Hr
GRC
4

PROJECT TITLE: Comparison of Spring Wheat and Barley Varietal Response Under Conditions of Low Versus Optimum Fertility Off-Station at Turner.

PROJECT LEADER: Gregg R. Carlson, Agronomist - Havre

PROJECT PERSONNEL: T.L. Allen, Research Specialist - Havre
L.E. Talbert, Breeder/Geneticist (SW) - Bozeman
S.P. Lanning, Research Associate (SW) - Bozeman
T.K. Blake, Breeder/Geneticist (BLY) - Bozeman
P.F. Hensleigh, Research Associate (BLY) - Bozeman
S.R. Williams, Blaine CEA - Chinook
L. Cederberg, Cooperating Landowner - Turner

OBJECTIVES:

1. To evaluate and demonstrate the general, long-term effects of optimum fertility on dryland spring wheat and barley production under conditions common to the "Big Flat" area of northern Blaine County.
2. To add "lower and moderate level" protein observations for spring wheat cultivars to existing databases utilized for evaluation of cultivar performance on the basis of gross production value as influenced by yield, protein and market.
3. To explore and classify potential differences, if any, among cultivars in their response to fertilizer, particularly nitrogen.

RESULTS:

General spring wheat and barley response to applied fertilizer at Turner was again strong in 1996, but not as dramatic in terms of yield differences as that seen in 1994 and 1995. Very strong protein responses were noted. Similarly dramatic protein responses, but without meaningful yield differences, were obtained in 1986 at the same location (data not reported here). Growers have reported that solid responses to fertilizer under commercial-scale dryland production systems on the Big Flat have been inconsistent. This is one reason this work is being conducted (5 year duration, beginning in 1994).

Agronomic performance data for 25 spring wheat cultivars grown in 1996, "Unfertilized" are presented in Table 1. Performance data in an identical format for the same cultivars, "Fertilized" are presented in Table 2. Table 3 presents an "agronomic and economic" comparison of unfertilized versus fertilized performance over a 2-year period for 15 hard red spring wheat cultivars common to the nurseries grown in both years. A factorial analysis (Years x Fertility x Cultivar relationships) for the 15 spring wheats is presented in Table 4. Table 5. features a factorial summary of relative agronomic and economic performance. Due to advancement of the MWBC report deadline, we were not able to update the economic comparisons to include 1996 data. The analyses necessary are too extensive to complete by early January when year-end market data is not available until the close of the calendar year. Such 3-year analyses will be completed as soon as possible and utilized for winter seminars with growers. For now, our 1994-1995, 2-yr summary data completed in late January a year ago will demonstrate our progress toward the objectives of this study.

In the absence of 1996 economic analyses, 1994-1995 Figures 1-4 have been included to graphically display the dollar impacts associated with low vs optimum fertility.

It is important to remember that these responses are associated with observations in only two years at a single location; and that few conclusions can be drawn at this point. Differences between unfertilized and fertilized spring wheat (over all cultivars) were statistically significant for most parameters measured.

Agronomic performance data for 16 spring barley cultivars grown in 1996, "Unfertilized" are presented in Table 6. Performance data in an identical format for the same cultivars, "Fertilized" are presented in Table 7. Table 8. summarizes fertility and variety comparisons over the 2-yr period for 16 cultivars included both years. A factorial analysis (Years x Fertility x Cultivar relationships) for the 16 barleys is presented in Table 9. Table 10. then features a factorial summary of relative agronomic performance of the same spring barleys. Figure 5. graphically displays the relative performance data detailed in Table 10. 1995 responses to fertilizer with barley were considerably weaker than in 1994, but agronomic responses were similar to those seen in spring wheat. Fertilized barley stands were slightly reduced; plant heights, yield, protein and percent thins were increased; while test weight and percent plump were reduced.

SUMMARY:

Four adjacent trials were established on unfertilized fallow (2 each for spring wheat and barley cultivars) with one trial for each crop fertilized at planting time. Standard plot techniques were employed with 3 replications in a randomized complete block design. Entries were planted in 3-row plots, 20 feet in length on a 12-inch spacing utilizing a self-propelled cone seeder equipped with `haybuster' hoe openers and capability to band fertilizer 1.5 inches directly below the seed. Plots were trimmed to 16 feet and harvested with a `Hege 125C' plot combine. Other variables specific to the trials are listed in the respective data tables.

FUTURE PLANS:

It is planned that these investigations be continued on an annual basis with the same cultivars at the same location for the duration of the proposed 5-yr study period (1994-1998). Arrangements have been made with the cooperating landowner to reserve a specified block of land from commercial fertilization during the study period. Depending upon future results, related investigations may be initiated under other environments. Similarly, investigations with fewer, prominent cultivars may be initiated where several rates of fertility would further be involved.

Hr
GRC
4

TABLE 1. *"UNFERTILIZED"* DRYLAND FALLOW SPRING WHEAT VARIETY EVALUATION NURSERY GROWN OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1996.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %
BZ684-23	VANNA (Soft White)	94.80	20.09	28.03	60.43	9.40
MT 9565	HI-LINE/PI372129//HI-LINE	99.30	19.67	25.40	60.73	12.00
MTHW9420	MT8182/MT8289 (Hard White)	99.30	19.32	25.30	61.47	11.93
MT 9433	MT8808/MARBERG	96.87	23.58	24.83	61.97	12.60
ND 606	AMIDON	99.30	22.36	24.63	60.67	12.17
PI574642	MCNEAL	96.17	20.63	24.50	59.77	12.10
PI483235	GLENMAN	98.97	21.88	24.30	58.83	11.40
PI549275	HI-LINE	90.97	19.72	23.90	60.40	12.43
CI 17430	NEWANA	96.87	19.48	23.70	62.07	11.53
ND 677	ERNEST	95.13	22.11	23.53	62.07	12.83
ND 626	GRANDIN	91.67	21.36	23.37	62.10	12.30
MTHW9503	MT8182/MT8289 (Hard White)	97.57	19.74	23.30	60.63	12.23
PNR 2375	PIONEER 2375	97.90	19.42	23.30	61.17	11.97
MT 9311	MT7819/(OLAF/LEW)	90.97	21.01	23.13	62.70	12.00
CI 17790	LEN	97.57	21.22	23.00	61.40	12.70
MT 9410	MT8808/MARBERG	97.57	22.02	22.97	62.23	12.23
ND 582	STOA	98.27	22.70	22.83	60.43	12.20
WBEXPRES	WESTBRED EXPRESS	95.83	19.55	22.83	61.30	12.87
ND 673	TRENTON	97.57	22.47	22.33	61.63	12.50
C982-324	RAMBO	98.60	20.89	22.27	62.77	11.83
CI 17429	LEW	99.30	21.94	21.93	60.57	11.73
WB 936	WESTBRED 936	95.13	19.68	21.93	60.77	12.47
WB 926	WESTBRED 926	96.90	18.15	21.80	60.90	12.77
CI 13596	FORTUNA	98.60	21.99	20.70	61.33	13.53
TR983239	FERGUS	99.30	18.57	20.13	61.53	13.20
EXPERIMENTAL MEANS		96.82	20.78	23.36	61.19	12.20
C.V. 2: (S OF MEAN/MEAN)*100		2.31	2.87	3.19	.52	1.91
LSD (0.05)		6.37	1.70	2.12	.90	.66

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 96-9950-SW Field: OffSta Design: __RCB__ # Ents: 25 # Reps: 3 Plot-Obsrv: 54 sqft. Hvst-Obsrv: 48 sqft.
Qtr: ____SE____ Section: 13 Twnshp: 36 N Range: 25 E Latitude: 48.88 N Longitude: 108.39 W Elevation: 2900 ft.

Seeding Date: 05/13/96 Sd'g Depth: 1.50 in. Depth to Moisture @ Sd'g: 0.50 in. Moist Soil Depth @ Sd'g: 55.0+ in.
Soil Temp @ Sd'g: __.F @ 1 in. 59.0F @ 2 in. 56.0F @ 4 in. Soil Texture: SCL Soil Series: _____
Cropping System: _X_ Fallow ___ Recrop _X_ Full-Till ___ Reduced-Till ___ No-Till # Tillages: 4 # Chem Apps: 0
Cropping System Details: __1995 Fallow Season = 3x Tillage w/Sweeps & Harrows, 1x Tillage w/Sweeps, Rods & Harrows__
Cropping History: 1 Yr Ago = 95 = ____Fallow____ 2 Yrs Ago = 94 = _____Durum____ 3 Yrs Ago = 93 = ____Fallow__
Fertilizer: 0#N, 0#P2O5, 0#K2O/ac _____ Herbicide: _'BanvelSGF'+LV6 @4.26+6.4oz/ac_
Harvest Date: 09/04/96 Root Penetration Depth: 38 in. Comments: _____

Depth	PRE-PLANT SOIL ANAL 05/13/96 Max Depth=48"									__/__/__	POST-HVST SOIL ANAL 10/18/96 (Max Depth=48"								
	in. PAW	pH	% OM	Lb/a NO3	ppm P	ppm K	ppm S	Soil Text	CEC Txt	in. PAW	in. PAW	pH	% OM	Lb/a NO3	ppm P	ppm K	ppm S	Soil Text	CEC Txt
0 -6"	.91	6.1	1.6	14	17	319	4	SCL-	21.7	_____	.97	6.8	1.3	4	17	328	9	SCL	21.7
6-24"	2.74			18			11	SCL-		_____	1.80			6			15	SCL-	
24-36"	1.63			8				SCL-		_____	.92			4				SCL	
36-48"	1.70			4				SCL-		_____	1.17			4				SCL	
TOTAL:	6.98			44						_____	4.86			18					

Precipitation & Stored Soil Water Summary: 05/13/96 to Sd'g: 0.00 in. (0.00 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 6.98 in.
05/13/96 to Hvst: 3.62 in. (2.89 in events =>.1 in.) Measured Resid Soil Water @10/18: 4.86 in.
Growing Season (05/13/96 to 14 days prior to Harvest Maturity: 3.62 in.) (2.89 in events =>.1 in.)
Post-Grwg Seas (14 days prior to Harvest Maturity to 10/18/96: 2.63 in.) (2.40 in events =>.1 in.)
Adj'd Summary: Init GS H2O Inv + 'Init GS Inv to Smpl' Prec - Smpl Resid H2O - 'PostGS' Prec (Calc'd ET: 8.37 in.)

Hr
GRC
4

TABLE 2. *"FERTILIZED"* DRYLAND FALLOW SPRING WHEAT VARIETY EVALUATION NURSERY GROWN OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1996.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %
BZ684-23	VANNA (Soft White)	88.57	19.55	30.47	58.87	12.73
PI483235	GLENMAN	95.47	20.88	30.10	59.03	14.57
CI 17430	NEWANA	84.40	19.75	29.90	61.53	15.33
PI549275	HI-LINE	91.00	19.68	29.70	59.80	15.77
ND 606	AMIDON	90.63	23.06	29.27	60.50	15.53
PI574642	MCNEAL	88.90	21.72	29.07	59.20	15.53
MT 9433	MT8808/MARBERG	91.63	21.67	28.77	60.70	16.07
ND 582	STOA	93.40	21.96	28.70	59.27	15.70
CI 17429	LEW	94.80	23.45	28.60	61.33	15.57
ND 677	ERNEST	87.13	22.26	28.43	61.40	15.93
MT 9311	MT7819/(OLAF/LEW)	79.87	21.94	28.33	62.03	14.90
MT 9565	HI-LINE/PI372129//HI-LINE	97.90	20.30	27.87	60.13	15.13
CI 17790	LEN	94.83	20.29	27.70	60.60	15.77
PNR 2375	PIONEER 2375	95.50	19.45	27.67	61.13	15.23
CI 13596	FORTUNA	88.87	22.85	27.33	62.03	16.17
WBEXPRES	WESTBRED EXPRESS	93.03	19.20	27.30	59.67	15.83
MTHW9420	MT8182/MT8289 (Hard White)	94.80	17.87	27.30	60.40	15.17
MT 9410	MT8808/MARBERG	90.97	23.43	27.10	61.40	14.93
MTHW9503	MT8182/MT8289 (Hard White)	97.20	19.99	26.57	59.60	16.37
WB 926	WESTBRED 926	88.90	19.11	26.23	60.27	16.17
ND 673	TRENTON	89.23	23.32	25.77	61.03	15.77
C982-324	RAMBO	95.83	19.62	25.50	61.20	15.03
ND 626	GRANDIN	93.40	22.09	24.70	60.93	15.80
TR983239	FERGUS	95.17	19.61	24.37	61.30	16.30
WB 936	WESTBRED 936	87.83	18.90	24.17	60.20	16.00
EXPERIMENTAL MEANS		91.57	20.88	27.64	60.54	15.49
C.V. 2: (S OF MEAN/MEAN)*100		3.94	2.44	5.51	.30	1.16
LSD (0.05)		10.25	1.45	4.33	.51	.51

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 96-9951-SW Field: OffSta Design: __RCB__ # Ents: 25 # Reps: 3 Plot-Obsrv: 54 sqft. Hvst-Obsrv: 48 sqft.
Qtr: ____SE____ Section: 13 Twnshp: 36 N Range: 25 E Latitude: 48.88 N Longitude: 108.39 W Elevation: 2900 ft.

Seeding Date: 05/13/96 Sd'g Depth: 1.50 in. Depth to Moisture @ Sd'g: 0.50 in. Moist Soil Depth @ Sd'g: 55.0+ in.
Soil Temp @ Sd'g: ___.F @ 1 in. 59.0F @ 2 in. 56.0F @ 4 in. Soil Texture: SCL Soil Series: _____
Cropping System: _X_ Fallow ___ Recrop _X_ Full-Till ___ Reduced-Till ___ No-Till # Tillages: 4 # Chem Apps: 0
Cropping System Details: __1995 Fallow Season = 3x Tillage w/Sweeps & Harrows, 1x Tillage w/Sweeps, Rods & Harrows__
Cropping History: 1 Yr Ago = 95 = ____Fallow____ 2 Yrs Ago = 94 = ____Durum____ 3 Yrs Ago = 93 = ____Fallow____
Fertilizer: 71#N,35#P2O5, 0#K2O/ac via gran.blend bnd'd 1.5" below seed_ Herbicide: _'BanvelSGF'+LV6 @4.26+6.4oz/ac_
Harvest Date: 09/04/96 Root Penetration Depth: 36 in. Comments: __Pre-Plant Soil Analysis was Pre-Fertilization___

Depth	PRE-PLANT SOIL ANAL 05/13/96 Max Depth=48" in. PAW	pH	% OM	Lb/a NO3	ppm P	ppm K	ppm S	Soil Text	CEC Txt	__/__/__ in. PAW	POST-HVST SOIL ANAL 10/18/96 (Max Depth=48" in. PAW	pH	% OM	Lb/a NO3	ppm P	ppm K	ppm S	Soil Text	CEC Txt
0 -6"	.83	5.7	2.0	20	25	341	5	SCL-	21.7	_____	.82	6.4	1.4	6	22	302	9	SCL-	21.7
6-24"	3.12			18			13	CL-		_____	2.28			24			16	CL	
24-36"	2.05			12				CL		_____	.88			4				CL	
36-48"	1.81			4				CL		_____	1.46			8				CL	
TOTAL:	7.81			54						_____	5.44			42					

Precipitation & Stored Soil Water Summary: 05/13/96 to Sd'g: 0.00 in. (0.00 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 7.81 in.
05/13/96 to Hvst: 3.62 in. (2.89 in events =>.1 in.) Measured Resid Soil Water @10/18: 5.44 in.
Growing Season (05/13/96 to 14 days prior to Harvest Maturity: 3.62 in.) (2.89 in events =>.1 in.)
Post-Grwg Seas (14 days prior to Harvest Maturity to 10/18/96: 2.63 in.) (2.40 in events =>.1 in.)
Adj'd Summary: Init GS H2O Inv + 'Init GS Inv to Smpl' Prec - Smpl Resid H2O - 'PostGS' Prec (Calc'd ET: 8.62 in.)

Hr
GRC
1

TABLE 3. 1/ *TWO-YEAR* AGRONOMIC AND ECONOMIC PERFORMANCE SUMMARY FOR *15 HARD RED SPRING WHEAT VARIETIES* GROWN UNDER *FERTILIZED VS. UNFERTILIZED* DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1995.

ID	FERTILITY	VARIETY	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %	GROSS @ MIN $/Ac 2/	PROTEIN PREMIUM $/Ac 3/	GROSS w/PREM $/Ac	GROSS -FERT $/Ac 4/
27	FERTILIZED	PONDERA	91.14	29.05	46.20	59.47	13.23	210.70	21.06	231.76	211.76
30	FERTILIZED	WESTBRED 926	91.68	26.76	44.95	57.77	13.38	200.70	23.84	224.54	204.54
24	FERTILIZED	McNEAL	93.58	29.90	43.95	58.50	13.60	197.80	21.79	219.59	199.59
20	FERTILIZED	GRANDIN	88.55	30.23	42.05	58.27	13.91	191.20	25.49	216.69	196.69
19	FERTILIZED	GLENMAN	97.40	29.11	47.15	58.15	12.30	202.10	10.32	212.42	192.42
21	FERTILIZED	HI-LINE	95.13	26.92	43.90	58.58	13.03	193.20	17.77	210.97	190.97
26	FERTILIZED	ERNEST	94.63	33.19	43.10	59.82	13.22	188.80	21.89	210.69	190.69
22	FERTILIZED	LEN	95.15	28.21	40.97	57.83	13.78	183.30	26.47	209.77	189.77
29	FERTILIZED	STOA	94.95	34.74	40.75	57.88	13.45	185.10	21.67	206.77	186.77
28	FERTILIZED	RAMBO	96.00	27.03	41.74	59.75	13.13	186.20	19.03	205.23	185.23
25	FERTILIZED	NEWANA	94.45	27.22	46.07	59.05	12.06	197.50	6.21	203.71	183.71
16	FERTILIZED	AMIDON	94.26	34.71	42.22	59.05	12.78	185.10	16.82	201.92	181.92
17	FERTILIZED	BORDER	90.63	28.18	39.27	57.90	13.65	179.90	21.42	201.32	181.32
18	FERTILIZED	FORTUNA	96.89	34.67	37.75	60.28	13.33	167.80	19.14	186.94	166.94
23	FERTILIZED	LEW	97.40	35.88	35.78	60.24	13.05	152.90	19.17	172.07	152.07
11	UNFERTILIZED	ERNEST	96.02	31.61	34.63	62.42	10.40	142.10	1.37	143.47	143.47
01	UNFERTILIZED	AMIDON	97.93	32.85	33.85	61.78	10.35	138.40	1.82	140.22	140.22
07	UNFERTILIZED	LEN	94.46	26.88	34.05	61.83	10.92	139.10	.30	139.40	139.40
15	UNFERTILIZED	WESTBRED 926	91.84	24.10	34.58	61.57	10.10	138.70	.00	138.70	138.70
09	UNFERTILIZED	McNEAL	96.54	26.69	32.85	61.20	10.01	134.70	.00	134.70	134.70
10	UNFERTILIZED	NEWANA	96.35	25.30	32.72	62.74	9.57	133.00	.00	133.00	133.00
14	UNFERTILIZED	STOA	96.02	31.76	32.90	61.90	9.75	130.90	.00	130.90	130.90
04	UNFERTILIZED	GLENMAN	96.39	28.17	32.68	61.25	9.46	129.40	.00	129.40	129.40
05	UNFERTILIZED	GRANDIN	89.75	26.98	30.63	62.10	10.85	126.90	1.88	128.78	128.78
13	UNFERTILIZED	RAMBO	96.37	24.42	31.78	63.19	9.68	127.10	.00	127.10	127.10
02	UNFERTILIZED	BORDER	96.70	25.23	28.83	61.76	11.07	123.10	2.05	125.15	125.15
06	UNFERTILIZED	HI-LINE	97.21	24.51	30.80	62.40	9.71	122.20	.00	122.20	122.20
12	UNFERTILIZED	PONDERA	92.00	26.08	28.33	62.32	10.68	117.30	.68	117.98	117.98
08	UNFERTILIZED	LEW	99.13	31.02	29.58	62.30	9.58	116.80	.00	116.80	116.80
03	UNFERTILIZED	FORTUNA	98.45	29.80	27.94	61.40	10.35	113.20	.52	113.72	113.72

STATISTICAL SUMMARY	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %	GROSS @ MIN $/Ac 2/	PROTEIN PREMIUM $/Ac 3/	GROSS w/PREM $/Ac	GROSS -FERT $/Ac 4/
OVERALL MEANS	94.90	29.04	37.07	60.42	11.68	158.50	10.02	168.50	158.50
F-RATIO, TMTS	1.12	7.71	5.85	14.37	2.07	8.91	1.31	9.39	5.13
P-VALUE, TMTS	.3811	.0000	.0000	.0000	.0270	.0000	.2326	.0000	.0000
CV (SE/MEAN)%	2.66	4.20	6.76	.77	9.67	6.84	89.76	8.03	8.88
LSD (0.05)	7.31	3.53	7.24	1.35	3.27	31.35	26.02	39.16	40.72

1/ Analyzed with Years as Reps for "Year x Tmt" Means arising from the original analysis of field trials conducted annually with 3 replications. Proposed study duration = 5 Yrs.
2/ 2-Yr Means for Yield x CY Ave PNW price for "milling wht" @ min quoted pro (12%), or "feed" (<12%)
3/ 2-Yr Means for Yield x CY Ave PNW price premium (quarter-ups calculated) for protein >12% and <=15%
4/ 2-Yr Means for Gross w/prot premium, if any; AFTER fert mat. costs (1994=$18.11/Ac,1995=$21.88/Ac)

Hr
GRC
1

TABLE 4. FACTORIAL SUMMARY OF AGRONOMIC AND ECONOMIC PERFORMANCE OF *15 HARD RED SPRING WHEAT VARIETIES* GROWN *2 YEARS* UNDER *FERTILIZED VS.UNFERTILIZED* DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1995.

ID	YEAR/FERTILITY/VARIETY	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %	GROSS @ MIN $/Ac 1/	PROTEIN PREMIUM $/Ac 2/	GROSS w/PREM $/Ac	GROSS -FERT $/Ac 3/
	FACTOR ANALYSIS - FACTOR 1 = YEAR *(across 2 fertility schemes & 15 varieties)*									
2	1995	92.81	31.75	45.28	60.57	11.74	208.70	2.29	211.00	200.00
1	1994	96.99 **	26.33 **	28.85 **	60.28 **	11.63 ns	108.30 **	17.76 **	126.10 **	117.00 **
	F =	66.31	747.68	480.46	14.47	1.22	898.65	259.16	559.69	535.11
	P =	.0000	.0000	.0000	.0000	.2724	.0000	.0000	.0000	.0000
	LSD (.05) =	1.02	.39	1.48	.15	.20	6.63	1.90	7.11	7.11
	FACTOR ANALYSIS - FACTOR 2 = FERTILITY SCHEME *(across 2 years & 15 varieties)*									
2	FERTILIZED	94.12	30.39	42.39	58.84	13.20	188.20	19.47	207.60	187.60
1	UNFERTILIZED	95.68 **	27.69 **	31.74 **	62.01 **	10.17 **	128.90 **	.57 **	129.40 **	129.40 **
	F =	9.12	185.53	201.80	1707.54	903.47	313.73	386.96	474.80	263.03
	P =	.0031	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	1.02	.39	1.48	.15	.20	6.63	1.90	7.11	7.11
	FACTOR ANALYSIS - FACTOR 3 = VARIETY *(across 2 years & 2 fertility schemes)*									
15	WESTBRED 926	91.76	25.43	39.77	59.67	11.74	169.70	11.92	181.60	171.60
09	McNEAL	95.06	28.29	38.40	59.85	11.81	166.20	10.89	177.10	167.10
11	ERNEST	95.33	32.40	38.87	61.12	11.81	165.40	11.63	177.10	167.10
12	PONDERA	91.57	27.57	37.27	60.89	11.96	164.00	10.87	174.90	164.90
07	LEN	94.81	27.54	37.51	59.83	12.35	161.20	13.38	174.60	164.60
05	GRANDIN	89.15	28.60	36.34	60.18	12.38	159.10	13.69	172.80	162.80
01	AMIDON	96.10	33.78	38.03	60.42	11.57	161.80	9.32	171.10	161.10
04	GLENMAN	96.89	28.64	39.92	59.70	10.88	165.70	5.16	170.90	160.90
14	STOA	95.48	33.25	36.83	59.89	11.60	158.00	10.83	168.80	158.80
10	NEWANA	95.40	26.26	39.39	60.89	10.82	165.30	3.11	168.40	158.40
06	HI-LINE	96.17	25.72	37.35	60.49	11.38	157.70	8.89	166.60	156.60
13	RAMBO	96.18	25.73	36.76	61.47	11.41	156.70	9.51	166.20	156.20
02	BORDER	93.67	26.71	34.05	59.83	12.36	151.50	11.73	163.20	153.20
03	FORTUNA	97.67	32.24	32.84	60.84	11.84	140.50	9.83	150.30	140.30
08	LEW	98.27 **	33.45 **	32.68 **	61.27 **	11.32 **	134.80 **	9.59 **	144.40 *	134.40 *
	F =	6.05	65.51	2.51	17.30	6.08	2.24	2.26	2.04	2.04
	P =	.0000	.0000	.0037	.0000	.0000	.0098	.0090	.0204	.0204
	LSD (.05) =	2.79	1.07	4.06	.42	.55	18.16	5.21	19.46	19.46
	GRAND MEANS (180 obs)	94.90	29.04	37.07	60.42	11.68	158.50	10.02	168.50	158.50
	Year x Fertility Interactions (P)	.0000	.0000	.0336	.0000	.0000	.4921	.0000	.0000	.0000
	Year x Variety Interactions (P)	.0000	.0000	.0290	.0000	.2219	.0192	.1484	.0356	.0356
	Fertility x Variety Interactions (P)	.6940	.0130	.3368	.0000	.3240	.3310	.0309	.4742	.4742
	Yr x Fert x Variety Interactions (P)	.6118	.0004	.6484	.4794	.7772	.6591	.1497	.5408	.5408

1/ Yield x CY Ave PNW price for "milling wheat" @ min quoted protein (12%), or "feed wheat" (<12%)
2/ Yield x CY Ave PNW price premium (quarter-ups calculated) for protein >12% and <=15%
3/ Gross Rtn w/protein premium, if any; AFTER fertilizer material costs (1994=$18.11/Ac,1995=$21.88/Ac)

Hr
GRC
1

TABLE 5. FACTORIAL SUMMARY OF RELATIVE AGRONOMIC AND ECONOMIC PERFORMANCE OF 15 *"FERTILIZED"* HARD RED SPRING WHEAT VARIETIES GROWN 2 YEARS UNDER DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1995.

ID	YEAR/VARIETY	STAND 1/	PLNT HT	YIELD	TEST WT	PROTEIN	$GROSS >FERT$s	ADDED $RTN >FERT$s	ADDED $RTN /FERT$
		--- *Percent of Unfertilized Performance* ----							
		(%)	(%)	(%)	(%)	(%)	(%) 2/	($/Ac) 3/	($) 4/
	FACTOR ANALYSIS - FACTOR 1 = YEAR *(across 15 varieties)*								
1	1994	96.43	107.00	137.40	94.12	157.80	193.50	74.39	4.11
2	1995	100.70	112.70	136.40	95.67	108.40	128.40	42.01	1.92
		**	**	ns	**	**	**	**	**
	F =	13.83	16.83	.05	44.83	594.63	140.28	35.37	70.52
	P =	.0000	.0000	.8296	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	2.32	2.81	9.17	.46	4.06	11.01	10.90	.52
	FACTOR ANALYSIS - FACTOR 2 = VARIETY *(across 2 years)*								
12	PONDERA	99.30	111.40	164.80	95.47	126.60	195.40	93.74	4.73
05	GRANDIN	99.72	112.70	140.80	93.85	131.10	168.30	67.88	3.49
15	WESTBRED 926	100.30	111.40	135.50	93.85	134.70	169.70	65.88	3.45
06	HI-LINE	97.98	109.80	144.10	93.90	136.70	164.50	68.74	3.43
09	McNEAL	97.02	112.00	135.70	95.58	139.50	162.20	64.83	3.27
04	GLENMAN	101.10	103.40	147.30	94.95	132.70	160.30	63.07	3.22
13	RAMBO	99.67	110.90	137.50	94.58	136.70	167.10	58.11	3.05
14	STOA	99.03	110.20	127.70	93.50	141.40	158.60	55.97	2.93
02	BORDER	93.85	111.70	136.10	93.73	127.40	159.60	56.15	2.89
03	FORTUNA	98.42	116.30	136.00	98.20	132.80	155.40	53.24	2.74
07	LEN	100.90	105.00	124.10	93.55	127.30	155.70	50.40	2.67
10	NEWANA	98.23	107.70	144.60	94.12	130.60	151.20	50.72	2.61
11	ERNEST	98.72	104.80	127.20	95.85	131.20	153.50	47.28	2.56
01	AMIDON	96.28	105.30	128.00	95.60	127.10	147.20	41.68	2.23
08	LEW	98.28	115.30	123.80	96.67	141.10	145.90	35.33	1.95
		ns	*	ns	**	ns	ns	ns	ns
	F =	.69	2.02	1.46	8.96	1.67	1.26	1.71	1.68
	P =	.7746	.0316	.1543	.0000	.0867	.2604	.0786	.0853
	LSD (.05) =	6.35	7.70	25.12	1.27	11.11	30.15	29.85	1.43
	GRAND MEANS (90 obs)	98.59	109.90	136.90	94.89	133.10	161.00	58.20	3.01
	Yr x Variety Interactions (P)	.6566	.0011	.3586	.3365	.5130	.3088	.1077	.1201

1/ Fertilized performance expressed as percent of the same variety's unfertilized performance.
2/ Fertilized Gross $ Return after Fertilizer Costs (expressed as % of unfertilized pair mate).
3/ Additional Gross $ Return/Ac (over unfertilized pair mate) after meeting fertilizer costs.
4/ Additional $ Return Impact for each Fertilzer $ Invested.

Fertilized Spring Wheat Performance
(Relationships with Unfertilized Pairs)
Leon Cederberg Farm, Turner - 1994-95

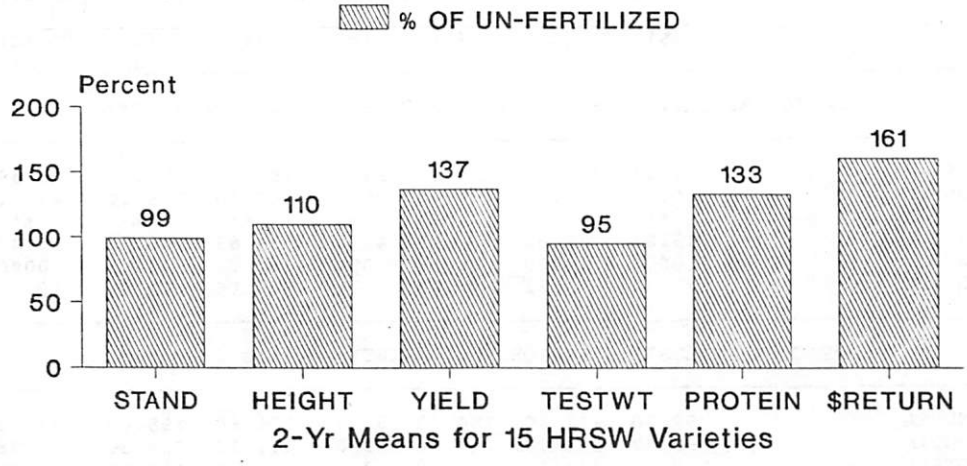

Figure 1.
MSU/AES/NARC-Havre

Fertilized vs Unfertilized Spring Wheat
(Gross $ Rtn, Base + Protein Premium)
Leon Cederberg Farm, Turner - 1994-95

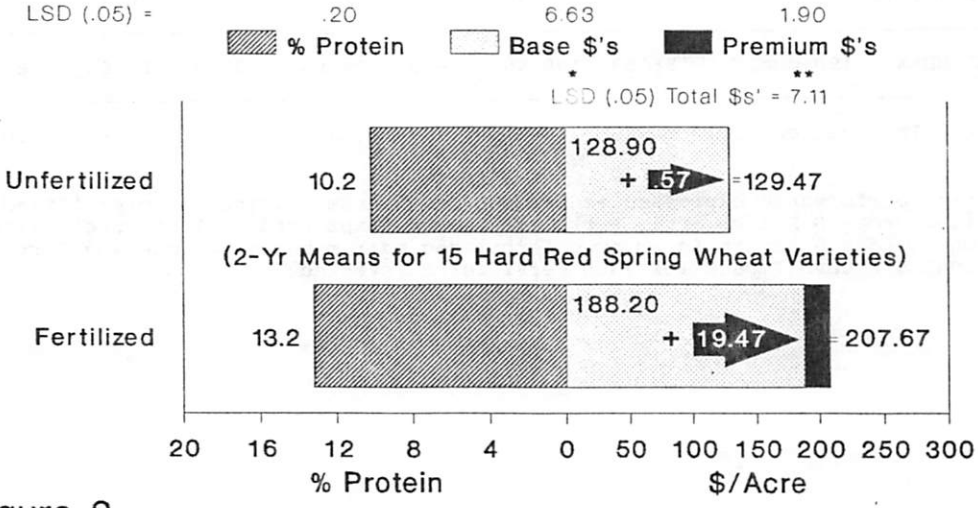

Figure 2.
MSU/AES/NARC-Havre

* @ Ave. Annual PNW Min. Quote milling(12%), or feed(<12%)
** @ Ave. Annual PNW Premium Quote (>12% and <=15% prot)

Fertilized vs Unfertilized Spring Wheat

(Gross $Rtn x Soil+Fert N Relationships)

Leon Cederberg Farm, Turner - 1994-95

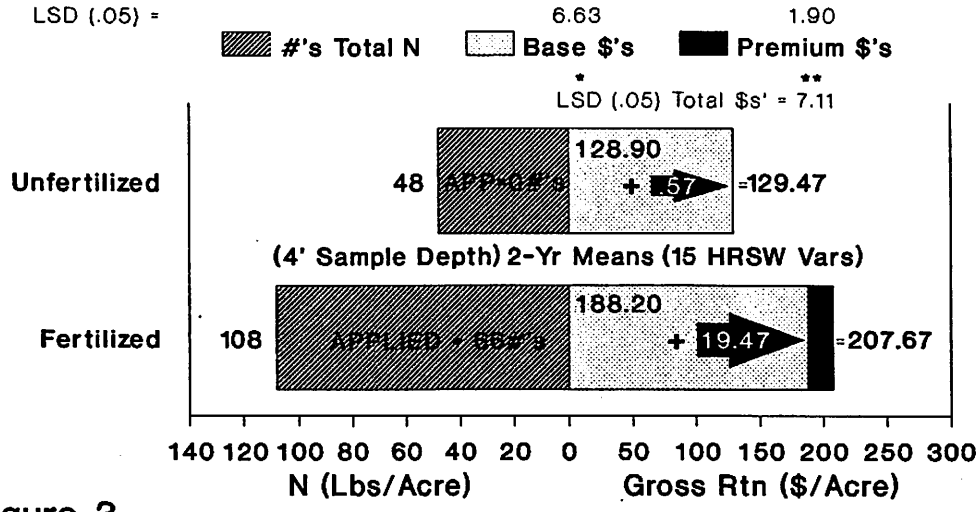

Figure 3.
MSU/AES/NARC-Havre

* @ Ave. Annual PNW Min. Quote milling(12%), or feed(<12%)
** @ Ave. Annual PNW Premium Quote (>12% and <=15% prot)

Fertilized vs Unfertilized Spring Wheat

(Gross $Rtn vs $Rtn After Fert Costs)

Leon Cederberg Farm, Turner - 1994-95

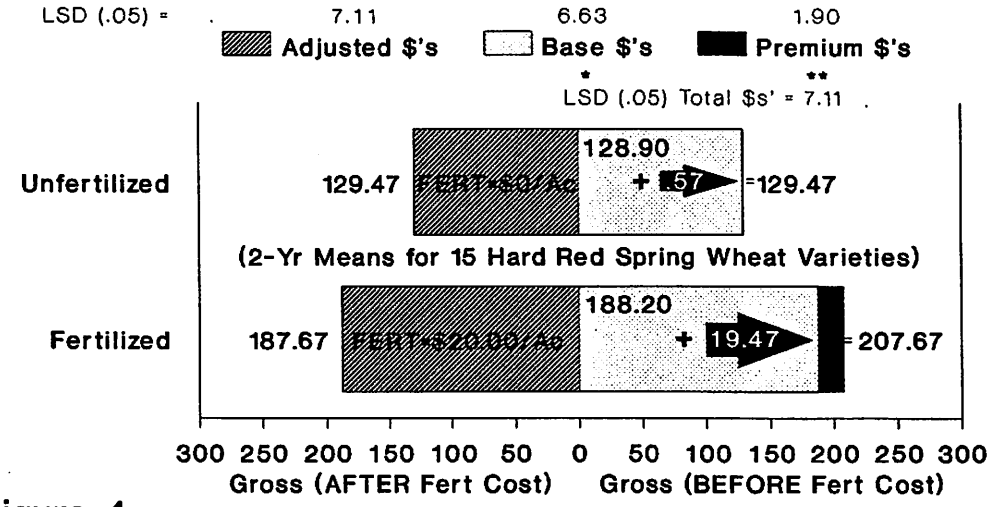

Figure 4.
MSU/AES/NARC-Havre

* @ Ave. Annual PNW Min. Quote milling(12%), or feed(<12%)
** @ Ave. Annual PNW Premium Quote (>12% and <=15% prot)

Hr
GRC
4

TABLE 6. ***"UNFERTILIZED"*** DRYLAND FALLOW BARLEY VARIETY EVALUATION NURSERY GROWN OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1996.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
H1851195	H1851195	80.90	17.83	42.60	48.47	94.47	1.57	8.47
PI537438	Targhee	85.43	17.13	40.70	48.07	88.63	3.37	7.83
MT886610	MT886610	85.07	17.98	40.43	48.53	82.03	5.97	9.40
ND 9866	Stark	88.57	17.62	37.70	50.63	95.67	1.03	8.43
H3860224	H3860224	78.50	17.90	37.13	48.50	90.80	2.87	9.47
CI 9558	Piroline	94.10	17.83	37.07	49.83	80.97	3.90	9.50
NS 78054	Baronesse	92.00	15.68	36.93	49.23	91.33	2.37	8.17
PI591823	Chinook	89.57	17.66	36.50	48.23	78.00	7.00	7.77
PI483237	Bowman	85.07	18.11	35.47	49.63	94.43	1.50	8.43
SK 76333	Harrington	87.50	16.54	35.33	49.37	93.77	1.53	8.40
CI 15514	Hector	86.80	18.96	34.47	48.77	84.80	5.60	8.40
CI 15856	Lewis	90.97	17.49	34.13	49.90	86.97	4.37	8.20
N1123111	Logan	93.77	16.46	33.80	48.50	94.10	1.30	7.93
PI491534	Gallatin	85.40	16.93	31.97	49.70	89.67	2.87	8.50
CI 15229	Steptoe	95.50	13.70	31.20	44.40	85.70	4.23	8.50
MN 56	Stander	83.33	15.41	29.17	47.90	91.77	2.13	8.50
EXPERIMENTAL MEANS		87.65	17.08	35.91	48.73	88.94	3.23	8.49
C.V. 2: (S OF MEAN/MEAN)*100		5.76	4.45	6.94	.78	2.45	23.83	4.86
LSD (0.05)		14.58	2.20	7.20	1.09	6.29	2.22	1.19

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 96-3650-SB Field: OffSta Design: __RCB__ # Ents: 16 # Reps: 3 Plot-Obsrv: 54 sqft. Hvst-Obsrv: 48 sqft.
Qtr: ____SE____ Section: 13 Twnshp: 36 N Range: 25 E Latitude: 48.88 N Longitude: 108.39 W Elevation: 2900 ft.

Seeding Date: 05/13/96 Sd'g Depth: 1.50 in. Depth to Moisture @ Sd'g: 0.50 in. Moist Soil Depth @ Sd'g: 55.0+ in.
Soil Temp @ Sd'g: __.__F @ 1 in. 59.0F @ 2 in. 56.0F @ 4 in. Soil Texture: SCL Soil Series: _____
Cropping System: _X_ Fallow ___ Recrop _X_ Full-Till ___ Reduced-Till ___ No-Till # Tillages: 4 # Chem Apps: 0
Cropping System Details: __1995 Fallow Season = 3x Tillage w/Sweeps & Harrows, 1x Tillage w/Sweeps, Rods & Harrows__
Cropping History: 1 Yr Ago = 95 = ____Fallow____ 2 Yrs Ago = 94 = _____Durum____ 3 Yrs Ago = 93 = ____Fallow____
Fertilizer: 0#N, 0#P2O5, 0#K2O/ac _____ Herbicide: _'BanvelSGF'+LV6 @4.26+6.4oz/ac_
Harvest Date: 09/04/96 Root Penetration Depth: 30 in. Comments: _____

Depth	PRE-PLANT SOIL ANAL 05/13/96 Max Depth=48"								__/__/__	POST-HVST SOIL ANAL 10/18/96 (Max Depth=48"							
	in. PAW	pH	% OM	Lb/a NO3	ppm P	ppm K	ppm S	Soil Text	CEC Txt	in. PAW	in. PAW	pH	% OM	Lb/a NO3	ppm P	ppm K	ppm S	Soil Text	CEC Txt
0 -6"	.91	6.1	1.6	14	17	319	4	SCL-	21.7	_____	.94	6.4	1.4	4	20	355	11	SCL	21.8
6-24"	2.74			18			11	SCL-		_____	2.54			6			12	SCL	
24-36"	1.63			8				SCL-		_____	.94			4				SCL	
36-48"	1.70			4				SCL-		_____	1.08			4				SCL	
TOTAL:	6.98			44							5.50			18					

Precipitation & Stored Soil Water Summary: 05/13/96 to Sd'g: 0.00 in. (0.00 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 6.98 in.
05/11/95 to Hvst: 3.62 in. (2.89 in events =>.1 in.) Measured Resid Soil Water @10/18: 5.50 in.
Growing Season (05/13/96 to 14 days prior to Harvest Maturity: 3.62 in.) (2.89 in events =>.1 in.)
Post-Grwg Seas (14 days prior to Harvest Maturity to 10/18/96: 2.63 in.) (2.40 in events =>.1 in.)
Adj'd Summary: Init GS H2O Inv + 'Init GS Inv to Smpl' Prec - Smpl Resid H2O - 'PostGS' Prec (Calc'd ET: 7.73 in.)

Hr
GRC
4

TABLE 7. ***"FERTILIZED"*** DRYLAND FALLOW BARLEY VARIETY EVALUATION NURSERY GROWN OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1996.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
PI483237	Bowman	80.93	19.61	49.43	49.97	96.03	.73	12.93
CI 15514	Hector	81.60	20.67	43.77	47.93	82.80	4.93	13.13
PI568246	Baronesse	90.60	16.71	43.43	48.93	92.17	1.40	14.77
H1851195	H1851195	87.17	17.15	42.63	47.77	90.20	2.07	14.57
CI 15229	Steptoe	90.63	16.82	42.47	42.07	83.77	5.20	11.40
MN 56	Stander	61.13	18.90	41.63	45.87	88.73	2.60	12.67
PI537438	Targhee	86.80	18.56	41.17	47.53	86.97	4.13	13.60
CI 15856	Lewis	87.87	17.98	40.90	49.07	84.63	4.70	14.03
ND 9866	Stark	89.23	18.83	39.33	49.67	96.63	.93	12.97
PI591823	Chinook	92.37	16.43	38.97	47.80	74.83	6.80	14.07
N1123111	Logan	88.53	19.00	38.93	48.47	87.97	2.70	13.20
H3860224	H3860224	88.53	18.37	38.67	47.70	89.47	3.13	14.13
PI491534	Gallatin	90.27	19.36	36.47	48.40	81.10	5.40	12.73
CI 9558	Piroline	95.13	19.45	34.47	48.00	69.07	7.73	14.40
MT886610	MT886610	94.10	18.90	33.90	48.67	81.80	6.07	13.67
SK 76333	Harrington	89.23	17.52	32.10	47.20	85.43	4.17	14.13
EXPERIMENTAL MEANS		87.13	18.39	39.89	47.81	85.73	3.92	13.52
C.V. 2: (S OF MEAN/MEAN)*100		6.46	4.82	7.88	.83	1.54	14.97	1.40
LSD (0.05)		16.27	2.56	9.08	1.15	3.81	1.69	.55

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 96-3651-SB Field: OffSta Design: __RCB__ # Ents: 16 # Reps: 3 Plot-Obsrv: 54 sqft. Hvst-Obsrv: 48 sqft.
Qtr: ____SE____ Section: 13 Twnshp: 36 N Range: 25 E Latitude: 48.88 N Longitude: 108.39 W Elevation: 2900 ft.

Seeding Date: 05/13/96 Sd'g Depth: 1.50 in. Depth to Moisture @ Sd'g: 0.50 in. Moist Soil Depth @ Sd'g: 55.0+ in.
Soil Temp @ Sd'g: __._F @ 1 in. 59.0F @ 2 in. 56.0F @ 4 in. Soil Texture: SCL Soil Series: _____
Cropping System: _X_ Fallow ___ Recrop _X_ Full-Till ___ Reduced-Till ___ No-Till # Tillages: 4 # Chem Apps: 0
Cropping System Details: __1995 Fallow Season = 3x Tillage w/Sweeps & Harrows, 1x Tillage w/Sweeps, Rods & Harrows__
Cropping History: 1 Yr Ago = 95 = ____Fallow____ 2 Yrs Ago = 94 = ____Durum____ 3 Yrs Ago = 93 = ____Fallow____
Fertilizer: 71#N,35#P2O5, 0#K2O/ac via gran.blend bnd'd 1.5" below seed_ Herbicide: _'BanvelSGF'+LV6 @4.26+6.4oz/ac_
Harvest Date: 09/04/96 Root Penetration Depth: 40 in. Comments: __Pre-Plant Soil Analysis was Pre-Fertilization___

Depth	PRE-PLANT SOIL ANAL 05/13/96 Max Depth=48"								__/__/__	POST-HVST SOIL ANAL 10/18/96 (Max Depth=48"							
	in. PAW	pH	% OM	Lb/a NO3	ppm P	ppm K	ppm S	Soil Text	CEC Txt	in. PAW	in. PAW	pH	% OM	Lb/a NO3	ppm P	ppm K	ppm S	Soil Text	CEC Txt
0 -6"	.83	5.7	2.0	20	25	341	5	SCL-	21.7	_____	.88	6.1	1.4	10	35	330	11	SCL	21.7
6-24"	3.12			18			13	CL-		_____	2.48			30			14	SCL	
24-36"	2.05			12				CL		_____	.70			12				SCL-	
36-48"	1.81			4				CL		_____	1.05			24				SCL	
TOTAL:	7.81			54						_____	5.11			76					

Precipitation & Stored Soil Water Summary: 05/13/96 to Sd'g: 0.00 in. (0.00 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 7.81 in.
05/13/95 to Hvst: 3.62 in. (2.89 in events =>.1 in.) Measured Resid Soil Water @ Hvst: 3.24 in.
Growing Season (05/13/96 to 14 days prior to Harvest Maturity: 3.62 in.) (2.89 in events =>.1 in.)
Post-Grwg Seas (14 days prior to Harvest Maturity to 10/18/96: 2.63 in.) (2.40 in events =>.1 in.)
Adj'd Summary: Init GS H2O Inv + 'Init GS Inv to Smpl' Prec - Smpl Resid H2O - 'PostGS' Prec (Calc'd ET: 8.95 in.)

Hr
GRC
1

TABLE 8. 1/ *TWO-YEAR* AGRONOMIC PERFORMANCE SUMMARY FOR *16 SPRING BARLEY VARIETIES* GROWN UNDER *FERTILIZED VS. UNFERTILIZED* DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1995.

ID	FERTILITY	VARIETY	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
32	FERTILIZED	STEPTOE	92.72	25.14	66.95	42.25	77.82	9.00	10.58
17	FERTILIZED	BARONESSE	92.53	24.98	63.43	48.02	77.04	8.77	11.82
29	FERTILIZED	H3860224	88.55	27.01	60.03	46.89	84.18	7.25	11.75
25	FERTILIZED	MT851195	93.75	27.42	58.42	48.25	82.30	6.15	11.91
30	FERTILIZED	PIROLINE	95.15	27.94	58.06	50.45	77.00	7.07	10.99
28	FERTILIZED	MT890008	97.07	25.85	58.05	46.15	74.96	9.18	10.85
31	FERTILIZED	STARK	96.54	28.17	58.00	50.93	92.37	3.03	11.48
20	FERTILIZED	COLTER	93.04	26.45	56.07	43.32	57.40	18.31	10.00
27	FERTILIZED	MT889106	88.87	27.60	55.55	49.85	92.62	3.12	11.86
19	FERTILIZED	CHINOOK	90.63	26.93	54.26	47.70	72.01	11.51	12.01
18	FERTILIZED	BOWMAN	89.92	26.64	53.93	49.74	90.55	3.78	11.83
24	FERTILIZED	LEWIS	90.63	28.08	53.74	48.52	77.93	8.83	11.93
26	FERTILIZED	MT886610	92.72	28.30	53.58	47.49	73.47	11.72	11.85
22	FERTILIZED	HARRINGTON	92.35	26.20	53.45	45.93	73.71	10.27	11.74
21	FERTILIZED	GALLATIN	92.18	28.05	52.40	48.74	70.85	11.16	11.25
01	UNFERTILIZED	BARONESSE	92.89	21.60	50.95	50.39	93.45	2.26	8.07
23	FERTILIZED	HECTOR	91.67	29.35	49.05	47.47	71.32	12.61	11.95
04	UNFERTILIZED	COLTER	84.71	22.02	48.26	46.62	85.45	5.27	7.93
13	UNFERTILIZED	H3860224	91.67	22.73	47.13	49.43	92.87	2.83	8.45
16	UNFERTILIZED	STEPTOE	94.63	20.90	47.08	44.83	90.35	3.50	8.58
02	UNFERTILIZED	BOWMAN	84.90	24.81	46.83	51.42	96.51	1.46	9.02
03	UNFERTILIZED	CHINOOK	87.30	23.85	46.65	50.63	90.62	3.73	8.60
06	UNFERTILIZED	HARRINGTON	89.23	22.81	45.51	49.10	93.05	2.48	8.50
14	UNFERTILIZED	PIROLINE	94.27	24.04	45.28	51.93	92.33	2.20	8.15
09	UNFERTILIZED	MT881195	89.76	23.97	45.03	49.25	94.67	2.48	8.58
08	UNFERTILIZED	LEWIS	84.55	23.92	44.75	50.75	88.67	5.00	8.45
10	UNFERTILIZED	MT886610	90.99	23.67	44.55	50.26	89.00	4.45	8.26
12	UNFERTILIZED	MT890008	94.27	21.89	44.22	48.68	89.90	4.35	7.98
07	UNFERTILIZED	HECTOR	90.96	23.69	41.52	49.35	85.30	6.98	8.93
05	UNFERTILIZED	GALLATIN	94.45	24.26	41.35	50.97	92.26	2.45	8.13
15	UNFERTILIZED	STARK	88.38	23.42	40.64	52.15	94.74	2.41	8.76
11	UNFERTILIZED	MT889106	91.83	23.65	38.83	51.77	96.00	1.77	9.05

STATISTICAL SUMMARY	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
OVERALL MEANS	91.35	25.17	50.74	48.73	84.71	6.11	9.98
F-RATIO, TMTS	.91	7.48	1.68	19.23	11.71	9.65	3.23
P-VALUE, TMTS	.6061	.0000	.0756	.0000	.0000	.0000	.0008
CV (SE/MEAN)%	3.64	3.34	10.65	1.13	3.35	21.35	8.97
LSD (0.05)	9.59	2.42	15.58	1.59	8.18	3.76	2.58

1/ Analyzed with Years as Reps for "Year x Tmt" Means arising from the original analysis of field trials conducted annually with 3 replications.

Hr
GRC
1

TABLE 9. FACTORIAL SUMMARY OF AGRONOMIC PERFORMANCE OF *16 SPRING BARLEY VARIETIES* GROWN *2 YEARS* UNDER *FERTILIZED VS. UNFERTILIZED* DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1995.

ID	YEAR/FERTILITY/VARIETY	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
	FACTOR ANALYSIS - FACTOR 1 = YEAR *(across 2 fertility schemes & 16 varieties)*							
2	1995	88.66	29.00	56.60	49.33	88.34	4.96	9.85
1	1994	94.03	21.34	44.87	48.12	81.08	7.26	10.11
		**	**	**	**	**	**	**
	F =	52.73	1154.1	141.41	100.45	132.44	42.24	19.06
	P =	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	1.46	.45	1.95	.24	1.25	.70	.12
	FACTOR ANALYSIS - FACTOR 2 = FERTILITY SCHEME *(across 2 years & 16 varieties)*							
2	FERTILIZED	92.39	27.13	56.56	47.60	77.85	8.86	11.49
1	UNFERTILIZED	90.30	23.20	44.91	49.85	91.57	3.35	8.47
		**	**	**	**	**	**	**
	F =	8.02	304.03	139.56	348.11	472.87	242.71	2672.5
	P =	.0054	.0000	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	1.46	.45	1.95	.24	1.25	.70	.12
	FACTOR ANALYSIS - FACTOR 3 = VARIETY *(across 2 years & 2 fertility schemes)*							
01	BARONESSE	92.71	23.29	57.19	49.20	85.24	5.52	9.94
16	STEPTOE	93.68	23.02	57.02	43.54	84.08	6.25	9.58
13	H3860224	90.11	24.87	53.58	48.16	88.52	5.04	10.10
04	COLTER	88.88	24.24	52.17	44.97	71.42	11.79	8.97
09	MT851195	91.76	25.69	51.73	48.75	88.48	4.32	10.25
14	PIROLINE	94.71	25.99	51.68	51.19	84.67	4.63	9.57
12	MT890008	95.67	23.87	51.13	47.42	82.43	6.77	9.42
03	CHINOOK	88.97	25.39	50.46	49.17	81.32	7.62	10.31
02	BOWMAN	87.41	25.73	50.38	50.58	93.53	2.62	10.43
06	HARRINGTON	90.79	24.50	49.48	47.52	83.38	6.37	10.12
15	STARK	92.46	25.79	49.32	51.54	93.55	2.72	10.13
08	LEWIS	87.59	26.00	49.24	49.63	83.30	6.92	10.19
10	MT886610	91.85	25.99	49.07	48.88	81.23	8.08	10.06
11	MT889106	90.35	25.63	47.19	50.81	94.31	2.44	10.46
05	GALLATIN	93.32	26.15	46.88	49.85	81.56	6.81	9.69
07	HECTOR	91.32	26.52	45.28	48.41	78.31	9.80	10.44
		**	**	**	**	**	**	**
	F =	2.65	5.68	2.73	79.55	22.48	13.02	13.08
	P =	.0016	.0000	.0012	.0000	.0000	.0000	.0000
	LSD (.05) =	4.14	1.26	5.52	.67	3.53	1.98	.33
	GRAND MEANS (192 obs)	91.35	25.17	50.74	48.73	84.71	6.11	9.98
	Year x Fert Interactions (P)	.0000	.0000	.0000	.0000	.0000	.0054	.0000
	Year x Variety Interactions (P)	.2465	.4284	.0268	.0053	.0129	.3559	.0000
	Fert x Variety Interactions (P)	.0962	.5987	.4565	.0236	.0000	.0000	.0000
	Yr x Fert x Var Interactions (P)	.7746	.6275	.8565	.0812	.0228	.0321	.0640

Hr
GRC
1

TABLE 10. FACTORIAL SUMMARY OF RELATIVE AGRONOMIC PERFORMANCE OF 16 *"FERTILIZED"* SPRING BARLEY VARIETIES GROWN 2 YEARS UNDER DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1995.

ID	YEAR/VARIETY	STAND	PLNT HT 1/	YIELD	TEST WT	PLUMP	THIN	PROTEIN
		------ *Percent of Unfertilized Performance* ------						
		(%)	(%)	(%)	(%)	(%)	(%)	(%)
	FACTOR ANALYSIS - FACTOR 1 = YEAR *(across 16 varieties)*							
1	1994	96.91	128.40	171.10	94.34	81.99	330.50	161.10
2	1995	109.40	110.50	106.50	96.63	88.02	276.30	114.70
		**	**	**	**	**	*	**
	F =	54.58	55.15	66.14	29.37	16.62	5.57	953.92
	P =	.0000	.0000	.0000	.0000	.0000	.0214	.0000
	LSD (.05) =	3.38	4.82	15.88	.84	2.96	45.91	3.00
	FACTOR ANALYSIS - FACTOR 2 = VARIETY *(across 2 years)*							
16	STEPTOE	98.25	127.10	159.60	94.22	85.98	264.60	124.60
15	STARK	109.70	122.50	153.90	97.70	97.55	163.10	133.00
11	MT889106	96.93	119.60	151.00	96.32	96.48	194.10	133.50
07	HECTOR	100.90	125.70	146.30	96.28	86.58	295.20	135.20
12	MT890008	103.20	120.70	142.20	94.83	83.30	211.90	138.80
05	GALLATIN	98.02	117.10	139.20	95.62	76.78	460.60	140.20
09	MT851195	105.40	116.50	139.10	97.97	86.95	262.10	141.50
13	H3860224	97.07	120.50	138.80	94.87	90.57	279.30	140.40
14	PIROLINE	101.30	117.00	137.20	97.15	83.30	340.60	136.70
03	CHINOOK	104.80	116.60	135.00	94.23	79.35	371.60	142.50
08	LEWIS	108.50	120.60	133.80	95.63	88.43	251.30	142.60
04	COLTER	112.20	124.00	132.90	92.90	67.02	354.10	127.60
06	HARRINGTON	104.40	116.80	132.50	93.58	79.12	437.40	140.60
01	BARONESSE	100.20	117.70	130.70	95.33	82.22	373.80	150.30
10	MT886610	103.20	121.10	130.50	94.45	82.57	301.10	145.70
02	BOWMAN	106.40	108.10	117.70	96.72	93.83	294.30	133.30
		*	ns	ns	**	**	**	**
	F =	1.84	.86	.42	2.99	6.81	3.25	4.78
	P =	.0480	.6046	.9692	.0012	.0000	.0005	.0000
	LSD (.05) =	9.56	13.63	44.91	2.39	8.37	129.90	8.48
	GRAND MEANS (96 obs)	103.20	119.50	138.80	95.50	85.00	303.40	137.90
	Yr x Variety Interactions (P)	.4570	.4427	.9673	.0317	.0218	.2055	.0196

1/ Fertilized performance expressed as percent of same variety's unfertilized performance.

Fertilized Spring Barley Performance

(Relationships with Unfertilized Pairs)

Leon Cederberg Farm, Turner - 1994-95

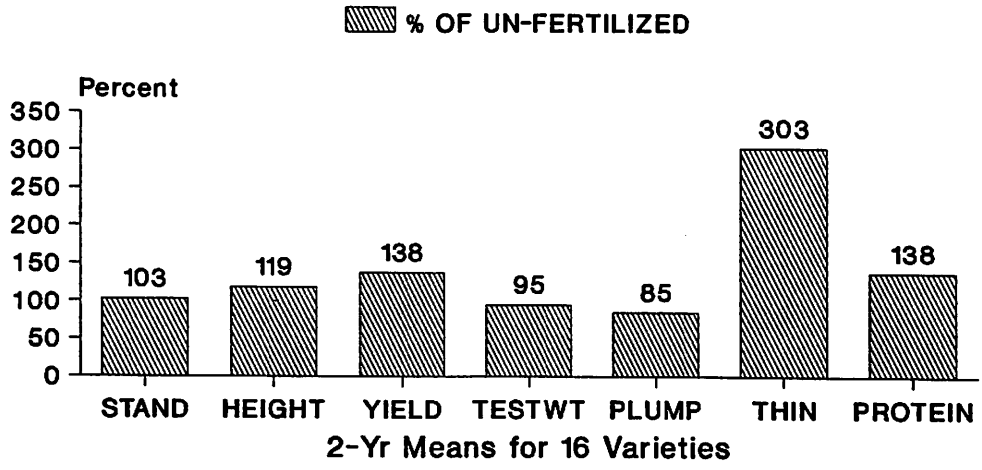

Figure 5.
MSU/AES/NARC-Havre