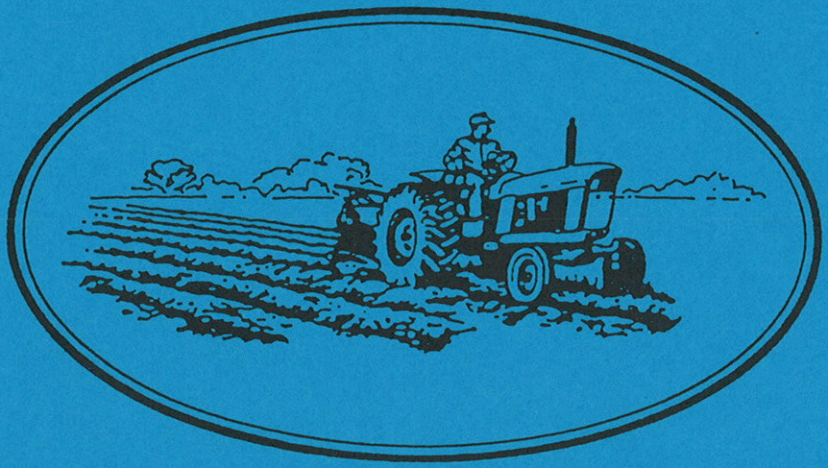
FIFTEENTH
ANNUAL

WESTERN DAKOTA

CROPS DAY

9:00 AM (MST)



HETTINGER ARMORY
DECEMBER 17, 1998

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15th Annual Western Dakota Crops Day

December 17, 1998

Hettinger Armory

"Changing the Way We Farm Through Genetic Innovation and Crop Diversity"

MST

9:00 am Registration
Coffee and doughnuts. Free time to view exhibits and visit with Ag. Industry Program Sponsors.

10:00 Earlybird Drawing

10:30 Opening Announcements

10:45 Crop Variety Updates and Highlights of Ongoing Crop Production Research

Rodger Ashley, Extension Agronomist, Dickinson

Pat Carr, Agronomist, Dickinson Research Extension 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

1:30 Specialty Crop Markets - The Outlook and the 'Look Outs'
Steven Edwardson, Crop Management Specialist, Minn-Dak Growers Ltd., Grand Forks, ND.

2:15 Innovations in Agriculture through Biotechnology
Craig Rystedt, Field Biologist, Monsanto, Powers Lake, ND.

3:00 Conclusion
Drawing for door prizes, coffee and opportunity to visit with sponsors.

Acknowledgments

The Hettinger and Dickinson Research Extension Centers 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 commitment and support.

1998 Western Dakota Crops Day Sponsors

Hettinger Chamber of Commerce
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Interstate Payco Seeds
Dekalb Genetics Corp.
ND State Seed Dept.
Hettinger Farmers Union Oil
ND Barley Council
ND Dry Pea & Lentil Association
UAP/ Big Sky

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
Neal and Monte Freitag, Scaranton
August and Perry Kirschmann, Regent
Dale and Calvin Hepper, Selfridge
Daryl Anderson, Reeder
Northern Great Plains Research Center, Mandan
Amos Gietzen, Glen Ullin
Ted Reich, Beulah
Pat Doll, Hannover

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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 to help differentiate production variables 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 and is a measure of the precision or effectiveness of the trial and the procedures used in conducting it. Attempts are made to control human error and some environmental conditions such as soil variability by replicating the variable in question. For example, there were four plots (replications) of the variety 2398 grown in the Hettinger HRSW variety trial. The plots are mixed and dispersed throughout the trial to help eliminated differences that might be a result of soil or other variations. The numbers that you see in the tables are an average of all four replications. The C.V. for yield in the 1998 Hettinger HRSW trial was 8.7% meaning that there was an 8.7 percent average variation between high and low yields among replications. 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 value, you can conclude that under like environmental conditions, variety A is expected to significantly out-yield variety B. 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 and gives you more precision than the LSD 5% value. Little confidence can be placed in variety or treatment differences unless the results differ by more than the LSD value.

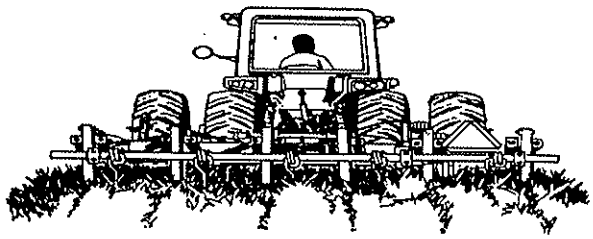


Table. 1998 Weather summary for the Dickinson Research Extension Center, Dickinson, ND.

Month	Max temp		Min temp		Precip		Small Grains GDD[1]		Corn GDD[2]	
	Long term 1897-1997	Current year	Long term 1897-1997	Current year	Long term 1897-1997	Current year	Long Term 1897-1997	Current Year	Long Term 1897-1997	Current Year
	°F	°F	°F	°F	in.	in.				
November-97	39.14	41.07	16.51	16.77	0.49	0.21				
December-97	27.21	37.68	5.52	13.10	0.39	0.03				
January	22.16	25.16	-0.33	2.39	0.51	0.17				
February	26.28	40.00	3.36	20.00	0.39	1.63				
March	37.59	31.03	14.70	9.35	0.72	0.42				
April	54.48	58.30	28.35	30.73	1.44	0.85	376	436		
May	66.27	69.71	39.20	41.26	2.28	1.86	667	742	271	314
June	74.72	69.47	48.78	46.23	3.57	6.55	905	755	408	288
July	82.46	85.00	53.49	55.87	2.19	1.70	1139	1198	568	627
August	81.36	84.81	50.90	56.03	1.73	2.90	1083	1198	528	615
September	70.37	79.27	40.53	46.60	1.35	2.03	738	935	328	448
October	57.36	56.94	29.85	32.06	0.92	4.50				
Mean	53.28	56.54	27.57	30.87						
Total					15.98	22.85	4907	5264	2104	2292

[1] *Small grains GDD, is growing degree days calculated with 95°F maximum temperature and 32°F base temperature.*

[2] *Corn GDD is growing degree days calculated with 86°F maximum temperature and 50°F base temperature.*

Source: Dickinson Research Extension Center, Data compiled by Jim Nelson; Animal Scientist, Roger Ashley; Extension Agronomist and Nichole Kuntz; Information Processing Specialist.

Trial	Location	Previous Crop	Seeding Rate
			pls/ac
SMALL GRAINS			
Barley	Dickinson	Lentil green fallow	1,200,000
Barley	Beulah	Oat	1,200,000
Barley	Glen Ullin	Barley	1,200,000
Barley	Hannover	Spring wheat	1,200,000
Durum	Dickinson	Lentil green fallow	1,200,000
Durum	Beulah	Pea	1,200,000
Durum	Glen Ullin	Barley	1200000
Durum	Hannover	Spring Wheat	1,200,000
Spring wheat	Dickinson	Clover green fallow	1,200,000
Spring wheat	Beulah	Pea	1,200,000
Spring wheat	Glen Ullin	Barley	1,200,000
Spring wheat	Hannover	Spring wheat	1,200,000
Winter wheat	Dickinson	Chem fallow	75 lbs*
Winter rye	Dickinson	Chem fallow	75 lbs*
Oat	Dickinson	Mustard-pea mix	1,000,000
Oat	Beulah	Barley	1,000,000
Oat	Glen Ullin	Barley	1,000,000
Oat	Hannover	Spring wheat	1,000,000
OTHER CROPS			
Chickpea	Dickinson	Vetch green fallow	120-180 lbs*
Corn	Dickinson	Pea	20,000
Field Pea (all trials)	Dickinson	Millet hay	325,000
Flax	Beulah	Spring wheat	30 lbs*
Flax	Glen Ullin	Barley	30 lbs*
Flax	Hannover	Spring wheat	30 lbs*
Mustard	Dickinson	Millet hay	8-12 lbs*
Lentil	Dickinson	Millet hay	550,000
Lentil	Beulah	Spring wheat	550,000
Lentil	Glen Ullin	Barley	550,000
Lentil	Hannover	Spring wheat	550,000
Safflower	Dickinson	Lentil green fallow	400,000
Cool Season Forage	Dickinson	Winter wheat	Various

* Rate is seed planted

Trial	Location	Soil Test N	Soil Test P	Fertilizer Applied 18-46-0	Fertilizer Applied 21-0-0-24	Fertilizer Applied 46-0-0
		lbs/ac	ppm	---------- lbs/ac ----------		
SMALL GRAINS						
Barley	Dickinson	50	10	55	490	0
Barley	Beulah	51	15	50	0	120
Barley	Glen Ullin	89	16	50	0	120
Barley	Hannover	61	9	50	0	120
Durum	Dickinson	26	5	87	0	180
Durum	Beulah	51	15	50	0	120
Durum	Glen Ullin	89	16	50	0	120
Durum	Hannover	61	9	50	0	120
Spring wheat	Dickinson	30	7	87	0	180
Spring wheat	Beulah	51	15	50	0	120
Spring wheat	Glen Ullin	89	16	50	0	120
Spring wheat	Hannover	61	9	50	0	120
Winter wheat	Dickinson	42	14	50	450	0
Winter rye	Dickinson	42	14	50	450	0
Oat	Dickinson	48	7	87	364	0
Oat	Beulah	51	15	50	0	120
Oat	Glen Ullin	89	16	50	0	120
Oat	Hannover	61	9	50	0	120
OTHER CROPS						
Chickpea	Dickinson	26	5	87	0	180
Corn	Dickinson	12	5	50	0	150
Field Pea (all trials)	Dickinson	32	11	0	0	0
Flax	Beulah	51	15	50	0	120
Flax	Glen Ullin	89	16	50	0	120
Flax	Hannover	61	9	50	0	120
Mustard	Dickinson	32	11	0	0	0
Lentil	Dickinson	32	11	0	0	0
Lentil	Beulah	51	15	50	0	120
Lentil	Glen Ullin	89	16	50	0	120
Lentil	Hannover	61	9	50	0	120
Safflower	Dickinson	50	10	55	490	0
Cool Season Forage	Dickinson	42	14	0	0	0

Growing Conditions
Hettinger Research Extension Center
1998

Hard red winter wheat was planted into dry soil during the last week of September 1997. A short wet period during the first part of October followed by temperatures in the 70's and 80's caused soil crusting and resulted in poor and uneven stands going into freeze up. The winter of 1997/98 was generally open with little precipitation. Bitterly cold temperatures in mid-January were followed by mild temperatures through February. Soil frost went out during the third week of February and winter wheat began to break dormancy. Winter kill was not evident on any winter wheat variety including susceptible southern varieties. El Nino on the west coast and southern states created concern for a long hot and dry growing season.

Small grain planting commenced during the second week of April, about normal. Very little precipitation during April and May provided for uninterrupted planting, dried out tilled seed beds and volatilized surface applied urea. Most row crops went in during the first half of May. Temperatures remained cool during this period and our normally windy conditions did not materialize.

A killing frost (21F) during the night of June 5 destroyed newly emerged buckwheat, dry bean and soybean trials. The frost killed pollen production on mustard which was in full bloom and on canola which was just beginning to bloom and resulted in very poor mustard yields and below normal canola yields. Minor frost injury was observed on other crops (small grains, peas, lentils, chickpeas, flax, sunflowers and crambe) but yield losses were not observed.

Timely rains in June provided relief to bone dry soils and to small grain crops that were changing from their vegetative to heavy water using reproductive growth stage. Cool temperatures throughout June aided in small grain development but delayed growth in warm season crops. Hot and dry weather during mid-July sped up small grain maturity resulting in an earlier than normal harvest start up date. Row crops also began to show signs of moisture stress. Corn and sunflower crops took advantage of heavy rainfall and hot temperatures in August and early September in many areas resulting in bumper crops.

All trials at the Hettinger Research Center were planted with our new no-till drill, although not all trials were planted into a non tilled seedbed. Most alternative crops were planted into small grain stubble and all small grain trials at the Hettinger site were planted into tilled summer fallow. Soil fertility was determined and fertilizer was applied according to specific yield goals for each crop. Urea (46-0-0) was the primary nitrogen source used and was generally surface broadcast at planting. Diammonium phosphate (18-46-0) was applied directly with all seed at planting. Nitrogen fertilizer management in a no-till system continues to be a challenge. Surface applied urea is susceptible to volatilization if not incorporated by precipitation or tillage shortly after application. This was the case at the Scranton, Mandan and Selfridge test sites where precipitation was not receive for an extended period of time after seeding. The resulting nitrogen loss was reflected in low protein levels at these sites.

All HRSW, durum and barley trials were treated post emergence for both grass weeds (foxtails and wild oats) and for broadleaf weeds (kochia, Russian thistle and wild buckwheat). All broadleaf crops were treated either pre-plant or post emergence for grass weeds and for broadleaf weeds when possible.

European corn borer (ECB) levels continued to increase and caused considerable damage to both corn and millet. The proso millet trial was destroyed and corn yields were affected by this pest. Grasshopper levels are on the decline after several years of area wide destruction, although, localized hot spots were still being reported.

Severe plant disease problems were not observed. Charcoal rot was diagnosed in one of six sunflower samples analyzed from the Hettinger area. This is the first documented case of this disease in North Dakota. Yield loss was minimal.

WEATHER DATA SUMMARY
HETTINGER

Precipitation

Precipitation (inches)	1995-96	1996-97	1997-98	43 year average
Sept. - Dec.	2.35	6.95	1.58	3.26
Jan. - March	1.82	0.55	2.77	1.27
April	1.02	3.68	0.64	1.65
May	5.20	1.16	1.53	2.72
June	2.45	3.79	3.56	3.43
July	0.86	1.16	1.67	2.03
August	0.53	0.73	1.82	1.70
Total	14.23	18.02	13.57	16.06

Air Temperature

Average Temperature F	1995	1996	1997	1998	43 year average
April	37.8	38.7	34.8	45.6	42.4
May	49.8	48.8	52.0	56.0	54.2
June	63.0	65.5	65.9	57.8	63.8
July	68.1	67.2	68.0	69.7	69.8
August	71.6	70.4	68.0	71.7	68.6
September	57.4	56.8	60.1	65.3	57.2

Growing Degree Units - Corn

Growing Degree Units (50-86)	1995	1996	1997	1998	32 year average
May	186	148	226	309	335
June	412	457	480	312	425
July	559	550	574	644	498
August	644	591	543	663	535
September	348	276	412	469	389
Total	2149	2022	2235	2397	2182

Frost Free Days

	28 F	32 F	Normal 32 F
Date of last frost	June 6	June 6	May 18
Date of first frost	Oct 12	Oct 1	Sep 20
Frost free days	128	117	125

1999 North Dakota hard red spring wheat variety description, agronomic traits.

Variety	Agent or Origin[1]	Year Released	Beard	Height	Straw Strength	Maturity	Reaction to Disease[2]				
							Stem Rust	Leaf Rust	Foliar Disease	Root Rot	Head (Scab)
Coteau	ND	1978	yes	med.	m.strg.	med.	R	R	M	MS	MS
Len	ND	1979	yes	s.dwf.	v.strg.	m.early	R	R	S	S	MS
Stoa	ND	1984	yes	med.	m.strg.	m.early	R	R	MS	M	MS
Butte 86	ND	1986	yes	med.	m.strg.	early	R	R	MS	MS	MS
Amidon	ND	1988	yes	med.	med.	med.	R	R	M	MR	S
Grandin	ND	1989	yes	s.dwf.	strg.	early	R	R	S	M	S
Gus	ND	1989	yes	s.dwf.	strg.	m.early	R	R	M	M	VS
2370	NDSURF	1990	yes	s,dwf.	v.strg	m.early	R	M	S	S	MS*
2375	NDSURF	1990	yes	s.dwf.	med.	m.early	R	MS	S	M	MS*
Sharp	SD	1990	yes	med.	med.	early	R	R	MS	S	MS*
AC Domain	Can	1993	no	med.	med.	early	R	R	S	M	MS
AC Barrie	Can	1994	no	med.	med.	med.	R	MS	M	M	M
Kulm	ND	1994	yes	med.	strg.	early	R	R	MS	MS	S
2398	NDSURF	1995	yes	s.dwf.	strg.	m.late	R	R	MR	MS	VS
Ernest	ND	1995	yes	med.	med.	med.	R	R	MS	MR	S
Glupro	ND	1995	yes	tall	med.	m.late	R	MS	N/A	N/A	VS
Gunner	AgriPro	1995	yes	med.	m.strg.	med.	R	R	MR	S	M
Hamer	AgriPro	1995	yes	s.dwf.	v.strg.	med.	R	R	M	N/A	S
Lars	AgriPro	1995	yes	s.dwf.	v.strg.	med.	R	R	MR	N/A	S
McNeal	MT	1995	yes	med.	strg.	m.early	MS	S	M	M	VS
Russ	SD	1995	yes	med.	med.	m.early	R	R	S	S	S*
Trenton	ND	1995	yes	med.	med.	med.	R	R	MS	S	S*
Verde	MN	1995	yes	s.dwf.	strg.	med.	R	R	MR	M	MS*
AC Splendor	Cargil Can	1996	no	med.	med.	early	R	MR	S	N/A	VS
AC Cora	Can	1996	no	med.	med.	med.	R	R	M	N/A	S*
AC Majestic	Cargil Can	1996	no	med.	med.	med.	R	MS	MR	N/A	S*
BacUp	MN	1996	yes	med.	med.	early	R	MR	S	N/A	MR
Keene	ND	1996	yes	med.	med.	med.	R	R	MR	M	S
Oxen	SD	1996	yes	s.dwf.	strg.	m.early	R	R	S	N/A	S
Sharpshooter	WPB	1996	yes	med.	med	early	R	R	MS	N/A	MS
AC Cadillac	Can	1997	no	med.	med.	med.	R	MS	MS	N/A	S
AC Elsa	Can	1997	no	med.	med.	med.	R	MS	MR	N/A	VS
Forge	SD	1997	yes	s.dwf.	m.strg.	early	R	R	MR	N/A	MS
Nora	AgriPro	1997	yes	s.dwf.	strg.	med.	R	R	MS	S	S
Argent	ND	1998	yes	s.dwf.	strg.	early	R	R	S	M	S
Hagar	Agripro	1998	yes	s.dwf.	strg.	med.	N/A	MS	N/A	N/A	S
HJ98	MN	1998	yes	s.dwf.	strg.	m.early	N/A	MR	N/A	N/A	MS
Ingot	SD	1998	yes	s.dwf.	med.	early	N/A	MS	S	N/A	S

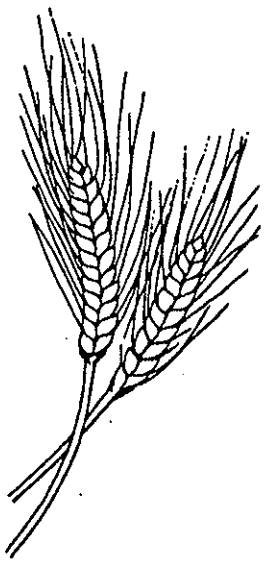
1 Refers to agent or developer: NDSURF = North Dakota State University Research Foundation; CDC = Crop Development Center, University of Saskatchewan; Can = Agriculture Canada.

2 R = resistant; MR = moderately resistant; M = intermediate; MS = moderately susceptible; S = susceptible; VS = very Susceptible. * Indicates yield and/or quality have often been higher than would be expected based on visual head blight symtoms alone.

Hard Red Spring Wheat in Southwestern North Dakota
Combined Means

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
		in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
2398	68	29	59.9	13.2	60.6	53.0	54.5	53.8	56.0
2375	66	30	60.0	13.5	57.2	49.6	50.4	50.0	52.4
Trenton	67	35	60.5	14.0	54.7	49.8	49.9	49.8	51.5
Amidon	67	35	60.4	13.3	53.7	51.3	48.9	50.1	51.3
Keene	67	35	61.3	13.4	55.2	48.3	48.3	48.3	50.6
2371	68	30	58.6	13.7	52.1	47.8	45.8	46.8	48.6
Ernest	68	34	60.3	13.6	51.3	47.3	46.1	46.7	48.2
Kulm	64	32	61.5	14.1	52.7	46.1	45.1	45.6	48.0
Grandin	68	31	58.6	13.9	51.8	45.0	44.5	44.8	47.1
Oxen	65	29	58.4	13.0		51.4	50.2	50.8	
Forge	64	31	61.4	13.0		49.2	51.1	50.2	
Argent HWSW	68	32	60.0	13.9			44.9		
# of locations	2	7	7	7	6	6	7	13	19

Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Yields are adjusted to 12% moisture.



Hard Red Spring Wheat - Fallow **Hettinger**

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield			Average Yield	
					1996	1997	1998	2 year	3 year
		in	lbs/bu	%	bu/ac				
2398	71	34	62.2	14.1	63.3	85.8	84.7	85.2	77.9
Lars	72	30	60.6	13.4	62.9	75.7	84.2	80.0	74.3
Trenton	70	39	61.4	14.6	55.0	81.4	77.4	79.4	71.3
Forge	66	35	63.4	13.8	60.8	70.6	81.0	75.8	70.8
Verde	72	33	61.3	13.9	56.6	79.4	76.2	77.8	70.7
Russ	70	35	62.2	14.1	57.9	76.7	76.9	76.8	70.5
Nora	70	29	62.2	15.5	57.2	77.0	76.2	76.6	70.1
McNeal	73	34	60.2	14.0	57.2	75.5	77.3	76.4	70.0
Sharp	67	35	63.1	14.7	58.1	78.6	72.7	75.6	69.8
2375	68	33	62.0	15.1	60.1	71.5	77.5	74.5	69.7
AC Barrie	72	36	60.6	15.4	55.6	78.3	73.5	75.9	69.1
Amidon	70	36	60.9	14.2	55.5	79.3	71.8	75.6	68.9
Oxen	68	32	61.9	14.4	58.7	79.4	68.5	74.0	68.9
Hammer	71	33	61.6	14.3	60.5	70.3	75.7	73.0	68.8
Argent HWSW	71	36	61.1	15.1	58.6	76.4	70.6	73.5	68.5
2371	70	33	61.1	14.8	57.1	71.8	75.1	73.4	68.0
Gunner	72	34	61.9	14.8	51.0	81.2	71.7	76.4	68.0
Keene	70	37	62.3	14.2	53.1	72.6	78.1	75.4	67.9
Butte 86	67	34	61.5	15.4	57.3	71.1	72.6	71.8	67.0
2370	68	34	61.9	14.5	56.9	70.5	72.4	71.4	66.6
Grandin	72	35	59.4	15.0	54.9	71.1	71.7	71.4	65.9
Kulm	68	32	63.1	15.3	56.1	68.5	73.2	70.8	65.9
Ernest	71	36	61.7	14.9	51.5	74.7	69.6	72.2	65.3
AC Eatonia	72	37	61.2	15.5	45.8	58.6	63.3	61.0	55.9
Bac Up	66	34	63.1	16.8	41.6	56.8	49.7	53.2	49.4

Continued

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
		in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
HJ98	71	32	61.1	14.0		83.3	83.4	83.4	
Hagar	72	33	60.7	14.2		78.7	79.9	78.3	
AC Cadillac	72	41	63.0	14.8		76.8	79.0	77.9	
Ingot	66	36	63.8	14.8		78.7	64.1	71.4	
AC Elsa	70	35	60.0	15.0		71.4	70.7	71.0	
Sharpshooter	68	35	63.6	14.3		65.5	75.3	70.4	
Majestic	74	36	60.5	15.3		66.2	66.9	66.6	
Splendor	67	38	61.0	15.6		61.0	68.6	64.8	
AC Crystal	73	34	60.0	12.8			75.3		
Trial Mean	70	35	61.7	14.6	55.3	74.2	73.9	--	--
C.V. %	1.7	5.1	1.0	3.0	9.6	8.1	8.7	--	--
LSD .05	2	2	0.9	0.6	7.4	9.8	8.9	--	--
LSD .01	2	3	1.2	0.8	9.8	13.0	11.8	--	--

Planting Date: April 9, 1998
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).

Harvest Date: July 30, 1998
Yields are adjusted to 12% moisture.

Hard Red Spring Wheat - Green Fallow **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Foliar Disease	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Returns	Average Yield 2 Year	Average Yield 3 Year
			in	%	lbs/bu	%	bu/ac	bu/ac	bu/ac	$/ac	bu/ac	bu/ac
Semidwarf												
2370	63	14,563	33	62	63.3	13.2	44.5	36.8	55.9	127.32	46.3	45.7
2371	65	14,522	39	32	62.3	15.2	40.4	45.2	57.1	143.19	51.2	47.6
2375	63	13,908	34	68	62.9	13.3	45.5	31.1	68.2	147.59	49.6	48.3
2398	65	13,469	33	32	61.9	12.3	53.5	48.0	72.9	153.43	60.5	58.1
Argent	64	13,228	36	33	62.3	15.0	42.2	36.2	63.7	161.46	49.9	47.4
Forge	62	13,555	35	42	63.5	13.9	45.7	40.4	67.7	159.49	54.0	51.3
Grandin	63	13,835	34	65	61.4	14.2	41.2	42.1	64.2	155.89	53.2	49.2
Gus	65	14,386	35	32	62.5	14.6	42.5	45.4	67.2	173.81	56.3	51.7
Hamer	64	14,360	31	33	62.3	13.0	42.8	41.1	61.5	139.10	51.3	48.5
Hagar	65	13,606	32	28	62.8	13.6	--	49.3	73.2	181.12	61.3	--
HJ 98	64	15,176	31	33	62.6	12.2	--	43.0	67.6	140.82	55.3	--
Lars	65	15,284	29	12	61.0	12.3	41.1	42.9	71.8	152.25	57.4	51.9
Len	66	13,982	32	53	61.5	14.7	--	47.7	54.5	141.44	51.1	--
McNeal	66	13,897	34	48	61.5	13.6	48.6	51.3	72.1	163.59	61.7	57.3
Nora	63	13,435	28	63	61.6	14.5	45.9	38.0	60.8	152.26	49.4	48.2
Oxen	62	15,726	32	63	61.8	13.3	44.7	48.2	68.6	162.22	58.4	53.8
Verde	64	13,990	32	22	62.1	13.6	47.4	45.2	64.8	157.15	55.0	52.5
Mean	64	14,357	35	40	62.6	14.0	44.5	44.5	65.0	156.09	--	--
C.V. %	1.1	3.5	3.7	41.1	0.8	6.1	14.6	29.6	9.3	12.0	--	--
LSD .05	1	708	1.8	27	0.7	1.4	9.1	NS	8.4	NS	--	--

Planting Date: April 23
Harvest Date: August 12
Foliar Disease = leaf spotting of flag leaf
Returns were calculated by multiplying the 1998 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

ariety	Days to Head	Seeds per Pound	Plant Height	Foliar Disease	Test Weight	Protein	Grain Yield 1996	1997	1998	Returns	Average Yield 2 Year	3 Year
			in	%	lbs/bu	%	---bu/ac---			$/ac	-bu/ac-	
nventional												
; Barrie	65	14,776	36	35	61.9	13.8	43.2	49.6	54.5	131.67	52.0	49.1
; Cadillac	64	13,987	39	28	63.4	14.6	42.9	48.2	61.3	160.61	54.8	50.8
; Crystal	67	14,234	33	20	62.0	11.8	--	--	70.1	157.26	--	--
: Domain	63	15,152	37	51	61.9	15.3	38.8	--	52.9	133.60	45.9	--
Eatonia	65	14,269	39	43	62.1	15.5	38.4	49.6	62.1	159.82	55.8	50.0
Elsa	64	14,949	36	33	62.1	14.3	43.6	40.5	59.5	150.96	50.0	47.9
ıidon	64	15,195	39	43	62.3	13.6	45.3	53.7	66.7	158.69	60.2	55.2
: Up	62	15,374	34	57	63.9	17.6	33.2	26.9	48.5	136.78	37.7	36.2
te 86	62	13,113	35	37	62.4	14.2	48.6	47.4	67.3	162.09	57.4	54.4
ıdy	64	13,775	33	38	61.8	14.2	--	53.6	54.6	132.63	54.1	--
ɜst	64	14,455	39	62	62.6	14.0	48.5	44.1	69.2	163.44	56.6	53.9
ıner	67	15,759	36	18	63.1	14.8	43.7	52.3	60.6	152.15	56.4	52.2
ɔt	61	14,737	37	58	64.0	15.5	--	45.4	63.6	166.99	54.5	--
ne	64	15,186	39	45	63.4	13.4	45.8	54.6	62.2	142.34	58.4	54.2
n	61	14,032	36	77	63.4	14.4	39.6	34.3	61.9	149.81	48.1	45.3
ɜstic	67	15,015	39	27	61.9	13.9	36.7	37.7	59.9	143.20	48.8	44.8
ɜ	63	14,761	36	68	62.1	13.4	38.4	42.9	68.3	154.61	55.6	49.9
p	62	13,576	35	35	63.4	14.4	44.6	37.6	63.4	159.81	50.5	48.5
pshooter	62	13,085	36	27	64.0	14.6	--	48.6	68.5	170.02	58.5	--
ndor	61	14,091	37	75	61.5	15.5	41.4	46.7	56.1	152.93	51.4	48.1
	65	14,751	39	42	61.4	14.1	--	--	62.3	155.25	--	--
ton	64	13,085	40	25	62.3	15.0	47.1	41.6	69.5	177.83	55.6	52.7
ı	64	14,357	35	40	62.6	14.0	44.5	44.5	65.0	156.09	--	--
%	1.1	3.5	3.7	41.1	0.8	6.1	14.6	29.6	9.3	12.0	--	--
05	1	708	1.8	27	0.7	1.4	9.1	NS	8.4	NS	--	--

ıg Date: April 23
ıt Date: August 12
Disease = leaf spotting of flag leaf
s were calculated by multiplying the 1998 yield by the protein premium/discount and test weight discount paid at uthwest Grain Terminal located at Gladstone on September 8.

Hard Red Spring Wheat - No-till Recrop **Scranton**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
2398	27	59.1	12.4	54.8	47.5	35.0	41.2	45.8
Amidon	34	59.3	11.9	55.6	43.6	34.6	39.1	44.6
Keene	32	60.6	12.3	55.4	38.6	32.1	35.4	42.0
2375	26	58.5	11.9	57.2	41.3	27.6	34.4	42.0
Trenton	31	59.2	--	50.1	41.8	32.9	37.4	41.6
2371	26	58.0	11.9	47.3	43.6	30.4	37.0	40.4
Kulm	28	60.8	12.5	45.9	44.1	29.3	36.7	39.8
Ernest	31	59.2	12.3	47.1	41.8	26.3	34.0	38.4
Grandin	28	58.0	13.3	47.7	36.4	27.5	32.0	37.2
Oxen	26	56.9	11.9		47.7	35.1	41.4	
Forge	28	60.0	12.0		42.6	29.2	35.9	
Agrent HWSW	30	59.6	12.5			31.6		
Trial Mean	29	59.1	12.3	51.7	42.9	31.0	--	--
C.V. %	4.1	1.5	--	8.5	10.6	9.8	--	--
LSD .05	2	1.2	--	7.4	7.6	4.4	--	--
LSD .01	2	1.7	--	10.0	NS	5.9	--	--

Planting Date: April 14, 1998
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Yields are adjusted to 12% moisture.
NS = no statistical difference between varieties.

Harvest Date: August 12, 1998
Previous Crop: 1996 = Fallow
1997 = Fallow
1998 = HRSW

Hard Red Spring Wheat - Recrop **Regent**

Variety	Plant Height	Test Weight	Protein	--Grain Yield -- 1996	1998	Average Yield 2 year
	in	lbs/bu	%	bu/ac		
2398	27	57.0	13.8	43.0	39.5	41.2
Trenton	31	58.5	13.6	37.8	37.8	37.8
2375	27	56.1	14.2	37.8	37.3	37.6
2371	28	55.8	13.9	37.0	37.7	37.4
Keene	31	59.9	13.5	32.1	38.5	35.3
Ernest	31	58.7	13.8	36.1	34.0	35.0
Kulm	29	59.8	14.2	34.9	32.7	33.8
Amidon	31	58.4	13.4	32.4	34.3	33.4
Grandin	28	56.1	14.2	36.1	29.8	33.0
Forge	29	59.0	13.4		39.0	
Oxen	27	56.4	13.6		37.2	
Argent HWSW	28	57.4	14.0		33.4	
Trial Mean	29	57.8	13.8	36.7	35.9	--
C.V. %	4.3	0.9	--	6.7	7.9	--
LSD .05	2	0.8	--	3.5	4.1	--
LSD .01	2	1.0	--	4.8	5.5	--

Planting Date: April 16, 1998
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Harvest Date: August 11, 1998
Previous Crop: 1996 = Fallow
1998 = HRSW
Yields are adjusted to 12% moisture.
NS = no statistical difference between varieties.
Notes: Heavy infestation of tan spot and septoria.

Hard Red Spring Wheat - Recrop **New Leipzig**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Amidon	29	60.3	14.5	58.5	68.0	33.8	50.9	53.4
2398	26	60.8	13.8	67.5	60.5	31.9	46.2	53.3
2375	24	60.1	14.1	63.0	62.3	31.4	46.8	52.2
Keene	28	61.0	14.4	63.4	64.6	26.2	45.4	51.4
Kulm	26	61.0	15.8	58.9	63.4	26.2	44.8	49.5
Trenton	28	60.8	14.0	58.4	62.1	27.5	44.8	49.3
Ernest	28	60.4	14.3	56.1	59.5	29.7	44.6	48.4
Grandin	26	60.1	15.0	57.2	59.5	27.8	43.6	48.2
2371	25	58.7	14.4	53.3	53.1	29.9	41.5	45.4
Oxen	24	59.3	14.5		60.2	36.4	48.3	
Forge	25	60.5	14.5		56.1	28.3	42.2	
Argent HWSW	28	61.2	--			28.8		
Trial Mean	27	60.4	14.5	59.1	61.2	29.7	--	--
C.V. %	7.4	0.8	--	9.2	6.4	9.9	--	--
LSD .05	3	0.7	--	7.8	6.6	4.4	--	--
LSD .01	4	0.9	--	NS	8.9	6.0	--	--

Planting Date: April 16, 1998
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Yields are adjusted to 12% moisture.
NS = no statistical difference between varieties.

Harvest Date: August 10, 1998
Previous Crop: 1996 = Fallow
1997 = Fallow
1998 = HRSW

Hard Red Spring Wheat - No-till Recrop **Selfridge**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
2398	32	59.3	13.1	68.8	38.1	58.9	48.5	55.3
Trenton	39	60.6	13.5	71.6	39.4	52.2	45.8	54.4
Amidon	38	60.7	12.7	70.3	39.3	50.7	45.0	53.4
Keene	38	61.0	12.9	69.0	31.5	50.5	41.0	50.3
2375	33	60.2	12.8	62.9	29.5	55.4	42.4	49.3
Ernest	37	59.8	13.0	62.0	33.4	47.0	40.2	47.5
2371	31	57.1	13.0	60.8	32.2	45.4	38.8	46.1
Kulm	36	61.2	13.3	59.1	26.3	46.4	36.4	43.9
Grandin	33	57.5	12.9	60.9	22.8	45.3	34.0	43.0
Forge	34	61.6	11.7		27.2	56.4	41.8	
Oxen	31	56.2	11.6		30.9	52.7	41.8	
Argent HWSW	34	59.2	13.3			43.0		
Trial Mean	35	59.5	12.8	64.4	31.6	50.3	--	--
C.V. %	3.2	1.0	--	8.7	18.5	7.0	--	--
LSD .05	2	0.8	--	9.5	8.4	6.0	--	--
LSD .01	2	1.1	--	12.9	NS	8.1	--	--

Planting Date: April 15, 1998
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Yields are adjusted to 12% moisture.
NS = no statistical difference between varieties.

Harvest Date: August 10, 1998
Previous Crop: 1996 = Fallow
1997 = HRSW
1998 = HRSW

Hard Red Spring Wheat - No-till Recrop	Mandan

Variety	Plant Height	Test Weight	Protein	--Grain Yield -- 1997	1998	Average Yield 2 year
	in	lbs/bu	%	bu/ac		
Forge	34	61.6	11.7	37.8	56.3	47.0
2375	33	60.2	12.8	38.4	55.2	46.8
Oxen	31	56.2	11.6	37.3	52.6	45.0
2398	23	59.3	13.1	29.3	58.8	44.0
2371	31	57.1	13.0	38.8	45.3	42.0
Amidon	38	60.7	12.7	33.0	50.6	41.8
Keene	38	61.0	12.9	32.6	50.4	41.5
Trenton	39	60.6	13.5	27.8	52.0	39.9
Grandin	33	57.5	12.9	32.5	45.2	38.8
Kulm	36	61.2	13.3	30.3	46.3	38.3
Ernest	37	59.8	13.0	28.7	46.9	37.8
Argent HWSW	34	59.2	13.3		42.9	
Trial Mean	35	59.5	12.8	34.0	50.2	--
C.V. %	3.2	1.0	--	20.7	7.0	--
LSD .05	2	0.8	--	NS	6.0	--
LSD .01	2	1.1	--	NS	8.0	--

Planting Date: April 15, 1998
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Harvest Date: August 10, 1998
Previous Crop: 1997 = corn
1998 = HRSW
Yields are adjusted to 12% moisture.
NS = no statistical difference between varieties.

Hannover Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	Grain Yield 1997	Grain Yield 1998	% of Grandin	Returns	2 Year Average
		lbs/bu	%	-----bu/ac-----			$/ac	bu/ac
2370	15,422	56.1	14.0	34.0	42.7	112	96.57	38.3
2375	13,389	57.5	13.3	40.0	48.1	126	106.87	44.1
2398	13,629	55.4	13.7	40.2	43.5	114	94.72	41.8
AC Barrie	15,110	55.5	14.8	36.6	39.0	103	93.14	37.8
Amidon	14,317	56.5	13.4	43.0	44.7	118	97.95	43.9
Butte 86	13,493	57.4	13.6	33.2	46.9	123	106.09	40.0
Ernest	14,594	56.9	14.1	42.7	43.7	115	101.09	43.2
Grandin	14,441	55.1	13.9	34.5	38.0	100	83.59	36.3
Keene	14,934	57.3	14.0	41.2	43.0	113	98.97	42.1
Oxen	15,177	55.5	13.5	34.7	50.7	133	110.12	42.7
Russ	14,513	55.9	13.3	40.3	46.7	123	100.43	43.5
Verde	15,202	55.0	13.7	41.5	42.1	111	91.42	41.8
Mean	14,518	56.2	13.8	38.5	44.1	--	98.14	--
C.V. %	5.0	1.0	1.7	8.1	7.2	--	7.0	--
LSD .05	1,038	0.8	0.3	4.5	4.6	--	9.93	--

Planting Date: May 5
Harvest Date: August 20
Returns were calculated by multiplying the 1998 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Glen Ullin Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	Grain Yield 1996	Grain Yield 1998	% of Grandin	Returns	2 Year Average
		lbs/bu	%	-----bu/ac-----			$/ac	bu/ac
2370	14,513	56.4	11.5	--	49.7	107	97.22	--
2375	12,828	57.4	11.8	71.4	49.9	108	99.66	60.7
2398	12,239	56.8	11.9	69.6	51.9	112	100.68	60.8
AC Barrie	14,537	56.8	11.7	--	41.0	88	82.18	--
Amidon	14,601	56.6	11.7	68.5	42.6	92	78.78	55.5
Butte 86	13,459	57.0	11.7	--	47.1	102	93.67	--
Ernest	14,229	57.1	11.4	67.6	44.1	95	88.03	55.8
Grandin	13,099	57.0	12.5	66.5	46.4	100	92.18	56.4
Keene	15,063	58.3	11.5	65.2	43.3	93	83.43	54.2
Oxen	13,800	56.1	11.6	--	57.1	123	109.70	--
Russ	13,554	56.1	11.5	67.1	49.9	108	98.92	58.5
Verde	14,183	56.5	11.9	--	51.0	110	100.93	--
Mean	13,842	56.8	11.7	65.7	47.8	--	93.78	--
C.V. %	4.3	1.4	5.0	4.0	7.7	--	8.5	--
LSD .05	863	1.1	NS	3.8	5.3	--	13.56	--

Planting Date: May 5
Harvest Date: August 27
Returns were calculated by multiplying the 1998 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Beulah Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	Grain Yield 1997	Grain Yield 1998	% of Grandin	Returns	2 Year Average
		lbs/bu	%	-----bu/ac-----			$/ac	bu/ac
2370	18,240	57.8	16.8	12.5	22.5	93	64.64	17.5
2375	17,714	57.9	15.5	24.4	26.7	110	76.48	25.5
2398	14,474	59.3	16.4	25.8	27.3	113	78.14	26.5
AC Barrie	19,274	58.0	17.1	15.4	23.1	96	65.54	19.2
Amidon	17,460	58.5	15.7	19.4	26.2	108	73.55	22.8
Butte 86	17,765	57.9	15.5	9.4	23.9	99	68.81	16.7
Ernest	18,177	58.6	16.4	18.0	26.0	107	75.00	22.0
Grandin	17,681	57.5	16.2	11.5	24.2	100	69.12	17.8
Keene	18,685	60.4	16.4	18.3	25.9	107	73.04	22.1
Oxen	19,114	57.3	16.4	16.9	24.7	102	69.84	20.8
Russ	17,712	57.6	15.6	16.3	24.6	102	69.80	20.5
Verde	15,707	59.3	16.6	22.6	25.1	104	69.83	23.9
Mean	17,667	58.3	16.2	17.5	25.0	--	71.15	--
C.V. %	6.5	0.9	2.4	15.8	7.2	--	7.3	--
LSD .05	1,652	0.8	0.7	NS	2.6	--	NS	--

Planting Date: May 5
Harvest Date: August 13
Returns were calculated by multiplying the 1998 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Hard Red Spring Wheat Quality Ratings

1999 North Dakota hard red spring wheat variety description, quality traits.

Variety	Quality factors		
	Test Weight	Wheat Protein	Quality Rating
Coteau	avg.	high	Good
Len	high	avg.	Good
Stoa	high	avg.	Average
Butte 86	high	avg.	Average
Amidon	high	avg.	Average-Good
Grandin	high	avg.	Good
Gus	high	high	Good
2370	high	avg.	Poor-Average
2375	high	avg.	Poor-Average
Sharp	v.high	avg.	Poor
AC Domain	high	high	Poor-Average
AC Barrie	high	avg.	Good
Kulm	high	high	Average-Good
2398	avg.	low	Poor
Ernest	high	high	Poor-Average
Glupro	avg.	v.high	Good
Gunner†	high	high	Good
Hamer	avg.	avg.	Poor
Lars	avg.	low	Poor
McNeal	avg.	avg.	Poor-Average
Russ	avg.	avg.	Average
Trenton	high	avg.	Average
Verde	avg.	low	Poor
AC Splendor	N/A	N/A	N/A
AC Cora	avg.	high	Poor-Average
AC Majestic	N/A	N/A	N/A
BacUp†	high	V. high	good
Keene	high	avg.	Average
Oxen	avg.	Avg.	Good
Sharpshooter	N/A	N/A	N/A
AC Cadillac	N/A	N/A	N/A
AC Elsa	N/A	N/A	N/A
Forge†	high	low	Poor-Average
Nora†	low	avg.	Average
Argent	high	Avg.	Good
Hagar	N/A	N/A	N/A
HJ98	N/A	N/A	N/A
Ingot	N/A	N/A	N/A

† Based on limited testing, rating may change.

The overall quality rating is based on a large number of quality parameters. These parameters are related to the physical kernel traits including protein content; milling performance; flour attributes; dough characteristics; and baking performance. Some of these quality parameters considered in the assessment of overall quality are listed in the Analytical Milling and Baking data Table.

Both protein quantity and quality are of extreme importance in establishing the rating score for hard red spring wheat varieties. Baking quality data given in this report is based on white sliced bread evaluation. Flour used for white sliced bread normally contains between 11.5-12.5% protein. However, the majority of hard red spring wheat used either domestically or in the export market is blended with lower protein wheat or lower quality wheat to improve baking performance. Another major use for hard red spring wheat is for specialty products such as bagels and frozen doughs that require a high protein content with strong gluten properties. In addition the majority of hard red spring wheat is exported at the 14.0% protein level.

Hard red spring wheat produced in the Upper Midwest is purchased largely for its quality, continued production of high quality wheat is paramount to maintaining future markets. Figure 1 illustrates the difference between bread made with poor quality wheat and that made with good quality.

Analytical milling and baking data from field plot variety trials, three year average 1995-1997. North Dakota Department of Cereal Science.

VARIETY	Test Weight	Falling Number	Protein 14% MB	Four Extract	Farinogram	Absorbance	Loaf Volume
	lb/bu	Second	%	%	CLASS	%	CC
2375	60.1	435	14.8	69.6	5.5	63.7	1054
2398	58.4	379	14.5	70.7	6.4	62.8	1100
AC BARRIE	60.4	435	15.7	71.1	6.3	61.9	1113
BUTTE 86	59.8	405	15.3	68.5	5.0	65.3	1071
GRANDIN	60.4	386	15.4	69.9	6.3	64.8	1095
HAMER	59.5	426	15.0	70.6	6.1	62.5	1081
KEENE	60.7	340	15.2	68.4	5.7	65.6	1074
KULM	60.7	392	15.8	69.2	6.2	64.2	1146
LARS	58.3	423	14.3	69.4	6.2	61.1	1027
ARGENT	60.8	381	15.6	70.0	6.2	66.0	1117
NORLANDER	59.2	400	15.2	67.3	6.2	66.7	1146
OXEN	59.7	401	15.0	70.1	6.6	63.5	1110
RUSS	59.7	392	14.8	69.4	6.4	64.9	1079
SHARP	61.5	390	15.0	69.8	5.3	63.8	1062
VERDE	59.2	437	14.3	70.8	4.9	60.7	1071

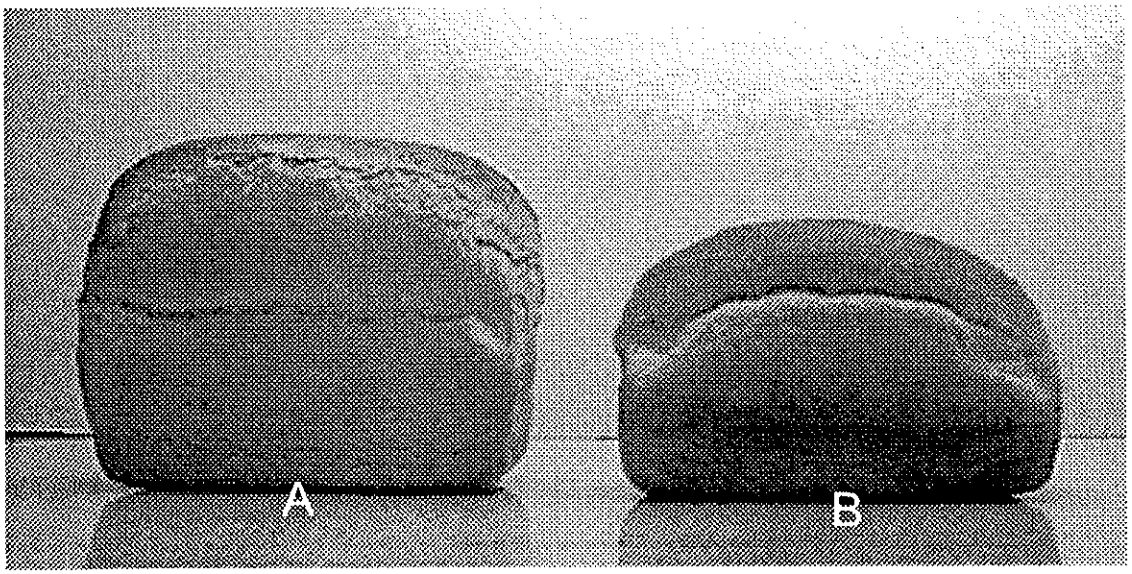


Figure 1. Loaf A is representative of bread made from wheat with a quality rating of good, loaf B is representative of bread made from wheat with a quality rating of poor.

1999 North Dakota durum variety description.

Variety	Agent or Origin[1]	Year Released	Chaff Color	Height	Straw Strength	Maturity	Reaction to Disease[2]				Quality Factors			
							Stem Rust	Leaf Rust	Foliar Disease	Scab	Test Wt.	% Vit. Kernel	Kernel Size[3]	Overall Quality
Ward	ND	1972	tan	tall	v.strg.	m.early	R	R	MR	S	59.0	92	med.	Poor
Rugby	ND	1973	tan	tall	v.strg.	m.early	R	R	MR	S*	59.2	90	med.	Poor
Cando	ND	1975	tan	s.dwf.	v.strg.	med.	R	R	M	VS	N/A	95	small	Poor
Vic	ND	1979	white	tall	med.	m.early	R	R	MR	S*	59.1	92	large	Good
Lloyd	ND	1983	white	s.dwf.	v.strg.	med.	R	MR	S	VS	57.5	87	med.	Average
Medora	Can.	1983	white	tall	strg.	m.early	R	R	MS	VS	58.8	92	large	Good
Kyle	Can.	1984	white	tall	weak	med.	R	MR	M	N/A	N/A	96	large	Good
Laker	WPB	1985	white	s.dwf.	strg.	med.	R	MR	S	S	58.6	90	med.	Average
Monroe	ND	1985	white	tall	med.	early	R	R	M	VS	58.4	92	large	Good
Fjord	AgriPro	1986	white	tall	strg.	m.early	R	R	M	S	N/A	93	large	Good
Renville	ND	1988	white	tall	med.	med.	R	R	M	S*	59.1	92	med.	Good
Plenty	Can.	1990	white	tall	weak	late	R	R	MR	MS	58.3	92	N/A	Good
Voss	AgriPro	1994	white	s.dwf.	v.strg.	med.	R	MR	MS	S	58.5	90	med.	Average
Munich	ND	1995	white	med.	v.strg.	med.	R	R	MR	S*	58.9	91	med.	Good
AC Melita	Can.	1995	white	tall	med.	med.	R	N/A	N/A	S	58.3	93	large	Good
Ben	ND	1996	white	med.	strong	med.	R	R	MR	S*	59.8	91	large	Good
Dressler	AgriPro	1996	white	tall	med.	med.	R	MR	N/A	VS	59.1	92	large	Good
Belzer	ND	1997	white	tall	med.	late	R	R	M	MR	57.9	93	large	Good
Maier	ND	1998	white	med	strong	m-late	R	R	M	S*	58.8	92	m-large	Good
Mountrail	ND	1998	white	med	strong	late	R	R	M	S*	59.2	92	m-large	Good

1 Refers to agent or developer: WPB = Western Plant Breeder.

2 R = resistant; MR = moderately resistant (slow rusters); M = intermediate; MS = moderately susceptible; S = susceptible; VS = very susceptible; Foliar Disease = reaction to tan spot and septoria leaf spot complex. Letter ratings for head blight (scab) based on visual head symptoms. * Indicates yields and/or quality have often been higher than would be expected based on visual head blight symptoms done.

3 No. seeds/lb.: Large = less than 11,000; medium = 11,000-12,000; small = more than 12,000.

Durum Wheat - Fallow **Hettinger**

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
		in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Laker	69	35	60.9	13.8	73.1	86.2	75.3	80.8	78.2
Maier	68	34	61.5	15.8	75.9	78.0	76.3	77.2	76.7
Lloyd	69	31	60.4	14.0	79.7	72.8	70.7	71.8	74.4
Voss	69	29	61.2	14.6	78.8	71.7	72.8	72.2	74.4
Ward	66	39	61.2	15.7	71.8	79.6	70.7	75.2	74.0
Monroe	64	36	61.6	15.1	72.3	78.5	66.9	72.7	72.6
Belzer	69	37	59.2	15.0	72.7	73.8	69.5	71.6	72.0
Regold	68	40	61.6	14.5	73.5	75.0	67.0	71.0	71.8
Renville	68	39	60.4	15.3	74.7	70.1	69.1	69.6	71.3
Plenty	68	41	59.8	15.8	71.8	71.2	69.7	70.4	70.9
Dressler	67	37	61.5	15.3	71.6	68.9	71.3	70.1	70.6
Rugby	66	39	61.3	15.6	68.2	73.9	68.4	71.2	70.2
Vic	66	39	62.2	14.6	70.8	72.3	66.7	69.5	69.9
Ben	68	36	61.8	15.4	71.0	68.1	69.6	68.8	69.6
Sceptre	66	36	59.6	15.2	70.9	69.6	68.4	69.0	69.6
Munich	66	33	60.4	15.7	70.2	68.4	69.5	69.0	69.4
AC Melita	68	39	60.8	15.2	71.4	68.2	67.6	67.9	69.1
Medora	66	39	61.4	15.8	67.5	72.2	66.7	69.4	68.8
Mountrail	69	36	60.0	15.2	79.9	71.3	65.1	68.2	72.1
Avonlea	66	36	61.4	14.0			71.4		
Trial Mean	68	36	61.1	14.9	61.7	72.6	69.4	--	--
C.V. %	1.2	3.9	0.7	4.7	11.0	8.4	9.1	--	--
LSD .05	1	2	0.6	1.0	9.5	8.5	ns	--	--
LSD .01	2	3	0.8	1.3	12.7	11.1	ns	--	--

Planting Date: April 9, 1998 Harvest Date: July 30, 1998
Seeding Rate: 1.25 million live seeds/A (approx. 2.2 bu/A). Yields are adjusted to 12.5% moisture.
Previous Crop: Fallow ns = no statistical difference between varieties.

Durum - Green Fallow **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Returns	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	$/ac	bu/ac	bu/ac
AC Melita	62	12,651	35	59.9	15.8	56.4	32.6	49.0	133.14	40.8	46.0
AC Morse	61	13,939	30	60.1	16.5	--	--	53.5	139.88	--	--
Avonlea	63	12,390	32	61.0	15.8	--	--	53.0	149.75	--	--
Belzer	63	12,860	34	60.3	15.2	61.6	33.9	55.9	158.50	44.9	50.4
Ben	63	12,547	33	61.8	15.7	59.3	30.0	54.5	148.22	42.2	47.9
Dressler	62	13,478	33	60.6	16.0	58.3	37.8	47.8	133.00	42.8	48.0
Laker	65	12,424	30	61.0	14.9	57.0	29.4	48.4	130.88	38.9	44.9
Lloyd	63	13,501	26	59.5	15.5	63.8	33.6	51.9	146.41	42.8	49.8
Maier	64	12,920	30	60.5	15.7	55.6	29.6	52.4	143.41	41.0	45.8
Medora	61	13,703	31	61.0	16.3	52.5	37.6	50.0	128.93	43.8	46.7
Monroe	59	12,739	32	59.9	15.9	52.3	26.3	50.5	135.42	38.4	43.0
Mountrail	64	13,279	31	60.0	15.4	61.3	38.9	53.8	143.11	46.3	51.3
Munich	62	15,118	30	59.6	16.1	56.1	34.7	54.0	143.99	44.4	48.3
Plenty	64	13,507	37	59.6	15.8	57.2	30.7	49.6	137.68	40.1	45.8
Regold	64	12,216	37	61.5	15.4	55.7	33.1	49.1	128.96	41.1	46.0
Renville	62	14,928	35	59.8	15.7	60.9	31.1	51.0	142.18	41.1	47.7
Rugby	63	12,718	36	60.9	15.9	51.6	34.8	47.6	131.84	41.2	44.7
Sceptre	68	12,720	32	60.1	15.6	58.1	33.7	44.0	114.83	38.8	45.3
Vic	61	12,211	34	61.0	15.5	55.7	27.7	60.1	172.89	43.9	47.8
Voss	63	12,649	26	61.0	15.5	54.2	37.7	50.7	138.87	44.2	47.6
Ward	61	12,570	33	61.4	15.7	57.1	35.1	52.4	148.21	43.7	48.2
Mean	63	13,198	31	60.7	15.6	44.5	32.7	52.8	144.57	--	--
C.V. %	1.2	6.8	5.4	1.2	3.4	14.6	18.7	11.2	11.0	--	--
LSD .05	1.0	1,262	2	1.0	0.9	9.1	NS	8.3	25.70	--	--

Planting Date: April 23
Harvest Date: August 11
Returns were calculated by multiplying the 1998 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Durum Wheat - No-till Recrop — **Scranton**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Ben	22	58.9	10.3	58.4	46.4	23.7	35.0	42.8
Munich	23	56.5	11.0	55.9	42.1	24.5	33.3	40.8
Renville	26	57.8	11.1	57.1	41.0	22.1	31.6	40.1
Belzer	24	56.0	11.2		44.2	19.6	31.9	
Mountrail	23	58.0	11.0			23.1		
Maier	22	57.5	11.7			19.2		
Trial Mean	23	57.5	11.0	56.1	43.2	22.0	--	--
C.V. %	4.7	1.4	--	6.6	7.6	8.0	--	--
LSD .05	2	1.2	--	5.0	NS	2.6	--	--
LSD .01	2	1.7	--	NS	NS	3.6	--	--

Planting Date: April 14, 1998
Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Yields are adjusted to 12.5% moisture.
NS = no statistical difference between varieties.
Notes: Thin stand with intense weed competition.

Harvest Date: August 12, 1998
Previous Crop: 1996 = Fallow
1997 = Fallow
1998 = HRSW

Durum Wheat - Recrop — **Regent**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1998	Average Yield 2 year
	in	lbs/bu	%	bu/ac	bu/ac	bu/ac
Ben	27	57.5	13.7	35.9	38.6	37.2
Renville	30	56.7	13.3	35.5	32.2	33.8
Munich	27	54.8	13.7	30.7	35.1	32.9
Mountrail	27	55.8	13.4		33.5	
Maier	26	54.7	14.1		30.8	
Belzer	29	53.1	13.3		27.7	
Trial Mean	28	55.4	13.6	33.7	33.0	--
C.V. %	5.7	1.4	--	8.7	7.7	--
LSD .05	2	1.1	--	4.4	3.8	--
LSD .01	3	1.6	--	NS	5.2	--

Planting Date: April 16, 1998
Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Harvest Date: August 11, 1998
Previous Crop: 1996 = Fallow
1998 = HRSW
Yields are adjusted to 12.5% moisture.
NS = no statistical difference between varieties.
Notes: Heavy infestation of tan spot and septoria.

Durum Wheat - No-till Recrop — **Selfridge**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Ben	36	63.0	11.6	62.2	35.5	64.6	50.0	54.1
Renville	37	61.6	10.3	62.5	34.0	63.5	48.8	53.3
Munich	34	60.8	11.5	59.6	27.9	55.4	41.6	47.6
Belzer	34	60.5	11.6		33.2	59.2	46.2	
Mountrail	36	60.9	11.1			60.9		
Maier	36	61.8	11.2			59.7		
Trial Mean	35	61.4	11.2	60.9	33.1	60.5	--	--
C.V. %	6.2	1.6	--	5.8	12.9	17.9	--	--
LSD .05	NS	1.5	--	NS	NS	NS	--	--

Planting Date: April 15, 1998
Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Yields are adjusted to 12.5% moisture.
NS = no statistical difference between varieties.

Harvest Date: August 10, 1998
Previous Crop: 1996 = Fallow
1997 = HRSW
1998 = HRSW

Durum Wheat - No-till Recrop — **Mandan**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year
	in	lbs/bu	%	bu/ac	bu/ac	bu/ac
Ben	37	61.9	13.7	42.5	53.6	48.0
Renville	37	60.5	12.4	40.9	52.1	46.5
Munich	33	60.1	13.2	34.2	51.5	42.8
Belzer	35	58.6	12.6	31.8	45.0	38.4
Mountrail	34	60.9	12.6		57.0	
Maier	35	61.7	13.4		54.6	
Trial Mean	35	60.6	13.0	37.5	52.3	--
C.V. %	3.8	1.8	--	15.7	5.2	--
LSD .05	2	1.7	--	NS	4.0	--
LSD .01	3	2.3	--	NS	5.5	--

Planting Date: April 15, 1998
Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Harvest Date: August 10, 1998
Previous Crop: 1997 = corn
1998 = HRSW
Yields are adjusted to 12.5% moisture.
NS = no statistical difference between varieties.

Glen Ullin Durum - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	Grain Yield 1996	Grain Yield 1998	% of Renville	Returns	2 Year Average
		lbs/bu	%	-------bu/ac-----			$/ac	bu/ac
Belzer	14,891	59.1	11.8	--	49.8	109	124.34	--
Ben	13,271	61.8	12.0	67.7	52.5	115	133.69	60.1
Munich	16,131	59.9	11.9	69.9	50.5	110	126.71	60.2
Renville	15,744	60.4	12.4	70.3	45.7	100	118.71	58.0
Mean	14,781	60.4	12.0	66.9	49.9	--	127.17	--
C.V. %	8.5	1.5	3.2	4.5	5.0	--	5.3	--
LSD .05	1,882	1.4	0.7	4.7	3.7	--	12.33	--

Planting Date: May 5
Harvest Date: August 13
Returns were calculated by multiplying the 1998 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Hannover Durum - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	Grain Yield 1997	Grain Yield 1998	% of Renville	Returns	2 Year Average
		lbs/bu	%	-------bu/ac-----			$/ac	bu/ac
Belzer	12,583	54.9	13.4	37.7	38.0	101	85.29	37.8
Ben	11,045	57.8	14.0	42.7	44.2	118	107.66	43.5
Munich	14,018	55.1	13.5	39.4	42.8	114	97.23	41.1
Renville	14,132	55.0	13.7	38.1	37.5	100	83.95	37.8
Mean	12,885	56.0	13.6	38.9	41.5	--	97.14	--
C.V. %	5.6	1.3	2.1	12.0	3.5	--	4.1	--
LSD .05	1,092	1.1	NS	7.0	2.2	--	7.28	--

Planting Date: May 5
Harvest Date: August 20
Returns were calculated by multiplying the 1998 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Beulah Durum - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	Grain Yield 1998	Grain Yield % of Renville	Returns
		lbs/bu	%	bu/ac		$/ac
Belzer	14,450	59.3	15.3	25.2	101	65.18
Ben	13,299	61.3	16.0	27.3	109	74.02
Munich	16,069	58.3	16.1	25.8	103	65.93
Renville	14,599	59.6	15.7	25.0	100	68.43
Mean	14,388	60.0	15.8	25.2	--	67.88
C.V. %	7.8	1.0	1.2	7.9	--	6.2
LSD .05	1,693	0.9	0.3	NS	--	NS

Planting Date: May 5
Harvest Date: August 13
Returns were calculated by multiplying the 1998 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Durum in Southwestern North Dakota
Combined Means

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
		in	lbs/bu	%	bu/ac				
Ben	66	32	60.6	13.6	57.8	48.1	47.6	47.8	51.2
Renville	65	34	59.1	13.3	58.4	46.5	44.2	45.4	49.7
Munich	64	30	58.4	13.6	54.2	43.2	45.5	44.4	47.6
Belzer	66	32	57.9	13.3		45.8	43.3	44.6	
Mountrail	66	31	59.3	13.1			48.9		
Maier	66	30	59.6	13.6			48.8		
# of locations	2	6	9	9	4	4	9	13	17

Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Yields are adjusted to 12.5% moisture.

1999 North Dakota barley variety description.

Variety	Use[3]	Origin	Year Released	Awn Type[1]	Aleurone Color	Height	Straw Strength	Relative Maturity	Reaction to Disease[2]			
									Stem	Loose	Spot	Net
Six-row												
Azure	M/F	ND	1982	S	blue	med.	m. strg.	m.early	S	S	MR-R	MS-S
Excel	M/F	MN	1990	S	white	m.short	strg.	med.	S	S	MR-R	MS-S
Foster	M/F	ND	1995	S	white	m.short	strg.	med.	S	S	MR-R	MS-S
Hazen	F	ND	1984	S	white	med.	m.strg.	med.	S	S	MR-R	MS-S
Morex	M/F	MN	1978	S	white	tall	med.	early	S	S	MR	S
Robust	M/F	MN	1983	S	white	med	m.strg.	med.	S	S	MR-R	MS-S
Stander	M/F	MN	1993	S	white	m.short	v.strg.	med.	S	S	MR-R	MS-S
MNBrite†	F	MN	1997	S	white	tall	med	early	S	S	MR-R	MS-S
Two-row												
Bowman	F	ND	1984	S	white	m.short	med.	early	S	S	MS-S	S-MS
Chinook[4]	F	MT	1994	R	white	med.	m.weak	late	S	S	MS	MS
Conlon[5]	F	ND	1996	S	white	m.short	med.	early	S	S	MS-	MR-R
Gallatin	F	MT	1986	R	white	med.	med.	m.late	S	S	MS	MS
Harrington[4]	F	Can.	1981	R	white	med.	m.weak	late	S	S	S	MR-
Logan	F	ND	1995	S	white	med.	strg.	med.	S	S	MS-	MR
Stark	F	ND	1991	S	white	m.tall	med.	m.late	S	S	S-MS	MS-S
Specialty												
Wanubet	SP	MT	1990	R	white	med.	weak	late	S	S	S	S

† Malting designation pending, Moderately resistant to *Fusarium* head blight.

[1] Rough or smooth awned.

[2] R = resistant; MR = moderately resistant; MS = moderately susceptible; S = susceptible; N/A = not available.

[3] M = malting; F = feed; SP = special uses (hulles).

[4] Recommended as a malting barley in western US.

[5] Lower DON accumulation than other varieties tested.

Barley in Southwestern North Dakota
Combined Means

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
		in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Logan	63	27	48.6	11.7	88.3	85.6	72.9	79.2	82.3
Stark	63	27	48.7	11.8	82.4	81.9	67.9	74.9	77.4
Conlon	60	26	48.1	11.7	82.4	81.2	68.2	74.7	77.3
Bowman	61	25	48.5	12.7	76.8	75.1	69.6	72.4	73.8
# of locations	2	7	10	10	6	6	10	16	22

Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Yields are adjusted to 12% moisture.

Barley - Fallow **Hettinger**

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
		in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Conlon	65	33	52.0	12.5	110.6	117.3	132.8	125.0	120.2
Excel	68	35	51.5	12.4	121.6	109.8	128.2	119.0	119.9
Logan	67	35	52.8	12.5	108.8	110.5	128.9	119.7	116.1
Chinook	71	33	51.1	13.9	113.8	109.4	108.3	108.8	110.5
Stark	66	34	51.8	13.3	118.7	109.3	101.8	105.6	109.9
Azure	67	37	53.0	14.3	102.6	117.3	101.9	109.6	107.3
Bowman	66	32	51.5	13.7	106.8	93.1	103.3	98.2	101.1
Harrington	74	34	49.7	13.6	99.6	97.3	100.0	98.6	99.0
MNBrite	68	35	52.1	14.8		116.7	105.0	110.8	
Robust	68	37	52.9	14.0			102.6		
Trial Mean	68	35	51.6	13.4	109.0	111.7	113.4	--	--
C.V. %	1.3	4.5	0.9	3.7	5.6	8.5	6.4	--	--
LSD .05	1	2	0.7	0.7	8.6	13.6	10.3	--	--
LSD .01	2	3	0.9	0.9	11.5	18.1	13.8	--	--

Planting Date: April 9, 1998
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Yields are adjusted to 12% moisture.

Harvest Date: July 28, 1998
Previous Crop: Fallow

Barley - Green Fallow — **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Lodging Score	Test Weight	Protein	% Plump	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Returns	Average Yield 2 Year	Average Yield 3 Year
			in	0-9	lbs/bu	%	>6/64	bu/ac	bu/ac	bu/ac	$/ac	bu/ac	bu/ac
Six Row													
Azure	60	14,095	34	2.5	45.6	13.0	63.2	60.7	72.5	92.3	103.65	82.4	75.2
Excel	61	16,474	34	2.5	42.3	12.6	40.9	67.2	79.8	103.2	105.14	91.5	83.4
Foster	60	13,762	35	2.5	44.4	11.8	70.1	64.1	81.3	98.5	107.96	89.9	81.3
MN Brite	61	14,953	36	1.3	45.3	14.2	61.1	--	74.0	99.0	111.35	86.5	--
Morex	60	16,646	35	0.8	43.0	13.7	44.5	54.2	63.3	86.8	91.11	75.0	68.1
Robust	61	14,190	35	1.3	45.5	12.9	56.6	56.8	78.6	89.2	101.29	83.9	74.9
Stander	61	10,543	34	0.0	46.5	11.6	75.2	62.2	94.1	104.0	119.64	99.1	86.8
Two Row													
Baronesse	63	12,806	29	0.8	46.9	12.7	81.4	--	88.0	101.0	115.40	94.5	--
Bowman	56	13,707	30	4.0	43.9	14.1	63.6	56.3	54.1	72.5	78.39	63.3	61.0
Chinook	62	13,476	32	3.8	44.8	14.3	67.5	57.7	82.4	85.7	94.29	84.1	75.3
Conlon	55	12,703	30	4.3	46.5	12.5	77.7	62.7	73.9	94.4	108.56	84.2	77.0
Harrington	63	14,450	32	2.8	43.0	13.1	53.4	56.9	71.1	75.9	79.75	73.5	68.0
Logan	59	11,891	32	1.0	46.6	13.1	69.7	74.9	90.2	103.6	119.18	96.9	89.6
Stark	60	12,777	32	4.8	45.1	13.5	64.0	56.2	74.4	85.6	95.57	80.0	72.1
Mean	60	13,702	33	1.9	45.1	12.8	65.8	62.2	76.9	95.0	105.80	--	--
C.V. %	1.7	10.5	2.6	95.2	2.0	5.6	8.7	13.4	6.6	5.7	6.1	--	--
LSD .05	1	2,032	1	2.6	1.3	1.0	8.1	11.8	7.2	7.7	9.18	--	--

Planting Date: April 22
Harvest Date: August 6
Lodging 0 = No lodging, 9 = Completely flat
Returns were calculated by multiplying the 1998 yields by the price paid for feed barley minus the test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Barley - No-till Recrop — **Scranton**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Logan	19	46.4	9.3	104.3	85.6	45.8	65.7	78.6
Stark	19	47.6	9.5	78.2	84.9	46.5	65.7	69.9
Conlon	18	44.8	10.1	91.4	78.6	34.6	56.6	68.2
Bowman	18	45.4	10.7	79.6	73.1	38.4	55.8	63.7
Trial Mean	19	46.0	9.9	90.8	83.4	41.3	--	--
C.V. %	6.1	2.1	--	11.4	7.4	10.0	--	--
LSD .05	2	1.5	--	15.8	9.3	6.3	--	--
LSD .01	NS	2.1	--	21.9	13.0	8.7	--	--

Planting Date: April 14, 1998
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Yields are adjusted to 12% moisture.
NS = no statistical difference between varieties.
Notes: Thin stand with intense weed competition.

Harvest Date: August 12, 1998
Previous Crop: 1996 = Fallow
1997 = Fallow
1998 = HRSW

Barley - Recrop — **Regent**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1998	Average Yield 2 year
	in	lbs/bu	%	bu/ac	bu/ac	bu/ac
Logan	23	48.8	13.4	54.3	70.8	62.6
Stark	22	48.3	13.0	48.9	71.2	60.0
Conlon	22	48.0	12.9	46.7	67.6	57.2
Bowman	22	47.0	13.9	44.5	58.8	51.6
Trial Mean	23	48.2	12.9	49.3	67.3	--
C.V. %	8.9	1.1	--	7.3	6.4	--
LSD .05	2	0.8	--	5.4	6.6	--
LSD .01	3	1.1	--	7.5	9.1	--

Planting Date: April 16, 1998
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Harvest Date: August 11, 1998
Previous Crop: 1996 = Fallow
1998 = HRSW
Yields are adjusted to 12% moisture.
NS = no statistical difference between varieties.

Barley - Recrop — **New Leipzig**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	in	lbs/bu	%	bu/ac				
Logan	25	50.8	12.7	75.1	109.2	60.5	84.8	81.6
Stark	28	51.3	12.5	69.6	93.2	62.6	77.9	75.1
Conlon	25	50.1	12.3	62.9	92.5	54.2	73.4	69.9
Bowman	24	50.6	12.8	63.7	70.5	60.3	65.4	64.8
Trial Mean	25	50.6	12.3	71.2	96.4	59.6	--	--
C.V. %	7.9	1.0	--	12.4	8.5	5.6	--	--
LSD .05	2	0.7	--	13.4	12.4	NS	--	--
LSD .01	NS	NS	--	18.6	17.2	NS	--	--

Planting Date: April 16, 1998
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Yields are adjusted to 12% moisture.
NS = no statistical difference between varieties.

Harvest Date: August 10, 1998
Previous Crop: 1996 = Fallow
1997 = Fallow
1998 = HRSW

Barley - No-till Recrop — **Selfridge**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	in	lbs/bu	%	bu/ac				
Stark	30	51.2	11.6	95.1	64.9	94.6	79.8	84.9
Logan	28	50.6	11.5	94.3	64.2	91.0	77.6	83.2
Conlon	28	50.0	12.1	93.0	58.2	88.0	73.1	79.7
Bowman	28	50.4	12.0	81.0	64.5	83.0	73.8	76.2
Trial Mean	29	50.5	11.7	91.3	63.7	88.5	--	--
C.V. %	6.4	0.9	--	9.1	13.1	5.6	--	--
LSD .05	NS	0.7	--	NS	NS	7.5	--	--
LSD .01	NS	0.9	--	NS	NS	NS	--	--

Planting Date: April 15, 1998
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Yields are adjusted to 12% moisture.
NS = no statistical difference between varieties.

Harvest Date: August 10, 1998
Previous Crop: 1996 = Fallow
1997 = HRSW
1998 = HRSW

Barley - No-till Recrop — **Mandan**

Variety	Plant Height	Test Weight	Protein	--Grain Yield -- 1997	1998	Average Yield 2 year
	in	lbs/bu	%	bu/ac		
Logan	25	51.3	12.4	46.7	77.2	62.0
Conlon	23	50.8	12.0	47.3	75.3	61.3
Bowman	22	50.9	11.7	51.2	71.0	61.1
Stark	27	51.3	11.1	36.1	77.6	56.8
Trial Mean	25	50.9	11.6	46.1	73.2	--
C.V. %	7.4	0.5	--	29.3	9.4	--
LSD .05	3	0.4	--	NS	NS	--
LSD .01	NS	0.5	--	NS	NS	--

Planting Date: April 15, 1998
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Harvest Date: August 10, 1998
Previous Crop: 1997 = corn
1998 = HRSW
Yields are adjusted to 12% moisture.
NS = no statistical difference between varieties.

Beulah Barley - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	% Plump	Grain Yield 1998	% of Stark	Returns
		lbs/bu	%	>6/64	bu/ac		$/ac
Foster	14,348	41.4	11.2	70.5	35.2	96	34.44
Stander	14,843	42.4	11.9	73.2	29.4	80	30.02
Conlon	10,835	46.4	11.7	96.0	40.6	111	46.46
Logan	11,309	46.8	11.3	89.3	47.7	130	54.91
Stark	10,791	47.8	12.0	91.4	36.7	100	42.23
Mean	12,658	44.7	11.6	83.2	37.3	--	40.77
C.V. %	4.0	1.3	3.5	2.8	10.9	--	11.1
LSD .05	755	0.9	NS	3.6	6.1	--	6.80

Planting Date: May 5
Harvest Date: August 13
Returns were calculated by multiplying the 1998 yields by the price paid for feed barley minus the test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Hannover Barley - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	% Plump	Grain Yield 1997	Grain Yield 1998	% of Stark	Returns	2 Year Average
		lbs/bu	%	>6/64	-----bu/ac-----			$/ac	bu/ac
Foster	13,198	42.4	10.1	84.6	63.7	50.2	92	51.27	56.9
Stander	13,115	42.9	10.5	84.4	65.3	53.8	98	55.93	59.5
Conlon	10,431	46.3	11.4	95.6	55.0	51.1	94	58.78	53.1
Logan	10,717	45.5	10.8	90.7	72.2	53.6	98	61.64	62.9
Stark	10,760	46.0	11.3	89.1	58.2	54.6	100	62.44	56.4
Mean	11,940	44.3	10.8	87.0	59.0	51.4	--	56.26	--
C.V. %	2.9	1.5	3.0	4.0	6.5	6.0	--	6.3	--
LSD .05	522	1.0	0.5	5.3	5.7	NS	--	5.36	--

Planting Date: May 5
Harvest Date: August 20
Returns were calculated by multiplying the 1998 yields by the price paid for feed barley minus the test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Glen Ullin Barley - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	% Plump	Grain Yield 1996	Grain Yield 1998	% of Stark	Returns	2 Year Average
		lbs/bu	%	>6/64	-----bu/ac-----			$/ac	bu/ac
Foster	14,572	41.9	9.2	61.5	110.7	45.5	95	45.43	78.1
Stander	13,387	43.6	9.8	75.8	117.5	38.6	81	41.31	78.0
Conlon	14,075	45.9	9.7	88.7	91.4	42.9	89	48.74	67.1
Logan	12,331	46.5	9.6	79.1	103.3	50.1	104	56.89	76.7
Stark	12,115	47.0	10.0	74.3	85.1	47.9	100	55.10	66.5
Mean	13,625	44.6	9.7	73.6	97.3	45.7	--	49.74	--
C.V. %	14.0	3.0	4.7	9.0	5.6	5.0	--	7.3	--
LSD .05	NS	2.0	NS	9.9	8.1	3.5	--	5.46	--

Planting Date: May 5
Harvest Date: August 13
Returns were calculated by multiplying the 1998 yields by the price paid for feed barley minus the test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

1999 Oat Variety Description

Variety*	Origin	Year Released	Grain Color	Height	Straw Strength	Maturity[2]	Reaction to Diseases: Stem rust[1]	Crown rust	Barley Y. Dwf.[4]	Quality Factors: Rel. Yield	bu/Wt	Protein[3]
Hytest	SD	1986	white	tall	m.strg.	E	S	MS	S	fair	v.good	H
Prairie	WI	1991	white	short	strg.	E	S	S	T	good	good	M
Premier	MN	1990	yellow	short	med.	M	R	MS	MT	v.good	v.good	H
Milton	MN	1994	yellow	med.	strg.	L	S	MS	MT	v.good	v.good	M
Jerry	ND	1994	white	tall	strg.	M	R	MS	MT	v.good	v.good	M
Newdak	ND/NY	1990	white	med.	strg.	M	R	S	T	v.good	good	M
Jim	MN	1995	yellow	med.	strg.	M	S	MS	MT	good	good	M
Brawn	IL	1993	yellow	short	v.strg.	M	S	S	T	v.good	good	M
Valley	ND	1988	ivory	short	strg.	L	R	MS	MT	v.good	v.good	M
Whitestone	ND	1994	white	short	strg.	L	R	MS	MT	v.good	good	L
Otana	MT	1977	white	m.tall	m.weak	L	S	S	S	v.good	v.good	ML
Jud	ND	1997	ivory	tall	med.	L	R	MR	T	v. good	good	MH
Troy	SD	1991	ivory	tall	m.strg.	L	S	MS	T	good	good	M
AC Belmont	Can.	1993	naked	med.	strg.	L	R	S	MT	good	v.good	M
Paul	ND	1994	naked	v.tall	strg.	L	R	R-MR	T	v.good	good	H
AC Medallion	Can. Cargill	1997	white	tall	med.	L	R	R	MT	good	good	ML
Dumont	Can.	1982	white	m.tall	m.weak	L	R	S	MS	good	good	ML
AC Preakness	Can. Proven Seed	1996	white	tall	strong	L	R	S	M	good	good	L
Bay	WI	1993	yellow	med.	v.strg.	L	S	MR-S	T	good	fair	H
AC Assiniboia	Can Proven Seed	1997	red	med	strong	L	R	R	T	v. good	good	ML
AC Marie	Can.	1992	white	tall	weak	VL	R	S	MT	fair	fair	ML
Triple Crown	Canterra	1998	white	tall	strong	L	S	R	S	good	good	L

* Varieties listed in order of maturity.

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

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.

Oats - Fallow

Hettinger

Variety	Days to head	Plant Height	Test Weight	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
		in	lbs/bu	bu/ac				
Monida	79	42	31.6	122.1	148.9	135.2	142.0	135.4
Brawn	74	37	36.3	117.4	152.1	135.3	143.7	134.9
Whitestone	78	38	35.0	120.4	151.8	131.2	141.5	134.5
Otana	76	43	35.6	107.9	148.6	126.5	137.6	127.7
Troy	76	44	37.2	106.4	150.2	122.9	136.6	126.5
Jerry	74	41	39.0	108.9	138.8	127.6	133.2	125.1
Derby	77	46	37.0	103.0	144.5	123.3	133.9	123.6
Jud	77	46	38.4	108.9	138.8	121.2	130.0	123.0
Calibre	79	44	35.0	103.0	143.2	115.6	129.4	120.6
Hytest	74	43	41.0	92.8	131.2	121.2	126.2	115.1
Paul*	77	44	43.6	72.5	80.3	88.5	84.4	80.4
AC Assinaboia	78	42	37.2		148.3	127.2	137.8	
AC Medallion	78	44	36.2		146.4	123.2	134.8	
CDC Boyer	78	43	35.4		142.0	126.1	134.0	
Trial Mean	77	42	36.4	109.0	138.6	124.9	--	--
C.V. %	1.1	3.7	2.3	7.1	10.9	5.9	--	--
LSD .05	1	2	1.2	10.9	21.1	10.3	--	--
LSD .01	2	3	1.6	14.5	27.9	13.7	--	--

Planting Date: April 9, 1998
Seeding Rate: 750,000 live seeds/A (approx. 1.7 bu/A).
Yields are adjusted to 12% moisture.

Harvest Date: July 30, 1998
* = Naked (hulless) type.
Previous Crop: Fallow

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Returns	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	bu/ac	bu/ac	bu/ac	$/ac	bu/ac	bu/ac
AC Assinaboia	69	16,053	31	34.0	--	97.4	87.6	56.64	92.5	--
AC Medallion	68	14,932	33	35.6	--	82.2	93.2	67.24	87.7	--
Brawn	64	14,942	27	32.4	84.1	124.8	106.3	63.70	115.6	105.1
CDC Boyer	69	15,928	32	32.9	--	74.2	96.5	58.28	85.4	--
Derby	67	15,193	33	34.5	101.2	119.9	94.4	63.77	107.2	105.2
Hytest	63	15,895	33	38.9	79.8	94.9	85.7	67.03	90.3	86.8
Jerry	60	16,588	29	34.9	85.3	95.3	89.0	60.58	92.1	89.8
Jud	67	15,638	34	36.3	65.5	99.5	96.2	70.40	97.9	87.1
Milton	64	17,617	29	34.6	70.1	91.4	92.1	62.82	91.8	84.5
Monida	67	18,027	30	30.9	87.6	109.3	100.4	51.64	104.8	99.1
Otana	67	18,243	34	34.8	84.7	114.5	108.7	74.33	111.6	102.6
Paul	69	21,386	36	40.6	64.7	82.3	61.6	49.24	71.9	69.5
Tripple Crown	72	16,271	33	32.1	--	--	103.6	59.94	--	--
Troy	66	17,422	32	34.5	90.0	108.0	99.9	66.16	104.0	99.3
Whitestone	67	16,128	27	32.3	96.2	98.4	101.3	59.02	99.9	98.6
Mean	66.2	16,597	31	34.0	82.7	99.8	95.2	61.25	--	--
C.V. %	2.9	8.8	5	3.0	14.3	13.8	6.5	10.6	--	--
LSD .05	2.7	2,062	2.2	1.4	16.7	22.4	8.8	9.16	--	--

Planting Date: April 17
Harvest Date: August 5
Returns were calculated by multiplying the 1998 yield by test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Oats - Recrop — **New Leipzig**

Variety	Plant Height	Test Weight	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	in	lbs/bu	bu/ac				
Whitestone	33	38.6	77.1	130.2	102.5	116.4	103.3
Troy	38	39.3	71.6	130.6	96.9	113.8	99.7
Jerry	34	38.6	63.7	123.8	74.7	99.2	87.4
Paul*	41	44.3	37.0	75.3	68.3	71.8	60.2
Jud	40	38.0		126.8	94.4	110.6	
AC Medallion	37	38.9			88.2		
Trial Mean	37	39.6	61.8	119.1	87.5	--	--
C.V. %	8.2	1.0	24.6	10.5	7.6	--	--
LSD .05	4	0.6	22.4	22.1	9.9	--	--
LSD .01	5	0.8	29.0	30.9	13.6	--	--

Planting Date: April 16, 1998 Harvest Date: August 10, 1998
Seeding rate: 750,000 live seeds/A (approx. 1.7 bu/A).
Yields are adjusted to 12% moisture. Previous Crop: 1996 = Fallow
NS = no statistical difference between varieties. 1997 = Fallow
*Naked (hulless) type. 1998 = HRSW

Oats - No-till Recrop — **Mandan**

Variety	Plant Height	Test Weight	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year
	in	lbs/bu	bu/ac		
Whitestone	38	39.0	73.7	130.9	102.3
Troy	38	40.5	50.4	119.2	84.8
Jud	42	39.8	53.4	112.9	83.2
Jerry	38	40.9	40.2	125.2	82.7
Paul*	42	45.4	33.8	93.3	63.6
AC Medallion	40	39.2		119.9	
Trial Mean	40	40.8	50.4	116.9	--
C.V. %	7.7	1.4	15.6	7.8	--
LSD .05	NS	0.9	11.6	13.6	--
LSD .01	NS	1.2	15.8	18.7	--

Planting Date: April 15, 1998 Harvest Date: August 10, 1998
Seeding rate: 750,000 live seeds/A (approx. 1.7 bu/A).
Previous Crop: 1997 = corn
1998 = HRSW NS = no statistical difference between varieties
Yields are adjusted to 12% moisture. * = Naked (hulless) type.

Hannover Oat - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Grain Yield 1997	Grain Yield 1998	% of Jerry	Returns	2 Year Average
		lbs/bu	-------bu/ac-------			$/ac	bu/ac
AC Assinaboia	11,111	37.1	--	82.8	110	63.88	--
CDC Boyer	11,256	36.8	75.0	70.9	94	53.73	73.0
Jerry	13,351	39.5	70.2	75.4	100	60.33	72.8
Jud	13,176	37.3	--	65.4	87	50.22	--
Paul	19,159	42.4	46.7	55.7	74	44.54	51.2
Whitestone	14,515	36.0	78.0	71.5	95	52.21	74.8
Mean	13,341	38.2	64.3	70.3	--	54.15	--
C.V. %	4.6	2.6	6.8	9.4	--	9.9	--
LSD .05	879	1.5	6.6	9.9	--	8.07	--

Planting Date: May 5 Harvest Date: August 20
Returns were calculated by multiplying the 1998 yield by test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Glen Ullin Oat - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Grain Yield 1996	Grain Yield 1998	% of Jerry	Returns	2 Year Average
		lbs/bu	-------bu/ac-------			$/ac	bu/ac
AC Assinaboia	13,510	36.6	--	97.9	105	73.45	--
CDC Boyer	13,072	35.1	--	92.0	99	63.38	46.0
Jerry	14,389	39.6	114.0	93.4	100	74.75	103.7
Jud	14,164	37.3	--	95.2	102	74.27	--
Paul	20,318	42.9	83.2	64.1	69	51.26	73.6
Whitestone	15,601	36.5	132.2	97.2	104	73.14	114.7
Mean	14,872	38.0	110.0	90.0	--	68.37	--
C.V. %	5	1.3	4.8	6.1	--	7.1	--
LSD .05	1,085	1.5	7.9	8.2	--	7.32	--

Planting Date: May 5 Harvest Date: August 13
Returns were calculated by multiplying the 1998 yield by test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Beulah Oat - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Grain Yield 1998	% of Jerry	Returns
		lbs/bu	bu/ac		$/ac
AC Assinaboia	11,913	35.3	39.4	92	27.64
CDC Boyer	11,653	35.6	37.9	89	27.05
Jerry	12,742	37.9	42.6	100	33.69
Jud	13,550	35.8	41.3	97	29.46
Paul	17,005	40.5	26.8	63	21.45
Whitestone	15,709	35.5	46.6	109	33.32
Mean	13,500	36.8	39.1	--	28.77
C.V. %	4.2	1.8	17.9	--	19.2
LSD .05	794	1.0	NS	--	NS

Planting Date: May 5 Harvest Date: August 13
Returns were calculated by multiplying the 1998 yield by test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Oats in Southwestern North Dakota
Combined Means

Variety	Days to Head	Plant Height	Test Weight	Grain Yield 1996	1997	1998	Average Yield 2 year	3 year
		in	lbs/bu	bu/ac				
Whitestone	72	34	36.1	115.5	107.9	97.3	102.6	106.9
Troy	71	38	37.9	102.2	100.6	109.7	105.2	104.2
Jerry	67	34	38.6	99.8	92.8	89.7	91.2	94.1
Paul*	73	41	42.8	68.5	59.3	65.5	62.4	64.4
CDC Boyer	74	38	35.2		100.2	84.7	92.4	
Jud	72	40	37.6		93.8	89.5	91.6	
AC Medallion	73	38	37.5			106.1		
# of locations	2	4	7	5	6	7	13	18

*Naked (hulless) type.
Seeding rate: 750,000 live seeds/A (approx. 1.7 bu/A).
Yields are adjusted to 12% moisture.

1999 Hard Red Winter Wheat Variety Descriptions

Variety	Agent or Origin	Year	Quality	Leaf rust[1]	Stem rust[1]	Maturity	Straw strength	Height	Winter[a] hardiness
Roughrider	ND	1975	Good	S	R[3]	med.	m. strong	med.	good
Norstar	Can.	1977	Average	S	S	late	med.	tall	good
Winridge	MT	1980	V. Poor	S	S	med.	strong	med.	poor
Rita	SD	1980	Average	MS	MR[2]	early	strong	med.	fair
Rose	SD	1981	Poor	S	MS[2]	early	v. strong	short	fair
Norwin*	MT	1983	Poor	S	MS	med.	strong	v.short	fair
Agassiz	ND	1983	Average	S	R	med.	med.	med.	good
Siouxland	NE	1984	Poor	MR	R	early	strong	med.	poor
Seward	ND	1987	Poor	S	R	med.	m. strong	med.	good
Abilene*	AgriPro	1987	2.5	S	MR	early	strong	v.short	poor
Judith	MT	1988	Average	S	S	med.	strong	med.	fair
Arapahoe	NE	1989	Poor	MR	MR	med.	med.	med.	fair
CDC Kestrel	Can.	1994	NA	S	S	med.	m. strong	med.	good
Elkhorn	ND	1995	Average	MR	R[4]	med.	med.	med.	good
Erhardt	MT	1996	NA	S	R	med.	strong	med	good
McGuire	MT	1996	NA	S	R	m. early	strong	m. tall	fair
Rampart**	MT	1996	NA	S	R	med.	strong	med.	poor
AC Readymade	Can.	1996	NA	S	S	med.	strong	med.	good
Nekota	SD/NE	1997	NA	MS	NA	early	v. strong	v. short	good
Alliance	NE	1997	NA	S	NA	early	strong	short	good
Crimson	SD	1997	NA	MS	NA	med.	m. strong	med.	NA
Tandem	SD	1997	NA	MS	NA	early	med.	med.	NA
Windstar	NE	1997	NA	MS	NA	early	med.	med.	NA
Ransom	ND	1998	Good	R	NA	m. early	med.	med.	good

[a] Varieties with less than good winterhardiness should be seeded only in tall stubble.

* Semidwarf, ** Saw fly resistant.

[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.

[4] Occasionally mixed with some susceptible plants.

Hard Red Winter Wheat **Hettinger**

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	1/1	in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Seward	163	35	63.5	13.3	76.0	57.1	68.0	62.6	67.0
CDC Kestrel	162	34	62.4	13.4	65.3	61.5	66.5	64.0	64.4
Ransom	160	30	62.9	14.0	71.8	56.4	62.3	59.4	63.5
Windstar	154	31	63.3	14.0	68.9	52.4	63.1	57.8	61.5
Elkhorn	162	35	63.0	14.5	62.0	54.4	65.4	59.9	60.6
Arapahoe	153	33	62.5	15.9	71.3	44.8	61.1	53.0	59.1
Agassiz	163	36	63.2	15.8	63.9	50.7	56.6	53.6	57.1
Roughrider	159	33	63.5	16.0	63.9	48.5	58.2	53.4	56.9
Nekota	149	25	62.6	15.3	68.6	46.6	50.6	48.6	55.3
Longhorn	154	28	63.6	14.3	62.4	44.9	58.0	51.4	55.1
Tomahawk	149	24	62.5	15.8	57.9	45.7	47.0	46.4	50.2
Alliance	150	26	63.5	15.2	60.7	42.3	47.3	44.8	50.1
Crimson	157	30	63.8	15.6		50.5	61.4	56.0	
Tandem	152	29	63.5	15.7		48.2	62.7	55.4	
Morgan	164	35	63.0	14.6			77.1		
Norstar	166	40	63.5	13.9			70.4		
Erhardt	162	30	63.4	16.1			65.2		
Abilene	153	25	63.6	15.3			54.4		
Ogallala	150	23	63.5	15.8			46.9		
Trial Mean	157	31	63.1	15.0	66.1	52.1	58.8	--	--
C.V. %	0.8	6.7	1.1	3.4	8.9	16.5	14.7	--	--
LSD .05	2	3	1.1	0.8	9.8	NS	14.1	--	--
LSD .01	3	5	1.5	1.1	13.0	NS	18.8	--	--

Planting Date: September 23, 1997 Harvest Date: July 28, 1998
Seeding Rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Yields are adjusted to 12% moisture.
No winter kill observed.
NS = no statistical difference between varieties.

Hard Red Winter Wheat - Fallow — Dickinson,ND

Variety	Days to Head	Winter Survival	Seeds per Pound	Height	Lodging Score	Test Weight	Protein	Grain Yield 1997	Grain Yield 1998	Returns	2 Year Average
		%		in	0-9	lbs/bu	%	-----bu/ac----		$/ac	bu/ac
Agassiz	57	97	15,315	40	0.3	61.1	13.8	61.9	77.9	170.77	69.9
Alliance	43	100	14,627	31	0.0	59.1	13.1	59.9	69.9	139.79	64.9
Arapahoe	51	98	15,651	34	0.0	59.4	13.9	71.7	73.5	158.60	72.6
CDC Kestrel	55	100	17,026	38	0.0	58.5	11.8	74.1	83.6	151.01	78.9
Crimson	51	97	15,007	34	0.0	61.6	13.9	--	71.1	154.29	--
Elkhorn	56	97	15,222	40	0.5	59.5	13.2	66.3	81.6	166.24	74.0
Erhardt	52	97	17,171	34	0.0	58.8	14.6	72.9	67.2	143.44	70.1
Nekota	44	98	13,006	30	0.0	60.5	14.8	64.3	69.2	153.72	66.7
Norstar	61	97	15,099	43	0.3	60.3	13.3	--	74.4	158.27	--
Ransom	53	100	15,442	36	0.3	59.1	12.9	66.1	78.7	159.92	72.4
Roughrider	54	97	15,173	37	1.0	60.9	14.0	68.1	70.9	151.70	69.5
Seward	54	100	14,632	39	0.0	60.0	11.9	68.2	83.8	156.15	76.0
Tandem	50	97	12,780	34	0.0	59.8	14.6	--	59.2	136.29	--
Windstar	53	100	14,923	34	0.0	60.8	12.8	68.3	77.6	153.69	72.9
Mean	52	98	15,285	36	0.2	59.9	13.5	67.0	75.4	156.67	--
C.V. %	0.4	2.7	4.9	3.2	169.2	1.2	1.8	10.3	6.8	6.9	--
LSD .05	1	NS	1,067	2	0.4	1.0	0.4	9.7	7.2	17.89	--

Planting Date: September 17, 1997 Harvest Date: August 7, 1998
Days to head = from Hard Red Spring Wheat planting date, (April 23, 1998)
Lodging 0 = No lodging, 9 = Completely flat
Returns were calculated by multiplying the 1998 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

1999 Winter Rye Variety Description

Variety	Origin	Year Released	Height	Straw Strength	Maturity	Seed Color	Seed Size	Test Weight	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 winter hardiness should not be seeded on bare soil.

Winter Rye — **Hettinger**

Variety	Days to Head	Plant Height	Test Weight	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
	1/1	in	lbs/bu	bu/ac				
Dacold	152	37	52.8	55.8	96.6	106.7	101.6	86.4
Prima	146	41	55.1	62.8	75.9	96.0	86.0	78.2
AC Rifle	150	35	54.7		69.0	83.3	76.2	
Trial mean	150	38	53.8	62.4	79.4	96.8	--	--
C.V. %	0.4	5.3	1.5	12.2	6.8	10.8	--	--
LSD .05	1	3	1.2	ns	8.2	16.2	--	--
LSD .01	1	4	1.8	ns	11.4	ns	--	--

Planting Date: September 23, 1997
Seeding rate: 1.1 million live seeds/A
Previous crop: Fallow
ns = no statistical difference between varieties.

Harvest Date: July 30, 1998
No winter kill observed.

Winter Rye - Fallow — **Dickinson,ND**

Variety	Seeds per Pound	Days to Head	Plant Height	Test Weight	Grain Yield
			in	lbs/bu	bu/ac
AC Rifle	19,216	40	32.9	51.0	70.8
Dacold	17,038	41	41.2	52.0	96.0
Prima	15,612	35	44.3	52.4	76.8
Mean	17,623	39	39.8	51.4	81.1
C.V. %	4.3	0.1	4.2	1.5	4.9
LSD .05	1,210	0	2.7	1.2	6.3

Planting Date: September 17, 1997
Harvest Date: August 7, 1998
Days to head = from Hard Red Spring Wheat planting date, (April 23, 1998)

Spring Triticale - Fallow — **Hettinger**

Variety	Days to Head	Plant Height	Test Weight	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	2 year average yield*
		in	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac
Wapiti	66	48	51.4	83.1	47.6	23.1	65.4
Norico	Severe herbicide injury			89.8	38.9	--	64.4
Tritical 2700	70	47	46.6	69.4	42.4	19.8	55.9
Marvel	65	43	44.0			22.3	
Trial Mean	67	46	47.3	81.8	43.7	21.7	--
C.V. %	0	3.7	1.7	5.7	18.5	19.5	--
LSD .05	--	3	1.3	6.9	NS	NS	--
LSD .01	--	4	2.0	9.5	NS	NS	--

Planting Date: April 21, 1998
Harvest Date: August 5, 1998
Seeding rate: 1 million live seeds/Ac.
Previous crop: Fallow
NS = no statistical difference between varieties.
* 2 year average yield (1996 & 1997)
Notes: Puma herbicide cause severe and permanent injury to Norico and moderate but temporary injury to Tritical 2700.

Canary Seed — **Hettinger**

Variety	Days to Head	Plant Height	Test Weight	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 year	Average Yield 3 year
		in	lbs/bu	lbs/ac	lbs/ac	lbs/ac	lbs/ac	lbs/ac
Keet	62	37	49.8	1700	1112	1900	1536	1591
Elias	62	35	50.2	1787	964	2013	1488	1588
CDC Marie	60	36	55.9			1793		
Trial Mean	61	36	51.6	1743	1038	1922	--	--
C.V. %	--	4.4	0.8	6.0	18.3	8.5	--	--
LSD .05	--	NS	0.7	NS	NS	NS	--	--

Planting Date: April 21, 1998
Harvest Date: August 5, 1998
Seeding rate: 30 lbs live seeds/A.
Previous crop: Fallow
NS = no statistical difference between varieties.

Mustard - No-till Recrop — **Hettinger**

Variety	Days to First Flower	Days to Last Flower	Days to Maturity	Plant Height	Test Wt.	Yield 1996	Yield 1997	Yield 1998	Average Yield 2 Year	Average Yield 3 Year
				inches	lbs/bu			lbs/ac		
Yellow										
AC Pennant	45	75	90	25	53.6	1767	2258	667	1462	1564
Tilney	47	76	90	22	51.9	1880	1885	590	1238	1452
Viscount	49	77	91	24	54.5	1773	1911	597	1254	1427
SA 92-75	48	76	90	23	52.1			547		
Oriental										
AC Vulcan	57	79	92	32	51.2	1920	1956	175	1066	1350
Forge	59	81	93	35	53.5	1800	1538	232	885	1190
Trial Mean	51	77	91	27.0	52.8	18.3	1953	468	--	--
C.V. %	2.0	0.8	0.7	11.9	1.5	8.0	10.5	27.7	--	--
LSD .05	2	1	1	5	1.2	NS	353	193	--	--
LSD .01	2	1	1	7	1.6	NS	484	265	--	--

Planting Date: April 3, 1998
Seeding Rate: Yellow = 12 lbs/ac, Oriental = 6 lbs/ac.
Lodging was not observed.
NS = no statistical difference between varieties.
Notes: A frost during mid-bloom caused poor seed set and yields.

Harvest Date: July 28, 1998
Previous Crop: HRWW

Mustard - Green Fallow — **Dickinson,ND**

Variety	Type	Days to Flower	Flower Duration	Seeds per Pound	Plant Height	Test Weight	Grain Yield	Returns
					in	lbs/bu	lbs/ac	$/ac
AC Pennant	Y	42	30	113,350	24	55.9	765	103.27
AC Vulcan	O	47	27	200,210	36	52.8	1,059	142.98
Forge	O	51	27	223,004	40	52.8	677	91.45
Tilney	Y	41	31	93,995	27	55.0	811	109.43
Viscount	Y	42	32	113,578	28	55.3	683	92.22
Mean	--	44	29	141,637	30	54.6	791	106.74
C.V. %	--	1	4.0	10.6	5.9	1.2	15.5	15.5
LSD .05	--	1	2	22,562	3	1.0	NS	NS

Planting Date: April 21
Harvest Date: August 5
Type: Y = Yellow, O = Oriental
Returns calculated using market value of $13.50/cwt

Brand	Variety	Type	Days to First Flower	Days to Maturity	Plant Ht	Oil	Test wt	Yield 1995	Yield 1997	Yield 1998
		*			in	%	lbs/bu	lbs/ac	lbs/ac	lbs/ac
Interstate	Hyola 401	H	58	100	29	36.8	50.9	2543	1876	2063
Interstate	Crusher	OP	66	102	38	38.9	51.3	1564	1549	1711
Interstate	Hyola 420	H	60	102	34	37.2	50.6		2080	1981
Interstate	Dynamite	OP	62	104	35	38.1	50.6		1374	1667
	Tobin	P	47	89	28	33.4	-	1590	1138	**
Interstate	Quantum	OP	61	102	35	35.8	53.5			1906
Limagrain	LG 3369		60	100	32	39.4	49.9			1822
Croplan	CL 2078	SYN	64	102	35	36.3	49.6			1756
Cargill	Roseau	OP	66	103	41	40.3	50.0			1731
Cargill	HyC 606	H	62	100	36	36.1	51.8			1714
Integra	Advantage	OP	62	102	36	36.9	50.2			1668
Integra	Eagle	OP	61	98	32	36.0	49.0			1622
Pioneer	46A65	OP	60	100	31	38.0	50.6			1572
Calgene	LA 161	OP	76	104	35	36.0	49.6			1563
Croplan	Hudson	OP	59	98	32	37.0	50.9			1545
Limagrain	LG 3333		59	100	33	37.4	49.4			1538
Croplan	CL 2070	H	64	102	34	36.4	52.7			1537
Calgene	LA 269	OP	65	100	36	36.9	50.5			1526
Cargill	Cavalier	OP	59	96	32	35.7	49.3			1490
Limagrain	LG 3260		60	97	31	38.7	50.3			1486
Agri-Tel	OAC Summit	OP	62	99	31	36.8	52.3			1481
Parsons	PSL 95-116	OP	62	100	33	37.1	50.2			1474
Integra	Battleford	OP	60	99	33	37.1	51.0			1415
Parsons	PSL 97-102	OP	61	102	33	40.0	48.6			1401
Pioneer	46A74	OP	63	103	35	37.6	50.2			1387
Croplan	CL 2020	H	59	98	32	36.1	50.4			1377

Continued

Canola continued — **Hettinger**

Brand	Variety	Type	Days to First Flower	Days to Maturity	Plant Ht	Oil	Test wt	Yield 1995	Yield 1997	Yield 1998
		*			in	%	lbs/bu	lbs/ac	lbs/ac	lbs/ac
Croplan	CL Ex57	OP	65	102	35	32.9	51.6			1354
Terra	Exp3	OP	60	98	30	36.0	47.2			1212
	AC Boreal	P	45	90	30	32.0	-			**
	Parkland	P	47	90	31	32.4	-			**
	Reward	P	48	90	30	33.0	46.2			**
Trial Mean			60	99	33	36.6	50.4	1713	1604	1410
C.V. %			1.7	1.8	10.4	3.0	2.6	16.0	13.9	22.2
LSD .05			1	2	5	1.6	1.8	394	374	440
LSD .01			2	3	6	2.1	2.4	529	506	584

Planting Date: April 14, 1998
Harvest Date: July 31, 1998
Seeding Rate: 7.5 lbs/ac, P = 4.5 lbs/ac.
Previous Crop: HRWW
*Type: OP = Open Pollinated, H = Hybrid, SYN = Synthetic, P=Polish (B. rapa).
**No yield due to frost during mid-bloom.

Late Seeded Canola — **Hettinger**

Brand	Variety	Type	Days to First Flower	Plant Ht	Oil	Test wt	Yield
		*		in	%	lbs/bu	lbs/A
Interstate	ZWP009	OP	57	32	38.1	50.2	1582
Interstate	ZSNA005	OP	56	32	37.2	50.0	1354
AgrEvo	HCN-41	OP	57	32	38.1	52.1	1078
Cargill	X5.189	OP	57	33	39.4	51.9	858
AgrEvo	HCN-35	OP	55	29	41.0	50.5	610
Trial Mean			56	32	38.7	51.0	1097
C.V. %			0.4	4.2	1.7	1.4	21.1
LSD .05			1	2	1.0	1.1	351
LSD .01			1	3	1.4	1.5	488

Planting Date: April 28, 1998
Harvest Date: July 31, 1998
Seeding Rate: 7.5 lbs/ac
Previous Crop: HRWW
*Type: OP = Open Pollinated

Canola Planting Date Trial	Hettinger

Planting Date	Days to First Flower	Days to Last Flower	Days to Maturity	Lodging	Plant Height	Oil	Test Weight	Yield
	M/DD	M/DD	M/DD	0 - 10*	in	%	lbs/bu	lbs/ac
April 14	6/6	7/2	7/20	1.5	35	38.0	52.7	1500
April 22	6/12	7/6	7/22	2.2	37	37.4	53.2	1173
May 5	6/23	7/10	7/21	3.5	31	36.5	51.5	400
May 20	7/3	7/16	8/2	3.8	34	36.3	52.8	533
May 27	7/10	7/21	8/6	1.8	28	35.0	--	133
June 3	7/14	7/23	8/5	0.8	28	34.6	--	100
June 12	7/18	7/27	8/8	0	24	36.4	--	80
C.V. %				51.3	7.2	2.3	0.9	29.7
LSD .05				1.5	3	1.3	0.8	274

*Lodging: 0 = no lodging, 10 = completely flat.

Summary

This study was designed to determine the optimum planting window of canola in southwestern North Dakota. Canola hybrid brand Hyola 401 was planted at two week intervals beginning on April 14. Agronomic characteristics were noted throughout the growing season and plots were harvested on July 31 for the first three planting dates (April 14, April 22 and May 5) and on August 12 for the remaining plots.

Flowering on the first two planting dates (April 14 and April 22) extended for almost a month while temperatures were generally mild. Hot temperatures during July adversely affected flowering by causing blossom abortion and a reduction in the duration of flowering. Duration of flowering declined to less than 14 days on all planting dates after May 5. Those hot temperatures also accelerated plant maturity. Lodging tended to increase with planting date through the May 20 planting date, then decreased with the remaining planting dates. Plant height and oil content tended to decrease with planting date. Lodging did not correspond with plant height. There was no trend observed with test weight. Test weights for the last three planting dates were not obtainable due to a lack of harvested seed. Yields decreased with planting date and decreased dramatically after the April 22 planting date. Yield was significantly higher for the first planting date.

Crambe - No-till Recrop — **Hettinger**

Variety	Days to First Flower	Days to Last Flower	Days to Matur	Plant Ht	Oil	Test wt	Yield 1996	Yield 1997	Yield 1998	Average Yield 2 Year	Average Yield 3 Year
				in	%	lbs/bu	lbs/ac	lbs/ac	lbs/ac	lbs/ac	lbs/ac
BelAnn	46	75	86	31		20.7	2160	2954	1876	2415	2330
Meyer	43	73	84	26		18.7	1580	2173	1325	1749	1693
Trial Mean	45	75	86	28		18.9	1816	2572	1337	--	--
C.V. %	1.5	1.4	1.3	6.8		7.1	16.0	10.6	15.7	--	--
LSD .05	1	2	2	3		2.2	404	382	347	--	--
LSD .01	1	2	3	4		ns	540	507	ns	--	--

Planting Date: April 28, 1998
Harvest Date: August 5, 1998
Previous Crop: Durum

Seeding Rate: 20 lbs/ac.
ns = no statistical difference between varieties.

Safflower - No-till Recrop — **Hettinger**

Variety	Days to Flower	Plant Ht	Oil	Test wt	Yield 1996	Yield 1997	Yield 1998	Average Yield 2 Year	Average Yield 3 Year
		in	%	lbs/bu	lbs/ac	lbs/ac	lbs/ac	lbs/ac	lbs/ac
S-518	88	23	38.5	41.4	2687	1674	1860	1767	2074
S-317	88	24	38.0	41.4	3014	1407	1794	1600	2072
Montola 2000	88	21	38.6	41.6	2222	1467	1700	1584	1796
Centennial	90	25	39.4	42.0	2114	1333	1580	1456	1676
S-541	88	23	39.4	42.5	2196	947	1667	1307	1603
Finch	88	22	34.7	45.8	2174	1233	1367	1300	1591
Montola 2001	88	23	37.4	41.8	1900	1207	1387	1297	1498
Morlin	89	24	36.4	41.3	1227	1600	1433	1516	1420
Trial Mean	88	23	37.3	42.7	2013	1383	1567	--	--
C.V. %	0.8	8.5	1.3	1.2	11.0	16.9	17.8	--	--
LSD .05	1	NS	0.7	0.8	317	333	400	--	--
LSD .01	1	NS	0.9	1.0	423	446	NS	--	--

Planting Date: April 21, 1998
Seeding Rate: 400,000 live seeds/acre
NS = no statistical difference between varieties.

Harvest Date: August 31, 1998
Previous Crop: Durum

Safflower - Green Fallow **Dickinson, ND**

Variety	Days to Flower	Seeds per Pound	Plant Height	Oil	Test Weight	Grain Yield	Returns
			in	%	lbs/bu	lbs/ac	
Centennial	87	14,087	26	38.9	41.0	1,692	203.06
Erlin	85	17,364	23	35.5	37.1	1,327	159.30
Finch	86	14,589	26	34.5	44.4	1,492	178.99
Montola 2000	86	16,147	22	36.3	38.0	1,477	177.23
Montola 2001	86	12,058	25	36.4	39.3	1,435	172.17
Morlin	88	18,358	25	36.0	40.0	1,479	177.44
S 317	86	14,209	27	36.8	38.3	1,769	212.30
S 518	87	14,399	25	35.6	37.0	1,990	238.77
S 541	87	14,316	24	38.7	40.0	1,793	215.13
Mean	86	14,931	25	36.4	39.9	1,610	193.18
C.V. %	0.7	4.4	4.2	1.7	0.8	7.1	7.1
LSD .05	1	956	2	0.9	0.5	165	19.83

Planting Date: April 23
Harvest Date: September 11
Returns were calculated using a market value of $12.00/cwt
Oil content is @ 8% moisture

1999 Flax Variety Description

Variety[1]	Origin	Year Released	Relative Maturity	Seed[2] Color	Plant Height	Wilt	Relative Yield
Webster	SD	1998	late	br	tall	MR	v. good
Cathay	ND	1998	mid	br.	med	MR	v. good
Pembina	ND	1998	mid	br.	med	MR	v. good
CDC-Valour	Can.	1996	early	br.	short	MR	v.good
AC-Watson	Can.	1996	early	br.	short	MR	v.good
CDC-Normandy	Can.	1995	mid.	br.	short	MR	v.good
AC-Emerson	Can.	1994	mid.	br.	med.	VR	v.good
McDuff	Can.	1993	late	br.	med.tall	MR	v.good
Linora	Can.	1993	late	br.	tall	R	v.good
Flanders	Can.	1989	late	br.	med.	MS	good
Somme	Can.	1989	mid	br.	med.	MS	good
Omega	ND	1989	mid	yel.	med.	MS	v.good
Neche	ND	1988	mid	br.	med.	R	good
Prompt	SD	1988	early	br.	med.	MR	good
Verne 93	SD	1993	early	br.	med.	R	v.good
Linton	ND	1985	early	br.	med.	R	v.good
Rahab 94	SD	1994	mid	br.	med.	MR	good
NorMan	Can.	1984	mid	br.	med.	MR	good
Clark	SD	1983	early	br.	med.	MR	good
NorLin	Can.	1982	early	br.	med.	MS	good
Flor	ND	1981	early	br.	med.	MS	v.good
McGregor	Can.	1980	late	br.	tall	R	v.good
Culbert 79	SD	1979	early	br.	med.	MR	good
Dufferin	Can.	1975	late	br.	tall	R	good

1 All varieties have resistance to prevalent races of rust; all have good oil yield and oil qulaity.
2 br = brown, yel = yellow.

Flax - No-till Recrop **Hettinger**

Variety	Days to Flower	Plant Height	Test Weight	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Average Yield 2 Year	Average Yield 3 Year
		in	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Ac Emerson	58	22	54.7	21.4	27.6	20.0	23.8	23.0
CDC Normandy	58	23	55.0	21.2	27.9	19.8	23.8	23.0
Flanders	60	22	54.5	20.3	29.5	17.9	23.7	22.6
NorMan	59	22	55.2	19.0	27.7	19.0	23.4	21.9
McGregor	60	22	54.8	21.1	27.5	16.8	22.2	21.8
Prompt	56	22	54.9	17.8	26.5	21.1	23.8	21.8
Linora	59	21	54.8	19.8	26.8	17.6	22.2	21.4
Rahab 93	60	22	54.5	16.7	26.7	20.5	23.6	21.3
McDuff	60	22	55.0	17.6	28.1	15.9	22.0	20.5
Neche	58	21	55.3	17.9	25.7	17.3	21.5	20.3
NorLin	58	23	54.8	17.6	25.7	17.0	21.4	20.1
Omega	60	23	55.1	18.6	22.0	19.0	20.5	19.9
Linton	59	22	54.9	16.2	24.8	18.3	21.6	19.8
Pembina	58	22	54.8		28.8	19.7	24.2	
Cathay	58	23	54.7		26.8	19.5	23.2	
CDC Valour	56	22	54.3		25.4	19.8	22.6	
AC Watson	56	21	53.2		24.4	17.8	21.1	
Webster	58	22	55.1			18.4		
Trial Mean	58	22	54.7	19.2	26.0	18.9	--	--
C.V. %	0.9	5.3	0.6	13.4	16.3	8.4	--	--
LSD .05	1	NS	0.5	4.3	NS	2.6	--	--
LSD .01	1	NS	0.7	5.7	Ns	3.5	--	--

Planting Date: April 29, 1998
Harvest Date: August 5, 1998
Seeding rate: 30 lbs/Acre
Previous crop: HRSW
NS = no statistical difference between varieties.

Beulah Flax - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Plant Height	Test Weight	Grain Yield	Returns
		in	lbs/bu	bu/ac	$/ac
Cathay	142,374	19	50.0	7.2	33.42
Flor	150,138	20	50.0	9.6	44.77
Neche	138,000	20	50.0	7.5	35.07
Omega	151,754	21	49.0	9.2	42.83
Pembina	158,624	21	50.0	8.8	40.85
Mean	148,178	39.38	49.8	8.5	39.38
C.V. %	11.7	11.8	--	11.8	11.8
LSD .05	NS	NS	--	NS	NS

Planting Date: May 5 Harvest Date: August 6
Returns were calculated by multiplying the 1998 yield by the test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Hannover Flax - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Plant Height	Test Weight	Grain Yield	Returns
		in	lbs/bu	bu/ac	$/ac
Cathay	83,366	26	56.6	25.9	120.29
Flor	90,348	24	56.4	25.0	116.47
Neche	85,641	25	57.1	23.6	109.74
Omega	81,750	26	56.4	23.0	107.17
Pembina	85,738	25	56.6	27.6	128.20
Mean	85,368	25	56.6	25.0	116.37
C.V. %	5.3	3.8	0.8	16.0	16.0
LSD .05	NS	NS	NS	NS	NS

Planting Date: May 5 Harvest Date: August 20
Returns were calculated by multiplying the 1998 yield by test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8.

Brand	Hybrid	Type	Days to mature	Test weight	Oil Content	Yield 1995	Yield 1997	Yield 1998	Avg. Yield 2 Year	Avg. Yield 3 Year
				lbs/bu	%	lbs/ac				
Asgrow	3211		132	33.7	48.5	2836	1923	2585	2254	2448
Asgrow	5101		132	33.6	49.0		2328	2463	2396	
Asgrow	5303		141	34.0	47.5		2558	1831	2914	
Asgrow	6305		142	32.9	43.5		2852	1399	2126	
Asgrow	8318		130	32.6	48.0			2712		
Asgrow	8306		126	34.3	46.0			2256		
Asgrow	8203		134	34.1	42.8			2208		
Asgrow	7101		136	34.1	46.2			1976		
Asgrow	8101		131	33.6	43.9			1587		
Asgrow	8102		141	34.5	42.9			1453		
Cargill	SF187		127	32.9	48.5		3090	2579	2834	
Cargill	SF270		127	34.2	49.9		2288	2469	2378	
Cargill	SF128		134	35.2	42.7			2220		
Croplan	803		124	35.0	51.4	2545	2471	2396	2434	2471
Croplan	745		133	33.5	49.2	2271	2081	2274	2178	2209
Croplan	757		131	33.4	48.7		2820	2171	2496	
Croplan	821		134	31.6	45.7			2816		
Dekalb	3868		124	34.5	52.6	3234	2836	3339	3088	3136
Dekalb	3790		131	36.0	51.6	2770	2701	2615	2658	2695
Dekalb	3875		134	33.3	50.6		3337	3704	3520	
Dekalb	3806		130	35.6	51.0			2718		
IS/Payco	6077		125	34.0	49.0		3027	2335	2681	
IS/Payco	5077		133	33.8	47.6		2598	2366	2482	
IS/Payco	6039		124	35.5	50.5			2506		
IS/Payco	6767		130	34.0	48.5			2299		
IS/Payco	311		120	33.2	51.6			2129		
IS/Payco	6111		122	34.9	47.0			2025		
Kaystar	8500		130	35.0	49.4			3065		

continued

Brand	Hybrid	Type	Days to mature	Test weight	Oil Content	Yield 1995	Yield 1997	Yield 1998	Avg. Yield 2 Year	Avg. Yield 3 Year
				lbs/bu	%	lbs/ac				
Kaystar	8300		121	32.2	51.1			2615		
NDSU	894		130	32.5	46.2		2812	2992	2902	
Pioneer	6300		122	34.4	51.0	3563	3067	2810	2938	3147
Pioneer	63A81		126	34.8	50.1		3241	2457	2849	
Pioneer	6451		132	32.4	50.3			2895		
Pioneer	XF4728	Nusun	122	34.1	51.3			2797		
Pioneer	63A51	High Oleic	130	33.4	45.6			2731		
Pioneer	XF379		135	30.7	50.5			2627		
Pioneer	64A61	High Oleic	128	31.6	45.7			2201		
Pioneer	6338		137	34.0	45.0			2189		
Pioneer	XF3711		124	35.2	50.2			1946		
Proseed	140		129	32.6	49.8	2857	2685	2250	2468	2597
Proseed	141		128	33.4	49.3	2224	2773	1691	2232	2229
Proseed	9310		138	34.6	41.6		2685	2603	2644	
Proseed	E9103	Nusun	132	32.2	47.7		2717	2250	2484	
Proseed	9215		117	35.2	49.9			2737		
Proseed	E9817		118	34.8	50.5			2591		
Proseed	E9149	Nusun	123	32.1	47.0			2396		
Proseed	E9536		117	30.8	48.2			2220		
Proseed	E9717	Nusun	125	30.6	45.5			2068		
Proseed	Ex9132		130	33.2	49.6			1873		
Seeds 2000	Wrangler		131	34.0	47.5		2749	2524	2636	
Trial Mean			129	33.6	48.1	2851	2646	2399		
C.V. %			5.4	2.6	3.1	13.0	11.8	15.0		
LSD .05			10	1.2	2.1	594	503	500		
LSD .01			13	1.6	2.8	790	675	660		

Planting date: May 15, 1998 Harvest date: October 22, 1998
Seeding rate: 21,000 seeds/acre, thinned to 18,000 plants/acre.
Row spacing: 28"
Previous crop: Summer fallow
Yields are adjusted to 9% moisture.

Field Pea	Hettinger

Variety	Days to First Flower	Days to Last Flower	Plant Ht. at Harvest	100 Kernel wt.	Test Weight	Yield 1996	Yield 1997	Yield 1998	Average Yield 2 year	Average Yield 3 year
			in	grams	lbs/bu	lbs/ac	lbs/ac	lbs/ac	lbs/ac	lbs/ac
Profi	60	74	29	23.8	62.8	3414	2365	3867	3116	3215
Majoret	66	73	28	23.9	63.8	3414	2160	3634	2897	3069
Carneval	66	76	29	19.7	63.3	3502	2356	3327	2842	3062
Highlight	65	76	22	16.5	63.4		2533	3307	2920	
Grande	69	76	28	19.3	63.3		2791	2940	2866	
Totem	64	76	20	18.9	61.2		2205	3420	2812	
Atomic	65	73	24	28.9	64.3		1965	3534	2750	
MP 1373	64	74	21	19.9	62.7			3974		
Phantom	59	72	18	24.0	62.2			3900		
Scuba	59	74	26	20.4	63.3			2940		
Trial Mean	64	74	25	21.5	63.0	3384	2280	3484	--	--
C.V. %	0.9	1.3	9.7	--	0.5	9.0	12.9	9.0	--	--
LSD .05	1	1	3	--	0.5	509	504	455	--	--
LSD .01	1	2	5	--	0.6	NS	689	613	--	--

Planting Date: April 21, 1998
Harvest Date: August 28, 1998
Seeding Rate: 250,000 live seeds/acre
Previous Crop: HRSW
NS = no statistical difference between varieties.

Field Pea - Recrop — **Dickinson, ND**

Variety	Type	Days to Flower	Flower Duration	Seeds per Pound	Plant Height	Lodging Score	Test Weight	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Returns	Average Yield 2 Year	Average Yield 3 Year
					in	0-9	lbs/bu	lbs/ac	lbs/ac	lbs/ac	$/ac	lbs/ac	lbs/ac
Adagio	G	59	19	1,744	20	3.5	63.3	--	--	2739	136.95	--	--
Atomic	G	60	19	1,421	25	0.0	64.3	--	--	3355	167.75	--	--
Grande	Y	62	18	1,864	19	4.0	62.3	2381	2309	2749	137.43	2529	2480
Highlight	Y	59	20	2,340	22	0.5	65.1	--	1759	3264	163.18	2511	--
Phantom	G	56	19	1,581	18	0.8	64.6	--	--	3200	159.98	--	--
Scuba	G	56	22	1,850	24	0.5	64.9	--	--	3007	150.36	--	--
Totem	G	61	18	1,890	14	5.8	63.1	--	1914	3051	152.56	2483	--
Mean	--	59	19	1,810	20	1.9	64.0	1722	1623	3170	158.49	--	--
C.V. %	--	0.9	4.2	4.4	14.1	84.6	1.5	17.1	13.8	8.4	8.4	--	--
LSD .05	--	1	1	117	4	2.4	1.4	NS	321	394	19.68	--	--

Planting Date: April 21
Harvest Date: July 27
Type: Y = Yellow, G = Green
Returns calculated using market value of $5.00/cwt
Lodging: 0 = No lodging, 9 = Completely flat

Field Pea Seeding Rate - Recrop **Dickinson, ND**

Treatment	Plant Stand	Seeds per Pound	Test Weight	Grain Yield
			lbs/bu	bu/ac
Seeding Rate (SR)				
200,000 PLS/acre	154,289	3,136	63.5	30
250,000 PLS/acre	188,167	3,121	63.7	33
300,000 PLS/acre	217,555	3,229	63.8	31
350,000 PLS/acre	233,882	3,272	63.6	31
400,000 PLS/acre	234,698	3,260	63.8	32
LSD .05	25,538	NS	NS	NS
Variety (V)				
Carneval	224,821	2,041	64.4	42
Trapper	186,616	4,366	63.0	21
LSD .05	16,152	116	0.4	2
Mean	205,718	3,204	63.7	31
C.V. %	12.1	5.6	0.9	8.8
SR X V	*	NS	NS	NS

Planting Date: April 21
Harvest Date: July 27 (Carneval) August 5 (Trapper)
* = significant at the $P < 0.05$ level.

Carneval Field Pea Pop-up Fertilizer Trial - Green Fallow **Dickinson, ND**

	Fertilizer Rate	Fertilizer Type	Plant Stand	Seeds per Pound	Test Weight	Grain Yield
	lbs/ac				lbs/bu	lbs/ac
	0	NONE	249,801	2,020	64.8	2,839
	6	46-0-0	241,637	2,042	64.4	2,834
	12	46-0-0	244,086	1,982	64.8	2,788
	18	46-0-0	217,963	2,066	64.5	2,567
	25	11-52-0	219,596	1,999	64.1	2,877
	50	11-52-0	176,330	1,836	64.5	2,843
	75	11-52-0	144,493	1,888	64.8	2,580
	30	0-44-0	250,617	2,030	64.1	2,979
	60	0-44-0	208,984	2,027	64.6	2,850
	90	0-44-0	202,453	1,950	64.0	2,933
Mean	--	--	215,596	1,984	64.5	2,809
C.V. %	--	--	11.5	9.1	0.8	6.4
LSD .05	--	--	36,056	NS	NS	259

Planting Date: April 21
Harvest Date: July 27

Chickpea - No-till Recrop — **Hettinger**

Variety	Days to First Flower	Days to Last Flower	Plant Ht.	100 Kernel wt.	Test Weight	Yield 1996	Yield 1997	Yield 1998	Average Yield 2 year	Average Yield 3 year
			in	grams	lbs/bu	lbs/ac	lbs/ac	lbs/ac		
Myles*	63	79	13	17.7	59.0	2489	2533	2047	2290	2356
UC-27	59	76	13	49.1	63.7	2687	1933	1693	1813	2104
Sanford	69	80	17	42.5	63.3	2347	1700	1607	1654	1885
Dwelley	70	80	17	49.5	62.1	1751	1387	1427	1407	1522
Mean	65	79	15	39.6	62.0	2347	1754	1693	--	--
C.V. %	1.6	0.7	11.4	--	0.6	11.0	11.3	9.3	--	--
LSD .05	2	1	3	--	0.6	420	304	246	--	--
LSD .01	2	1	4	--	0.8	593	423	347	--	--

*Myles = Desi type, other varieties are kabuli type.
Planting Date: April 21, 1998
Seeding Rate: Desi = 120 lbs live seed/acre, Kabuli = 180 lbs live seed/acre
Previous Crop: HRSW
Harvest Date: August 28, 1998

Chickpea - Green Fallow — **Dickinson, ND**

Variety	Type	Days to Flower	Seeds per Pound	Plant Height	Test Weight	Grain Yield	Returns
				in	lbs/bu	lbs/ac	$/ac
Dwelley	K	68	876	18	60.6	1,953	351.63
Myles	D	59	2,580	17	60.5	2,317	417.14
Sanford	K	67	1,031	19	61.8	1,914	344.48
UC 27	K	59	883	18	62.1	2,200	395.92
Mean	--	63	1,342	18	61.3	2,096	377.29
C.V. %	--	0.8	7.9	3.6	1.0	3.7	3.7
LSD .05	--	1	169	1	1.0	123	22.14

Planting Date: April 24
Harvest Date: August 18
Type: K = Kabuli, D = Desi
Returns calculated using a market value of $18.00/cwt

Lentil - No-till Recrop — **Hettinger**

Variety	Days to First Flower	Days to Last Flower	Plant Height	100 Kernel weight	Test weight	Yield 1996	Yield 1997	Yield 1998	Average Yield 2 Year	Average Yield 3 Year
			inches	grams	lbs/bu	lbs/ac				
CDC Richlea	66	80	15	4.4	58.9	2093	1341	2353	1847	1929
Eston	66	79	13	2.6	62.0	1293	1064	2507	1786	1621
Crimson	66	80	11	2.9	61.8	1156	955	2560	1758	1557
Brewer	59	78	13	5.1	58.2	907	1058	2393	1726	1453
Laird	69	81	18	6.2	58.4	942	693	1880	1286	1172
Mason	59	77	14	6.5	59.0			2667		
Red Chief	59	79	15	4.4	58.3			2267		
Trial Mean	63	79	14	4.6	59.5	1339	1048	2375	--	--
C.V. %	0.4	1.2	9.1	--	0.6	25.0	21.6	7.7	--	--
LSD .05	1	1	2	--	0.5	490	332	269	--	--
LSD .01	1	2	3	--	0.7	664	450	366	--	--

Planting Date: April 21, 1998
Seeding Rate: 550,000 live seeds/acre

Harvest Date: July 31, 1998
Previous Crop: HRSW

Lentil - Green Fallow — **Dickinson,ND**

Variety	Type	Days to Flower	Seeds per Pound	Plant Height	Test Weight	Grain Yield 1996	Grain Yield 1997	Grain Yield 1998	Returns	Average Yield 2 Year	Average Yield 3 Year
				in	lbs/bu	lbs/ac			$/ac	lbs/ac	
Brewer	C	54	9,585	12	61.3	815	1232	1726	138.09	1479	1258
CDC Richlea	C	63	10,359	13	62.0	1285	1197	1809	144.73	1503	1430
Crimson	R	63	16,526	12	63.6	810	1187	1629	130.35	1408	1209
Eston	P	63	17,005	13	64.4	1025	1316	1752	140.17	1534	1364
Laird	C	70	6,835	14	59.5	945	947	1496	119.68	1221	1129
Mason	C	55	8,467	12	62.5	--	--	1729	138.29	--	--
Red Chief	R	57	10,495	11	61.5	--	--	1676	134.07	--	--
Mean	--	61	1,324	12	62.1	948	1246	1688	135.05	--	--
C.V. %	--	1	4.8	4.0	0.8	14.8	14.0	7.4	7.4	--	--
LSD .05	--	1	803	1	0.7	205	250	NS	NS	--	--

Planting Date: April 21
Type: C = Chilean, R = Red, P = Persian
Harvest Date: July 28 (Brewer, Crimson, Eston, Mason, Red Chief) August 5 (CDC Richlea, Laird)
Returns calculated using market value of $8.00/cwt

Beulah Lentil - Recrop **Dickinson, ND**

Variety	Type	Seeds per Pound	Plant Height	Lodging Score	Test Weight	Grain Yield	Returns
			in	0-9	lbs/bu	lbs/ac	$/ac
Brewer	C	9,439	9	2.3	58.0	454	36.33
CDC Richlea	C	10,408	11	0.8	59.0	558	44.64
Crimson	R	15,357	7	6.0	62.0	582	46.57
Eston	P	15,676	8	1.5	62.0	507	40.52
Mean	--	12,720	9	2.6	60.3	525	42.02
C.V. %	--	5.4	8.7	43.5	--	19.1	19.1
LSD .05	--	1,088	1	1.8	--	NS	NS

Planting Date: May 5 Harvest Date: August 6
Type: C = Chilean, R = Red, P = Persian
Returns calculated using a market value of $8.00/cwt
Lodging: 0 = No lodging, 9 = Completely flat

Glen Ullin Lentil - Recrop **Dickinson, ND**

Variety	Type	Seeds per Pound	Plant Height	Lodging Score	Test Weight	Grain Yield	Returns
			in	0-9	lbs/bu	lbs/ac	$/ac
Brewer	C	8,672	13	4.8	58.0	1,038	83.05
CDC Richlea	C	9,507	15	6.0	59.5	1,147	91.80
Crimson	R	14,217	10	6.3	62.0	1,093	87.45
Eston	P	15,198	12	0.8	61.5	1,035	82.78
Mean	--	11,899	12	4.4	60.3	1,078	86.27
C.V. %	--	3.4	7.6	27.7	--	15.8	15.8
LSD .05	--	646	2	2.0	--	NS	NS

Planting Date: May 5 Harvest Date: August 6
Type: C = Chilean, R = Red, P = Persian
Returns calculated using a market value of $8.00/cwt
Lodging: 0 = No lodging, 9 = Completely flat

Hannover Lentil - Recrop — **Dickinson, ND**

Variety	Type	Seeds per Pound	Plant Height	Lodging Score	Test Weight	Grain Yield	Returns
			in	0-9	lbs/bu	lbs/ac	$/ac
Brewer	C	8,518	13	6.0	60.0	1,904	152.32
CDC Richlea	C	9,976	15	6.5	59.5	2,359	188.69
Crimson	R	14,429	11	4.0	62.0	1,962	156.94
Eston	P	15,538	14	1.3	61.5	2,329	186.36
Mean	--	12,115	13	4.4	60.8	2,138	171.07
C.V. %	--	3.2	9.0	14.8	--	10.5	10.5
LSD .05	--	623	2	1.0	--	359	28.68

Planting Date: May 5 Harvest Date: August 6
Type: C = Chilean, R = Red, P = Persian
Returns calculated using a market value of $8.00/cwt
Lodging: 0 = No lodging, 9 = Completely flat

Specialty Crops — **Hettinger**

Crop	Variety	Yield
		lbs/ac
Coriander		480
Fenugreek		843
Camolina		1680
Anise		129
Dill	Mamoth	106
Radish	Sparkler	292
Radish	Parot Sperling	219
Radish	Giant White Globe	214
Radish	French Breakfast	686

Planting date: April 29, 1998
Previous crop: Summer fallow
Harvest date: August 14, 1998
Radish - August 31, 1998

Brand	Hybrid	Genetic traits*	Relative matur.	Harvest moist.	Silage 1997	Silage 1998	Test weight	Grain Yield 1997	Grain Yield 1998
			days	%	-----Tons/ac**----		lbs/bu	-----bu/ac***-----	
Cargill	1877		80	75	3.99	2.16	56.5	79.7	37.6
Cargill	x1801		80	67		2.59	52.8		37.4
Cargill	HS60A	HS	108	73		3.39	--	--	--
Croplan	N2555	Bt	86	70		2.44	55.6		37.9
Croplan	212		85	67		2.07	54.1		32.4
Dekalb	385B		88	62	4.23	3.20	54.2	89.0	43.6
Dekalb	440		94	70		2.83	48.3		57.8
Dekalb	431		93	70		2.65	51.1		44.4
Dekalb	493	RR	99	72		2.73	49.0		28.7
Dekalb	404	SR	90	70		3.04	51.4		33.0
G. Harvest	2265		88	69		2.74	51.8		31.4
G. Harvest	2274		90	68		2.71	50.2		38.4
IS/Payco	4x85		85	67		3.12	53.0		40.5
Kaystar	380		90	72		2.48	47.4		29.6
Kaystar	330		85	71		2.46	50.1		33.5
Pioneer	38W36	Bt	94	72		2.55	53.1		55.7
Pioneer	38B22	Bt + Lib	92	68		3.00	52.1		45.1
Pioneer	3921		86	61		2.55	53.8		23.6
Pioneer	3963		79	65		2.49	57.3		29.1
Proseed	180		80	69	5.30	2.69	55.3	87.4	37.4
Proseed	185		85	74	5.69	2.67	48.3	82.3	38.3
Trial Mean					5.17	2.69	52.2	81.6	37.9
C.V. %					24.2	13.0	2.2	11.8	28.4
LSD .05					NS	0.58	1.9	NS	17.8
LSD .01					NS	0.77	2.5	NS	NS

Planting date: May 15, 1998
Seeding rate: 21,000 seeds/acre, thinned to 18,000 plants/acre.
Row spacing: 28"
Previous crop: Summer fallow
*Genetic traits: HS = high sugar silage, Bt = European Corn Borer resistance, RR = Roundup herbicide resistance, SR = Sethoxydim herbicide resistance, Lib = Liberty herbicide resistance.
**Silage yields are adjusted to 0% moisture.
***Grain yields are adjusted to 13.5% moisture.
NS = no statistical difference between hybrids.
Harvest date: Silage - September 9, 1998
Grain - October 27, 1998

1998 Hybrid Corn - Recrop — **Dickinson, ND**

						Silage Yield			
			---- Grain ----		Harvest	70%	---------- DM Basis -------		
Brand	Hybrid	RM	Yield	TW	Moisture	Moisture	1997	1998	2 yr avg
		days	bu/ac	lb/bu	%	----------Tons/ac ----------			
Dekalb	DK-355	85	55.0	57.0	64	13.4	--	4.0	--
Dekalb	DK-385 B	88	51.7	57.5	66	15.7	5.1	4.7	4.9
Dekalb	DK-404SR	90	68.6	55.2	67	12.4	--	3.7	--
Dekalb	DK-405	90	60.3	55.4	67	14.5	--	4.3	--
Dekalb	DK-431	93	60.0	55.4	69	15.4	--	4.6	--
Dekalb	DK-493RR	99	70.2	53.2	69	14.7	--	4.4	--
Cargill	HS60A	108	33.2	51.8	73	12.9	--	3.9	--
Croplan	max 40	84	66.6	58.6	62	14.0	--	4.2	--
Croplan	154	78	59.7	57.4	57	12.6	--	3.8	--
Payco	4x85	85	64.0	56.2	64	13.3	--	4.0	--
Proseed	180	80	51.0	58.2	65	11.3	3.6	3.4	3.5
Proseed	185	85	68.6	54.0	66	12.4	4.3	3.7	4.0
Mean			59.1	55.8	65.8	13.6	--	4.1	--
C.V. %			16.6	1.6	3.1	12.7	--	12.7	--
LSD .05			NS	1.3	2.9	2.5	--	0.7	--

RM = relative maturity
TW = test weight
Planting Date: May 22
Harvest Date: September 9 (silage) October 1 (grain)
Damage due to birds lowered the grain yield by an estimated average of 27% per variety

Oat Hay	Hettinger

Variety	Plant Height	Hay Yield 1995	Hay Yield 1996	Hay Yield 1998	Average Yield 2 year	Average Yield 3 year
	in	Tons/ac*	Tons/ac*	Tons/ac*	Tons/ac*	Tons/ac*
Whitestone	38	4.30	6.63	5.60	6.12	5.51
Otana	41	4.21	5.67	5.06	5.36	4.98
Monida	42	3.81	5.64	4.79	5.22	4.75
Paul	45	3.29	5.69	4.28	4.98	4.42
Dumont	41	3.11	5.08	4.43	4.76	4.21
Settler	37		7.13	5.46	6.30	
Troy	44		6.07	5.81	5.94	
Derby	43		6.23	4.68	5.46	
Calibre	43		5.06	4.53	4.80	
AC Medallion	41			5.26		
Jud	44			4.91		
AC Assinaboia	39			4.70		
CDC Boyer	43			4.60		
Trial Mean	42	3.75	5.82	4.93	--	--
C.V. %	4.1	11.49	8.09	11.11	--	--
LSD .05	2	0.62	0.67	0.78	--	--
LSD .01	3	0.84	0.89	1.05	--	--

Planting Date: April 9, 1998
Harvest Date: July 17, 1998 (soft dough)
Seeding rate: 750,000 live seeds/ac (about 1.7 bu/ac).
Previous crop: Fallow
* Yields are adjusted to a dry weight basis (0% moisture).

Millet Hay - No-till Recrop **Hettinger**

Variety	Type	Plant Height	Hay Yield 1996	1997	1998	2 yr avg	3 yr avg
		inches	Tons / acre*				
Earlybird	Proso	35	3.69	2.53	3.15	2.84	3.12
Manta	Foxtail	30	3.00	3.12	2.91	3.02	3.01
Siberian	Foxtail	29	2.89	2.97	3.07	3.02	2.98
Minsum	Proso	33	3.57	2.45	2.75	2.60	2.92
Huntsman	Proso	33	3.45	2.46	2.74	2.60	2.74
Rise	Proso	32	3.78	2.33	2.50	2.42	2.87
Dawn	Proso	29	3.20	2.46	2.71	2.58	2.79
Sunrise	Proso	33	2.94	2.25	2.90	2.58	2.70
Snowbird	Proso	33	2.73	2.32	2.69	2.50	2.58
Sunup	Proso	33	2.78	2.08	2.61	2.34	2.49
Cerise	Proso	34	2.51	2.43	2.47	2.45	2.47
Trial Mean		33	3.09	2.48	2.77	--	--
C.V.%		6.7	13.3	14.7	10.7	--	--
LSD .05		3	0.59	0.52	NS	--	--
LSD .01		4	0.79	NS	NS	--	--

Planting date: May 12, 1998
Harvest date: August 11, 1998
Seeding rate: 25 lbs live seed / acre
Previous crop: HRSW
*Yields are adjusted to a dry weight (0% moisture) basis.
NS = no statistical difference between varieties.

1998 Cool Season Forage Trial - Recrop **Dickinson, ND**

				DM Basis					
	--- Harvest Moisture---			---------- Yield ----------			---------- CP ----------		
Variety	1997	1998	avg	1997	1998	avg	1997	1998	avg
	---------- % ----------			---------- Tons/ac -------			---------- % ----------		
Haybet barley	63	64	64	1.8	3.5	2.7	11.3	8.1	9.7
Stark barley	--	64	--	--	3.0	--	--	8.8	--
Trapper pea	78	75	77	1.4	2.5	2.0	13.4	14.8	14.1
Indianhead lentil	77	75	76	0.7	1.7	1.2	16.2	22.2	19.2
Aladin faba bean	83	--	--	0.6	--	--	18.0	--	--
2700 triticale	65	65	65	1.9	3.0	2.5	11.5	9.0	10.3
2700/Trapper	63	66	65	2.2	3.2	2.7	10.5	10.8	10.7
Paul oat	76	70	73	1.2	2.7	2.0	11.8	8.9	10.4
Paul/Trapper	75	70	73	1.5	2.9	2.2	12.6	11.3	12.0
Whitestone oat	69	67	68	1.6	3.3	2.5	10.1	7.6	8.9
Whitestone/Trapper	73	67	70	1.8	3.3	2.6	11.8	10.5	11.2
Robert oat/Trapper	75	--	--	1.5	--	--	12.3	--	--
Mean	73	68	70	1.5	2.9	2.2	12.7	11.2	11.8
C.V. %	4.8	3.7	--	17.0	14.1	--	13.0	18.9	--
LSD .05	10	4	--	NS	0.6	--	2.4	3.6	--

Planting Date: April 30
Harvest Date: Triticale and Triticale/Trapper July 13
Barley July 16
Paul oat, Whitestone oat, Oat/Trapper mixes, and Lentils July 21
CP = crude protein
Seeding rate: sole cereals 800,000 pls/ac
sole pea 325,000 pls/ac
sole lentil 511,000 pls/ac
oat/pea oat 500,000 pls pea 200,000 pls/ac
pls/ac = pure live seed per acre

1998 Cool Season Forage Trial - Recrop **Dickinson, ND**

	DM Basis					
	ADF			NDF		
Variety	1997	1998	avg	1997	1998	avg
	%					
Haybet barley	33	42	38	52	68	60
Stark barley	--	40	--	--	61	--
Trapper pea	46	49	48	51	55	53
Indianhead lentil	35	31	33	41	42	42
Aladin faba bean	49	--	--	51	--	--
2700 triticale	41	50	46	63	74	69
2700/Trapper	43	47	45	59	71	65
Paul oat	44	42	43	60	64	62
Paul/Trapper	45	43	44	53	61	57
Whitestone oat	44	44	44	65	67	66
Whitestone/Trapper	44	42	43	58	62	60
Robert oat/Trapper	42	--	--	56	--	--
Mean	42	43	43	55	62	59
C.V. %	6.7	5.6	--	5.3	4.6	--
LSD .05	4	4	--	4	5	--

ADF = acid detergent fiber
NDF = neutral detergent fiber

1998 Cool Season Forage Trial - Recrop **Dickinson, ND**

	Plant height					
	Cereal			Legume		
Variety	1997	1998	avg	1997	1998	avg
	in			in		
Haybet barley	23	34	29	--	--	--
Stark barley	--	33	--	--	--	--
Trapper pea	--	--	--	26	24	25
Indianhead lentil	--	--	--	16	18	17
Aladin faba bean	--	--	--	28	--	--
2700 triticale	38	49	44	--	--	--
2700/Trapper	37	48	43	--	40	--
Paul oat	29	42	36	--	--	--
Paul/Trapper	31	42	37	--	43	--
Whitestone oat	27	34	31	--	--	--
Whitestone/Trapper	28	35	32	--	40	--
Robert oat/Trapper	28	--	--	--	--	--
Mean	30	40	34	23	37	21
C.V. %	4.9	5.3	--	3.6	6.7	--
LSD .05	2	3	--	1	4	--

1998 Cool Season Annual Forages - No-till - Recrop **Hettinger**

Crop	Variety	Plant Height	Harvest Moisture	Yield 1996	1997	1998	2 yr avg	3 yr avg
		cm	%	Tons / acre*				
Triticale	2700	108	65		4.46	3.17	3.82	
Barley	Haybet	73	62		4.42	3.42	3.92	
Oats	Whitestone	76	67	4.76	4.21	3.06	3.64	3.34
Oats	Paul	91	68	3.32	3.64	2.88	3.26	3.28
Triticale / Pea	2700/Trapper	106	68		4.81	2.84	3.82	
Oat / Pea	Paul / Trapper	89	72	1.67	3.38	2.53	2.96	2.53
Oat / Pea	W'stone/Trap	78	76	2.62	3.33	2.18	2.76	2.71
Pea	Trapper	56	84	1.90	2.56	1.24	1.90	1.90
Lentils	Indian Head	34	77		--	1.13		
Fenugreek	common	44	76			1.55		
Safflower	Finch	62	83			0.82		
Trial Mean		74		2.45	3.85	2.26	--	--
C.V.%		6.2		18.3	15.9	12.4	--	--
LSD .05		7		0.63	0.74	0.40	--	--
LSD .01		9		0.84	0.99	0.54	--	--

Planting date: April 29, 1998
Harvest date: July 17, 1998
Previous crop: HRSW
*Yields are calculated on a dry matter (0% moisture) basis.

1998 Forage Pea Trial - Recrop **Dickinson, ND**

				DM Basis					
	Harvest Moisture			Yield			CP		
Variety	1997	1998	avg	1997	1998	avg	1997	1998	avg
	%			Tons/ac			%		
Algera	79	72	76	1.4	2.7	2.1	17.5	15.5	16.5
Carneval	80	70	75	1.2	2.8	2.0	17.0	11.8	14.4
Grande	82	75	79	1.4	2.8	2.1	18.8	16.2	17.5
SW Bravo	--	69	69	--	2.7	2.7	--	13.9	--
Motazz	81	70	76	0.9	1.8	1.4	19.8	12.5	16.2
Pro 2100	79	70	75	1.2	2.3	1.8	16.9	15.2	16.1
Trapper	--	78	--	--	2.5	2.5	--	19.1	--
Nutrigreen	84	79	82	1.2	2.2	1.7	20.3	19.9	20.1
Hors/Carneval	--	66	--	--	2.5	2.5	--	11.8	--
Yorkton	80	73	77	1.2	2.9	2.1	17.7	18.5	18.1
Highlite	81	--	--	1.0	--	--	18.6	--	--
Precourse	80	--	--	1.2	--	--	18.1	--	--
Quintessa	79	--	--	1.0	--	--	17.3	--	--
Quayessa	82	--	--	1.2	--	--	17.2	--	--
Totem	82	--	--	0.7	--	--	20.0	--	--
Mean	81	72	76	1.1	2.5	1.9	18.3	15.4	17.0
C.V. %	1.8	2.4	--	15.7	9.1	--	9.0	13.5	--
LSD .05	2	3	--	NS	0.3	--	2.4	1.8	--

Planting Date: April 21
Harvest Date: July 15
Seeding Rate: 325,000 pls/ac
pls/ac = pure live seed per acre
CP = crude protein
Hors/Carneval: Horsford barley and Carneval pea mix

1998 Forage Pea Trial - Recrop **Dickinson, ND**

	DM Basis								
	ADF			NDF			RFV		
Variety	1997	1998	avg	1997	1998	avg	1997	1998	avg
	%								
Algera	38	32	35	43	41	42	131	150	141
Carneval	33	40	37	44	52	48	134	112	123
Grande	33	34	34	41	41	41	147	146	147
SW Bravo	--	35	--	--	45	--	--	128	--
Motazz	34	38	36	43	49	46	137	114	126
Pro 2100	--	33	--	--	42	--	--	140	--
Trapper	--	32	--	--	39	--	--	156	--
Nutrigreen	--	34	--	--	40	--	--	144	--
Hors/Carneval	--	38	--	--	51	--	--	110	--
Yorkton	35	31	33	43	36	39.5	133	173	153
Highlite	31	--	--	41	--	--	149	--	--
Precourse	34	--	--	40	--	--	146	--	--
Quintessa	35	--	--	41	--	--	141	--	--
Quayessa	36	--	--	42	--	--	137	--	--
Totem	29	--	--	37	--	--	169	--	--
Mean	34	35	35	42	43.5	43	141	138	138
C.V. %	1.9	17.6	--	7.8	16.0	--	11.7	23.7	--
LSD .05	6	NS	--	5	NS	--	24	NS	--

ADF = Acid Detergent Fiber
NDF = Neutral Detergent Fiber
RFV = Relative Feed Value
RFV calculated by using formula: RFV = ((88.9-(0.77*ADF))*(120/NDF))/1.29

1998 Forage Pea Trial - Recrop **Dickinson, ND**

	Plant count			Plant ht			Lodging		
Variety	1997	1998	avg	1997	1998	avg	1997	1998	avg
	plants/ac			in				0-9	
Algera	254,264	294,760	274,512	27	18	23	2	8	5
Carneval	286,966	267,290	277,128	24	30	27	0	1	1
Grande	307,405	328,335	317,870	28	17	23	0	6	3
SW Bravo	--	277,319	--	--	29	--	--	0	--
Motazz	276,338	193,164	234,751	26	17	22	2	7	5
Pro 2100	--	242,436	--	--	16	--	--	8	--
Trapper	--	230,663	--	--	19	--	--	8	--
Nutrigreen	--	393,741	--	--	18	--	--	8	--
Hors/Carneval	--	--	--	--	28	--	--	2	--
Yorkton	264,892	350,573	307,733	24	17	21	0	6	3
Highlite	290,236	--	--	--	--	--	0	--	--
Precourse	276,338	--	--	--	--	--	3	--	--
Quintessa	248,541	--	--	--	--	--	0	--	--
Quayessa	264,074	--	--	--	--	--	0	--	--
Totem	294,324	--	--	--	--	--	0	--	--
Mean	278,916	283,467	282,399	25	21	23	1	5	3
C.V. %	9.8	9.9	--	18.2	17.0	--	54.9	17.3	--
LSD .05	NS	47,964	--	NS	5	--	1	1	--

1998 Arvika Forage Pea Fertility Trial - Recrop **Dickinson, ND**

Treatment	Yield		DM Basis			
lbs of N/ac	12%	DM Basis	CP	ADF	NDF	RFV
	Tons/ac		%			
0	3.2	2.8	16.6	38	44	124
20	3.0	2.6	16.4	41	51	107
40	2.9	2.6	16.2	37	47	120
60	2.8	2.5	17.8	37	46	124
Mean	3.0	2.6	16.8	39	47	118
C.V. %	6.5	6.5	16.2	13.1	12.9	17.3
LSD .05	NS	NS	NS	NS	NS	NS

CP = crude protein; ADF = acid detergent fiber; NDF = neutral detergent fiber
RFV = relative feed value
RFV calculated by using formula: RFV = ((88.9-(0.77*ADF))*(120/NDF))/1.29

1998 Arvika Forage Pea Fertility Trial - Recrop **Dickinson, ND**

Treatment	Harvest			Plant	
lbs of N/ac	Moisture	Vine length	Pods/ Plant	Count	Lodging
	%	in		plants/ac	0-9
0	73	56	5	269,405	8
20	72	57	5	248,998	8
40	75	57	5	284,154	8
60	76	59	5	240,398	8
Mean	74	57	5	260,738	8
C.V. %	2.4	5.4	15.9	8.7	0.0
LSD .05	NS	NS	NS	NS	NS

Planting date: April 21
Harvest date: July 15 when varieties were finished flowering
Ammonium nitrate was used as nitrogen source
Lodging: 0 = no lodging 9 = laying completely flat

1998 Cereal/Pea Cutting Date Trial - Recrop **Dickinson, ND**

Variety	Seeding rate		Yield DM Basis				
	Cereal	Pea/Lentil	1st	2nd cut	3rd	4th	5th cut
			Tons/ac				
Horsford/Trapper	1,125,000	487,000	2.0	2.8	3.3	3.8	0.7
Horsford/Trapper	750,000	325,000	1.7	2.5	3.3	3.5	0.6
Horsford/Trapper	375,000	162,500	1.3	2.4	3.1	3.0	0.8
Horsford barley	750,000	--	1.9	2.8	3.2	3.3	0.8
Dumont/Trapper	1,125,000	487,000	2.3	2.7	3.6	2.9	0.6
Dumont/Trapper	750,000	325,000	1.8	2.5	3.6	3.5	0.5
Dumont/Trapper	375,000	162,500	1.3	2.2	3.2	3.1	0.6
Dumont oat	750,000	--	1.5	2.7	4.0	3.3	0.6
Dumont/Indianhead	750,000	278,000	2.0	2.6	3.9	3.1	0.6
Indianhead lentil	--	278,000	0.1	0.7	1.4	2.0	0.8
Trapper pea	--	325,000	0.8	1.5	2.4	3.4	0.3
Mean			1.5	2.3	3.2	3.2	0.6
CV %			25.0	10.5	14.0	12.7	37.2
LSD .05			NS	0.4	0.6	0.6	NS

1st cut = early heading June 25 for sole barley and barley mixes; June 30 for others
2nd cut = July 10 for all (generally corresponded to milky ripe stage of cereal kernel development)
3rd cut = July 16 for sole barley and barley mixes; others July 27 (cereal growth at the kernel soft dough stage of development)
4th cut = July 21 for sole barley and barley mixes, July 27 for pea and lentil, July 29 for sole oats and oat mixes (cereal growth at the kernel hard dough stage of development)
5th cut = July 29 regrowth of cereals, lentil, pea, cereal/pea, and cereal/lentil

1998 Cereal/Pea Cutting Date Trial - Recrop **Dickinson, ND**

Variety	Seeding rate		Harvest moisture				
	Cereal	Pea/Lentil	1st cut	2nd cut	3rd cut	4th cut	5th cut
			%				
Horsford/Trapper	1,125,000	487,000	84	78	70	59	70
Horsford/Trapper	750,000	325,000	84	81	70	60	70
Horsford/Trapper	375,000	162,500	84	79	72	62	70
Horsford barley	750,000	---	82	77	70	59	72
Dumont/Trapper	1,125,000	487,000	81	80	60	57	72
Dumont/Trapper	750,000	325,000	84	82	63	58	75
Dumont/Trapper	375,000	162,500	86	84	63	61	74
Dumont oat	750,000	---	84	79	60	60	73
Dumont/Indianhead	750,000	278,000	81	81	60	60	73
Indianhead lentil	---	278,000	83	86	79	67	69
Trapper pea	---	325,000	89	87	80	65	75
Mean			84	81	68	61	72
CV %			3.4	1.7	2.9	4.3	5.5
LSD .05			NS	1.2	2.8	3.8	NS

1998 Forage Lentil Trial - Recrop **Dickinson, ND**

				DM Basis					
	Harvest Moisture			Yield			CP		
Variety	1997	1998	avg	1997	1998	avg	1997	1998	avg
	%			Tons/ac			%		
Crimson	--	73	--	--	0.7	--	--	20.4	--
CDC Richlea	66	73	70	1.8	1.2	1.5	16.3	20.2	18.2
Indian Head	70	75	73	2.0	1.2	1.6	18.2	21.7	20.0
CDC Milestone	64	70	67	1.2	1.2	1.2	16.0	17.2	16.6
Mean	66	73	70	1.7	1.1	1.4	16.8	19.9	18.3
C.V. %	3.0	0.9	--	15.7	14.4	--	7.5	5.0	--
LSD .05	3	1	--	NS	0.2	--	1.9	1.9	--

1998 Forage Lentil Trial - Recrop **Dickinson, ND**

	DM Basis								
	ADF			NDF			RVF		
Variety	1997	1998	avg	1997	1998	avg	1997	1998	avg
	%								
Crimson	--	22	--	--	31	--	--	216	--
CDC Richlea	34	23	29	40	34	37	144	197	171
Indian Head	36	25	31	42	35	39	136	185	161
CDC Milestone	33	25	29	39	34	37	152	189	171
Mean	34	24	29	40	34	38	144	197	167
C.V. %	10.9	9.7	--	7.6	5.4	--	10.9	7.4	--
LSD .05	NS	NS	--	NS	NS	--	NS	NS	--

Planting date: April 30
Harvest date: July 16
Growth stage: flowering but pods are formed
CP = crude protein, ADF = acid detergent fiber, NDF = neutral detergent fiber, RFV = relative feed value
RFV was calculated by using formula: RFV = ((88.9-(.77*ADF))*(120/NDF))/1.29

1998 Forage Lentil Trial - Recrop — **Dickinson, ND**

Variety	Plant count 1997	Plant count 1998	Plant count avg	Plant ht 1997	Plant ht 1998	Plant ht avg	Pod ht 1997	Pod ht 1998	Pod ht avg
	plants/ac			in			in		
Crimson	--	209,297	--	--	14	--	--	7	--
CDC Richlea	438,216	348,284	393,250	15	17	16	7	8	8
Indian Head	533,054	292,689	412,871	16	18	17	11	9	10
CDC Milestone	448,027	376,081	412,054	12	15	13	5	8	6
Mean	462,198	306,588	406,058	14	16	15	7	8	8
C.V. %	7.4	11.9	--	7.0	5.3	--	13.8	24.5	--
LSD .05	51,579	58,550	--	1	1	--	2	NS	--

Seeding rate: 511,000 pls/ac

pls/ac = pure live seed per acre

1998 Warm Season Annual Forages - No-till - Recrop — **Hettinger**

Crop	Variety	Plant Height	Harvest Moisture	Yield 1996	Yield 1997	Yield 1998	Yield 2 yr avg	Yield 3 yr avg
		cm	%	Tons / acre*				
Corn	Cargill 809	129	61	2.50	--	2.74		
Oats - mature	Paul	86	8		3.72	2.76	3.24	
Sorghum	Mor-Cane 2	106	71		2.10	2.43	2.26	
Sudangrass	Piper	147	62	1.79	2.29	2.29	2.29	2.12
Sorg/sudan	H'land sweet	117	67			2.85		
Millet	German	77	68	2.60	2.43	2.15	2.29	2.39
Millet	Red Proso	94	62		2.04	2.24	2.14	
Millet	Siberian	84	59		2.44	2.27	2.36	
Trial Mean		105		2.30	2.14	2.46	--	--
C.V.%		8.8		18.3	15.9	12.3	--	--
LSD .05		14		0.63	0.74	0.44	--	--
LSD .01		18		ns	0.99	0.60	--	--

Planting date: May 12, 1998

Harvest date: August 11, 1998

*Yields are calculated on a dry matter (0% moisture) basis.

Previous crop: HRSW

ns = no statistical difference between varieties

1998 Alfalfa Plant Density	Dickinson, ND

	Harvest		Hay Yield 12%		DM Basis		
Seeding rate/ac	Moisture		Moisture		1998		
	%		Tons/ac				
	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	Total
Hand 1 plant/sqft	69	76	1.1	1.3	0.9	1.2	2.1
Hand 2 plant/sqft	68	78	1.5	1.7	1.3	1.5	2.8
Hand 3 plant/sqft	69	79	1.2	1.3	1.0	1.2	2.2
Hand 4 plant/sqft	68	79	1.3	1.5	1.1	1.4	2.5
1 lbs PLS/ac	70	78	1.2	1.4	1.0	1.2	2.2
2 lbs PLS/ac	68	78	1.2	1.5	1.1	1.3	2.4
4 lbs PLS/ac	68	78	1.0	1.5	0.9	1.3	2.2
8 lbs PLS/ac	68	80	1.2	1.6	1.0	1.4	2.4
16 lbs PLS/ac	68	80	1.2	1.8	1.0	1.6	2.6
32 lbs PLS/ac	69	80	0.9	1.7	0.8	1.5	2.3
Mean	68	78	1.2	1.5	1.0	1.4	2.4
C.V. %	1.6	1.3	18.8	15.3	18.8	15.3	--
LSD .05	NS	1.5	NS	NS	NS	NS	--

1st cut = June 3, corresponds to 10-20% bloom
2nd cut = July 13, corresponds to 10-20% bloom
PLS = Pure Live Seed

1998 Alfalfa Plant Density	Dickinson, ND

	Hay Yield			
	DM Basis			
Seeding rate/ac	1996	1997	1998	3 yr avg
	Tons/ac			
Hand 1 plant/sqft	0.3	1.7	2.1	1.4
Hand 2 plant/sqft	0.4	2.3	2.8	1.8
Hand 3 plant/sqft	0.5	2.3	2.2	1.7
Hand 4 plant/sqft	0.5	2.3	2.5	1.8
1 lbs PLS/ac	0.7	2.1	2.2	1.7
2 lbs PLS/ac	0.8	2.1	2.4	1.8
4 lbs PLS/ac	0.8	2.4	2.2	1.8
8 lbs PLS/ac	0.8	2.6	2.4	1.9
16 lbs PLS/ac	0.8	2.6	2.6	2.0
32 lbs PLS/ac	0.7	2.7	2.3	1.9
Mean	0.6	2.2	2.4	1.8
C.V. %	13.9	--	--	--
LSD .05	0.1	--	--	--

1996 yield based on one cut: 1997 and 1998 yield based on two cuts per year

VARITAL TOLERANCE TO FAR-GO HERBICIDE AT HETTINGER

Stand reduction: + = susceptible, ? = questionable, 0 = tolerant

Variety	5/26/98	6/18/97	6/20/96	6/9/95
AC Barrie	?	0	+	+
AC Eatonia	0	0	0	+
Butte 86	0	0	0	0
Kulm	0	0	+	+
2371	0	0	0	0
2375	0	0	0	0
2398	0	0	0	0
Grandin	0	0	0	0
Argent HWSW	0	0	0	0
Amidon	+	+	+	+
Keene	+	0	+	0
Trenton	0	0	0	0
Ernest	?	0	+	0
McNeal	0	0	0	0
Hammer	+	0	+	+
Lars	0	0	0	0
Sharp	0	0	0	0
Russ	?	0	0	0
Oxen	0	0	0	0
Verde	0	0	0	0
Nora	0	0	0	
Forge	0	0	+	
Gunner	0	0	+	
AC Elsa	0	0		
Splendor	0	0		
Cadillac	0	0		
BacUp	0	0		
Sharpshooter	0	0		
HJ98	0	0		
AC Crystal	+			
Gus			+	0
Glupro			0	+
Norlander			0	0
AC Cora			0	+
Len				0
Stoa				0
2370				0
Bergen				0
Dalen				0
Krona				+
Sonja				0
CDC Teal				0
AC Domain				+
Norm				0
Prospect				0
Penawawa HWSW				0
Alpowa HWSW				0
Edwall HWSW				0

Planting date: 4/8/98, 4/29/97, 4/18/96, 4/7/95

Date of Application: 4/3/98, 4/3/97, 4/19/96, 4/24/95

Rate of Application: 1997/8 = 3 pts/A, 1995/6 = 2 pts/A

Puma herbicide in wheat, Hettinger 1997. Kulm hard red spring wheat was seeded on April 29. Treatments 1 and 2 were applied to 2 leaf wheat and to 1 to 2 leaf wild oats on May 23 with 56 F, 99% RH, hazy sky and 2 mph wind. Treatments 3 and 4 were applied to 3 1/2 leaf wheat and to 2 to 3 1/2 leaf wild oats on June 2 with 62 F, 90% RH, clear sky and 2 mph wind. Treatments 5 and 6 were applied to 6 leaf wheat and to 3 to 5 leaf wild oats on June 12 with 58 F, 97% RH, hazy sky and 2 mph wind. Wild oat density was 30 plants per square foot. One tenth of an ounce of Ally plus one pint of Bronate was applied to control broadleaf weeds on May 30. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 17 gpa at 40 psi through 8001 flat fan nozzles to a 5 foot wide area the length of 10 by 28 ft plots. The experiment was a randomized complete block design with four replications. Evaluations were on July 3 for crop injury and for wild oat control, and on August 4 for wild oat control. Harvest for grain yield was on August 15.

			7/3		8/4	8/15
Treatment	Crop stage	Product rate	Wht inj	Wiot	Wiot	Grain yield
	leaf	oz/A	------	%	------	bu/A
1. Puma	2	5.3	0	88	77	38.5
2. Puma	2	10.7	0	87	88	37.3
3. Puma	3 1/2	5.3	0	36	36	29.8
4. Puma	3 1/2	10.7	0	67	77	34.4
5. Puma	6	5.3	0	52	90	25.0
6. Puma	6	10.7	0	86	99	22.6
Untreated			0	0	0	23.7
C.V. %			-	39	27	23.4
LSD 5%			-	33	26	10.2
# of reps			4	4	4	4

Summary

Crop injury was not observed. Wild oat control was generally good with the exception of treatments 3 and 4. Treatments 3 and 4 expressed reduced wild oat control due to antagonism caused by the broadleaf weed treatment and the Puma treatments being applied too close together (3 days). This antagonism was however somewhat overcome by the higher rate of Puma. Grain yields were significantly higher with the early treatments (1 and 2) then with the later treatments (5 and 6). Although wild oat control was superior when Puma was applied at a later growth stage, this delay resulted in a significant yield reduction cause by wild oat competition with the young crop.

The Influence of Crop Rotations on Root Disease in Southwest North Dakota

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Introduction

Implementation of the Federal Agriculture Improvement and Reform (FAIR) Act in 1996 and favorable prices for hard red spring wheat, durum, and barley in 1996 and 1997 prompted many western North Dakota producers to abandon summer fallow and initiate continuous cropping of these cereal grains. A statewide study indicated North Dakota producers in 1997 seeded nearly 62% of their wheat acres on fields that were either in wheat or barley the previous year. In western North Dakota, of the known previous crops reported in this study, 75% of the wheat grown had been in wheat the previous year. Water normally limits yield of dryland wheat and durum in western North Dakota. Surface residues remaining in no-till and minimum-till systems save water. However wheat and durum yields are lower not higher when following wheat, durum, or barley.

Research conducted by North Dakota State University and Canadian scientists has shown that root and crown diseases reduce yields on an average of between five and ten percent. In continuous cereal and cereal fallow rotations yields are commonly lower than can be expected based on available soil moisture and growing season precipitation.

Producers are encouraged to incorporate crop rotations into their farming practices. Crop rotations have been shown to reduce problems with insects, weeds and diseases while improving yields and quality of subsequent crops. Many producers do not fully realize the extent of yield and quality losses as a result of root and crown disease problems.

This project demonstrated the impact of root diseases on dryland wheat and durum wheat in southwestern North Dakota and the role that crop rotation can play in their control.

Procedure

Five locations with a crop rotation history of either continuous cereal grain or cereal grain with a one-year break or cereal grain with a two-year break of a crop other than wheat, barley, or durum were selected.

A randomized complete block design with four replications was used at all locations except at Dickinson where a split block design was used. Each plot was 300 square feet. Plots to be fumigated were covered with a six mil plastic sheet, edges buried in trenches four to six inches deep to seal the covered area, and methyl bromide was metered through plastic hoses at the rate of 1 ½ pounds per 100 square feet. The fumigated plots remained covered for 48 to 72 hours after which time the plastic was removed. Non-fumigated or natural soil plots served as checks. After the plastic was removed, producers farmed through the fumigated and natural soil plots with their normal management practices. An additional 30 pounds of nitrogen per acre in the form of ammonium sulfate was applied to the entire demonstration area when plants were in the three to five leaf stage to reduce the chance of a nitrogen deficiency occurring. Root samples were collected from plots between Haun stage 5 (five leaves) and 11.4 (flowering) and again at Haun stage 14.5 (soft dough). These samples were carefully washed by hand. A visual evaluation of the first group of samples was completed at the Dickinson Research Extension Center. Root counts, evaluation of subcrown internodes, and *Rhizoctonia* symptoms were noted. The second group was sent to the NDSU plant clinic for culture plate evaluation and a visual evaluation of root mass, root color, and subcrown internodes.

Yield samples were harvested from each plot by hand from an area four rows wide by eight feet long, bagged, threshed, and yield and quality factors measured. Protein was analyzed with an NIR analyzer at Southwest Grain, Dickinson, ND. All data was statistically analyzed using SAS statistical software version 6.12.

Results and Discussion

Significant differences in grain yield (Figure 1) were detected between fumigated and natural soil plots in continuous cereal rotation at Hazen. The durum grain yield from the fumigated plots was 42% greater than from the natural soil plots. Continuous wheat grain yields from fumigated plots at Amidon and Beach in 1997 (data not shown) were 40% greater than from natural soil plots. At the 1998 Regent site where wheat had been grown continuously for three years, plants growing on the fumigated plots exhibited a mottled yellow appearance soon after emergence and was visible through to the second root sampling. These

symptoms disappeared just before the crop completed the soft dough stage. These symptoms are typical of methyl bromide sensitive wheat cultivars and the data for Regent is not shown for this reason.

At Dickinson, the difference between fumigated and natural soil plot wheat grain yields in the wheat-oat-wheat-wheat (W-O-W-W) rotation was 36% (Figure 2). Oat is generally thought to not be a host or a poor host to many of the root pathogens that invade wheat roots. When two years of non-cereal crops were introduced into the rotation, mean fumigated plot wheat grain yields were seven percent greater than natural soil plot yields. The wheat-oat-millet-wheat (W-O-M-W) rotation produced a wheat grain yield that was 33% greater than the wheat grain yield from W-O-W-W rotation. Both the W-O-M-W and wheat-oat-pea-wheat (W-O-P-W) wheat grain yields were significantly greater than the wheat grain yield from the W-O-W-W rotation. Grain protein (Figure 3) and test weight (data not shown) tended to be greater for wheat grown in rotations that included a two-year break from cereals compared to continuous wheat. No significant differences were detected in grain yield, test weight, or protein in any of the rotations when fumigation was used.

Crop rotations which included a two year break in cereals proved to be nearly equal to fumigated treatments in farm fields located at Beach and Amidon, ND. Fumigated plot grain yields were 1.5% greater at Beach and 1.1 % less at Amidon than yields from natural soil plots (Figure 1). Grain protein content was nearly the same for fumigated and natural soil plots (Figure 4). However, there was about a one pound difference in grain test weight (Figure 5).

Head density in continuous wheat rotations was significantly greater for fumigated plots then natural soil plots (Figure 6 and 7). However, when crop rotations with a two-year break between cereal crops was analyzed, no significant differences were observed.

Subcrown internode ratings and *Rhizoctonia* lesion counts provide an indication of the severity of common root rot and Rhizoctonia root disease respectively. Subcrown internode ratings in fumigated and rotations that included a two year break from cereals were approximately one half of those ratings found in non-fumigated continuous wheat samples (data not shown). Average *Rhizoctonia* lesion counts of zero were the same in both fumigated plots and rotations that included a two year break from cereals while all continuous wheat rotations exhibited some lesions (data not shown).

In a similar study at the Williston Research Extension Center, data indicates that water-use efficiency and straw yield was greater for wheat grown on fumigated plots compared to natural soil plots.

Implications of Demonstration

Root disease ratings were consistently lower in fumigated plots than non-fumigated plots when the field had a history of continuous wheat. When wheat or durum was grown in a continuous wheat rotation, grain yields were 36 to 42% less and quality factors lower than yields from fumigated plots. When crop rotations that include crops that are poor hosts to wheat root disease were incorporated into the farm's cropping system, no significant differences were detected in grain yield or quality between fumigated and non-fumigated plots.

Producers can expect reduced wheat grain yields and quality when wheat or durum is grown in a continuous wheat rotation. Producers can also expect less straw returned to the soil by smaller and poorly tillered plants, typical of wheat with root disease. Less straw means less coverage, making soil more susceptible to water and wind erosion. This could eventually lead to a decline in soil health and productivity. Wheat plants with root disease are inefficient in utilizing water and nutrients, especially nitrogen. Also a crop with root disease can leave a wheat crop more vulnerable to weeds because diseased plants are less competitive.

This demonstration has shown the impact of root disease on crop quantity and quality can be reduced through the use of crop rotations that limit the use of crops that are common hosts to root disease pathogens.

Figure 1. Hard red spring wheat and durum yields in selected rotations at three locations in southwest ND, 1998.

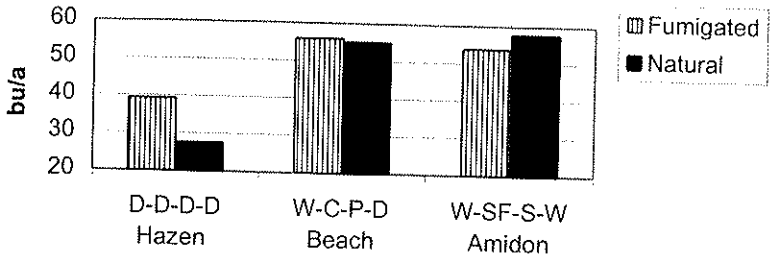


Figure 2. Hard red spring wheat yield of select rotations and rotations plus fumigation at Dickinson, ND, 1998.

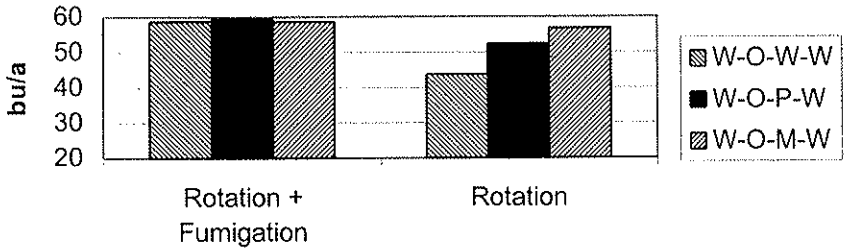


Figure 3. Hard red spring wheat protein content in select rotations and rotations plus fumigation at Dickinson, ND, 1998.

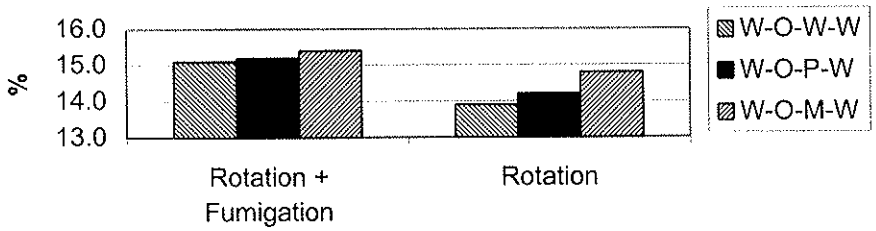
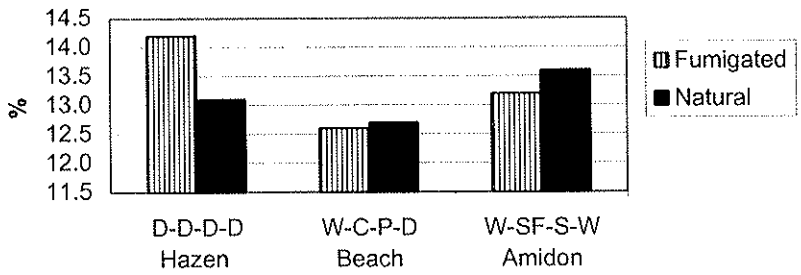


Figure 4. Hard red spring wheat and durum protein in selected rotations at three locations in southwest ND, 1998.



Crop Key	
C = Corn	P = Field pea
D = Durum wheat	S = Soybean
M = Millet	SF = Summer Fallow
O = Oat hay	W = Hard red spring wheat

Figure 5. Hard red spring wheat and durum test weight in selected rotations at three locations in southwest ND, 1998.

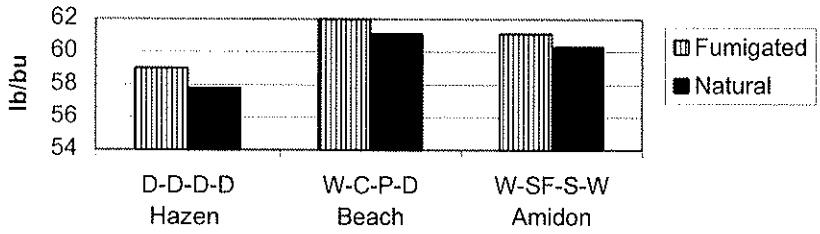


Figure 6. Hard red spring wheat and durum head densities in selected rotations at three locations in southwest ND, 1998.

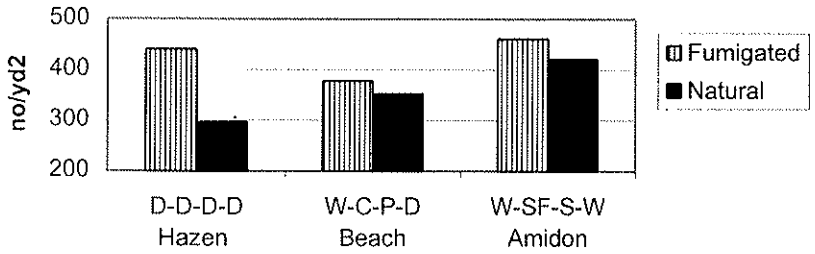
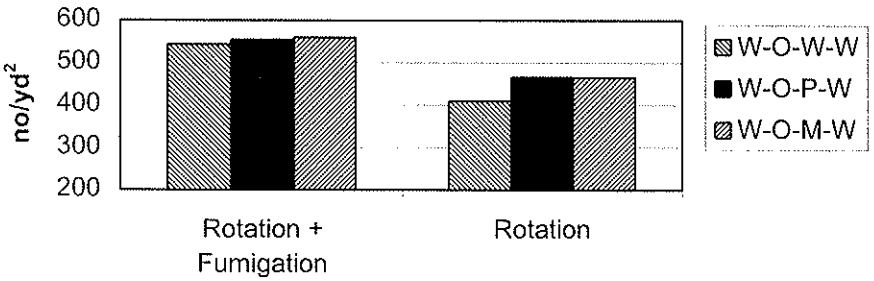


Figure 7. Hard red spring wheat Head density of selected rotations and rotations plus fumigation at Dickinson, ND, 1998.



Crop Key	
C = Corn	P = Field pea
D = Durum wheat	S = Soybean
M = Millet	SF = Summer Fallow
O = Oat hay	W = Hard red spring wheat

CANOLA PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Canola is a cool season crop. Emergence typically occurs 7 to 10 days after planting. Flowering occurs approximately 30 days after emergence. Drought stress during flowering can cause yield reduction. Argentine canola matures in about 95 days. Polish varieties mature in about 80 days.

SOILS: Fertile, well drained soils are important to canola production. Crop performance is reduced on sandy, coarse textured soils.

PLANTING RATE: Argentine type (Brassica napus) 5 to 8 lbs/acre, Polish type (Brassica campestris) 4 to 7 lbs/acre

PLANTING DATE: April 20 to May 15. Soil temperatures of at least 40 degrees F are necessary for germination. Planting after May 15 results in significant yield reduction.

PLANTING DEPTH: 1/2" to 1 inch.

FERTILITY: Nitrogen: 65 lbs of N per 1000 lbs of yield goal (soil plus applied). Phosphorous use is similar to small grains. Use of sulfur fertilizer highly recommended.

WEED CONTROL: Treflan, Poast, and Ultima 160 are labeled in ND (1996). Rotary hoeing prior to crop emergence can assist in weed control.

CHEMICAL CARRYOVER: Sensitive to carryover of Tordon, atrazine, and sulfonylurea products (e. g. Glean, Ally, etc.).

ROTATION: Between small grains. Shatter loss in canola can be controlled in small grains with numerous broad leaf herbicides (e. g. 2, 4-D, dicamba, etc.).

WATER USE: Fairly efficient water user. Water stress during mid-June to mid-July may greatly reduce yields.

INSECTS: Flea beetles are usually a serious problem. Diamondback moths also reported.

DISEASES: Black leg can cause serious yield losses in canola. Since blackleg can be carried over on seed, be certain to use treated canola seed. Sclerotinia (white mold), downy mildew, and alternaria are other diseases that can affect canola.

HARVEST: Swathed (Argentine) or straight combined (Polish) depending upon variety selection and growing season. Swath when 25% of seeds are brown to assist in reducing shatter loss. Use a flax roller to prevent swaths from rolling in the wind. Storage moisture is 8%.

VARIETIES: Numerous.

MARKET: Edible oil, meal can be used for livestock feed.

TYPICAL YIELDS: Polish types usually yield less than Argentine types. Average yields of 700 lbs/acre in drier regions, 1800 lbs/acre in cooler, wetter regions. Yields can vary widely depending upon the environment.

NOTES

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YELLOW MUSTARD PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Emerges 7 to 10 days after planting. Well adapted to North Dakota. Flowering occurs 30 to 40 days after planting, and can occur for several weeks depending upon temperatures. From 2 to 6 seeds can be found in a given pod. Matures in 90 to 95 days. Typical plant height is 30" to 40".

SOILS: Adapts well to many soils. Fertile, well drained soils are usually best.

PLANTING RATE: 10 to 14 lbs/acre.

PLANTING DATE: mid-April to early May. Seedlings are frost tolerant.

SEEDING DEPTH: 0.5 to 1.5 inches

FERTILITY REQUIREMENTS: 65 lbs. of N per 1000 lbs. of yield. Similar to small grains in phosphorous use. Use of 10 to 15 lbs/acre of sulfur is highly suggested.

WEED CONTROL: Treflan is labeled for weed control.

CHEMICAL CARRYOVER: Sensitive to carryover of sulfonylureas (e. g. Glean, Ally), also sensitive to atrazine and picloram (Tordon).

ROTATION: Usually between small grains.

WATER USE: Fairly drought tolerant. Rooting depth similar to small grains.

INSECTS: Flea beetles (not near as serious as in canola - usually not treated), cutworms.

DISEASES: Sclerotinia (white mold), downy mildew, alternaria. Most are of minor importance if sound rotation practices are followed.

HARVEST: Straight combining is preferred. Harvest when crop is 100% ripe. Green seeds do not change color, and result in grade discounts. Harvest during cooler parts of the day to reduce shatter loss. Storage moisture is 9%.

MARKETS: Table (hot dog) mustard, used also as a binding agent in processed meats.

TYPICAL YIELDS: 1000 to 1500 lbs/acre.

ORIENTAL MUSTARD PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Emerges 7 to 10 days after planting. Well adapted to North Dakota. Flowering occurs 30 to 40 days after planting, and can occur for several weeks depending upon temperatures. Pods are long with many seeds. Matures in 90 to 95 days. Typical plant height is 36" to 48".

SOILS: Adapts well to many soils. Fertile, well drained soils are usually best.

PLANTING RATE: 4 to 6 lbs/acre. There are approximately 180,000 seeds/pound.

PLANTING DATE: mid-April to early May. Seedlings are frost tolerant.

SEEDING DEPTH: 0.5 to 1.0 inches

FERTILITY REQUIREMENTS: 65 lbs. of N per 1000 lbs. of yield. Similar to small grains in phosphorous use. Us of 10 to 15 lbs/acre of sulfur is highly suggested.

WEED CONTROL: Treflan is labeled for weed control.

CHEMICAL CARRYOVER: Sensitive to carryover of sulfonylureas (e. g. Glean, Ally), also sensitive to atrazine and picloram (Tordon).

ROTATION: Usually between small grains.

WATER USE: Fairly drought tolerant.

INSECTS: Flea beetles (not near as serious as in canola - usually not treated), cutworms.

DISEASES: Sclerotinia (white mold), downy mildew, alternaria. Most are of minor importance if sound rotation practices are followed.

HARVEST: Swath when crop is 95 to 100% ripe. Green seeds do not change color, and can result in grade discounts. Use a roller to prevent swaths from rolling in the wind. Harvest during cooler parts of the day to reduce shatter loss. Storage moisture is 9%.

MARKETS: Hot mustard sauces and condiments.

TYPICAL YIELDS: 1000 to 1500 lbs/acre. Yields of 2000 lbs/acre have been obtained in ND.

DRY FIELD PEA PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Emerges 7 to 10 days after planting. Cool weather during flowering is preferred. Lodging is typical. Plant height ranges from 30" to 48". Maturity occurs in 90 to 100 days.

SOILS: Prefers fertile, well drained soils. Peas do poorly on salt affected soils.

PLANTING RATE: 110 to 170 lbs/acre, 6 or 7 inch row spacing. Depends upon seed size.

PLANTING DATE: April 15 to May 10. Seedlings are frost tolerant.

PLANTING DEPTH: 1.5 to 3 inches.

FERTILITY: Inoculate seed with proper bacteria strain to fix nitrogen. Phosphorus required in large amounts.

WEED CONTROL: Numerous chemicals are registered on peas.

CHEMICAL CARRYOVER: Sensitive to carryover of sulfonylureas (e. g. Glean, Ally), also sensitive to atrazine and picloram (Tordon).

INSECTS: Aphids (usually not a big problem).

DISEASES: Root rot, sclerotinia (white mold), fusarium wilt, bacterial blight, ascochyta.

HARVEST: Swathed or straight combined. Pea swaths roll easily. Straight harvesting with a floating cutter bar and a pickup reel is preferred. Sometimes peas are straight harvested with a raking pickup attachment. Use care in combining to avoid cracking and splitting the peas. Storage moisture is 13% to 14%.

MARKETS: Livestock feed, human food, bird food.

TYPICAL YIELDS: 1200 to 2200 lbs/acre.

FIELD PEA AND OAT PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

USES: Intercropping field peas and oats makes an excellent annual forage for livestock with higher protein than oats alone.

SOILS: Adapted to a wide range of soil types in ND.

PLANTING RATE: Typical ratio is 60 pounds of peas to 40 pounds of oats. Set the drill according to the pea setting for 90 to 95 pounds of peas per acre. Mixing can be done in a truck box with a shovel or through a grain auger (a grain auger can tend to crack the peas and reduce the quality of the pea planting seed).

PLANTING DATE: April 15 to May 10. Peas are frost tolerant in seedling stage.

PLANTING DEPTH: 1 to 2 inches.

FERTILITY: Starter fertilizer (e. g. 40 lbs/acre 18-46-0) can be used. Peas are a legume, so inoculation of peas is suggested.

WEED CONTROL: Selecting clean fields is the best practice. MCP Amine can be used if the peas are less than 6 inches tall. Rate is 0.5 pints/acre (Rhomene only).

CHEMICAL CARRYOVER: Peas are sensitive to carryover of atrazine, Tordon, and some sulfonylurea products (e. g. Glean, Ally).

ROTATION: Between small grains.

INSECTS: Grasshoppers can sometimes be a problem. Since this is grown for livestock forage, carefully consult label directions if you feel insecticde is needed.

DISEASES: Peas are subject to sclerotinia wilt. Avoid close rotation with sunflowers.

HARVEST: Harvest the oat/pea mixture when the oats are in the milk stage (just after heading).

VARIETY SELECTION: For peas, the variety Trapper is suggested, since it has a smaller seed size and seeds more evenly with the oats. Trapper peas mature in 95 to 100 days, so later maturing oat varieties are suggested (e. g. Dumont, Otana, Monida, Porter, etc.).

TYPICAL FORAGE YIELDS: Approximately 2 tons per acre.

TYPICAL FORAGE QUALITY: 17 - 18% protein. (Oat hay: 8.6% protein).

LENTIL PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Emerge 7 to 10 days after planting. Lentils exhibit a low growth habit which makes harvest difficult. Lentils form green pods, each containing 1 or 2 seeds. Plant height varies from 10 inches to 24 inches. Maturity is from 90 to 100 days, depending on environment. Lodging is common.

ROOTING DEPTH: 18 - 32 inches. Lentils are fairly efficient in their water use.

SOILS: Fairly adaptable to a wide range of soil conditions. Medium texture soils are preferred. Lentils do not like water logged soils.

PLANTING DATE: April 15 to May 15 in North Dakota. Seedlings are frost tolerant.

PLANTING RATE: 40-70 lbs/acre (depends on seed size and type). Populations range from 700,000-1,225,000 plants/acre. Lentils should be solid seeded (6 to 7 inch row spacing). The field should be free of rocks, and should be rolled after planting. Flat, level fields make harvest easier.

PLANTING DEPTH: 1 to 1.5 inches

FERTILITY: Inoculate with proper bacteria strain to fix nitrogen. Lentils are a high sulfur user. Phosphorus is also required. Starter fertilizer applications are acceptable, but no more than 18 lbs/acre of actual P2O5 should be placed with the seed.

WEED CONTROL: Lentils are a poor competitor. Poast, Assure II, Far-Go, Sencor, Treflan, and Prowl are labeled in ND (1996). Harrowing prior to emergence can assist in controlling small weeds.

CHEMICAL CARRYOVER: Lentils are sensitive to carryover of sulfonylurea herbicides (e. g. Glean, Ally), atrazine, picloram (Tordon), and others.

ROTATION: Between small grains. Avoid close rotation with other broadleaf crops.

INSECTS: Wireworms, cutworms, aphids, thrips, and lygus bugs have all been reported in lentils. Problems are usually minor.

DISEASES: Root rot (fusarium and rhizoctonia), sclerotinia (white mold), ascochyta blight. Plant disease free seed to assist in ascochyta management.

HARVEST: Swath or straight combine. It is very important that the field has been rolled immediately after planting. This makes harvest easier. Swath when plants begin to turn yellow, and lower pods become brown to yellow brown. Swath when crop is slightly damp to avoid excessive shatter loss. Use of pickup guards and/or a pickup reel is very helpful. Combine using a cylinder speed of 400 rpm to reduce cracking. Lentils store at 13% to 14% moisture.

VARIETIES: Eston, Laird, others. Different seed sizes and colors; yellow cotyledon, red cotyledon

MARKETS: Human food (various soup mixtures). Lentils are commonly raised as a green manure crop.

TYPICAL YIELDS: 800 to 1400 lbs/acre. Higher yields are possible.

NOTES

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BUCKWHEAT PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Emerges 5 to 7 days after planting. Begins flowering about 5 weeks after planting. Optimum seed set period is during weeks 5 - 7 after planting. Makes many flowers, but not all will set a seed. Wilts in hot weather, not real drought tolerant. Matures in 75 to 90 days.

ROOTING DEPTH: 18 - 24 inches.

SOILS: Adapts to a wide range of soil types. Prefers medium texture soils. Peforms well on poor soils. Soils that crust easily can cause emergence problems.

PLANTING RATE: 45 to 60 lbs/acre, 6 or 7 inch row spacing.

PLANTING DATE: May 25 to June 15. Planting up to July 1 has occurred in North Dakota, but yields are reduced. Buckwheat is not frost tolerant at any stage.

PLANTING DEPTH: 1 to 2 inches.

FERTILITY: Nitrogen: 49 lbs of N per 1000 lbs. of yield goal (soil plus applied).
Phosphorous use is similar to wheat (use of starter is a good practice).

WEED CONTROL: No chemicals registered in U. S. Buckwheat is usually quite competitive.

CHEMICAL CARRYOVER: Sensitive to carryover of treflan, atrazine, sulfonylurea products (e. g. Glean, Ally), Tordon, Assert.

ROTATION: Between small grains.

INSECTS: Aphids (usually not a big problem). Grasshoppers occassionally cause damage.

DISEASES: Subject to Rhizoctonia root rot (not reported often).

HARVEST: Swath when 75% of seeds are ripe. Swath when field is damp to reduce shatter loss. Swath immediately after a frost to reduce shatter loss. Stores safe at 14% to 16% moisture content when seed is clean of foreign material.

VARIETIES: Mancan, Manor, and Giant American (large seeded).

MARKET: Used in Japan for milling into flour. Flour is used in buckwheat (soba) noodles.

TYPICAL YIELDS: 1000 to 1500 lbs/acre. Yields up to 2000 lbs/acre reported. Depends upon environment in a given region.

VARIABLE COSTS: $25.00 to $40.00/acre for seed, fertilizer, fuel, repairs, etc.

NOTES

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CANARY SEED PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Emerges 7 to 10 days after planting. Maturity is similar to spring wheat. Canary seed has a shallow, fibrous root system. Best adapted to northeastern North Dakota.

SOILS: Tolerance to saline soils is similar to wheat. Prefers well drained, fine to medium texture soils. Sandy soils should be avoided.

PLANTING RATE: 35 to 40 lbs/acre, 6 or 7 inch row spacing.

PLANTING DATE: April 15 to May 10.

PLANTING DEPTH: 1 to 2 inches.

FERTILITY: Similar to small grains.

WEED CONTROL: Poor competitor with weeds. Bromoxynil and MCPA are labeled in ND (1996).

CHEMICAL CARRYOVER: Sensitive to carryover of treflan and sonalan.

ROTATION: Plant in rotation with broadleaf or cereal crops.

INSECTS: Aphids (usually not a major problem).

DISEASES: Very few reported in North Dakota.

HARVEST: Swathed or straight combined. Resistant to shattering. Cylinder speed should be 600 to 700 RPM to prevent dehulling. Storage moisture is 12%.

VARIETIES: Keet, Elias.

MARKETS: Birdseed.

TYPICAL YIELDS: 750 to 1300 lbs/acre (depends upon environment).

PROSO MILLET PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Emerges 8 to 10 days after planting. Proso millet is a warm season grass. Typical plant height is 30 to 40 inches. Matures in 70 to 75 days.

SOILS: Medium texture, well drained soils.

PLANTING RATE: 20 to 30 lbs/acre.

PLANTING DATES: June 1 to June 25. Seedlings establish best at 65 degrees F soil temperature. Millet is not frost tolerant.

PLANTING DEPTH: 1" deep in firm seedbed that is weed free.

WEED CONTROL: Poor competitor with weeds when in seedling stage. Becomes more competitive after reaching height of 6 to 8 inches. Tolerent to atrazine carryover. May be sprayed with 2,4-D when 1"- 6" tall at rate of 1/2 to 1 pint/acre (not all 2, 4-D brands are labeled on millet). Dicamba (Banvel) can also be used on millet.

FERTILITY: High levels of N can cause lodging. Needs about 40 lbs. N per 1000 lbs. of yield. Drill row application of N can cause seedling injury. Phosphorous use is similar to small grains.

DISEASE: Fairly disease free crop. Treat seed with thiram fungicide to prevent head smut and improve seedling survival.

HARVESTING: Swath when seeds in upper half of panicle have matured. Stems and leaves are usually still green when swathed. Swathing too late causes shatter loss. Storage moisture is 13%.

USES: Livestock feed, commercial birdseed mixes. White or red seed is used in birdfeed.

TYPICAL YIELDS: 1200-1500 lbs./acre. Yields up to 3000 lbs/acre are attainable.

OIL SUNFLOWER PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Emerges 7 to 12 days after planting. Flower buds appear 30 to 40 days after planting. Flowering occurs about 55 to 65 days after planting, and lasts for 7 to 10 days, depending upon temperature. Maturity occurs about one month after flowering is completed. Matures in 90 to 105 days, depending upon hybrid and accumulated growing degree days (GDD's). Typical plant height is 60 inches to 85 inches.

SOILS: Adapts well to many soils. Fertile, well drained soils are usually best.

PLANT POPULATION: When seeded as a row crop in 30 inch rows, the desired plant populations are 19,000 to 24,000 plants per acre. Seed rates of 3 to 4 lbs/acre are typically sufficient to achieve these populations, depending upon seed size. There are approximately 7,700 seeds/pound.

PLANTING DATE: Early May to late May is typical. Seedlings have some frost tolerance.

SEEDING DEPTH: 1.5 to 2.5 inches.

FERTILITY REQUIREMENTS: 50 lbs. of N per 1000 lbs. of yield. Similar to small grains in phosphorous use. Use of 10 to 15 lbs/acre of sulfur is suggested.

WEED CONTROL: Soil applied herbicides include Eptam, Sonalan, trifluralin (Treflan), and Prowl. Post emergence options include Assert and sethoxydim (Ultima 160).

CHEMICAL CARRYOVER: Sensitive to carryover of sulfonylureas (e. g. Glean, Ally), also sensitive to atrazine and picloram (Tordon).

ROTATION: Usually between small grains.

WATER USE: Fairly drought tolerant, deep rooted crop.

INSECTS: Sunflower midge, red seed weevil, gray seed weevil, stem weevil, sunflower beetle, banded sunflower moth. Numerous insecticides are labeled for insect control.

DISEASES: Sclerotinia (white mold), downy mildew, alternaria, rust, head rot, phoma black stem. Diseases are typically managed by using good rotation practices. Seed treatment with Apron is beneficial in preventing downy mildew.

HARVEST: Sunflowers are typically harvested 30 to 45 days after maturity, since it takes this long for the plant to dry down. Use of sunflower pans on a straight header attachment is the most common practice. Cylinder speeds of 300 to 500 rpm are typical, depending upon moisture content. Typical concave settings are 1" in front and 0.75" in rear. Typical sieve settings are 1/2" to 5/8" on top, and 3/8" on bottom. Seed moisture should be less than 10% for storage. Drying is quite typical.

MARKETS: Whole seed can be used in birdfood products. Oil sunflowers are typically crushed for their oil, which is used in cooking and other food ingredient applications.

TYPICAL YIELDS: 1000 to 1500 lbs/acre. Yields of 2000 lbs/acre are possible.

VARIETIES: Numerous hybrid varieties are available.

NOTES

CONFECTION SUNFLOWER PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Emerges 7 to 12 days after planting. Flower buds appear 30 to 40 days after planting. Flowering occurs about 55 to 65 days after planting, and lasts for 7 to 10 days, depending upon temperature. Maturity occurs about one month after flowering is completed. Matures in 95 to 110 days, depending upon hybrid and accumulated growing degree days (GDD's). Typical plant height is 60 inches to 90 inches.

SOILS: Adapts well to many soils. Fertile, well drained soils are usually best.

PLANT POPULATION: When seeded as a row crop in 30 inch rows, the desired plant population is 15,000 to 18,000 plants per acre. Seed rates of 3 to 5 lbs/acre are typically sufficient to achieve these populations, depending upon seed size. There are approximately 4,300 seeds/pound.

PLANTING DATE: Early May to late May is typical. Seedlings have some frost tolerance.

SEEDING DEPTH: 1.5 to 2.5 inches.

FERTILITY REQUIREMENTS: 50 lbs. of N per 1000 lbs. of yield. Similar to small grains in phosphorous use. Use of 10 to 15 lbs/acre of sulfur is suggested.

WEED CONTROL: Soil applied herbicides include Eptam, Sonalan, trifluralin (Treflan), and Prowl. Post emergence options include Assert and sethoxydim (Ultima 160).

CHEMICAL CARRYOVER: Sensitive to carryover of sulfonylureas (e. g. Glean, Ally), also sensitive to atrazine and picloram (Tordon).

ROTATION: Usually between small grains.

WATER USE: Fairly drought tolerant, deep rooted crop.

INSECTS: Sunflower midge, red seed weevil, gray seed weevil, stem weevil, sunflower beetle, banded sunflower moth. Numerous insecticides are labeled for insect control.

DISEASES: Sclerotinia (white mold), downy mildew, alternaria, rust, head rot, phoma black stem. Diseases are typically managed by using good rotation practices. Seed treatment with Apron is beneficial in preventing downy mildew.

HARVEST: Sunflowers are typically harvested 30 to 45 days after maturity, since it takes this long for the plant to dry down. Use of sunflower pans on a straight header attachment is the most common practice. Cylinder speeds of 300 to 500 rpm are typical, depending upon moisture content. Typical concave settings are 1" in front and 0.75" in rear. Typical sieve settings are 1/2" to 5/8" on top, and 3/8" on bottom. Seed moisture should be less than 10% for storage. It is important to avoid cracking and dehulling. Drying is quite typical.

MARKETS: Edible whole sunflower seeds. Dehulled seeds (or nut meats) are used in breads, cereals, salad toppings, and other condiment applications.

TYPICAL YIELDS: 1000 to 1500 lbs/acre. Yields of 2000 lbs/acre are possible.

VARIETIES: Numerous hybrid varieties are available.

NOTES

SAFFLOWER PRODUCTION

Compliments of MINN-DAK Growers Ltd., P. O. Box 13276, Grand Forks, ND 58208-3276. Tel. 701-746-7453.

CROP DEVELOPMENT: Emerges 1 to 3 weeks after planting. Well adapted to western North Dakota. Taproot can penetrate 8 to 10 feet in soil. Drought tolerant, frost tolerant in seedling stage (25 degrees F). Flowering occurs 30 to 40 days after emergence, and lasts for 14 to 21 days. 1 to 5 flower heads are typically formed on each plant, with 15 to 20 seeds per head. Thistle like plant. Matures in 100 - 105 days. Typical plant height is 28" to 36".

SOILS: Adapts well to many soils, best on fertile, well drained soils. Saline tolerance is similar to barley.

PLANTING RATE: 20 to 25 lbs/acre.

PLANTING DATE: April 15 to May 10. Late planting can result in crop not reaching maturity. Safflower is quite frost tolerant in the seedling stage.

SEEDING DEPTH: 1 to 1.5 inches

FERTILITY REQUIREMENTS: 50 lbs. of N per 1000 lbs. of yield. Similar to small grains in phosphorous use. A starter fertilizer containing phosphorous is recommended.

WEED CONTROL: Treflan, Eptam, and Dual are labeled for weed control in ND (1996). Poor competitor. Clean fields are essential.

ROTATION: Usually between small grains.

WATER USE: Fairly drought tolerant.

INSECTS: Grasshoppers.

DISEASES: Sclerotinia (white mold), botrytis, alternaria. Diseases are a problem under moist, humid conditions. Some varieties have disease resistance.

HARVEST: Straight combining is by far preferred. Swaths roll very easily. Harvest as soon as it is ready to avoid sprout damage from fall rains. Storage moisture is 8%.

MARKETS: Birdfood, cooking oil.

VARIETIES: Numerous. Finch and S-208 are the main birdfood varieties.

TYPICAL YIELDS: 1000 to 1500 lbs/acre.

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