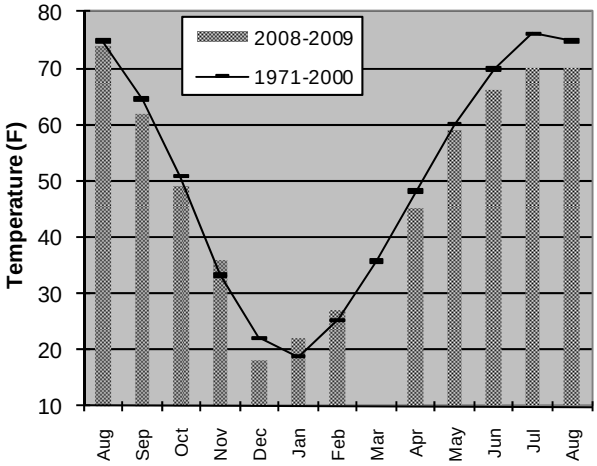


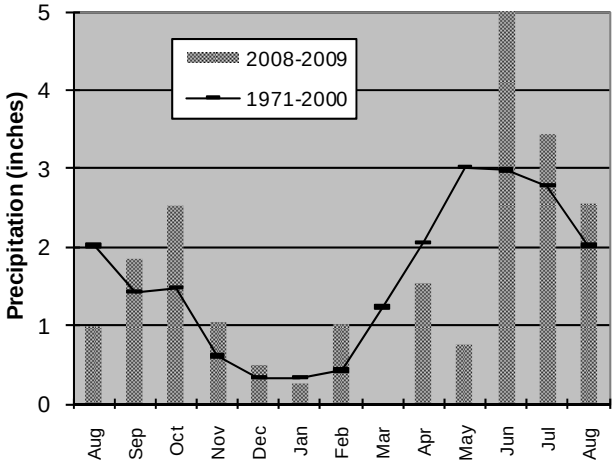
Temperature and Precipitation Charts for Oelrichs (Fall River County Reporting Station).

There is no temperature data for Oelrichs in 2008 - 2009



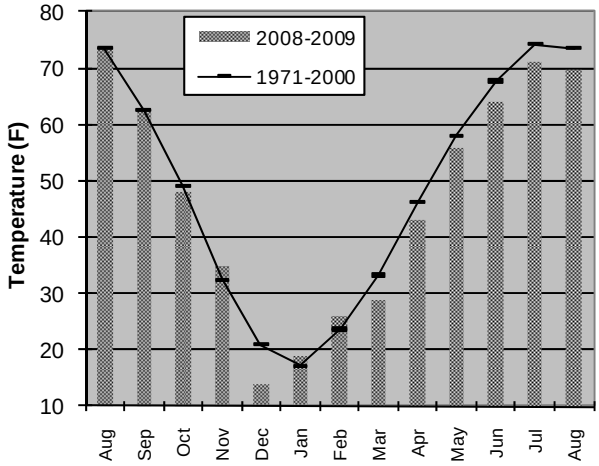
Temperature and Precipitation Charts for Kennebec (Lyman County Reporting Station).

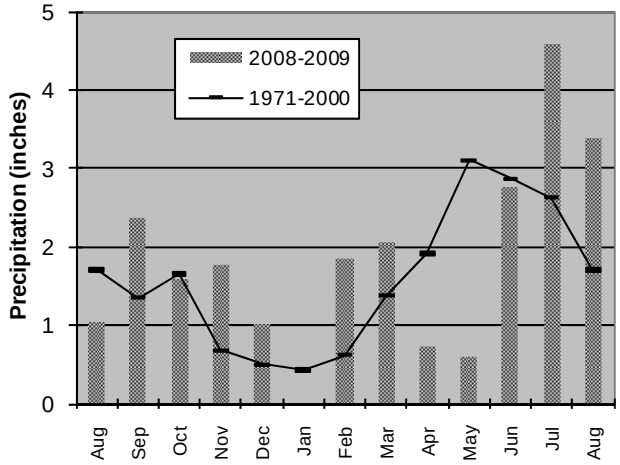




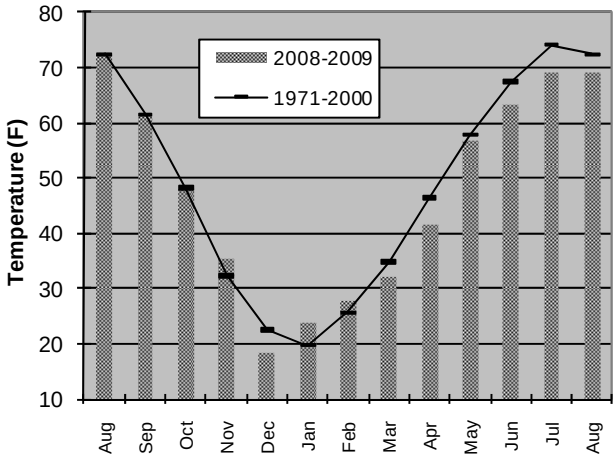
Average temperatures and precipitation obtained from NOAA Climatological Data. Weather data is collected from the reporting station nearest the experimental sites.

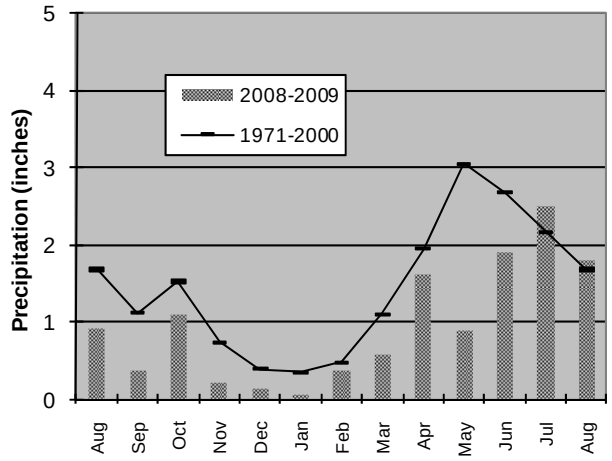
Temperature and Precipitation Charts for Kirley (Haakon County Reporting Station).



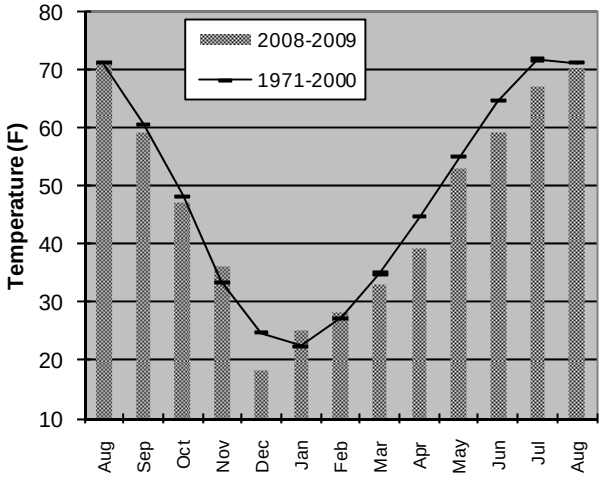


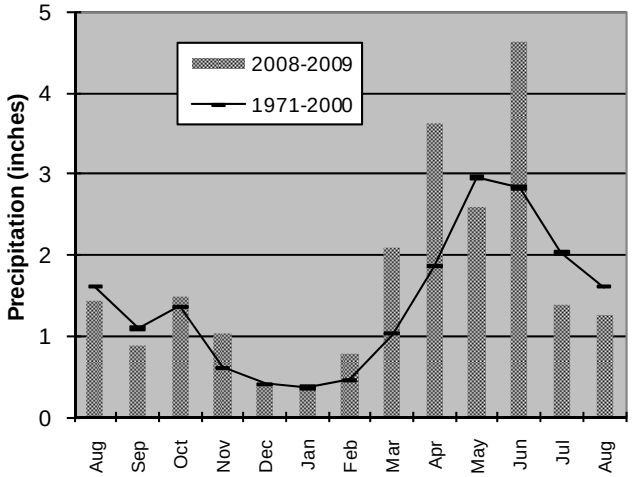
Temperature and Precipitation Charts for Wall (Rotation Study Site).





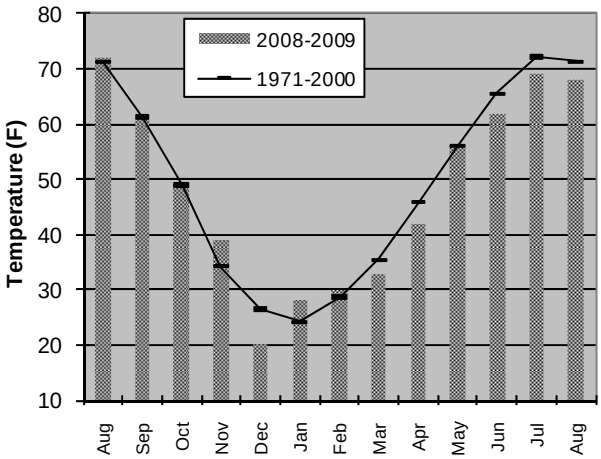
Temperature and Precipitation Charts for Rapid City Airport (Pennington County Reporting Station).

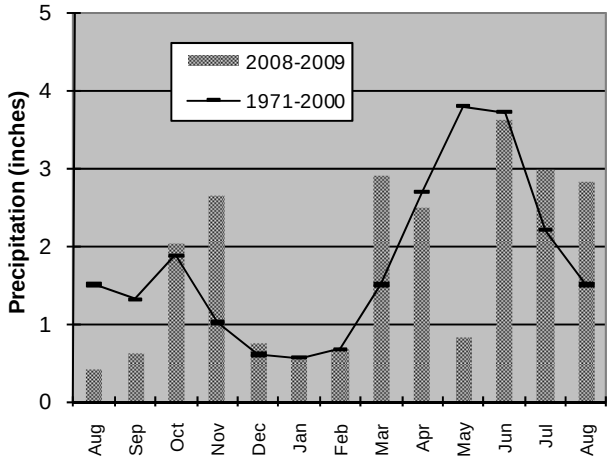




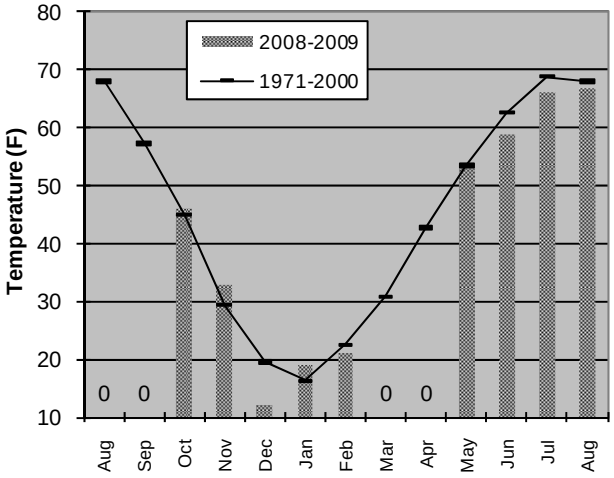
Average temperatures and precipitation obtained from NOAA Climatological Data. Weather data is collected from the reporting station nearest the experimental sites.

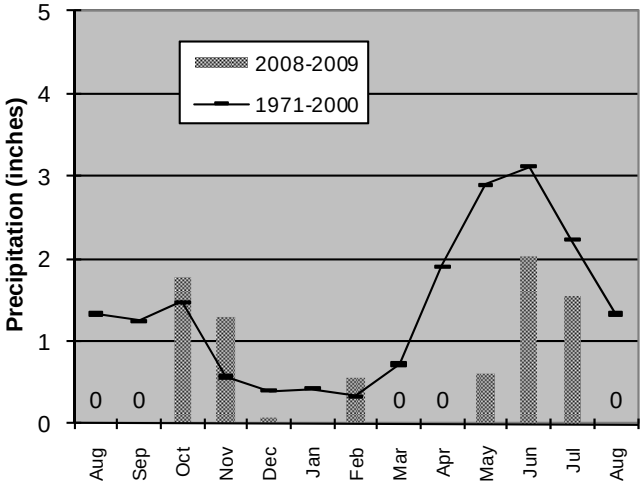
Temperature and Precipitation Charts for Fort Meade *(Sturgis)* (Meade County Reporting Station).





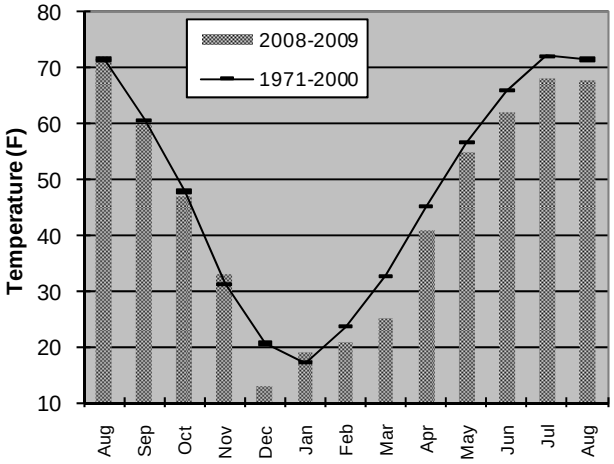
Temperature and Precipitation Charts for Ludlow (Harding County Reporting Station).

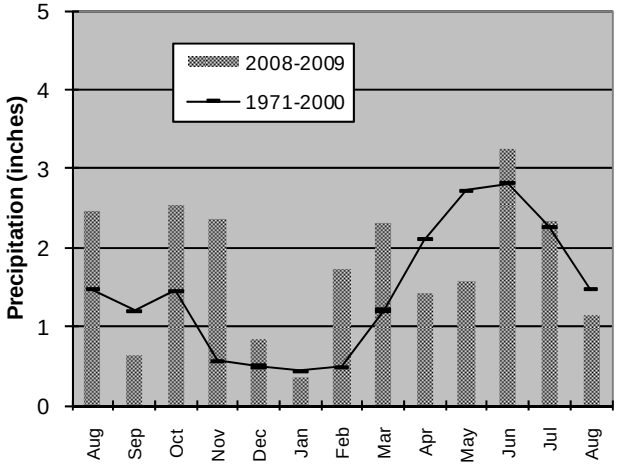




0 = Missing Data

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 (2008-2009).

Location	Date of Freeze* 2009		Total Moisture (inches)		
	Last in Spring (^{o} F)	First in Fall (^{o} F)	Aug. 08 - July 09	Sept. 08 - Aug 09	April 09 - Aug 09
Bennett County (Martin)	May 15 25^o	Oct 4 26^o	21.6	24.4	15.3
Harding County (Ludlow)	May 15 24^o	Oct 9 25^o	M	M	M
Jones County (Murdo)	April 10 26^o	Oct 10 17^o	22.6	27.3	18.3
Meade County (Ft. Meade)	April 10 23^o	Oct 10 18^o	20.4	22.8	12.7
Pennington County (Rapid City AP)	May 11 26^o	Oct 13 27^o	20.6	20.4	13.5
Pennington County (Wall)	April 10 28^o	Oct 9 13^o	10.8	11.6	8.7
Perkins County (Bison)	May 15 27^o	Oct 10 22^o	21.9	20.6	9.8
Lyman County (Kennebec)	May 28 21^o	Oct 10 24^o	19.0	20.6	13.4

* = Last 28^o temperature in Spring or first 28^o temperature in Fall.
M = Missing data from weather station site.

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 and October 2008 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 2008 and April 2009. 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 22, 2008 Herbicide: Cleanwave (14 oz/A)
Harvested: July 20, 2009 Additional Nitrogen: 80 Lb/Ac
Previous crop: Conventional fallow

Yields at Oelrichs were poor in 2009 averaging only 19 Bu/A. The top yielding varieties in 2009 were Hatcher, Harding,AP502CL and Darrell. There are no three year averages for Oelrichs. Results are presented in Table 2.

Bennett County – Martin

Planted: October 1, 2008 Herbicide: Harmony GT ($^1/_2$ oz/A)
Harvested: July 31, 2009 Additional Nitrogen: 50 Lb/A
Previous crop: Millet stubble, no-till planted

Martin had mediocre yields in 2009 because of light stands and root rot pressure. Yields averaged 30 Bu/A. Because of the variability in the plot (CV = 23.4%) no yield comparisons can be made in 2009. There are no three year averages for Martin. Results are presented in Table 3.

Lyman County – Kennebec

Planted: September 21, 2008 Herbicide: None
Harvested: July 21, 2009 Additional Nitrogen: 50 Lb/A
Previous crop: Fallow

Yields were excellent at Kennebec averaging 56 Bu/A. The top yielding varieties in 2009 were Wahoo, Harding, Radiant, Expedition, Smoky Hill and Striker. The top varieties over the last three years were Lyman, Overland, Millennium, Wahoo, Arapahoe, Harding and NuDakota. Results are presented in Table 4.

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

Variety	Height	Lodging	Test Wt	Protein	Yield
	Inches	0-9*	Lb/Bu	Percent	Bu/A
Hard Red					
ALLIANCE	25	0	56.7	12.4	18.0
ARAPAHOE	27	0	56.2	14.6	12.6
EXPEDITION	26	0	56.7	12.9	15.1
DARRELL	26	0	56.4	13.7	21.0
FULLER	25	0	57.4	13.7	14.8
HARDING	29	0	56.0	12.8	22.8
HATCHER	24	0	56.7	12.6	**28.0**
HAWKEN	23	0	58.1	14.3	16.8
JAGALENE	24	0		13.3	14.1
JERRY	29	0	55.4	14.0	16.9
MILLENNIUM	28	0	55.8	14.4	19.0
OVERLAND	28	0	56.2	13.8	16.9
SMOKY HILL	24	0	57.0	15.1	18.0
WAHOO	26	0	55.6	13.7	20.4
WESLEY	24	0	54.4	14.1	14.4
AP503CL2	23	0	57.8	13.0	22.0
INFINITY CL	28	0	57.1	13.5	20.5
Hard White					
ALICE	25	0	56.1	13.9	13.9
NUDAKOTA	24	0	55.5	13.6	20.1
WENDY	25	0	57.9	13.3	18.0
Average	25.6	0.0	56.5	13.6	18.2
LSD (P=.05)	2.9	0.0	2.9	.	3.8
CV	6.9		3.5	.	14.6

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

Table 3. Hard Winter Wheat Variety Trial - Bennett County (Martin), 2009.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Protein Percent	Yield Bu/A
Hard Red					
ARAPAHOE	31	0	57.6	14.9	27.2
ART	24	0	59.7	14.9	22.0
DARRELL	27	0	59.2	14.6	32.2
EXPEDITION	28	0	60.5	14.8	27.8
FULLER	25	0	61.0	15.5	27.9
HARDING	29	0	59.6	14.7	32.2
HAWKEN	24	0	58.6	15.4	25.9
HATCHER	27	0	59.9	13.4	27.1
JAGALENE	26	0	60.1	14.6	21.7
JERRY	32	0	59.8	13.9	34.5
LYMAN	29	0	59.8	16.0	34.5
MILLENNIUM	29	0	59.5	14.6	35.0
OVERLAND	27	0	59.8	13.4	30.9
RADIANT	28	0	59.4	12.0	33.7
SMOKY HILL	26	0	59.7	14.0	31.5
STRIKER	26	0	61.5	13.9	26.8
WAHOO	30	0	60.2	12.4	34.2
WESLEY	25	0	59.0	14.7	35.0
INFINITY CL	29	0	60.2	14.0	37.3
SETTLER CL	25	0	59.3	12.8	23.5
AP503CL2	25	0	61.9	13.8	27.7
SD05118	28	0	58.8	13.8	42.0
SD03164-2	27	0	59.7	14.7	23.4
SD06069	27	0	60.3	13.8	41.4
SD06158	29	0	59.8	13.9	26.8
SD06163	29	0	60.4	15.9	36.4
Hard White					
ALICE	23	0	59.8	15.9	26.3
NUDAKOTA	23	0	59.0	14.1	25.9
WENDY	24	0	59.5	15.0	31.5
SD05W018	28	0	59.7	13.8	27.1
Average	27.0	0.0	59.8	14.3	30.3
LSD (P=.05)	2.5	0.0	2.3	.	10.0
CV	6.5	0.0	2.7	.	**23.4**

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

Table 4. Hard Winter Wheat Variety Trial - Lyman County (Kennebec), 2007 - 2009.

Variety	Height	Lodging	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	0-9*	Lb/Bu	Percent	2009	3 Year
Hard Red							
ARAPAHOE	39	0	95	59.5	13.8	57.4	**66**
ART	31	0	95	59.7	14.8	45.3	.
DARRELL	36	0	95	59.9	15.3	58.7	60
EXPEDITION	31	0	95	60.1	15.0	59.9	60
FULLER	32	0	91	59.6	13.5	51.7	.
HARDING	39	0	95	60.9	14.8	**61.3**	**66**
HAWKEN	29	0	84	60.4	15.0	51.6	60
HATCHER	29	0	75	57.2	15.0	45.5	55
JAGALENE	31	0	95	60.3	14.4	51.4	48
JERRY	41	0	95	59.4	15.8	56.3	58
LYMAN	38	0	95	59.7	14.7	51.7	**71**
MILLENNIUM	37	0	95	60.9	14.6	56.9	**67**
OVERLAND	34	0	95	59.6	13.7	58.4	**69**
RADIANT	38	0	95	60.2	13.6	**60.8**	.
SMOKY HILL	30	0	90	61.5	13.7	59.6	.
STRIKER	33	0	95	59.9	13.6	59.3	.
WAHOO	34	0	95	59.2	13.5	**68.3**	**67**
WESLEY	29	0	95	59.2	14.4	57.4	**62**
INFINITY CL	35	0	95	59.5	13.4	56.2	.
SETTLER CL	31	0	95	59.8	13.0	58.9	.
AP503CL2	30	0	95	60.5	13.5	52.6	.
SD05118	32	0	95	59.7	13.6	62.4	.
SD03164-2	31	0	95	59.1	14.5	46.4	.
SD06069	33	0	95	60.7	13.7	**63.2**	.
SD06158	33	0	95	61.4	13.4	**62.6**	.
SD06163	33	0	95	59.7	14.0	**61.1**	.
Hard White							
ALICE	30	0	95	59.4	15.1	51.7	56
NUDAKOTA	30	0	95	57.3	13.7	56.0	**63**
WENDY	27	0	95	59.6	13.5	44.9	56
SD05W018	34	0	95	59.8	13.3	50.2	.
Average	32.7	0.0	93.7	59.8	14.1	55.9	62
LSD (P=.05)	2.9	0.0	4.1	1.7	.	8.3	9
CV	4.3	0.0	3.1	2.0	.	10.5	7

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

Stanley County - Hayes

Planted: September 17, 2008 Herbicide: Widematch
Harvested: July 22, 2009 Additional Nitrogen: 60 lb/A
Previous crop: Hailed out wheat, no-till planted

Hayes had yields averaging 49 Bu/A with the varieties Settler CL, Radiant, Expediton, Infinity CL, Wendy and Arapahoe showing top yields in 2009. The varieties with the best three year averages were Expedition, Wendy, Darrell, Lyman, Overland and Wahoo. Results are presented in Table 5.

Pennington County - Wall

Planted: September 24, 2008 Herbicide: Starane NXT (27.5 oz/A)
Harvested: July 30, 2009 Additional Nitrogen: 80 lb/A
Previous crop: Chemical fallow, no-till planted

The Wall location suffered from poor tillering and stands in 2009 and averaged 46 Bu/A. The best yielding varieties at Wall were Radiant, Jerry, Wahoo, Harding, Hatcher, and Infinity CL. There was no significant difference in yield in varieties tested over the past three years. The results are presented in Table 6.

Meade County - Sturgis

Planted: September 20, 2008 Herbicide: Amber (0.4 oz/A)
Harvested: August 12, 2009 Additional Nitrogen: 80 lb/A
Previous crop: Wheat, no-till planted

The Sturgis location had good yields for recrop wheat in 2009 averaging 56 Bu/A. The varieties with the best yields in 2009 were Hatcher, Wahoo, Wesley, Overland and Harding. The varieties in the top yield group over the past three years were Hatcher, Wahoo, Lyman, Wesley, Expedition and Darrell. The results are presented in Table 7.

Perkins County - Bison

Planted: September 19, 2008 Herbicide: Olympus (.9 oz/A fall)
Starane NXT (27.5 oz/A spring)
Harvested: August 13, 2009 Additional Nitrogen: 75 lb/A
Previous crop: Wheat, no-till planted

The Bison location suffered from poor fall growth and downy bromegrass pressure, which limited yields to 34 Bu/A. Because of the variability in the plot, no yield comparisons can be made in 2009. There are no three year averages for Bison. Results are presented in Table 8.

Table 5. Hard Winter Wheat Variety Trial - Stanley County (Hayes), 2007 - 2009.

Variety	Height	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	Percent	2009	3 Year
Hard Red						
ARAPAHOE	37	0	61.4	13.3	**49.9**	59
ART	35	0	63.0	13.8	49.2	.
DARRELL	38	0	62.4	13.2	**52.9**	**62**
EXPEDITION	36	0	61.8	12.6	**53.5**	**64**
FULLER	35	0	62.5	13.2	44.6	.
HARDING	40	0	62.2	14.8	48.6	59
HAWKEN	31	0	62.6	13.2	45.8	58
HATCHER	32	0	62.1	13.3	44.3	56
JAGALENE	35	0	65.0	12.9	45.2	55
JERRY	40	0	61.5	13.0	49.8	55
LYMAN	37	0	62.6	13.7	48.3	**60**
MILLENNIUM	35	0	62.7	12.2	48.6	59
OVERLAND	35	0	62.8	10.2	**49.9**	**60**
RADIANT	36	0	63.8	11.2	**54.4**	.
SMOKY HILL	30	0	63.8	10.4	48.7	.
STRIKER	34	0	61.9	11.3	**52.8**	.
WAHOO	36	0	62.2	10.4	47.7	**60**
WESLEY	30	0	62.1	11.6	44.6	58
INFINITY CL	36	0	62.9	11.7	**53.2**	.
SETTLER CL	31	0	62.3	10.2	**55.6**	.
AP503CL2	30	0	64.4	11.7	47.5	.
SD05118	32	0	62.1	11.3	49.8	.
SD03164-2	34	0	62.5	10.8	46.6	.
SD06069	32	0	63.2	10.7	48.6	.
SD06158	32	0	63.3	10.8	45.3	.
SD06163	33	0	62.3	11.2	**52.8**	.
Hard White						
ALICE	33	0	62.6	14.9	45.5	56
NUDAKOTA	29	0	60.6	12.8	45.9	58
WENDY	30	0	63.3	10.8	**50.8**	**63**
SD05W018	35	0	63.4	10.9	46.2	.
Average	33.7	0.0	62.6	12.1	48.9	59
LSD (P=.05)	3.4	0.0	1.5	.	5.7	4
CV	5.0	0.0	1.7	.	8.3	8

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

Table 6. Hard Winter Wheat Variety Trial - Pennington County (Wall), 2007-2009.

Variety	Height	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	Percent	2009	3 Year
Hard Red						
ARAPAHOE	34	0	59.1	14.6	45.9	56
ART	27	0	59.3	14.3	37.4	.
DARRELL	31	0	59.0	13.4	46.0	56
EXPEDITION	31	0	61.1	14.9	38.9	57
FULLER	29	0	59.0	14.2	37.8	.
HARDING	34	0	58.4	13.4	50.7	54
HAWKEN	27	0	59.3	14.1	38.9	58
HATCHER	28	0	60.7	12.3	49.1	58
JAGALENE	28	0	60.3	13.2	36.5	54
JERRY	35	0	61.1	12.9	**54.6**	53
LYMAN	32	0	59.9	15.8	42.4	54
MILLENNIUM	34	0	60.5	14.0	49.6	58
OVERLAND	31	0	61.0	14.2	50.8	62
RADIANT	34	0	59.0	12.3	**55.5**	.
SMOKY HILL	26	0	59.9	14.5	42.2	.
STRIKER	27	0	61.1	12.8	46.1	.
WAHOO	31	0	61.1	13.3	**52.8**	59
WESLEY	28	0	60.9	13.3	43.3	59
INFINITY CL	32	0	61.3	13.7	49.1	.
SETTLER CL	29	0	59.3	13.0	44.7	.
AP503CL2	28	0	61.0	14.9	34.8	.
SD05118	30	0	59.9	12.6	48.2	.
SD03164-2	31	0	61.2	13.9	42.7	.
SD06069	29	0	61.0	12.6	**56.7**	.
SD06158	29	0	60.4	12.7	**53.3**	.
SD06163	32	0	60.8	14.9	44.1	.
Hard White						
ALICE	26	0	61.2	15.1	38.4	56
NUDAKOTA	26	0	58.9	12.8	48.2	59
WENDY	27	0	61.7	15.1	41.7	61
SD05W018	32	0	57.7	12.1	43.9	.
Average	29.8	0.0	60.2	13.7	45.5	57
LSD (P=.05)	2.2	0.0	1.6	.	4.0	**NS**
CV	5.1	0.0	1.9	.	6.2	8

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

Table 7. Hard Winter Wheat Variety Trial - Meade County (Sturgis), 2007 - 2009.

Variety	Height	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	Percent	2009	3 Year
Hard Red						
ARAPAHOE	36	0	60.6	13.2	56.9	41
ART	31	0	58.4	12.8	49.6	.
DARRELL	35	0	60.5	12.8	59.3	**43**
EXPEDITION	34	0	59.6	12.4	58.4	**43**
FULLER	32	0	59.1	13.0	55.4	.
HARDING	37	0	61.2	12.2	59.7	**42**
HAWKEN	29	0	59.9	12.2	53.6	41
HATCHER	32	0	60.5	11.3	**65.1**	**46**
JAGALENE	32	0	59.8	11.8	55.0	41
JERRY	38	0	61.3	11.6	57.1	**42**
LYMAN	37	0	60.3	13.3	58.1	41
MILLENNIUM	34	0	61.8	11.8	57.9	**44**
OVERLAND	34	0	61.1	11.5	59.7	**42**
RADIANT	33	0	62.0	11.7	58.5	.
SMOKY HILL	29	0	60.2	11.6	53.4	.
STRIKER	31	0	60.4	12.0	49.9	.
WAHOO	33	0	58.9	11.7	**63.9**	**46**
WESLEY	31	0	59.3	12.8	**60.0**	**43**
INFINITY CL	34	0	59.6	11.9	54.2	.
SETTLER CL	30	0	60.2	11.5	50.1	.
AP503CL2	29	0	60.5	12.3	48.8	.
SD05118	33	0	60.4	11.6	59.2	.
SD03164-2	35	0	59.8	12.4	56.0	.
SD06069	30	0	59.9	12.1	**64.1**	.
SD06158	30	0	60.2	12.4	**61.7**	.
SD06163	33	0	60.0	12.9	54.7	.
Hard White		0				
ALICE	30	0	60.2	12.8	55.7	41
NUDAKOTA	29	0	57.6	12.2	53.2	41
WENDY	30	0	60.5	12.3	49.9	39
SD05W018	32	0	59.9	12.4	49.6	.
Average	32.3	0.0	60.1	12.2	56.3	42
LSD (P=.05)	2.2	0.0	2.0	.	5.2	4
CV	4.9	0.0	2.3	.	6.5	9

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

Table 8. Hard Winter Wheat Variety Trial - Perkins County (Bison), 2009.

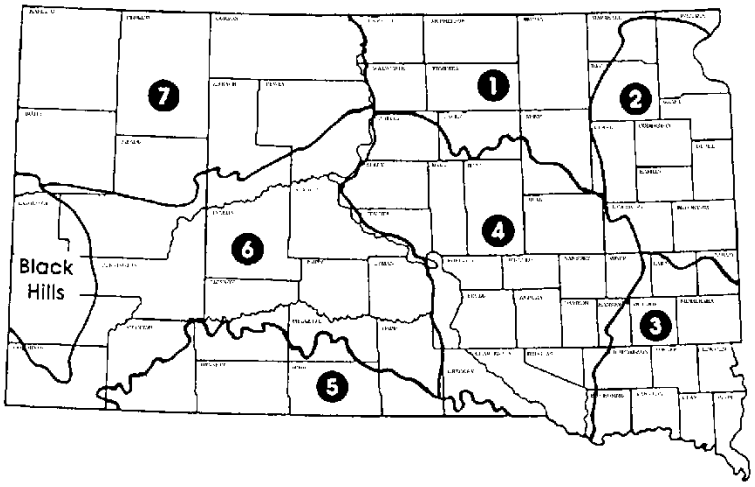
Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Protein Percent	Yield Bu/A
Hard Red					
ARAPAHOE	28	0	60.5	12.8	36.4
ART	24	0	60.9	12.6	31.4
DARRELL	27	0	60.4	12.6	40.1
EXPEDITION	25	0	61.1	11.8	35.2
FULLER	23	0	60.0	13.1	26.4
HARDING	29	0	61.2	12.7	44.0
HAWKEN	23	0	59.5	13.8	30.7
HATCHER	25	0	61.6	12.3	33.1
JAGALENE	26	0	59.7	13.3	29.1
JERRY	26	0	60.5	11.9	35.9
LYMAN	27	0	61.8	13.6	41.9
MILLENNIUM	28	0	60.9	11.9	34.1
OVERLAND	26	0	61.3	11.6	36.7
RADIANT	30	0	58.0	11.5	51.1
SMOKY HILL	25	0	62.4	12.2	34.0
STRIKER	23	0	61.3	11.9	32.6
WAHOO	27	0	59.7	11.6	39.9
WESLEY	22	0	59.5	13.3	32.5
INFINITY CL	27	0	62.2	12.4	36.2
SETTLER CL	25	0	61.0	10.9	31.0
AP503 CL2	22	0	62.4	11.9	30.0
SD05118	25	0	60.6	11.4	28.2
SD03164-2	26	0	60.4	12.5	27.4
SD06069	25	0	61.9	11.9	38.0
SD06158	26	0	61.0	11.8	38.0
SD06163	28	0	60.1	12.5	30.3
Hard White					
ALICE	24	0	59.9	13.8	26.2
NUDAKOTA	23	0	59.2	12.0	34.0
WENDY	22	0	60.2	13.2	36.7
SD05W018	27	0	59.5	11.6	30.1
Average	25.3	0.0	60.6	12.4	34.4
LSD (P=.05)	2.5	0.0	2.4	.	9.4
CV	4.8	0.0	2.7	.	**19.4**

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

WHEAT VARIETY RECOMMENDATIONS FOR 2010

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],4,5,6,7 [pc]
Harding [PVP]	1 [pc],2 [pc],4,7
Millennium [PVP]	1 [pc],4 [pc],5,6,7 [pc]
NuDakota (white) [PVP]	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 [PVP]	5,6,7 [pc]
Wesley	5,6,7 [pc]

SPRING WHEAT

Recommended:

Variety	*Crop Adaptation Area*
Brick [PVP]	Statewide
Briggs [PVP]	All except 3
Faller [PVP]	Statewide
Granger [PVP]	All except 3
Howard [PVP]	Statewide
RB07 [PVP]	All except 3
Steele-ND [PVP]	All except 3
Traverse [PVP]	Statewide

Acceptable/Promising:

Variety	*Crop Adaptation Area*
Albany [PVP]	Statewide
Glenn [PVP]	Statewide
Tom [PVP]	3,4

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 20.

[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 and Field Peas, 2010 Variety Recommendations, EC774, South Dakota State University. (http://plantsci.sdstate.edu/varietytrials/vartrial.html)

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 April and May 2009 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 and September 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: May 14, 2009 Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: Sept. 10, 2009 Additional Nitrogen: 75 lb/A
Previous crop: Wheat, no-till planted

The spring wheat at Bison was planted late into very wet soils in 2009, this probably caused sidewall compaction which inhibited root growth. The trial averaged 26 Bu/A with test weights averaging 58.4 Lb/Bu. There was too much variation in the plot for valid yield comparisons to be made in 2009 (CV = 16.6). There are no three year averages for Bison. Results are shown in Table 9.

Harding County – Ralph

Planted: May 14, 2009 Herbicide: Widematch (1.3 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: Sept. 1, 2009 Additional Nitrogen: 65 lb/A
Previous crop: Conventional Fallow

The spring wheat at Ralph was planted late in 2009, but the cool conditions throughout the summer favored good growth and grain fill. The location did have a fair amount of wheat stem sawfly damage, which caused some of the varieties to lodge. The trial averaged 47 Bu/A with test weights averaging 58.4 Lb/Bu. The top yielding varieties in 2009 were Faller, Sabin, RB07, Albany, Mott, Breaker, Granger, Traverse and Select. The variety Mott is a semi-solid stemmed variety that would be a good choice if wheat stem sawfly is a concern. There are no three year averages for Ralph. Results are shown in Table 10.

Pennington County - Wall

Planted April 15, 2009 Herbicide: Starane NXT (27.5 oz/A)
Harvested: August 13, 2009 Additional Nitrogen: 50 lb/A
Previous crop: Chemical fallow

Wall had good growing conditions for spring wheat with yields averaging 43 Bu/A with test weights averaging 60.3 Lb/Bu. The top yield group in 2009 consisted of Traverse, Select, Granger, RB07, Faller, Sabin and Brick. There are no three year averages for Wall. Results are shown in Table 11.

Table 9. Hard Red Spring Wheat Variety Trial – Harding County (Bison), 2009.

Variety	Height Inches	Lodging 0-9*	Test Wt. Lb/Bu	Yield Bu/A
ALBANY	28	0	56.5	30.4
ALSEN	29	0	58.0	20.9
BARLOW	30	0	58.6	31.6
BREAKER	29	0	59.5	27.5
BRENNAN	27	0	58.5	24.1
BRICK	30	0	59.9	31.2
BRIGGS	33	0	58.8	27.8
BROGAN	27	0	59.4	24.0
CHRIS (Check)	35	0	56.1	19.4
FALLER	31	0	58.7	28.4
GLENN	30	0	58.1	30.2
GRANGER	33	0	57.4	29.5
HOWARD	32	0	56.5	26.3
KELBY	27	0	59.4	21.2
KUNTZ	26	0	56.8	20.8
MOTT	29	0	57.3	22.6
RB07	26	0	58.0	28.1
REEDER	26	0	58.6	22.1
SABIN	22	0	58.3	21.7
SAMSON	27	0	57.2	29.9
SELECT	35	0	61.7	33.4
STEELE-ND	28	0	60.2	27.6
TOM	27	0	59.3	22.0
TRAVERSE	29	0	58.3	30.8
VANTAGE	28	0	60.5	23.7
MN 03196	29	0	60.0	20.0
ND 808	28	0	58.4	29.2
SD 3997	31	0	57.4	21.4
SD 4011	27	0	57.5	26.3
SD 4023	28	0	60.2	28.4
SD 4024	25	0	57.5	26.7
SD 4035	29	0	57.2	31.8
SD 4036	27	0	59.0	23.4
SD 4046	34	0	59.5	30.1
SD 4073	29	0	55.9	20.9
SD 4076	26	0	59.2	22.3
Average	28.7	0.0	58.4	26.2
LSD (P=.05)	3.9	0.0	3.0	6.1
CV	6.7	0.0	3.6	**16.6**

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

Table 10. Hard Red Spring Wheat Variety Trial – Perkins County (Ralph), 2009.

Variety	Height Inches	Lodging 0-9*	Test Wt. Lb/Bu	Yield Bu/A	Protein %
ALBANY	32	0.5	63.0	**54.1**	13.1
ALSEN	32	3.5	62.8	46.2	15.5
BARLOW	34	2.5	64.3	50.1	15.6
BREAKER	34	2.0	64.8	**53.4**	15.2
BRENNAN	28	1.5	64.0	42.1	15.2
BRICK	36	3.5	63.8	46.2	15.3
BRIGGS	34	3.0	63.7	51.1	16.1
BROGAN	30	2.5	65.3	44.3	14.8
CHRIS (Check)	39	1.5	63.3	43.3	15.8
FALLER	33	2.0	62.9	**57.5**	15.1
GLENN	31	2.5	64.0	45.1	16.4
GRANGER	38	2.5	63.9	**52.3**	15.2
HOWARD	35	2.5	64.4	48.0	16.0
KELBY	27	2.0	63.5	36.8	16.0
KUNTZ	29	6.0	63.1	35.4	13.7
MOTT	34	0.0	63.1	**53.9**	15.2
RB07	32	3.5	63.0	54.7	15.8
REEDER	32	2.5	63.4	49.8	15.6
SABIN	31	2.0	63.8	**57.1**	15.2
SAMSON	27	4.0	62.6	36.3	15.0
SELECT	34	2.0	66.1	**51.7**	15.6
STEELE-ND	33	2.5	65.1	46.8	15.5
TOM	32	3.5	63.6	45.2	13.6
TRAVERSE	34	2.5	61.6	**51.6**	15.7
VANTAGE	30	1.5	64.8	41.8	15.3
MN 03196	32	1.0	63.6	49.2	14.0
ND 808	33	2.0	62.6	**51.6**	14.2
SD 3997	33	4.0	64.6	38.4	15.1
SD 4011	33	2.0	62.9	46.4	16.2
SD 4023	30	1.5	64.5	**55.9**	14.1
SD 4024	30	1.0	64.1	**52.6**	14.6
SD 4035	30	5.5	63.4	34.2	15.7
SD 4036	26	4.5	62.8	32.5	15.7
SD 4046	35	3.0	63.9	44.2	14.6
SD 4073	31	2.5	62.9	49.4	14.8
SD 4076	31	2.5	65.0	43.6	14.7
Average	31.9	2.5	63.6	47.1	15.1
LSD (P=.05)	4.3	1.7	1.9	5.9	.
CV	6.7	33.3	2.1	9.0	.

* 0=No lodging, 9 = 100% lodged – lodging was due to wheat stem sawfly damage.

Table 11. Hard Red Spring Wheat Variety Trial – Pennington County (Wall), 2009.

Variety	Height Inches	Lodging 0-9*	Test Wt. Lb/Bu	Yield Bu/A	Protein %
ALBANY	28	0	59.8	38.7	13.3
ALSEN	27	0	60.9	39.6	14.6
BARLOW	32	0	62.4	41.7	14.6
BREAKER	28	0	63.2	41.6	14.1
BRENNAN	26	0	60.7	44.4	15.3
BRICK	32	0	61.1	**45.3**	13.3
BRIGGS	30	0	59.2	43.2	13.9
BROGAN	25	0	60.6	44.3	13.5
CHRIS (Check)	36	0	58.8	32.2	14.7
FALLER	31	0	59.6	**46.5**	13.5
GLENN	31	0	62.0	39.0	15.5
GRANGER	34	0	61.1	**48.6**	13.3
HOWARD	31	0	60.9	43.1	14.0
KELBY	22	0	60.8	38.7	15.0
KUNTZ	26	0	59.4	42.5	13.7
MOTT	32	0	59.9	35.7	14.5
RB07	30	0	59.5	**47.6**	15.1
REEDER	27	0	59.3	36.8	14.0
SABIN	28	0	60.1	**46.5**	13.9
SAMSON	26	0	58.9	44.1	13.5
SELECT	34	0	61.6	**49.2**	14.5
STEELE-ND	31	0	60.2	42.2	13.5
TOM	30	0	61.1	42.2	14.0
TRAVERSE	33	0	58.2	**49.2**	12.8
VANTAGE	28	0	61.8	35.9	14.9
MN 03196	28	0	61.2	38.7	14.3
ND 808	30	0	59.6	44.4	13.6
SD 3997	34	0	61.4	40.7	14.8
SD 4011	31	0	57.9	44.7	14.6
SD 4023	28	0	61.4	43.1	12.9
SD 4024	27	0	61.0	42.5	13.6
SD 4035	27	0	60.2	43.4	13.6
SD 4036	24	0	59.5	41.4	13.7
SD 4046	35	0	61.2	**47.9**	13.4
SD 4073	31	0	59.0	**46.7**	13.3
SD 4076	30	0	60.9	42.8	12.8
Average	29.4	0.0	60.3	42.9	13.9
LSD (P=.05)	2.7	0.0	1.4	4.2	.
CV	4.6	0.0	1.7	7.0	.

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

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 May 2009 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 September 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: May 14, 2009 Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: Sept. 10, 2009 Additional Nitrogen: 75 lb/A
Previous crop: Wheat, no-till planted

Durum wheat yields averaged 22 Bu/A at Bison with test weights averaging 57.4 Lb/Bu. There was too much variation in the plot for valid yield comparisons to be made in 2009 (CV = 18.9). There are no three year averages at Bison. Results are shown in Table 12.

Harding County – Ralph

Planted: May 14, 2009 Herbicide: Widematch (1.3 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: Sept. 10, 2009 Additional Nitrogen: 65 lb/A
Previous crop: Conventional Fallow

The spring wheat at Ralph was planted late in 2009, but the cool conditions throughout the summer favored good growth and grain fill. The trial did have some wheat stem sawfly damage, which caused some lodging. The trial averaged 50 Bu/A with excellent test weights averaging 63.0 Lb/Bu. The top yielding varieties in 2009 were Divide, Mountrail and Grenora. There are no three year averages for Ralph. Results are shown in Table 13.

Table 12. Durum Wheat Variety Trial – Perkins County (Bison), 2009.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Yield Bu/A	Protein %
ALKABO	28	0	56.3	17.0	13.6
BEN	31	0	58.4	22.4	14.5
GRENORA	29	0	57.8	24.5	13.7
LEBSOCK	28	0	54.8	19.0	14.3
MOUNTRAIL	30	0	57.7	23.2	13.1
DIVIDE	30	0	59.7	27.4	14.6
Average	29.1	0.0	57.4	22.3	14.0
LSD (P=.05)	3.0	0.0	2.5	6.4	--
CV	4.0	0.0	2.7	**18.9**	--

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

Table 13. Durum Wheat Variety Trial – Harding County (Ralph), 2009.

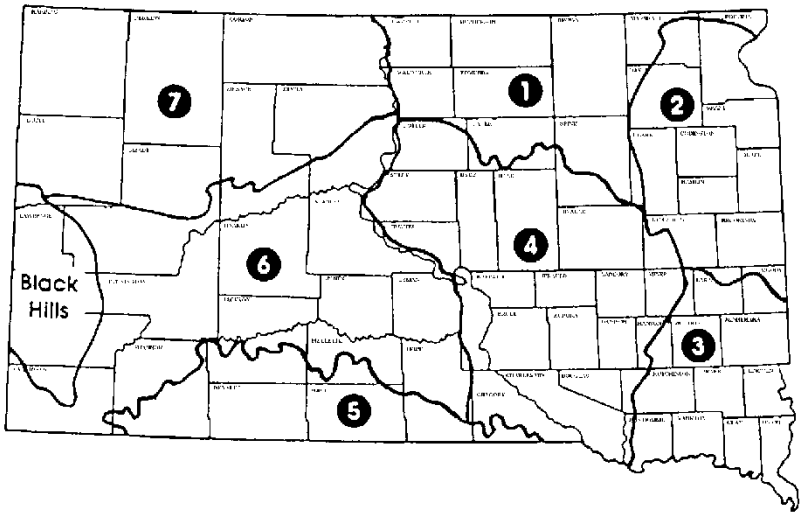
Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Yield Bu/A	Protein %
ALKABO	33	1.0	62.9	47.9	13.3
BEN	35	0.8	62.5	46.5	13.6
GRENORA	31	1.0	62.8	**50.2**	13.6
LEBSOCK	35	0.5	63.5	47.1	13.5
MOUNTRAIL	33	0.3	62.8	**53.4**	13.9
DIVIDE	36	0.5	63.5	**55.1**	14.4
Average	33.7	0.7	63.0	50.0	13.7
LSD (P=.05)	1.6	0.6	1.2	6.0	--
CV	3.1	61.2	1.3	7.9	--

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

OAT AND BARLEY VARIETY RECOMMENDATIONS FOR 2010

Crop Adaptation Areas for South Dakota

(Revised 1992)



OATS

Recommended:

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

Acceptable/Promising:

Variety	*Crop Adaptation Area*
Don	5,6,7
HiFi [PVP]	1,2,7
Jerry [PVP (non-title V status)]	5,6,7
Reeves	5,6,7
Rockford	1,2,7
Buff (hull-less)	Statewide
Streaker [PVP] (hull-less)	Statewide

SPRING BARLEY

Recommended:

Variety	*Crop Adaptation Area*
6 Row	
Lacey [PVP]	Statewide
Rassmusson [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	
Drummond [PVP]	Statewide
2 Row	

Conlon, Drummond, Lacey, Rasmusson, Robust, Stellar-ND are approved American Malting Barley Association varieties.

[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 and Field Peas 2010 Variety Recommendations, EC774, South Dakota State University. (http://plantsci.sdstate.edu/varietytrials/vartrial.html)

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 April and May 2009 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 with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest.

Location Summaries:

Perkins County – Bison

Planted: May 14, 2009 Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A)
Harvested: Sept. 1, 2009 Additional Nitrogen: 75 lb/A
Previous crop: Wheat, no-till planted

The trial at Bison averaged 50 Bu/A with test weights averaging 38.5 Lb/Bu. The top yield group in 2009 consisted of HiFi, Jerry, Shelby427, Morton, Rockford, Beach, Souris and Hytest. There are no three year averages for Bison. Results are presented in Table 14.

Jones County - Okaton

Planted: April 23, 2009 Herbicide: None
Harvested: August 3, 2009 Additional Nitrogen: 80 lb/A
Previous crop: Proso millet

Oat yields averaged 50 Bu/A with average test weights of 39.3 Lb/Bu. The best yielding varieties in 2009 were Rockford, Morton, Beach, Souris, Jerry, HiFi and Stallion. The varieties Souris, Beach, HiFi, Morton, Stallion, Don, Jerry and Colt make up the top yield group over the past three years. Results are presented in Table 15.

Pennington County - Wall

Planted April 15, 2009 Herbicide: Starane NXT (27.5 oz/A)
Harvested: July 30, 2009 Additional Nitrogen: 50 lb/A
Previous crop: Chemical fallow

The yields at Wall averaged 81 Bu/A with average test weights of 39.3 Lb/Bu. The best yielding varieties in 2009 were Rockford, Stallion and Beach. There are no three year averages for Wall. Results are presented in Table 16.

Table 14. Oat Variety Trial - Perkins County (Bison), 2009.

Variety	Heading Date*	Height Inches	Lodging 0-9**	Test Wt Lb/Bu	Yield Bu/A
BUFF (hulless)	3	28	0	38.7	36.3
STARK (hulless)	7	37	0	39.4	45.2
STREAKER (hulless)	3	35	0	43.8	36.8
SD 051502 (hulless)	.	34	0	44.5	27.4
BEACH	7	36	0	39.8	**54.1**
COLT	0	31	0	36.0	48.0
DON	1	29	0	35.5	48.4
HIFI	8	35	0	36.7	**62.3**
HYTEST	4	34	0	40.3	**51.2**
JERRY	5	32	0	36.6	**58.8**
MORTON	8	37	0	36.6	**57.1**
REEVES	2	32	0	35.7	37.7
ROCKFORD	8	36	0	38.7	**56.7**
SOURIS	7	31	0	36.0	**54.0**
STALLION	9	34	0	38.9	42.6
SD 060966	.	28	0	39.1	50.8
SD 031128-245	.	34	0	37.9	**59.6**
SHELBY427	.	33	0	37.2	**58.8**
SD 041445-93	.	35	0	38.6	**51.2**
SD 1445-119	.	36	0	39.3	**62.4**
Average		33.1	0.0	38.5	50.0
LSD (P=.05)		2.8	0.0	1.7	11.5
CV		4.0	0.0	2.7	13.9

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

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

Table 15. Oat Variety Trial – Jones County (Okaton), 2007 - 2009.

Variety	Height Inches	Lodging 0-9**	Test Wt Lb/Bu	Yield 2009	Bu/A 3 Year
BUFF (hulless)	23	0	43.7	39.6	75
STARK (hulless)	32	0	40.5	46.2	62
STREAKER (hulless)	29	0	45.4	44.6	73
SD 051502 (hulless)	28	0	44.2	30.6	.
BEACH	33	0	38.8	**56.2**	**95**
COLT	27	0	39.1	48.4	**90**
DON	24	0	37.1	48.7	**92**
HIFI	29	0	35.4	**53.0**	**95**
HYTEST	33	0	39.7	40.9	76
JERRY	31	0	37.7	**53.1**	**92**
MORTON	33	0	37.8	**58.1**	**95**
REEVES	32	0	39.4	42.3	82
ROCKFORD	32	0	38.7	**60.6**	.
SOURIS	27	0	36.4	**55.5**	**102**
STALLION	29	0	38.4	**52.7**	**94**
SD 060966	26	0	38.6	50.3	.
SD 031128-245	31	0	39.9	**52.6**	.
SHELBY427	29	0	39.9	**52.9**	.
SD 041445-93	31	0	36.6	48.9	.
SD 1445-119	28	0	39.0	**54.1**	.
Average	29.2	0.0	39.3	49.5	86
LSD (P=.05)	4.0	0.0	1.6	8.2	12
CV	6.6	0.0	2.9	11.8	10.1

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

Table 16. Oat Variety Trial – Pennington County (Wall), 2009.

Variety	Height Inches	Lodging 0-9**	Test Wt Lb/Bu	Yield Bu/A
BUFF (hulless)	28	0	44.7	74.5
STARK (hulless)	37	0	39.4	80.4
STREAKER (hulless)	35	0	44.6	85.7
SD 051502 (hulless)	34	0	45.3	70.7
BEACH	36	0	38.7	**90.1**
COLT	31	0	38.8	80.6
DON	29	0	37.3	79.7
HIFI	35	0	37.0	84.7
HYTEST	34	0	38.7	66.8
JERRY	32	0	37.2	74.0
MORTON	37	0	37.9	76.8
REEVES	32	0	36.7	79.1
ROCKFORD	36	0	37.7	**97.3**
SOURIS	31	0	36.8	85.7
STALLION	34	0	40.0	**92.3**
SD 060966	28	0	39.4	**91.6**
SD 031128-245	34	0	38.9	**91.6**
SHELBY427	33	0	39.6	**91.9**
SD 041445-93	35	0	38.2	67.5
SD 1445-119	36	0	38.9	67.3
Average	33.1	0.0	39.3	81.4
LSD (P=.05)	2.8	0.0	1.2	7.3
CV	4.0	0.0	2.2	6.4

***** 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 2009 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 and September with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest.

Location Summaries:

Perkins County – Bison

Planted: May 14, 2009 Herbicide: Widematch (1 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: Sept. 10, 2009 Additional Nitrogen: 75 lb/A
Previous crop: Wheat, no-till planted

At Bison, yields averaged 31 Bu/A and test weights averaged 45.7 Lb/Bu. The best performing variety in 2009 was Eslick with all the other varieties yielding 10 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. There are no three year averages for Bison. Results are shown in Table 17.

Harding County – Ralph

Planted: May 14, 2009 Herbicide: Widematch (1.3 pt/A) + MCPA (8 oz/A) + Axial XL (1 pt/A)
Harvested: Sept. 1, 2009 Additional Nitrogen: 65 lb/A
Previous crop: Conventional Fallow

At Ralph, yields averaged 60 Bu/A and test weights averaged 49.3 Lb/Bu. The top performing variety in 2009 was Eslick, with all the other varieties yielding 20 - 30 Bu/A less than Eslick. Also 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 18.

Pennington County - Wall

Planted: April 15, 2009 Herbicide: Starane NXT (27.5 oz/A)
Harvested: August 13, 2009 Additional Nitrogen: 50 lb/A
Previous crop: Chemical fallow

Yields averaged 74 Bu/A at Wall with a 48.3 Lb/Bu average test weight. The top performing varieties were Eslick and Rawson. There are no three year averages for Wall. Results are shown on Table 19.

Table 17. Spring Barley Variety Trial - Perkins County (Bison), 2009.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Yield Bu/A
TWO ROW				
CONLON	22	0	**	12.8**+**
ESLICK	19	0	46.6	**43.4**
PINNACLE	22	0	46.0	31.7
RAWSON	22	0	46.0	36.1
SIX ROW				
LACEY	22	0	46.0	32.5
STELLAR-ND	23	0	44.8	27.2
DRUMMOND	23	0	44.1	32.3
M122	25	0	44.8	27.4
ROBUST	23	0	45.9	28.3
RASMUSSON	21	0	46.7	33.0
Average	21.9	0.0	45.7	30.5
LSD (P=.05)	3.6	0.0	2.1	6.0
CV	7.3	0.0	3.1	13.5

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

Table 18. Spring Barley Variety Trial – Harding County (Ralph), 2009.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Yield Bu/A
TWO ROW				
CONLON	29	0	**	9.4**+**
ESLICK	27	0	51.1	**90.1**
PINNACLE	28	0	49.0	70.0
RAWSON	29	0	50.2	73.4
SIX ROW				
LACEY	29	0	50.1	63.6
STELLAR-ND	28	0	48.2	60.8
DRUMMOND	28	0	49.1	58.3
M122	31	0	46.9	58.0
ROBUST	31	0	50.1	50.6
RASMUSSON	29	0	49.0	65.7
Average	28.7	0.0	49.3	60.0
LSD (P=.05)	3.3	0.0	1.9	10.0
CV	5.0	0.0	2.7	11.5

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

Table 19. Spring Barley Variety Trial – Pennington County – (Wall), 2009.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Yield Bu/A
TWO ROW				
CONLON	27	0	49.3	70.6
ESLICK	25	0	49.4	**85.7**
PINNACLE	28	0	48.6	78.2
RAWSON	29	0	48.5	**82.5**
SIX ROW				
LACEY	28	0	48.8	73.3
STELLAR-ND	27	0	47.2	72.5
DRUMMOND	29	0	47.8	68.3
M122	30	0	46.8	68.3
ROBUST	30	0	48.5	69.3
RASMUSSON	28	0	47.7	70.4
Average	27.9	0.0	48.3	73.9
LSD (P=.05)	2.6	0.0	1.2	5.5
CV	4.2	0.0	1.7	5.1

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

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 May 5th, 2009 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: May 5, 2009
Harvested: Not harvested
Previous crop: Chemical Fallow

Herbicide: Prowl H_20 (3 pt/A)
Additional Nitrogen: 50 Lb/Ac

Discussion: The safflower trial suffered from herbicide injury and poor stands and was abandoned prior to harvest.

SUNFLOWER VARIETY TRIAL

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

Procedure: Plots of four rows, 30 feet long, spaced 30 inches apart were planted on June 4, 2009 with a 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 most were also treated with fungicide. Plots were over seeded and thinned to a plant population of 17,400 plants/acre. Spartan herbicide was applied prior to planting and the plot was cultivated on July 7th. The center two rows of each plot were harvested with a Wintersteiger Delta small plot combine on November 9, 2009. 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 890 lbs/acre with 29.5 lbs/bu test weights and oil content averaged 45.5%. 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://plantsci.sdstate.edu/varietytrials/ Results are presented in Table 20.

Table 20. Oilseed Sunflower Hybrid Trial - Perkins County (Bison), 2007 - 2009.

Brand	Hybrid	Hybrid Type*	Seed Yield 2009	Seed Yield 2-yr Avg.	Seed Yield 3-yr Avg.	Oil Cont	Plant Ht	Lodg	Har Mst	Test Wt	Pop. x1000 Plt/a
			----------lb/a----------			%	inch	%	%	lb/bu	plants
Croplan	306DMRNS	NS,DM	944	1406	--	45.8	51	6.4	4.4	28.4	16.4
Croplan	3080DMRNS	NS,DM	**1029**	1518	--	48.4	51	11.8	6.3	29.7	18.0
Croplan	356ANS	NS	910	--	--	46	48	1.6	5.9	28.6	17.8
Croplan	369DMRNS	NS,DM	817	1164	--	44.8	53	4.4	6.9	27.2	16.0
Croplan	378DMRNS	NS,DM	999	1438	--	43.6	55	3.4	13.0	29.7	17.6
Croplan	460ENS	NS,Ex	637	--	--	46.1	52	6.0	9.8	29.0	17.6
Croplan	555CLDMRNS	NS,CL,DM	710	--	--	46.7	53	5.3	7.4	26.5	17.3
KingSeed	SunKing4404NSCL	NS,CL	832	1539	--	44.3	48	1.1	7.4	29.4	17.8
KingSeed	SunKing4444NS	NS	882	--	--	42.1	54	3.3	9.9	29.2	15.3
Syngenta	DKF34-33NS/DM	NS,DM	667	1122	1031	46.3	48	6.3	5.9	34.2	16.2
Syngenta	DKF34-80CL	NS,CL	614	1122	1196	45.5	49	10.7	5.3	31.0	17.2
Syngenta	DKF37-31NS	NS	796	1026	1154	45.0	50	9.4	7.6	29.9	16.9
Syngenta	DKF37-32NS	NS	820	--	--	44.3	47	7.5	7.0	31.3	17.0
Syngenta	DKF38-45HO	HO	872	1417	1567	47.4	48	2.8	8.3	31.3	16.7
Syngenta	DKF38-75NS	NS	827	1420	1506	42.9	50	7.2	7.8	28.2	15.7
Syngenta	DKF39-80CL	NS,CL	643	1155	--	45.1	57	5.3	7.7	29.0	15.9
Syngenta	IS7120HO/DM	HO,DM	**1020**	1346	1316	44.8	49	5.8	5.5	31.3	17.2
Syngenta	MH9001CL	NS,CL	821	--	--	45.4	52	5.8	11.8	29.3	16.5
Syngenta	MH9002CL	NS,CL	785	--	--	44.6	50	4.0	8.2	29.6	18.1
MycogenSeeds	8H449DM	HO,DM	**1296**	1713	1566	48.7	57	1.2	10.9	31.3	17.8
MycogenSeeds	8N187	NS	927	1369	--	44.3	46	3.3	6.7	31.1	17.3
MycogenSeeds	8N358CLDM	NS,CL,DM	**1058**	1469	1201	45.4	46	10.4	7.4	32.2	16.8
MycogenSeeds	8N433DM	NS,DM	**1023**	--	--	47.1	51	8.8	7.6	27.4	17.7
MycogenSeeds	8N510	NS	**1266**	1426	1494	45.4	50	0.0	9.4	26.5	18.2
PioneerHi-Bred	PioneerBrand63M91	NS	628	--	--	45.2	51	1.8	11.0	31.8	17.1
PioneerHi-Bred	PioneerBrand63N82	NS,Ex	983	--	--	45.2	50	0.0	10.3	30.7	17.8
PioneerHi-Bred	PioneerBrand64H41	HO	737	--	--	45.0	52	6.2	10.3	29.5	16.8
TriumphSeed	s671	NS,SS	**1185**	1582	--	45.3	37	3.2	7.9	28.0	18.4
TriumphSeed	s674	NS,SS	**1302**	--	--	46.5	39	0.5	9.1	27.4	18.5
TriumphSeed	s678	NS,SS	**1086**	1435	1506	45	45	2.9	7.7	27.6	16.9
TriumphSeed	s655	NS,SS	911	--	--	45.7	33	1.1	8.0	30.5	17.9
TriumphSeed	TRXs9422	NS,SS	728	--	--	45.2	37	1.6	7.8	24.6	17.7
TriumphSeed	s680CL	NS,CL,SS	876	--	--	44.9	36	2.9	9.6	29.5	17.6
USDA(check)	894	Trad.	619	856	860	47.7	44	2.4	9.9	31.3	16.1
Grand Mean			890	1343	1309	45.5	48	4.5	8.2	29.5	17.2
LSD 5%			289	305	267	1.9	4.0	ns	1.6	1.9	ns
C.V.			19.9	**21.3**	**20.7**	3	6.1	100.9	14	4.5	6.8

* NS=NuSun, HO=High Oleic, Trad.=Traditional linoleic, CL=Clearfield, Ex=ExpressSun, DM=downy mildew resistant.
Yield is reported at 10% moisture. Oil % is adjusted for oleic acid content.

SPRING CAMELINA VARIETY TRIAL

Objective: To evaluate Camelina (*Camelina sativa)* varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Camelina, also known as falseflax, is an oilseed crop with potential for biodiesel production. Prowl H_20 (3½ pints/A) was applied just after planting at locations near Wall and Bison, South Dakota. The plots were seeded on April 24,(Wall) and May 14, (Bison) 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 3 pounds per acre. Plots were trimmed to 5' x 25' after heading.

Summary: We had our best ever yields at Wall averaging 600 Lb/A, due to the abnormally cool conditions this summer. The trial at Bison suffered from severe weed pressure and the seed pods shattered before it could be harvested. Shatter is a serious problem for camelina and fields have to be monitored very closely when they are ripe. Another problem is that there are no herbicides labeled for camelina and this crop is not very competitive with weeds in our environment. Our five year average yield at Wall is only 279 Lb/A, certainly not high enough to make this a potential crop for southwestern South Dakota. From our observations, it appears that camelina is not well adapted to the typical hot weather that starts in mid June in southwestern South Dakota, plus its tendency to shatter easily makes it difficult to harvest.

Table 21. Spring Camelina Variety Trial – Pennington County – (Wall), 2009.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Yield Lb/A
Blaine Creek	26	0	48.9	494
GP07	25	0	51.9	537
GP10	28	0	52.2	686
GP11	27	0	52.8	632
GP12	26	0	52.5	563
GP42	27	0	51.9	671
GP43	29	0	52.0	520
GP68	27	0	50.2	621
GP69	27	0	50.9	576
GP73	28	0	52.0	702
Average	26.8	0.0	51.5	600
LSD (P=.05)	2.1	0.0	1.0	163
CV	5.5	0.0	1.3	**18.8**

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

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 Selby, 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)* just prior to planting. A John Deere 750 drill with 10-inch spacing was used to plant the trials in April and May 2009. The peas were harvested for grain in July, August and September with a small plot combine equipped with vine lifters and a pickup reel.

Location Information:

Pennington County – Wall

Planted: April 24, 2009 Herbicide: Prowl H_2O (3.5 pint/A)
Harvested: July 30, 2009 Additional Nitrogen: Inoculated
Previous crop: Soybeans, no-till planted

Perkins County - Bison

Planted: May 14, 2009 Herbicide: Prowl H_2O (3.5 pint/A)
Harvested: September 1, 2009 Additional Nitrogen: Inoculated
Previous crop: Wheat, no-till planted

Walworth County - Selby

Planted: April 28, 2009 Herbicide: Spartan
Harvested: August 27, 2009 Additional Nitrogen: Inoculated
Previous crop: Soybeans, no-till planted

Summary: The trial at Bison was too variable, so yields are not reported. Yields at Wall are typical for West River, with Wall averaging 31 Bu/A. The yields East River were outstanding averaged 85 and 75 Bu/A at Selby and South Shore respectively, mainly due to the cool temperature and good moisture in 2009. Top yielding varieties at South Shore were Thunderbird, Commander, Arcadia, Cooper, Meadow and Golden. The top yielding varieties at Selby in 2009 were Cooper, Spider, Meadow and Summit. There was no significant difference in yields at Wall. The varieties Spider, Cooper, Arcadia, Meadow, Golden and Striker perform the best statewide over the past two years. Variety characteristics are presented in Table 22 and yield results in Table 23.

Table 22. Field Pea Characteristics.

Variety	Seed Source	Rel Mat	Vine type	Grain Protein %	Fusarium Wilt	Powdery Mildew	Mycos-phaerella Blight	PVP or PBR Status
DS 98244	PUSA-09	VE	S-L	-	-	-	-	-
Agassiz	MS-09	E	S-L	24.9	-	R	MS	Yes
Arcadia	LL-07	E	S-L	23.5	MS	MS	VS	Yes
CDC Meadow	ASS-06	E	S-L	23.7	MS	MR	MS	No
Commander	PUSA	E	S-L	24.9	R	MR	-	Yes
DS Admiral	LL-02	E	S-L	23.9	MS	MR	MS	Yes
Sage	ASS-05	E	S-L	23.3	MR	MR	MS	Yes
Summit	ASS-09	E	S-L	23.5	R	MR	-	Yes
SW Midas	LL-05	E	S-L	23.6	MS	MR	MS	Yes
Korando	PUSA-09	M	S-L	25.8	R	MR	-	Yes
Spider	LL-08	M	S-L	24.9	MR	S	MS	Yes
CDC Golden	ASS-03	M	S-L	25.0	MS	MR	MS	No
CDC Striker	ASS-02	M	S-L	25.2	MR	S	MS	Yes
Thunderbird	MS-09	M	S-L	24.9	MS	MR	MS	-
Cooper	MS-02	L	S-L	23.5	MS	MR	MS	Yes

Table 23. Field Pea Variety Trial Yields (Bu/A), 2008 - 2009.

Variety, Relative Maturity	Location yield Avg. Bu/A at 13% moist.						All locations Yield Avg. Bu/A	
	South Shore		Wall		Selby			
	2009	2-yr	2009	2-yr	2009	2-yr	2009	2-yr
Spider, M	76	**75**	**32**	.	**95**	**66**	68	71
Cooper, L	**81**	**75**	**33**	.	**96**	**62**	70	69
Arcadia, E	**84**	**76**	**29**	.	**84**	53	66	65
CDC Meadow, E	**80**	**71**	**31**	.	**92**	**59**	68	65
CDC Golden, M	**79**	**71**	**34**	.	**85**	**56**	66	64
CDC Striker, M	64	**64**	**34**	.	**85**	**57**	61	61
SW Midas, E	72	61	**31**	.	81	53	61	57
DS Admiral, E	59	59	**32**	.	77	52	56	56
Thunderbird, M	**87**	.	**30**	.	**86**	.	68	.
Commander, E	**85**	.	**33**	.	**84**	.	67	.
Summit, E	77	.	**30**	.	**90**	.	66	.
Agassiz, E	74	.	**33**	.	81	.	63	.
Korando, M	58	.	**26**	.	78	.	54	.
Sage, E	70	.	**32**	.	71	.	58	.
DS 98244, VE	.	.	**32**	.	.	.	.	.
Average	75	69	31	.	85	57	64	64
LSD (.05)	9	14	NS		12	10		
C.V.	8	9	11		10	12		

VE=Very Early, E=Early, M=Medium, L=Late.

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 Oelrichs, the entire trial was harvested on the same day with a small plot forage harvester. The Wall location was not harvested due to herbicide injury to the broadleaf entries. 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 Wall and Oelrichs, 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.

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 - 2009

Trial	Planting Date	Harvest Date
Wall Cool Season	April 23	Not Harvested
Oelrichs Cool Season	April 30	July 9
Ralph Cool Season	May 12	July 7, 14, 21, 28, Aug 4
Wall Warm Season	June 17	Sept 9
Oelrichs Warm Season	June 16	Sept 3
Ralph Warm Season	June 22	Aug 11, 18, 25, Sept 1, 8

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: 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 boot to heading 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 1.0 ton/acre at the first harvesting date to 2.4 tons/acres at the fifth harvesting date. 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 cereal crops. 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 the cereals alone in the first dates and yielded slightly less than the straight cereals by the fifth date. The Wall cool season trial was abandoned due to herbicide injury to the broadleaf crops. The Oelrichs plot was quite variable with a coefficient of variation (CV) of 31.9%, so yield comparisons should not be made. The spring wheat at Oelrichs did suffer from wheat streak mosaic virus disease which caused severe yield loss. Forage quality measured by crude protein content decreased with delayed harvesting to later maturity stages for all crops (Table 28). Hairy vetch forage had highest crude protein at all harvest dates. Crude protein was improved significantly by adding a legume to the cereal forage. Relative feed value generally improved with addition of legume portion in the forage.

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 the September 8th harvest date the millets were soft dough while the sorghum sudangrass were boot to flowering. 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 1.1 tons/acre recorded for the August 11 harvesting date and the highest forage yield of 2.8 tons/acre recorded for the September 1 harvest date. When individual crops were compared, the foxtail millets gave the greatest yields while cowpea had the lowest forage yield for all harvesting dates. Teff grass had poor yield earlier in the season but gave similar yields to foxtail millets later in the season. It was also noted that the early cuttings of Teff grass produced some regrowth by September 8th, but none of the other crops did. Teff grass also has a more vigorous root system that may tolerate grazing unlike the proso and foxtail millets. At Oelrichs, forage yields were low due to dry

conditions and the crop was severely drought stressed at harvest time. Wall had excellent yields from good moisture through August with the sorghum sudangrass hybrids growing over seven feet tall. Crude protein content decreased with delayed harvesting to later maturity stages for all crops (Table 31). When individual crops were compared cowpea had the higher crude protein at all harvest dates.

Table 24. Forage Yield (Tons/Acre @ 13% moisture) of Cool Season Crops at Ralph and Oelrichs, SD in 2009.

	Ralph					Oelrichs	Average
Crop (Variety)	July 7	July 14	July 21	July 28	Aug 4	July 8	
Pea (Arvika)	0.8	1.7	2.4	2.4	2.2	1.3	1.6
Pea (Mozart)	0.9	1.3	2.3	1.9	1.4	1.1	1.3
Hairy Vetch	0.2	0.7	1.3	1.1	1.6	0.2	0.6
Oat (Troy)	1.5	2.1	2.7	2.7	2.9	2.0	2.2
Oat/Pea (60% Troy / 40% Arvika)	1.5	2.1	2.5	2.7	2.4	1.4	1.8
Barley (Haybet)	1.4	2.0	2.6	3.1	2.6	1.4	1.9
Barley/Pea (60% Haybet / 40% Arvika)	1.2	1.9	2.5	2.4	2.2	1.3	1.7
Spring Triticale (Common)	1.0	1.5	2.1	2.4	3.1	1.1	1.6
Spring Triticale / Pea (60%s.trit/40% Arvika)	0.9	1.6	2.1	2.4	2.9	1.3	1.6
Spring Wheat (Traverse)	1.1	1.5	1.8	2.2	2.6	0.1	1.0
Mean	1.0	1.6	2.2	2.3	2.4	1.1	1.5
LSD (.05)	0.2	0.4	0.5	0.6	0.6	0.5	--
CV	14.1	17.7	14.9	17.1	15.9	31.9	--

Table 25. Forage Yield (Tons/Acre @ 13% moisture) of Warm Season Crops at Ralph, Wall, and Oelrichs, SD in 2009.

	Ralph					Wall	Oelrichs	Average
Crop (Variety)	Aug 11	Aug 18	Aug 25	Sept 1	Sept 8	Sept 9	Sept 3	
Teff Grass (Tiffany)	0.8	1.6	2.1	2.9	1.9	1.5	0.6	1.3
Foxtail Millet (Manta)	1.5	2.5	2.8	3.2	3.6	2.1	2.0	2.3
Foxtail Millet (Golden German)	1.4	2.1	2.9	3.2	3.6	4.0	2.0	2.9
Foxtail Millet (White Wonder)	1.3	2.0	2.4	3.0	3.1	3.7	2.0	2.7
Proso Millet (Sunup)	1.4	2.0	2.6	3.3	2.8	2.6	2.6	2.5
Pearl Millet (Producers Pro Millet)	1.3	1.7	2.2	3.1	2.7	4.3	1.5	2.7
Sorghum Sudan (Honey Sweet)	1.0	1.6	2.2	2.7	3.1	4.7	2.2	3.0
Sorghum Sudan (Honey Sweet 2)	1.1	1.6	1.7	2.3	2.2	5.1	2.0	3.0
Sorghum Sudan (Honey Sweet BMR)	1.0	1.6	2.3	2.6	2.6	4.5	2.4	3.0
Cowpea (Red Ripper)	0.7	0.9	1.0	1.2	0.8	0.8	0.5	0.7
Mean	1.1	1.8	2.2	2.8	2.7	3.3	1.8	2.4
LSD (.05)	0.3	0.4	0.6	0.6	0.9	0.8	0.5	--
CV	15.4	16.5	18.4	14.8	23.7	15.8	20.6	--

Table 26. Moisture Content and Crop Stage at Harvest of Cool Season Crops at Oelrichs, SD in 2009.

	Oelrichs (July 9)	
Crop (Variety)	Mois %	Crop Stage
Pea (Arvika)	73	Pod filling
Pea (Mozart)	75	Mid-pod filling
Hairy Vetch	81	Flowering
Oat (Troy)	68	Milk stage
Oat/Pea (60% Troy / 40% Arvika)	69	Milk stage / *pod filling*
Barley (Haybet)	63	Anthesis
Barley/Pea (60% Haybet / 40% Arvika)	66	Anthesis / *pod filling*
Spring Triticale (Common)	62	Anthesis
Spring Triticale / Pea (60%s.trit/40% Arvika)	74	Anthesis / p*od filling*
Spring Wheat (Traverse)	63	Milk stage
Mean	69	
LSD	9.9	
CV (%)	9.9	

Table 27: Moisture Content and Crop Stage at Harvest of Cool Season Crops at Ralph, SD in 2009.

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)	85	Early Flowering	80	Early pod fill	77	Late pod fill	72	Mid-pod fill	66	Late pod-filling
Pea (Mozart)	84	Flowering to some flat pods	83	Mid pod fill	76	Mid pod fill	72	Late-pod fill	58	Hard dough
Hairy Vetch	81	Short & vegetative	78	Vegetative	73	Vegetative	72	Vegetative	69	Early bloom
Oat (Troy)	80	Late anthesis	72	Milk stage	67	Late milk stage	61	Late milk to soft dough	55	Late milk to ripe
Oat/Pea (60% Troy / 40% Arvika)	82	Late anthesis / *Early flowering*	74	Milk Stage / *Early pod fill*	68	Late milk stage / *Late pod fill*	63	Late milk to soft dough / *mid-pod fill*	59	Late milk to ripe / *late pod filling*
Barley (Haybet)	80	anthesis	73	Anthesis	67	Late milk stage	58	Late milk	54	Soft dough
Barley/Pea (60% Haybet / 40% Arvika)	81	Anthesis / *Early flowering*	75	Anthesis / *Early pod fill*	70	Late milk stage / *Late pod fill*	65	Late milk / *mid-pod fill*	59	Soft dough / *late pod filling*
Spring Triticale (Common)	82	Boot stage	76	Heading	69	anthesis	64	Late anthesis	61	Late milk stage
Spring Triticale / Pea (60%s.trit/40% Arvika)	83	Boot stage / *Early Flowering*	78	Heading / *Early pod fill*	70	Anthesis / *Late pod fill*	67	Late anthesis / *Mid-pod fill*	62	Late milk stage / *late pod filling*
Spring Wheat (Traverse)	80	headed	72	Anthesis	65	Early soft dough	60	Late milk to soft dough	57	Late milk to soft dough
Mean	82		76		70		65		60	
LSD (P=.05)	1.2		2.9		2.3		2.1		3.3	
CV	1.0		2.6		2.2		2.2		3.8	

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

Crop (Variety)	July 7				July 14				July 21				July 28				August 4			
	CP (%)	NDF (%)	ADF (%)	RFV	CP (%)	NDF (%)	ADF (%)	RFV	CP (%)	NDF (%)	ADF (%)	RFV	CP (%)	NDF (%)	ADF (%)	RFV	CP (%)	NDF (%)	ADF (%)	RFV
Pea (Arvika)	20.4	37	29	165	17.0	38	29	162	14.1	36	28	172	14.6	37	27	170	9.3	48	35	121
Pea (Mozart)	19.5	36	27	176	16.0	35	25	189	13.0	38	26	169	11.7	39	26	164	8.7	45	31	135
Hairy Vetch	23.1	42	27	151	22.0	43	26	149	15.2	53	31	116	11.8	50	31	123	14.8	48	30	126
Oat (Troy)	15.3	61	33	97	10.6	62	35	93	9.7	57	33	104	8.1	59	35	98	6.9	59	33	102
Oat/Pea (60% / 40%)	16.6	54	31	113	12.5	56	33	107	10.3	56	33	104	9.1	56	32	106	8.3	54	31	112
Barley (Haybet)	16.0	59	33	100	11.7	62	34	94	10.7	57	31	106	9.3	55	30	112	7.2	63	36	91
Barley/Pea (60% / 40%)	18.7	51	30	120	14.6	54	31	113	11.4	49	30	126	9.7	54	32	111	7.0	58	36	98
Spring Triticale (Common)	18.9	53	30	116	14.1	60	33	99	11.4	63	37	89	9.3	59	35	98	7.2	57	34	103
Spring Triticale / Pea (60% /40%)	21.2	45	28	140	15.1	55	32	110	11.8	59	35	97	9.5	57	35	101	7.4	57	33	104
Spring Wheat (Traverse)	16.4	60	32	99	12.0	63	35	92	10.2	60	34	97	11.3	53	32	115	6.4	60	35	97
Mean	18.6	50	30	128	14.6	53	31	121	11.8	53	32	118	10.4	52	32	120	8.3	55	33	109
LSD	3.0	6.1	3.3	19.1	1.8	7.3	3.2	32.6	2.2	8.0	3.0	20.6	5.9	11.6	5.3	34.7	2.2	6.6	5.0	18.2
CV (%)	7.2	5.5	4.8	6.6	5.3	6.1	4.5	12.0	8.4	6.7	4.1	7.7	24.8	9.9	7.4	12.8	11.7	5.3	6.6	7.4

CP = Crude protein.
NDF = Neutral detergent fiber.
ADF = Acid detergent fiber.
RFV = Relative feed value

Table 29. Forage Quality of Cool Season Crops at Oelrichs in 2009.

Crop (Variety)	Oelrichs			
	CP (%)	NDF (%)	ADF (%)	RFV
Pea (Arvika)	17.1	36	28	173
Pea (Mozart)	16.2	30	22	223
Hairy Vetch	23.6	36	24	188
Oat (Troy)	13.0	55	31	109
Oat/Pea (60% Troy / 40%Arvika)	13.2	50	28	126
Barley (Haybet)	11.2	54	29	115
Barley/Pea (60% Haybet / 40% Arvika)	11.4	51	28	123
Spring Triticale (Common)	13.9	57	31	107
Spring Triticale / Pea (60%s.Trit/40%Arvika)	18.7	35	23	191
Spring Wheat (Traverse)	15.2	52	27	123
Mean	15.3	45	27	148
LSD	7.1	7.8	3.6	38.6
CV (%)	20.4	7.6	5.8	11.6

CP = Crude protein.
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 2009.

Crop (Variety)	August 11		August 18		August 25		Sept 1		Sept 8	
	Mois %	Crop Stage	Mois %	Crop Stage	Mois %	Crop Stage	Mois %	Crop Stage	Mois %	Crop Stage
Teff Grass (Tiffany)	75	Vegetative	70	Heading	65	Headed but no seed	61	Headed – no seed	63	Headed – no seed
Foxtail Millet (Manta)	80	Early heading	71	Heading	64	Headed	63	Hard dough	53	Soft/hard dough
Foxtail Millet (Golden German)	83	Vegetative	77	Late boot to early heading	72	Late boot to early heading	69	50% headed	66	Headed
Foxtail Millet (White Wonder)	82	Vegetative	78	Boot stage	74	Boot-stage	71	Boot stage	68	Boot to early headed
Proso Millet (Sunup)	81	Heading	74	Late heading	71	Soft dough	67	Hard dough	66	Soft/hard dough
Pearl Millet (Producers Pro Millet)	82	Vegetative	79	Vegetative	76	Boot-stage	74	30% headed	71	Headed – no seed
Sorghum Sudan (Honey Sweet)	83	Vegetative	79	Vegetative	76	Vegetative	75	70% headed	73	Late anthesis
Sorghum Sudan (Honey Sweet 2)	81	Vegetative	78	Vegetative	72	Vegetative	72	10% headed	73	Boot to early headed
Sorghum Sudan (Honey Sweet BMR)	81	Vegetative	79	Vegetative	76	Vegetative	76	5% headed	75	Headed
Cowpea (Red Ripper)	81	Vegetative	76	Vegetative	76	Vegetative	73	Vegetative	77	Vegetative
Mean	81		76		72		70		69	
LSD (P=.05)	1.8		3.8		4.3		5.5		5.5	
CV	1.6		3.5		4.1		5.4		5.5	

Mois % = Moisture percent at harvest.

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

Crop (Variety)	August 11				August 18				August 25				September 1				September 8			
	CP (%)	NDF (%)	ADF (%)	RFV	CP (%)	NDF (%)	ADF (%)	RFV	CP (%)	NDF (%)	ADF (%)	RFV	CP (%)	NDF (%)	ADF (%)	RFV	CP (%)	NDF (%)	ADF (%)	RFV
Teff Grass (Tiffany)	18.5	61	29	100	14.3	63	30	96	10.9	66	32	90	8.4	58	33	105	8.7	67	34	87
Foxtail Millet (Manta)	15.2	61	32	98	12.9	60	31	101	11.1	60	31	101	7.3	64	34	91	8.1	64	36	90
Foxtail Millet (Golden German)	16.0	60	31	102	12.3	61	32	99	10.8	60	33	97	8.0	61	32	99	8.9	59	31	103
Foxtail Millet (White Wonder)	14.8	62	31	98	12.9	60	32	100	11.8	62	32	97	7.9	62	33	95	8.9	62	32	96
Proso Millet (Sunup)	17.5	57	28	110	11.7	59	29	106	10.2	60	30	101	6.6	64	33	92	8.0	60	32	98
Pearl Millet (Producers Pro Millet)	18.6	58	30	106	15.4	60	30	103	12.1	60	30	101	9.1	62	32	96	9.4	62	33	95
Sorghum Sudan (Honey Sweet)	14.7	59	29	104	12.1	58	30	104	9.2	60	31	101	7.2	60	30	102	9.4	58	30	105
Sorghum Sudan (Honey Sweet 2)	15.6	60	29	103	12.5	59	29	105	10.7	60	30	101	7.8	61	31	99	8.2	58	28	108
Sorghum Sudan (Honey Sweet BMR)	15.7	59	29	104	12.7	60	29	103	9.8	59	30	103	7.7	60	30	103	9.8	58	29	107
Cowpea (Red Ripper)	18.6	54	29	116	15.5	61	32	98	14.7	61	30	100	11.3	56	33	108	10.9	54	32	114
Mean	16.5	59	30	104	13.2	60	30	101	11.1	61	31	99	8.1	61	32	99	9.0	60	32	100
LSD	2.8	6.2	3.8	17.0	2.6	3.7	2.9	9.9	4.1	3.5	4.5	9.7	3.7	15.2	6.4	34.7	4.0	8.9	3.5	22.2
CV (%)	7.4	4.6	5.6	7.2	8.7	2.7	4.2	4.3	16.2	2.5	6.4	4.3	20.1	11.1	8.9	15.5	19.7	6.5	4.9	9.8

CP = Crude protein.
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 Wall and Oelrichs, SD in 2009.

	Wall		Oelrichs	
Crop (Variety)	Mois %	Crop Stage	Mois %	Crop Stage
Teff Grass (Tiffany)	66	Headed – no seed	58	Vegetative – no seed
Foxtail Millet (Manta)	58	Ripe	53	95% ripe
Foxtail Millet (Golden German)	58	Soft/hard dough	64	Late boot stage
Foxtail Millet (White Wonder)	64	Headed to clear dough	68	Late boot stage
Proso Millet (Sunup)	57	Ripe	57	Soft dough to ripe
Pearl Millet (Producers Pro Millet)	67	Late anthesis	71	5% headed
Sorghum Sudan (Honey Sweet)	68	Late anthesis to milk stage	69	25% headed
Sorghum Sudan (Honey Sweet 2)	67	headed	69	Vegetative
Sorghum Sudan (Honey Sweet BMR)	71	Late anthesis	71	25% headed
Red Ripper (Cowpea)	85	Early flower – plus pods	84	Vegetative
Mean	66		66	
LSD	5.2		2.9	
CV (%)	5.4		3.0	

Mois % = moisture percent at harvest.

Table 33. Forage Quality Analysis of Warm Season Crops at Oelrichs and Wall, SD in 2009.

Crop (Variety)	Oelrichs				Wall			
	CP (%)	NDF (%)	ADF (%)	RFV	CP (%)	NDF (%)	ADF (%)	RFV
Teff Grass (Tiffany)	12.0	67	30	91	10.1	69	37	81
Foxtail Millet (Manta)	10.4	58	28	108	5.6	63	35	92
Foxtail Millet (Golden German)	13.4	53	25	122	5.6	63	35	91
Foxtail Millet (White Wonder)	11.4	56	26	114	6.4	65	36	88
Proso Millet (Sunup)	10.0	56	27	113	5.6	56	32	106
Pearl Millet (Producers Pro Millet)	12.4	60	27	105	7.2	63	33	94
Sorghum Sudan (Honey Sweet)	10.7	55	24	119	5.9	59	32	101
Sorghum Sudan (Honey Sweet 2)	9.7	57	26	112	7.3	58	30	105
Sorghum Sudan (Honey Sweet BMR)	10.1	57	27	112	5.8	59	32	101
Cowpea (Red Ripper)	22.3	32	21	210	17.2	39	25	168
Mean	12.2	55	26	120	7.7	60	33	102
LSD	3.4	6.8	2.0	27.0	5.1	6.4	4.9	14.4
CV (%)	12.3	5.3	3.3	9.7	29.7	4.7	6.6	6.2

CP = Crude protein.
NDF = Neutral detergent fiber.
ADF= Acid detergent fiber.
RFV = Relative feed value.

SKIP-ROW SUNFLOWER FOR DROUGHT AVOIDANCE IN DRYLAND CROPPING SYSTEMS - 2007-2009

Background:

Sunflower (*Helianthus annuus*) is a major crop in South Dakota. In 2005, 550,000 acres were planted and production totaled 876.95 million pounds. Currently, most of sunflower production is grown in the central part of the state. Although the crop is well adapted to the eastern part of the state, sunflower production in eastern South Dakota has been replaced by corn and soybean in recent years. The production acres lost to corn and soybean can be replaced by increasing sunflower production in the western part of the state. Sunflower is well adapted to western South Dakota but lack of adequate soil moisture is a major limitation to sunflower yields in the region. The crop frequently runs out of moisture before seed production, lowering yield potential and increasing yield variation from year to year. The skip-row technique involves leaving some rows unplanted has been reported to improve yields of corn compared to conventional planting in the High Plains. This technique uses wider rows to store soil moisture between the rows by keeping the developing plants from using all the available soil moisture early in the growing season. This skip-row technology has not been evaluated as a drought avoidance strategy for sunflower in South Dakota.

Objectives:

The objectives of the study were 1) to determine the impact of row arrangement (plant one/skip one row, plant two/skip two rows, and conventional planting in 20-inch rows) and plant population on performance of sunflower in a semi-arid environment in western South Dakota and 2) to assess how the skip-row technology would affect weed pressure and weed management in a sunflower crop.

Materials and Methods:

The study was conducted under dry land no-till conditions in Pennington County near Scenic, South Dakota in 2007, 2008 and 2009. Treatments included three row arrangements; conventional planting in 20-inch rows (conventional), plant one/skip one row (P1S1), and plant two/skip two rows (P2S2) and two plant populations (12,500 plants/acre and 16,600 plants/acre). Treatments were arranged in factorial design giving a total of six treatments (3 row arrangements x 2 populations). The experimental design was a randomized complete block with four replications. Plots were planted using a JD 7100 planter with five rows, 20 inches apart. Each plot was 33.3 ft. wide and 100 ft long. Row units on the planter were shut off as necessary to achieve desired row width. The sunflower hybrid, Pannar Seeds 8560 NS/CL/Cruiser was used in the study. The field was sprayed with a Glyphosate burn down prior to planting and Spartan herbicide was applied to control weeds. The whole plot was harvested with a Wintersteiger Delta small plot combine.

Planting and Harvest Dates

Year	Planting Date	Harvest Date
2007	June 11, replanted June 28	November 13
2008	June 12	October 23
2009	June 2	November 12

Table 34. 2007 - 2009 Combined Analysis, Sunflower Skip Row Study, Scenic, South Dakota.

Treatment	Weed Pressure (0-9)*	Lodging (%)	Plant Height (Inches)	Final stand (Plants/Ac)	Test Wt (Lb/Bu)	Yield (Lb/Ac)
Population (plants / A)						
12,500	3.2	2	49	7980	25.3	680
16,600	2.6	4	50	10337	26.2	659
LSD (0.05)	0.5	NS	NS	540	0.4	NS
---Row Arrangement (RA)----------						
Conventional 20”	2.4	2	49	9868	25.8	676
Plant 1 Skip 1	3.1	3	50	8851	25.6	654
Plant 2 Skip 2	3.1	2	51	8757	25.9	679
LSD (0.05)	0.4	NS	1.5	NS	NS	NS
---Pop x RA----------						
12,500- Conventional	2.9	1	48	8479	25.2	713
12,500-P1S1	3.4	3	49	7904	25.3	635
12,500-P2S2	3.2	1	50	7556	25.5	692
16,600 -Conventional	1.9	3	49	11256	26.4	638
16,600-P1S1	2.9	4	50	9799	25.9	673
16,600-P2S2	2.0	4	51	9957	26.4	666
LSD (0.05)	NS	NS	NS	NS	NS	NS
C.V. (%)	34.8	145.4	5.4	17.1	3.7	18.8

* Weed pressure assessed at a scale of 0 to 9; 0 = weed free 9 = completely covered by weeds

Table 35. 2009 Sunflower Skip Row Study, Scenic, South Dakota.

Treatment	Weed Pressure (0-9)*	Lodging (%)	Plant Height (Inches)	Final stand (Plants/Ac)	Test Wt (Lb/Bu)	Yield (Lb/Ac)
Population (plants / A)						
12,500	1	3	51	8750	24.3	689
16,600	1	6	52	10296	25.9	637
LSD (0.05)	NS	NS	NS	1189	NS	NS
---Row Arrangement (RA)----------						
Conventional	1	4	49	10949	25.3	638
Plant 1 Skip 1	2	6	53	9240	24.5	661
Plant 2 Skip 2	1	3	52	8380	25.5	690
LSD (0.05)	NS	NS	NS	NS	NS	NS
---Pop x RA----------						
12,500- Conventional	2	6	52	8946	23.9	762
12,500-P1S1	1	1	52	7140	24.6	703
12,500-P2S2	1	2	49	10165	24.3	600
16,600 -Conventional	0	6	50	11732	26.4	514
16,600-P1S1	1	7	54	9534	25.0	722
16,600-P2S2	1	5	52	9621	26.4	676
LSD (0.05)	NS	NS	NS	2059	NS	NS
C.V. (%)	51.6	135.2	5.4	17.1	3.5	18.4

* Weed pressure assessed at a scale of 0 to 9; 0 = weed free 9 = completely covered by weeds

Table 36. 2008 Sunflower Skip Row Study, Scenic, South Dakota.

Treatment	Weed Pressure (0-9)*	Lodging (%)	Plant Height (Inches)	Final stand (Plants/Ac)	Test Wt (Lb/Bu)	Yield (Lb/Ac)
Population (plants / A)						
12,500	6.1	0.8	55.7	7209	25.4	754
16,600	5.3	1.0	57.5	10378	25.9	823
LSD (0.05)	NS	NS	NS	1556	NS	NS
---Row Arrangement (RA)----------						
Conventional	4.8	.3	55.6	8786	25.4	833
Plant 1 Skip 1	6.3	.4	56.3	8463	25.8	743
Plant 2 Skip 2	6.1	2.0	57.9	9132	25.9	790
LSD (0.05)	1.0	NS	NS	NS	NS	NS
---Pop x RA----------						
12,500- Conventional	5.5	0.0	55.0	6793	25.1	789
12,500-P1S1	6.5	0.8	55.3	6862	25.6	739
12,500-P2S2	6.3	1.5	56.8	7972	25.5	734
16,600 -Conventional	4.0	0.5	56.3	10778	25.7	878
16,600-P1S1	6.0	0.0	57.3	10064	26.0	746
16,600-P2S2	6.0	2.5	59.0	10292	26.2	846
LSD (0.05)	NS	NS	NS	NS	NS	NS
C.V. (%)	17.1	259.4	4.0	20.3	1.7	11.9

* Weed pressure assessed at a scale of 0 to 9; 0 = weed free 9 = completely covered by weeds.

Table 37. 2007 Sunflower Skip Row Study, Scenic, South Dakota.

Treatment	Weed Pressure (0-9)*	Plant Height (Inches)	Test Wt (Lb/Bu)	Yield (Lb/Ac)
---Population (Pop) (plants/Ac)---				
12,500	2.3	40.6	26.2	598
16,600	1.6	41.1	26.7	517
LSD (0.05)	NS	NS	NS	70
---Row Arrangement (RA)- ---------				
Conventional	2.7	41.0	26.6	557
Plant 1 Skip 1	2.5	39.9	26.4	558
Plant 2 Skip 2	2.3	41.7	26.4	558
LSD (0.05)	NS	NS	NS	NS
---Pop x RA----------				
12,500- Conventional	3.7	40.5	26.1	590
12,500-P1S1	3.7	40.0	26.2	565
12,500-P2S2	2.7	41.5	26.2	639
16,600 -Conventional	1.7	41.5	27.1	523
16,600-P1S1	1.2	39.7	26.6	550
16,600-P2S2	1.7	42.0	26.7	476
LSD (0.05)	NS	NS	NS	NS
C.V. (%)	55.1	6.9	3.1	14.3

* Weed pressure assessed at a scale of 0 to 9; 0 = weed free 9 = completely covered by weeds.

Summary: In 2007, the plot had to be replanted due to cutworm damage and even after the replant, stands were less than ideal. That year the only significant difference was a slight yield advantage to the lower plant population. The 2008 plot suffered from significant late season kochia and russian thistle pressure. That year, there were no significant yield differences among any of the treatments, but the alternate planting arrangements (P1S1, P2S2) did have slightly higher weed pressure than the conventional 20" rows. There were no significant differences among treatments in any of the measured traits in 2009. The three-year analysis showed slightly higher weed pressure for the wider rows (P1S1, P2S2) and a slight increase in height for the P2S2 treatment. Otherwise, there was no significant difference in yield and test weight between the six treatments. This study also shows how difficult it can be to get good sunflower stands as final stands were only 63% of planted seeds over the three years.

Analyzed over three years (Table 34), row arrangement and population had no impact on yield and little impact on the other measured traits. It would appear from this study that there is no advantage to wider row spacing for yield in western South Dakota. Also, wider rows can cause a slight increase in weed pressure, probably due to the lack of shading versus the conventional rows.

Acknowledgments: Thank you to our cooperator Pat Brown. This project was funded by a grant from the National Sunflower Association.

DRY PEA PLANTING DATE STUDY – JONES COUNTY (OKATON, SD) - 2009

Objective: To evaluate the impact of planting date on yield and agronomic characteristics of dry pea varieties in west-central South Dakota.

Procedures: Four dry pea varieties (Arvika, Grande, CDC Mozart, Cooper) were planted in a randomized complete block design with four replications at five planting dates near Okaton, South Dakota in the spring of 2009. Glyphosate (Roundup) was sprayed on as a burn down in the fall of 2008 and Poast was applied on June 12, 2009 for grass control. The seeding rate was at 330,000 seeds/A. The peas were inoculated with a granular pea inoculum at 10 grams/packet (*Rhizobium leguminosarium* biovar *viceae)* prior to planting. A John Deere 750 drill with 10-inch spacing was used to plant the trials at five planting dates on March 20, April 14, April 23, May 5 and May 13, 2009. Plant samples (five plants per plot) were taken just prior to harvest. The five plants collected per plot were used to calculate pods per plant and seeds per pod. The peas were harvested for grain on August 3, 2009 with a Wintersteiger Delta small plot combine equipped with vine lifters and a pickup reel. The variety characteristics of the peas are listed in Table 38.

Table 38. Dry Pea Variety Characteristics

Variety	Seeds / lb	Leaf Type	Seed Color	Maturity
Arvika (forage type)	3690	Normal	Mottled	Late
Grande	2730	Normal	Yellow	Medium
CDC Mozart	2223	Semi-leafless	Yellow	Early
Cooper	1776	Semi-leafless	Green	Late

Planting Date Comments:

March 20, 2009: Muddy conditions, drill picked up mud and furrows did not close very well.

April 14, 2009: Muddy conditions, drill picked up mud and furrows did not close very well.

April 23, 2009: Drier than the first two dates, but still wet conditions

May 5, 2009: Perfect planting conditions, planted into good moisture, furrows closed well.

May 13, 2009: Perfect planting conditions, planted into good moisture, furrows closed well.

Summary: The intent was to plant every two weeks after the first date was planted, but because of snow and wet weather we were not able to get the second date in until 3 ½ weeks later. The third date was put in only a week later to try and get the dates back on track and the last two dates were put in on two week intervals thereafter.

The first three dates had similar yields, with the fourth date in early May date yielding 15% less and the last date yielding only 10 Bu/A. This was a 65% decrease in yield over the first three dates. As we have seen in the past, the test weight of peas is mostly unaffected by planting date. The numbers of pods and seeds per plant decreased with the later planting dates. This year's results agree with past years studies as we have found that planting dry peas later than late April, is not recommended in western South Dakota. This is because peas are very sensitive to high temperatures during flowering. If peas are planted later than late April they flower in July when conditions are typically hot and dry.

Overall, it is best to plant peas by mid April, but also there appears to be no yield advantage to planting peas in March. Handling of peas in freezing weather can spilt the seed, killing the germ. If a producer has spring seeded cereal grains like spring wheat or oats, it makes sense to plant those first before the peas. The cereal grains are quicker to get out of the ground when soil temperatures are cold. Yield reductions can be seen even with mid April planting dates for the cereal grains.

Acknowledgments: Thank you to our cooperator Henry Roghair.

Results:

Table 39. Seeds /Plant, Pods/Plant, Test Weight and Yield of Dry Pea at Okaton, SD (Jones County) in 2009.

Planting Date	Seeds / plant	Pods / plant	Test Wt. (Lb/Bu)	Yield (Bu/A)
March 20, 2009	156	37	60.4	27.1
April 14, 2009	128	27	62.4	28.1
April 23, 2009	112	24	61.6	27.9
May 5, 2009	113	23	62.5	23.3
May 13, 2009	67	15	.	9.8
Date Mean	115	25	61.7	23.2
LSD (.05)	37	8	0.8	2.2
CV	44.9	45.1	2.0	13.3

Table 40. Seeds/Plant, Pods/Plant, Test Weight and Yield of Four Dry Pea Varieties at Okaton, SD (Jones County) in 2009.

Variety	Seeds / plant	Pods / plant	Test Wt. (Lb/Bu)	Yield (Bu/A)
Arvika	131	26	61.8	23.3
Grande	107	25	62.1	25.8
CDC Mozart	123	29	62.6	22.6
Cooper	99	21	60.4	21.2
Variety Mean	115	25	61.7	23.2
LSD (.05)	NS	NS	0.7	2.0
CV	44.9	45.1	2.0	13.3

Table 41. Effect of Planting Date by Variety on Performance of Dry Pea at Okaton, SD (Jones County) in 2009.

Planting Date	Variety	Seeds / plant	Pods / plant	Test Wt. (Lb/Bu)	Yield (Bu/A)
March 20, 09	Arvika	158	33	61.2	29.9
	Grande	134	35	60.8	26.7
	CDC Mozart	179	47	61.2	23.8
	Cooper	151	32	58.5	27.9
Mean		**156**	**37**	**60.4**	**27.1**
April 14, 09	Arvika	146	29	61.9	25.4
	Grande	127	30	62.6	33.0
	CDC Mozart	139	31	64.0	26.1
	Cooper	99	21	61.0	27.7
Mean		**128**	**27**	**62.4**	**28.1**
April 23, 09	Arvika	107	24	62.1	24.5
	Grande	112	27	60.9	31.8
	CDC Mozart	103	21	62.9	27.3
	Cooper	559	25	60.6	28.0
Mean		**112**	**24**	**61.6**	**27.9**
May 5, 09	Arvika	146	26	62.0	25.6
	Grande	105	20	63.9	26.4
	CDC Mozart	127	29	62.5	24.7
	Cooper	76	17	61.6	16.6
Mean		**113**	**23**	**62.5**	**23.3**
May 13, 09	Arvika	100	19	*	11.2
	Grande	58	13	*	11.3
	CDC Mozart	68	18	*	11.0
	Cooper	41	10	*	5.8
Mean		**67**	**15**	*****	**9.8**
	LSD (0.05)	NS	NS	1.5	4.4
	CV (%)	44.9	45.1	2.0	13.3

* = Not enough sample for a test weight measurement

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. Proso millet, dry peas, hairy vetch/spring 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 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.

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 44). 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.

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 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 yield s in rotation 1 and rotation 2a we can determine if mechanical tillage is necessary during the fallow period for higher yields.

2) For Rotation 5a, in 2005 we substituted feed barley for spring wheat. The feed barley has excellent seedling vigor in the spring and yields have been better.

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. The hairy vetch stubble holds better to the soil surface than the field pea stubble that we used before.

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. Ascochyta blight disease decimated the chickpea crop. It was decided to readjust this rotation again in 2009 by substituting dry pea for chickpeas. The new sequence will be winter wheat / proso millet / dry peas. A down side to this sequence is that the winter wheat being planted into dry pea residue does not have very much protective cover.

Table 45 shows the estimated yield goals used for fertilizer recommendations of each crop and rotation since 1999. Thus, all crops have been adequately fertilized with nitrogen since the beginning of the study in 1994. However, our long term results (Table 44) show that attained yields for some crops have been below yield goals (Table 45). 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 Precipitation by Month (inches) – September 2008 to August 2009

September 2008	0.37”	January 2009	0.08”	May 2009	0.90”
October 2008	1.12”	February 2009	0.38”	June 2009	1.91”
November 2008	0.23”	March 2009	0.60”	July 2009	2.50”
December 2008	0.15”	April 2009	1.62”	August 2009	1.81”

2009 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 tillages 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 poor in the fall due to limited soil moisture conditions. Winter-kill occurred during the winter months so this rotation was replanted to Traverse Spring Wheat on April 22, 2009. Spring rainfall was adequate with 1.62 inches in April, 0.90 inches in May and 1.91 inches in June. In 2009, winter wheat yields were at 44.5 Bu/A of spring wheat. The 11-year average yield on winter/spring wheat in Rotation 1 is 48.7 Bu/A. This rotation had a net return of $ - 75.46 / acre in 2009.

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 44) 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 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 and 2.5 tons per acre in 2009. (Table 44). 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 46.

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 44). 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. Wheat yields were good too. 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.

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.

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.

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 44). 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. 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. but 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 46.

Rotation 9: 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 46.

Table 42. Hard Red Winter Wheat Yields and Hard Red Spring Wheat from The Nine Rotation Sequences at Wall in 2009 and Long Term (11 year) data (1999-2009).

Rotation	Crop Sequence(*)	Protein 2009 (%)	Test Wt 2009 (Lb/Bu)	Yield 2009 (Bu/A)	Ave Yield 1999-09 (Bu/A)
1	***SW*** / F	14.3	58.8	44.5sw	48.7
2a	WW / C / F/ ***SW*** / Su / HM	14.3	58.8	56.2sw	57.2
2a	**WW** / C / F/ SW / Su / HM	10.8	62.3	37.5ww	40.8
3	**WW** / Sa / PM	11.4	62.0	42.6ww	41.3
4	**WW** / PM	11.7	60.6	25.9ww	35.4
5a	**WW** / C / Su / S Bar	12.0	62.3	42.3ww	36.5
6a	***SW*** / SW / Sa / DP	14.4	58.9	51.7sw	43.2
6a	SW / ***SW*** / Sa / DP	14.5	59.6	25.2sw	33.7
9a	***SW*** / SW / Sa / HV	14.6	58.2	44.5sw	43.3
9a	SW / ***SW*** / Sa / HV	14.3	58.2	23.0sw	34.0
10	***SW*** / PM / DP	12.9	59.5	34.9sw	40.6
11	**WW** / C / PM	11.5	63.1	48.3ww	43.4
	Mean	13.1	60.2	39.8	41.7
	LSD (.05)	0.9	1.8	10.0	--
	CV	4.7	2.1	17.5	--

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

(*)Note: In some rotations, SW-Spring wheat was planted into winter-killed winter wheat after the winter of 2008-09.

Table 43. Net Returns from 2009 Crop at The Wall Rotation

Rotations and Crop Yields:								Dollars Return / A.
1	Winter Wheat (SW) 44.5 bu	/	Fallow					$-75.46
2a	Winter Wheat-A (SW) 56.2 bu	/	Sunflower 2294 lbs	/	Hay Millet 2.5 Tons / A	/	Winter Wheat-B 37.5 bu / Corn 88.8 bu / Fallow	$-46.97
3	Winter Wheat 42.6 bu	/	Safflower 1744 lbs	/	Proso Millet 540 lbs			$-62.28
4	Winter Wheat 25.9 bu	/	Proso Millet 1149 lbs					$-157.35
5a	Winter Wheat 42.3 bu	/	Corn 78.7 bu	/	Sunflower 1708 lbs	/	Spring Barley 56.6 bu	$-59.46
6a	Winter Wheat-B (SW) 25.2 bu	/	Safflower 1825 lbs	/	Dry Pea 1164 lbs	/	Winter Wheat-A (SW) 51.7 bu	$-73.12
9a	Winter Wheat-B (SW) 23.0 bu	/	Safflower 1873 lbs	/	Hairy Vetch	/	Winter Wheat–A (SW) 44.5 bu	$-117.53
10	Winter Wheat (SW) 34.9 bu	/	Proso Millet 517 lbs	/	Dry Pea 1110 lbs			$-135.66
11	Winter Wheat 48.3 bu	/	Corn 75.0 bu	/	Proso Millet 952 lbs			$-73.90

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.

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 to 12,500 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 44).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.

GENERAL OVERVIEW OF THE 2009 CROPPING YEAR

The fall of 2008 and spring and summer of 2009 experienced tremendous price swings in fertilizer costs combined with winter-killed wheat that absolutely destroyed the economics of our study. We saw starter fertilizer costs (10-34-0) up to $1300 per ton in the fall of 2008. Liquid nitrogen (28-0-0) costs were high in the fall of 2008 at $534.00 per ton. We opted to spend the money on fertilizer to insure good yields. We fertilized according to soil tests that we sampled in the fall of 2008. Winter-kill was an issue in our fallow ground of Rotation 1 and 2a and in the reduced cover of wheat in

Rotation 6a, 9a and 10a. We had marginal stands on winter wheat in the late fall because soil conditions were dry at planting time. The replanted spring wheat, back into winter-killed winter wheat did well in the summer of 2009 because we had a cooler and wetter spring that extended further into the growing season. The forage millet in Rotation 2a had an average year. Our challenge with the hay millet was waiting long enough to get the green and yellow foxtail flushes and stink grass flushes before planting of the hay millet. Our six-year rotation has shown us that longer diverse rotations are more profitable than the mostly three-year rotations we started with. The down side is that Rotation 2a requires more types of equipment thus making it more expensive to operate.

Safflower yields were at an all time high this year. Corn performed better in 2009 than most years, partly due to timely rainfall and partly due to going to 40 inch row spacing. Proso millet yields were poor and economics of the proso millet were bad. Dry peas didn't perform very well this year. We don't really know why this happened. The peas looked good up to harvest time but didn't yield very well. The sunflowers yielded well but fertilizer costs destroyed the profitability of them. The barley yielded about average.

Overall, the crops at the rotation looked good in 2009 but there were too many expensive inputs to make them profitable. No Federal Government farm payments or crop insurance are calculated into the economics that we calculate. Loan Deficiency Payments (LDP) is included where applicable.

SUMMARY TO DATE

Our long term Economic Trends (Table 46) 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.

Our 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. Sunflowers yield well most years if we get adequate moisture but high input costs 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.

Table 44. Long-Term Yield Trends at The Wall Rotation Study (1999-2009).

Rotation & Crop	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Ave Yield (Bu/A) or (Lb/A) (2007-09)	Ave Yield (Bu/A) or (Lb/A) (1999-09)
Rotation 1													
Winter Wheat	70.9	58.3	38.6	28.6	77.1	17.7	60.0	31.0	52.2	56.2	44.5*	**50.9**	**48.7 bu**
Fallow	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Rotation 2a													
Winter Wheat-a	67.1	66.9	51.1	30.9	72.8	34.3	70.0	49.8	60.4	69.3	56.2*	**61.9**	**57.2 bu**
Sunflower	2091	2602	2082	400	584	1093	860	1030	382	1690	2294	**1455**	**1373 lb**
Proso Millet (99-06) Hay Millet (07-09)	1500	1300	2000	326	0	449	1405	300	Hay millet 1.57T	Hay millet 2.5 T	Hay millet 2.5 T	**Hay millet 2.19 T**	**n/a**
Winter Wheat-b	62.8	46.0	40.2	10.7	46.3	27.1	50.0	38.1	43.7	47.6	37.5	**42.9**	**40.8 bu**
Corn	107.6	65.8	97.5	0	0	70.3	55.0	0	30.0	33.0	88.8	**50.6**	**49.8 bu**
Fallow	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Rotation 3													
Winter Wheat	57.2	45.4	38.1	9.8	47.8	24.2	50.0	40.3	43.3	51.0	42.6	**45.6**	**41.3 bu**
Safflower	976	1391	1575	360	614	957	685	489	375	1483	1744	**1200**	**968 lb**
Millet	1500	1266	2000	783	0	867	1906	400	1307	1224	540	**1023**	**1071 lb**
Rotation 4													
Winter Wheat	47.2	32.6	33.7	14.7	57.4	28.9	35.0	37.8	39.2	36.8	25.9	**33.9**	**35.4 bu**
Millet	1500	1370	1800	1182	1500	1888	1848	1000	1241	949	1149	**1113**	**1402 lb**
Rotation 5a													
Winter Wheat	36.5	47.6	33.1	3.4	34.9	34.1	49.7	37.0	37.6	45.9	42.3	**41.9**	**36.5 bu**
Corn	100.9	50.2	101.6	0	0	54.9	50.0	0	30.0	33.0	78.7	**47.2**	**45.8 bu**
Sunflower	2010	1958	1443	250	722	455	680	N/A	63.0	1494	1708	**1088**	**1026 lb**
S Wheat (99-04) Barley (05-09)	36.3	31.8	28.4	1.6	26.2	0	41.6	15.8	37.0	73.7	56.6	**55.7**	**n/a**
Rotation 6a													
Winter Wheat-a	63.9	60.8	48.0	10.8	35.9	34.5	55.6	25.5	45.6	43.6	51.7*	**46.9**	**43.2 bu**
Winter Wheat-b	34.1	48.9	33.0	5.2	35.4	24.7	52.5	26.5	35.5	50.0	25.2*	**36.9**	**33.7 bu**
Sunflower (99-04) Safflower(05-09) Pea Fallow (99-04) Field Pea (05-09)	2210 sunf 0-pf	2468 sunf 0-pf	2011 sunf 0-pf	200 sunf 0-pf	1132 sunf 0-pf	818 sunf 0-pf	651 saff 1405 fp	548 saff 1308 fp	278 saff 1170 fp	1650 saff 2004 fp	1825 saff 1164 fp	**1251** **1446 fp**	**n/a** **n/a**
Rotation 9a													
Winter Wheat-a	68.3	57.1	50.0	9.2	44.0	0	64.8	34.4	44.7	59.2	44.5*	**49.4**	**43.3 bu**
Winter Wheat-b	29.8	43.0	38.2	4.9	31.7	27.5	56.8	35.2	36.4	48.5	23.0*	**35.9**	**34.0 bu**
Safflower	1277	1546	1624	230	1106	617	885	516	539	1559	1873	**1323**	**1070 lb**
Pea Fallow (99-04) H. Vetch (05-09)	0-pf	0-pf	0-pf	0-pf	0-pf	0-pf	0 - hv	0-hv	0-hv	0-hv	0-hv	**0-hv**	**n/a**
Rotation 10													
Winter Wheat	65.1	48.9	40.8	13.1	58.7	22.5	45.0	33.5	45.8	29.9	34.9*	**36.8**	**40.6 bu**
Chickpea(99-06) *to millet (07-09)*			1585	95	667	976	292	800	*1420*	*764*	517	**900**	**n/a**
Millet (99-06) *Chickpea (07-08) field pea (2009)*	1500	1524	2000	622	925	1197	2000	900	*700*	*0*	1110 fp	**n/a**	**n/a**
Rotation 11													
Winter Wheat	54.2	37.8	42.2	13.5	59.4	28.2	53.0	41.7	45.0	54.8	48.3	**49.3**	**43.4 bu**
Corn	99.2	60.2	106.4	0	39.7	76.6	55.0	0	35	29.7	75.0	**46.5**	**52.4 bu**
Millet	1500	1300	2000	829	0	1017	1634	600	1483	1228	952	**1221**	**1140 lb**
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"**		

N / A = Sunflowers were destroyed by deer when heads were 2" in diameter. In 2009; some winter wheat plots were replanted to spring wheat due to winter kill. They have an '*' to denote replant to spring wheat.

Table 45. Estimated Yield Goals of The Wall Rotation Study (1999-2010).

Crop	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Rotation 1												
Winter Wheat	60	60	60	60	60	60	60	55	55	55	55	55 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	60 bu
Sunflower	2000	2000	2000	2000	2000	2000	2000	1600	1600	1600	1600	1600 lb
Proso Millet (99-06)	2000	2000	2000	2000	2000	2000	1500	1200	2 tons/a	2 tons/a	2	2
Winter Wheat-b	45	45	45	45	45	45	45	45	45	45	45	45 bu
Corn	80	80	80	80	80	80	80	80	80	80	80	60 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	45 bu
Safflower	1500	1500	2000	2000	2000	1500	1200	1200	1200	1200	1200	1200 lb
Millet	2000	2000	2000	2000	2000	2000	1500	1500	1500	1500	1500	1500 lb
Rotation 4												
Winter Wheat	45	45	45	45	45	45	40	35	35	35	35	35 bu
Millet	2000	2000	2000	2000	2000	2000	2000	1500	1500	1500	1500	1500 lb
Rotation 5a												
Winter Wheat	45	45	45	45	45	45	40	40	40	40	40	40 bu
Corn	80	80	80	80	80	80	70	80	80	80	80	60 bu
Sunflower	2000	2000	2000	2000	2000	2000	1500	1300	1300	1300	1300	1300 lb
Spring Barley	n/a	n/a	n/a	n/a	n/a	n/a	50	60	60	60	60	60 bu
Rotation 6a												
Winter Wheat-a	60	60	60	60	60	60	60	45	45	45	45	45 bu
Winter Wheat-b	45	45	45	45	45	45	45	45	45	45	45	45 bu
Safflower	n/a	n/a	n/a	n/a	n/a	n/a	1500	1200	1200	1200	1200	1200 lb
Dry Peas	n/a	n/a	n/a	n/a	n/a	n/a	1800	1800	1800	1800	1800	1800 lb
Rotation 9a												
Winter Wheat-a	60	60	60	60	60	60	60	45	45	45	45	50 bu
Winter Wheat-b	45	45	45	45	45	45	45	45	45	45	45	45 bu
Safflower	1500	1500	2000	2000	2000	1500	1500	1200	1200	1200	1200	1200 lb
Hairy Vetch	n/a	n/a	n/a	n/a	n/a	n/a	--	--	--	--	--	--
Rotation 10												
Winter Wheat	45	45	45	45	45	45	45	45	45	45	45	45 bu
Millet (2007-10)	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500 lb
Dry pea (2009-10)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1800	1800 lb
Rotation 11												
Winter Wheat	45	45	45	45	45	45	45	45	45	45	45	45 bu
Corn	80	80	80	80	80	80	80	80	80	80	80	60 bu
Millet	2000	2000	2000	2000	2000	2000	1500	1500	1500	1500	1500	1500 lb
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”	

Table 46. Long-Term Economic Trends of The Wall Rotation Study (1999-2009) (Net Income - $ per Acre)

Rot	Crop	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	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	***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	***-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	***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	***197.41***	***107.41***
	Sunf	40.45	84.65	39.43	-109.29	-92.02	3.19	-80.10	-29.44	-113.89	69.54	-26.57	***-16.54***	***-17.52***
99-06 07-09	**Grain Millet Hay Millet**	-27.28	4.37	-19.28	-57.29	-77.58	-73.57	-22.11	-76.21	-9.97	41.70	-84.55	***-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	***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	***-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	***-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	-46.97	***+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	***53.00***	***14.65***
	Saff	-23.86	17.92	51.48	-84.25	-46.52	23.70	-33.35	-57.25	-72.94	238.61	63.65	***76.44***	***7.02***
	Millet	-27.28	11.01	-19.28	-1.81	-77.58	-45.38	7.12	-56.00	-5.90	-61.65	-169.18	***-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	***+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	***-6.82***	***-4.89***
	Millet	-28.73	9.27	-35.90	49.06	-48.44	0.25	3.96	-30.94	-11.50	-110.45	-159.38	***-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	***-50.29***	***-18.94***
5a	**W Wht**								41.07	143.54	51.14	-82.05	***37.54***	***n/a***
	Corn								-133.25	-68.70	-103.45	-21.55	***-64.56***	***n/a***
	Sunf								-80.50	-150.76	49.36	-56.20	***-52.53***	***n/a***
	S. Bar								-77.88	-16.10	110.31	-78.07	***5.38***	***n/a***
	Ave Inc.								-62.64	-23.00	26.84	-59.46	***-18.54***	***n/a***
6a	**W Wht-a**								21.44	194.41	83.14	-70.45	***69.03***	***n/a***
	W Wht-b								-8.47	93.98	69.06	-239.82	***-25.59***	***n/a***
	Saff								-48.60	-93.95	287.37	78.23	***90.55***	***n/a***
	Dry Pea								-20.98	15.15	51.52	-60.44	***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	***85.16***	***n/a***
	W Wht-b								22.31	118.36	68.49	-238.94	***-17.36***	***n/a***
	Saff								-53.29	-37.39	261.11	86.87	***103.53***	***n/a***
	H. Vetch								-96.51	-108.38	-146.20	-211.33	***-155.30***	***n/a***
	Ave Inc.								-22.75	39.58	89.97	-117.53	***+4.01***	***n/a***
10	**WWht (07-09)**									174.58	-15.21	-162.87	***-1.16***	***n/a***
	Mil(07-09)									*-19.53*	*-118.60*	-179.39	***- 105.84***	***n/a***
	CP (07-08)									-22.84	-171.63			
	DP (09)											-64.72	***- 86.39***	***n/a***
	Ave Inc.									44.07	-101.81	-135.66	***- 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	***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	***-62.61***	***-49.45***
	Millet	-27.85	13.60	-19.28	16.85	-87.98	-35.30	-9.53	-52.99	8.40	-50.06	-129.42	***-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	***-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"**		

Note: No Federal Government farm payments or crop insurance are calculated into these values. LDP is included where applicable.

2009 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 starter fertilizer (10-34-0) on September 18, 2008. Soil conditions were dry. Precipitation in October was 1.12" for the month. Winter wheat development was limited swollen kernels to about 1-2 leaf-stage resulting in poor stands late in the fall which led to winter-kill of the crop. Winter-kill ratings were done on March 22, 2009. Due to winter kill the fallow wheat was replanted to spring wheat (Traverse) on April 22, 2009. April had 1.62" rainfall for the month. May received .90" and June at 1.91". July received 2.50" rain and August was at 1.81" rain for this last summer. The relatively higher rainfall received from April to June helped the winter and spring wheat crops along.

Recrop Winter Wheat- was planted to Overland Hard Red Winter Wheat with a JD 750 no-till drill plus liquid starter fertilizer on September 24, 2008. Soil conditions were dry but there was good stubble protection for the seedling crop. Winter-kill was variable, depending on the rotation. Rotations 2a recrop, Rotation 3, Rotation 4, Rotation 5a, and Rotation 11 had adequate stands in the spring so replanting was not done on them.

Rotation 2A planted on chemical fallow ground had no stubble protection. It had extensive winter-kill. Rotations 6a and 9a following the dry pea and hairy vetch crops respectively had inadequate stubble protection and thus froze out. Winter wheat planted on winter wheat stubble in rotations 6a and 9a had adequate wheat stands in the spring but had heavy infestations of downy brome so the plots were sprayed out and replanted to spring wheat. All four series of wheat in 6a and 9a were sprayed in the fall of 2008 in anticipation of downy brome pressure. However, winds to 70 mph shortly after spraying, blew nearly all of the pea and hairy vetch stubble away, removing the Olympus chemical from the plots. The second year wheat of both rotations 6a and 9a also had downy brome pressure even after being sprayed in the fall. This indicated that the downy brome came later, probably in the spring of the year and that the Olympus was not effective at that time. Downy brome continues to be an ongoing problem in winter wheat in rotations 6a and 9a. Rotation 10a had winter wheat planted back on dry pea stubble. It had winter-kill on part of the plots, so the plot was recropped to spring wheat. A borderline stand of winter wheat plot was left in Rotation 10a to evaluate the yield of wheat without replanting. The results showed that, in 2009, we were much better off spraying out the weakened stand of winter wheat and replanting back to spring wheat.

Hairy Vetch- is a nitrogen fixing cover crop. Hairy vetch was planted into safflower stubble in Rotation 9a with a JD 750 no-till drill on September 24, 2008. Soil conditions were dry. Stands in the fall were poor due to dry soil conditions. Winter-kill evaluations in April indicated that a replant was inevitable. Hairy vetch at 20 lbs/acre and spring triticale at 60 lbs/acre rate were seeded on April 22, 2009. We know that hairy vetch typically gets much more growth when planted in the fall as compared to planting it in the spring so the spring triticale was added to help provide additional cover.

Spring Barley-Eslick feed barley was seeded into sunflower stalks of Rotation 5a with a JD 750 no-till drill plus starter fertilizer on April 22, 2009. Soil moisture levels were good at planting time. Barley stands were excellent this year. Grain yield was at 56.6 bushels per acre in 2009.

Dry Peas-were planted in rotations 6a and 10a. Admiral peas were planted with a JD 750 drill on April 22, 2009. Rhizobium inoculants was applied to the seed at planting. Peas were grown for grain. Growing conditions including soil moisture were good this year for peas but the yields were down.

Safflower- Nitrogen and phosphorus fertilizer is injected the fall before planting. The variety Finch was planted on May 4, 2009 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 were at

60 degrees at planting time (10am) this year. Stands were excellent and yields were the highest we have seen since starting the study in 1994. No seed treatments, insecticides, or fungicides were used during this year's crop. One plot was delayed (15 days) in being planted until May 19, 2009 for comparison. It yielded 400 pounds less than the earlier seeded safflower.

Corn- Nitrogen and phosphorus fertilizer is injected the fall before planting. Atrazine was applied in October of 2008. 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 May 4, 2009. Seeding rate was at 15,450 with a theoretical final stand of 13,900 plants per acre. Our actual stand counts in the field are as follows: Rotation 2a; 12,350, Rotation 5a; 11,450, Rotation 11; 10,800 plants per acre. Seeding conditions were good and we had decent subsoil moisture recharge. Roundup was sprayed one time during the cropping season on June 23, 2009. Corn yields were good this year at 75-90 bushels per acre.

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 starter fertilizer on June 17, 2009. This hay millet was weedier than we like to see. We should have delayed planting for another week and planted it the same time as the proso millet. Stink grass was a problem in this segment of Rotation 2a. It was hayed off, so the weed seed load was not a problem but the stink grass did compete with the hay millet for moisture and nutrients.

Proso Millet- Horizon Proso Millet was seeded at 18 pounds per acre plus starter fertilizer with a JD 750 no-till drill on June 24, 2009. 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 23, 2009.
The summer of 2009 was cooler than normal so weed germination and crop development were slow with the proso millet crop. Rotations 3 and 10a had weak yields this year. Rotations 4 and 11 had decent yields.

Sunflowers- Nitrogen and phosphorus is injected the fall before planting. Sunflower planting was first tried on June 2, 2009. The ground was so hard particularly in Rotation 2a that the planter would not penetrate the ground. Rotation 5a would have seeded on June 2 but it was decided to wait on it and plant both rotations the same day. The hard crusted layer is from tillage 2 years earlier in Rotation 2a.

We received .3" of rain on June 4th that loosened up the ground. Pannar 8560 NS/CL/Cruiser was planted on June 5, 2009 with a JD 7100 planter at 20" row spacing. This year we went to a size 4 seed which is larger than we had in previous years. Seedling vigor was better with the larger seed size. Rotation 2a was very dry at planting on the surface but had better subsurface moisture than Rotation 5a.

Appendix 1 Detailed Cultural Practices for Each Rotation in 2009

Rotation 1
WINTER WHEAT / SUMMER FALLOW

Cost / A.	2009 Winter Wheat
$7.50	-Pre-plant preparation work plots with 12" sweeps – September 18, 2008
77.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds / acre. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on September 18, 2008.
40.50	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 50 lb N / Acre rate (16.7 gal/Acre). – March 22, 2009.
54.88	-Extensive winter kill on Overland HRW. Replanted w/ JD 750 drill + 10-34-0 @ 6 gpA rate to Traverse Hard Red Spring Wheat @ 1,400,000 seeds per acre , 15,090 seeds per pound, 92.7 pounds of seed per acre rate. –April 22, 2009
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 27, 2009.
25.00	-Harvest 44.5 bu/A spring wheat – August 5, 2009 Test weight – 58.8 lb / bu (Protein Content – 14.3 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$273.69	Total Cost of Wheat Production (**Spring** Wheat)

Rotation 1
WINTER WHEAT / *SUMMER FALLOW*

Cost / A.	2009 Summer Fallow
$13.53	-Spray w / 16 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate. 8 gpA rate. – October 24, 2008.
18.13	-Spray w / 24 oz Roundup Original Max + 28-0-0 @ 10% as a carrier to improve efficiency and reduce drift. 8 gpA –April 27, 2009
20.41	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate + 8 oz Banvel 4L. 8 gpA – June 8, 2009.
7.50	-Work w / 24" sweeps. – June 23, 2009.
7.50	-Work w / 12" sweeps. – August 4, 2009.
46.00	-Land Charges 2009
$113.07	Cost of Summer Fallow

Rotation 1 SUMMARY 2009

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$235.85	-	$273.69	=	$ - 37.84	
Fallow	$ 0.00	-	$113.07	=	$ -113.07	
	$ 235.85	-	$386.76	=	$-150.91	÷ 2 = **$ - 75.46**

$ - 75.46 Average Income / acre for Rotation 1 - 2009

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Rotation 2a

WINTER WHEAT-A / SUNFLOWER /HAY MILLET / WINTER WHEAT-B / CORN / FALLOW

Cost / A.	2009 Winter Wheat-A
$16.89	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
54.30	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 70 lb N / Acre rate (23.3 gal/Acre). – March 22, 2009.
54.88	-Extensive winter kill on Overland HRW. Replanted w/ JD 750 drill + 10-34-0 @ 6 gpA rate to Traverse Hard Red Spring Wheat @ 1,400,000 seeds per acre , 15,090 seeds per pound, 92.7 pounds of seed per acre rate. –April 22, 2009
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 27, 2009.
25.00	-Harvest 56.2 bu/A spring wheat – August 5, 2009 Test weight – 58.8 lb / bu (Protein Content – 14.3 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$300.88	Total Cost of Wheat-a Production (**Spring** Wheat)

Rotation 2a

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

Cost / A.	2009 Sunflowers
$114.74	-Inject 28-0-0 + 10-34-0 (80 lb N / 20 lb P2O5) with injector implement set @ 20" row spacing. – October 15, 2008.
13.53	-Spray w / 16 oz Roundup Original Max + liquid ammonium Sulfate @ 50 ml / gal. 8 gpA spray rate. – October 24, 2008.
27.42	-Spray w / 24 oz Roundup Original Max + liquid ammonium Sulfate @ 50 ml / gal + 4 oz / acre Spartan75 df. 10 gpA spray rate. – May 27, 2009.
30.42	-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 5, 2009.
25.00	-Harvest 2294 lb / Acre Sunflowers – October 26, 2009. Test weight – 26.7 lb / bushel
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$257.61	Total Cost of Sunflower Production

Rotation 2a

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

Cost / A.	2009 Hay Millet
$40.50	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 50 lb N / Acre rate (16.7 gal/Acre). – March 22, 2009.
20.25	-Spray w / 32 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –May 27, 2009.
46.14	-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 17, 2009.
68.66	-Swath & bale 2.5 Tons / Acre Hay Millet @ 13.5% Moisture – September 9, 2009.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$222.05	Total Cost of Hay Millet Production

Hay Millet Quality and Yield - 2008.

NDF %	ADF %	RFV	Crude Protein %	Yield (Tons/A)
63.0	32.2	94	5.2	2.5

Rotation 2a

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

Cost / A.	2009 Winter Wheat –B
$16.89	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate . 8 gpA –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
68.10	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 90 lb N / Acre rate (30.0 gal/Acre). – March 21, 2009.
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 18, 2009.
25.00	-Harvest 37.5 bu/A winter wheat – July 27, 2009 Test weight – 62.3 lb / bu (Protein Content – 10.8 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$259.80	Total Cost of Winter Wheat-B Production

Rotation 2a

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

Cost / A.	2009 Corn
$114.74	-Injected 28-0-0 + 10-34-0 (80 lbN/acre plus 20 lb P2O5 per acre). 20 inch row spacing. –October 15, 2008.
18.91	- Spray w / Atrazine 90df@ 2 lbsai/acre + 16 oz Roundup Original Max + Liquid Ammonium Sulfate. 10 gpA spray rate. – October 24, 2008.
34.41	-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. - May 4, 2009.
16.89	- Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal. 8 gpA spray rate. – June 23, 2009.
25.00	-Harvest 88.8 bushels / acre corn – October 26, 2009. Test weight – 58.5 lbs/bu.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$256.45	-Total Cost of Corn Production

Rotation 2a

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

Cost / A.	2009 Summer Fallow
$24.97	-Planted w / JD 750 drill w/ 10” row spacing to 4 way mix of: flax (20 lbs/a rate), Lentil (7 lbs/a rate) + innoculum, Canola (2 lbs/a rate), Camelina (.5 lb/a rate). – April 22, 2009
20.41	-Spray w / 24 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate + 8 oz Banvel 4L. 8 gpA – June 23, 2009.
15.45	-Spray w / 16 oz Roundup Original Max + 50 ml/gal Liquid Ammonium Sulfate + 12 oz LV6. 8 gpA – August 1, 2009.
46.00	-Land Charges 2009
$106.83	Cost of Summer Fallow

Rotation 2a SUMMARY 2009

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat-A	$ 297.86	-	$ 386.34 ($300.88 + $85.46)	=	$ -88.48	
Sunflower	$ 252.34	-	$ 278.98 ($257.61 + $21.37)	=	$ -26.64	
Hay Millet	$ 137.50	-	$ 222.05	=	$ - 84.55	
Winter Wheat-B	$ 145.50	-	$ 259.80	=	$-114.30	
Corn	$ 288.60	-	$ 256.45	=	$ 32.15	
Fallow	$ 0.00	-	$ 0.00*	=	$ 0.00*	
	$1121.80	-	$1403.62	=	$-281.82	÷ 6 = **$-46.97**

***The expense of the fallow ($106.83) was split 80% to the Winter Wheat-A ($85.46) and 20% to the Sunflowers ($21.37).

$ - 46.97 Average Income / acre for Rotation 2a – 2009

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Rotation 3

WINTER WHEAT / SAFFLOWER / MILLET

Cost / A.	2009 Winter Wheat
$16.89	-Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
68.10	-Top dressed with 28-0-0 @ 90 lb N / acre (30 gal/a). – March 21, 2009.
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 18, 2009.
25.00	-Harvest 42.6 bu/A winter wheat – July 27, 2009 Test weight – 62.0 lb / bu (Protein content – 11.4 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$259.80	Total Cost of Winter Wheat Production

Rotation 3

WINTER WHEAT / *SAFFLOWER* / MILLET

Cost / A.	2009 Safflower
$22.17	-Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml / gallon + 12 oz LV6 / acre. 10 gpA spray rate. – August 6, 2008.
95.58	-Injected 28-0-0 +10-34-0 (60 lb N/acre + 20 lb P2O5 / acre) - October 15, 2008.
13.53	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –October 24, 2008.
30.99	-Spray w / 24 oz Roundup Original Max + liquid ammonium sulfate @ 50 ml / gal + 3 ½ pints Prowl H2O. 8 gpA spray rate. – April 27, 2009.
16.50	-Plant to Finch w / JD 7100 planter @ 210,000 seeds/acre rate. (20 lbs/acre). – May 4, 2009.
25.00	-Harvest 1744 lb / Acre Safflowers –Test weight – 45.4 lb / bushel. - September 25, 2009.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$250.27	Total Cost of Safflower Production

Rotation 3

WINTER WHEAT / SAFFLOWER / *MILLET*

Cost / A.	2009 Proso Millet
$26.70	-Top dressed with 28-0-0 @ 30 lb N / acre (10.0 gal/a). – March 21, 2009.
18.13	-Spray w / 24 oz Roundup Original Max + 28-0-0 @ 10% as a carrier to improve efficiency and reduce drift. 8 gpA –April 27, 2009
18.65	-Sprayed w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate + 4 oz/A Banvel 4L . 8 gpA spray rate. – May 27, 2009.
16.89	-Sprayed w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate . 8 gpA spray rate. – June 23, 2009.
45.66	-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, 2009.
25.00	-Harvest 540 lb / acre Test weight- 57.6 lbs/bushel – September 30, 2009.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$197.53	Total Cost of Millet Production

Rotation 3 SUMMARY 2009

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$178.49	-	$259.80	=	$ - 81.31	
Safflower	$313.92	-	$250.27	=	$ 63.65	
Millet	$ 28.35	-	$197.53	=	$ -169.18	
	$520.76	-	$707.60	=	$ -186.84	÷ 3 = **$ - 62.28**

$ - 62.28 Average Income / acre for Rotation 3 – 2009

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Rotation 4

WINTER WHEAT / MILLET

Cost / A.	2009 Winter Wheat
$16.89	-Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
19.66	-Spray w / Olympus WG @ .9 oz / acre plus Induce @ 18 ml / gal + 28-0-0 @ 10% of the carrier to enhance efficiency of Olympus. 10 gpA spray rate. - October 24, 2008
54.30	-Top dressed with 28-0-0 @ 70 lb N / acre (23.3 gal/a). – March 22, 2009.
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 18, 2009.
25.00	-Harvest 25.9 bu/A winter wheat – July 27, 2009 Test weight – 60.6 lb / bu (Protein content – 11.7 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$265.66	Total Cost of Winter Wheat Production

Rotation 4

WINTER WHEAT / *MILLET*

Cost / A.	2009 Proso Millet
$22.17	-Spray w / 32 oz Roundup Original Max + liquid ammonium sulfate + 12 oz LV6/a. - 8 gpA spray rate. – August 6, 2008.
26.70	-Top dressed with 28-0-0 @ 30 lb N / acre (10.0 gal/a). – March 21, 2009.
18.13	-Spray w / 24 oz Roundup Original Max + 28-0-0 @ 10% as a carrier to improve efficiency and reduce drift. 8 gpA –April 27, 2009
18.65	-Sprayed w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate + 4 oz/A Banvel 4L . 8 gpA spray rate. – May 27, 2009.
16.89	-Sprayed w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate . 8 gpA spray rate. – June 23, 2009.
45.66	-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, 2009.
25.00	-Harvest 1149 lb / acre Test weight- 58.5 lbs/bushel – September 30, 2009.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$219.70	Total Cost of Millet Production

Rotation 4 SUMMARY 2009

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$110.33	-	$265.66	=	$ -155.33	
Millet	$ 60.32	-	$219.70	=	$ -159.38	
	$170.65	-	$485.36	=	$ - 314.71	÷ 2 = **$-157.35**

$ - 157.35 Average Income / acre for Rotation 4 – 2009

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Rotation 5a

WINTER WHEAT / CORN / SUNFLOWER / SPRING BARLEY

Cost / A.	2009 Winter Wheat
$22.17	-Spray w / 32 oz Roundup Original Max + liquid ammonium sulfate + 12 oz LV6/a. - 8 gpA spray rate. – August 6, 2008.
16.89	-Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
54.30	-Top dressed with 28-0-0 @ 70 lb N / acre (23.3 gpA). – March 22, 2009.
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 18, 2009.
25.00	-Harvest 42.3 bu/A winter wheat – July 27, 2009 Test weight – 62.3 lb / bu (Protein content - 12.0 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$268.17	Total Cost of Winter Wheat Production

Rotation 5a

WINTER WHEAT / *CORN* / SUNFLOWER / SPRING BARLEY

Cost/A.	2009 Corn
$22.17	-Spray w / 32 oz Roundup Original Max + liquid ammonium sulfate + 12 oz LV6/a. - 8 gpA spray rate. – August 6, 2008.
114.74	-Injected 28-0-0 + 10-34-0 (80 lbN/acre plus 20 lb P2O5 per acre). 20 inch row spacing. –October 15, 2008.
17.61	- Spray w / Atrazine 90df @ 1 1/2 lbs ai / acre + 16 oz Roundup Original Max + Liquid Ammonium Sulfate. 10 gpA spray rate. – October 24, 2008.
34.41	-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. - May 4, 2009.
16.89	- Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal. 8 gpA spray rate. – June 23, 2009.
25.00	-Harvest 78.7 bushels / acre corn – October 26, 2009. Test weight – 57.4 lbs / bu.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$277.32	Total Cost of Corn Production

Rotation 5a

WINTER WHEAT / CORN / *SUNFLOWER* / SPRING BARLEY

Cost / A.	2009 Sunflower
$114.74	-Inject 28-0-0 + 10-34-0 (80 lb N / 20 lb P2O5) with injector implement set @ 20" row spacing. – October 15, 2008.
27.42	-Spray w / 24 oz Roundup Original Max + liquid ammonium Sulfate @ 50 ml / gal + 4 oz / acre Spartan75 df. 10 gpA spray rate. – May 27, 2009.
30.42	-Plant to Pannar 8560 NS/CL @ 16,600 seeds / acre, 20" rows, w / JD 7100 planter. Note: Seed was treated w / Cruiser for wire worm control. – June 5, 2009.
25.00	-Harvest 1708 lb / Acre Sunflowers – October 26, 2009. Test weight – 28.5 lb / bushel
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$244.08	Total Cost of Sunflower Production

Rotation 5a

WINTER WHEAT / CORN / SUNFLOWER / *SPRING BARLEY*

Cost / A.	2009 Spring Barley
$68.10	-Top dressed with 28-0-0 @ 90 lb N / acre (30 gpA). – March 21, 2009.
54.03	-Plant to Eslick Barley @ 69.7 lb or 1,219,680 seeds (1.45 bushels) / acre rate. Seeded w / JD 750 drill. Starter fertilizer 10-34-0 was applied at 6 gallons per acre rate. – April 22, 2009.
18.13	-Spray w / 24 oz Roundup Original Max + 28-0-0 as 10% carrier to heat up the mix and reduce drift. 8 gpA spray rate. – April 27, 2009.
21.96	-Spray barley with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 27, 2009.
25.00	-Harvest 56.6 bu/A Barley Test weight –47.6 lb / bu (Protein content - 12.6 %) – August 10, 2009.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$233.72	Total Cost of Spring Barley Production

Rotation 5a SUMMARY 2009

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$186.12	-	$268.17	=	$ - 82.05	
Corn	$255.77	-	$277.32	=	$ - 21.55	
Sunflower	$187.88	-	$244.08	=	$ - 56.20	
Spring Barley	$155.65	-	$233.72	=	$ - 78.07	
	$ 785.42	-	$1023.29	=	$ - 237.87	÷ 4 = **$ - 59.46**

$ - 59.46 Average Income / acre for Rotation 5a - 2009

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Rotation 6a

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

Cost / A.	2009 Winter Wheat – B
$22.17	-Spray w / 32 oz Roundup Original Max + liquid ammonium sulfate + 12 oz LV6/a. - 8 gpA spray rate. – August 6, 2008.
16.89	-Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
19.66	-Spray wheat with Olympus WG@ .9 oz / acre rate plus Induce @ 18 ml / gallon + 28-0-0 as 10% carrier to heat up the mix and reduce drift.. 10 gpA spray rate. – October 24, 2008.
68.10	-Top dressed with 28-0-0 @ 90 lb N / acre (30 gpA). – March 21, 2009.
54.88	-Heavy downy brome pressure!!! Replanted w/ JD 750 drill + 10-34-0 @ 6 gpA rate to Traverse Hard Red Spring Wheat @ 1,400,000 seeds / acre rate. 15,090 seeds per pound , 92.7 pounds of seed per acre rate. – April 24, 2009.
18.13	-Spray w / 24 oz Roundup Original Max + 28-0-0 as 10% carrier to heat up the mix and reduce drift. 8 gpA spray rate. – April 27, 2009.
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 27, 2009.
25.00	-Harvest 25.2 bu/A **Spring** Wheat – August 5, 2009 Test weight – 59.6 lb / bu (Protein content -14.5 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$374.64	Total Cost of Wheat –B Production (**Spring** Wheat)

Rotation 6a

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

Cost / A.	2009 Safflower
$22.17	-Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml / gallon + 12 oz LV6 / acre. 10 gpA spray rate. – August 6, 2008.
95.58	-Injected 28-0-0 +10-34-0 (60 lb N/acre + 20 lb P2O5 / acre) - October 15, 2008.
13.53	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –October 24, 2008.
30.99	-Spray w / 24 oz Roundup Original Max + liquid ammonium sulfate @ 50 ml / gal + 3 ½ pints Prowl H2O. 8 gpA spray rate. – April 27, 2009.
16.50	-Plant to Finch w / JD 7100 planter @ 210,000 seeds/acre rate. (20 lbs/acre). – May 4, 2009.
25.00	-Harvest 1825 lb / Acre Safflowers –Test weight – 44.7 lb / bushel. - September 25, 2009.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$250.27	Total Cost of Safflower Production

Rotation 6a

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

Cost / A.	2009 Dry Pea
$51.17	-Plant to Admiral peas @ 330,000 seeds per acre (172 lbs/A) (1918 seeds/lb)+ 5lb / acre granular innoculum w / JD 750 drill. No starter fertilizer added. – April 22, 2009.
27.42	-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 27, 2009.
28.00	-Harvest 1164 lb or 19.4 bushels / Acre Admiral peas (yellow seed) – August 10, 2009. Test weight – 60.7 lb / bushel
46.00	-Land Charges 2009
$152.59	Total Cost of Dry Pea Production

Rotation 6a

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

Cost / A.	2009 Winter Wheat – A
$22.17	-Spray w / 32 oz Roundup Original Max + liquid ammonium sulfate + 12 oz LV6/a. - 8 gpA spray rate. – August 6, 2008.
16.89	-Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. (13,190 seeds per pound) Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
19.66	-Spray wheat with Olympus WG@ .9 oz / acre rate plus Induce @ 18 ml / gallon + 28-0-0 as 10% carrier to heat up the mix and reduce drift.. 10 gpA spray rate. – October 24, 2008.
40.50	-Top dressed with 28-0-0 @ 50 lb N / acre (16.6 gpA). – March 22, 2009.
54.88	- Extensive winter-kill on Overland HRW. Replanted w/ JD 750 drill + 10-34-0 @ 6 gpA rate to Traverse Hard Red Spring Wheat @ 1,400,000 seeds / acre rate. 15,090 seeds per pound , 92.7 pounds of seed per acre rate. – April 24, 2009.
18.13	-Spray w / 24 oz Roundup Original Max + 28-0-0 as 10% carrier to heat up the mix and reduce drift. 8 gpA spray rate. – April 27, 2009.
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 27, 2009.
25.00	-Harvest 51.7 bu/A **Spring Wheat** – August 5, 2009 Test weight – 58.9 lb / bu (Protein content -14.4 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$347.04	Total Cost of Wheat-A Production (**Spring** Wheat)

Rotation 6a SUMMARY 2009

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat-B	$134.82	-	$374.64	=	$ - 239.82	
Safflower	$328.50	-	$250.27	=	$ 78.23	
Dry pea	$ 92.15	-	$152.59	=	$ - 60.44	
Winter Wheat-A	$276.59	-	$347.04	=	$ - 70.45	
	$832.06	-	$1124.54	=	$ - 292.48	÷ 4 = **$ - 73.12**

$ - 73.12 Average Income / acre for Rotation 6a - 2009

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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.	2009 Winter Wheat –B
$22.17	-Spray w / 32 oz Roundup Original Max + liquid ammonium sulfate + 12 oz LV6/a. - 8 gpA spray rate. – August 6, 2008.
16.89	-Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
19.66	-Spray wheat with Olympus WG@ .9 oz / acre rate plus Induce @ 18 ml / gallon + 28-0-0 as 10% carrier to heat up the mix and reduce drift.. 10 gpA spray rate. – October 24, 2008.
54.30	-Top dressed with 28-0-0 @ 70 lb N / acre (23.3 gpA). – March 22, 2009.
54.88	-Heavy downy brome pressure!!! Replanted w/ JD 750 drill + 10-34-0 @ 6 gpA rate to Traverse Hard Red Spring Wheat @ 1,400,000 seeds / acre rate. 15,090 seeds per pound , 92.7 pounds of seed per acre rate. – April 24, 2009.
18.13	-Spray w / 24 oz Roundup Original Max + 28-0-0 as 10% carrier to heat up the mix and reduce drift. 8 gpA spray rate. – April 27, 2009.
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 27, 2009.
25.00	-Harvest 23.0 bu/A **Spring** Wheat – August 5, 2009 Test weight – 58.2 lb / bu(Protein content -14.3 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$360.84	Total Cost of Wheat–B (**Spring** Wheat)

Rotation 9a

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

Cost / A.	2009 Safflower
$22.17	-Spray w / 32 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml / gallon + 12 oz LV6 / acre. 10 gpA spray rate. – August 6, 2008.
95.58	-Injected 28-0-0 +10-34-0 (60 lb N/acre + 20 lb P2O5 / acre) - October 15, 2008.
13.53	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –October 24, 2008.
30.99	-Spray w / 24 oz Roundup Original Max + liquid ammonium sulfate @ 50 ml / gal + 3 ½ pints Prowl H2O. 8 gpA spray rate. – April 27, 2009.
16.50	-Plant to Finch w / JD 7100 planter @ 210,000 seeds/acre rate. (20 lbs/acre). – May 4, 2009.
25.00	-Harvest 1873 lb / Acre Safflowers –Test weight – 44.6 lbs / bushel. - September 25, 2009.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$250.27	Total Cost of Safflower Production

Rotation 9a

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

Cost / A.	2009 Hairy Vetch / Spring Triticale
$16.89	-Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –September 15, 2008.
45.20	-Plant to Hairy Vetch @ (20 lb/A) + 5 lb / acre granular pea / lentil innoculum w / JD 750 drill. – September 24, 2008. -Extensive Winter-Kill !!!
64.70	Reseeded w / JD 750 drill to Hairy Vetch @ (20 lb/A) + 5 lb / acre granular pea/lentil innoculum + Spring Triticale @ 60 lbs / acre rate. – April 22, 2009.
18.13	-Spray w / 24 oz Roundup Original Max + 28-0-0 @ 10% as a carrier to improve efficiency and reduce drift. 8 gpA –April 27, 2009
20.41	-Spray to terminate hairy vetch w / 24 oz Roundup Original Max + 50 ml / gal liquid ammonium sulfate + 8 oz / A Banvel 4L. 8 gpA spray rate. – June 23, 2009.
46.00	-Land Charges 2009
$211.33	Total Cost of Hairy Vetch / Spring Triticale Cover Crop Production

Rotation 9a

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

Cost / A.	2009 Winter Wheat-A
$22.17	-Spray w / 32 oz Roundup Original Max + liquid ammonium sulfate + 12 oz LV6/a. - 8 gpA spray rate. – August 6, 2008.
16.89	-Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. (13,190 seeds per pound) Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
19.66	-Spray wheat with Olympus WG@ .9 oz / acre rate plus Induce @ 18 ml / gallon + 28-0-0 as 10% carrier to heat up the mix and reduce drift.. 10 gpA spray rate. – October 24, 2008.
40.50	-Top dressed with 28-0-0 @ 50 lb N / acre (16.6 gpA). – March 22, 2009.
54.88	- Extensive winter-kill on Overland HRW. Replanted w/ JD 750 drill + 10-34-0 @ 6 gpA rate to Traverse Hard Red Spring Wheat @ 1,400,000 seeds / acre rate. 15,090 seeds per pound , 92.7 pounds of seed per acre rate. – April 24, 2009.
18.13	-Spray w / 24 oz Roundup Original Max + 28-0-0 as 10% carrier to heat up the mix and reduce drift. 8 gpA spray rate. – April 27, 2009.
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 27, 2009.
25.00	-Harvest 44.5 bu/A **Spring Wheat** – August 5, 2009 Test weight – 58.2 lb / bu (Protein content -14.6 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$347.04	Total Cost of Wheat-A Production (**Spring** Wheat)

Rotation 9a SUMMARY 2009

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat-B	$121.90	-	$360.84	=	$ - 238.94	
Safflower	$337.14	-	$250.27	=	$ 86.87	
Hairy Vetch	$ 0.00	-	$211.33	=	$ - 211.33	
Winter Wheat-A	$240.30	-	$347.04	=	$ - 106.74	
	$699.34	-	$1169.48	=	$ - 470.14	÷ 4 = **$ -117.53**

$ - 117.53 Average Income / acre for Rotation 9a – 2009

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Rotation 10

WINTER WHEAT / MILLET / DRY PEA

Cost / A.	2009 Winter Wheat
$16.89	-Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. (13,190 seeds per pound) Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
68.10	-Top dressed with 28-0-0 @ 90 lb N / acre (30.0 gpA). – March 21, 2009.
54.88	- Extensive winter-kill on Overland HRW. Replanted w/ JD 750 drill + 10-34-0 @ 6 gpA rate to Traverse Hard Red Spring Wheat @ 1,400,000 seeds / acre rate. 15,090 seeds per pound , 92.7 pounds of seed per acre rate. – April 24, 2009.
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 18, 2009.
25.00	-Harvest 34.9 bu/A **Spring Wheat** – August 5, 2009 Test weight – 59.5 lb / bu (Protein content -12.9%)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$314.68	Total Cost of Wheat Production

Rotation 10

WINTER WHEAT / *MILLET* / DRY PEA

Cost / A.	2009 Proso Millet
$22.17	-Spray w / 32 oz Roundup Original Max + liquid ammonium sulfate + 12 oz LV6/a. - 8 gpA spray rate. – August 6, 2008.
13.53	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –October 24, 2008.
18.13	-Spray w / 24 oz Roundup Original Max + 28-0-0 @ 10% as a carrier to improve efficiency and reduce drift. 8 gpA –April 27, 2009
18.65	-Sprayed w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate + 4 oz/A Banvel 4L . 8 gpA spray rate. – May 27, 2009.
16.89	-Sprayed w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate . 8 gpA spray rate. – June 23, 2009.
45.66	-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, 2009.
25.00	-Harvest 517 lb / acre Test weight - 58.7 lbs/bushel – September 30, 2009.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$206.53	Total Cost of Proso Millet Production

Rotation 10

WINTER WHEAT / MILLET / *DRY PEA*

	2009 Dry Peas
$51.17	-Plant to Admiral Peas @ 330,000 seeds per acre (172 lbs/A) (1918 seeds/lb)+ 5lb / acre granular innoculum w / JD 750 drill. No starter fertilizer added. – April 22, 2009.
27.42	-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 27, 2009.
28.00	-Harvest 1110 lb or 18.5 bushels / Acre Admiral peas (yellow seed) – August 10, 2009. Test weight – 61.2 lb / bushel
46.00	-Land Charges 2009
$152.59	Total Cost of Dry Pea Production

Rotation 10 SUMMARY 2009

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$151.81	-	$314.68	=	$-162.87	
Millet	$ 27.14	-	$206.53	=	$-179.39	
Dry Pea	$ 87.87	-	$152.59	=	$- 64.72	
	$ 266.82	-	$673.80	=	$- 406.98	÷ 3 = **$-135.66**

$ - 135.66 Average Income / acre for Rotation 10 - 2009

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Rotation 11

WINTER WHEAT / CORN / MILLET

Cost / A.	2009 Winter Wheat
$16.89	-Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate. 8 gpA spray rate. –September 15, 2008.
81.35	-Plant to Overland @ 72.7 lbs or 960,000 seeds/acre. (13,190 seeds per pound) Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 24, 2008.
68.10	-Top dressed with 28-0-0 @ 90 lb N / acre (30.0 gpA). – March 21, 2009.
21.96	-Spray wheat with 27 oz / acre Starane NXT + Penetrate II @ 6 oz / acre. 10 gpA spray rate. – May 18, 2009.
25.00	-Harvest 48.3 bu/A Winter Wheat – July 27, 2009 Test weight – 63.1 lb / bu (Protein content -11.5 %)
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$259.80	Total Cost of Winter Wheat Production

Rotation 11

WINTER WHEAT / *CORN* / MILLET

Cost / A.	2009 Corn
$22.17	-Spray w / 32 oz Roundup Original Max + liquid ammonium sulfate + 12 oz LV6/a. - 8 gpA spray rate. – August 6, 2008.
114.74	-Injected 28-0-0 + 10-34-0 (80 lbN/acre plus 20 lb P2O5 per acre). 20 inch row spacing. –October 15, 2008.
18.91	- Spray w / Atrazine 90df@ 2 lbsai/acre + 16 oz Roundup Original Max + Liquid Ammonium Sulfate. 10 gpA spray rate. – October 24, 2008.
34.41	-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. - May 4, 2009.
16.89	- Spray w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate @ 50 ml/gal. 8 gpA spray rate. – June 23, 2009.
25.00	-Harvest 75.0 bushels / acre corn Test weight – 56.5 lbs/bu. – October 26, 2009.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$278.62	Total Cost of Corn Production

Rotation 11

WINTER WHEAT / CORN / *MILLET*

Cost / A.	2009 Proso Millet
$26.70	-Top dressed with 28-0-0 @ 30 lb N / acre (10.0 gal/a). – March 21, 2009.
18.65	-Sprayed w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate + 4 oz/A Banvel 4L . 8 gpA spray rate. – May 27, 2009.
16.89	-Sprayed w / 24 oz Roundup Original Max + Liquid Ammonium Sulfate . 8 gpA spray rate. – June 23, 2009.
45.66	-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, 2009.
25.00	-Harvest 952 lb / acre Test weight- 57.6 lbs/bushel – September 30, 2009.
.50	-Soil Sampling / acre
46.00	-Land Charges 2009
$179.40	Total Cost of Proso Millet Production

Rotation 11 SUMMARY 2009

Crop	Income		Expense		Net Income Per Acre	
Winter Wheat	$202.37	-	$259.80	=	$ - 57.43	
Corn	$243.75	-	$278.62	=	$ - 34.87	
Millet	$ 49.98	-	$179.40	=	$ -129.42	
	$496.10	-	$717.82	=	$ -221.72	÷ 3 = **$ - 73.90**

$ - 73.90 Average Income / acre for Rotation 11 - 2009

****

COST OF INPUTS – 2009

SEED

Overland Winter Wheat	$ 20.00 / bushel
Winter Triticale	$ 19.64 / bushel
Spring Triticale	$ 19.50 / bushel
Eslick Barley	$ 9.00 / bushel
Traverse Spring Wheat	$ 9.00 / bushel
Finch Safflower	$ 17.50 / 50 lbs
Dekalb Econo Brand RR/YG Corn (80,000 kernels)	$129.00 / bag
Pannar 8560 NS / CL + Cruiser Sunflower – Size 4 (200,000 seeds)	$252.00 / bag
Golden German Hay Millet	$ .43 / lb
Horizon Millet	$ .26 / lb
Hairy Vetch	$ 1.50 / lb
Admiral field peas (yellow)	$12.50/bushel
Flax	$ .22/lb
Lentil	$ .55/lb
Canola	$ .55/lb
Camelina	$1.25/lb

HERBICIDES

(From Warne Chemical, Rapid City, SD – Dec, 2008)

Assure II	$142.22 / gal
Beyond 1L	$593.00 / gal
Bronate (Brox M)	$ 39.58 / gal
Roundup Original Max	$ 53.60 / gal
Atrazine 90df	$ 2.33 / lb
Harmony GT	$ 14.90 / oz
Harmony Extra (Affinity TM)	$ 15.20 / oz
Ally	$ 24.21 / oz
Treflan 10% granules	$ 0.83 / lb
2,4D Ester LV6	$ 21.32 / gal
Clarity (dicamba)	$ 56.00 / gal
Poast	$ 69.30 / gal
Spartan 75df	$ 41.32 / lb ($2.58 /oz)
Spartan 4F	$405.76 / gal($3.17/oz)
Starane	$111.36 / gal
Starane NXT	$ 72.45/gal
Maverick	$ 14.80 / oz
Olympus WG	$ 10.94 / oz
Olympus Flex	$ 4.03 / oz
Aim	$181.40 / quart ($5.66 / oz)
Crop Oil	$ 7.80 / gal
Penetrate II	$ 18.50 / gal
Induce	$ 20.00 /gal ($.16/oz)
Ammonium Sulfate	$ 7.73 / gal
Prowl H2O	$ 32.24 / gal

INSECTICIDES

Lorsban 4E	$ 41.85 / gallon

FUNGICIDES

Tilt	$419.00 / gallon
Headline	$292.90 / gallon

FERTILIZER

(Fall 2008 Prices)

(Johnson's Ranchers Supply,Wall, SD – Oct 2008)

10-34-0 $1200.00 / Ton ($7.02 / gallon)

(Warne Chemical, Rapid City, SD – Oct 15, 2008)

28-0-0 $534.80 / Ton ($2.84 / gallon) ($.95 /lb N)

(Spring 2009 Prices)

(Johnson's Ranchers Supply, Wall, SD – March11, 2009)

10-34-0 $740.00 / Ton ($4.33 / gallon)

(Warne Chemical, Rapid City, SD – March 23 , 2009)

28-0-0 $383.35 / Ton ($2.06 / gallon) ($.69 / lb N)

SEED TREATMENTS

Granular Inoculum for chickpeas	$55.95 / 40 lb bag
Vitavax/Thiram/RTU	$33.41 / gal
Raxil MDW	$87.80 / 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

Harvest Fee (wheat,barley,corn,sunf,saff, proso millet)	$25.00 / acre
Harvest Fee (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 2009 crop from Dakota Mill & Grain, Rapid City, SD - December 15, 2009)

Winter Wheat	See chart on next page.
Sunflower (oil-type)	$ 11.00 / cwt.
Corn #2 yellow	$ 3.25 / bu
Safflower	$ 18.00 / cwt
Proso Millet	$ 5.25 / cwt
Barley	$ 2.75 / bu
Field peas (yellow)	$ 4.75 / bu *
Field pea (green)	$ 6.50 / bu*

*(*price quote from SUNBIRD, INC. Huron, SD, Dec 17, 2009)*

HAY SALE VALUES

Golden German millet hay	$55.00 / ton

2009 Rotation Winter/Spring Wheat Protein Content by Rotation

Rot 1 – 14.2% SW	Rot 3 – 11.4% WW	Rot 6a-a -14.4% SW	Rot 9a-b – 14.2% SW
Rot 2a-a – 14.2% SW	Rot 4 – 11.6% WW	Rot 6a-b – 14.4% SW	Rot 10a – 12.8% SW
Rot 2a-b – 10.8% WW	Rot 5a – 12.0% WW	Rot 9a-a – 14.6% SW	Rot 11 – 11.4% WW

Winter Wheat Value Per Bushel with Protein Adjustment.
(Prices from Dakota Mill and Grain, Rapid City as of December 15, 2009)
(Average sale value for fall of 2009)

Protein Content	Winter Wheat $ / Bushel	Spring Wheat $ / Bushel
8.8%	$3.18	
9.0	$3.25	
9.2	$3.32	
9.4	$3.39	
9.6	$3.46	
9.8	$3.53	
10.0%	$3.60	$3.75
10.2	$3.67	$3.75
10.4	$3.74	$3.75
10.6	$3.81	$3.75
10.8	$3.88	$3.75
11.0%	$3.95	$3.75
11.2	$4.02	$3.75
11.4	$4.19	$3.75
11.6	$4.26	$3.75
11.8	$4.33	$3.75
12.0%	**$4.40**	**$3.75**
12.2	$4.42	$3.90
12.4	$4.44	$4.05
12.6	$4.46	$4.20
12.8	$4.48	$4.35
13.0%	$4.50	$4.50
13.2	$4.52	$4.65
13.4	$4.54	$4.80
13.6	$4.56	$4.95
13.8	$4.58	$5.10
14.0%	$4.60	**$5.25**
14.2	$4.62	$5.30
14.4	$4.64	$5.35
14.6	$4.66	$5.40
14.8	$4.68	$5.45
15.0%	$4.70	$6.25
15.2	$4.72	
15.4	$4.74	
15.6	$4.76	
15.8	$4.78	
16.0%	$4.80	
16.2	$4.82	

Precipitation for September 2004 through August 2009

Wall Rotation Rainfall Data - 2004-05 (inches)

Month	Total Precip.	Month	Total Precip.	Month	Total Precip.
September 04..	3.48”	January 05…	0.03”	*May……*	4.75”
October…….	0.76”	February……	0.00”	*June……*	1.95”
November…….	0.08”	March…….	0.50”	*July……*	1.82”
December…….	0.07”	*April……..*	1.35”	*August……*	1.02”

(Accumulative total precipitation from Sept.1, 2004 to Aug. 31, 2005 is 15.81 ")
(Accumulative total precipitation from Apr.1 to Aug. 31, 2005 is 10.89 ")

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 ")

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 January 12, 2010 for the 2010 Season.

Plot No.	2010 Crop and estimated yield goal	Soil Texture	Soil pH	Soluble Salts	Organic Matter %	NO3-N lbs / acre 0-6" 0-24"		P ppm	K ppm	Add N lbs/A	Add P205 lbs/A	Add K2O lbs/A	2009 Yield (Bushels, tons, Lbs / acre)
						top	total						
101-1	HRW-55bu	Medium	6.4	0.5	1.1	15	87	16	426	50	0	0	Fallow
102-1	Fallow	Medium	6.3	0.5	1.1	6	80	12	377	--	--	--	36.9 bu HRS
117-2a	Corn-60bu	Medium	6.2	0.5	1.5	7	52	35	568	20	0	0	37.5 bu HRW-b
118-2a	Fal (4 way mix)	Medium	6.3	0.5	1.4	7	34	16	520	--	--	--	88.8 bu Corn
119-2a	HRW-60bu	Medium	6.5	0.6	1.5	13	83	14	565	65	10	0	Fallow
103-2a	Sunf 1600 lb	Medium	6.4	0.5	1.2	7	83	25	508	0	0	0	56.2 bu HRS-a
104-2a	Mil Hay- 2 T/a	Medium	6.1	0.5	1.4	7	25	17	516	25	0	0	2294 lb Sunflower
105-2a	HRW-45bu	Medium	6.1	0.5	1.3	8	36	23	429	75	0	0	2.5 T/a Millet Hay
106-3	Saff-1200 lb	Medium	6.4	0.6	1.5	12	41	14	478	20	5	0	42.6 bu HRW
107-3	Mil-1500 lb	Medium	6.5	0.6	1.3	5	29	15	437	25	0	0	1744 lb Safflower
108-3	HRW-45bu	Medium	6.6	0.5	1.3	7	28	19	524	85	0	0	540 lb Millet
109-4	HRW-35bu	Medium	6.1	0.5	1.5	7	28	22	465	60	0	0	1149 lb Millet
110-4	Mil-1500 lb	Medium	6.4	0.5	1.1	6	50	19	411	5	0	0	25.9 bu HRW
111-5a	Corn-60bu	Medium	6.1	0.5	1.4	6	51	23	458	20	0	0	42.3 bu HRW
122-5a	Sunf 1300 lb	Medium	5.9	0.5	1.4	15	69	21	491	0	0	0	78.7 bu Corn
112-5a	Barley 60bu	Medium	6.6	0.5	1.3	14	95	19	519	5	0	0	1708 lb Sunflower
113-5a	HRW-40bu	Medium	6.6	0.6	1.3	9	58	10	607	40	15	0	56.6 bu Barley
114-6a	Saff-1200 lb	Medium	6.5	0.5	1.5	5	71	16	451	0	0	0	25.2 bu HRS-b
115-6a	Dry Pea-1800 lb	Medium	6.2	0.5	1.4	6	34	11	482	0	10	0	1825 lb Safflower
121-6a	HRW-a 45bu	Medium	5.9	0.5	1.3	8	52	20	488	20	0	0	1164 lb Dry peas
116-6a	HRW-b 45bu	Medium	6.3	0.5	1.6	11	64	18	552	50	0	0	51.7 bu HRS-a
123-9a	Saff-1200 lb	Medium	6.3	0.5	1.5	9	59	20	427	0	0	0	23.0 bu HRS-b
124-9a	H. Vetch/W Trit	Medium	6.5	0.6	1.3	7	32	11	396	0	20	0	1873 lb Safflower
125-9a	HRW-a 50bu	Medium	6.3	0.5	1.5	8	70	19	449	55	0	0	HVetch g. manure
120-9a	HRW-b 45bu	Medium	6.4	0.6	1.2	25	175	13	547	0	10	0	44.5 bu HRS-a
126-10	Mil-1500 lb	Medium	6.2	0.5	1.5	6	56	18	422	0	0	0	34.9 bu HRS
127-10	Dry Pea-1800 lb	Medium	6.4	0.5	1.5	5	27	13	441	0	5	0	517 lb Millet
128-10	HRW-45bu	Medium	6.4	0.5	1.5	8	43	16	397	30	0	0	1110 lb Dry peas
129-11	Corn-60bu	Medium	6.2	0.5	1.5	12	53	28	444	45	0	0	48.3 bu HRW
130-11	Mil-1500 lb	Medium	6.0	0.5	1.4	14	39	13	407	15	5	0	75.0 bu Corn
131-11	HRW-45bu	Medium	6.4	0.5	1.1	8	43	30	429	70	0	0	952 lb Millet

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

2009 Wall Rotation Yields, Expense/Acre, Break-Even Costs & Break-Even Yields

Net return/A	Rotation & Crop	(A) Yield/Acre	(B) Expense of Crop/Acre	(C) Cost of Production	(D) Yield to Break-Even
1	W Wheat	44.5 bu	$273.69 + $113.07	$ 8.69 / bu	72.9 bu
($-75.46)	Fallow at $113.07 / acre.				
2a	W Wheat-A	56.2 bu	$300.88 + *$85.46*	$ 6.87 / bu	72.8 bu
($-46.97)	Sunflower	2294 lb	$257.61 + *$21.37*	$ .12 / lb	2536 lb
	Hay Millet	2.5 Tons	$222.05	$88.82 / ton	4.03 tons
	W Wheat-B	37.5 bu	$259.80	$ 6.92 / bu	66.9 bu
	Corn	**88.8 bu**	**$256.45**	**$ 2.88 / bu**	**78.9 bu**
	Fallow at *$106.83* / acre. *($85.46 + $21.37)***				
3	W Wheat	42.6 bu	$259.80	$ 6.09 / bu	62.0 bu
($-62.28)	**Safflower**	**1744 lb**	**$250.27**	**$ .14 / lb**	**1390 lb**
	Millet	540 lb	$197.53	$ .36 / lb	3762 lb
4	W Wheat	25.9 bu	$265.66	$ 10.25 / bu	62.3 bu
($-157.35)	Millet	1149 lb	$219.70	$ .19 / lb	4184 lb
5a	W Wheat	42.3 bu	$268.17	$ 6.33 / bu	60.9 bu
($-59.46)	Corn	78.7 bu	$277.32	$ 3.52 / bu	85.3 bu
	Sunflower	1708 lb	$244.08	$ .14 / lb	2218 lb
	Barley	56.6 bu	$233.72	$ 4.12 / bu	84.9 bu
6a	W Wheat-B	25.2 bu	$374.64	$14.86 / bu	70.0 bu
($-73.12)	**Safflower**	**1825 lb**	**$250.27**	**$ .13 / lb**	**1390 lb**
	Field Pea	19.4 bu	$152.59	$7.86 / bu	32.1 bu
	W Wheat-A	51.7 bu	$347.04	$6.71 / bu	64.8 bu
9a	W Wheat-B	23.0 bu	$360.84 + *$42.27*	$ 17.52 / bu	76.0 bu
($-117.53)	**Safflower**	**1873 lb**	**$250.27**	**$ .13 / lb**	**1390 lb**
	Hairy Vetch (green fallow) *$211.33 / acre. ($169.06 + $42.27)**				
	W Wheat-A	44.5 bu	$347.04 + *$169.06*	$11.59 / bu	95.5 bu
10	W Wheat	34.9 bu	$314.68	$ 6.53 / bu	72.3 bu
($ -135.66)	Millet	517 lb	$206.53	$ .39 / lb	3933 lb
	Dry pea	1110 lb	$152.59	$ .13 / lb	1926 lb
11	W Wheat	48.3 bu	$259.80	$ 5.37 / bu	62.0 bu
($ -73.90)	Corn	75.0 bu	$278.62	$ 3.71 / bu	85.7 bu
	Millet	952 lb	$179.40	$ .18 / lb	3417 lb
			C = B / A	**D = B / E**	

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

Winter or Spring Wheat……..…See Chart Below	Corn…….. ..$ 3.25 / bu
Hay Millet……$ 55 / ton	Proso Millet……$ .0525 / lb
Sunflower…… $ .11 / lb	Safflower……..$ .18 / lb
Barley……..……$ 2.75 / bu	Field Pea……(yellow)…… $ 4.75 / bu

Spring / Winter Wheat Chart (values adjusted for protein content) **(E)**

Rot 1 - $5.30 / bu SW	Rot 3 - $4.19 / bu WW	Rot 6a-a -$5.35 / bu SW	Rot 9a-b - $5.30 / bu SW
Rot 2a-a - $5.30 / bu SW	Rot 4 - $4.26 / bu WW	Rot 6a-b - $5.35 / bu SW	Rot 10a - $4.35 / bu SW
Rot 2a-b - $3.88 / bu WW	Rot 5a - $4.40 / bu WW	Rot 9a-a - $5.40 / bu SW	Rot 11 - $4.19 / bu WW

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

Note: SW = spring wheat. WW = winter wheat Note: "**bolded**" rows above made money in 2009.

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, 2009. 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.

Discussion: Overall, the most weed free rotation in 2009 was Rotation 1 (Wheat/Fallow) followed closely by Rotations 2A and 5A. The winter-killed fallow wheat plots were not sprayed with Roundup in the spring of 2009 prior to planting back to spring wheat. Traverse Spring Wheat was planted on April 22, 2009. The early planting allowed the spring wheat to get a good early start and provide competition against early weeds. We had extensive winter-kill on wheat planted into dry pea stubble of Rotation 6a and hairy vetch stubble of Rotation 9a. Rotation 10a also had winter-kill due to having limited winter protection from the chickpea stubble that it was planted into. Rotation 10a was changed in 2009 to: Winter Wheat / Proso Millet / Dry Pea.

All wheat of Rotations 6a and 9a were sprayed with Olympus in the fall of 2008 but heavy winds shortly after spraying, blew most of the dry pea stubble and hairy vetch stubble away. We hadn't received any rainfall between spraying and the strong winds so most of the Olympus herbicide was still on the wind removed stubble. The Olympus didn't have an opportunity to leach into the soil yet. In most years, Olympus works well. It should be cautioned that continued use of Olympus will in time, allow resistant strains of weeds to develop. These wheat plots (all of 6a, 9a, 10a) were planted to spring wheat on April 24, 09 and then the plots were sprayed out with Roundup on April 27, 2009. The second year of stacked wheats in both Rotations 6a and 9a survived the winter-kill but had heavy downy brome in the spring that needed to be controlled with Roundup. The Roundup spray treatment worked well in terms of controlling the downy brome, however; the dying downy brome and winter wheat produced toxins that adversely affected the yields of the second year stacked wheat crops.

Starane NXT was applied to every winter wheat, spring wheat and barley in the spring of 2009. The surviving winter wheat was sprayed on May 18, 09 and all spring wheat and barley were sprayed on May 27, 2009. The Starane NXT was sprayed to control all Kochia types. Starane NXT also has some other broadleaf weed activity (wild buckwheat, lambsquarters, annual sunflower and Russian Thistle).

There is a green fallow period in Rotation 9a (hairy vetch) that helps to smother out weeds. The hairy vetch is planted in the fall and although it doesn't produce ground cover quickly in the early spring, it does have a very dense growth by the time it is sprayed off with herbicide in June. The canopy of sprayed off hairy vetch eliminates weed pressure during that time period.

The corn was very clean this summer. The Atrazine applied in the fall and Roundup sprayed in crop worked very well to keep the corn weed free.

The rotation in 2009 with the most overall weed pressure was Rotation 4 (Winter Wheat / Proso Millet). Rotation 4 is historically (2004-09) 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 soil moisture is not being properly utilized.

Table 74 is a combined average of April, July, and October weed pressure over a 6 year period (2004-2009). It indicates that Rotation 9a is the over-all cleanest rotation with a rating of 1.53. There are five rotations that are in the middle with ratings of 2.2 to 2.6. Rotations 10a and 4 are definitely the weediest in the trial at 3.3 and 3.6 respectively.

Table 75 shows what weeds are present at the 3 rating dates of April 15, July 15, and October 15 in 2009. Weeds are listed from highest count to least in each of the crops or fallow listed.

Table 76 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 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. 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 73. Wall Rotation Weed Rating Scores and Rankings - 2009.

Rotation	Rank as of 4-15-09	Apr 15, 2009 rating	Rank as of 7-15-09	July 15, 2009 rating	Rank as of 10-15-09	Oct 15, 2009 rating	**Overall Rank Apr,Jul,Oct 2009**	**Total Weed Pressure (Apr 15, July 15, Oct 15) 2009**
1	4th	0.6	2nd	0.3	2nd	0.4	1st	0.43
2a	3rd	0.4	7th	0.6	4th	0.7	3rd	0.56
3	9th	1.7	5th	0.4	3rd	0.7	8th	0.93
4	8th	1.7	9th	0.8	7th	0.9	9th	1.13
5a	2nd	0.0	8th	0.7	8th	1.0	2nd	0.56
6a	7th	1.7	4th	0.3	1st	0.3	5th	0.76
9a	6th	1.5	1st	0.2	6th	0.9	7th	0.86
10a	5th	1.2	6th	0.5	5th	0.7	6th	0.80
11	1st	0.0	3rd	0.3	9th	2.0	4th	0.76
Total		8.8		4.1		7.6		6.8

Table 74. Wall Rotation Weed Rating Scores and Rankings - (2004 - 2009).

Rotation	Average for April 15th, (04,05,06,07,08,09)	Average for July 15th, (04,05,06,07,08,09)	Average for October 15th, (04,05,06,07,08,09)	Total Weed Pressure 4-15,7-15,10-15 for (04,05,06,07,08,09)	Overall Ranking
1	0.6	0.9	0.8	2.39	4th
2a	0.7	0.7	0.7	2.22	2nd
3	1.1	0.8	0.4	2.40	5th
4	1.5	1.4	0.6	3.66	9th
5a	0.6	0.7	1.0	2.45	6th
6a	0.7	0.9	0.4	2.24	3rd
9a	0.5	0.5	0.4	1.53	1st
10a	1.2	1.5	0.6	3.34	8th
11	0.7	0.8	1.0	2.64	7th
Total	8.0	8.7	6.1	2.54 (*Mean*)	

Table 75. Wall Rotation Weed Ratings, 2009.

Rotation Number & crop	April 15, 2009		July 15, 2009		October 15, 2009	
	Weed Rating	Weeds Present	Weed Rating	Weeds Present	Weed Rating	Weeds Present
Rotation 1						
Fallow	1.250	Vw,db,pc	0.000	None	0.875	Db,wg,ko,rt,byg
W. Wheat	0.000	None	0.625	Byg, jc	0.000	None
Rot Mean	**0.625**		**0.312**		**0.437**	
Rotation 2a						
Sunflower	1.500	Vw	0.125	Pl,ko,mt,byg,pov	0.625	Wg
Forage Millet	0.000	Traces of dandelion	2.000	Sg,mt,pov,gft	0.125	Mt,ko,sg
W. Wheat-b	1.375	Pc,da	1.500	Pl	0.500	Sg, wg
Corn	0.000	None	0.000	None	2.125	Tg, db
Fallow	0.000	Traces of Pc	0.000	None	0.000	Traces of Sg
W. Wheat-a	0.000	Traces of Pc	0.000	Traces of Sg,jc	1.250	Tg
Rot Mean	**0.479**		**0.604**		**0.770**	
Rotation 3						
Safflower	2.500	Vw, db	0.625	Mt,pl,rt,jc,fxb	1.625	Tg, db
Proso Millet	1.875	Db, pc	0.000	Traces of F mar	0.500	Sg, ko, rt
W. Wheat	1.000	Pc, da, db	0.750	Pl,jc,db	0.000	Traces of Fm
Rot Mean	**1.791**		**.458**		**0.708**	
Rotation 4						
Proso Millet	3.500	Vw,db,pc	0.000	Traces of Pov	1.875	Tg
W. Wheat	0.000	None	1.625	Db,sg,mt,gft,byg	0.000	Traces of Sg
Rot Mean	**1.750**		**0.812**		**0.937**	
Rotation 5a						
Sunflower	0.000	Traces of db	2.250	Sg,pl,ko,	0.000	Traces of Sg
S. Barley	0.125	Vw,da,db	0.000	Traces of Db	2.500	Wg, ko, sg
W. Wheat	0.000	Traces of pennycress	0.625	Db,pl	0.000	Traces of Sg
Corn	0.000	Traces of vw	0.000	none	1.500	Db, tg
Rot Mean	**0.031**		**0.718**		**1.000**	
Rotation 6a						
Dry Pea	2.250	Pc, db	0.000	Traces of Pl, mt	0.250	Mt, sg, rt
W. Wheat-a	0625	Db	0.000	None	0.000	Traces of Fm
W. Wheat-b	4.000	Db	1.250	Db,gft,sg	0.125	Wg, sg
Safflower	0.250	Vw, db	0.250	Pl, mt, fxb	1.125	Wg, sg
Rot Mean	**1.718**		**0.375**		**0.375**	
Rotation 9a						
Hairy Vetch	1.500	Db,da	0.000	Traces ofTg	0.125	Ko
W. Wheat-a	0.500	Db	0.000	Traces of Gft	2.500	Hv, tg
W. Wheat-b	2.750	Db	0.750	Db, Gft, sg	0.375	Wg, tg, sg
Safflower	1.250	Vw, db	0.375	Pl, mt, jc	0.625	Sg, tg, wg
Rot Mean	**1.500**		**0.281**		**0.906**	
Rotation 10a						
Proso Millet	2.750	Db	0.000	None	2.000	Fm, wg, tg, db
Dry pea	1.000	Db,pc,da	0.000	None	0.000	Traces of Tg, sg
W. Wheat	0.000	None	1.750	Fm, pl	0.375	Fm
Rot Mean	**1.250**		**0.583**		**0.791**	
Rotation 11						
Corn	0.000	None	0.000	None	1.250	Tg, sg
Proso Millet	0.000	Traces of Da,pc,rt,ko	0.500	Gft, pov	0.375	Sg
W. Wheat	0.000	Traces of Pc,da	0.500	Pl, byg	4.500	Sg
Rot Mean	**0.000**		**0.333**		**2.041**	

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, s-sedge, rt – Russian thistle, sg – stinkgrass, lq – lambs quarters, byg – barnyard grass, pig - 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, wg – witchgrass, pl – prickly lettuce, tm – tansy mustard, sal-salsify.

Table 76. Weeds at the Wall Rotation Study and their Characteristics - 2009.

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
Stink grass	Grass	Annual	Europe	Warm	Seeds
Pennycress	Forb	Annual / Winter Annual	Europe	April-June	Seeds
Prickly Lettuce	Forb	Annual	Europe	July-Sept	Seeds
Tumble grass	Grass	Perennial	Native	Warm	Seeds
Witch grass	Grass	Annual	Native	Warm	Seeds
ALS Kochia	Forb	Annual	Eurasia	July-October	Seeds
Non-ALS Kochia	Forb	Annual	Eurasia	July-October	Seeds
Dandelion	Forb	Perennial	Eurasia	Apr-October	Seeds
Mare's Tail	Forb	Annual	Native	June-Sept	Seeds
Volunteer Wheat	Grass	Winter Annual		Cool	Seeds
Fetid Marigold	Forb	Annual	Native	July-Sept	Seeds
Barnyard Grass	Grass	Annual	Europe	Warm	Seeds
Russian Thistle	Forb	Annual	Europe	Aug-October	Seeds
Foxtail Barley	Grass	Perennial	Native	Cool	Seeds
Shepherds-purse	Forb	Annual / Winter Annual	Europe	March-November	Seeds
Western Salsify	Forb	Biennial / sl per.	Eurasia	May-July	Seeds
Prostrate Spurge	Forb	Annual	Native	June-October	Seeds
Green Foxtail	Grass	Annual	Eurasia	Warm	Seeds
Yellow Foxtail	Grass	Annual	Europe	Warm	Seeds
Sedge	Sedge	Perennial	Eurasia	July-Sept	Seed, rootstocks, tubers
Blue Lettuce	Forb	Perennial	Native	June-Sept	Rhizomes / seed
Tansy Mustard	Forb	Annual	Native	March-Aug	Seeds
Lance-leaf Sage	Forb	Annual	Native	June-October	Seeds
Common Purslane	Forb	Annual	Eurasia	May-Nov	Seed/stem fragments
Wild Buckwheat	Forb	Annual	Europe	June-Sept	Seeds
Common Sunflower	Forb	Annual	Native	July-Sept	Seeds
Curlycup gumweed	Forb	Biennial / sl per.	Native	July-October	Seeds
Black Nightshade	Forb	Annual	Native	May-October	Seeds
Lambsquarters	Forb	Annual	Europe	June-Sept	Seeds
Redroot Pigweed	Forb	Annual	Native	July-October	Seeds
Sand bur	Grass	Annual / sl per.	Native	Warm	Seeds
Buffalo bur	Forb	Annual	Native	May-October	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 2009 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.