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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:
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S.R. Williams, Blaine CEA - Chinook
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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 1997 in terms of both yield and protein. 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, 1994-1998).

Agronomic performance data for 23 spring wheat cultivars grown in 1997, "Unfertilized" are presented in Table 1, and 4-yr comparable average yield and test weight performance featuring all varieties having been grown for at least three of the four years are presented in Table 2. 1997 performance data in an identical format for the same cultivars, "Fertilized" are presented in Tables 3 and 4. Figures 1 and 2 show annual mean spring wheat yield and protein relationships among fertility scenarios over the four years studied to date.

Agronomic performance data for 16 spring barley cultivars grown in 1997, "Unfertilized" are presented in Table 5, and 4-yr comparable average yield and test weight performance featuring all varieties having been grown for at least three of the four years are presented in Table 6. 1997 performance data in an identical format for the same cultivars, "Fertilized" are presented in Tables 7 and 8. Figures 3 and 4 show annual mean barley yield and protein relationships among fertility scenarios over the four years.

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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 until 1997 when a `Wintersteiger 1541-21' plot combine (partially funded by MWBC) replaced the former machine. Other variables specific to the trials are listed in the respective data tables.

An in-depth factorial analysis completed in 1996 after the second year of the trials revealed highly significant, positive economic impacts due to fertilization (over $3 returned per fertilizer dollar invested for spring wheat). Those data were presented in considerable detail in previous MWBC reports.

FUTURE PLANS:

These investigations will be continued on-site for one additional data year to complete the 5-year database as initially planned. Following the fifth and final year a comprehensive summary report will be prepared detailing all agronomic and economic performance data gathered over the entire project period. Depending upon final results, related investigations may be initiated under other environments. Such investigations may include use of an air drill with fewer cultivars and varying levels of fertility.

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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. 1997.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %
BZ684-23	VANNA (soft white)	97.23	25.52	43.33	59.47	8.20
MTHW9520	CAN1/MT8182 (hard white)	99.30	26.47	37.47	60.57	8.47
ND 606	AMIDON	99.30	30.21	36.03	59.57	11.57
CI 17790	LEN	99.30	26.68	35.60	60.30	12.47
MTHW9420	MT8182/MT8289 (hard white)	98.27	25.21	34.73	60.00	12.03
ND 673	TRENTON	98.60	30.18	34.33	60.37	12.37
ND 626	GRANDIN	95.13	27.13	34.33	61.17	11.00
MT 9433	MT8808/MARBERG	100.00	29.71	33.70	61.37	11.80
PI549275	HI-LINE	99.30	26.08	32.73	61.00	11.17
WB 926	WESTBRED 926	96.87	22.91	32.53	60.37	12.67
PI574642	McNEAL	100.00	25.85	31.27	60.67	10.77
ND 582	STOA	100.00	29.00	31.23	59.70	10.93
CI 17430	NEWANA	100.00	23.39	30.80	61.33	11.47
CI 17429	LEW	100.00	31.31	30.47	60.13	11.27
WBEXPRES	WESTBRED EXPRESS	98.97	21.92	30.47	60.57	11.27
ND 677	ERNEST	98.97	28.83	29.93	59.50	10.93
C982-324	RAMBO	95.87	25.00	29.70	61.47	11.33
TR983239	FERGUS	99.30	24.95	29.60	61.03	12.73
WB 936	WESTBRED 936	95.83	21.64	29.20	60.43	11.43
PI483235	GLENMAN	100.00	25.56	28.93	59.27	11.13
PNR 2375	PIONEER 2375	92.70	25.17	28.50	60.13	11.00
MT 9508	FORTUNA/PONDERA//PONDERA	99.67	24.86	27.90	60.37	12.30
CI 13596	FORTUNA	98.97	30.62	25.47	58.83	12.57
	EXPERIMENTAL MEANS	98.42	26.44	32.10	60.33	11.34
	C.V. 2: (S OF MEAN/MEAN)*100	1.15	2.94	7.07	.68	4.35
	LSD (0.05)	3.23	2.22	6.47	1.17	1.41

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 97-9950-SW Field: OffSta Design: __RCB__ # Ents: 23 # 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: 05/12/97 Sd'g Depth: 1.25 in. Depth to Moisture @ Sd'g: 1.00 in. Moist Soil Depth @ Sd'g: 55.0+ in.
Soil Temp @ Sd'g: ___.F @ 1 in. 72.0F @ 2 in. 68.0F @ 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: __1996 Fallow Season = 3x Tillage w/Sweeps, Spring 1997 = 1x Tillage w/Sweeps & Rods_____
Cropping History: 1 Yr Ago = 96 = ____Fallow____ 2 Yrs Ago = 95 = _Spring Wheat_ 3 Yrs Ago = 94 = ____Fallow____
Fertilizer: 0#N, 0#P2O5, 0#K2O _None Applied,Experimental "Low" Fertility_ Herbicide: LV6+'BanvelSGF' (.3+.25pt/ac)
Harvest Date: 09/13/97 Root Penetration Depth: 42 in. Comments: (Yr#4 of 5-yr"Fertility x SW Variety Evals" On-Loc)

Depth	PRE-PLANT SOIL ANAL 04/17/97 Max Depth=48"									__/__/__	POST-HVST SOIL ANAL 09/13/97 (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"	.55	6.0	2.2	18	15	383	7	SCL	21.7	_____	.54	6.1	2.0	6	16	416	8	CL-	21.8
6-24"	2.00			18			7	SCL		_____	1.52			6			8	CL	
24-36"	.89			4				SCL		_____	.89			4				CL	
36-48"	.86			4				SCL		_____	1.07			4				CL	
TOTAL:	4.30			44						_____	4.02			20					

Precipitation & Stored Soil Water Summary: 04/17/97 to Sd'g: 0.47 in. (0.23 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 4.77 in.
Sd'g to 09/13/97: 11.15 in. (10.37 in events =>.1 in.) Meas'd Resid Soil Water 09/13/97: 4.02 in.
Growing Season (05/12/97 to 14 days prior to Harvest Maturity: 10.48 in.) (9.72 in events =>.1 in.)
Post-Grwg Seas (14 days prior to Harvest Maturity to 09/13/97: 0.67 in.) (0.65 in events =>.1 in.)
Adj'd Summary: Init GS H2O Inv + 'Init GS Inv to Hvst' Prec - Hvst Resid H2O - 'PostGS' Prec (Calc'd ET: 11.23 in.)

TABLE 2. FOUR-YEAR YIELD AND TEST WEIGHT SUMMARY ON SELECTED ENTRIES FROM AN UNFERTILIZED FALLOW SPRING WHEAT VARIETY NURSERY GROWN AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1997.

		1/ YIELD (BUSHELS PER ACRE)								TEST WEIGHT (POUNDS PER BUSHEL)							
2/ VARIETY OR SELECTION	NO. OF YEARS TESTED	1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	4-YR. COMPAR. AVERAGE YIELD 3/	PERCENT OF FORTUNA YIELD 4/	1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	4-YR. COMPAR. AVERAGE TEST WT 3/	PERCENT OF FORTUNA TEST WT 4/
BZ684-23 WB VANNA(P+)(s	3	-	52.5	28.0	43.3	-	41.3	41.7	163.5	-	61.7	60.4	59.5	-	60.5	60.9	100.3
WBEXPRES WB EXPRESS (P+	3	-	42.8	22.8	30.5	-	32.1	32.4	126.9	-	62.2	61.3	60.6	-	61.4	61.8	101.7
ND 606 AMIDON	4	24.6	43.1	24.6	36.0	-	32.1	32.1	125.8	61.9	61.7	60.7	59.6	-	61.0	61.0	100.3
PNR 2375 PIONEER 2375	3	-	42.5	23.3	28.5	-	31.4	31.7	124.4	-	62.2	61.2	60.4	-	61.2	61.6	101.4
CI 17790 LEN	4	24.3	43.8	23.0	35.6	-	31.7	31.7	124.2	62.1	61.5	61.4	60.3	-	61.3	61.3	101.0
TR983239 WB FERGUS (P+)	3	-	44.3	20.1	29.6	-	31.4	31.7	124.1	-	62.8	61.5	61.0	-	61.8	62.1	102.3
WPB 926R WB 926R (P)	4	24.4	44.7	21.8	32.5	-	30.9	30.9	121.0	61.7	61.5	60.9	60.4	-	61.1	61.1	100.6
WB 936 WB 936 (P+)	3	-	40.4	21.9	29.2	-	30.5	30.8	120.8	-	61.1	60.8	60.4	-	60.8	61.1	100.6
ND 677 ERNEST (+)	4	24.7	44.6	23.5	29.9	-	30.7	30.7	120.3	62.8	62.0	62.1	59.5	-	61.6	61.6	101.4
PI574642 McNEAL	4	24.6	41.1	24.5	31.3	-	30.4	30.4	119.0	60.4	62.0	59.8	60.7	-	60.7	60.7	100.0
CI 17430 NEWANA	4	25.0	40.4	23.7	30.8	-	30.0	30.0	117.5	62.8	62.7	62.1	61.3	-	62.0	62.0	102.0
ND 582 STOA	4	25.2	40.6	22.8	31.2	-	30.0	30.0	117.5	62.2	61.6	60.4	59.7	-	61.0	61.0	100.4
ND 626 GRANDIN	4	23.5	37.7	23.4	34.3	-	29.7	29.7	116.6	62.4	61.8	62.1	61.2	-	61.9	61.9	101.9
PI483235 GLENMAN	4	26.1	39.2	24.3	28.9	-	29.6	29.6	116.2	61.2	61.3	58.8	59.3	-	60.2	60.2	99.0
PI549275 HI-LINE	4	24.1	37.5	23.9	32.7	-	29.6	29.6	115.9	62.2	62.6	60.4	61.0	-	61.6	61.6	101.3
C982-324 WB RAMBO (P+)	4	23.1	40.5	22.3	29.7	-	28.9	28.9	113.2	63.5	62.9	62.8	61.5	-	62.7	62.7	103.1
CI 17429 LEW	4	24.2	34.9	21.9	30.5	-	27.9	27.9	109.3	62.1	62.5	60.6	60.1	-	61.3	61.3	101.0
CI 13596 FORTUNA	4	26.3	29.6	20.7	25.5	-	25.5	25.5	100.0	61.8	61.0	61.3	58.8	-	60.7	60.7	100.0
MEAN (ENTRIES LISTED)		24.6	41.1	23.1	31.7	-	-	30.8	-	62.1	61.9	61.0	60.3	-	-	61.4	-
5/ Growing Season Precip. (in.)		3.93	8.71	3.62	10.48		6.69										
Soil PAW (in.) to SD at Plntng.		6.84	6.08	6.07	4.77		5.94										
Total Plant Avail. Water (in.)		10.77	14.79	9.69	15.25		12.63										
Soil NO3 (lbs.) to SD at Plntng.		28.0	66.0	44.0	44.0												
SD (Sampling Depth in inches)		48.0	48.0	48.0	48.0												
Fertilizer Applied (# N)		66.0	0.0	0.0	0.0												
(# P2O5)		33.0	0.0	0.0	0.0												

Check variety is Fortuna.

1/ See MCES Bulletin 1093 for evaluation of other important variety performance characteristics to include protein, quality, disease resistance, etc. before making variety selection decisions.

2/ P = Private variety, + = Protected variety.

3/ 4-yr. CA = (x/y) * z where x = average yield or test weight of the entry for years tested, y = average yield or test weight for Fortuna for the same years, and z = 4-yr. average yield or test weight for the check variety Fortuna.

4/ Percent of Fortuna yield or test weight for the same data years as those in which the entry was tested.

5/ Seeding to 14 days prior to harvest maturity.

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TABLE 3. *"FERTILIZED"* DRYLAND FALLOW SPRING WHEAT VARIETY EVALUATION NURSERY GROWN OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1997.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %
ND 606	AMIDON	98.97	33.73	46.53	56.93	13.27
BZ684-23	VANNA (soft white)	100.00	27.48	46.23	52.10	13.10
MT 9433	MT8808/MARBERG	100.00	31.18	45.90	58.47	13.73
PI574642	McNEAL	100.00	29.62	45.47	56.40	14.10
WB 936	WESTBRED 936	99.33	26.48	45.03	55.97	14.77
ND 582	STOA	100.00	31.42	44.37	55.33	14.50
TR983239	FERGUS	99.30	27.52	44.07	56.40	14.20
CI 17430	NEWANA	100.00	28.12	43.83	56.90	13.17
MT 9508	FORTUNA/PONDERA//PONDERA	99.67	30.52	43.73	58.40	13.80
WB 926	WESTBRED 926	99.33	27.70	43.07	55.57	14.73
ND 626	GRANDIN	97.57	29.95	42.97	55.70	14.07
WBEXPRES	WESTBRED EXPRESS	99.30	25.62	42.63	56.37	13.77
PI549275	HI-LINE	99.30	28.07	42.27	55.53	14.47
MTHW9420	MT8182/MT8289 (hard white)	99.67	25.92	42.20	55.40	14.13
ND 673	TRENTON	100.00	34.53	41.90	56.17	14.17
ND 677	ERNEST	99.30	32.70	41.77	56.23	14.40
PNR 2375	PIONEER 2375	99.30	30.04	41.63	56.97	14.03
PI483235	GLENMAN	99.30	30.34	41.53	55.87	13.03
CI 17790	LEN	99.67	28.19	40.73	56.17	14.23
MTHW9520	CAN1/MT8182 (hard white)	99.67	27.59	39.30	54.80	14.73
C982-324	RAMBO	99.67	28.33	38.03	58.03	13.93
CI 17429	LEW	100.00	32.57	37.60	57.37	13.73
CI 13596	FORTUNA	100.00	32.99	36.80	56.90	14.37
EXPERIMENTAL MEANS		99.54	29.59	42.50	56.26	14.02
C.V. 2: (S OF MEAN/MEAN)*100		.49	2.09	2.45	.59	2.34
LSD (0.05)		1.39	1.76	2.96	.94	.93

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 97-9951-SW Field: OffSta Design: __RCB__ # Ents: 23 # 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: 05/12/97 Sd'g Depth: 1.25 in. Depth to Moisture @ Sd'g: 1.00 in. Moist Soil Depth @ Sd'g: 55.0+ in.
Soil Temp @ Sd'g: __.__F @ 1 in. __.__F @ 2 in. __.__F @ 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: __1996 Fallow Season = 3x Tillage w/Sweeps, Spring 1997 = 1x Tillage w/Sweeps & Rods_____
Cropping History: 1 Yr Ago = 96 = ____Fallow____ 2 Yrs Ago = 95 = _Spring Wheat__ 3 Yrs Ago = 94 = ____Fallow____
Fertilizer: 70#N,40#P2O5, 0#K2O/ac via gran.blend banded 1.5" below seed___ Herbicide: LV6+'BanvelSGF'(.3+.25pt/ac)
Harvest Date: 09/13/97 Root Penetration Depth: 42 in. Comments: (Yr#4 of 5-yr"Fertility x SW Variety Evals" On-Loc)

Depth	PRE-PLANT SOIL ANAL 04/17/97 (Max Depth=48")									__/__/__	POST-HVST SOIL ANAL 09/13/97 (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"	.55	6.1	1.2	10	13	256	5	SCL	21.7	_____	.50	6.1	1.4	6	14	263	7	SCL	21.7
6-24"	1.91			30			14	SCL		_____	1.13			6			16	SCL	
24-36"	1.03			8				SCL		_____	.70			4				SCL	
36-48"	.91			12				SCL		_____	.50			4				VFSL	
TOTAL:	4.40			60						_____	2.83			20					

Precipitation & Stored Soil Water Summary: 04/17/97 to Sd'g: 0.47 in. (0.23 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 4.87 in.
Sd'g to 09/13/97: 11.15 in. (10.37 in events =>.1 in.) Meas'd Resid Soil Water 09/13/97: 2.83 in.
Growing Season (05/12/97 to 14 days prior to Harvest Maturity: 10.48 in.) (9.72 in events =>.1 in.)
Post-Grwg Seas (14 days prior to Harvest Maturity to 09/13/97: 0.67 in.) (0.65 in events =>.1 in.)
Adj'd Summary: Init GS H2O Inv + 'Init GS Inv to Hvst' Prec - Hvst Resid H2O - 'PostGS' Prec (Calc'd ET: 12.52 in.)

TABLE 4. FOUR-YEAR YIELD AND TEST WEIGHT SUMMARY ON SELECTED ENTRIES FROM A FERTILIZED FALLOW SPRING WHEAT VARIETY NURSERY GROWN AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1997.

2/ VARIETY OR SELECTION	NO. OF YEARS TESTED	1/ YIELD (BUSHELS PER ACRE) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	4-YR. COMPAR. AVERAGE YIELD 3/	PERCENT OF FORTUNA YIELD 4/	TEST WEIGHT (POUNDS PER BUSHEL) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	4-YR. COMPAR. AVERAGE TEST WT 3/	PERCENT OF FORTUNA TEST WT 4/
BZ684-23 WB VANNA(P+)(S	3	-	61.7	30.5	46.2	-	46.1	45.2	129.5	-	57.8	58.9	52.1	-	56.3	56.3	94.1
WB 936 WB 936 (P+)	3	-	57.9	24.2	45.0	-	42.4	41.5	119.0	-	58.3	60.2	56.0	-	58.2	58.2	97.3
PI483235 GLENMAN	4	37.5	56.8	30.1	41.5	-	41.5	41.5	118.8	57.7	58.6	59.0	55.9	-	57.8	57.8	96.5
CI 17430 NEWANA	4	36.3	55.8	29.9	43.8	-	41.5	41.5	118.8	58.6	59.5	61.5	56.9	-	59.1	59.1	98.8
WBEXPRES WB EXPRESS(P+)	3	-	56.4	27.3	42.6	-	42.1	41.3	118.2	-	59.6	59.7	56.4	-	58.5	58.6	97.9
PI574642 McNEAL	4	30.3	57.6	29.1	45.5	-	40.6	40.6	116.3	57.1	59.9	59.2	56.4	-	58.2	58.2	97.1
PNR 2375 PIONEER 2375	3	-	54.0	27.7	41.6	-	41.1	40.3	115.4	-	60.0	61.1	57.0	-	59.4	59.4	99.3
ND 606 AMIDON	4	32.3	52.1	29.3	46.5	-	40.1	40.1	114.8	58.5	59.6	60.5	56.9	-	58.9	58.9	98.3
PI549275 HI-LINE	4	30.6	57.2	29.7	42.3	-	39.9	39.9	114.4	57.3	59.8	59.8	55.5	-	58.1	58.1	97.1
WPB 926R WB 926R (P)	4	35.6	54.3	26.2	43.1	-	39.8	39.8	114.0	57.8	57.8	60.3	55.6	-	57.8	57.8	96.6
ND 677 ERNEST (+)	4	33.8	52.4	28.4	41.8	-	39.1	39.1	112.0	59.9	59.7	61.4	56.2	-	59.3	59.3	99.1
TR983239 WB FERGUS (P+)	3	-	50.8	24.4	44.1	-	39.8	39.0	111.6	-	59.0	61.3	56.4	-	58.9	59.0	98.5
ND 582 STOA	4	33.9	47.6	28.7	44.4	-	38.6	38.6	110.7	57.7	58.0	59.3	55.3	-	57.6	57.6	96.2
ND 626 GRANDIN	4	34.6	49.5	24.7	43.0	-	37.9	37.9	108.7	58.8	57.8	60.9	55.7	-	58.3	58.3	97.4
CI 17790 LEN	4	31.7	50.3	27.7	40.7	-	37.6	37.6	107.7	57.5	58.2	60.6	56.2	-	58.1	58.1	97.1
C982-324 WB RAMBO (P+)	4	34.2	49.3	25.5	38.0	-	36.8	36.8	105.3	59.7	59.8	61.2	58.0	-	59.7	59.7	99.7
CI 13596 FORTUNA	4	32.8	42.7	27.3	36.8	-	34.9	34.9	100.0	60.1	60.5	62.0	56.9	-	59.9	59.9	100.0
CI 17429 LEW	4	31.5	40.0	28.6	37.6	-	34.4	34.4	98.7	59.6	60.9	61.3	57.4	-	59.8	59.8	99.9
MEAN (ENTRIES LISTED)		33.5	52.6	27.7	42.5	-	-	39.4	-	58.5	59.1	60.5	56.2	-	-	58.6	-
5/ Growing Season Precip. (in.)		3.93	8.71	3.62	10.48		6.69										
Soil PAW (in.) to SD at Plntng.		6.84	5.09	6.01	4.87		5.70										
Total Plant Avail. Water (in.)		10.77	13.80	9.63	15.35		12.39										
Soil NO3 (lbs.) to SD at Plntng.		28.0	54.0	54.0	60.0												
SD (Sampling Depth in inches)		48.0	48.0	48.0	48.0												
Fertilizer Applied (# N)		66.0	66.0	71.0	70.0												
(# P2O5)		33.0	33.0	35.0	40.0												

Check variety is Fortuna.

1/ See MCES Bulletin 1093 for evaluation of other important variety performance characteristics to include protein, quality, disease resistance, etc. before making variety selection decisions.

2/ P = Private variety, + = Protected variety.

3/ 4-yr. CA = (x/y) * z where x = average yield or test weight of the entry for years tested, y = average yield or test weight for Fortuna for the same years, and z = 4-yr. average yield or test weight for the check variety Fortuna.

4/ Percent of Fortuna yield or test weight for the same data years as those in which the entry was tested.

5/ Seeding to 14 days prior to harvest maturity.

Mean Yields - Fallow Spring Wheat
(Unfertilized vs Fertilized)
Leon Cederberg Farm, Turner

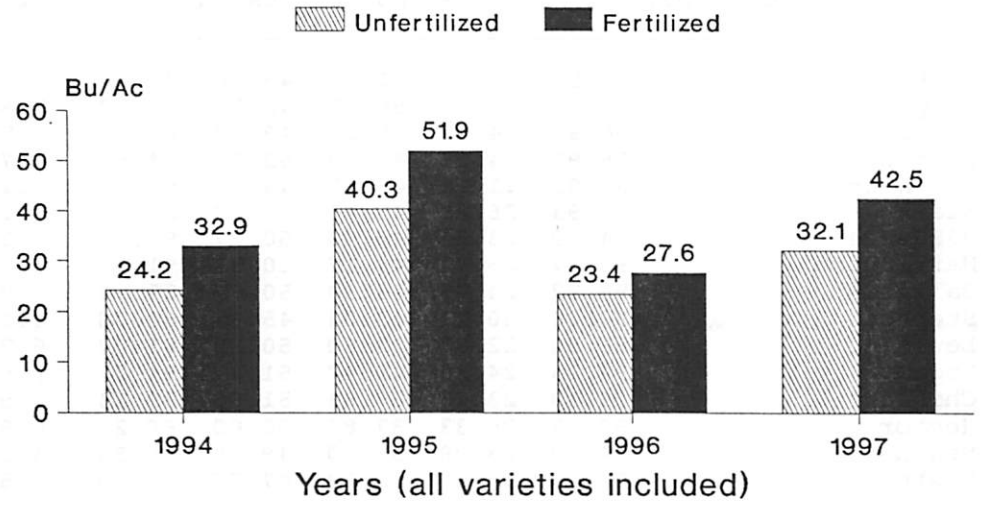

Figure 1.
MSU/AES/NARC-Havre

Mean Protein - Fallow Spring Wheat
(Unfertilized vs Fertilized)
Leon Cederberg Farm, Turner

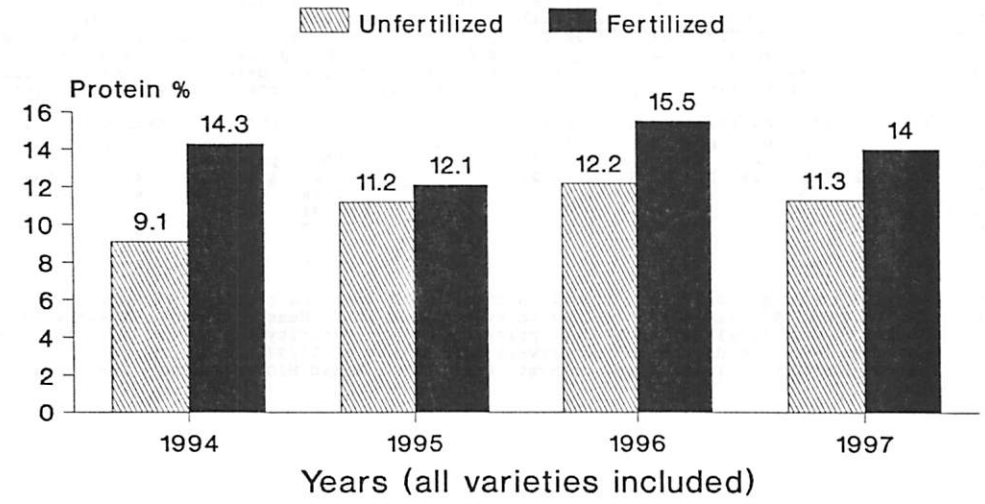

Figure 2.
MSU/AES/NARC-Havre

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GRC
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TABLE 5. *"UNFERTILIZED"* DRYLAND FALLOW BARLEY VARIETY EVALUATION NURSERY GROWN OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1997.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
MT886610	MT886610	95.50	24.63	51.23	49.80	77.50	7.27	12.63
PI537438	Targhee	98.97	25.12	50.40	48.70	78.70	7.80	12.21
H1851195	H1851195	96.90	24.62	48.27	49.47	87.47	3.50	12.39
PI483237	Bowman	98.97	24.25	46.10	52.00	94.83	1.77	11.92
PI568246	Baronesse	97.90	21.18	45.57	49.60	86.57	3.40	9.80
ND 9866	Stark	97.93	25.25	45.43	51.00	89.90	3.17	11.65
H3860224	H3860224	94.80	23.56	45.03	50.17	90.73	3.10	11.55
SK 76333	Harrington	90.27	25.72	44.17	50.33	91.00	2.67	11.74
PI491534	Gallatin	98.27	24.76	43.30	50.67	85.13	5.00	11.01
CI 15229	Steptoe	97.20	20.21	43.03	45.37	86.70	4.13	9.35
CI 15856	Lewis	96.20	22.97	42.60	50.63	81.07	6.27	12.59
N1123111	Logan	97.23	24.38	40.47	51.87	94.77	1.53	10.07
PI591823	Chinook	99.30	23.46	37.83	51.60	89.13	2.97	10.72
CI 15514	Hector	98.27	26.33	37.83	50.80	80.20	6.93	12.51
MN 56	Stander	94.10	23.08	35.60	49.70	85.53	4.17	12.33
ND 11055	Foster	96.90	24.44	30.23	47.77	83.50	4.50	10.58
EXPERIMENTAL MEANS		96.79	24.00	42.94	49.97	86.42	4.26	11.44
C.V. 2: (S OF MEAN/MEAN)*100		2.77	4.32	11.97	1.38	5.99	45.16	5.92
LSD (0.05)		7.73	3.00	14.85	2.00	14.95	5.56	1.96

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 97-3650-SW 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: 05/12/97 Sd'g Depth: 1.25 in. Depth to Moisture @ Sd'g: 1.00 in. Moist Soil Depth @ Sd'g: 55.0+ in.
Soil Temp @ Sd'g: __.__F @ 1 in. 72.0F @ 2 in. 38.0F @ 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: __1996 Fallow Season = 3x Tillage w/Sweeps, Spring 1997 = 1x Tillage w/Sweeps & Rods_____
Cropping History: 1 Yr Ago = 96 = ____Fallow____ 2 Yrs Ago = 95 = _Spring Wheat_ 3 Yrs Ago = 94 = ____Fallow____
Fertilizer: 0#N, 0#P2O5, 0#K2O _None Applied,Experimental "Low" Fertility_ Herbicide: LV6+'BanvelSGP'(.3+.25pt/ac)
Harvest Date: 09/13/97 Root Penetration Depth: 42 in. Comments:(Yr#4 of 5-yr"Fertility x Bly Variety Evals" On-Loc)

Depth	PRE-PLANT SOIL ANAL 04/17/97 Max Depth=48"									__/__/__	POST-HVST SOIL ANAL 09/13/97 (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"	.55	6.0	2.2	18	15	383	7	SCL	21.7	_____	.49	5.9	1.7	4	15	236	9	SCL-	21.7
6-24"	2.00			18			7	SCL		_____	1.58			6			17	CL	
24-36"	.89			4				SCL		_____	.91			4				CL	
36-48"	.86			4				SCL		_____	1.07			4				CL+	
TOTAL:	4.30			44						_____	4.05			18					

Precipitation & Stored Soil Water Summary: 04/17/97 to Sd'g: 0.47 in. (0.23 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 4.77 in.
Sd'g to 09/13/97: 11.15 in. (10.37 in events =>.1 in.) Meas'd Resid Soil Water 09/13/97: 4.05 in.
Growing Season (05/12/97 to 14 days prior to Harvest Maturity: 9.88 in.) (9.16 in events =>.1 in.)
Post-Grwg Seas (14 days prior to Harvest Maturity to 09/13/97: 1.27 in.) (1.21 in events =>.1 in.)
Adj'd Summary: Init GS H2O Inv + 'Init GS Inv to Hvst' Prec - Hvst Resid H2O - 'PostGS' Prec (Calc'd ET: 10.60 in.)

TABLE 6. FOUR-YEAR YIELD AND TEST WEIGHT SUMMARY ON SELECTED ENTRIES FROM AN UNFERTLIZED FALLOW SPRING BARLEY VARIETY NURSERY GROWN OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1997.

2/ VARIETY OR SELECTION	NO. OF YEARS TESTED	1/ YIELD (BUSHELS PER ACRE) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	4-YR. COMPAR. AVERAGE YIELD 3/	PERCENT OF HECTOR YIELD 4/	TEST WEIGHT (POUNDS PER BUSHEL) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	4-YR. COMPAR. AVERAGE TEST WT 3/	PERCENT OF HECTOR TEST WT 4/
PI537438 TARGHEE	3	-	57.0	40.7	50.4	-	49.4	46.3	119.3	-	49.7	48.1	48.7	-	48.8	48.3	97.5
NS 78054 BARONESSE (P+)	4	38.1	63.8	36.9	45.6	-	46.1	46.1	118.7	50.9	49.9	49.2	49.6	-	49.9	49.9	100.7
MT851195 MT851195	4	35.5	54.5	42.6	48.3	-	45.2	45.2	116.5	48.8	49.7	48.5	49.5	-	49.1	49.1	99.1
MT886610 MT81143/LEWIS	4	34.4	54.7	40.4	51.2	-	45.2	45.2	116.4	49.8	50.7	48.5	49.8	-	49.7	49.7	100.3
H3860224 LEWIS/APEX	4	33.4	60.8	37.1	45.0	-	44.1	44.1	113.6	48.8	50.1	48.5	50.2	-	49.4	49.4	99.6
PI483237 BOWMAN	4	40.2	53.5	35.5	46.1	-	43.8	43.8	112.8	51.5	51.4	49.6	52.0	-	51.1	51.1	103.1
SK 76333 HARRINGTON	4	32.5	58.5	35.3	44.2	-	42.6	42.6	109.8	48.2	50.0	49.4	50.3	-	49.5	49.5	99.8
CI 9558 PIROLINE	3	35.5	55.1	37.1	-	-	42.5	42.2	108.6	51.9	51.9	49.8	-	-	51.2	51.7	104.2
CI 15229 STEPTOE	4	35.1	59.1	31.2	43.0	-	42.1	42.1	108.4	44.7	45.0	44.4	45.4	-	44.9	44.9	90.5
PI591823 CHINOOK (+)	4	35.2	58.1	36.5	37.8	-	41.9	41.9	107.9	49.5	51.7	48.2	51.6	-	50.3	50.3	101.4
CI 15856 LEWIS	4	33.2	56.3	34.1	42.6	-	41.6	41.6	107.0	49.7	51.8	49.9	50.6	-	50.5	50.5	101.9
ND 9866 STARK	4	34.8	46.5	37.7	45.4	-	41.1	41.1	105.8	52.6	51.7	50.6	51.0	-	51.5	51.5	103.9
PI491534 GALLATIN	4	33.2	49.5	32.0	43.3	-	39.5	39.5	101.7	50.4	51.5	49.7	50.7	-	50.6	50.6	102.0
CI 15514 HECTOR	4	31.2	51.9	34.5	37.8	-	38.8	38.8	100.0	48.1	50.6	48.8	50.8	-	49.6	49.6	100.0
MEANS (ENTRIES LISTED)		34.8	55.7	36.5	44.7	-	-	42.9	-	49.6	50.4	48.8	50.0	-	-	49.7	-
5/ Growing Season Precip. (in.)		3.93	8.71	3.62	9.88		6.54										
Soil PAW (in.) to SD at Plntng.		6.84	6.08	6.07	4.77		5.94										
Total Plant Avail. Water (in.)		10.77	14.79	9.69	14.65		12.48										
Soil NO3 (lbs.) to SD at Plntng.		28.0	66.0	44.0	44.0												
SD (Sampling Depth in inches)		48.0	48.0	48.0	48.0												
Fertilizer Applied (# N)		0.0	0.0	0.0	0.0												
(# P2O5)		0.0	0.0	0.0	0.0												

Check variety is Hector.

1/ See MCES Bulletin 1094 for evaluation of other important variety performance characteristics to include malting potential, disease resistance etc., before making variety selection decisions.

2/ P = Private variety, + = Protected variety.

3/ 4-yr. CA = (x/y) * z where x = average yield or test weight of the entry for years tested, y = average yield or test weight for Hector for the same years, and z = 4-yr. average yield or test weight for the check variety Hector.

4/ Percent of Piroline yield or test weight for the same data years as those in which the entry was tested.

5/ Seeding to 14 days prior to harvest maturity.

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TABLE 7. ***"FERTILIZED"*** DRYLAND FALLOW BARLEY VARIETY EVALUATION NURSERY GROWN OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1997.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
PI483237	Bowman	98.27	27.44	65.10	51.33	89.70	2.70	12.63
N1123111	Logan	97.57	25.75	64.37	50.37	72.87	7.93	12.85
ND 9866	Stark	98.27	28.45	62.83	49.87	79.60	5.90	13.12
H3860224	H3860224	99.30	24.11	60.43	47.77	75.13	8.30	13.33
CI 15229	Steptoe	100.00	22.93	60.40	44.37	74.90	8.77	10.78
PI491534	Gallatin	99.33	26.61	59.37	48.50	58.87	14.57	12.87
H1851195	H1851195	98.97	24.59	58.43	48.30	72.03	7.70	13.62
MT886610	MT886610	100.00	24.82	58.07	47.67	53.93	17.20	12.88
PI537438	Targhee	100.00	24.19	57.33	47.47	59.73	15.63	12.75
SK 76333	Harrington	99.30	25.33	57.00	47.20	70.20	9.30	13.18
PI568246	Baronesse	100.00	23.27	56.67	46.57	55.13	14.37	12.77
CI 15856	Lewis	96.53	25.87	54.87	48.40	58.33	15.87	13.09
PI591823	Chinook	98.27	24.71	54.77	47.70	42.33	23.27	13.24
CI 15514	Hector	98.97	24.96	54.40	49.13	52.90	16.63	13.26
MN 56	Stander	93.77	25.93	48.83	48.70	66.83	10.57	13.34
ND 11055	Foster	100.00	26.09	45.67	45.80	48.63	22.30	12.70
EXPERIMENTAL MEANS		98.66	25.31	57.41	48.07	64.45	12.56	12.90
C.V. 2: (S OF MEAN/MEAN)*100		1.21	2.80	3.22	.76	3.23	7.73	2.36
LSD (0.05)		3.44	2.05	5.34	1.05	6.01	2.81	.88

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 97-3651-SW 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: 05/12/97 Sd'g Depth: 1.25 in. Depth to Moisture @ Sd'g: 1.00 in. Moist Soil Depth @ Sd'g: 55.0+ in.
Soil Temp @ Sd'g: __.__F @ 1 in. 72.0F @ 2 in. 68.0F @ 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: __1996 Fallow Season = 3x Tillage w/Sweeps, Spring 1997 = 1x Tillage w/Sweeps & Rods_____
Cropping History: 1 Yr Ago = 96 = ____Fallow____ 2 Yrs Ago = 95 = _Spring Wheat_ 3 Yrs Ago = 94 = ____Fallow____
Fertilizer: 70#N,40#P2O5, 0#K2O/ac via gran.blend banded 1.5" below seed___ Herbicide: LV6+'BanvelSGF'(.3+.25pt/ac)
Harvest Date: 09/13/97 Root Penetration Depth: 36 in. Comments:(Yr#4 of 5-yr"Fertility x Bly Variety Evals" On-Loc)

Depth	PRE-PLANT SOIL ANAL 04/17/97 Max Depth=48"								__/__/__	POST-HVST SOIL ANAL 09/13/97 (Max Depth=36"							
	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"	.55	6.1	1.2	10	13	256	5	SCL	21.7	_____	.56	6.2	1.3	8	14	239	9	SCL	21.7
6-24"	1.91			30			14	SCL		_____	1.16			6			12	SCL	
24-36"	1.03			8				SCL		_____	.51			4				SCL	
36-48"	.91			12				SCL		_____	_n/a_			_n/a_				_n/a_	
TOTAL:	4.40 (3'=3.49)			60						_____	2.23 (3')			18 (3')					

Precipitation & Stored Soil Water Summary: 04/17/97 to Sd'g: 0.47 in. (0.23 in events =>.1 in.) Calc'd Init Soil Wtr @Sd'g to 3': 3.96 in.
Sd'g to 09/13/97: 11.15 in. (10.37 in events =>.1 in.) Meas'd Resid Soil Water 09/13/97: 2.23 in.
Growing Season (05/12/97 to 14 days prior to Harvest Maturity: 9.88 in.) (9.16 in events =>.1 in.)
Post-Grwg Seas (14 days prior to Harvest Maturity to 09/13/97: 1.27 in.) (1.21 in events =>.1 in.)
Adj'd Summary: Init GS H2O Inv + 'Init GS Inv to Hvst' Prec - Hvst Resid H2O - 'PostGS' Prec (Calc'd ET: 11.61 in.)

TABLE 8. FOUR-YEAR YIELD AND TEST WEIGHT SUMMARY ON SELECTED ENTRIES FROM A FERTILIZED FALLOW SPRING BARLEY VARIETY NURSERY GROWN OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1997.

		1/ YIELD (BUSHELS PER ACRE)								TEST WEIGHT (POUNDS PER BUSHEL)							
2/ VARIETY OR SELECTION	NO. OF YEARS TESTED	1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	4-YR. COMPAR. AVERAGE YIELD 3/	PERCENT OF HECTOR YIELD 4/	1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	4-YR. COMPAR. AVERAGE TEST WT 3/	PERCENT OF HECTOR TEST WT 4/
CI 15229 STEPTOE	4	65.6	68.3	42.5	60.4	-	59.2	59.2	120.6	42.0	42.5	42.1	44.4	-	42.7	42.7	89.0
NS 78054 BARONESSE (P+)	4	55.2	71.7	43.4	56.7	-	56.7	56.7	115.6	47.0	49.1	48.9	46.6	-	47.9	47.9	99.8
PI483237 BOWMAN	4	53.8	54.1	49.4	65.1	-	55.6	55.6	113.3	48.8	50.7	50.0	51.3	-	50.2	50.2	104.6
H3860224 LEWIS/APEX	4	50.8	69.3	38.7	60.4	-	54.8	54.8	111.7	45.1	48.7	47.7	47.8	-	47.3	47.3	98.6
ND 9866 STARK	4	58.2	57.8	39.3	62.8	-	54.5	54.5	111.2	50.2	51.6	49.7	49.9	-	50.4	50.4	104.9
PI537438 TARGHEE	3	-	63.4	41.2	57.3	-	54.0	54.5	111.1	-	48.1	47.5	47.5	-	47.7	47.3	98.5
MT851195 MT851195	4	57.7	59.1	42.6	58.4	-	54.5	54.5	111.0	47.1	49.4	47.8	48.3	-	48.1	48.1	100.3
CI 9558 PIROLINE	3	58.1	58.0	34.5	-	-	50.2	52.1	106.2	50.3	50.6	48.0	-	-	49.6	50.0	104.2
CI 15856 LEWIS	4	51.6	55.9	40.9	54.9	-	50.8	50.8	103.6	47.6	49.5	49.1	48.4	-	48.6	48.6	101.3
PI591823 CHINOOK (+)	4	56.0	52.5	39.0	54.8	-	50.6	50.6	103.1	46.7	48.7	47.8	47.7	-	47.7	47.7	99.4
PI491534 GALLATIN	4	54.1	50.7	36.5	59.4	-	50.2	50.2	102.2	47.8	49.7	48.4	48.5	-	48.6	48.6	101.2
MT886610 MT81143/LEWIS	4	50.2	57.0	33.9	58.1	-	49.8	49.8	101.5	46.3	48.7	48.7	47.7	-	47.8	47.8	99.6
CI 15514 HECTOR	4	50.6	47.5	43.8	54.4	-	49.1	49.1	100.0	46.7	48.2	47.9	49.1	-	48.0	48.0	100.0
SK 76333 HARRINGTON	4	48.7	58.2	32.1	57.0	-	49.0	49.0	99.9	45.2	46.7	47.2	47.2	-	46.6	46.6	97.0
MEANS (ENTRIES LISTED)		54.7	58.8	39.8	58.4	-	-	53.0	-	47.0	48.7	47.9	48.0	-	-	47.9	-
5/ Growing Season Precip. (in.)		3.93	8.71	3.62	9.88		6.54										
Soil PAW (in.) to SD at Plntng.		6.84	5.09	6.01	3.96		5.48										
Total Plant Avail. Water (in.)		10.77	13.80	9.63	13.84		12.02										
Soil NO3 (lbs.) to SD at Plntng.		28.0	54.0	54.0	60.0												
SD (Sampling Depth in inches)		48.0	48.0	48.0	48.0												
Fertilizer Applied (# N)		66.0	66.0	71.0	70.0												
(# P2O5)		33.0	33.0	35.0	40.0												

Check variety is Hector.

1/ See MCES Bulletin 1094 for evaluation of other important variety performance characteristics to include malting potential, disease resistance etc., before making variety selection decisions.

2/ P = Private variety, + = Protected variety.

3/ 4-yr. CA = (x/y) * z where x = average yield or test weight of the entry for years tested, y = average yield or test weight for Hector for the same years, and z = 4-yr. average yield or test weight for the check variety Hector.

4/ Percent of Hector yield or test weight for the same data years as those in which the entry was tested.

5/ Seeding to 14 days prior to harvest maturity.

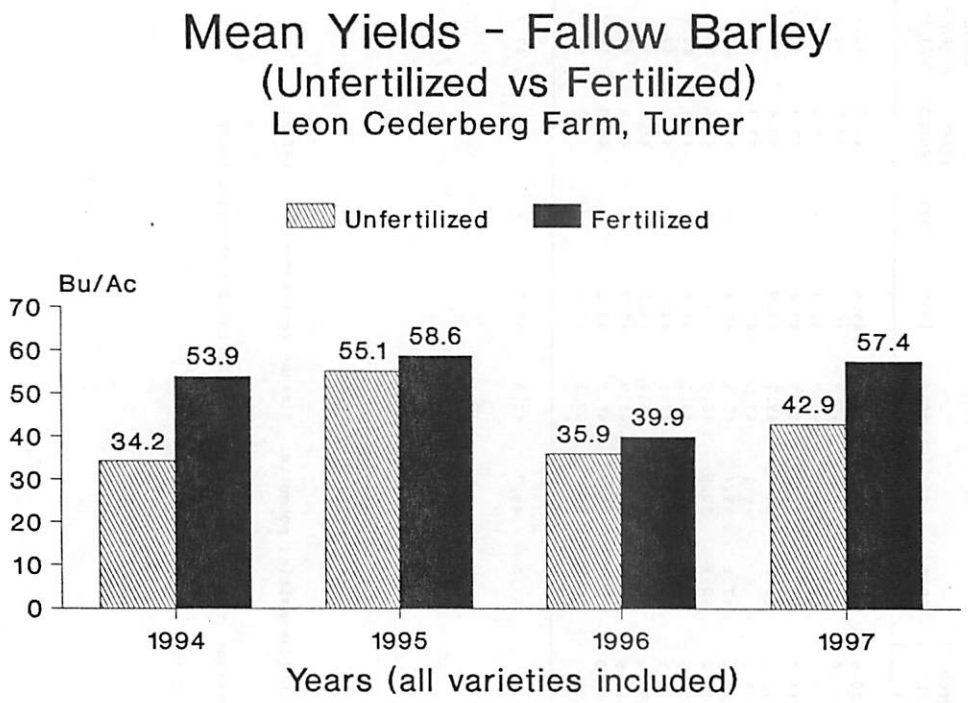

Figure 3.
MSU/AES/NARC-Havre

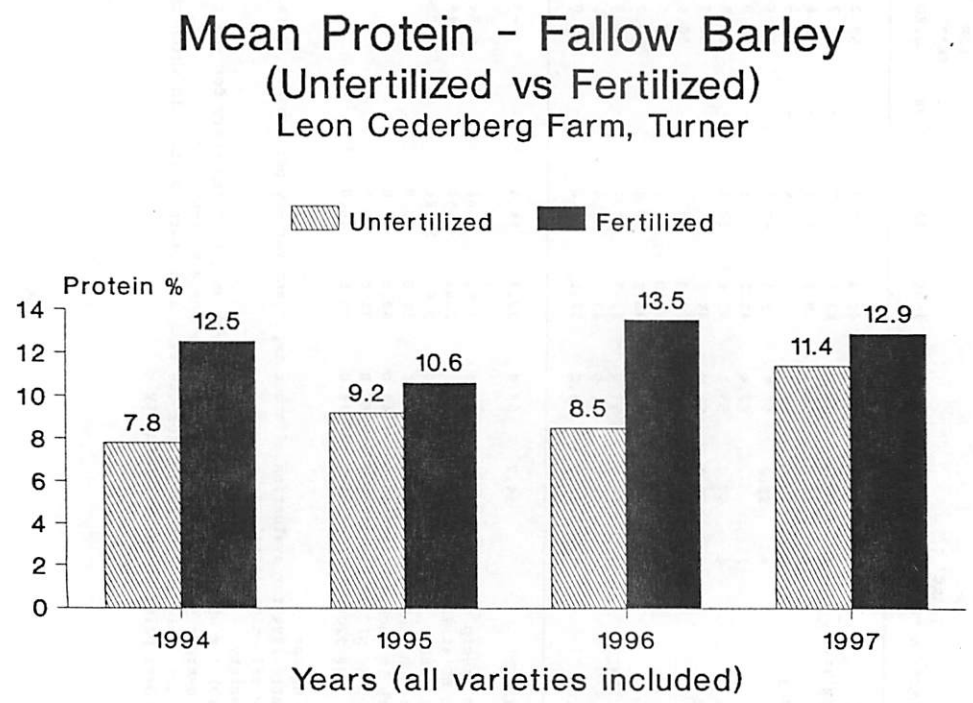

Figure 4.
MSU/AES/NARC-Havre