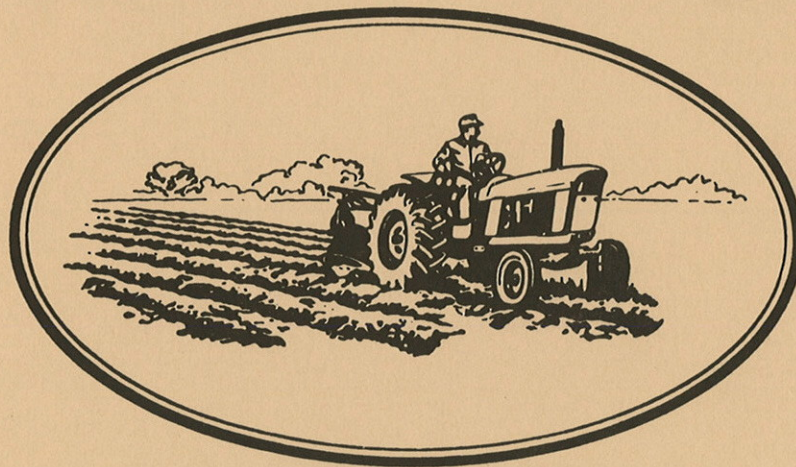


TENTH
ANNUAL

WESTERN DAKOTA

CROPS DAY RESEARCH REPORT



HETTINGER ARMORY
DECEMBER 16, 1993

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10th ANNUAL WESTERN DAKOTA CROPS DAY

DECEMBER 16, 1993

HETTINGER ARMORY

MST

- 9:00 am Registration
Coffee and doughnuts. Free time to view exhibits
and visit with Ag Industry Program Sponsors.
- 10:30 Welcome
- 10:45 Crop Variety Updates and Highlights of Ongoing Crop
Production Research
Pat Carr, Agronomist, Dickinson Research Center

Eric Eriksmoen, Agronomist, Hettinger Research
Extension Center
- 12:00 Lunch
Provided by Program Sponsors. Free time to
visit with sponsors.
- 1:00 Ag Industry Update
Alfalfa Stand Establishment
Mr. Gregg Webster, BASF, Hillsboro, ND.

Seed Treatments from Agsco
Mr. Bruce Bjerke, Agsco Inc., Grand Forks, ND.

Getting the most from Corn Silage
Mr. Mark Turner, Pioneer Seeds, Wibaux, MT.
- 1:30 Farming with Soil Quality as a Guide
Dr. John Gardner, Superintendent/Agronomist,
Carrington Research Extension Center,
Carrington, ND.
- 2:00 Performance of New Varieties of Cool Season Grasses
Mr. Russell Haas, Plant Materials Specialist,
USDA Plant Materials Center, Bismarck, ND.
- 2:30 Conclusion
Drawing for door prizes, coffee and opportunity
to visit with sponsors.

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ACKNOWLEDGEMENTS

The Hettinger Research Extension Center and Dickinson Research Center gratefully acknowledge and thank the following companies and organizations for their financial support and participation in this year's Western Dakota Crops Day. Those listed below have provided for the noon meal and have sponsored the event in total. We thank them for their past and present commitment and support.

1993 WESTERN DAKOTA CROPS DAY SPONSORS

HETTINGER CHAMBER OF COMMERCE
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CIBA
AGRIPRO SEEDS
THE SEXAUER COMPANY

We also acknowledge and thank the following individuals for their willingness to cooperate with us at our off-station plot sites. Their participation has enabled us to gather valuable information which would not otherwise be possible.

Daryl Birdsall, New Leipzig
Neil and Monte Freitag, Scranton
August and Perry Kirschmann, Regent
Dale and Calvin Hepper, Selfridge
Daryl Anderson, Reeder
Amos Gietzen, Glen Ullin
Ted Reich, Beulah
Pat Doll, Hannover
Golden Valley SCD, Beach

GROWING CONDITIONS
HETTINGER RESEARCH EXTENSION CENTER
-1993-

Hettinger had a moderately dry Fall of 1992. Soil water recharge was greater than 4 feet on fallow going into the 1993 planting season. The year's planting season started around the first of April but did not get into full swing until mid to late April.

Fertility levels were determined to a 4 foot depth at all research sites prior to seeding. Adequate fertilizer was applied according to yield goals set for each crop.

Several frosts during late May caused some injury to sensitive crops and delayed herbicide applications. Herbicide applications were further delayed by rain and windy conditions.

Mild daytime temperatures and cool night time temperatures were prevalent throughout the growing season. These conditions, along with an abundance of rain created almost ideal small grain growing conditions. Yields were generally well above average throughout southwestern North Dakota. Row crops were adversely affected by the lack of sun and heat. Dry edible beans, soybeans, grain corn and grain sorghum all froze prior to grain maturity and therefore were not harvested.

A hail storm completely destroyed crops and pastures in a 10 mile wide band that stretched from south of Scranton to Elgin.

Harvest was extended by a constant threat of rain and a canopy of green sucker heads emerging through the mature crop, however, most of the areas small grain crops were harvested with little yield or quality loss.

Tan spot was observed on all HRSW and durum fields throughout the area with infections being most severe on early plantings. Tan spot moved onto the flag leaf early during kernel fill causing reduced yields and light test weights in many fields.

Conditions for Scab infection were favorable with long periods of moisture during flowering. Actual scab formation was however highly dependent on planting date, with early seeded crops being most susceptible. Scab was observed on all varieties of HRSW, durum and barley but to a much lesser extent than what was observed in eastern North Dakota. Scab was generally not a problem in southwestern North Dakota.

WEATHER DATA SUMMARY
HETTINGER

Precipitation (inches)	1990-91	1991-92	1992-93	38 year average
Sept. - Dec.	0.94	4.60	2.26	3.08
Jan. - March	1.41	1.63	1.50	1.24
April - June	9.85	7.95	7.03	7.81
July - August	2.78	6.06	5.60	3.68
Total	14.98	20.24	16.39	15.81

Average Temperature F	1991	1992	1993	38 year average
April	45.2	42.7	42.1	42.8
May	55.2	57.4	54.5	54.3
June	66.0	62.5	59.2	63.9
July	70.0	61.4	62.3	70.4
August	72.0	62.7	64.2	68.8
September	58.6	56.6	52.0	57.1

Growing Degree Units (50-86)	1991	1992	1993	38 year average
May	258	357	279	136
June	480	412	327	416
July	620	376	395	625
August	682	441	475	583
Total	2040	1586	1476	1760

	28 F	32 F	Normal 32 F
Date of last frost	May 20	May 20	May 18
Date of first frost	Sept. 14	Sept. 7	Sept. 20
Frost free days	119	112	125

Dickinson Research Center

Growing Conditions 1990-93

Below-normal precipitation between September through December of 1992 allowed for some recharge of soil moisture going into the 1993 growing season. Soil profiles in fallowed fields were completely recharged from precipitation received during the previous 18 month period. Establishment of the winter wheat nurseries at the Dickinson Research Extension Center (DREC) was rated as good, but lack of adequate snow cover along with frigid winter temperatures caused extensive winterkill, forcing abandonment of the nurseries. Precipitation amounts received between January and March was less than the 100 year average but provided sufficient soil moisture for generally excellent plant stand establishment at the DREC in the spring of 1993.

Cool temperatures along with greater than average amounts of precipitation from mid-April to late May created near-ideal growing conditions for small grain crops. Frequent rains and cool temperatures continued through July, creating an environment conducive for disease development among small grain crops. Foliar and head diseases were widespread among small grains, reducing quality as well as lowering yield compared to 1992's bumper crop. For example, test weight and grain yield averaged 46 bu/ac and 59 lbs, respectively, for the HRSW variety trial in 1993, compared to 64 bu/ac and 63 lbs in 1992.

Corn failed to produce grain at Dickinson due to the cool temperatures which persisted throughout the growing season, along with the dry conditions which developed in August and September. Similarly, safflower plants failed to produce seed at Dickinson. The dry conditions persisted through the fall of 1993, and winter wheat plant stands going into the 1993-94 winter months, even in no-till environments. However, it is likely that 1993 will be remembered as a "good" year by many crop producers in southwestern North Dakota.

1991-93 Weather Data Summary

	Average Precipitation (inches)			100-year Average
	1990-91	1991-92	1992-93	
Sept. - Dec.	1.53	3.65	2.34	3.16
Jan. - March	0.74	1.52	1.13	1.55
Apr. - June	8.42	7.29	7.88	5.23
July - Aug.	2.05	3.88	5.46	5.12
Total	12.74	15.52	16.81	15.88

	Average Temperature (F)			
April	44	40	41	41
May	55	55	54	54
June	65	61	57	61
July	70	61	62	69
August	71	62	64	67

INTERPRETING STATISTICAL ANALYSIS

Field research involves the testing of one or more variables such as crop varieties, fertilizers, tillage methods, etc. Field testing of such variables are conducted in order to determine which variety, tillage method, or fertilizer etc. is best for the particular area of production. The main objectives of crop production research are to determine the best means of producing the crop and how to maximize yield and economic return from farming.

Agricultural researchers use statistics as a tool in helping to differentiate the production variables in question so that real and meaningful conclusions can be drawn from a relatively large amount of data. One of these tools is the Coefficient of Variability (C.V. %). This statistic gives an indication of the amount of variation in an experimental trial. Trials conducted at Hettinger use four replications or repetitions of the variable in question. For example, the variety Stoa HRSW appeared four times (four replications) in the HRSW variety trial. In this case, the C.V.% for yield of the Hettinger HRSW variety trial on fallow was 10.2%. This C.V.% is a relative measure of how much the yield of all HRSW varieties varied between replications. In other words, C.V.% is a measure of the precision or effectiveness of the trial and procedures used in conducting the trial.

More can be said about a field trial with a relatively low C.V.% (15 or less) than one with a C.V.% of over 15. Attempts are made to control human error and some environmental conditions such as conducting field studies on a uniform soil so variability between replicates is minimized with a resulting low value for C.V.% (15 or less). In summation, a trial with a C.V.% of 8 is more precise and more can be concluded from it than a trial with a C.V.% of 18.

Another important statistical tool is the Least Significant Difference or LSD. If the yield of variety A exceeds variety B by more than the LSD 5% value you can conclude that under like environmental conditions, variety A will significantly out-yield variety B 95% of the time. The LSD value allows you to separate varieties, tillage practices, or any other variable and determine whether or not they are actually different. The LSD 1% value is always larger than the value for LSD 5% and is used in the same manner. If the yield of variety A exceeds variety B by more than the LSD 1% value you can conclude that under like environmental conditions, variety A will significantly out-yield variety B 99% of the time. Little confidence can be placed in variety or treatment differences unless the results differ by more than the LSD value.

Hard Red Spring Wheat
Variety Descriptions

Variety	Agent or Origin ¹	Year re-leases	Beard	Height	Strength of Straw	Maturity	Reaction to disease			Quality factors		
							Stein rust ²	Leaf rust ²	Test wt.	Wheat protein	Quality rating ³	Comments
Grandin	ND	1989	yes	s.dwf.	strg.	early	R	R	high	avg.	4.0	
Gus	ND	1989	yes	s.dwf.	strg.	m.early	R	R	high	high	4.0	
Amudon	ND	1988	yes	med.	med.	med.	R	R	high	avg.	4.0	Tol. to common root rot
Len	ND	1979	yes	s.dwf.	v.strg.	m.early	R	R	high	avg.	4.0	
Coteau	ND	1978	yes	med.	m.strg.	med.	R	R	avg.	high	4.0	Some res. to tan spot*
Waldron	ND	1969	no	med.	strg.	m.early	R ^{4,5}	MS	avg.	high	4.0	Ergot susceptible
Butte 86	ND	1986	yes	med.	m.strg.	early	R ⁵	R	high	avg.	3.0	False bl. chaff
Cutless	ND	1986	yes	s.dwf.	med.	m.early	R	R	high	avg.	3.0	Res. sawfly
Stoa	ND	1984	yes	med.	m.strg.	m.early	R	R	high	avg.	3.0	
Alex	ND	1981	no	med.	med.	med.	MR ⁷	R	high	avg.	3.0	Sensitive to Fargo herb.
Minipro	MN	1989	yes	s.dwf.	strg.	m.early	R	R	low	high	3.0	
Katepwa	Can.	1984	no	med.	med.	m.early	R ⁷	MS	avg.	high	3.0	
Columbus	Can.	1981	no	med.	m.strg.	m.late	R ⁷	MR	high	high	3.0	Pre-harvest seed dormancy
2371	NDSURF	1991	yes	s.dwf.	v.strg.	m.early	R ⁵	R	high	avg.	3.0	
Lew	Mont.	1976	no	med.	med.	med.	R ⁶	MS	high	low	2.5	Res. sawfly
2375	NDSURF	1990	yes	s.dwf.	med.	m.early	R ⁶	R	high	avg.	2.5	
2370	NDSURF	1990	yes	s.dwf.	v.strg.	m.early	R ⁶	R	high	avg.	2.5	
Norm	MN	1992	yes	s.dwf.	v.strg.	med.	R	R	high	low	2.0	
Vance	MN	1989	yes	s.dwf.	strg.	med.	R	R	high	low	2.0	
Sharp	SD	1990	yes	med.	med.	early	R	R	v.high	avg.	2.0	
Prospect	SD	1988	yes	s.dwf.	v.strg.	m.early	R ⁶	MR	high	avg.	2.0	
Shield	SD	1987	yes	med.	med.	early	R ⁷	R	high	low	2.0	Susc. to shatter
Hi-Line	Mont.	1991	yes	s.dwf.	v.strg.	early	R ⁶	R	avg.	low	2.0	
CDC-Teal	CDC	1991	no	med.	med.	m.early	R	MR	high	avg.	N/A	
AC Minto	Can.	1991	no	med.	med.	m.early	R	MR	low	avg.	N/A	Pre-harvest seed dormancy
Pasqua	Can.	1990	yes	med.	med.	med.	R ⁶	R	high	high	3.0	Pre-harvest seed dormancy
Sonja	AgriPro	1992	yes	s.dwf.	med.	v.late	R ⁵	R	high	avg.	N/A	
Krona	AgriPro	1991	yes	s.dwf.	v.strg.	m.early	R	MR	high	low	2.0	
Dalen	AgriPro	1991	yes	s.dwf.	v.strg.	m.late	R	R	high	avg.	2.0	
Bergen	AgriPro	1990	yes	s.dwf.	v.strg.	early	R ⁵	R	high	avg.	2.0	
Nordic	AgriPro	1986	yes	s.dwf.	v.strg.	m.early	R ⁶	R	high	avg.	2.0	Some tol. to leaf spot
Express	WPB	1990	yes	s.dwf.	strg.	m.late	R	MR	high	low	2.0	Low protein
Rambo	WPB	1987	yes	s.dwf.	v.strg.	m.early	R	MR	low	avg.	N/A	
Glennan	Mont.	1984	no	s.dwf.	v.strg.	m.early	R ⁷	R	high	avg.	2.0	Res. sawfly
						med.	R ^{4,7}	MS	avg.	low	1.0	Res. sawfly

¹ Refers to agent or developer; AgriPro = AgriPro; NDSURF = North Dakota State University Research Foundation; WPB = Western Plant Breeder; CDC = Crop Development Center, University of Saskatchewan; Can. = Agriculture Canada.

² R = resistant; MR = moderately resistant; M = intermediate; MS = moderately susceptible; S = susceptible; * = occasionally mixed with some susceptible plant; ³ = MR, ⁶ = M, ⁷ = S or MS in artificial induced epidemics;

1.0 = Very poor quality; 2.0 = Poor quality; 2.5 = Average quality; 3.0 = Average quality; 3.5 = Average to good quality; 4.0 = Good quality; N/A = Quality data not available; Quality assessed by the Department of Cereal Science and Food Technology, NDSU;

* During prolonged wet periods, all varieties are susceptible to tan spot.

1993 Hettinger Hard Red Spring Wheat Variety Trial on Fallow

Variety	Test weight lbs/bu	Grain protein %	Heading date June	Ht cm	Yield				
					1993	1992	1991	2yr	3yr
					-----bu/A-----				
Krona	53.4	14.5	28	78	65.5	98.0	75.0	81.8	79.5
Norm	56.4	15.0	26	80	69.3	85.5	70.7	77.4	75.2
2371	57.3	16.4	24	73	68.1	84.2	72.7	76.2	75.0
Bergen	56.4	15.6	25	71	63.3	80.8	80.3	72.0	74.8
Amidon	59.2	16.2	26	88	62.0	86.0	73.6	74.0	73.9
Gus	57.6	17.0	26	82	63.1	90.7	64.2	76.9	72.7
Dalen	56.8	16.5	22	69	54.9	83.9	76.3	69.4	71.7
2375	57.7	16.3	23	76	61.1	78.4	74.7	69.8	71.4
Butte 86	59.0	15.9	22	79	66.2	74.7	70.0	70.4	70.3
Prospect	56.2	15.1	26	75	58.7	81.2	74.0	68.8	70.0
Vance	56.5	16.0	28	84	57.5	85.8	66.2	71.6	69.8
Grandin	57.1	16.7	25	84	58.8	78.8	68.9	68.8	68.8
2370	58.4	16.1	23	76	57.5	76.9	69.8	67.2	68.1
Stoa	56.9	16.4	26	87	61.5	76.3	65.0	68.9	67.6
Sharp	58.8	15.9	22	81	62.6	77.6	62.3	70.1	67.5
HiLine	55.2	15.9	24	72	52.8	77.2	68.0	65.0	66.0
Len	55.0	16.6	27	80	48.5	73.7	68.5	61.1	63.6
Alex	56.0	17.4	26	87	44.6	81.0	60.1	62.8	61.9
Cutless	54.8	17.7	24	77	35.5	47.8	57.5	41.6	46.9
McNeal	59.4	15.8	26	84	71.1	106.1		88.6	
Express	55.1	15.9	23	66	59.0	81.5		70.2	
Teal	57.6	16.6	24	85	51.8	79.7		65.8	
Sonja	57.4	15.9	26	70	67.3				
AC Domain	59.0	16.7	24	83	55.3				
AC Minto	57.4	17.3	27	93	49.4				
AC Eatonia	56.7	17.1	25	82	47.7				
Merlin	55.4	17.0	25	88	46.9				
XW398A4	59.7	15.6	26	76	78.0				
ND671	60.8	16.0	22	86	70.8				
ND678	60.5	15.8	25	90	70.8				
ND673	60.3	15.8	26	92	70.8				
ND687	60.8	14.9	19	73	66.4				
ND677	61.4	15.8	26	85	65.0				
ND684	58.9	16.5	25	92	60.4				
ND674	58.9	17.3	25	80	60.2				
ND686	59.2	15.8	25	81	59.7				
ND685	60.6	16.5	23	87	56.6				
Trial mean	57.8	16.2	25	81	60.0	81.4	68.4		
C.V. %	2.1	1.8	4	5	10.2	14.0	9.3		
LSD 5%	1.7	0.4	1	6	8.6	16.3	8.9		
LSD 1%	2.3	0.6	2	8	11.3	21.8	11.7		

Planting date: April 9 Harvest date: August 20
 Seeding rate: 1.1 million live seeds/A (approx. 1.1 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 1/3 oz/A Harmony Ext. + 3/4 pt/A Assert
 Yields are adjusted to 12.5% moisture.
 Light test weights caused by severe infestation of Tan Spot.

1993 Hettinger Hard Red Spring Wheat Variety Trial on Recrop

Variety	Test	Grain	Heading	Ht	Yield		
	weight	protein	date		1993	1992	2yr
	lbs/bu	%	June	cm	-----bu/A-----		
Grandin	57.0	15.7	19	79	58.9	40.8	49.8
Krona	56.4	13.4	22	62	56.0	43.3	49.6
Sharp	60.7	14.8	16	76	61.7	34.8	48.2
Prospect	58.0	14.2	19	63	61.4	33.9	47.6
Amidon	59.1	15.6	19	73	53.8	40.8	47.3
Norm	59.7	14.2	20	70	54.6	34.8	44.7
Gus	56.6	16.5	20	67	52.5	36.8	44.6
Stoa	57.8	15.6	20	76	54.0	35.0	44.5
2371	57.9	15.1	20	73	54.4	29.8	42.1
2375	59.8	14.9	18	69	55.7	28.3	42.0
Alex	57.7	15.4	21	77	52.0	30.5	41.2
Bergen	59.9	14.4	19	63	53.5	28.8	41.0
HiLine	57.6	14.5	18	67	58.9	22.4	40.6
Butte 86	59.8	15.3	15	78	55.2	23.6	39.4
Len	54.8	15.4	22	75	40.0	36.0	38.0
Dalen	57.8	14.8	15	67	49.6	23.7	36.6
Cutless	57.6	15.6	19	68	40.7	24.1	32.4
XW398A4	59.5	15.2	22	72	63.7		
2370	59.5	15.6	17	69	56.7		
Sonja	57.6	15.0	18	67	56.3		
Express	58.5	13.9	19	62	56.3		
Vance	57.4	15.2	21	63	54.6		
McNeal	57.8	15.3	22	69	54.0		
AC Minto	56.9	16.2	21	82	49.2		
ND671	61.0	17.1	15	73	48.5		
Teal	57.3	15.2	18	68	47.8		
Trial mean	58.2	15.2	19	71	53.7	34.0	
C.V. %	1.9	3.6	6	9	13.6	28.5	
LSD 5%	1.8	0.9	2	10	12.0	14.3	
LSD 1%	2.4	1.2	2	14	16.0	ns	

Planting date: April 9 Harvest date: August 11
 Seeding rate: 1.1 million live seeds/A (approx. 1.1 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 1/3 oz/A Harmony Ext. + 3/4 pt/A Assert
 Yields are adjusted to 12.5% moisture.
 Light test weights caused by severe infestation of Tan Spot.

1993 Regent Hard Red Spring Wheat Variety Trial

Variety	Test weight lbs/bu	Grain protein %	Plant height cm	Yield				
				1993	1992	1991	2yr	3yr
Amidon	57.9	15.1	90	62.6	80.1	60.0	71.4	67.6
Grandin	60.6	15.1	90	62.2	64.7	62.5	63.4	63.1
2371	57.6	15.2	83	58.4	50.9	65.6	54.6	58.3
2375	59.6	14.6	80	58.3	54.7	62.0	56.5	58.3
Sharp	61.0	14.0	82	58.0	52.9	60.8	55.4	57.2
Krona	57.4	13.0	81	72.0	76.8		74.4	
Norm	58.8	14.5	87	65.2	68.5		66.8	
ND671	62.0	15.2	89	61.3	41.8		51.6	
XW398A4	60.1	15.2	89	75.8				
McNeal	57.9	14.8	90	72.3				
Sonja	59.3	14.8	79	65.3				
Dalen	59.4	15.0	78	62.4				
Trial mean	59.3	14.7	85	64.2	61.5	61.6		
C.V. %	0.6	2.4	--	4.2	11.9	7.3		
LSD 5%	0.5	0.5	--	3.9	11.4	ns		
LSD 1%	0.7	0.7	--	5.2	16.1	ns		

Planting date: April 26 Harvest date: August 25
 Seeding rate: 1.1 million live seeds/A (approx. 1.1 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 2 pt/A Hoelon + 1 pt/A Bucril +
 1.5 oz/A MCPA ester

1993 Scranton Hard Red Spring Wheat Variety Trial

Variety	Test weight lbs/bu	Grain protein %	Plant height cm	Yield				
				1993	1992	1991	2yr	3yr
2375	62.9	13.7	75	78.2	38.7	43.2	58.4	53.4
2371	59.6	14.5	78	72.6	47.6	37.9	60.1	52.7
Sharp	63.2	14.0	80	73.9	43.5	39.4	58.7	52.3
Grandin	62.0	15.0	85	74.7	44.6	36.4	59.6	51.9
Amidon	60.7	14.3	90	73.3	47.6	32.9	60.4	51.3
Krona	59.7	12.1	75	82.4	53.0		67.7	
Norm	60.0	13.5	86	76.5	49.0		62.8	
ND671	63.5	14.8	90	77.8	44.0		60.9	
XW398A4	60.8	13.8	87	86.2				
McNeal	59.8	14.2	95	80.2				
Sonja	61.3	14.1	75	77.6				
Dalen	61.4	14.2	74	71.6				
Trial mean	61.2	14.0	82	77.1	45.5	36.8		
C.V. %	0.7	2.0		5.1	13.3	7.0		
LSD 5%	0.6	0.4		5.6	9.4	3.7		
LSD 1%	0.8	0.5		7.6	13.3	4.9		

Planting date: April 27 Harvest date: August 25
 Seeding rate: 1.1 million live seeds/A (approx. 1.1 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: Cheyenne

1993 New Leipzig Hard Red Spring Wheat Variety Trial

Variety	Test weight lbs/bu	Grain protein %	Plant height cm	Yield				
				1993	1991	1990	2yr	3yr
2375	62.2	15.7	78	63.1	55.3	46.9	59.2	55.1
Grandin	61.6	16.8	80	63.9	49.6	36.3	56.8	49.9
Amidon	61.3	16.2	85	56.8	45.6	38.8	51.2	47.1
Sharp	62.3	16.2	79	62.8	52.0		57.4	
2371	60.6	16.4	70	61.3	49.9		55.6	
McNeal	60.8	15.6	80	70.1				
Dalen	61.0	16.0	73	68.8				
Sonja	61.2	15.8	73	67.5				
ND671	62.0	16.4	79	66.0				
XW398A4	61.7	15.9	80	65.4				
Krona	59.3	14.2	73	64.8				
Norm	61.3	15.5	79	60.5				
Trial mean	61.3	15.9	77	64.2	50.4	39.2		
C.V. %	0.6	1.7	--	6.2	6.7	9.9		
LSD 5%	0.5	0.4	--	5.8	5.7	5.5		
LSD 1%	0.7	0.5	--	7.7	ns	7.4		

Planting date: April 26 Harvest date: August 24
 Seeding rate: 1.1 million live seeds/A (approx. 1.1 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 2 pt/A Hoelon + 1 pt/A Buctril +
 0.3 oz/A Harmony Extra

1993 Selfridge Hard Red Spring Wheat Variety Trial

Variety	Test weight lbs/bu	Grain protein %	Plant height cm	Yield				
				1993	1992	1990	2yr	3yr
2375	57.9	14.8	86	52.6	63.2	60.8	57.9	58.9
Amidon	58.2	15.5	87	41.0	69.1	60.8	55.0	57.0
Grandin	57.9	15.8	85	46.6	62.7	53.1	54.6	54.1
Krona	56.1	14.2	79	54.2	76.7		65.4	
Norm	58.9	15.0	85	59.4	69.4		64.4	
2371	57.8	15.4	78	54.5	63.2		58.8	
Sharp	59.8	15.6	85	50.6	62.3		56.4	
ND671	59.3	15.5	82	55.6	53.2		54.4	
XW398A4	59.6	15.0	83	63.2				
Sonja	58.8	15.2	80	62.6				
Dalen	58.2	15.4	76	51.4				
McNeal	57.6	15.0	83	49.4				
Trial mean	58.4	15.2	82	53.5	66.0	59.0		
C.V. %	1.7	3.7	--	8.5	9.8	9.0		
LSD 5%	1.4	0.8	--	6.5	10.1	7.3		
LSD 1%	1.9	1.1	--	8.7	14.2	9.8		

Planting date: April 21 Harvest date: August 24
 Seeding rate: 1.1 million live seeds/A (approx. 1.1 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 2 pt/A Hoelon + 1 pt/A Buctril +
 0.3 oz/A Harmony Extra

1993 Hettinger and Off-Station HRSW Variety Trials
 Combined Means - 6 Sites*

Variety	Test weight lbs/bu	Grain protein %	Plant height cm	Yield				
				1993	1992	1991	2yr	3yr
Amidon	54.4	15.5	86	58.2	70.7	55.5	64.4	61.5
2375	59.7	15.0	77	61.5	58.8	60.0	60.2	60.1
2371	58.5	15.5	76	61.6	61.5	58.7	61.6	60.6
Grandin	59.4	15.8	84	60.8	62.7	55.9	61.8	59.8
Sharp	61.0	15.1	80	62.2	59.1	54.2	60.6	58.5
Krona	57.0	13.6	75	65.8	76.1		71.0	
Norm	59.2	14.6	81	64.2	68.1		66.2	
XW398A4	60.2	15.1	81	72.0				
McNeal	58.9	15.1	84	66.2				
Sonja	59.3	15.1	74	66.1				
ND671	61.4	15.8	83	63.3				
Dalen	59.1	15.3	73	59.8				

* Hettinger fallow & recrop, Regent, Scranton, New Leipzig & Selfridge

1993 HRSW Seeding Rate Trial
 Combined means - 4 locations*

Seeding rate/A	Test weight	Grain protein	Plant height
Kernels 1000's	lbs/bu	%	cm
250	25	34.3	56.6
500	51	46.2	58.4
750	76	51.4	59.4
1000	101	55.9	59.8
1250	127	58.4	60.3
1500	152	59.5	60.4

Variety: Grandin

* Regent, Scranton, New Leipzig and Selfridge

Dryland Spring Wheat Trial-Fallow

Dickinson, ND, 1993

Variety	Seed/lb	Test Wt LBS	Protein %	Yield		
				1993	1992	AVG
				BU/A		
Bergen	13266	58.5	--	54.6	82	68.3
Vance	12013	59.8	--	51.5	80	65.8
Gus	11940	59.5	16.9	49.5	79	64.3
2371	13790	59.6	16.9	42.6	73	57.8
Dalen	12590	60.9	17.0	51.2	70	60.6
Amidon	13165	59.2	--	47.4	69	58.2
Grandin	11798	60.5	16.2	46.8	68	57.4
Pasqua	14446	59.2	16.5	42.4	63	52.7
Leader	15165	57.5	18.4	35.8	62	---
Coteau	13882	59.2	19.2	43.4	59	---
Len	13549	58.2	16.7	37.8	57	47.4
Butte 86	12134	59.2	17.5	41.1	56	48.6
Stoa	13465	58.9	17.8	46.6	56	51.3
2375	12920	58.6	16.3	45.1	54	49.6
2370	13366	58.6	16.0	42.1	52	47.1
CDC Teal	13202	58.6	18.8	42.1	47	---
XW398A4	11103	60.2	16.5	54.3	91	---
AC Domain	13421	58.9	17.4	35.7	--	---
AC Minto	12404	59.1	17.0	48.9	--	---
Max	14589	58.4	--	45.5	--	---
Penewawa	13575	58.1	--	46.7	--	---
Rambo	13831	57.0	16.0	40.2	--	---
Sonja	12522	58.4	--	56.8	--	---
McNeal	11895	60.0	--	55.1	87	71.1
ND 678	13229	59.8	16.6	51.1	78	64.6
ND 673	11720	60.1	16.6	47.8	60	53.9
ND 677	13002	60.4	--	50.8	60	55.4
ND 674	12807	60.5	17.6	49.5	56	52.8
ND 684	10450	60.1	17.4	45.2	--	---
ND 685	12524	61.5	15.8	46.3	--	---
ND 686	12508	61.1	15.9	51.4	--	---
ND 687	12033	60.5	16.3	41.1	--	---
Mean	12885	59.4	16.5	46.5		
C.V. %	4.3	1.4	5.6	12.4		
LSD .05	793	1.2	1.5	8.1		

Previous crop: Fallow

Planting date: April 26

Planting rate: 1,000,000 pure live seed (PLS) per acre

Fertilizer applied: 100 lb urea per acre

Herbicide applied: 2.5 pt Hoelon on May 27; 0.5 pt Harmony Extra + 0.75 pt 2,4-D ester on June 2

Harvest date: September 18

Variety	Dickinson	Beach	Glen Ullin	Hannover	Average 4 Sites
BU/AC					
Coteau	43.4	46.0	41.4	31.0	40.4
2375	45.1	53.8	50.0	67.8	54.2
Bergen	54.6	54.8	52.5	29.3	47.8
MT 8849	55.1	58.8	53.6	34.4	50.4
Grandin	46.8	43.3	47.9	27.3	41.3
Stoa	46.6	42.0	42.8	30.9	40.6
Amidon	47.4	51.7	48.5	29.5	44.3
Butte 86	41.1	48.1	45.0	33.2	41.8
Len	37.8	32.9	31.7	21.0	30.8
Vance	51.5	49.0	43.6	30.5	43.6
Gus	49.5	52.9	45.0	35.3	45.7
Leader	40.2	38.8	33.5	22.2	33.7
XW398A4	54.3	68.8	58.0	34.2	53.8
Mean	47.2	49.3	45.7	30.5	
C.V. %	--	7.8	9.3	7.1	
LSD .05	--	5.5	6.1	3.1	
TEST WEIGHT (LB/BU)					
Coteau	59.2	56.6	58.5	56.3	57.6
2375	58.6	57.5	59.1	57.8	58.2
Bergen	58.5	56.8	56.5	51.8	55.9
MT 8849	60.0	58.6	58.6	56.1	58.3
Grandin	60.5	56.9	58.8	55.5	57.9
Stoa	58.9	55.8	55.8	54.3	56.2
Amidon	59.2	57.0	58.4	55.8	57.6
Butte 86	59.2	57.0	58.6	55.9	57.7
Len	58.2	54.1	54.0	52.0	54.6
Vance	59.8	56.6	58.4	55.0	57.4
Gus	59.5	57.9	58.9	53.9	57.5
Leader	57.0	57.5	57.8	55.1	56.8
XW398A4	60.2	59.6	59.8	54.9	58.6
Mean	59.4	57.1	57.9	54.9	
C.V. %	--	1.3	1.3	3.2	
LSD .05	--	1.0	1.1	2.5	
PROTEIN %					
Coteau	19.2	11.2	16.0	17.8	15.2
2375	16.2	10.1	14.4	16.1	14.2
Bergen	15.4	9.6	15.2	17.8	14.5
MT 8849	15.3	9.7	14.5	17.4	14.2
Grandin	16.2	11.1	15.4	17.9	15.1
Stoa	17.8	11.0	15.8	17.8	15.6
Amidon	15.8	9.8	14.6	16.5	14.1
Butte 86	17.5	10.1	15.4	17.5	15.1
Len	16.7	11.4	16.4	19.5	16.0
Vance	15.5	10.7	15.5	18.0	14.9
Gus	16.9	11.2	15.5	18.4	15.5
Leader	18.4	11.6	16.5	18.3	16.2
XW398A4	16.5	10.4	15.2	17.9	15.0
Mean	16.7	10.6	15.4	17.8	
C.V. %	--	5.1	5.4	3.1	
LSD .05	--	0.9	NS	0.9	

Planting date: April 26 (Dickinson) May 10 (Hannover); May 11 (Glen Ullin); and May 12 (Beach); Planting rate: 1,000,000 pure live seed (PLS) per acre; Fertilizer applied: 100 lbs urea per acre at Dickinson; no fertilizer was applied at off-station sites; Herbicide applied: 2.5 pt Heolon on May 27 and 0.5 pt Harmony Extra + 0.75 pt 2,4-D ester per acre (Dickinson); 1 pt Buctril per acre (Hannover); 2 pt Hoelon + 1 pt Buctril per acre (Glen Ullin); 1.5 pt Bronate per acre (Beach) Harvest date: September 18 (Dickinson); September 29 (Hannover and Glen Ullin); September 15 (Beach)

1993 Hettinger Durum Variety Trial on Fallow

Variety	Test weight lbs/bu	Heading date June	Plant height cm	Yield				
				1993	1992	1991	2yr	3yr
				-----bu/A-----				
Regold	58.1	24	89	54.4	91.4	73.2	72.9	73.0
Renville	57.2	26	86	59.8	85.4	71.4	72.6	72.2
Sceptre	58.0	25	78	60.1	86.2	67.6	73.2	71.3
Ward	58.7	23	81	60.5	75.5	75.7	68.0	70.6
Rugby	59.2	24	84	61.8	78.9	67.1	70.4	69.3
Vic	58.8	24	83	56.2	82.6	68.9	69.4	69.2
Medora	53.7 ^{58.5}	24	82	53.7	85.5	66.0	69.6	68.4
Lloyd	56.6	27	69	51.3	81.1	69.2	66.2	67.2
Laker	54.8	26	76	45.1	82.5	65.9	63.8	64.5
Monroe	58.2	19	82	55.5	71.0	63.4	63.2	63.3
Plenty	58.0	24	91	65.2	86.5		75.8	
D87130	60.3	25	77	66.5				
D88303	58.0	25	72	65.4				
D8460	57.4	24	71	64.0				
D89135	59.0	24	76	63.4				
D89111	57.8	26	78	60.5				
D89476	58.0	24	81	59.8				
D89008	57.4	24	74	58.0				
D89335	59.2	25	84	57.5				
D89424	56.9	25	70	57.5				
D87122	57.3	24	80	56.8				
D89172	56.6	26	72	55.8				
D89235	57.8	25	82	55.5				
D89346	56.7	25	77	55.3				
D89538	56.5	25	73	53.8				
D89263	58.0	24	76	52.3				
D871534	55.9	26	67	51.9				
D87450	54.6	24	71	51.9				
D87240	53.3	26	82	51.8				
D88289	57.0	22	73	51.1				
D89331	58.2	24	83	50.6				
D88273	56.3	25	75	49.2				
D88793	56.0	24	80	47.9				
D87436	56.0	24	69	46.3				
D88450	55.1	26	76	45.5				
Trial mean	57.3	24	78	55.8	79.6	70.6		
C.V. %	2.1	5	5	10.9	11.3	11.5		
LSD 5%	1.7	1	5	8.5	13.3	ns		
LSD 1%	2.2	2	7	11.3	18.1	ns		

Planting date: April 9 Harvest date: August 18
 Seeding rate: 1.25 million live seeds/A (approx. 1.9 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 1/3 oz/A Harmony Extra + 3/4 pt/A Assert
 Yield is adjusted to 12.5% moisture.
 Light test weights caused by severe infestation of Tan Spot.

1993 Regent Durum Variety Trial

Variety	Test weight lbs/bu	Plant height cm	Yield				
			1993	1992	1991	2yr	3yr
Ward	59.4	99	63.5	76.2	63.6	69.8	67.8
Renville	58.0	98	62.1	75.8	65.5	69.0	67.8
Vic	59.8	100	60.0	77.2	60.7	68.6	66.0
Medora	57.4	96	55.5	80.0	60.5	67.8	65.3
Sceptre	56.8	96	62.8	80.3		71.6	
Plenty	57.7	98	70.4				
Trial mean	58.2	98	62.4	75.7	61.1		
C.V. %	1.8	--	6.3	7.4	6.0		
LSD 5%	1.6	--	5.9	10.2	ns		
LSD 1%	2.2	--	7.3	ns	ns		

Planting date: April 26 Harvest date: August 25
 Seeding rate: 1.25 million live seeds/A (approx. 1.9 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 2 pt/A Hoelon + 1 pt/A Buctril +
 1.5 oz/A MCPA ester

1993 Scranton Durum Variety Trial

Variety	Test weight lbs/bu	Plant height cm	Yield				
			1993	1992	1991	2yr	3yr
Ward	62.3	99	65.1	51.4	37.3	58.2	51.3
Renville	60.7	97	59.8	50.3	36.5	55.0	48.9
Medora	61.2	94	55.2	52.7	35.5	54.0	47.8
Vic	61.8	98	55.9	46.3	33.8	51.1	45.3
Sceptre	59.9	95	60.7	50.0		55.4	
Plenty	61.0	106	73.2				
Trial mean	61.1	98	61.7	50.2	35.5		
C.V. %	0.7	--	4.3	6.0	7.5		
LSD 5%	0.6	--	4.0	5.5	ns		
LSD 1%	0.8	--	4.9	ns	ns		

Planting date: April 27 Harvest date: August 25
 Seeding rate: 1.25 million live seeds/A (approx. 1.9 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 2.5 pt/A Hoelon + 1 pt/A Buctril +
 0.28 oz/A Amber

1993 New Leipzig Durum Variety Trial

Variety	Test weight lbs/bu	Plant height cm	Yield				
			1993	1991	1990	2yr	3yr
Medora	59.0	80	51.6	61.9	41.8	56.8	51.8
Renville	58.6	81	51.4	60.9	39.1	56.2	50.5
Ward	59.2	84	50.5	59.1	36.9	54.8	48.8
Vic	57.9	86	40.4	57.1	39.6	48.8	45.7
Plenty	57.4	85	47.4				
Sceptre	57.2	70	43.9				
Trial mean	58.2	81	47.5	58.6	38.6		
C.V. %	1.3	--	11.9	5.1	10.2		
LSD 5%	1.1	--	8.5	5.2	ns		
LSD 1%	1.4	--	ns	ns	ns		

Planting date: April 26 Harvest date: August 24
 Seeding rate: 1.25 million live seeds/A (approx. 1.9 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 2 pt/A Hoelon + 1 pt/A Buctril +
 0.3 oz/A Harmony Extra

1993 Selfridge Durum Variety Trial

Variety	Test weight lbs/bu	Plant height cm	Yield				
			1993	1992	1991	2yr	3yr
Ward	58.0	90	52.6	55.1	43.6	53.8	50.4
Renville	56.8	99	40.4	60.5	45.8	50.4	48.9
Medora	57.1	93	44.5	51.0	45.2	47.8	46.9
Vic	57.6	92	40.3	51.4	44.8	45.8	45.5
Sceptre	57.0	90	48.1	58.8		53.4	
Plenty	58.6	98	54.3				
Trial mean	57.5	94	46.7	54.0	44.8		
C.V. %	1.6	--	7.5	4.8	14.0		
LSD 5%	1.3	--	5.2	4.7	ns		
LSD 1%	1.7	--	6.5	7.4	ns		

Planting date: April 21 Harvest date: August 24
 Seeding rate: 1.25 million live seeds/A (approx. 1.9 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 2 pt/A Hoelon + 1 pt/A Buctril +
 0.3 oz/A Harmony Extra

1993 Hettinger and Off-Station Durum Variety Trials
 Combined Means - 5 Sites*

Variety	Test	Plant	Yield				
	weight	height	1993	1992	1991	2yr	3yr
	lbs/bu	cm	-----bu/A-----				
Ward	59.5	91	58.4	64.6	58.9	61.5	60.6
Renville	58.3	92	54.7	68.0	57.8	61.4	60.2
Medora	57.7	89	52.1	67.3	54.0	59.7	57.8
Vic	59.2	92	50.6	64.4	54.5	57.5	56.5
Sceptre	57.8	86	55.8	68.8		62.3	
Plenty	58.5	96	62.1				

* Hettinger, Regent, Scranton, New Leipzig & Selfridge

Dryland Durum Wheat Trial-Fallow

Dickinson, ND, 1993

Variety	Test Weight	Seeds/lbs	Yield		
			1993	1992	Ave.
	LBS			BU/A	
Laker	56.2	11168	48.8	51	49.9
Lloyd	54.5	12843	45.7	47	46.3
Medora	54.6	13488	40.5	44	42.2
Monroe	56.1	12780	41.9	49	45.4
Plenty	57.7	10571	51.8	50	50.9
Regold	57.4	11322	48.9	--	---
Renville	55.6	12886	44.9	47	45.9
Rugby	58.9	11647	54.6	43	48.8
Sceptre	56.6	12352	52.1	45	48.5
Vic	58.2	10921	48.1	43	45.5
Ward	58.4	11254	52.0	44	48.0
Mean	56.8	11930	48.1		
C.V.%	1.4	4.0	8.6		
LSD .05	1.2	695	6.0		

Previous crop: fallow

Planting date: April 16

Planting rate: 1,000,000 pure live seed (PLS) per acre

Fertilizer applied: 100 lbs urea per acre

Herbicide applied: 2.5 pt Hoelon on May 27; 0.5 pt Harmony Extra + 0.75 pt 2,4-D ester on June 2

Harvest date: September 7

Dryland Durum Trial

Dickinson and off-station sites, 1993

Variety	Dickinson	Beach	Glen Ullin	Hannover	Average 4 Sites
BU/AC					
Vic	48.1	54.4	35.4	23.8	40.4
Renville	44.9	49.7	36.6	19.0	37.5
Monroe	41.9	55.0	37.8	18.9	38.4
Medora	40.5	49.8	30.3	17.1	34.4
Sceptre	52.1	54.3	45.9	29.7	45.5
Mean	48.1	53.9	38.2	23.5	
C.V.%		4.2	7.5	10.0	
LSD .05		3.4	4.3	3.5	
TEST WEIGHT (LB/BU)					
Vic	58.4	54.1	58.8	51.5	55.7
Renville	55.6	55.1	57.0	50.8	54.6
Monroe	56.1	54.3	58.9	51.4	55.2
Medora	54.6	54.8	55.0	51.1	53.9
Sceptre	56.6	55.5	57.4	53.3	55.7
Mean	56.8	55.1	57.6	53.3	
C.V.%		1.8	1.9	1.4	
LSD .05		1.5	1.6	1.1	

Planting date: April 16 (Dickinson); May 10 (Hannover); May 11 (Glen Ullin); May 12 (Beach)

Planting rate: 1,000,000 pure live seed (PLS) per acre

Fertilizer applied: 100 lbs urea per acre (Dickinson); no fertilizer applied at off-station sites

Herbicide applied: 2.5 pt Hoelon, 0.5 pt Harmony Extra + 0.75 pt 2,4-D ester per acre (Dickinson); 1 pt Buctril per acre (Hannover); 2 pt Hoelon + 1 pt Buctril per acre (Glen Ullin); 1.5 pt Bronate per acre (Beach)

Harvest date: September 7 (Dickinson); September 29 (Hannover and Glen Ullin); September 15 (Beach)

Notes: All sites were fallowed prior to implementing these trials. Conventional seedbeds were prepared except at Beach, where the experiment was conducted in a no-till environment.

Barley
Variety Descriptions

Variety	Origin	Year re-leased	Awn type ¹	Aleurone color	Height	Straw strength	Rel. maturity	Rel. yield	Stem rust	Loose smut	Leaf diseases	Reaction to ²	
												Quality ³	
<u>6-rowed</u>													
Azure	ND	1982	S	blue	med.	strg.	m.early	v.good	S	S	MS	M or F	
Robust	MN	1983	S	white	tall	m.strg.	med.	v.good	S	S	MS	M or F	
Morex	MN	1978	S	white	tall	med.	early	fair	S	S	MS	M or F	
Excel	MN	1990	S	white	m.short	v.strg.	med.	v.good	S	S	MS	M or F	
B 1602	BARI	1989	R	white	med.	m.strg.	med.	good	S	S	MS	C or F	
B 1603	BARI	1990	R	white	med.	med.	med.	fair	S	S	MS	M or F	
Hazen	ND	1984	S	white	med.	v.strg.	med.	v.good	S	S	MS	F	
Stander	MN	1993	S	white	m.short	v.strg.	med.	v.good	S	S	MS	F	
<u>2-rowed</u>													
Bowman	ND	1984	S	white	short	m.strg.	m.early	good	S	S	MS	F	
Clark	Mont	1981	R	white	m.short	m.weak	m.late	good	S	S	MS	F ⁴	
Gallatin	Mont	1986	R	white	med.	m.strg.	m.late	v.good	S	S	S	F	
Harrington	Can.	1981	R	white	med.	m.weak	late	good	S	S	MS	F ⁴	
Stark	ND	1991	S	white	med.	m.strg.	m.late	v.good	VS	S	MR	F	
Hector	Can.	1973	R	white	med.	weak	m.late	fair	S	S	S	F	
<u>Specialty</u>													
Wanabet	Mont	1990	R	white	med.	weak	late	v.poor	S	S	MS	NA	

¹ Rough or smooth awned.

² R = resistant; S = susceptible; MS = moderately susceptible; MR = moderately resistant.

³ M = malting; F = feed; C = malting under contract only.

⁴ Recommended as a malting barley in western U.S.

1993 Hettinger Barley Variety Trial on Fallow

Variety	Test weight lbs/bu	Grain protein %	Heading date June	Ht cm	Yield				
					1993	1992	1991	2yr	3yr
Excel	45.6	14.3	21	78	117.0	170.4	86.7	143.7	124.7
Hazen	46.4	15.2	21	80	113.6	153.2	69.2	133.4	112.0
Stark	50.3	15.5	20	72	99.1	137.7	93.1	118.4	110.0
Azure	47.4	15.3	20	80	107.4	147.6	73.1	127.5	109.4
Robust	48.2	15.3	21	78	102.3	151.0	71.5	126.6	108.3
B1602	46.6	15.4	23	74	102.5	147.4	71.6	125.0	107.2
Gallatin	49.2	15.1	22	75	95.4	134.3	90.2	114.8	106.6
Morex	47.2	15.0	22	82	100.9	136.7	74.8	118.8	104.1
Bowman	48.7	16.1	18	72	93.2	126.0	92.6	109.6	103.9
Harrington	46.8	15.9	26	65	96.5	137.1	66.6	116.8	100.1
Stander	47.0	14.7	21	78	113.3	147.4		130.4	
Horsford	37.8	16.0	18	77	50.6	88.1		69.4	
ND11055	47.1	14.1	20	74	113.6				
ND11231-11	49.8	15.4	18	73	111.1				
ND10981	46.8	14.5	21	81	110.1				
ND11231-12	49.7	15.5	16	78	106.3				
ND12201	47.0	15.2	21	80	106.0				
MT860756	48.6	15.8	25	72	105.9				
Manley	47.4	16.2	29	75	104.7				
ND11853-3R	48.5	15.7	16	66	103.0				
ND12567	48.9	15.2	20	71	101.5				
Trial mean	47.4	15.3	21	75	102.6	134.1	76.0		
C.V. %	2.7	1.9	4	7	10.2	8.3	16.7		
LSD 5%	1.8	0.4	1	7	14.8	15.8	17.9		
LSD 1%	2.4	0.5	2	10	19.7	21.0	23.8		

Planting date: April 9 Harvest date: August 11
 Seeding rate: 750,000 live seeds/A (approx. 1.25 bu/A)
 Yield goal: 100 bu/A
 Herbicide application: 1/3 oz/A Harmony Ext. + 3/4 pt/A Assert
 Yields are adjusted to 12% moisture.

1993 Scranton Barley Variety Trial

Variety	Test weight lbs/bu	Grain protein %	Plant height cm	Yield				
				1993	1992	1991	2yr	3yr
Excel	49.7	13.8	75	101.4	111.0	67.9	106.2	93.4
Stark	50.4	13.9	71	94.4	104.2	71.2	99.3	89.9
Bowman	49.1	14.4	67	83.5	91.6	60.6	87.6	78.6
Gallatin	49.5	13.4	70	89.9		75.0		
Stander	51.0	13.6	79	104.6				
ND11853-3R	49.6	14.0	64	91.1				
Trial mean	49.9	13.8	71	94.2	99.3	67.0		
C.V. %	0.6	2.6	--	7.9	7.8	8.3		
LSD 5%	0.5	0.5	--	11.1	11.5	ns		
LSD 1%	0.6	0.7	--	14.3	15.8	ns		

Planting date: April 27 Harvest date: August 25
 Seeding rate: 750,000 live seeds/A (approx. 1.25 bu/A)
 Yield goal: 100 bu/A
 Herbicide application: 2.5 pt/A Hoelon + 1 pt/A Buctril +
 0.28 oz/A Amber

1993 New Leipzig Barley Variety Trial

Variety	Test weight lbs/bu	Grain protein %	Plant height cm	Yield				
				1993	1991	1990	2yr	3yr
Bowman	51.1	15.9	71	74.8	65.9	51.7	70.4	64.1
Gallatin	49.4	15.8	58	69.0	66.2	48.7	67.6	61.3
Excel	48.4	15.2	70	78.2	80.6		79.4	
Stark	51.2	15.4	71	68.5	62.2		65.4	
Stander	49.0	14.7	70	78.2				
ND11853-3R	50.0	15.8	65	69.9				
Trial mean	49.8	15.5	68	73.1	61.6	47.4		
C.V. %	1.5	1.8	--	14.0	14.4	19.0		
LSD 5%	1.1	0.4	--	ns	13.0	ns		
LSD 1%	1.5	0.5	--	ns	ns	ns		

Planting date: April 26 Harvest date: August 25
 Seeding rate: 750,000 live seeds/A (approx. 1.25 bu/A)
 Yield goal: 100 bu/A
 Herbicide application: 2 pt/A Hoelon + 1 pt/A Buctril +
 0.3 oz/A Harmony Extra

1993 Selfridge Barley Variety Trial

Variety	Test weight lbs/bu	Grain protein %	Yield				
			1993	1992	1991	2yr	3yr
Excel	44.8	12.9	77.8	113.6	72.9	95.7	88.1
Stark	48.4	13.2	70.9	115.6	71.7	93.2	86.1
Bowman	47.8	14.1	66.5	95.6	45.3	81.0	69.1
Gallatin	45.1	13.3	70.6		67.5		
Stander	46.6	13.0	78.1				
ND11853-3R	48.2	13.6	68.1				
Trial mean	46.8	13.4	71.7	109.7	63.2		
C.V. %	0.8	3.5	17.5	4.7	15.3		
LSD 5%	0.5	0.7	18.7	7.8	14.2		
LSD 1%	0.7	0.9	24.2	10.7	19.3		

Planting date: April 21 Harvest date: August 24
 Seeding rate: 750,000 live seeds/A (approx. 1.25 bu/A)
 Yield goal: 100 bu/A
 Herbicide application: 2 pt/A Hoelon + 1 pt/A Buctril +
 0.3 oz/A Harmony Extra

1993 Hettinger and Off-Station Barley Variety Trials
 Combined Means - 6 Sites*

Variety	Test weight lbs/bu	Grain protein %	Plant height cm	Yield				
				1993	1992	1991	2yr	3yr
Excel	47.7	14.0	68	104.2	136.6	79.9	120.4	106.9
Stark	50.2	14.3	68	86.2	124.5	76.2	105.4	95.6
Bowman	49.3	14.9	69	78.4	108.3	69.6	93.4	85.4
Gallatin	48.7	14.2	67	83.4		76.3	79.8	
Stander	48.8	14.0	70	92.8				
ND11853-3R	49.4	14.6	64	85.0				

* Hettinger fallow & recrop, Regent, Scranton, New Leipzig and Selfridge

Dryland Barley Trial-Fallow

Dickinson, ND, 1993

Variety	Test Weight LBS	Seeds/LB	Yield		
			1993	1992	AVG
				BU/A	
Harrington	46.5	12824	70.2	88	79.1
Excel	45.7	11463	85.3	86	85.6
Gallatin	46.2	12206	67.3	80	73.6
Robust	47.5	10990	72.9	80	76.4
Bowman	46.5	10601	67.2	79	73.1
Stark	48.4	9722	81.8	78	79.9
Hazen	46.2	10863	92.9	69	80.9
Morex	46.5	12106	66.0	69	67.5
Azure	45.5	11251	79.2	64	71.6
Wanubet	47.0	12588	64.0	60	62.0
B1602	46.2	12454	72.6	77	74.8
ND10981	45.6	10965	86.2	76	81.1
ND11055	45.7	11042	87.5	73	80.2
Horsford	36.9	13581	69.4	--	---
MT860756	48.9	10092	93.7	--	---
Stander	45.9	10806	87.9	--	---
Manley	47.4	10311	97.2	--	---
ND11231-11	47.9	10149	81.1	--	---
ND11231-12	48.6	10101	80.8	--	---
ND11853-3R	46.9	9206	72.9	--	---
ND12201	45.8	11376	87.3	--	---
ND12567	47.5	9575	75.5	--	---
ND14049	45.5	10978	59.2	--	---
ND14053	45.4	11188	48.4	--	---
Mean	46.3	11101	77.0	---	---
C.V. %	2.7	3.7	6.9	---	---
LSD .05	1.8	573	7.5	---	---

Previous crop: fallow

Planting date: April 16

Planting rate: 750,000 pure live seed (PLS) per acre

Fertilizer applied: 100 lbs urea per acre

Herbicide applied: 2.5 pt Hoelon on May 27; 0.5 pt Harmony Extra + 0.75 pt 2,4-D ester on June 2

Harvest date: August 23

Dryland barley trial

Dickinson and off-station sites, 1993

Variety	Dickinson	Beach	Glen Ullin	Hannover	Average 4 Sites
BU/AC					
ND11853-3R	72.9	81.2	50.3	48.0	63.1
Excel (6R)	85.3	57.5	58.6	50.0	62.8
Gallatin (2R)	67.3	67.2	48.0	34.5	54.2
Stark (2R)	81.8	72.9	51.4	48.6	63.7
Azure	79.2	45.3	59.0	47.6	57.8
Morex (6R)	66.0	38.4	49.4	44.7	49.6
Bowman (2R)	67.2	71.5	48.7	34.8	55.5
Robust	72.9	36.2	54.6	49.4	53.3
Mean	77.0	58.8	52.5	44.7	
C.V.%		7.9	12.2	9.9	
LSD .05		6.9	NS	6.5	
TEST WEIGHT (LB/BU)					
ND11853-3R	46.9	49.0	45.6	42.7	46.0
Excel	45.7	47.0	44.0	38.2	43.7
Gallatin	46.2	49.0	44.7	40.7	45.1
Stark	48.4	49.9	46.5	41.5	46.6
Azure	45.5	47.1	44.5	37.4	43.6
Morex	46.5	46.2	44.7	39.2	44.1
Bowman	46.5	48.6	45.9	39.7	45.2
Robust	47.5	48.5	45.9	41.4	45.8
Mean	46.3	48.2	45.2	40.1	
C.V. %		1.4	1.9	2.0	
LSD .05		1.0	1.3	1.2	

Planting date: May 10 (Hannover); May 11 (Glen Ullin); May 12 (Beach)

Planting rate: 750,000 pure live seed (PLS) per acre

Fertilizer applied: None

Herbicide applied: 1 pt Buctril per acre (Hannover); 2 pt Hoelon + 1 pt Buctril per acre (Glen Ullin); 1.5 pt Bronate per acre (Beach)

Harvest date: September 9 (Hannover and Glen Ullin); September 15 (Beach)

Notes: All fields were fallowed in 1992; barley was sown in conventional seedbeds at Dickinson, Glen Ullin, and Hannover, and in a no-till seedbed at Beach. Trials at Glen Ullin and Hannover were flooded for several days during the growing season, and the trial at Hannover was inadvertently grazed.

Oat
Variety Description

Varieties listed in order of maturity	Origin	Year released	Color grain	Height	Straw strength	Maturity ²	Resis. to stem rust ¹	Crown rust	Tol. to barley yellow dwarf ⁴	Rel. yield
Don	IL	1985	white	m.short	strg.	E	VS	S	T	good
Horicon	WI	1989	tan	short	strg.	E	S	R-MR	T	good
Settler	SD	1989	white	tall	m.strg.	E	S	MR	MT	good
Hazel	IL	1985	ivory	short	strg.	E	S	S	T	good
Hyttest	SD	1986	white	tall	m.strg.	E	S	MR-MS	S	fair
Prairie	WI	1991	white	short	strg.	E	S	S	T	good
Premier	MN	1990	yellow	short	med.	M	R	MR	MT	v.good
Newdak	ND/NY	1990	white	med.	strg.	M	R	S	T	v.good
Brawn	IL	1993	yellow	short	v.strg.	M	S	S	T	v.good
Riel	Can.	1985	red	tall	m.strg.	M	R	S	S	v.good
Proat	MN	1985	white	med.	strg.	M	S	MR	S	good
Steele	ND	1984	white	tall	strg.	M	R	S	MT	good
Sandy	SD	1986	white	tall	m.strg.	M	S	MR-MS	S	good
Kelsey	Can.	1967	white	m.tall	m.weak	L	S	S	S	v.good
Moore	MN	1979	white	tall	strg.	L	S	MR	S	v.good
Valley	ND	1988	ivory	short	strg.	L	R	MS	MT	v.good
Otana	MT	1977	white	m.tall	m.weak	L	S	S	S	v.good
Troy	SD	1991	ivory	tall	m.strg.	L	S	R	T	good
Monida	ID	1985	white	m.tall	m.weak	L	S	S	MS	v.good
Porter	IN	1982	tan	med.	strg.	L	S	MS	T	v.good
AC Belmont	Can.	1993	naked	med.	strg.	L	R	S	MT	fair
Dumont	Can.	1982	white	m.tall	m.weak	L	R	S	MS	good
Fidler	Can.	1980	white	med.	strg.	L	R	MR	MT	good
Bay	WI	1993	yellow	med.	v.strg.	L	S	MR-S	T	good
Terra	Can.	1977	naked	med.	m.strg.	L	S	S	MS	good
AC Marie	Can.	1992	white	tall	weak	VL	R	S	MT	fair

¹ Stem rust races most prevalent now. S = susceptible; M = moderately; R = resistant; v = very

² E = early; M = medium; L = late.

³ H = high; M = medium; L = low; V = very; VL = very low

⁴ S = susceptible; MS = moderately susceptible; MT = moderately tolerant; T = tolerant.

Varieties rated Mt or T have a relatively good degree of protection against barley yellow dwarf virus.

1993 Hettinger Oat Variety Trial on Fallow

Variety	Test weight lbs/bu	Heading date June	Plant height cm	Yield				
				1993	1992	1991	2yr	3yr
				-----bu/A-----				
Robert	36.2	31 7/11	99	195.5	198.8	125.9	197.2	173.4
Porter	38.0	28	84	175.3	208.7	115.9	192.0	166.6
Monida	35.0	32 7/2	89	162.5	210.1	111.7	186.3	161.4
Troy	38.4	28	94	160.6	208.1	115.1	184.4	161.3
Valley	38.5	29	82	176.5	186.6	119.5	181.6	160.9
Otana	37.6	30	101	154.0	206.9	114.9	180.4	158.6
Kelsey	35.8	26	90	143.5	193.0	125.0	168.2	153.8
Newdak	35.6	23	84	165.6	196.8	94.6	181.2	152.3
Riel	36.9	28	92	149.3	186.3	106.9	167.8	147.5
Dumont	33.9	31 7/11	94	145.1	190.7	104.1	167.9	146.6
Hyttest	41.6	24	93	143.5	161.1	88.5	152.3	131.0
Tibor	39.4	28	104	79.1	130.9	88.3	105.0	99.4
Prairie	34.7	27	82	193.1	205.5		199.3	
Derby	36.4	30	93	132.6	195.0		163.8	
Calibre	34.6	31 7/11	94	121.8	187.8		154.8	
ND880224	37.3	30	89	209.8				
MN86231	38.6	26	80	194.7				
ND862095	38.1	28	87	190.4				
Bay	35.0	30	84	186.9				
ND881508	37.6	32 7/2	100	176.9				
ND870952	39.1	26	94	173.8				
AC Marie	33.0	7/1	96	168.3				
ND870258	37.8	29	83	167.2				
ND880946	35.5	30	88	166.0				
ND881374	37.0	28	92	158.2				
ND852107	36.9	28	92	157.5				
ND880979	37.8	30	85	156.3				
ND880107	35.7	30	95	151.6				
ND862915	43.0	7/1	98	118.7				
AC Belmont	38.9	7/1	95	104.5				
Magnum II	32.0	36 7/6	114	93.5				
Trial mean	37.0	29	92	157.6	188.5	103.4		
C.V. %	2.1	5	9	10.5	13.4	24.1		
LSD 5%	1.1	2	12	23.4	35.2	35.1		
LSD 1%	1.5	3	15	30.8	46.5	ns		

Planting date: April 9 Harvest date: August 16
 Seeding rate: 750,000 live seeds/A (approx. 1.5 bu/A)
 Yield goal: 150 bu/A
 Herbicide application: 1/3 oz/A Harmony Extra

1993 Hettinger Oat Variety Trial on Recrop

Variety	Test	Heading		Grain
	weight	date	Ht	yield
	lbs/bu	June	cm	bu/A
Prairie	37.8	26	72	122.2
Monida	38.2	30	81	112.2
Troy	38.5	28	87	111.7
Porter	38.3	29	67	109.0
Kelsey	38.0	28	87	107.3
Newdak	36.0	25	73	107.1
Robert	37.2	30	78	106.8
Otana	39.7	30	98	105.7
Valley	38.8	29	70	97.0
Riel	37.8	28	77	96.5
Hytest	42.5	26	79	90.3
Dumont	35.7	30	85	86.2
Tibor	44.6	28	94	40.1
Trial mean	38.7	28	81	99.4
C.V. %	3.1	3	9	14.1
LSD 5%	1.7	1	10	20.0
LSD 1%	2.3	2	14	26.8

Planting date: April 9 Harvest date: August 18
 Seeding rate: 750,000 live seeds/A (approx. 1.5 bu/A)
 Yield goal: 150 bu/A
 Herbicide application: 1/3 oz/A Harmony Extra
 Yield is adjusted to 12% moisture.

1993 Regent Oat Variety Trial

Variety	Test weight	Plant height	Yield				
			1993	1992	1991	2yr	3yr
	lbs/bu	cm	-----bu/A-----				
Monida	35.0	100	173.5	192.1	150.7	182.8	172.1
Newdak	36.2	96	146.6	162.8	146.3	154.7	151.9
Otana	38.1	108	155.6	155.6	143.3	155.6	151.5
Prairie	36.0	80	159.9				
Troy	39.6	105	154.2				
Trial mean	37.0	98	158.0	158.4	143.9		
C.V. %	1.3	-	10.7	5.7	4.9		
LSD 5%	0.7	-	ns	13.4	ns		
LSD 1%	1.0	-	ns	18.4	ns		

Planting date: April 26 Harvest date: August 25
 Seeding rate: 750,000 live seeds/A (approx. 1.5 bu/A)
 Yield goal: 150 bu/A
 Herbicide application: 1 pt/A Buctril

1993 Scranton Oat Variety Trial

Variety	Test weight lbs/bu	Plant height cm	Yield				
			1993	1992	1991	2yr	3yr
Otana	42.0	120	165.8	151.2	87.2	158.5	134.7
Monida	40.2	113	168.2	160.4	65.4	164.3	131.3
Newdak	39.3	110	145.6	156.1	91.6	150.8	131.1
Prairie	39.9	100	127.0				
Troy	43.2	130	123.6				
Trial mean	40.9	115	146.0	137.0	75.5		
C.V. %	1.5	-	8.1	5.7	30.9		
LSD 5%	1.1	-	21.7	ns	ns		
LSD 1%	1.6	-	31.2	ns	ns		

Planting date: April 27 Harvest date: August 25
 Seeding rate: 750,000 live seeds/A (approx. 1.5 bu/A)
 Yield goal: 150 bu/A
 Herbicide application: 1.5 pt/A Bronate

1993 New Leipzig Oat Variety Trial

Variety	Test weight lbs/bu	Plant height cm	Yield				
			1993	1991	1990	2yr	3yr
Monida	37.0	93	132.7	92.6	71.3	112.6	98.9
Newdak	36.4	94	118.5	89.7	54.6	104.1	87.6
Otana	38.8	108	96.5	83.2	63.4		
Troy	38.7	98	131.1				
Prairie	37.2	85	123.1				
Trial mean	37.6	96	120.4	75.2	57.7		
C.V. %	2.1	--	12.3	15.8	13.1		
LSD 5%	1.2	-	22.4	ns	ns		
LSD 1%	1.7	-	31.0	ns	ns		

Planting date: April 26 Harvest date: August 24
 Seeding rate: 750,000 live seeds/A (approx. 1.5 bu/A)
 Yield goal: 150 bu/A
 Herbicide application: 1 pt/A Buctril + 0.3 oz/A Harmony Extra

1993 Selfridge Oat Variety Trial

Variety	Test weight lbs/bu	Plant height cm	Yield				
			1993	1992	1991	2yr	3yr
Monida	36.6	108	137.3	193.4	108.8	165.4	146.5
Newdak	37.4	100	113.7	181.7	95.6	147.7	130.3
Otana	38.7	110	108.4	157.3	105.3	132.8	123.7
Troy	40.0	108	130.8				
Prairie	37.8	90	130.2				
Settler	39.7	95	92.6				
Trial mean	38.3	102	118.8	167.5	99.0		
C.V. %	2.0	-	8.5	7.3	9.2		
LSD 5%	1.2	-	15.1	18.3	ns		
LSD 1%	1.6	-	20.8	25.1	ns		

Planting date: April 21 Harvest date: August 24
 Seeding rate: 750,000 live seeds/A (approx. 1.5 bu/A)
 Yield goal: 150 bu/A
 Herbicide application: 1 pt/A Buctril + 0.3 oz/A Harmony Extra

1993 Hettinger and Off-Station Oat Variety Trials Combined Means - 6 Sites*

Variety	Test weight lbs/bu	Plant height cm	Yield				
			1993	1992	1991	2yr	3yr
Monida	37.0	97	147.7	189.0	109.2	168.4	148.6
Newdak	36.8	93	132.8	174.4	107.0	153.6	138.1
Otana	39.2	108	131.0	167.8	112.7	149.4	137.2
Troy	39.7	104	135.3				
Prairie	37.2	85	142.6				

* Hettinger fallow & recrop, Regent, Scranton, New Leipzig & Selfridge

Dryland Oat Trial-Fallow

Dickinson, ND, 1993

Variety	Heading	Height	Test	Seeds/LB	Yield		
	Date		Weight		1993	1992	AVG
	JULY	IN	LBS		BU/A		
AC Belmont	4	48	40	17242	143	---	---
AC Marie	5	50	33	14511	131	---	---
Bay	5	46	34	15169	192	---	---
Calibre	5	51	35	14825	136	104	120
Derby	5	51	35	14036	130	110	120
Dumont	5	47	35	13766	144	97	121
Hyttest	2	49	40	13043	116	99	108
Monida	5	48	32	16950	141	112	127
Newdak	1	46	34	15550	132	108	120
Otana	3	47	37	15369	129	104	117
Porter	5	49	37	14734	184	103	144
Prairie	1	43	34	14792	143	97	120
Riel	4	47	37	13400	159	109	134
Robert	6	47	35	12115	156	103	130
Tibor	4	54	40	13408	87	102	95
Troy	4	48	37	15364	133	106	120
Valley	3	43	37	14228	159	97	128
MN 86231	2	41	38	14379	163	---	---
ND 852107	4	48	35	15903	135	109	122
ND 862095	4	48	39	14439	154	96	125
ND 862915	6	54	43	16070	127	78	103
ND 870258	4	45	35	15459	130	103	117
ND 870952	1	46	36	14033	149	101	125
ND 880107	5	49	36	14568	120	---	---
ND 880224	5	48	37	13507	174	107	141
ND 880946	5	50	36	16214	145	---	---
ND 880979	4	45	37	14561	154	---	---
ND 881374	5	49	38	15474	150	---	---
ND 881508	6	52	38	15139	136	---	---
Mean	181.8	48.0	36.5	14767	143.2		
C.V.%	10.6	5.3	2.6	4.0	10.2		
LSD .05	1.3	3.6	1.3	821	20.6		

Planting date: April 28

Planting rate: 750,000 pure live seed (PLS) per acre

Fertilizer applied: None

Herbicide applied: 1.25 lbs Stampede + 0.5 pt MCPA ester + 0.5 pt Crop Oil Concentrate per acre

Harvest date: August 30

Notes: Many oat plots were completely flooded for several days during the growing season.

Dryland Oat Trial

Dickinson and off-station sites, 1993

Variety	Dickinson	Beach	Glen Ullin	Hannover	Average 4 Sites
BU/AC					
Dumont	144	105.7	119.4	99.1	117.0
Monida	141	109.6	106.8	101.0	114.6
Derby	130	109.5	124.4	102.6	116.6
Otana	129	112.4	123.2	105.2	117.4
Kelsey	--	101.6	99.7	106.8	102.7
ND 870952	149	129.9	107.6	98.0	121.1
Mean	138.60	111.5	113.5	102.1	
C.V.%		7.6	11.3	6.4	
LSD .05		15.4	NS	NS	
TEST WEIGHT (LB/BU)					
Dumont	35.0	37.0	33.0	33.2	34.5
Monida	32.0	38.6	34.9	33.2	34.6
Derby	35.0	39.2	36.2	32.7	35.7
Otana	37.0	39.0	36.5	35.2	36.9
Kelsey	--	38.0	35.6	34.7	36.1
ND870952	36.0	40.5	38.5	37.1	38.0
Mean	35.0	38.7	35.8	34.4	
C.V.%		1.9	2.6	3.3	
LSD .05		1.1	1.4	1.7	

Planting date: April 28 (Dickinson); May 10 (Hannover); May 11 (Glen Ullin); May 12 (Beach)

Planting rate: 750,000 pure live seed (PLS) per acre

Fertilizer applied: None

Herbicide applied: 1.25 lbs Stampede + 0.5 pt MCPA ester + 0.5 pt Crop Oil Concentrate per acre (Dickinson and Glen Ullin); 1 pt Buctril per acre (Hannover); 1.5 pt Bronate per acre (Beach)

Harvest date: August 30 (Dickinson); September 9 (Hannover and Glen Ullin); September 15 (Beach)

Notes: All fields were fallowed in 1992; oat was sown in conventional seedbeds at Dickinson, Glen Ullin, and Hannover, and in a no-till seedbed at Beach. Trials at Dickinson, Glen Ullin, and Hannover were flooded for several days during the growing season, and the trial at Hannover was inadvertently grazed.

**Hard Red Winter Wheat
Variety Descriptions**

Variety	Agent or origin	Year	Quality	Leaf rust ¹	Stem rust ¹	Maturity	Straw strength	Height	Winter ^b hardiness
Roughrider	ND	1975	4.0*	S	R ¹	med.	m.strg.	med.	good
Agassiz	ND	1983	3.0	S	R	med.	med.	med.	good
Seward	ND	1987	2.0	S	R	med.	strong	med.	good
Norstar	Can.	1977	3.0	S	S	late	med.	tall	good
Rita	SD	1980	3.0	MS	MR ²	early	strong	med.	fair
Rose	SD	1981	2.0	S	MS ²	early	v.strg.	short	fair
Winnidge	MT	1980	1.0	S	S	med.	strong	med.	poor
Norwin*	MT	1983	2.0	S	MS	med.	strong	v.short	fair
Siouxland	NE	1984	2.0	MR	R	early	strong	med.	poor
Arapahoe	NE	1989	2.0	MR	MR	med.	med.	med.	fair
Judith	MT	1988	3.0	S	S	med.	strong	med.	fair
Abilene*	AgriPro	1987	2.5	S	MR	early	strong	v.short	poor

* 1.0 = Very poor quality; 2.0 = Poor quality; 2.5 = Poor to average quality; 3.0 = Average quality; 3.5 = Average to good quality; 4.0 = Good quality; Quality assessed by the Department of Cereal Science and Food Technology, NDSU;

^b Varieties with less than good winterhardiness should be seeded only in tall stubble or in standing solid seeded or narrow strip flax.

* Semidwarf.

¹ R = resistant; MR = moderately resistant; MS = moderately susceptible; S = susceptible.

² Susceptible in artificially induced epidemics.

³ Slow rusting type of resistance to race 15.

1993 Hettinger Hard Red Winter Wheat Variety Trial

Variety	Test weight lbs/bu	Grain protein %	Heading date June	Plant height cm	Winter survival %	Yield				
						1993	1992	1990	2yr	3yr
Seward	58.6	12.4	18	78	84	42.8	57.7	76.4	50.2	59.0
Roughrider	60.2	14.7	16	82	92	49.8	50.6	67.9	50.2	56.1
Siouxland	58.9	13.4	14	76	72	35.0	57.0	68.3	46.0	53.4
Agassiz	58.4	14.3	19	86	82	40.3	59.2	60.4	49.8	53.3
Arapahoe	59.5	13.9	14	72	74	34.2	48.3	76.4	41.2	53.0
Norstar	60.6	13.0	18	90	92	51.1	43.3	63.8	47.2	52.7
Abilene	59.8	14.0	14	60	65	30.4	46.5	58.4	38.4	45.1
Judith	53.5	14.8	19	78	38	13.7	45.3	70.0	29.5	43.0
TAM 107	59.5	14.0	12	60	50	16.6	24.6		20.6	
Longhorn	58.0	13.8	14	72	41	21.2				
Tomahawk	59.7	15.3	16	56	32	12.2				
ND8974	59.4	13.5	16	81	90	48.9				
ND8933	60.3	13.7	17	86	89	45.2				
ND8955	58.8	13.5	16	79	86	43.1				
ND8889	58.6	14.6	17	86	88	42.2				
ND8892	58.8	13.6	18	82	81	37.8				
ND90109	58.2	13.5	17	71	79	36.9				
ND8844	58.0	13.6	17	83	84	36.8				
ND8530	57.9	14.3	16	76	79	35.1				
Trial mean	58.8	13.9	16	77	74	35.4	57.2	67.3		
C.V. %	1.7	2.4	9	6	18	22.2	29.5	13.8		
LSD 5%	1.4	0.5	2	6	19	11.1	23.9	13.2		
LSD 1%	1.9	0.6	3	8	25	14.8	31.7	18.0		

Planting date: September 14, 1992 Harvest date: August 19, 1993
 Seeding rate: 1.1 million live seeds/A (approx. 1.1 bu/A)
 Fertilizer applied: 51 lbs/A 11-52-0 at planting
 Yield goal: 60 bu/A
 Herbicide application: 1/3 oz/A Harmony Extra + 3/4 pt/A Assert

Winter Rye
Variety Descriptions

Variety	Origin	Year released	Height	Straw strength	Maturity	Seed color	Seed size	Test wt.	Winter hardiness
Dacold	ND	1989	med.	good ¹	v.late	bl-grn.	med.	low	good
Prima	Can.	1984	tall	good	med.	blue	large	med.	v.good
Frederick	SD	1984	tall	fair	late	tan	med.	high	good
Musketeer	Can.	1980	tall	good	m.early	blue	large	med.	v.good
Rymin	MN	1973	tall	v.good	late	grn-gray	large	high	fair ²

¹ Under certain environments lodging has been observed

² Varieties with fair winterhardiness should not be seeded on bare land

1993 Hettinger Winter Rye Variety Trial

Variety	Test weight lbs/bu	Plant height cm	Yield				
			1993	1992	1991	2yr	3yr
			-----bu/A-----				
Prima	53.8	108	61.1	47.0	70.1	54.0	59.4
Dacold	50.3	94	45.0	50.2	72.4	47.6	55.9
Muskateer	52.7	102	40.5	45.2	67.9	42.8	51.2
Fredrick	54.0	103	70.3	18.2	61.8	44.2	50.1
Trial mean	52.7	102	54.2	39.7	66.5		
C.V. %	0.5	6	16.6	36.0	7.0		
LSD 5%	0.6	ns	17.4	22.5	6.9		
LSD 1%	0.8	ns	25.7	ns	9.4		

Planting date: September 14 Harvest date: August 10
 Seeding rate: 1.1 million live seeds/A (approx. 1.2 bu/A)
 Yield goal: 60 bu/A
 Herbicide application: 1/3 oz/A Harmony Extra + 3/4 pt/A Assert

1993 Hettinger Safflower Variety Trial

Variety	Test weight lbs/bu	First flower July	Yield				
			1993	1992	1991	2yr	3yr
Finch	42.1	30	1333	1386	840	1360	1186
S-541	36.8	8/2	1271	1298	877	1284	1149
Montola 2000	35.3	30	1277	1361	700	1319	1113
C/W 4440	34.6	30	1017	1334	877	1176	1076
Centennial	35.2	8/2	1250	1215	728	1232	1064
S-208	33.8	8/4	569	1250	774	910	864
Girard	38.0	8/2	768	1058	504	913	777
S-501	34.3	30	1530	1346		1438	
Stirling	38.8	28	1831	1017		1424	
Morlin	34.4	8/2	1192	1264		1228	
Saffire	40.3	26	1354	1071		1212	
90B6011	34.3	8/4	1626				
85B3910	36.0	30	1282				
88B3006	31.2	8/4	1280				
90B6817	35.0	30	1207				
Trial mean	36.0	8/1	1253	1155	703		
C.V. %	4.5	5	20	26	19		
LSD 5%	2.3	2	357	428	216		
LSD 1%	3.0	3	478	571	290		

Planting date: April 22 Harvest date: September 27
 Seeding rate: 400,000 live seeds/A
 Yield goal: 2000 lbs/A
 Herbicides applied: 0.25 oz/A Pinnacle
 Pinnacle herbicide caused slight crop injury.

1993 Hettinger Canola Variety Trial

Variety	Test weight lbs/bu	First flower June	Ht cm	Oil cont %	Yield				
					1993	1992	1991	2yr	3yr
Global	49.6	12	86	35.5	3798	3458	1600	3628	2952
Westar	49.6	7	74	36.5	2979	1973	1167	2476	2040
Tobin	49.9	2	71	35.6	2201	1933	1380	2067	1838
Hyola 401	49.0	3	70	36.8	3615	2714		3164	
Legend	48.3	6	79	36.3	3167	2380		2774	
6SN024*	49.7	18	75	36.3	3026				
6SN029*	50.2	18	71	35.2	2865				
6SN038*	50.2	16	71	35.4	2758				
Trial mean	49.6	10	75	35.9	3029	2458	1526		
C.V. %	1.4	14	10	1.6	14	21	14		
LSD 5%	1.0	2	11	0.8	615	729	328		
LSD 1%	1.4	3	ns	1.1	837	979	450		

Planting date: April 9, * = April 28 Harvest date: August 23
 Seeding rate: 10 lbs/A
 Yield goal: 2000 lbs/A
 Herbicide applied: 2 pt/A Sonalan, Pre-plant incorporated

1993 Hettinger Tame Mustard Variety Trial

Variety	Test weight lbs/bu	First flower June	Ht cm	Oil cont %	Yield				
					1993	1992	1991	2yr	3yr
Oriental	50.5	4	84	30.6	2437	3668	940	3052	2348
Tilney	53.9	2	66	20.8	2485	2763	1280	2624	2176
Kirby	53.6	3	68	21.9	2472	2454	1227	2463	2051
Brown	51.5	5	81	26.9	1944	3346	633	2645	1974
Trial mean	52.4	3	75	25.0	2335	2529	800		
C.V. %	0.8	14	10	2.9	15	13	14		
LSD 5%	0.7	1	11	1.1	ns	493	170		
LSD 1%	0.9	1	16	1.6	ns	682	233		

Planting date: April 9 Harvest date: August 25
 Seeding rate: 10 lbs/A
 Yield goal: 2000 lbs/A
 Herbicide applied: 2 pt/A Sonalan, Pre-plant incorporated

1993 Hettinger Crambe Performance Trial

Variety	Test weight lbs/bu	Oil content %	Yield				
			1991	1992	1993	2yr	3yr
			-----lbs/A-----				
BelAnn	32.8	31.3	1113	2787	2575	2681	2158
Prophet	31.4	32.1	1287	2514	2390	2452	2064
Belenzian	32.6	31.5	1133	2587	2421	2504	2047
Indy	32.7	32.2	1033	2267	2585	2426	1962
Meyer	31.4	29.5	1100	1840	1877	1858	1606
C-29	32.1	31.4		2600	2616	2608	
C-37	33.2	31.6		2334	2862	2598	
NM 99	31.7				2790		
NM 95	31.5				2657		
NM 09	31.1				2616		
NM 21	31.0				2585		
NM 71	32.2				2523		
C-22	31.8	30.4			2472		
NM 106	31.5				2434		
NM 02	31.4				2434		
NM 28	32.4				2400		
NM 89	30.6				2390		
NM 06	31.6				2339		
NM 84	32.4				2328		
NM 41	30.2				2328		
NM 97	32.8				2308		
NM 98	32.8				2298		
NM 19	31.8				2298		
NM 65	31.0				2287		
NM 01	31.0				2267		
NM 33	31.5				2257		
NM 31	31.4				2246		
NM 93	31.4				2236		
NM 85	31.0				2216		
R-87	31.3				2175		
NM 07	30.8				2175		
NM 16	32.0				2164		
NM 53	31.2				2154		
NM 15	31.9				2134		
NM 83	31.4				2123		
NM 56	32.4				2103		
NM 12	31.2				2093		
NM 107	31.7				2082		
NM 100	31.2				2065		
NM 61	31.0				2024		
NM 70	31.6				2010		
NM 26	31.3				2010		
NM 29	30.8				2000		
NM 55	29.9				2000		

Continued on next page.

1993 Hettinger Crambe Performance Trial continued

Variety	Test weight lbs/bu	Oil content %	Yield		
			1991	1992	1993
			-----lbs/A-----		
NM 22	31.9				1997
NM 80	31.6				1990
O-11	31.6				1939
NM 20	30.8				1846
NM 18	28.0				1559
Trial mean	31.5	31.2	1133	2418	2261
C.V. %	5.2	3.3	16	12	15
LSD 5%	ns	1.5	ns	442	494
LSD 1%	ns	--	ns	602	659

Planting date: April 9, 1993 Harvest date: August 26, 1993
 Seeding rate: 25 lbs/A
 Yield goal: 2000 lbs/A
 Herbicide application: 2.25 pt/A Sonalan Pre-plant incorp.

1993 Hettinger Crambe Date and Rate of Planting Trial

Planting date	Yield lbs/A	Test weight lbs/bu	Oil content %	Plant height cm	Plant Stand/A 1000's
April 22	3492	30.4	31.4	63	876
May 4	2852	32.7	33.3	72	529
May 19	1643	27.9	30.4	60	626
Trial mean	2840	30.2	31.4	64	738
C.V. %	13	5.5	2.4	9	46
LSD 5%	251	ns	2.0	4	76
LSD 1%	334	ns	2.7	12	101

Seeding rate lbs/A	Yield		Test weight lbs/bu	Oil content %	Plant height cm	Plant Stand/A 1000's
	1992	1993				
10	1917	2858	30.3	31.7	69	417
20	2189	2806	30.8	30.7	64	611
30	2207	2806	29.9	31.5	62	848
40	1997	2893	29.7	31.6	60	1077
Trial mean	2078	2840	30.2	31.4	64	738
C.V. %	40	27	8.0	4.8	11	38
LSD 5%	ns	ns	ns	ns	5	20

Variety: Meyer
 Herbicides applied: 2 pt/A Sonalan, pre-plant incorp.

Flax
Variety Description

Variety	Origin	Year re-leased	Relative maturity	Seed ¹ color	Seed size	Plant height	Wilt	Rust	Relative yield ability	Oil yield	Oil quality
Neche	ND	1988	mid	br.	med.	med.	R	R	good	good	good
Flanders	Can.	1989	late	br.	med.	med.	MS	R	good	good	good
Somme	Can.	1989	mid	br.	med.	med.	MS	R	good	good	good
Omega	ND	1989	mid	yel.	med.	med.	MS	R	v. good	v. good	good
Day	SD	1989	early	br.	med.	med.	MR	R	good	good	good
Prompt	SD	1988	early	br.	med.	med.	MR	R	good	good	good
Verne	MN	1987	early	br.	med.	med.	R	R	v. good	good	good
Linton	ND	1985	early	br.	med.	med.	R	R	v. good	good	good
NorMan	Can.	1984	mid	br.	med.	med.	MR	R	good	good	good
Rahab	SD	1984	mid	br.	med.	med.	MR	R	good	good	good
Clark	SD	1983	early	br.	med.	med.	MR	R	good	good	good
NorLin	Can.	1982	early	br.	med.	med.	MS	R	good	good	good
Flor	ND	1981	early	br.	med.	med.	MS	R	v. good	good	good
McGregor	Can.	1980	late	br.	med.	tail	R	R	v. good	good	good
Culbert 79	SD	1979	early	br.	med.	med.	MR	R	good	good	good
Dufferin	Can.	1975	late	br.	med.	tail	R	R	good	good	good
Linott	Can.	1966	early	br.	med.	med.	MS	R	good	good	good

¹ bl. = Blue; br. = Brown; yel. = Yellow.

1993 Hettinger Flax Variety Trial

Variety	Test weight lbs/bu	Plant height cm	Yield				
			1993	1992	1991	2yr	3yr
Norlin	54.2	58	43.2	32.4	27.1	37.8	34.1
Norman	54.5	66	41.3	33.1	27.6	37.2	34.0
Flor	54.2	52	39.8	32.1	28.5	36.0	33.5
Somme	53.9	57	38.2	31.8	29.5	35.0	33.2
Neché	54.3	62	36.2	33.3	28.3	34.8	32.6
Linton	54.2	62	38.7	37.7	20.9	38.2	32.4
Flanders	54.1	62	34.2	37.2	25.3	35.7	32.2
Omega	54.3	55	35.3	31.0	26.6	33.2	31.0
Prompt	53.8	53	36.4	27.0	29.5	31.7	31.0
Verne	54.5	55	35.4	27.5	27.0	31.4	30.0
McGregor	53.8	71	31.0	33.9	17.6	32.4	27.5
Linora	53.5	55	37.4	27.8		32.6	
McDuff	54.1	67	36.7				
CI3297	54.2	63	40.2				
CI3318	53.8	60	33.6				
CI3301	53.1	63	31.9				
Trial mean	54.1	60	36.6	31.2	26.5		
C.V. %	0.9	6	9.5	13.2	16.2		
LSD 5%	0.8	6	5.8	5.9	6.2		
LSD 1%	1.0	8	7.8	7.8	8.3		

Planting date: May 11 Harvest date: September 14
 Seeding rate: 30 lbs/A
 Yield goal: 30 bu/A
 Herbicide application: 0.25 oz/A Pinnacle

1993 Hettinger Buckwheat Variety Trial

Variety	Test weight lbs/bu	Yield				
		1993	1992	1991	2yr	3yr
Tokyo	42.3	1956	3020	288	2488	1755
Mancan	40.2	2187	2647	252	2417	1695
Mannor	39.4	2080	2474	194	2277	1583
Giant American	37.3	1769	2200	181	1984	1383
Trial mean	39.8	1998	2585	246		
C.V. %	1.8	11	14	65		
LSD 5%	1.4	ns	571	ns		
LSD 1%	2.1	ns	805	ns		

Planting date: May 12 Harvest date: September 1
 Seeding rate: 700,000 live seeds/A
 Yield goal: 2000 lbs/A
 Herbicide application: none

1993 Hettinger Coriander Date and Rate of Planting Trial

Planting date	Yield lbs/A	Test weight lbs/bu	Plant Stand/A 1000's
April 14	1197	27.9	151
April 28	1075	27.4	112
May 12	1022	26.5	106
May 19	210	28.6	3
C.V. %	37	16.1	72
LSD 5%	232	ns	15
LSD 1%	309	ns	20

Planting rate lbs/A	Yield lbs/A	Test weight lbs/bu	Plant Stand/A 1000's
5	583	26.8	37
10	809	26.7	81
15	1020	28.9	107
20	1092	26.9	146
C.V. %	55	16.0	84
LSD 5%	339	ns	17
LSD 1%	451	ns	23

Variety: Common

Herbicides applied: 2 pt/A Sonalan, pre-plant incorp.

1993 Hettinger Specialty Crops Trial

Crop	Test weight lbs/bu	Plant height cm	Seed date	Harv. date	Yield				
					1993	1992	1991	2yr	3yr
Proso millet	54.5	--	5/11	9/14	2189	1416	1147	1798	1581
Coriander	25.6	--	5/11	9/27	940	778	713	859	810
Garbanzo beans	59.3	--	5/12	9/27	920	0	0	460	307
Natto beans	poor	emergence	5/12	--	0	0	403	0	134
Flax +	55.1	60	5/11	9/1	1313	1350	348	1332	1004
Lentil*	59.8	30	5/11	9/1	747	580	327	664	551
HRSW +	57.2	63	5/11	9/1	1854	4206		3030	
Flax*	54.0	53	5/11	9/1	187	312		250	
Fenugreek	58.5	--	5/11	9/27	1480	1152		1316	
Camelina	52.5	67	5/11	8/19	2680	504		1592	
Amaranth	60.0	--	5/11	9/27	453	423		438	
Speltz	43.0	70	4/14	8/16	2387	3174		2780	
Spring rye	50.8	98	4/14	8/16	2920	3557		3238	
Lupine	frosted	--	5/12	--	0	0		0	

This trial was not replicated.

* Companion crops.

1993 Hettinger Oat Hay Variety Trial

Variety	Plant height cm	Moisture at harvest %	Yield*		
			1993	1992	2 yr.
			--Tons per acre--		
Robert	103	57	8.52	5.75	7.14
Monida	108	64	6.76	6.09	6.42
Otana	105	55	7.39	5.24	6.32
Steele	104	59	6.91	5.65	6.28
Dumont	92	56	6.35	6.05	6.20
Valley	94	60	6.78	5.58	6.18
Magnum	126	65	5.36	6.41	5.88
Mammoth	118	65	5.45	6.00	5.72
Tibor	108	61	5.95	5.49	5.72
Porter	91	58	7.64		
Newdak	102	60	6.77		
Magnum II	117	64	5.63		
Trial mean	106	60	6.63	5.61	
C.V. %	11		15.18	13.20	
LSD 5%	16		1.44	ns	
LSD 1%	22		1.94	ns	

Planting date: April 9
 Harvest date: August 3 (early dough growth stage)
 Seeding rate: 750,000 live seeds/A
 Yield goal: 5 Tons/A
 Herbicide used: 1/3 oz/A Harmony Extra
 * Yields are adjusted to 12 % moisture content.

1993 Hettinger Millet Hay Variety Trial

Variety	Moisture at harvest %	Yield*		
		1993	1992	2 yr.
		--Tons per acre--		
Rise proso	60	4.21	3.98	4.10
Sunup proso	59	4.05	3.90	3.98
Red foxtail	56	4.20	3.48	3.84
White foxtail	58	4.11	3.42	3.76
Golden German	65	2.67	2.97	2.82
Siberian foxtail	60	1.76	2.80	2.28
Trial mean	59	3.43	3.42	
C.V. %		13	18	
LSD 5%		0.68	0.93	
LSD 1%		0.92	ns	

Planting date: May 12 Harvest date: August 20
 Seeding rate: 15 lbs/A
 Yield goal: 5 Tons/A
 Herbicide used: 16 oz/A 2,4-D amine
 * Yields are adjusted to 12 % moisture content.

1993 Hettinger, Regent and New Leipzig Hybrid Corn Trials

Brand	Hybrid	Silage yield*			Average
		Hettinger	Regent	New Leipzig	
-----Tons per Acre-----					
Dekalb	381	13.08	10.15	18.20	13.81
Jacques	4120	12.40	9.99	17.35	13.25
Northrup King	SB95	11.67	10.69	15.53	12.63
Dekalb	401	12.42	9.19	15.47	12.36
Golden Harv.	EX830	11.97	9.16	15.09	12.08
Pioneer	3963	10.99	10.07	13.86	11.64
Northrup King	SB85	13.23	6.63	13.70	11.19
Pioneer	3917	11.11	8.17	12.78	10.69
Dahlgren	5862	8.89	6.74	12.64	9.42
Trial mean		11.75	8.98	14.96	
C.V. %		12.77	15.47	13.14	
LSD 5%		2.18	2.02	2.86	
LSD 1%		2.95	2.73	3.86	

Planting date: May 11 May 11 May 11
Harvest date: Sept. 17 Sept. 20 Sept. 20
Seeding rate: 21,000 seeds/A, thinned to 18,000 plants/A
Row spacing: 30 inches

* Silage yields are based on 70% moisture.

Note: Due to the short growing season, none of these hybrids developed mature grain. All of these hybrids with the exception of Northrup King's SB85 and SB95 are grain corn hybrids.

Dryland Hybrid Corn Trial - Fallow

Dickinson, ND, 1993

Brand	Hybrid	Relative Maturity Days	Harvest Moisture %	Silage Yield	
				70% M Tons/A	DM Basis Tons/A
Cargill	1077	75	67	9.8	2.9
Cargill	2037	80	72	11.1	3.3
Cargill	809	85	71	7.3	2.2
Dahlgren	D 5802	80	70	8.3	2.5
Dahlgren	D 5903	90	69	10.0	3.0
Dekalb	DK 343	84	70	10.2	3.1
Jacques	Exp. 3077	80	71	11.9	3.6
Jacques	2650	80	71	8.3	2.5
Cenex LOL	1185E	85	68	13.5	4.1
Cenex LOL	3088	88	69	6.8	2.0
Cenex LOL	166	78	70	10.6	3.2
Pioneer	3917	87	71	10.5	3.2
Pioneer	3963	79	71	10.9	3.3
Mean			70	9.9	3.0
C.V. %			4.1	23.4	23.2
LSD .05			NS	NS	NS

Planting date: May 19

Planting rate: approximately 18,000 plants/ac

Fertilizer applied: None

Herbicide applied: None

Harvest date: Silage cut on September 16; grain did not fully develop and could not be collected

Notes: Asana XL was applied for cutworm control in this trial. Extremely wet conditions prevented timely application of herbicides, as well as all but an early-season cultivation. Weed pressure was severe and undoubtedly competed with corn plants for growth resources until they were rogued. This weed pressure may account for our inability to detect significant differences in silage yield among hybrids because of the unexplained variability (as indicated by the high CV %) within this trial.

HETTINGER ALFALFA VARIETY DEMONSTRATION

Planted S to N

Planting date: 4/28/92

Source	Variety	Plants/ft ²	
		8/28/92	6/30/93
AgriPro	9750	17	13
AgriPro	Dart	24	14
Northrup King	MultiKing 1	16	13
Northrup King	Spredor 2	10	16
Garst	636	8	12
Garst	645	11	13
Dekalb	120	28	16
Dekalb	122	9	17
Pioneer	5364	30	17
Pioneer	5262	25	12
public	Ladak	35	13
public	Travois	36	10
public	Vernal	22	18
Interstate	Clipper	33	22
Interstate	WL225	18	13
Cenex LOL	Blazer	27	19
Cenex LOL	Legend	29	12
Cargill	Trident II	11	14
Cargill	Crown II	30	14
Jacques	Multi-plier	12	11
Jacques	Chief	31	20

Planting date: 7/8/93

8/17/93

ARS-Mandan Rangelander
Ag. Canada Anik
ARS-Mandan Heinrichs

24
17
19

Planting rate: 10 lbs/A

Nurse crop: Oats @ 25 lbs/A

Herbicides applied: 4/1/92 1.5 pt/A Treflan EC (PPI)
6/6/92 1.5 pt/A Poast + 2 pt/A Dash
5/3/93 1.5 pt/A Poast + 2 pt/A Dash

1993 Hettinger Oat / Pea Intercropping Trial (hay)

Seeding rate*		Yield** Tons/A	Plant stand 1000's		
Oat	Pea		Oat	Pea	
0	: 0.5	1.21	0	131	
0	: 1.0	2.37	0	212	<u>*Seeding Rates</u>
0	: 1.5	2.66	0	230	live seeds/A
0.5	: 0	4.44	286	0	<u>Oats - Dumont</u>
0.5	: 0.5	3.98	330	87	0.5 = 400,000
0.5	: 1.0	4.80	348	87	1.0 = 800,000
0.5	: 1.5	4.46	311	255	1.5 = 1,200,000
1.0	: 0	5.00	597	0	
1.0	: 0.5	4.60	473	19	<u>Peas - Trapper</u>
1.0	: 1.0	5.47	591	93	0.5 = 162,500
1.0	: 1.5	5.04	454	131	1.0 = 325,000
1.5	: 0	4.35	753	0	1.5 = 487,500
1.5	: 0.5	4.71	772	56	
1.5	: 1.0	5.87	709	149	
1.5	: 1.5	4.42	703	218	
C.V. %		17.25	29	80	
LSD 5%		1.04	176	40	
LSD 1%		1.38	235	53	

Planting date: April 22, 1993 Harvest date: August 3, 1993
 ** Yields are adjusted to a 12% moisture bases.

1993 Hettinger Oat / Pea Intercropping Trial (grain)

<u>Seeding rate*</u> Oat : Pea	<u>Grain Yield</u>		<u>Test Weight</u>		<u>Plant stand</u>	
	Oat bu/A	Pea lb/A	Oat lbs/bu	Pea	Oat 1000's	Pea
0 : 0.5		1642		62.3		156
0 : 1.0		1661		61.0		168
0 : 1.5		2222		62.3		311
0.5 : 0	108		32.6		286	
0.5 : 0.5	108	79	32.8	--	292	100
0.5 : 1.0	99	176	33.5	--	342	162
0.5 : 1.5	101	262	32.8	--	342	236
1.0 : 0	118		33.6		492	
1.0 : 0.5	112	24	33.5	--	485	62
1.0 : 1.0	118	31	33.3	--	516	37
1.0 : 1.5	110	97	33.5	--	386	268
1.5 : 0	120		34.6		554	
1.5 : 0.5	121	36	33.9	--	516	56
1.5 : 1.0	113	47	34.8	--	535	75
1.5 : 1.5	106	27	33.8	--	579	118
C.V. %	9	54	3.1	1.8	31	48
LSD 5%	14	464	1.5	ns	156	79
LSD 1%	18	625	2.0	ns	209	106

Planting date: April 22, 1993

Harvest date: August 26, 1993

Grain yields are adjusted to a 12% moisture bases.

*Seeding Rates
live seeds/A

Oats - Dumont
0.5 = 400,000
1.0 = 800,000
1.5 = 1,200,000

Peas - Trapper
0.5 = 162,500
1.0 = 325,000
1.5 = 487,500

1993 Hettinger Alternative Forage/Hay Trial

Crop	Variety/Type	Yield ^a tons/A	Crude Protein %	ADF ^b %	IVDMD ^c %	Nitrate ^d %
Corn	Pioneer 3963	3.57	8.6	29.8	76.4	0.6
Forage Sorghum	Sorgo 10	4.89	9.1	28.2	75.3	0.7
Sorghum/Sudan	Haybuster III	4.91	8.7	32.5	68.1	0.5
Sorghum/Sudan	Greentreat II	4.54	8.1	36.4	63.4	0.5
Sorghum/Sudan	Highland Sweet	5.08	10.7	31.9	69.6	2.0
Sudangrass	Piper	3.65	8.8	36.4	62.4	0.5
Amaranth		3.85	14.3	29.1	65.5	4.5
Spg Rye	Gazelle	3.27	11.4	37.4	58.5	0.5
Triticale		4.16	13.8	36.3	69.0	0.6
Speltz		3.75	14.3	40.0	66.5	1.1
HRSW	Amidon	2.22	14.6	35.3	64.6	0.9
Oats	Monida	4.00	14.3	37.8	65.1	2.3
Barley	Bowman	2.33	12.6	27.1	69.8	0.5
Forage Barley	Horseford	3.96	12.6	30.2	64.6	0.7
Millet	Rise	3.69	12.5	26.1	73.2	1.3
Millet	Hybrid Pearl	3.59	15.1	34.4	72.8	3.1
C.V. %		15.86				
LSD 5%		0.93				
LSD 1%		1.25				

Planting dates: 4/14/93 and 5/12/93

Harvest dates: 8/3/93 and 9/1/93

Herbicide applied: 16 oz/A 2,4-D amine. None on amaranth.

a Yield is on a 12% moisture bases.

b Acid Detergent Fiber is an indication of fiber content.

c In-Vitro Dry Matter Digestibility is an estimation of the ruminants ability to digest the feed.

d Nitrate levels higher than 1.5% are potentially toxic to livestock.

Recrop No-Till Feed Grain Variety Trial

Dickinson, ND, 1993

Crop	Variety	Heading Date	Height	Test Weight		Yield
		JUNE	IN	LBS	LBS/AC	BU/AC
Emmer wheat	Bowman	30	31.3	39.8	2343.0	39.1
Spring rye	Gazelle	15	27.5	53.1	2413.1	43.1
Barley	Lewis	23	24.5	47.8	1866.7	38.9
HRSW	Newana	27	24.0	53.3	1577.0	26.3
Oat	Otana	30	30.0	36.3	1178.5	36.8
Emmer wheat	PI254148	22	22.5	30.6	1147.5	19.1
Polish wheat	common	25	30.5	49.5	1392.7	23.2
Speltz wheat	common	28	31.0	41.0	1729.8	28.8
Mean		176.2	27.7	43.9	1706.1	31.9
C.V.%		0.9	23.9	4.7	12.1	11.8
LSD .05		2.2	NS	3.0	303.2	5.5

Dryland Fallow Spring Triticale Variety Trial

Dickinson, ND, 1993

Variety	Heading Date	Height	Test Weight	Seed/lb	Yield	
	JULY	IN	LBS		LBS/AC	BU/AC
Buffalo	28.0	129.8	54.5	10246.8	3838	76.9
Florico	18.3	119.3	52.9	10840.7	3876	77.7
Kerry	28.0	125.8	53.8	10354.8	3782	75.8
Osiris	23.0	118.8	53.9	11008.6	3063	51.4
Patriot	28.0	127.3	53.3	10738.3	3200	64.1
Springfest	10.0	131.3	44.9	11109.3	3980	79.8
T16a	28.3	105.0	53.8	11664.6	2435	48.8
T71	10.0	134.3	46.8	11182.6	3888	77.9
Wapiti	28.0	106.8	51.9	11813.0	3712	74.4
Mean	22.4	122.0	51.7	10995.1	3530	70.7
C.V.%	25.0	4.2	2.4	5.4	11.8	11.8
LSD .05	8.2	7.5	1.8	865	607.4	12.2

Planting date: April 14 (Feed Grain Trial); April 26 (Triticale Trial); Fertilizer applied: 100 lbs urea per acre (Triticale Trial); ; Herbicide applied: 1.5 pt Buctril per acre (Feed Grain Trial); 0.5 pt Harmony Extra + 0.75 pt 2,4-D ester (Triticale Trial); Harvest date: August 28 (Feed Grain Trial); September 7 (Triticale Trial)

1993 Hettinger Broadleaf Herbicide Trial

Treatment	Rate oz/A	Kochia control %	Crop injury %	Plant height cm	Crop Yield bu/A
2,4-D amine	6	39	0	60	20.1
MCPA amine	6	18	0	58	24.1
2,4-D ester	4	58	0	58	20.1
MCPA ester	4	62	0	57	21.4
Banvel	2	96	0	58	25.3
Bronate	8	96	0	62	25.6
Buctril	4	92	0	59	29.0
Banvel+MCPA amine	1.5+4	94	0	62	25.4
Curtail	9.5	22	0	62	28.2
Ally+2,4-D est.+Banvel+X-77	1/16+4+1+.125%	96	0	61	28.8
Ally+MCPA ester+Banvel+X-77	1/16+4+1+.125%	99	0	63	30.7
Express+2,4-D est.+Banvel+X-77	1/8+4+1+.125%	98	0	57	29.0
Express+MCPA ester+Banvel+X-77	1/8+4+1+.125%	97	0	60	23.6
Ally+X-77	1/16+.125%	80	0	60	27.3
Express+X-77	1/8+.125%	68	0	60	25.0
Ally+2,4-D ester+X-77	1/16+4+.125%	94	0	59	25.6
Ally+MCPA ester+X-77	1/16+4+.125%	84	0	60	28.9
Stampede EDF+MCPA ester+COC	.17+4+32	46	0	58	27.6
Dakota	6.5	32	0	59	25.7
Untreated	0	0	0	58	28.4
C.V. %		35	-	7	23.0
LSD 5%		23	-	ns	ns
LSD 1%		31	-	ns	ns

Planting date: April 14, 1993

Variety: Grandin HRSW

Harvest date: August 17, 1993

Date of application: May 31, 1993

Crop growth stage: 6 leaf

Weed & growth stage: Kochia 1/4 - 3"

Temperature: 60 F

Humidity: 70%

Sky: Cloudy

Wind: 5 mph NE

Rainfall: June 1, 1993

Trial was sprayed with 1 pt/A Assert on May 13 to control wildoats.

Application of treatments were delayed due to adverse weather conditions.

**1993 Hettinger Reduced Rates of Broadleaf Herbicides
on Hard Red Spring Wheat**

Treatment	Rate oz/A	Crop injury %	Weed Control		
			Kochia %	Rus.Th* %	1992** %
Express	1/6	0	81	74	97
Express	1/10	0	70	61	95
Express	1/15	0	85	96	79
Harmony Extra	1/3	0	91	99	96
Harmony Extra	1/6	0	76	99	95
Harmony Extra	1/10	0	65	--	90
Ally	1/10	0	89	70	96
Ally	1/15	0	96	58	99
Ally	1/20	0	97	99	88
Abmer	1/4	0	94	94	93
Amber	1/8	0	90	94	94
Amber	1/10	0	65	99	97
MCPA ester	8.0	0	79	50	90
Untreated	0	0	0	0	0
C.V. %		-	34	40	15
LSD 5%		-	36	38	10
LSD 1%		-	48	50	13

Crop and Growth Stage: HRSW - 4 leaves
Weed and Growth Stage: Kochia - 1/4 - 3"
Rus.Th - 2 - 4"

* Russian thistle

** % Kochia control in 1992

All treatments were applied with 8.0 oz/A MCPA ester (4 lb/G).
1 pt/A Assert was applied on May 13 to control wild oats.

Reference to commercial products and trade names are made
with no intended endorsement. Herbicides, treatments and
treatment rates used in this trial do not imply endorsement
of non-labeled uses. USE ALL PESTICIDES ONLY AS LABELED.

1993 Hettinger Wildoat Herbicide Trial

Treatment	Rate oz/A	Wildoat control %	Crop injury %	Plant height cm	Crop Yield bu/A
Hoelon + Sun-It II	12 + 23	64	0	56	9.0
Hoelon + Buctril	12 + 4	48	2	54	10.5
Assert-LC + Sun-It II	5 + 23	49	0	52	9.3
Assert-LC + X-77	5 + .25%	36	2	52	9.5
Assert-LC + Avenge + X-77	2.5 + 6 + .25%	32	0	52	8.3
Assert-LC + Avenge + X-77	3.7 + 8 + .25%	39	2	44	6.9
Assert-LC + Harm.Ext. + Sun-It II	5 + 1/4 + 23	43	0	50	7.6
Avenge	12	27	0	50	7.0
Avenge + Harm.Ext. + X-77	12 + 1/4 + .25%	25	2	52	7.5
Tiller	9.4	82	0	53	11.6
Tiller + Harm.Ext. + Banvel	9.4 + .22 + 1	68	0	54	9.9
Tiller + Express + Banvel	9.4 + 1/8 + 1	72	0	54	9.7
Cheyenne TP	7.3	89	0	53	8.9
Untreated	0	0	0	49	9.1
C.V. %		58	378	14	33.0
LSD 5%		28	ns	ns	ns
LSD 1%		37	ns	ns	ns

Planting date: April 14, 1993

Variety: Grandin HRSW

Harvest date: August 17, 1993

Date of application: May 31, 1993

Crop growth stage: 6 leaf

Weed & growth stage: Wildoat - 4 leaf

Temperature: 60 F

Humidity: 70%

Sky: Cloudy

Wind: 5 mph NE

Rainfall: June 1, 1993

Trial was sprayed with 1/3 oz/A Harmony Extra on May 13.

Application of treatments were delayed due to adverse weather conditions.

Crop stand was severely reduced by wildoat competition prior to treatment application.

1993 HETTINGER REDUCED WILDOAT HERBICIDE TRIAL

Product	Rate	oz/A	Wildoat Control		
			1992	1993	mean
			-----%-----		
Hoelon	Full rate	32	68	84	76
Hoelon	3/4 rate	24	23	79	51
Hoelon	1/2 rate	16	16	64	40
Hoelon	1/4 rate	8	15	64	40
Assert	Full rate	16	89	82	86
Assert	3/4 rate	12	82	74	78
Assert	1/2 rate	8	66	62	64
Assert	1/4 rate	4	64	57	60
Avenge	Full rate	40	45	42	44
Avenge	3/4 rate	30	43	46	44
Avenge	1/2 rate	20	37	32	34
Avenge	1/4 rate	10	42	9	26
Tiller	Full rate	24	--	87	--
Tiller	3/4 rate	18	--	82	--
Tiller	1/2 rate	12	--	75	--
Tiller	1/4 rate	6	--	48	--
Untreated			0	0	0
C.V. %			55	38	
LDS 5%			29	22	
LSD 1%			38	29	

Application date: 6/4/93
 Crop & growth stage: Bowman Barley - 4 leaf
 Weed & growth stage: Wildoat - 4 leaf
 Trial was sprayed with 1/3 oz/A Harmony Extra on 5/13/93

Reference to commercial products and trade names are made with no intended endorsement. Herbicides, treatments and treatment rates used in this trial do not imply endorsement of non-labeled uses. USE ALL PESTICIDES ONLY AS LABELED.

1993 Hettinger Crop Tolerance to Avenge Wildoat Herbicide

This trial was conducted to determine varietal tolerances to Avenge wildoat herbicide. Four pints per acre (actual product) of Avenge was applied to hard red spring wheat, barley and durum varieties (see following table). Crop injury was determined by visual comparison with untreated checks.

Several varieties of HRSW and durum were injured by Avenge and are noted in the following table. There were no barley varieties exhibiting injury caused by Avenge. This trial was not replicated.

Planting Date: 4/8/93
 Planting Rate: HRSW - 1.1 million live seeds/A
 Durum - 1.25 million live seeds/A
 Barley - 750,000 live seeds/A
 Fertilizer Applied: 44 lbs/A 11-52-0
 Herbicide Applied: Avenge at 4 pt/A (product) - 5/13/93
 1/3 oz/A Harmony Extra - 5/13/93
 Carrier: Water at 10 gal/A
 Crop Injury Ratings: 0 = none
 1 = leaf spotting
 2 = stunting and leaf chlorosis
 3 = stunting and leaf necrosis

HRSW		Durum		Barley	
Variety	Injury	Variety	Injury	Variety	Injury
Krona	0	Sceptre	0	Bowman	0
Norm	0	Medora	0	Stark	0
2375	0	Ward	0	Gallatin	0
Grandin	2	Renville	1	Harrington	0
Amidon	0	Vic	2	Manley	0
Dalen	0	Plenty	0	Mores	0
Sonja	0	Regold	1	Azure	0
Sharp	0	Rugby	0	Robust	0
2371	0	Monroe	0	Hazen	0
Hi-Line	0	Lloyd	0	Excel	0
Gus	0	Laker	1	B1602	0
2370	0			Stander	0
Cutless	0			Horsford	0
Bergen	0				
Prospect	1				
Butte 86	0				
AC Minto	0				
Stoa	0				
Alex	3				
Vance	0				
Len	3				
Express	0				
Teal	1				
AC Domain	1				
McNeal	0				

1993 Hettinger HRSW Varietal Response to Varying Rates of Avenge Wild Oat Herbicide

Treatment Means:

<u>Variety</u>	<u>Rate</u> pt/A	<u>Yield</u> bu/A	<u>Test</u> <u>weight</u> lbs/bu	<u>Plant</u> <u>height</u> cm	<u>Crop</u> <u>injury*</u>
Gus	0.0	33.0	54.9	56	0.00
Gus	2.5	26.8	53.2	53	1.50
Gus	4.0	30.4	55.1	55	2.00
Gus	6.0	33.0	55.7	62	2.00
Gus	8.0	32.7	56.2	58	2.00
2375	0.0	34.9	55.1	59	0.00
2375	2.5	36.2	55.6	59	0.50
2375	4.0	37.7	56.4	54	0.75
2375	6.0	36.1	56.9	56	1.50
2375	8.0	31.1	56.1	53	2.00
Norm	0.0	37.8	56.1	62	0.00
Norm	2.5	32.5	55.6	60	0.25
Norm	4.0	34.4	55.6	65	0.75
Norm	6.0	36.3	56.0	62	1.50
Norm	8.0	33.7	56.1	65	1.75
C.V. %		28.9	4.5	10	37.10
LSD 5%		ns	ns	ns	0.60

Rate Means:

<u>Rate</u> pt/A	<u>Yield</u> bu/A	<u>Test</u> <u>weight</u> lbs/bu	<u>Plant</u> <u>height</u> cm	<u>Crop</u> <u>injury*</u>
0.0	35.2	55.4	59	0.00
2.5	31.8	54.8	58	0.75
4.0	34.2	55.7	58	1.17
6.0	35.1	56.2	60	1.67
8.0	32.5	56.1	59	1.92
C.V. %	27.2	4.3	11	49.44
LSD 5%	ns	ns	ns	0.46

*Crop Injury
 0 = no injury
 1 = moderate stunting
 2 = severe stunting &
 leaf necrosis

Planting date: 4/28/93

Harvest date: 9/1/93

Application date: May 13

Crop growth stage at time
of application: 4 leaf

Varietal Means:

<u>Variety</u>	<u>Yield</u> bu/A	<u>Test</u> <u>weight</u> lbs/bu	<u>Plant</u> <u>height</u> cm	<u>Crop</u> <u>injury*</u>
2375	35.2	56.0	56	0.95
Gus	31.2	55.0	57	1.60
Norm	34.9	55.9	63	0.85
C.V.%	26.5	4.2	10	68.80
LSD 5%	ns	ns	4	0.50

1993 Hettinger Accent / Adjuvant Herbicide Trial on Corn

Treatment	Rate oz/A	Grass control %
Accent	1/3	0
Accent + 2% Methylated Seed Oil (MSO)	1/3 + 24	14
Accent + 1% MSO	1/3 + 12	1
Accent + .5% MSO	1/3 + 6	15
Accent + .25% MSO	1/3 + 3	71
Accent + 2,4-D + 2% MSO	1/3 + 6 + 24	25
Accent + 2,4-D + 1% MSO	1/3 + 6 + 12	35
Accent + 2,4-D + .5% MSO	1/3 + 6 + 6	9
Accent + 2,4-D + .25%	1/3 + 6 + 3	18
Accent + 2,4-D	1/3 + 6	12
Accent + 28% N	1/3 + 51	32
Accent + Ammonium Sulfate (AS)	1/3 + 51	19
Accent + 28% N + 1% MSO	1/3 + 51 + 12	69
Accent + AS + 1% MSO	1/3 + 51 + 12	66
Accent + 28% N + .5% MSO	1/3 + 51 + 6	64
Accent + AS + .5% MSO	1/3 + 51 + 6	65
Accent + 2,4-D + 28% N + 1% MSO	1/3 + 6 + 51 + 12	74
Accent + 2,4-D + AS + 1% MSO	1/3 + 6 + 51 + 12	75
Accent + 2,4-D + 28% N + .5% MSO	1/3 + 6 + 51 + 6	52
Accent + 2,4-D + AS + .5% MSO	1/3 + 6 + 51 + 6	69
Accent + NIS (Spray Booster S)	1/3 + 3	20
Accent + NIS (Preference)	1/3 + 3	8
Accent + 17% Petroleum Oil Con. (PO)	1/3 + 3	9
Accent + 2,4-D + Spray Booster S	1/3 + 6 + 3	19
Accent + 2,4-D + Preference	1/3 + 6 + 3	24
Accent + 2,4-D + PO	1/3 + 6 + 3	1
Accent + Banvel	1/3 + 4	20
Accent + Banvel + Spray Booster S	1/3 + 4 + 3	6
Accent + Banvel + 1% MSO	1/3 + 4 + 12	9
Accent + Banvel + Preference	1/3 + 4 + 3	4
Accent + Banvel + PO	1/3 + 4 + 3	5
Accent + Atrazine + 1% MSO	1/3 + 8 + 12	15
Untreated	0	0
C.V. %		76
LSD 5%		30
LSD 1%		39

Date of application: July 2, 1993
 Crop growth stage: 6 leaves = 1 foot
 Weed and growth stage: Wildoat - late boot to heading

Reference to commercial products and trade names are made with no intended endorsement. Herbicides, treatments and treatment rates used in this trial do not imply endorsement of non-labeled uses. USE ALL PESTICIDES ONLY AS LABELED.

1993 Hettinger Seedling Alfalfa Herbicide Trial

OBJECTIVES: To observe crop tolerance and weed control of different herbicides to seedling alfalfa.

Treatment	Alfalfa height cm	Pop./ 1'row plants	Control		Yield* Tons/A
			Kochia %	Barley %	
Untreated	45	6	0	0	0.77
2 pt Poast + 1 pt Buctril	60	13	90	100	1.66
2 pt Hoelon + 1 pt Buctril	40	12	95	0	0.90
1 pt Assert + 1 pt Buctril	40	8	95	0	0.66
4 oz Pursuit	40	12	90	50	0.85
2 pt Poast	58	8	0	100	1.26
2 pt Hoelon	50	11	0	0	0.87
1 pt Assert	40	11	0	0	0.73
4 pt Avenge	40	6	0	0	0.73

Planting date: April 13, 1993

Seeding rate: Alfalfa - 7 lbs/A
Barley - 1 bu/A

Fertilizer applied: 50 lbs/A 11-46-0

Date of herbicide application: May 25, 1993

Growth stage at application: Alfalfa - 4 trifoliolate leaves
Barley - 5 leaves
Kochia - 0.25 to 2.5 inches

Harvest date: August 17, 1993 (2nd cutting)

* Yields have been adjusted to 12% moisture.

Reference to commercial products and trade names are made with no intended endorsement. Herbicides, treatments and treatment rates used in this trial do not imply endorsement of non-labeled uses. USE ALL PESTICIDES ONLY AS LABELED.

1993 HETTINGER TILLAGE/FERTILITY TRIAL

In response to the need for additional field research on systems approaches for crop production in southwestern North Dakota, this long term study was implemented to investigate production systems for hard red spring wheat.

Systems being studied involve the use of five different cropping systems and three different fertility schemes within each cropping system. Cropping systems are (1) a conventional fallow system utilizing tillage equipment for weed control, (2) a minimum tillage fallow system utilizing chemicals and tillage equipment for weed control, (3) a no-tillage fallow system utilizing chemicals for all weed control, (4) a continuous cropping system utilizing conventional tillage practices for Fall weed control and seedbed preparation, and (5) a no-tillage continuous cropping system utilizing chemicals for all weed control. Fertility schemes within each cropping system are (1) urea fertilizer (46-0-0) broadcast and incorporated in the Spring plus an application of diammonium phosphate (18-46-0) fertilizer applied with the seed based on residual soil fertility analysis and a yield goal of 60 bushels per acre, (2) anhydrous ammonia (82-0-0) applied in the Fall plus an application of 18-46-0 fertilizer applied with the seed based on residual soil fertility analysis and a yield goal of 60 bushels per acre, and (3) an application of 50 pounds per acre of 18-46-0 fertilizer applied with the seed.

This trial was initiated in 1990 with work being conducted to get all tillage and fertilizer treatments into a workable sequence. The first complete set of data was collected in 1991.

The 1993 trial was planted on April 13, with Grandin HRWS at a rate of 75 pounds per acre. Residual soil fertility analysis indicated between 198 and 26 pounds of available nitrogen per acre in the top 24 inches and between 32 and 22 pounds of available phosphorous per acre in the top 6 inches, depending on the tillage system.

Fertilizer rates were applied according to fertility scheme objectives stated above.

One third of an ounce per acre of Harmony Extra herbicide plus 3/4 pint per acre of Assert herbicide were applied on May 13 to control broadleaf weeds and wildoats.

There was no statistical difference between fertilizer treatments for yield or plant height (Table 1). The mean test weight of the Fall applied anhydrous ammonia fertilizer treatment was significantly lower than the 50 pound per acre application of 18-46-0 applied with the seed. Percent grain protein was significantly higher for the Fall applied anhydrous ammonia fertilizer treatment than the 50 pound per acre application of 18-46-0 applied with the seed.

Highly significant differences were observed for yield, test weight and plant height within cropping systems (Table 2). Yield results of all fallow systems have been adjusted to an annual yield bases. The yield from the continuous, conventional tillage system was significantly lower than other tillage systems in 1993. Adjusted yields for the fallow systems and the continuously cropped no-tillage system were not significantly different in 1993.

Averaging the yield means from the last 3 years indicate an advantage to utilizing the continuously cropped no-till system followed by the minimum tilled fallow system, the no-till fallow system, the continuously cropped conventionally tilled system and finally the conventionally tilled fallow system. At this time there does not appear to be any trend as to which fertility scheme may be more or less efficient however, due to the high residual nitrogen levels over the past 3 years, these results must be interpreted with caution. Fertilizer treatments and cropping systems require several years of testing before meaningful conclusions may be made.

Table 1. Fertilizer treatment means.

Treatment	Test weight lbs/bu	Grain protein %	Plant height cm	Yield				
				1993	1992	1991	2yr	3yr
Spring Urea + 18-46-0	55.8	16.1	79	43.4	78.5	55.3	61.0	59.1
Fall Anhydrous + 18-46-0	55.6	16.2	78	43.0	78.9	52.4	61.0	58.1
50 lbs/A 18-46-0	56.4	15.9	80	42.9	77.6	55.9	60.2	58.8
LSD 5%	0.6	0.2	ns	ns	ns	ns		

Table 2. Cropping system means.

System	Test weight lbs/bu	Grain protein %	Plant height cm	Yield*				
				1993	1992	1991	2yr	3yr
Conventional Tilled Fallow	57.5	16.0	85	26.2	35.6	34.4	30.9	32.2
Minimum Tilled Fallow	57.0	16.0	85	28.9	48.9	35.4	38.9	37.7
No-tilled Fallow	56.7	15.8	88	28.5	47.2	35.8	37.8	37.1
Contin. Cropped Convent. Till	53.2	16.3	61	21.9	59.5	15.8	40.7	32.4
Contin. Cropped No-tillage	55.4	16.1	76	26.4	68.7	49.5	47.6	48.2
C.V. %	1.4	1.7	4	9.2	4.4	6.9		
LSD 5%	1.1	ns	9	4.0	3.0	3.2		
LSD 1%	1.5	ns	13	5.8	4.0	4.4		

* Yields have been adjusted to an annual yield bases.

ns = no statistical difference between treatments.

Cropping Systems Trials - Dickinson

Several long-term experiments were begun at Dickinson in 1993. Many of these trials are designed to explore the interactions of two or more management variables (e.g., cropping sequence and seedbed preparation) on crop yield, quality, and economics. Data from these trials were collected in 1993, however, it is not included in this publication because many treatments are not yet fully in place. For example, a wheat-fallow cropping sequence will require two years (1992-93 and 1993-94) before one cycle of the sequence is completed. Additional information concerning these trials can be obtained by contacting the agronomist at the Dickinson Research Extension Center.

Long-Term Trials Begun in 1993 at Dickinson

HRSW Variety x Seeding Rate x Tillage System Trial - This trial explores how different HRSW varieties respond to different seeding rates in no-tillage, reduced-tillage, and conventional-tillage environments in a wheat-fallow cropping sequence. Agronomists at the Dickinson Research Extension Center are working in cooperation with Joe Kuprinsky, a USDA-ARS plant pathologist located at Mandan, Mike Weiss, an entomologist at NDSU, and Richard Frohberg, the HRSW plant breeder at NDSU, in this trial.

HRSW Variety x Cropping System Trial - This trial compares and contrasts how several HRSW varieties respond in wheat-fallow, wheat-wheat, and wheat-corn cropping sequences. Agronomists at the Dickinson Research Extension Center are cooperating with Richard Frohberg, the HRSW plant breeder at NDSU, in this trial.

HRSW N Fertilizer x Fungicide x Tillage System Trial - This trial compares and contrasts the performance of the HRSW variety 'Stoa' in low and moderate N level environments across no-tillage, reduced-tillage, and conventional-tillage environments, with and without fungicide, in regards to Tan Spot incidence. Agronomists at the Dickinson Research Extension Center are working in cooperation with Joe Kuprinsky, a USDA-ARS plant pathologist located at Mandan, and Marcia McMullen, a plant pathologist at NDSU, in this trial.

HRSW Variety x Wheat Aphid Trial - This trial is designed to determine the economic threshold for three aphid species on HRSW and to determine if different HRSW varieties have different economic threshold levels. Phil Boeve is a graduate student in the Department of Entomology at NDSU who is conducting this research in partial fulfillment for his Ph.D. degree. Mike Weiss is Phil's research director.

Weed Cropping Systems Trial - This trial compares and contrasts weed populations and types of weeds which develop in a wheat-silage corn-fallow cropping sequence across conventional-tillage, no-tillage, and "reduced purchased input" environments. Cathy Morton is a post-doctorate research associate working with John Nalewaya in the Crop and Weed Sciences Department at NDSU who are directing the project at Dickinson.

Mechanical Weed Control Trial - This trial compares grass and broadleaf weed control across several alternative crops using various tillage implements alone and in combination with herbicides. Treatments involving only herbicides are also included. Agronomists at the Dickinson Research Extension Center are cooperating with weed scientists at Montana State University in this trial.

Cereal-Pulse Intercrop Trials - These trials compare forage and grain production and quality of cereal-pea and corn-bean crop mixtures compared to growing cereal crops alone in conventional tillage and no-tillage environments across crop-fallow and crop-crop environments. Agronomists at

the Dickinson Research Extension Center are cooperating with Eric Eriksmoen at the Hettinger Research Extension Center, Anthony Thilmony and Kent KcKay at the North Central Research Extension Center located at Minot, Blaine Schatz and Steve Zwinger at the Carrington Research Extension Center, and farmer cooperators, on this trial.

Feed Grain Legume Trials - These trials are evaluating the potential which lupin and other grain legumes may have as feed grain crops in southwestern North Dakota. Agronomists at the Dickinson Research Extension Center are cooperating with Blaine Schatz at the Carrington Research Extension Center in this trial. Blaine is overall director of this research effort, and Anthony Thilmony at the North Central Research and Extension Center located at Minot is also involved.

Soil Conservation Service
Plant Materials Center
Bismarck, North Dakota

Project No.: 38A339X Hettinger, North Dakota

Project Title: Field evaluation of cool-season grasses for pasture, range, wildlife habitat, and protection of surface and ground water.

- I. Cooperators: USDA, Soil Conservation Service (SCS); in cooperation with the North Dakota State University (NDSU), Hettinger Research and Extension Center (HREC); Adams County Soil Conservation District (ACSCD); and Mr. Joseph Clement, private landowner.
- II. Location: Legal Description; SE1/4 sec. 24, T. 129, R. 96, Adams County, North Dakota. Approximately 2 miles south of Hettinger.

PLANTING DATE: April 6, 1992

PROJECT: 38A339X Hettinger, North Dakota
 PROJECT TITLE: Field evaluation of cool season grasses for pasture, rangeland, wildlife habitat,
 and erosion control

Table FP-2: Plant performance 1992-1993. The plots were seeded April 6, 1992.

SPECIES/ENTRY/NO.	(1) EMERGENCE		WEED (2) COMPETITION		STAND (3) DENSITY		PLANT(4) HEIGHT		(5) DISEASE		SEED(6) PROD		FORAGE(7) YIELD	
	1992	1993	1992	1993	1992	1993	1993	1993	1993	1993	1993	1993	1993	
FAIRWAY WHEATGRASS														
1. Parkway	2.0	1.7	1.7	1.7	53	75	70	70	2.0	2.0	2.3	2.3	2660	
2. Kirk	3.3	2.7	2.0	2.0	52	68	80	80	2.0	2.0	1.3	1.3	2961	
3. SD-77	3.7	3.0	1.7	1.7	39	64	75	75	2.0	2.0	1.0	1.0	3187	
4. Ephraim	3.3	3.7	1.7	1.7	40	59	65	65	2.0	2.0	2.7	2.7	1957	
5. Ruff	3.7	3.3	1.7	1.7	48	69	73	73	2.0	2.0	1.7	1.7	2864	
6. NEAC1	3.7	2.3	2.7	2.7	46	56	62	62	2.0	2.0	2.0	2.0	1962	
7. NEAC2	3.7	2.3	2.3	2.3	48	66	73	73	2.0	2.0	1.7	1.7	3454	
CRESTED WHEATGRASS														
8. Summit	3.3	3.0	1.7	1.7	45	62	77	77	2.0	2.0	1.7	1.7	2777	
9. Nordan	4.0	4.3	2.7	2.7	41	66	80	80	2.0	2.0	2.0	2.0	3382	
10. NEAD1	3.0	3.7	1.7	1.7	45	72	78	78	2.0	2.0	1.7	1.7	2458	
FAIRWAY x CRESTED CROSS														
11. Hycrest	3.3	2.7	1.7	1.7	42	68	82	82	2.0	2.0	1.3	1.3	2688	
12. Hycrest #2	3.0	2.7	1.3	1.3	40	61	70	70	1.7	1.7	1.7	1.7	2475	
SIBERIAN WHEATGRASS														
13. P-27	5.3	4.7	3.0	3.0	38	51	85	85	2.0	2.0	1.3	1.3	2860	

- (1) Rating Stand uniformity and emergence seven weeks after seeding: 1=excellent, 5=fair, 9=no emergence
- (2) Weed competition rated 7/21/92 and 8/17/93; 1=none, 5=moderate, 9=severe
- (3) Estimated density; percent of full rows in sample frames
- (4) Plant height in inches (v indicates vegetative height), 8/17/93
- (5) Rating of disease problems, mainly stem and leaf rust, 8/17/93; 1=none, 5=moderate, 9=severe
- (6) Rating of potential seed production by the number of culms, 8/17/93; 1=excellent, 5=fair, 9=poor
- (7) Yield in lb/ac, oven dry matter

PROJECT: 38A339X Hettinger, North Dakota

SPECIES/ENTRY/NO.	(1) EMERGENCE		WEED (2) COMPETITION		STAND (3) DENSITY		PLANT(4) HEIGHT		(5) DISEASE		SEED(6) PROO		FORAGE(7) YIELD	
	1992	1993	1992	1993	1992	1993	1993	1993	1993	1993	1993	1993	1993	1993

INTERMEDIATE WHEATGRASS

14. Chief	3.0		4.7	1.7	52	60	107	2.0		1.3		4040
15. Clarke	2.7		3.3	2.0	60	75	107	2.0		1.7		4806
16. Reliant	2.0		1.3	1.0	58	77	113	2.0		1.3		4330
17. Oahe	1.7		2.3	1.3	56	61	108	2.0		1.7		3919
18. SD-54	2.0		1.3	1.0	47	66	113	2.0		1.7		5526
19. *Tegmar	1.0		1.0	1.0	88	48	80	2.0		2.0		-----
20. *Greenar	-----		-----	1.0	-----	58	95	2.0		2.0		-----
21. State	1.3		1.7	1.3	64	70	110	2.0		2.0		3510
22. NET11	2.7		3.7	2.0	64	64	115	2.0		1.3		3897
23. NET12	1.7		2.0	1.3	60	70	110	2.0		1.7		4081
24. NET13	2.0		2.0	1.7	58	60	112	2.0		1.3		4619
25. NESOC3	3.0		2.7	2.0	48	70	107	2.0		2.0		4213
26. NECASPIAN3	2.0		2.7	1.3	62	60	120	2.0		1.0		4592
27. *Amur	-----		1.0	1.0	41	40	110	2.0		2.0		-----

PUBESCENT WHEATGRASS

28. Greenleaf	3.0		3.3	2.0	56	67	113	2.0		2.0		3978
29. MDN-759	2.7		2.0	1.0	55	64	108	2.0		2.0		3583
30. Manska	2.0		2.3	1.3	44	63	105	2.0		1.7		4300
31. *Iopar	-----		1.0	1.0	58	52	80	2.0		2.0		-----
32. *Luna	-----		1.0	1.0	60	50	100	2.0		2.0		-----

TALL WHEATGRASS

33. Orbit	3.3		5.3	1.7	49	61	122	2.0		2.0		4397
34. Alkar	3.3		4.7	1.7	40	66	118	2.0		2.0		4664
35. Platte	3.0		4.3	1.3	54	63	130	2.0		2.0		3536
36. *Jose	-----		1.0	1.0	82	70	135	2.0		2.0		-----
37. *Largo	-----		2.0	1.0	46	51	135	2.0		2.0		-----

QUACKGRASS

38. RS Hoffman	3.3		3.3	1.0	48	63	97	2.0		3.3		3454
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* Entries preceded by an asterisk are not replicated, forage production data was not collected.

PROJECT: 38A339X Hettinger, North Dakota

SPECIES/ENTRY/NO.	(1) EMERGENCE		(2) WEED COMPETITION		(3) STAND DENSITY		(4) PLANT HEIGHT		(5) DISEASE		(6) SEED PROO		(7) FORAGE YIELD	
	1992	1993	1992	1993	1992	1993	1993	1993	1993	1993	1993	1993	1993	1993
BLUEBUNCH x QUACK CROSS														
77. RS-1 Hybrid N	3.3	4.0	1.7	1.7	40	67	112	2.0	2.0	2.3	2.3	1360		
78. RS-1 Hybrid R	3.0	3.0	1.7	1.7	53	64	97	2.0	2.0	3.0	3.0	3434		
SMOOTH BROMEGRASS														
39. Magna	3.3	2.7	1.0	1.0	40	77	88	2.0	2.0	2.3	2.3	3999		
40. S-7133	3.0	3.7	2.0	2.0	37	66	87	2.0	2.0	3.7	3.7	2826		
41. Manchar	3.3	3.0	2.0	2.0	42	76	82	2.0	2.0	2.0	2.0	2888		
42. Rebound	3.7	2.7	1.3	1.3	44	80	80	2.0	2.0	3.3	3.3	2684		
43. Cottonwood	4.7	3.0	1.0	1.0	38	80	85	2.0	2.0	3.3	3.3	3190		
44. Lincoln	3.0	2.0	1.7	1.7	44	76	75	2.0	2.0	3.3	3.3	3033		
SMOOTH x MEADOW CROSS														
45. S-9183	3.7	2.7	1.7	1.7	38	64	87	2.0	2.0	2.7	2.7	2843		
MEADOW BROMEGRASS														
46. Fleet	1.7	2.0	1.0	1.0	53	76	87	2.0	2.0	4.0	4.0	3668		
47. Paddock	2.7	2.0	1.0	1.0	54	73	82	2.0	2.0	5.7	5.7	3139		
48. Regar	2.7	4.3	1.0	1.0	33	74	75	2.0	2.0	6.7	6.7	2855		
ORCHARDGRASS														
49. *Paiute	----	3.0	2.0	2.0	76	41	65	2.0	2.0	8.0	8.0	----		
RUSSIAN WILDRYE														
50. Mayak	4.7	4.0	3.0	3.0	40	57	102	2.0	2.0	4.3	4.3	2105		
51. Swift	4.7	5.0	2.3	2.3	26	53	102	2.0	2.0	5.0	5.0	2439		
52. Cabree	4.3	3.3	1.7	1.7	36	63	95	2.0	2.0	3.0	3.0	2255		
53. Vinall	3.0	4.3	3.0	3.0	27	62	105	2.0	2.0	3.3	3.3	2101		
54. Mankota	5.7	5.3	3.0	3.0	41	56	108	2.0	2.0	3.0	3.0	2327		
55. MON-1831	5.7	5.7	1.7	1.7	31	49	103	1.7	1.7	2.7	2.7	2356		
56. Bozolsky Select	5.3	4.0	1.7	1.7	40	56	118	2.0	2.0	2.0	2.0	2513		
57. PI-272136	4.3	2.3	1.7	1.7	29	56	110	2.0	2.0	4.0	4.0	2112		
58. Syn A NL	5.3	5.7	2.0	2.0	29	52	108	2.0	2.0	3.3	3.3	2571		

PROJECT: 38A339X Hettinger, North Dakota

SPECIES/ENTRY/NO.	(1) EMERGENCE		(2) WEED COMPETITION		(3) STAND DENSITY		(4) PLANT HEIGHT		(5) DISEASE		(6) SEED PROD		(7) FORAGE YIELD	
	1992	1993	1992	1993	1992	1993	1993	1993	1993	1993	1993	1993	1993	1993
THICKSPIKE WHEATGRASS														
89. Elbee	2.0	3.0	1.7	48	71	70	2.0	3.0	2046					
90. Critana	3.7	4.0	2.0	43	68	65	3.7	4.3	2480					
WESTERN WHEATGRASS														
91. Walsh	3.7	4.3	2.3	50	74	60	2.0	7.0	2253					
92. Rodan	3.3	4.0	1.3	53	79	65	2.0	6.0	3780					
93. *Rosana	---	6.0	3.0	54	57	55	2.0	6.0	---					
94. Flintlock	3.0	4.0	2.0	36	54	80	2.0	5.7	3575					
95. *Barton	---	6.0	3.0	24	50	65	2.0	5.0	---					
96. *Arriba	---	6.0	3.0	53	49	75	2.0	4.0	---					
SLENDER WHEATGRASS														
97. Revenue	2.7	1.7	2.0	71	64	100	2.0	1.0	4146					
98. Adanac	1.7	2.0	2.3	69	62	95	2.7	1.3	2559					
99. Pryor	4.0	2.7	2.3	35	50	83	2.7	1.7	2082					
100. *San Luis	---	6.0	3.0	36	59	90	3.0	1.0	---					
101. Primar	2.0	2.0	2.3	40	62	92	2.3	1.7	2831					

Farming with Soil Quality as a Guide

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Farming practices are usually locally adapted based on experience and results. While crop yield is the ultimate test and indicator of a successful cropping system, there are economic, environmental, and climatic limits which farmers must deal with. Management tools, or guides, are used to help assess these limits and put together the best combination of practices available. Measuring soil moisture content in the spring before seeding, for example, has been used to help determine reasonable yield goals for fertilizer applications. Scouting of weeds helps make decisions on if, when, and what herbicides might be most economical for weed control. Soil testing is used as a guide to determine the fertility of the soil and whether additional fertilizer might be needed. Guides such as these are used by many farmers to help them make decisions each season.

Unlike guides or indicators which fluctuate with weather from year-to-year like weeds, nitrogen fertility, and soil moisture, the soil also contains many properties which are more slowly affected by annual farming practices. For example, organic matter is changed over time, but the influence of a given year has only a minor impact on its overall level. Other chemical, physical, and biological characteristics of the soil have various time frames in which they are changed through our farming practices. Study and use of more soil characteristics could be useful in providing even better indicators of cropping system success on both a short and long-term basis. Not only could they serve as a guide in achieving crop yield, but also doing so in manner which is both economically profitable and environmentally responsible.

Soil Quality

Soil is a dynamic and living body important in agriculture, but also to a large extent, maintaining global environmental quality. It provides a medium for plant growth, regulates and partitions water flow in the environment, and serves as an environmental buffer in the formation, capture, and degradation of both natural and synthetic hazardous compounds. Recognizing the many functions of the soil, our study and observation of it has, and is, growing.

We are just beginning to pull the individual pieces of soil science together to view it as a whole rather than a sum of its parts. Using the analogy of human health, one may regularly work out, and be of high muscular strength, but still be unhealthy due to either a short-term cold or a chronic disease such as cancer. Similarly, soils may be of high fertility but result in low short-term yields due to a water imbalance, or a long-term environmental problem such as leaching. We are working on expanding our observation and understanding of what determines soil 'health'.

Measuring Soil Quality

Again, using the analogy of human health, the observation of a soil's health could be envisioned like a physician's check-up. The medical doctor uses an array of observations which might include body temperature, blood pressure, pulse rate, and visual inspection of the eyes, ears, or throat. With soil, though sampling routines have been worked out for nutrients, we have yet to develop other key indicators of a 'healthy' soil for use on the farm. Some of these include bulk density (or compaction), the size of the soil crumbs, and the extent of biological life in the soil. We measure the quantity of organic matter in our routine soil tests, but have no way of knowing the rate at which organic matter is being broken down and recycled. This could be thought of as analogous to

knowing the quantity of blood in the body, but not knowing the pulse rate of the heart.

Across the country, we are working with a team of research, extension, crop consultants, and farmers in developing better methods of giving the soil a 'check-up'. It's our feeling that if inexpensive, rapid, field methods could be developed, this would put a valuable tool in the hands of the farmer to help guide important management decisions. It could lead to a more informed use of pesticides and fertilizers and help reduce the chances of environmental degradation without further regulation.

Farming to Improve Soil Quality

Having found no better benchmark, we have used native prairie sites across North Dakota as the quality 'standards' from which to compare various farming systems. After studying various farms (i.e. conventional tillage, minimum tillage, no-tillage, continuous cropped, organic farming, crop/fallow, and others), we've come to the conclusion that increasing soil organic matter content should be among our current top priorities for improving overall soil quality. Past and current farming practices have depleted organic matter content by 50-75% as compared to nearby native prairie. In doing so, we have created smaller soil aggregates which are more easily eroded, decreased water infiltration which has increased run-off, increased the likelihood of crusting problems during crop emergence, reduced the nutrient holding capacity of the soil, decreased the biological activity of soil which both changes nutrient cycling and reduces the capacity of the soil to detoxify natural and synthetic toxicants.

The two strategies which North Dakota farmers are successfully using to increase soil organic matter are to either reduce tillage, or increase the return of organic matter to the soil. tillage has been reduced through substitution of herbicides for tillage, growing more winter annual, biennial, and perennial crops, and changing the tillage tools from those which invert the surface layer (plow) to those which don't (seep). Increasing the return of organic matter is being accomplished by including a green manure crop in the rotation, purposely growing higher residue crops and varieties, spreading and use of livestock or manure, and growing cover crops.

Other natural resources, like air and water, have 'quality' standards which have been studied and are presently in use. Likewise, 'quality' seems to be a term gaining acceptance in speaking about soil in a broader context. Several of our current projects at the Carrington Research Extension Center are directed at two central objectives: 1)defining the properties which best describe a quality soil for a given region in North Dakota, and, 2)discover and continue to develop cropping systems which best promote soil quality as a means of achieving success over both the short and long term.