

## **SMALL GRAIN CROPS IN SOUTHWESTERN NORTH DAKOTA**

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### **SUMMARY**

New crop cultivars must be developed for the continued viability of crop and crop-livestock systems in southwestern North Dakota. The North Dakota State University Dickinson Research Extension Center (DREC) is obligated to provide unbiased data and interpretations for use by producers when choosing cultivars for farm production. This project will collect and publish information on the comparative performance of small grain cultivars in southwestern North Dakota. This project will also provide grain for quality evaluation.

This publication will be made available in alternative formats upon request.

North Dakota State University is an equal opportunity institution.

### **INTRODUCTION**

Crop production is a significant income generator for southwestern farmers and ranchers. Cash receipts from crops accounted for 41% of total farm income in the Missouri Slope region in 1992 (Wiyatt and Hamlin, 1993). When

government payments were considered, 53% of total farm income came directly from cash receipts for crops. This excludes the value of forages grown and fed directly to livestock on farms.

Wheat, barley, and oat are the major small grain crops grown in western North Dakota. Development of improved small grain cultivars is necessary to ensure that the farm income generated by grain crops, either directly by cash payment or indirectly through livestock, can be maintained or enhanced.

Cultivar comparison trials have been the foundation of yield, quality, and agronomic evaluation of crop cultivars in North Dakota. Early reports from the Agricultural Experiment Station contained data obtained from comparison trials (Hays, 1893a, 1893b). These trials still are important to obtain information for varietal release and recommendations (Cox et al., 1988; Frohberg, 1991). Each year approximately 40 or more hard red spring wheat, 25 to 30 durum wheat, 20 to 25 oat, and 25 to 30 barley are evaluated in comparison studies at the Dickinson Research Extension Center (DREC). These comparisons include both named cultivars and experimental lines from NDSU, and other public and private breeding programs in the U.S. and Canada. Evaluations are used to make cultivar recommendations.

Grain produced in plots from the comparison trials is used in quality evaluations by personnel of the Department of Cereal Chemistry and Food Technology at NDSU, Fargo, ND. Quality evaluations of experimental lines are compared to cultivars currently grown by producers. The quality and agronomic performance of an experimental line at various locations is one of the major bases for the recommended release of that line as a named cultivar or its removal from consideration for further testing.

Experimental lines from other state experiment stations and private plant breeding companies also are evaluated for quality. Although data from this project are not instrumental in the eventual release or rejection of lines from these sources, it does provide information on agronomic characteristics prior to release and does assist in cultivar recommendations.

Soils at the Dickinson Research Extension Center (DREC) are representative of a large percentage of southwestern North Dakota soils. However, not all prominent soil types occurring in the southwestern portion of the state occur at the DREC. Moreover, local climatic differences between different areas in the region exist. For these reasons,

cultivar comparison studies are conducted at sites besides the DREC to provide an area test of crop cultivar performance at several locations in southwestern North Dakota.

## **MATERIALS AND METHODS**

Seed of cultivars evaluated in comparison trials generally were provided by plant breeders at North Dakota State University in Fargo, or from drill strips at the DREC. Cultivars developed from neighboring land-grant institutions and Canada, as well as private plant breeding companies were included.

Cultural practices including tillage and seeding, fertilization, herbicide application, and harvesting followed currently acceptable agronomic procedure in implementing and maintaining cultivar comparison trials. Cultivars and genotypes of each small grain crop (hard red spring wheat, durum wheat, barley, and oat) were evaluated using a replicated randomized complete block design. Demonstration strips also were maintained for grower observation, crop field tours, and for a sufficient amount of seed for quality evaluations. All crop trials were conducted on previously fallowed cropland.

Plant growth was monitored throughout the growing season. Variables that were measured on each plot included: date of emergence, date of plant establishment, days to heading, plant height, plant lodging at physiological maturity, grain yield, 100 seed weight, grain volume weight, grain protein content for wheat, and percentage of plump kernels for barley. Ten random plants in each plot of three replicates within the hard red spring wheat comparison trial were evaluated for flag leaf spotting, using the system developed by McMullen and Francl (M. McMullen and L. Francl, per. comm., 1992).

Data collected at off-station sites included grain yield, grain volume weight, and grain protein content for wheat. Quality characteristics for product acceptance will be determined by the Department of Cereal Science and Food Technology at North Dakota State University from grain samples provided.

Data were analyzed using a computer statistical program.

## **RESULTS**

## Hard Red Spring Wheat

2398 continued to be among the highest yielding cultivars evaluated at Dickinson, although several other cultivars produced comparable amounts of grain at Dickinson in 1995. These included: Amidon, Bergen, Dalen, Krona, Lars, McNeal, and Verde, a new Minnesota release. Test weight of 2398 was among the heaviest of any cultivar evaluated at Dickinson in 1995. Grain protein content of 2398 was below the average in 1995. Cultivars with grain protein content more than 15% included: AC Domain, AC Eatonia, CDC Teal, Glupro (a low-yielding, high-protein cultivar released in 1995 by NDSU), Gus, Len, and Trenton (a 1995 NDSU release).

Highest gross returns after considering protein premiums/discounts and test weight discounts were: Amidon, Bergen, Dalen, Ernest, Lars, McNeal, 2398, Trenton, and Verde.

## Durum Wheat

Voss produced the most grain in 1995, although the grain yield of Voss was not significantly more than that produced by Munich, a 1995 release from NDSU, Rugby, or Vic. Grain with the heaviest test weight was produced by Rugby (60.6 lbs/bu), although other cultivars produced grain of comparable test weight. These included: Monroe, Vic, Voss, and Ward. Plenty produced grain with a higher crude protein content than produced by any other cultivar included in the trial.

Highest returns were generated by Rugby, Vic, and Voss. Lloyd and Medora generated lower returns than any other cultivar included in the trial.

## Barley

Logan, a 1995 2-rowed barley released by NDSU, produced the most grain among cultivars included in the 1995 trial. Chinook, Excel, and Stander produced more grain than other cultivars in the trial, except for Logan. Morex, Harrington, Hazen and Royal were among the lowest yielding cultivars in the trial.

Stark continued to produce grain with a relatively heavy test weight. Bowman, Gallatin, and other barley cultivars grown in the southwest produced grain with a lower test weight than that produced by Stark.

Highest returns when grain was sold in the feed market were generated by Logan. Chinook, Excel, and Stander all generated comparable returns that were higher than several other cultivars included in the trial.

## Oat

Bay was the highest yielding cultivar in the trial, producing more grain than any other cultivar except Whitestone. In two of the last three years, Bay has produced more grain than most other cultivars evaluated at Dickinson. Bay was released by the Wisconsin Agricultural Experiment Station and is among the shortest oat cultivars evaluated. It produces a large, succulent leaf and is also being evaluated for forage yield and quality.

Paul produced grain with the heaviest test weight in 1995; however, test weight for all cultivars was relatively light compared to test weights over the past several years. The discount prices paid for light test weight had considerable impact on how the cultivars ranked in gross returns generated. For example, though grain yield for Dumont oat was higher than that of Hytest oat, Hytest generated significantly greater returns when sold in the feed oat market.

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**DRYLAND HARD RED SPRING WHEAT - GREEN FALLOW --- DICKINSON**

			Days to	F. leaf		Lodging		Test
Variety		Type	Head	Disease	Height	Score <sup>1</sup>	Seeds	Weight
				%	inches	%	lb	lbs/bu
2370		Semidwarf	58	59	30	0	15,538	60.1
2371		Semidwarf	66	26	34	0	15,328	60.4
2375		Semidwarf	59	32	30	1	14,003	60.4
2398		Semidwarf	62	14	28	0	13,308	61.1
AC Barrie		Medium	62	24	33	0	15,457	59.9
AC Cora		Medium	66	9	34	1	15,440	59.9
AC Domain		Medium	57	81	31	0	14,879	60.0
AC Eatonia		Medium	59	60	33	5	15,864	59.8
Alpowa		Semidwarf	60	76	28	0	16,360	57.5
Amidon		Medium	63	14	34	0	15,494	59.8
Bergen		Semidwarf	59	20	27	0	13,846	58.9
Butte 86		Medium	57	46	31	0	13,582	60.4
CDC Teal		Medium	59	20	32	0	15,092	59.4

Dalen		Semidwarf	59	19	27	0	13,632	61.0
Edwall		Semidwarf	59	61	28	0	15,697	59.8
Ernest		Medium	62	19	34	1	14,425	59.8
Glupro		Medium	65	43	35	2	15,697	56.5
Grandin		Semidwarf	59	40	30	0	14,317	59.6
Gus		Semidwarf	64	15	29	0	16,731	57.4
Hamer		Semidwarf	59	11	28	0	13,299	59.0
HiLine		Semidwarf	60	57	28	0	16,123	57.6
Krona		Semidwarf	62	17	27	0	15,492	57.7
Kulm		Medium	58	35	33	0	14,353	61.0
Lars		Semidwarf	61	6	25	0	14,904	59.2
Len		Semidwarf	67	27	28	0	15,943	57.5
McNeal		Semidwarf	62	27	30	0	14,544	59.1
Norlander		Semidwarf	58	39	27	0	17,872	58.7
Norm		Semidwarf	60	12	29	0	13,285	58.6
Penewawa		Semidwarf	60	68	27	0	16,064	57.6
Russ		Medium	60	36	32	0	15,170	60.8

Sharp		Medium	59	36	32	0	14,312	60.8
Sonja		Semidwarf	62	18	27	0	13,909	58.2
Stoa		Medium	64	32	33	0	15,925	58.0
Trenton		Medium	61	17	34	0	13,735	59.9
Verde		Semidwarf	62	21	30	0	14,072	59.6
Mean			60.9	32	30.2	0.3	14,963	59.2
CV(%)			2.5	38	3.4	167	5.5	1.1
LSD.05			2.1	20	1.4	5	1155	0.9

<sup>1</sup>0 = no lodging; 9 = completely flat

Previous crop: Black lentil (plow down); Soil test results: 50 lbs N, 10 ppm P - applied 50 lbs DAP and 224 lbs urea per acre; Planted on May 4 at 1,200,000 Pure Live Seed per acre at a 1.25 inch depth; Applied 2.5 pt Hoelon + 1.33 pt Buctril per acre on June 1; Harvested on August 22.

DRYLAND HARD RED SPRING WHEAT - GREEN FALLOW --- DICKINSON								
			Grain Yield					
						---- Averages ----	% of	
Variety	Protein	Returns <sup>2</sup> s	1995	1994	1993	3-Year	2-Year	Grandin



	%	\$/acre	bu/ac					
2370	14.5	224.87	46.8	44.2	42.1	44.4	45.5	94
2371	14.9	238.02	49.1	42.3	42.6	44.7	45.7	95
2375	14.0	232.56	49.1	44.1	45.1	46.1	46.6	97
2398	13.9	287.83	60.7	50.7	54.3	55.2	55.7	116
AC Barrie	14.8	246.94	50.7	40.4	--	--	45.6	95
AC Cora	14.9	222.26	45.3	38.4	--	--	41.9	87
AC Domain	15.5	197.68	39.4	39.4	35.7	38.2	39.4	82
AC Eatonia	15.5	180.38	36.0	39.1	--	--	--	--
Alpowa	12.3	201.24	46.9	--	--	--	--	--
Amidon	14.0	283.35	59.6	40.0	47.4	49.0	49.8	103
Bergen	13.8	268.80	57.6	49.2	54.6	53.8	53.4	111
Butte 86	14.5	253.98	52.7	43.5	41.1	45.8	48.1	100
CDC Teal	15.3	226.97	45.4	38.2	42.1	41.9	41.8	87
Dalen	14.7	285.78	59.1	43.8	51.2	51.4	51.5	107
Edwall	12.3	188.10	47.9	--	--	--	--	--
Ernest	14.6	266.53	55.2	45.3	50.8	50.4	50.3	104
Glupro	16.8	171.20	35.4	--	--	--	--	--
Grandin	14.8	260.13	54.0	42.3	46.8	47.7	48.2	100

Gus	15.3	254.30	52.8	44.7	49.5	49.0	48.8	101
Hamer	14.6	258.02	53.8	52.3	--	--	53.1	110
HiLine	14.5	191.98	41.3	--	--	--	--	--
Krona	13.2	260.05	57.9	45.2	--	--	51.6	107
Kulm	14.9	254.35	51.8	47.3	--	--	49.6	103
Lars	13.6	290.04	62.1	49.3	--	--	55.7	116
Len	15.0	200.33	41.9	42.1	37.8	40.6	42.0	87
McNeal	14.0	290.44	61.5	47.4	55.1	54.7	54.5	113
Norlander	14.1	252.02	53.7	40.9	--	--	47.3	98
Norm	14.0	255.11	54.6	49.3	--	--	52.0	108
Penewawa	11.9	200.44	47.0	43.2	46.7	45.6	45.1	94
Russ	14.2	237.78	49.7	41.8	--	--	45.8	95
Sharp	14.6	232.50	48.2	44.3	--	--	46.3	96
Sonja	14.5	253.26	53.8	44.6	56.8	51.7	49.2	102
Stoa	14.5	219.30	46.7	45.3	46.6	46.2	46.0	95
Trenton	15.0	262.96	53.6	44.4	47.8	48.6	49.0	102
Verde	14.1	267.81	56.4	49.6	--	--	53.0	110
Mean	14.4	240.49	50.8					

CV(%)	1.6	8.2	8.0					
LSD.05	0.3	27.64	5.7					

<sup>2</sup>Returns were calculated by multiplying the 1995 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on November 28.

DRYLAND DURUM - GREEN FALLOW --- DICKINSON						
		Days to		Lodging		Test
Variety	Type	Head	Height	Score	Seeds	Weight
			inches		lb	lbs/bu
Laker	Semidwarf	64	27.8	0	12,214	56.7
Lloyd	Semidwarf	63	25.9	0	12,691	56.5
Medora	Tall	62	28.8	2	13,787	58.5
Monroe	Tall	58	32.0	1	10,855	60.0
Munich	Medium	62	28.1	0	13,030	57.0
Plenty	Tall	64	35.6	2	11,622	58.6
Regold	Tall	64	35.0	0	10,548	57.4
Renville	Tall	63	31.8	1	12,217	58.4
Rugby	Tall	63	37.0	0	12,644	60.6
Sceptre	Medium	64	29.8	0	12,757	57.2

Vic	Tall	62	33.2	0	11,211	59.7
Voss	Semidwarf	63	26.5	0	11,389	59.9
Ward	Tall	62	33.4	1	12,097	59.9
Mean		62.8	31.1	0.6	12,082	58.5
C.V.(%)		2.1	7.6	169	7.3	2.3
LSD0.05		1.9	3.4	1.3	1275	1.9

Previous Crop: Black lentil (burn down)

Planting Date: May 4

Harvest Date: August 21

0 = no lodging; 9 = completely flat

DRYLAND DURUM - GREEN FALLOW --- DICKINSON									
			Grain Yield						
						Averages		% of	
Variety	Protein	Returns <sup>1</sup>	1995	1994	1993	3-Year	2-Year	Renv	
	%	\$/acre	bu/ac						

Laker	13.2	230.91	50.0	40.7	48.8	46.5	45.4	98
Lloyd	13.6	215.43	46.9	38.1	45.7	43.6	42.5	92
Medora	13.6	216.93	45.0	38.7	40.5	41.4	41.9	91
Monroe	14.3	238.22	48.7	33.3	41.9	41.3	41.0	89
Munich	14.2	261.33	56.9	35.1	--	--	46.0	100
Plenty	15.1	243.22	50.3	35.7	51.8	45.9	43.0	93
Regold	13.8	247.96	53.0	33.4	48.9	45.1	43.2	94
Renville	13.8	261.31	54.3	38.0	44.9	45.7	46.2	100
Rugby	14.4	273.79	56.0	41.1	54.6	50.6	48.6	105
Sceptre	14.3	244.28	52.9	39.3	52.1	48.1	46.1	100
Vic	14.4	273.54	56.2	37.8	48.1	47.4	47.0	102
Voss	13.5	291.81	59.6	39.8	--	--	49.7	108
Ward	14.4	262.40	53.9	42.6	52.0	49.5	48.3	104
Mean	14.0	250.86	52.6					
C.V.(%)	1.6	7.3	6.1					
LSD0.05	0.3	26.40	4.6					

<sup>2</sup>Returns were calculated by multiplying the 1995 yield by the protein premium/discount and test weight discount paid at the Southwest Grain Terminal located at Gladstone on November 28.

DRYLAND BARLEY - GREEN FALLOW --- DICKINSON						
		Days to		Lodging		Test
Variety	Type	Head	Height	Score	Seed	Weight
			inches	%	lb	lbs/bu
Azure	6R	60	26	3	12,857	48.1
Bowman	2R	59	25	7	11,469	48.9
Chinook	2R	64	27	5	12,411	49.0
Crystal	2R	68	26	0	11,875	48.0
Excel	6R	62	24	1	12,865	47.2
Foster	6R	63	25	0	11,757	47.9
Gallatin	2R	65	27	2	12,995	47.9
Harrington	2R	67	27	2	12,818	47.0
Hazen	6R	62	26	2	12,745	48.7
Logan	2R	61	26	3	10,649	49.1
Manley	2R	70	27	0	11,784	48.9
Morex	6R	61	30	4	13,150	47.4
Robust	6R	63	27	0	12,111	49.1
Royal	6R	64	22	2	13,306	47.6

Stander	6R	64	24	0	12,035	48.6
Stark	2R	61	29	3	10,749	50.1
Mean		63.6	26.2	2.1	12,223	48.3
CV%		2.2	5.7	76.8	5.5	1.3
LSD.05		2.0	2.1	2.3	957	0.9

Previous Crop: Black lentil (burn down)

Planting Date: May 3

Harvest Date: August 21

0=no lodging; 9= completely flat

DRYLAND BARLEY - GREEN FALLOW --- DICKINSON								
			Grain Yield					
						----- Averages -----		% of
Variety	Protein	Returns <sup>1</sup>	1995	1994	1993	3-Year	2-Year	Stark
	%	\$/acre	bu/ac					
Azure	14.4	164.75	57.8	94.6	79.2	77.2	76.2	98

Bowman	13.4	161.50	56.7	81.0	67.2	68.3	68.9	88
Chinook	13.6	179.19	62.9	--	--	--	--	--
Crystal	14.2	145.16	50.9	--	--	--	--	--
Excel	14.0	185.75	65.2	95.7	85.3	82.1	80.5	103
Foster	13.8	160.53	56.3	97.8	87.5	80.5	77.1	99
Gallatin	13.1	156.09	54.8	96.9	67.3	73.0	75.9	97
Harrington	13.4	143.54	50.4	89.8	70.2	70.1	70.1	90
Hazen	14.7	146.91	51.5	91.2	92.9	78.5	71.4	92
Logan	13.5	208.05	73.0	98.1	81.1	84.1	85.6	110
Manley	14.5	151.34	53.1	88.0	97.2	79.4	70.6	90
Morex	15.5	130.57	45.8	84.1	66.0	65.3	65.0	83
Robust	15.5	161.62	56.7	90.4	72.9	73.3	73.6	94
Royal	15.1	138.71	48.7	84.5	--	--	66.6	85
Stander	13.8	191.11	67.1	102.8	87.9	85.9	85.0	109
Stark	13.5	167.78	58.9	97.0	81.8	79.2	78.0	100
Mean	14.2	162.04	56.9					
CV%	3.6	5.8	5.8					
LSD.05	0.7	13.31	4.7					



<sup>2</sup>Returns were calculated by multiplying the 1995 yield by the price paid for feed barley minus the test weight discount paid at the Southwest Grain Terminal located at Gladstone on November 28.

DRYLAND OAT - GREEN FALLOW --- DICKINSON					
	Stampede	Days to			Test
Variety	Rating <sup>1</sup>	Head	Height	Seeds	Weight
			inches	lb	lbs/bu
AC Belmont	1	53	35	15,414	31.9
Bay	0	53	30	14,614	29.6
Brawn	0	54	32	11,235	31.5
Calibre	1	54	37	12,928	31.6
Derby	1	53	38	12,865	32
Dumont	2	54	34	13,414	29.9
Hyttest	0	50	36	13,522	34.1
Jerry	1	50	32	13,164	33.2
Kelsey	2	52	37	14,850	32.5
Milton	1	50	28	15,305	32.1
Monida	1	54	33	13,867	31.9
Newdak	0	50	31	13,971	30.7

Otana	1	53	36	15,136	33.2
Paul	1	54	37	16,330	36.6
Porter	0	54	33	13,368	34.1
Prairie	0	49	31	13,152	31.1
Riel	1	53	36	14,005	31.7
Robert	1	54	33	11,116	31.2
Troy	2	53	35	15,197	32.9
Valley	1	53	30	13,773	33.9
Whitestone	1	54	28	14,868	32.5
Mean	0.8	52.6	33.4	13,909	32.3
CV(%)	60.4	1	4.4	7.2	3.7
LSD.05	0.7	0.7	2.1	1409	1.7

Previous Crop: Black lentil (Plow Down)

Planting Date: May 17

Harvest Date: August 17

DRYLAND OAT - GREEN FALLOW ---DICKINSON

					---- Averages ----		% of
Variety	Returns <sup>1</sup>	1995	1994	1993	3-Year	2-Year	Otana
		bu/ac					
AC Belmont	79.52	91.3	134.6	143.0	123.0	113.0	85
Bay	55.52	110.3	159.1	192.0	153.8	134.7	101
Brawn	80.76	100.6	143.5	--	--	122.1	92
Calibre	78.76	98.1	180.6	136.0	138.2	139.4	105
Derby	88.73	99.4	172.0	130.0	133.8	135.7	102
Dumont	34.91	80.0	163.7	144.0	129.2	121.9	92
Hytest	87.53	73.0	117.0	116.0	102.0	95.0	72
Jerry	105.73	95.4	139.4	149.0	127.9	117.4	88
Kelsey	89.54	91.4	159.6	--	--	125.5	95
Milton	70.85	82.3	138.9	163.0	128.1	110.6	83
Monida	88.73	105.9	174.5	141.0	140.5	140.2	106
Newdak	56.50	93.0	155.4	132.0	126.8	124.2	94
Otana	108.33	95.0	170.6	129.0	131.5	132.8	100
Paul	121.66	92.0	107.7	127.0	108.9	99.9	75
Porter	126.91	103.8	157.8	184.0	148.5	130.8	98
Prairie	74.00	100.1	157.0	143.0	133.4	128.6	97

Riel	67.87	79.9	154.1	159.0	131.0	117.0	88
Robert	67.46	95.3	148.0	156.0	133.1	121.7	92
Troy	106.29	100.2	139.8	133.0	124.3	120.0	90
Valley	105.06	91.3	143.5	159.0	131.3	117.4	88
Whitestone	105.68	107.1	154.0	130.0	130.4	130.6	98
Mean		94.5					
CV(%)		7.8					
LSD.05		10.5					

<sup>2</sup>Returns were calculated by multiplying the 1995 yield by the price paid for feed oat minus the test weight discount paid at the Southwest Grain Terminal located at Gladstone on November 28.

HARD RED SPRING WHEAT - FALLOW --- BEACH										
	Sawfly <sup>1</sup>		Test		Grain Yield					% of
Variety	Lodging	Seeds	weight	Protein	1995	1994	1993	3- Year	2- Year	Grandin
	%	lbs	lbs/bu	%	bu/ac					
2371	11	17,761	55.3	15.8	28.7	--	--	--	--	--
2375	16	14,857	57.9	14.8	33.8	43.3	53.8	43.6	38.6	111

Amidon	7	17,374	57.5	14.2	31.4	38.3	51.7	40.5	34.9	100
Butte 86	8	14,804	58.3	15.0	39.5	40.6	48.1	42.7	40.1	115
Ernest	2	16,951	57.4	14.3	37.9	--	--	--	--	--
Glupro	24	16,889	53.9	17.2	25.2	--	--	--	--	--
Grandin	19	15,248	56.9	14.7	33.1	36.5	43.3	37.6	34.8	100
Gus	13	19,603	56.4	15.6	32.5	37.6	52.9	41.0	35.1	101
Kulm	21	16,857	59.6	14.7	34.8	45.4	--	--	40.1	115
McNeal	9	16,569	57.0	14.3	36.8	37.4	58.8	44.3	37.1	107
Sonja	9	16,187	56.6	14.6	35.2	--	--	--	--	--
Trenton	24	17,466	56.4	14.7	32.8	--	--	--	--	--
Mean	13	16,714	56.9	14.9	33.5					
CV(%)	31.5	4.6	1.1	1.5	7.0					
LSD.05	6.0	1096.6	0.9	0.3	3.3					

DURUM - FALLOW --- BEACH										
	Sawfly		Test		Grain Yield					% of

Variety	Lodging	Seeds	weight	Protein	1995	1994	1993	3-Year	2-Year	Renville
	%	lbs	lbs/bu	%	bu/ac					
Medora	0	13,393	57.8	14.7	42.2	33.3	30.3	35.3	37.8	97
Munich	2	13,097	57.4	14.7	43.9	--	--	--	--	--
Plenty	0	13,588	56.5	15.7	41.9	--	--	--	--	--
Renville	5	13,504	57.4	14.7	42.1	35.4	36.6	38.0	38.8	100
Vic	4	11,858	57.4	15.2	43.3	33.2	35.4	37.3	38.3	99
Mean	2	13,088	57.3	14.9	42.7					
CV(%)	60.6	3	0.6	2.1	4.2					
LSD.05	2.0	595.0	0.6	0.5	NS					

<sup>1</sup>Sawfly lodging = lodging resulting from stem cutting

Previous crop: Black lentil (burndown): Soil test results: 210 lbs N, 11 ppm P, 435 ppm K, 211 lbs S, 0.7 ppm Zn, 40 lbs Cl per acre - no fertilizer applied; Planted on May 18 at 1,200,000 Pure Live Seed per acre at a 1.25 inch depth; No herbicides were applied; Harvested on September 8.

<b>BARLEY - FALLOW --- BEACH</b>										
		Test		----- Grain Yield -----						% of
Variety	Seeds	weight	Protein	1995	1994	1993	3-Year	2-Year	Stark	

	lbs	lbs/bu	%	bu/ac					
Bowman	10,979	47.5	12.9	51.6	77.8	71.5	67.0	64.7	104
Crystal	13,085	43.8	13.5	56.3	--	--	--	--	--
Foster	13,052	37.8	12.1	53.8	--	--	--	--	--
Logan	10,037	46.8	12.6	69.4	--	--	--	--	--
Manley	14,417	40.1	12.9	57.9	63.0	--	--	60.5	97
Stark	10,762	47.1	12.8	50.9	73.9	72.9	65.9	62.4	100
Mean	11,959	43.7	12.7	53.9					
CV(%)	6.6	2.9	3.8	9.9					
LSD.05	1154.9	1.9	0.7	7.8					

Previous crop: Black lentil (burndown): Soil test results: 210 lbs N, 11ppm P, 435 ppmK, 211 lbs S, 0.7 ppm Zn, 40 lbs Cl per acre - no fertilizer applied; Planted on May 18 at 800,000 Pure Live Seed per acre at a 1.25 inch depth; No herbicides were applied; Harvested on September 8.

OAT - FALLOW --- BEACH								
	Test		Grain Yield					% of
Variety	weight	Seeds	1995	1994	1993	3-Year	2-Year	Otana

	lbs/bu	lbs	bu/ac					
Jerry	36.9	13,008	68.9	84.5	129.9	94.4	76.7	102
Otana	35.8	17,959	54.9	94.9	112.4	87.4	74.9	100
Paul	39.6	19,562	20.1	57.6	--	--	38.9	52
Porter	36.4	18,804	76.0	--	--	--	--	--
Settler	36.9	14,345	60.9	--	--	--	--	--
Whitestone	33.6	18,701	79.8	107.3	--	--	93.6	125
Mean	36.5	17,603	60.1					
CV(%)	1.1	25.4	11.2					
LSD.05	0.6	NS	10.1					

Previous crop: Black lentil (burndown): Soil test results: 210 lbs N, 11 ppm P, 435 ppm K, 211 lbs S, 0.7 ppm Zn, 40 lbs Cl per acre - no fertilizer applied; Planted on May 18 at 800,000 Pure Live Seed per acre at a 1.25 inch depth; No herbicides were applied; Harvested on September 8.

HARD RED SPRING WHEAT - FALLOW --- BEULAH									
		Test		Grain Yield					% of
Variety	Seeds	weight	Protein	1995	1994	1992	3-Year	2-Year	Grandin
	lbs	lbs/bu	%	bu/ac					



2371	18,022	53.8	15.7	34.1	--	--	--	--	--
2375	15,259	56.3	14.3	44.6	59.9	87.0	63.8	52.3	111
Amidon	16,721	55.4	14.7	40.3	60.2	100.0	66.8	50.3	107
Butte 86	14,705	55.1	14.5	46.8	54.5	81.0	60.8	50.7	108
Ernest	15,769	56.1	15.2	41.2	--	--	--	--	--
Glupro	16,523	52.5	17.5	22.4	--	--	--	--	--
Grandin	16,056	54	15.5	37.3	56.5	84.0	59.3	46.9	100
Gus	17,555	54.8	15.8	39.3	58.6	82.0	60.0	49.0	104
Kulm	16,350	57.9	15.2	40.0	58.3	--	--	49.2	105
McNeal	16,277	55.5	14.8	39.4	56.0	--	--	47.7	102
Sonja	15,847	54.5	14.9	45.2	--	--	--	--	--
Trenton	15,354	56.1	15.5	38.6	--	--	--	--	--
Mean	16,203	55.2	15.3	39.1					
CV(%)	4.1	1.2	1.6	6.3					
LSD.05	946.5	0.9	0.4	3.6					

DURUM - FALLOW --- BEULAH

		Test		Grain Yield					% of
Variety	Seeds	weight	Protein	1995	1994	1992	3-Year	2-Year	Renville
	lbs	lbs/bu	%	bu/ac					
Medora	17,555	56.1	14.1	38.3	59.9	73.0	60.0	49.0	84.4
Munich	16,350	56.5	14.3	43.6	--	--	--	--	--
Plenty	16,277	55.5	14.9	38.8	--	--	--	--	--
Renville	15,847	56.3	14.3	44.0	72.4	75.0	63.8	58.2	100.0
Vic	15,354	57.0	14.7	41.9	66.6	--	--	--	--
Mean	16,203	56.3	14.4	41.3					
CV(%)	3.2	0.6	2.2	12.9					
LSD.05	677.2	0.5	0.5	8.2					

Previous crop: Fallow: Soil test results: 41 lbs N, 7 ppm P - applied 50 lbs DAP and 244 lbs urea per acre; Planted on May 19 at 1,200,000 Pure Live Seed per acre at a 1.25 inch depth; Applied 2.7 pt Hoelon + 0.33 oz Harmony Extra + 0.75 pt MCPA ester on June 13; Harvested on September 11.

BARLEY - FALLOW --- BEULAH									
		Test		Grain Yield					% of
Variety	Seeds	weight	Protein	1995	1994	1992	3-Year	2-Year	Stark

	lbs	lbs/bu	%	bu/ac					
Bowman	12,792	44.5	13.3	46.0	75.5	102.0	74.5	88.8	85
Crystal	14,986	40.6	14.0	37.0	--	--	--	--	--
Foster	12,608	42.5	12.5	40.9	--	--	--	--	--
Logan	11,251	44.2	13.2	50.8	--	--	--	--	--
Manley	14,502	40.7	14.5	32.9	95.9	--	--	95.9	92
Stark	11,859	45.6	13.5	37.0	86.6	122.0	81.9	104.3	100
Mean	12,820	43.1	13.3	41.8					
CV(%)	5.6	2.1	1.4	8.6					
LSD.05	1058	1.3	0.3	5.2					

Previous crop: Fallow: Soil test results: 41 lbs N, 7 ppm P - applied 50 lbs DAP and 244 lbs urea per acre; Planted on May 19 at 800,000 Pure Live Seed per acre at a 1.25 inch depth; Applied 2.7 pt Hoelon + 0.33 oz Harmony Extra + 0.75 pt MCPA ester to barley, and 0.33 oz Harmony Extra + 0.75 pt MCPA ester to oat, on June 13; Harvested on September 11.

OAT - FALLOW --- BEULAH									
	Lodge	Test		Grain Yield					% of
Variety	Score <sup>1</sup>	weight	Seeds	1995	1994	1992	3-Year	2-Year	Otana

		lbs/bu	lbs	bu/ac					
Jerry	4	34.2	12,102	58.3	108.3	--	--	83.3	81
Otana	6	30.0	14,274	56.1	150.0	78.4	94.8	103.1	100
Porter	4	34.1	13,180	70.9	--	--	--	--	--
Paul	2	42.6	16,037	56.1	86.6	--	--	71.4	69
Settler	6	34.7	13,150	78.1	--	--	--	--	--
Whitestone	8	30.0	14,768	80.4	121.4	--	--	100.9	98
Mean	5	34.3	13,918	66.5					
CV(%)	18.6	4.0	7.0	9.9					
LSD.05	1.5	2.1	1463	9.9					

<sup>1</sup>0 = no lodging; 9 = completely flat

Previous crop: Fallow: Soil test results: 41 lbs N, 7 ppm P - applied 50 lbs DAP and 244 lbs urea per acre; Planted on May 19 at 800,000 Pure Live Seed per acre at a 1.25 inch depth; Applied 2.7 pt Hoelon + 0.33 oz Harmony Extra + 0.75 pt MCPA ester to barley, and 0.33 oz Harmony Extra + 0.75 pt MCPA ester to oat, on June 13; Harvested on September 11.

HARD RED SPRING WHEAT - FALLOW --- GLEN ULLIN									
		Test		Grain Yield					% of
Variety	Seeds	weight	Protein	1995	1994	1993	3-Year	2-Year	Grandin

	lbs	lbs/bu	%	bu/ac					
2371	15,569	58.0	15.1	51.8	--	--	--	--	--
2375	14,239	59.3	13.8	63.8	51.3	50.0	55.0	57.6	114
Amidon	15,151	57.9	14.1	60.4	49.4	48.5	52.8	54.9	108
Butte 86	13,995	57.8	13.4	69.3	48.5	45.0	54.3	58.9	116
Ernest	15,214	58.0	14.8	62.9	--	--	--	--	--
Glupro	15,196	55.9	16.7	45.8	--	--	--	--	--
Grandin	15,475	56.9	14.2	54.8	46.5	47.9	49.7	50.7	100
Gus	16,208	57.8	15.1	59.6	46.0	45.0	50.2	52.8	104
Kulm	16,039	58.8	14.2	59.8	48.9	--	--	54.4	107
McNeal	16,176	57.8	14.2	60.1	48.2	53.6	54.0	54.2	107
Sonja	16,013	57.0	14.2	67.7	--	--	--	--	--
Trenton	14,628	59.0	14.8	59.6	--	--	--	--	--
Mean	15,325	57.8	14.6	59.6					
CV(%)	5.4	1.5	2.1	7.4					
LSD.05	1199	1.2	0.4	6.3					

DURUM - FALLOW --- GLEN ULLIN									
		Test		Grain Yield					% of
Variety	Seeds	weight	Protein	1995	1994	1993	3-Year	2-Year	Renville
	lbs	lbs/bu	%	bu/ac					
Medora	12,994	58.3	12.6	54.6	38.1	30.3	41.0	46.4	80
Munich	11,845	59.6	12.6	63.4	--	--	--	--	--
Plenty	11,267	58.6	12.7	57.1	--	--	--	--	--
Renville	12,446	58.9	13.0	66.5	48.6	36.6	50.6	57.6	100.0
Vic	11,146	59.6	13.1	65.3	43.7	35.4	48.1	54.5	95
Mean	11,939	59.0	12.8	61.4					
CV(%)	2.7	0.5	2.8	6.3					
LSD.05	496	0.4	NS	6.0					
<p>Previous crop: Fallow; Soil test results: 51 lbs N, 10 ppm P - applied 50 lbs DAP and 220 lbs urea per acre: Planted on May 19 at 1,200,000 Pure Live Seed per acre at a 1.25 inch depth; Applied 2.7 pt Hoelon + 0.33 oz Harmony Extra + 0.75 pt MCPA per acre on June 13: Harvested on September 12.</p>									

BARLEY - FALLOW --- GLEN ULLIN									
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		Test		Grain Yield					% of
Variety	Seeds	weight	Protein	1995	1994	1993	3-Year	2-Year	Stark
	lbs	lbs/bu	%	bu/ac					
Bowman	14,016	42.0	12.3	51.3	68.8	59.0	59.7	60.1	82
Crystal	12,562	45.0	12.6	49.3	--	--	--	--	--
Foster	15,362	38.3	12.1	65.3	--	--	--	--	--
Logan	11,722	44.9	11.9	71.4	--	--	--	--	--
Manley	12,768	45.0	13.1	57.7	92.5	--	--	75.1	102
Stark	12,093	44.8	12.4	61.9	84.6	51.4	66.0	73.3	100
Mean	12,937	42.7	12.4	61.9					
CV(%)	6.8	3.9	2.9	7.4					
LSD.05	1302	2.4	0.5	6.7					

Previous crop: Fallow; Soil test results: 51 lbs N, 10 ppm P - applied 50 lbs DAP and 220 lbs urea per acre: Planted on May 19 at 800,000 Pure Live Seed per acre at a 1.25 inch depth; Applied 2.7 pt Hoelon + 0.33 oz Harmony Extra + 0.75 pt MCPA per acre to barley, and 0.33 oz Harmony Extra + 0.75 pt MCPA per acre to oat, on June 13: Harvested on September 12.

OAT - FALLOW --- GLEN ULLIN

	Test		Grain Yield					% of
Variety	weight	Seeds	1995	1994	1993	3-Year	2-Year	Otana
	lbs/bu	lbs	bu/ac					
Jerry	34.5	13,645	103.7	107.6	107.6	106.3	105.7	100
Otana	30.5	14,832	89.2	122.3	123.2	111.6	105.8	100
Paul	41.9	16,290	83.2	77.4	--	--	80.3	76
Porter	34.4	14,553	111.7	--	--	--	--	--
Settler	35.0	14,102	98.7	--	--	--	--	--
Whitestone	31.1	14,667	132.2	99.2	--	--	115.7	109
Mean	34.6	14,682	103.1					
CV(%)	2.1	5.9	9.3					
LSD.05	1.1	1321.6	14.5					

Previous crop: Fallow; Soil test results: 51 lbs N, 10 ppm P - applied 50 lbs DAP and 220 lbs urea per acre: Planted on May 19 at 800,000 Pure Live Seed per acre at a 1.25 inch depth; Applied 2.7 pt Hoelon + 0.33 oz Harmony Extra + 0.75 pt MCPA per acre to barley, and 0.33 oz Harmony Extra + 0.75 pt MCPA per acre to oat, on June 13: Harvested on September 12.

1995 HARD RED SPRING WHEAT - RECROP --- HANNOVER



		Test		Grain Yield					% of
Variety	Seeds	weight	Protein	1995	1994	1993	3-Year	2-Year	Grandin
	lbs	lbs/bu	%	bu/ac					
2371	19,588	52.3	15.8	26.3	--	--	--	--	--
2375	16,810	54.4	14.4	36.0	39.6	37.8	37.8	37.8	128
Amidon	19,201	53.6	14.7	27.9	36.6	29.5	31.3	32.3	109
Butte 86	15,857	52.4	14.4	38.7	40.4	33.2	37.4	39.6	134
Ernest	18,202	52.9	15.1	31.3	--	--	--	--	--
Glupro	17,959	51.4	16.9	23.9	--	--	--	--	--
Grandin	19,951	50.0	15.2	23.4	35.5	27.3	28.7	29.5	100
Gus	19,632	52.3	15.5	24.3	36.5	35.3	32.0	30.4	103
Kulm	18,684	55.1	14.6	31.5	43.0	--	--	37.3	126
McNeal	17,595	53.8	14.9	32.2	40.9	34.4	35.8	36.6	124
Sonja	19,486	50.9	15.3	34.5	--	--	--	--	--
Trenton	17,155	53.5	15.1	29.3	--	--	--	--	--
Mean	18,343	52.7	14.4	29.9					
CV(%)	5.9	1.8	1.6	10.7					
LSD .05	1549.8	1.4	0.3	4.6					

1995 DURUM - RECROP --- HANNOVER									
		Test		Grain Yield					% of
Variety	Seeds	weight	Protein	1995	1994	1993	3-Year	2-Year	Renville
	lbs	lbs/bu	%	bu/ac					
Medora	17,183	52.1	13.4	23.5	31.1	17.1	23.9	27.3	74
Munich	14,846	54.1	13.5	37.4	--	--	--	--	--
Plenty	15,379	54.6	14.3	35.3	--	--	--	--	--
Renville	15,099	54.6	13.8	34.5	39.1	19.0	30.9	36.8	100
Vic	13,212	55.1	13.7	39.2	35.5	23.8	32.8	37.4	101
Mean	15,144	54.1	13.7	33.9					
CV(%)	7.7	1.3	1.1	8.7					
LSD .05	1790	1.1	0.2	4.5					
Previous crop: Corn; Soil test results: 50 lbs N, 5 ppm P - applied 50 lbs DAP and 225 lbs urea per acre. Planted on May 19 at 1,200,000 Pure Live Seed per acre at a 1.5 inch depth; Applied 2.7 pt Hoelon + 0.33 oz Harmony Extra + 0.75 pt MCPA per acre on June 13; harvested on September 13.									

BARLEY - RECROP --- HANNOVER									
		Test		Grain Yield					% of
Variety	Seeds	weight	Protein	1995	1994	1993	3-Year	2-Year	Stark
	lbs	lbs/bu	%	bu/ac					
Bowman	14,226	41.9	13.2	30.2	55.3	34.8	40.1	42.8	92
Crystal	13,515	41.4	14.3	34.2	--	--	--	--	--
Foster	14,313	38.9	12.9	38.4	--	--	--	--	--
Logan	11,902	42.7	13.1	46.1	--	--	--	--	--
Manley	12,811	39.9	14.4	34.9	50.2	--	--	42.6	92
Stark	12,483	43.6	13.4	35.8	57.0	48.6	47.1	46.4	88
Mean	13,208	41.4	13.5	36.6					
CV(%)	4.3	1.7	2.5	8.9					
LSD.05	836	1.0	0.4	4.9					
<p>Previous crop: Corn; Soil test results: 50 lbs N, 5 ppm P - applied 50 lbs DAP and 225 lbs urea per acre. Planted on May 19 at 800,000 Pure Live Seed per acre at 1.5 inch depth; Applied 2.7 pt Hoelon + 0.33 oz Harmony Extra + 0.75 pt MCPA per acre to barley, and 0.33 oz/acre Harmony Extra + 0.75 pt MCPA per acre to oat on June 13; Harvested on September 13.</p>									

OAT - RECROP --- HANNOVER

	Test		Grain Yield					% of
Variety	weight	Seeds	1995	1994	1993	3-Year	2-Year	Otana
	lbs/bu	lbs	bu/ac					
Jerry	32.2	14,320	65.9	60.3	98.0	74.7	63.1	107
Otana	25.9	17,668	46.2	71.3	105.2	74.2	58.8	100
Paul	40.0	19,865	62.8	54.1	--	--	58.5	99
Porter	29.9	15,507	66.2	--	--	--	--	--
Settler	32.6	16,930	71.2	--	--	--	--	--
Whitestone	26.9	17,387	68.2	61.8	--	--	65.0	111
Mean	31.2	16,946	63.4					
CV(%)	3.5	11.6	13.6					
LSD.05	1.7	2962	13.0					

Previous crop: Corn; Soil test results: 50 lbs N, 5 ppm P - applied 50 lbs DAP and 225 lbs urea per acre. Planted on May 19 at 800,000 Pure Live Seed per acre at 1.5 inch depth; Applied 2.7 pt Hoelon + 0.33 oz Harmony Extra + 0.75 pt MCPA per acre to barley, and 0.33 oz/acre Harmony Extra + 0.75 pt MCPA per acre to oat on June 13; Harvested on September 13.

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