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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.

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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 varieties to existing databases utilized for evaluation of variety 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 varieties in their response to fertilizer, particularly nitrogen.

RESULTS:

General spring wheat and barley response to applied fertilizer at Turner was strong throughout a 5-year study ending in 1998. In a previous, single-year study at the same location in 1986, dramatic and economically significant responses due to protein were obtained in the absence of meaningful yield differences (data not reported here). Growers reported that economic response to fertilizer under commercial-scale dryland production systems on the Big Flat were inconsistent. After acquiring plot equipment more appropriate for fertility work, NARC initiated a 5-year trial series at the Turner location in 1994.

All 1994-1998 results presented here are in five-year summary format. Data for the 20 individual trial scenarios (fertilized and unfertilized spring wheat and barley trial pairs for each year) are not included here. These data with detailed climatic, crop management, and other interpretive information will be component to a final popularized report released later this winter.

Agronomic and economic performance data for 13 spring wheat varieties grown in each of the 5 years, fertilized and unfertilized, are presented in Table 1 with treatments listed in decending order by 5-year average $/Ac return (gross less fertilizer cost). `Year by fertility by spring wheat variety' factorial data are presented in Table 2. Table 3 shows fertilized spring wheat performance for years and varieties expressed as "percent of unfertilized performance". Table 3 also shows added net returns for fertilizer and added net dollars received per fertilizer dollar invested. Spring wheat fertility relationship data is graphically presented in Figures 1 through 4.

Agronomic performance data for 8 barley varieties grown in each of the 5 years, fertilized and unfertilized, are presented in Table 4 with treatments listed

in decending order by 5-year average yield. `Year by fertility by spring barley variety' factorial data are presented in Table 5. Table 6 shows fertilized barley performance for years and varieties expressed as "percent of unfertilized performance". Barley fertility relationship data is graphically presented in Figure 5.

Tables 7, 8, 9, and 10 present "comparable average" summaries for yield and test weight of ALL varieties or experimental lines evaluated for fertilized spring wheat, unfertilized spring wheat, fertilized barley and unfertilized barley, respectively. These data are presented to show relative performance of other varieties not grown in all five years of the study. Standard off-station variety trials were utilized as the variety component for this project, and involved 16 to 25 entries annually, but changed somewhat from year to year. For the 5-year period, 13 spring wheat and 8 barley varieties were included in all years.

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 granular fertilizer 1.0-1.5 inches directly below the seed. Applied fertilizer was constant at 66#N and 33#$P_2O_5$ per acre. 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.

Bread wheat prices used are based on annual average values for each year under procedures reported separately by NARC-Havre in this 1999 report to MWBC from the Research Centers. Average annual feed wheat prices were used for any production below 12% protein. Fertilizer prices are based on average annual retail values for the Hi-Line area.

In-depth factorial analyses completed after the final year of the trials reveal highly significant, positive economic impacts due to fertilization ($3.27 returned per fertilizer dollar invested for spring wheat).

As would be expected, `year' and `fertility' effects for most response variables were very strong as were `variety' effects. Most `year by fertilizer' and `year by variety' interaction effects were also strong, but response variables of true net economic importance for spring wheat (yield and ultimate market value) did not show significant `fertility x variety' interaction effects. For barley, significant `fertility x variety' interactions are potentially more economically meaningful, depending on ultimate end use (malt vs. feed).

FUTURE PLANS:

These investigations will be terminated as collection of a 5-year database as initially planned has been completed. Depending upon further interpretation of results, related investigations may be initiated under other environments in the future. Such investigations may include use of an air drill with fewer varieties and varying levels of fertility.

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TABLE 1. FIVE-YEAR AGRONOMIC AND ECONOMIC PERFORMANCE SUMMARY FOR 13 HARD RED SPRING WHEAT VARIETIES GROWN UNDER UNFERTILIZED VS. FERTILIZED DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1998.

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/
24	FERTILIZED	McNEAL	95.07	28.38	42.79	58.20	14.58	190.60	24.40	215.00	195.80
21	FERTILIZED	HI-LINE	95.55	26.08	42.58	58.10	14.31	187.80	23.35	211.20	191.90
16	FERTILIZED	AMIDON	95.63	32.16	42.23	58.85	13.93	186.30	20.50	206.80	187.60
30	FERTILIZED	WESTBRED 926	94.18	25.46	40.92	57.80	14.63	182.00	24.39	206.30	187.10
25	FERTILIZED	NEWANA	94.66	26.09	43.48	58.93	13.48	190.00	15.70	205.70	186.50
26	FERTILIZED	ERNEST	94.59	31.10	41.17	59.33	14.65	181.50	24.04	205.50	186.30
20	FERTILIZED	GRANDIN	93.55	28.59	40.25	58.20	14.83	179.40	24.46	203.80	184.60
19	FERTILIZED	GLENMAN	97.63	27.78	42.71	57.55	13.38	187.10	15.97	203.10	183.80
29	FERTILIZED	STOA	96.45	31.40	39.69	57.60	14.65	178.50	23.40	201.90	182.70
22	FERTILIZED	LEN	96.89	27.08	39.57	58.09	14.64	176.10	25.09	201.20	181.90
28	FERTILIZED	RAMBO	97.29	26.20	38.63	59.53	14.01	171.40	20.58	192.00	172.70
18	FERTILIZED	FORTUNA	96.04	31.93	36.35	60.02	14.44	161.90	21.06	183.00	163.80
23	FERTILIZED	LEW	97.78	32.58	36.92	59.93	14.17	161.60	21.13	182.80	163.50
07	UNFERTILIZED	LEN	97.09	25.92	32.22	61.37	11.78	134.10	2.06	136.20	136.20
01	UNFERTILIZED	AMIDON	98.89	30.60	33.45	61.03	11.12	129.90	1.26	131.10	131.10
11	UNFERTILIZED	ERNEST	97.23	29.25	31.85	61.62	11.35	128.10	1.80	129.90	129.90
15	UNFERTILIZED	WESTBRED 926	95.49	22.98	31.17	61.06	11.58	126.60	2.80	129.40	129.40
09	UNFERTILIZED	McNEAL	97.85	25.68	31.50	60.75	10.88	124.20	.00	124.20	124.20
05	UNFERTILIZED	GRANDIN	93.26	26.21	30.90	61.83	11.44	120.80	2.01	122.90	122.90
14	UNFERTILIZED	STOA	98.06	29.55	30.89	60.97	10.90	120.70	.79	121.40	121.40
06	UNFERTILIZED	HI-LINE	96.94	24.41	30.48	61.65	10.97	119.20	.66	119.80	119.80
10	UNFERTILIZED	NEWANA	97.77	24.15	31.52	62.13	10.52	116.20	.33	116.50	116.50
03	UNFERTILIZED	FORTUNA	98.89	28.72	26.25	60.91	11.76	109.70	2.64	112.30	112.30
13	UNFERTILIZED	RAMBO	97.30	24.21	29.78	62.46	10.81	109.70	.00	109.70	109.70
04	UNFERTILIZED	GLENMAN	98.35	26.39	30.68	60.32	10.37	109.40	.00	109.40	109.40
08	UNFERTILIZED	LEW	99.51	29.47	29.11	61.59	10.58	109.20	.06	109.30	109.30

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	96.61	27.78	35.66	59.99	12.68	149.70	11.48	161.20	151.60
F-RATIO, TMTS	2.00	17.38	16.72	15.57	17.68	27.22	8.33	31.18	17.74
P-VALUE, TMTS	.0078	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
CV (SE/MEAN)%	1.24	2.37	3.69	.66	3.18	4.06	32.65	4.67	5.10
LSD (0.05 by t)	3.36	1.85	3.69	1.12	1.13	17.07	10.52	21.14	21.70

1/ Analyzed with Years as Reps for "Year x Tmt" Means arising from the original analysis of field trials conducted annually with 3 replications.
2/ 5-Yr Means for Yield x CY Ave PNW price for "milling wht" @ min quoted pro (12%), or "feed" (<12%)
3/ 5-Yr Means for Yield x CY Ave PNW price premium (quarter-ups calculated) for protein >12% and <=15%
4/ 5-Yr Means for Gross w/prot premium, if any; AFTER fert mat. costs (1994=$18.11/Ac, 1995=$21.88/Ac, 1996=$19.63/Ac, 1997=$ 18.99/Ac, and 1998=$17.56\Ac for a 5-Yr average of $19.23/Ac).

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TABLE 2. FACTORIAL SUMMARY OF AGRONOMIC AND ECONOMIC PERFORMANCE OF 13 SPRING WHEAT VARIETIES GROWN 5 YEARS UNDER UNFERTILIZED vs. FERTILIZED DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1998.

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 & 13 varieties)									
1	1994	97.35	26.50	29.06	60.28	11.58	109.00	17.50	126.50	117.50
2	1995	93.16	32.17	45.51	60.58	11.64	208.20	2.15	210.40	199.40
3	1996	94.07	21.20	25.60	60.78	13.94	134.60	8.61	143.20	133.40
4	1997	99.11	28.70	36.69	58.32	12.74	149.60	9.36	158.90	149.40
5	1998	99.39	30.35	41.42	59.99	13.52	147.00	19.78	166.80	158.00
		**	**	**	**	**	**	**	**	**
	F =	61.93	877.39	362.37	230.85	208.88	279.91	173.74	176.69	170.01
	P =	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	1.01	.40	1.22	.18	.21	6.07	1.51	6.61	6.61
	FACTOR ANALYSIS - FACTOR 2 = FERTILITY SCHEME (across 5 years & 13 varieties)									
1	UNFERTILIZED	97.43	26.73	30.75	61.36	11.08	119.80	1.11	120.90	120.90
2	FERTILIZED	95.79	28.83	40.56	58.62	14.28	179.50	21.85	201.40	182.20
		**	**	**	**	**	**	**	**	**
	F =	25.33	269.58	630.88	2233.7	2329.9	939.61	1823.5	1438.0	832.72
	P =	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	.64	.25	.77	.11	.13	3.84	.96	4.18	4.18
	FACTOR ANALYSIS - FACTOR 3 = VARIETY (across 5 years & 2 fertility schemes)									
09	McNEAL	96.46	27.03	37.14	59.48	12.73	157.40	12.20	169.60	160.00
01	AMIDON	97.26	31.38	37.84	59.94	12.53	158.10	10.88	169.00	159.30
07	LEN	96.99	26.50	35.89	59.73	13.21	155.10	13.58	168.70	159.00
15	WESTBRED 926	94.83	24.22	36.05	59.42	13.10	154.30	13.59	167.90	158.30
11	ERNEST	95.91	30.18	36.51	60.47	13.00	154.80	12.92	167.70	158.10
06	HI-LINE	96.25	25.25	36.53	59.88	12.64	153.50	12.01	165.50	155.90
05	GRANDIN	93.40	27.40	35.57	60.02	13.13	150.10	13.24	163.30	153.70
14	STOA	97.26	30.47	35.29	59.29	12.78	149.60	12.09	161.70	152.10
10	NEWANA	96.22	25.12	37.50	60.53	12.00	153.10	8.02	161.10	151.50
04	GLENMAN	97.99	27.08	36.70	58.93	11.88	148.20	7.98	156.20	146.60
13	RAMBO	97.30	25.20	34.21	60.99	12.41	140.50	10.29	150.80	141.20
03	FORTUNA	97.47	30.32	31.30	60.46	13.10	135.80	11.85	147.70	138.00
08	LEW	98.65	31.03	33.01	60.76	12.37	135.40	10.60	146.00	136.40
		**	**	**	**	**	**	**	**	**
	F =	5.43	123.44	6.96	35.36	13.11	4.83	4.58	4.80	4.80
	P =	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	1.64	.64	1.96	.29	.33	9.78	2.44	10.65	10.65
	GRAND MEANS (390 obs)	96.61	27.78	35.66	59.99	12.68	149.70	11.48	161.20	151.60
	Year x Fert Interactions (P)	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	Year x Variety Interactions (P)	.0000	.0000	.0013	.0000	.0416	.0039	.0084	.0100	.0100
	Fert x Variety Interactions (P)	.3672	.0330	.2274	.0000	.0196	.0301	.0044	.2111	.2111
	Yr x Fert x Var Interactions (P)	.8387	.0006	.9302	.2986	.8330	.7749	.0040	.4558	.4558

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 costs (based on actual for respective years)

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TABLE 3. FACTORIAL SUMMARY OF RELATIVE AGRONOMIC AND ECONOMIC PERFORMANCE OF 13 "FERTILIZED" HARD RED SPRING WHEAT VARIETIES GROWN 5 YEARS UNDER DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1998.

ID	YEAR/VARIETY	STAND	PLNT HT 1/	YIELD	TEST WT	PROTEIN	$GROSS >FERT$s 2/	ADDED $RTN >FERT$s 3/	ADDED $RTN /FERT$ 4/
		------ % of Unfertilized Performance -------						($/Ac)	($)
		(%)	(%)	(%)	(%)	(%)	(%)		
	FACTOR ANALYSIS - FACTOR 1 = YEAR (across 13 varieties)								
1	1994	96.73	107.00	136.30	94.23	158.80	191.20	73.40	4.05
2	1995	101.10	112.20	133.30	95.65	109.30	125.60	37.86	1.73
3	1996	94.57	101.00	121.70	99.24	127.40	142.80	39.55	2.02
4	1997	100.80	112.40	140.00	93.60	122.90	173.30	72.65	3.83
5	1998	99.04	106.40	139.20	95.06	134.70	172.80	82.71	4.71
		**	**	**	**	**	**	**	**
	F =	12.33	17.58	4.39	136.78	172.23	27.47	19.94	31.11
	P =	.0000	.0000	.0023	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	2.20	3.14	9.89	.53	3.89	14.08	13.13	.66
	FACTOR ANALYSIS - FACTOR 2 = VARIETY (across 5 years)								
4	GLENMAN	99.31	105.10	140.00	95.45	130.50	176.20	74.45	3.92
6	HI-LINE	99.01	106.60	139.60	94.29	132.00	167.40	72.11	3.80
9	McNEAL	97.13	110.40	136.00	95.81	135.80	167.30	71.59	3.79
10	NEWANA	96.85	108.30	139.50	94.85	130.30	170.90	69.94	3.71
13	RAMBO	100.00	107.90	131.60	95.32	130.50	168.60	63.00	3.37
5	GRANDIN	100.80	109.40	130.70	94.11	130.80	159.70	61.72	3.28
14	STOA	98.41	106.20	130.10	94.48	136.40	160.20	61.22	3.26
15	WESTBRED 926	98.82	110.90	133.50	94.67	128.00	158.90	57.70	3.08
11	ERNEST	97.31	106.10	130.30	96.27	130.70	156.10	56.40	3.05
1	AMIDON	96.71	105.10	127.50	96.45	127.00	151.60	56.43	3.05
8	LEW	98.27	110.30	140.30	97.32	136.20	159.30	54.27	2.95
3	FORTUNA	97.11	110.90	138.70	98.55	125.00	151.80	51.43	2.74
7	LEN	99.88	104.10	125.40	94.66	125.10	146.80	45.77	2.48
		ns	ns	ns	**	**	ns	ns	ns
	F =	1.12	1.79	.84	18.45	2.91	1.11	1.34	1.34
	P =	.3482	.0566	.6123	.0000	.0013	.3603	.2028	.2055
	LSD (.05) =	3.55	5.07	15.94	.85	6.27	22.71	21.17	1.07
	GRAND MEANS (195 obs)	98.43	107.80	134.10	95.56	130.60	161.10	61.23	3.27
	Yr x Variety Interactions (P)	.7864	.0057	.7808	.0818	.3572	.4739	.4265	.3882

1/ Fertilized performance expressed as percent of the same cultivar'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 - 1994-98

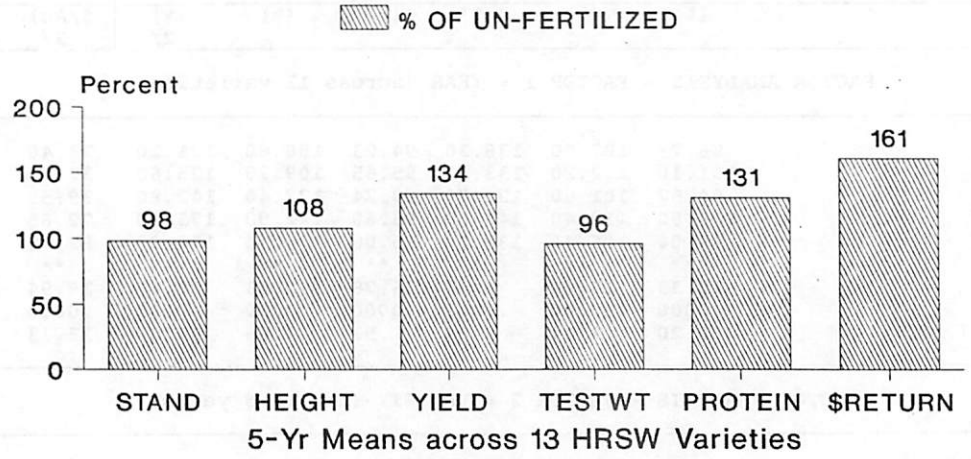

Figure 1.
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Fertilized vs Unfertilized Spring Wheat
(Gross $ Rtn, Base + Protein Premium)
Leon Cederberg Farm, Turner - 1994-98

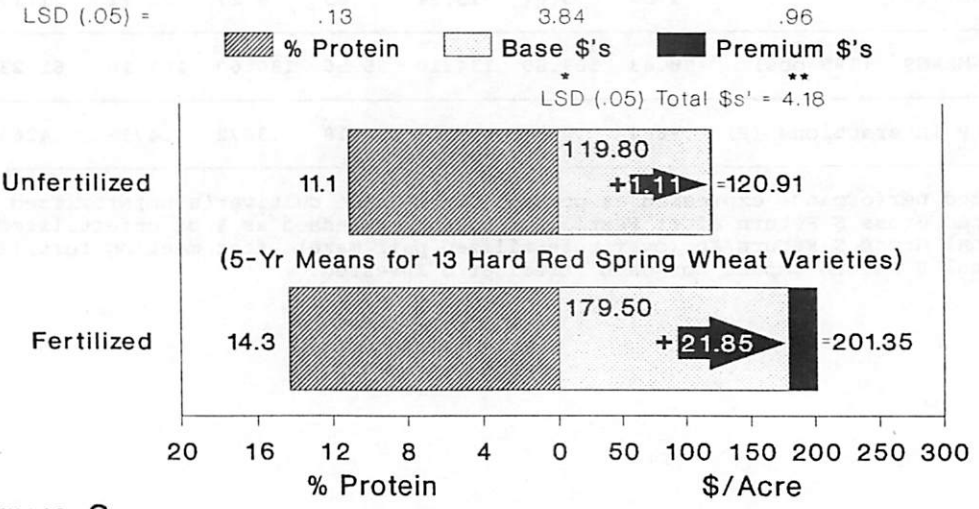

Figure 2.
MSU/AES/NARC-Havre

* @ 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 - 1994-98

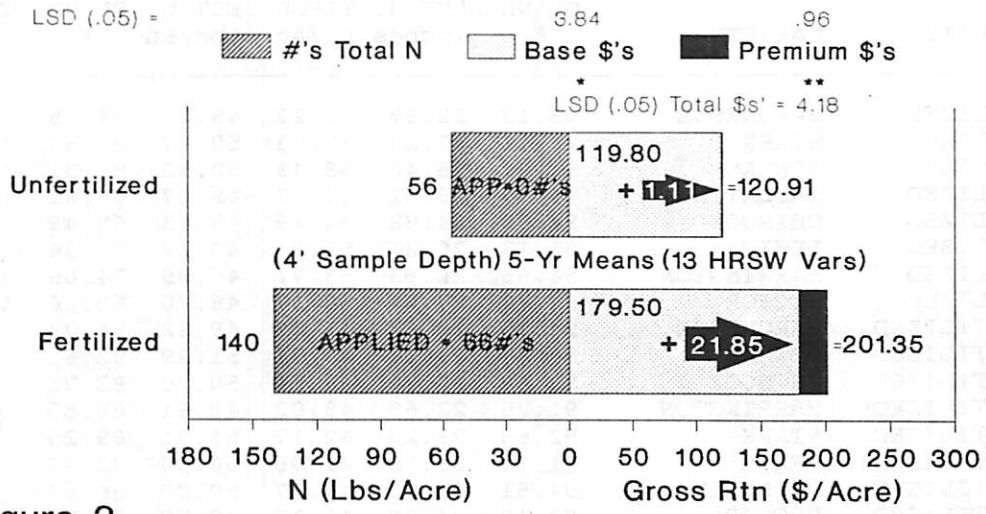

Figure 3.
MSU/AES/NARC-Havre

* @ 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 - 1994-98

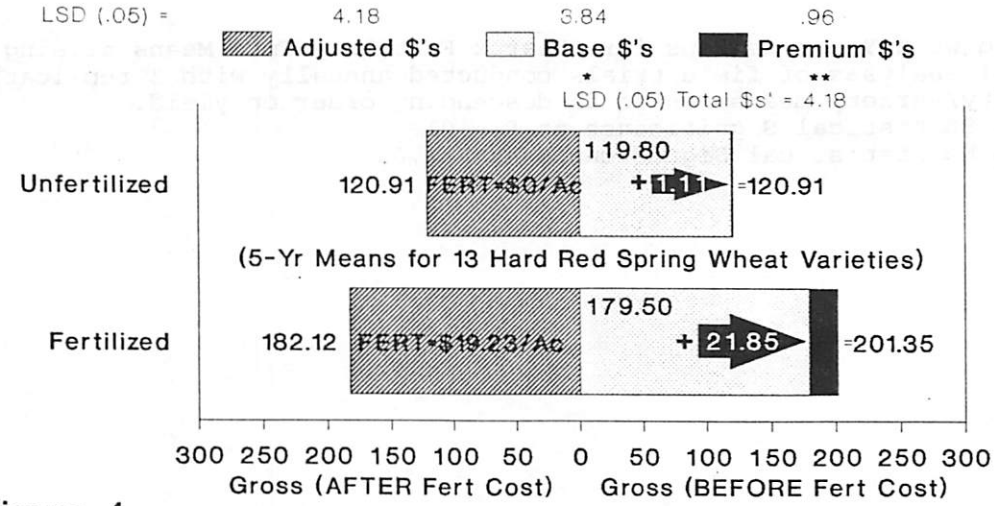

Figure 4.
MSU/AES/NARC-Havre

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

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TABLE 4. FIVE-YEAR AGRONOMIC PERFORMANCE SUMMARY FOR 8 SPRING BARLEY VARIETIES GROWN UNDER UNFERTILIZED vs. FERTILIZED DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARACH CENTER. HAVRE, MONTANA. 1994-1998. 1/

ID	FERTILITY	VARIETY	STAND %	PLNT HT Inches	YIELD Bu/Ac 2/	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
17	FERTILIZED	BARONESSE	95.13	22.97	60.22	48.17	74.05	9.54	12.81
31	FERTILIZED	STARK	96.11	27.20	58.63	50.77	87.59	5.05	12.36
18	FERTILIZED	BOWMAN	91.81	25.40	58.43	50.55	89.01	4.26	12.41
21	FERTILIZED	GALLATIN	94.79	26.61	54.27	49.07	69.81	11.48	12.11
19	FERTILIZED	CHINOOK	94.38	24.88	54.19	48.43	65.49	14.19	12.95
24	FERTILIZED	LEWIS	93.13	26.21	53.97	49.37	75.34	9.71	12.86
22	FERTILIZED	HARRINGTON	94.65	24.93	53.71	46.99	74.06	10.10	12.72
23	FERTILIZED	HECTOR	92.78	27.07	52.17	48.70	69.28	12.54	12.74
01	UNFERTILIZED	BARONESSE	94.99	20.62	45.15	49.62	84.79	5.83	8.52
02	UNFERTILIZED	BOWMAN	90.77	23.14	43.81	51.39	92.61	2.70	9.51
03	UNFERTILIZED	CHINOOK	92.69	22.79	43.21	50.78	83.71	5.84	8.87
06	UNFERTILIZED	HARRINGTON	91.25	22.69	43.02	49.61	88.55	4.07	9.05
15	UNFERTILIZED	STARK	92.65	23.25	42.17	51.71	89.29	4.24	9.18
08	UNFERTILIZED	LEWIS	91.11	23.18	41.95	50.80	82.45	7.23	9.45
05	UNFERTILIZED	GALLATIN	94.51	23.39	41.57	50.80	86.67	4.55	8.87
07	UNFERTILIZED	HECTOR	93.40	24.28	40.13	49.78	78.27	9.56	9.55

STATISTICAL SUMMARY	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
	ns	**	**	**	**	**	**
OVERALL MEANS	93.39	24.29	49.16	49.78	80.69	7.55	10.87
F-RATIO, TMTS	1.30	9.59	6.39	9.82	6.64	6.95	15.50
P-VALUE, TMTS	.2278	.0000	.0000	.0000	.0000	.0000	.0000
CV (SE/MEAN)%	1.52	2.47	5.73	.83	4.05	17.50	4.28
LSD (0.05 by t)	4.02	1.70	7.96	1.17	9.23	3.74	1.32

1/ Analyzed with Years as Reps for "Year x Fertility Tmt" Means arising from the original analyses of field trials conducted annually with 3 replications.
2/ Fertility/Variety means ranked in descending order on yield.
** Denotes Statistical Significance at P<=.01
ns Denotes No Statistical Significance at P<=.05

Hr
GRC
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TABLE 5. FACTORIAL SUMMARY OF AGRONOMIC PERFORMANCE OF 8 SPRING BARLEY VARIETIES GROWN 5 YEARS UNDER UNFERTILIZED vs. FERTILIZED DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1998.

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 & 8 varieties)							
1	1994	93.10	21.51	44.15	48.81	81.35	7.17	10.31
2	1995	88.04	29.34	55.40	50.16	88.69	4.93	10.00
3	1996	88.00	17.88	37.93	49.03	88.02	3.46	10.94
4	1997	97.88	25.04	50.49	49.71	75.31	8.42	12.26
5	1998	99.91	27.69	57.84	51.21	70.06	13.79	10.86
		**	**	**	**	**	**	**
	F =	43.58	378.37	59.61	31.88	57.92	46.48	108.42
	P =	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	2.32	.67	2.96	.48	2.96	1.63	.23
	FACTOR ANALYSIS - FACTOR 2 = FERTILITY SCHEME (across 5 years & 8 varieties)							
1	UNFERTILIZED	92.67	22.92	42.63	50.56	85.79	5.50	9.13
2	FERTILIZED	94.10	25.66	55.70	49.01	75.58	9.61	12.62
		ns	**	**	**	**	**	**
	F =	3.68	164.35	190.59	104.09	116.13	61.75	2210.8
	P =	.0569	.0000	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	1.47	.42	1.87	.30	1.87	1.03	.15
	FACTOR ANALYSIS - FACTOR 3 = VARIETY (across 5 years & 2 fertility schemes)							
01	BARONESSE	95.06	21.80	52.68	48.89	79.42	7.68	10.67
02	BOWMAN	91.29	24.28	51.12	50.97	90.81	3.48	10.96
15	STARK	94.38	25.23	50.40	51.24	88.44	4.64	10.77
03	CHINOOK	93.54	23.84	48.70	49.61	74.60	10.01	10.91
06	HARRINGTON	92.95	23.81	48.36	48.30	81.31	7.08	10.89
08	LEWIS	92.12	24.70	47.96	50.08	78.90	8.47	11.16
05	GALLATIN	94.65	25.00	47.92	49.94	78.24	8.01	10.49
07	HECTOR	93.09	25.68	46.15	49.24	73.78	11.05	11.14
		ns	**	*	**	**	**	**
	F =	1.51	15.84	2.45	21.40	20.56	11.67	4.67
	P =	.1659	.0000	.0209	.0000	.0000	.0000	.0001
	LSD (.05) =	2.94	.84	3.74	.60	3.74	2.07	.29
	GRAND MEANS (240 obs)	93.39	24.29	49.16	49.78	80.69	7.56	10.87
	Year x Fert Interactions (P)	.0015	.0000	.0000	.0000	.0000	.0000	.0000
	Year x Variety Interactions (P)	.7483	.0136	.2381	.0023	.0661	.7041	.0089
	Fert x Variety Interactions (P)	.8268	.3582	.7534	.0322	.0000	.0024	.0000
	Yr x Fert x Var Interactions (P)	.9832	.5264	.9678	.9145	.1151	.2181	.2810

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TABLE 6. FACTORIAL SUMMARY OF RELATIVE AGRONOMIC PERFORMANCE OF 8 FERTILIZED SPRING BARLEY VARIETIES GROWN 5 YEARS UNDER DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1998. 1/

ID	YEAR/VARIETY	STAND	PLNT HT	YIELD	TESTWT	PLUMP	THIN	PROTEIN
		----- Percent of Unfertilized Performance ------						
	FACTOR ANALYSIS - FACTOR 1 = YEAR (across 8 varieties)							
		%	%	%	%	%	%	%
1	1994	98.5	126.4	168.9	94.8	83.4	350.4	163.5
2	1995	109.8	109.9	103.4	96.5	87.6	311.4	115.9
3	1996	99.8	106.4	117.4	98.4	97.1	124.5	165.0
4	1997	101.9	107.1	139.7	95.6	72.9	386.7	114.6
5	1998	100.2	115.1	165.7	99.7	113.8	150.6	149.8
		**	**	**	**	**	**	**
	F =	7.47	14.16	16.23	8.99	12.53	23.42	103.54
	P =	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	LSD (.05) =	4.63	6.17	20.21	1.89	12.30	69.49	6.89
	FACTOR ANALYSIS - FACTOR 2 = VARIETY (across 5 years)							
		%	%	%	%	%	%	%
15	STARK	104.2	117.7	147.7	98.2	100.8	175.9	137.6
07	HECTOR	99.3	112.9	143.8	97.9	95.9	222.9	136.9
01	BARONESSE	100.4	112.1	139.8	97.2	93.5	277.4	152.8
08	LEWIS	102.9	114.6	138.3	97.3	95.7	224.7	140.6
02	BOWMAN	101.4	110.6	138.1	98.4	96.4	195.0	133.5
05	GALLATIN	100.6	115.1	137.2	96.6	81.0	316.7	139.4
03	CHINOOK	102.6	110.1	135.9	95.5	80.1	369.2	149.1
06	HARRINGTON	104.9	110.9	131.4	94.8	84.4	336.2	144.2
		ns	ns	ns	*	ns	**	**
	F =	.88	.89	.30	2.36	2.06	5.13	4.45
	P =	.5231	.5155	.9532	.0309	.0582	.0001	.0003
	LSD (.05) =	5.85	7.80	25.57	2.39	15.55	87.90	8.72
		%	%	%	%	%	%	%
	GRAND MEANS (120 obs)	102.0	113.0	139.0	97.0	91.0	264.7	141.8
	Yr x Variety Interactions (P)	.7283	.4642	.9308	.8967	.6632	.0030	.6143

1/ Fertilized performance expressed as percent of the unfertilized performance for individual years across varieties and individual varieties across years.

Fertilized Spring Barley Performance

(Relationships with Unfertilized Pairs)

Leon Cederberg Farm, Turner - 1994-98

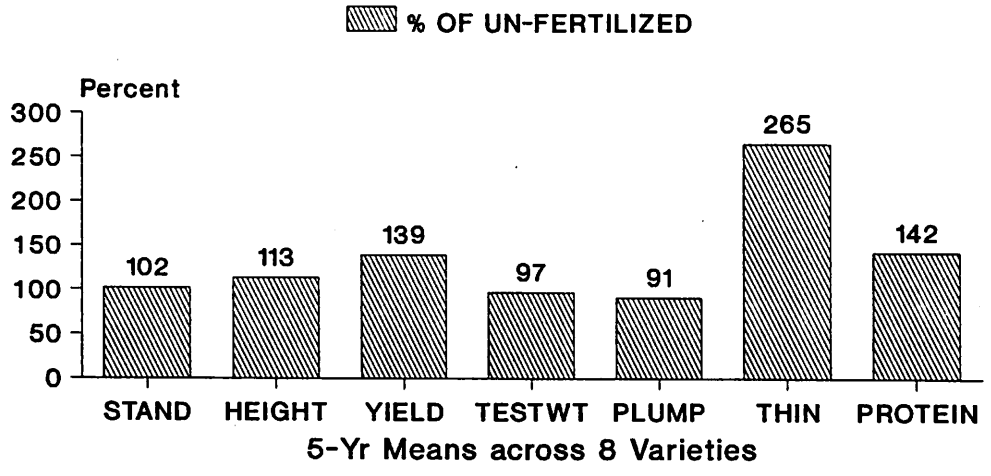

Figure 5.
MSU/AES/NARC-Havre

TABLE 7. FIVE-YEAR YIELD AND TEST WEIGHT SUMMARY ON SELECTED ENTRIES FROM A FERTILIZED FALLOW SPRING WHEAT VARIETY NURSERY GROWNN AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1998.

2/ VARIETY OR SELECTION	NO. OF YEARS TESTED	1/ YIELD (BUSHELS PER ACRE) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	5-YR. COMPAR. AVERAGE YIELD 3/	PERCENT OF FORTUNA YIELD 4/	TEST WEIGHT (POUNDS PER BUSHEL) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	5-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	47.1	129.5	-	57.8	58.9	52.1	-	56.3	56.5	94.1
CI 17828 PONDERA	2	36.4	56.0	-	-	-	46.2	44.5	122.4	58.9	60.0	-	-	-	59.5	59.2	98.6
CI 17430 NEWANA	5	36.3	55.8	29.9	43.8	51.5	43.5	43.5	119.6	58.6	59.5	61.5	56.9	58.1	58.9	58.9	98.2
MT 9508 FORTUNA/PONDER	1	-	-	-	43.7	-	43.7	43.2	118.8	-	-	-	58.4	-	58.4	61.6	102.6
WB 936 WB 936 (P+)	4	-	57.9	24.2	45.0	49.3	44.1	43.0	118.4	-	58.3	60.2	56.0	57.4	58.0	58.0	96.6
MT 9433 MT8808/MARBERG	3	-	-	28.8	45.9	50.8	41.8	42.9	118.1	-	-	60.7	58.5	59.5	59.6	59.7	99.5
WBEXPRES WB EXPRESS(P+)	4	-	56.4	27.3	42.6	49.2	43.9	42.8	117.9	-	59.6	59.7	56.4	58.1	58.4	58.5	97.4
PI574642 McNEAL	5	30.3	57.6	29.1	45.5	51.5	42.8	42.8	117.7	57.1	59.9	59.2	56.4	58.4	58.2	58.2	97.0
PNR 2375 PIONEER 2375	4	-	54.0	27.7	41.6	51.9	43.8	42.8	117.7	-	60.0	61.1	57.0	59.5	59.4	59.4	99.0
PI483235 GLENMAN	5	37.5	56.8	30.1	41.5	47.6	42.7	42.7	117.5	57.7	58.6	59.0	55.9	56.5	57.5	57.5	95.9
PI549275 HI-LINE	5	30.6	57.2	29.7	42.3	53.1	42.6	42.6	117.2	57.3	59.8	59.8	55.5	58.0	58.1	58.1	96.8
MT 9360 LEW/PND	1	-	49.7	-	-	-	49.7	42.2	116.2	-	60.2	-	-	-	60.2	59.8	99.6
ND 606 AMIDON	5	32.3	52.1	29.3	46.5	50.9	42.2	42.2	116.2	58.5	59.6	60.5	56.9	58.7	58.8	58.8	98.0
PI486139 KLASIC (hrd wh	1	37.7	-	-	-	-	37.7	41.8	115.0	57.5	-	-	-	-	57.5	57.4	95.7
MTHW9420 MT8182/MT8289	3	-	-	27.3	42.2	51.2	40.2	41.3	113.6	-	-	60.4	55.4	57.7	57.8	58.0	96.6
ND 677 ERNEST (+)	5	33.8	52.4	28.4	41.8	49.5	41.2	41.2	113.3	59.9	59.7	61.4	56.2	59.4	59.3	59.3	98.8
WPB 926R WB 926R (P)	5	35.6	54.3	26.2	43.1	45.4	40.9	40.9	112.6	57.8	57.8	60.3	55.6	57.6	57.8	57.8	96.3
MT 9609 FORTUNA/AMIDON	1	-	-	-	-	47.4	47.4	40.9	112.5	-	-	-	-	58.9	58.9	58.4	97.2
CI 17904 OWENS(sft wht)	1	36.5	-	-	-	-	36.5	40.5	111.5	57.2	-	-	-	-	57.2	57.1	95.2
ND 626 GRANDIN	5	34.6	49.5	24.7	43.0	49.5	40.2	40.2	110.7	58.8	57.8	60.9	55.7	57.8	58.2	58.2	97.0
MTHW9406 MT8182/KLASIC	1	-	47.3	-	-	-	47.3	40.2	110.7	-	57.5	-	-	-	57.5	57.0	95.0
TR983239 WB FERGUS (P+)	4	-	50.8	24.4	44.1	44.4	40.9	39.9	109.9	-	59.0	61.3	56.4	58.1	58.7	58.7	97.8
ND 582 STOA	5	33.9	47.6	28.7	44.4	43.9	39.7	39.7	109.2	57.7	58.0	59.3	55.3	57.6	57.6	57.6	96.0
CI 17790 LEN	5	31.7	50.3	27.7	40.7	47.5	39.6	39.6	108.9	57.5	58.2	60.6	56.2	58.0	58.1	58.1	96.8
MTHW9520 CAN1/MT8182 (h	1	-	-	-	39.3	-	39.3	38.8	106.8	-	-	-	54.8	-	54.8	57.8	96.3
C982-324 WB RAMBO (P+)	5	34.2	49.3	25.5	38.0	46.2	38.6	38.6	106.3	59.7	59.8	61.2	58.0	58.9	59.5	59.5	99.2
ND 673 TRENTON	3	-	-	25.8	41.9	44.9	37.5	38.5	105.9	-	-	61.0	56.2	58.5	58.6	58.7	97.9
WA 6920 PENAWAWA (sfwh	1	34.4	-	-	-	-	34.4	38.2	105.1	57.2	-	-	-	-	57.2	57.2	95.2
MT 9354 MT7810/(SU73/L	1	-	44.8	-	-	-	44.8	38.1	104.8	-	59.3	-	-	-	59.3	58.9	98.1
BZ984326 WB BORDER (P+)	2	28.9	49.7	-	-	-	39.3	37.8	104.0	57.5	58.3	-	-	-	57.9	57.6	96.0
MT 9311 MT7819/(OLAF/L	1	-	-	28.3	-	-	28.3	37.7	103.7	-	-	62.0	-	-	62.0	60.0	100.0
MT 9565 HI-LINE/PI3721	1	-	-	27.9	-	-	27.9	37.1	102.0	-	-	60.1	-	-	60.1	58.2	96.9
CI 17429 LEW	5	31.5	40.0	28.6	37.6	46.8	36.9	36.9	101.6	59.6	60.9	61.3	57.4	60.5	59.9	59.9	99.9
CI 13596 FORTUNA	5	32.8	42.7	27.3	36.8	42.1	36.3	36.3	100.0	60.1	60.5	62.0	56.9	60.6	60.0	60.0	100.0
MT 9410 MT8808/MARBERG	1	-	-	27.1	-	-	27.1	36.0	99.2	-	-	61.4	-	-	61.4	59.4	99.0
MTHW9503 MT8182/MT8289	1	-	-	26.6	-	-	26.6	35.3	97.2	-	-	59.6	-	-	59.6	57.7	96.1
NDCUT CUTLESS	1	29.5	-	-	-	-	29.5	32.7	89.9	60.1	-	-	-	-	60.1	60.0	100.0
CANLANC LANCER	1	28.3	-	-	-	-	28.3	31.4	86.5	59.2	-	-	-	-	59.2	59.1	98.5
MEAN (ENTRIES LISTED)		33.3	51.9	27.6	42.5	48.3	-	40.1	-	58.4	59.1	60.5	56.3	58.5	-	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	5.41	5.64										
Total Plant Avail. Water (in.)		10.77	13.80	9.63	15.35		12.33										
Soil NO3 (lbs.) to SD at Plntng.		28.0	54.0	54.0	60.0	176.0	74.4										
SD (Sampling Depth in inches)		48.0	48.0	48.0	48.0	48.0											
Fertilizer Applied (# N)		66.0	66.0	66.0	66.0	66.0											
(# P2O5)		33.0	33.0	33.0	33.0	33.0											

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/ 5-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 = 5-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.

TABLE 8. FIVE-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. 1994-1998.

2/ VARIETY OR SELECTION	NO. OF YEARS TESTED	1/ YIELD (BUSHELS PER ACRE) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	5-YR. COMPAR. AVERAGE YIELD 3/	PERCENT OF FORTUNA YIELD 4/	TEST WEIGHT (POUNDS PER BUSHEL) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	5-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	42.9	163.5	-	61.7	60.4	59.5	-	60.5	61.1	100.3
MTHW9520 CAN1/MT8182 (h	1	-	-	-	37.5	-	37.5	38.6	147.1	-	-	-	60.6	-	60.6	62.7	103.0
MTHW9406 MT8182/KLASIC	1	-	41.9	-	-	-	41.9	37.1	141.5	-	61.1	-	-	-	61.1	61.0	100.1
MT 9354 MT7810/(SU73/L	1	-	39.6	-	-	-	39.6	35.1	133.7	-	62.4	-	-	-	62.4	62.3	102.2
MTHW9420 MT8182/MT8289(	3	-	-	25.3	34.7	38.5	32.8	34.3	130.6	-	-	61.5	60.0	61.9	61.1	61.5	100.9
PNR 2375 PIONEER 2375	4	-	42.5	23.3	28.5	36.1	32.6	34.1	129.7	-	62.2	61.2	60.4	61.5	61.3	61.5	101.0
ND 606 AMIDON	5	24.6	43.1	24.6	36.0	38.9	33.5	33.5	127.4	61.9	61.7	60.7	59.6	61.3	61.0	61.0	100.2
WBEXPRES WB EXPRESS (P+	4	-	42.8	22.8	30.5	37.0	33.3	33.3	126.8	-	62.2	61.3	60.6	61.3	61.3	61.6	101.1
MT 9433 MT8808/MARBERG	3	-	-	24.8	33.7	36.4	31.6	33.1	125.9	-	-	62.0	61.4	62.1	61.8	62.1	102.0
TR983239 WB FERGUS (P+)	4	-	44.3	20.1	29.6	30.7	31.2	32.6	124.1	-	62.8	61.5	61.0	62.0	61.8	62.1	101.9
CI 17790 LEN	5	24.3	43.8	23.0	35.6	34.4	32.2	32.2	122.7	62.1	61.5	61.4	60.3	61.5	61.4	61.4	100.8
MT 9565 HI-LINE/PI3721	1	-	-	25.4	-	-	25.4	32.2	122.7	-	-	60.7	-	-	60.7	60.3	99.0
ND 673 TRENTON	3	-	-	22.3	34.3	35.6	30.8	32.1	122.4	-	-	61.6	60.4	61.6	61.2	61.5	101.0
ND 677 ERNEST (+)	5	24.7	44.6	23.5	29.9	36.5	31.8	31.8	121.3	62.8	62.0	62.1	59.5	61.7	61.6	61.6	101.2
MT 9609 FORTUNA/AMIDON	1	-	-	-	-	35.2	35.2	31.6	120.3	-	-	-	-	61.4	61.4	60.7	99.7
MT 9360 LEW/PND	1	-	35.6	-	-	-	35.6	31.6	120.3	-	61.5	-	-	-	61.5	61.4	100.9
CI 17430 NEWANA	5	25.0	40.4	23.7	30.8	37.7	31.5	31.5	120.1	62.8	62.7	62.1	61.3	61.8	62.1	62.1	102.0
PI574642 McNEAL	5	24.6	41.1	24.5	31.3	36.0	31.5	31.5	120.0	60.4	62.0	59.8	60.7	60.9	60.8	60.8	99.8
WPB 926R WB 926R (P)	5	24.4	44.7	21.8	32.5	32.4	31.2	31.2	118.7	61.7	61.5	60.9	60.4	60.9	61.1	61.1	100.2
ND 626 GRANDIN	5	23.5	37.7	23.4	34.3	35.5	30.9	30.9	117.7	62.4	61.8	62.1	61.2	61.7	61.8	61.8	101.5
ND 582 STOA	5	25.2	40.6	22.8	31.2	34.6	30.9	30.9	117.7	62.2	61.6	60.4	59.7	60.9	61.0	61.0	100.1
PI483235 GLENMAN	5	26.1	39.2	24.3	28.9	34.8	30.7	30.7	116.9	61.2	61.3	58.8	59.3	61.0	60.3	60.3	99.0
WB 936 WB 936 (P+)	4	-	40.4	21.9	29.2	31.1	30.7	30.7	116.8	-	61.1	60.8	60.4	61.5	61.0	61.2	100.4
PI549275 HI-LINE	5	24.1	37.5	23.9	32.7	34.2	30.5	30.5	116.1	62.2	62.6	60.4	61.0	62.1	61.7	61.7	101.2
C982-324 WB RAMBO (P+)	5	23.1	40.5	22.3	29.7	33.4	29.8	29.8	113.4	63.5	62.9	62.8	61.5	61.7	62.5	62.5	102.5
MTHW9503 MT8182/MT8289(	1	-	-	23.3	-	-	23.3	29.6	112.6	-	-	60.6	-	-	60.6	60.2	98.9
MT 9311 MT7819/(OLAF/L	1	-	-	23.1	-	-	23.1	29.3	111.7	-	-	62.7	-	-	62.7	62.3	102.2
MT 9410 MT8808/MARBERG	1	-	-	23.0	-	-	23.0	29.1	111.0	-	-	62.2	-	-	62.2	61.8	101.5
CI 17429 LEW	5	24.2	34.9	21.9	30.5	34.0	29.1	29.1	110.9	62.1	62.5	60.6	60.1	62.6	61.6	61.6	101.1
MT 9508 FORTUNA/PONDER	1	-	-	-	27.9	-	27.9	28.8	109.5	-	-	-	60.4	-	60.4	62.5	102.6
WA 6920 PENAWAWA (sfwh	1	28.5	-	-	-	-	28.5	28.5	108.4	61.2	-	-	-	-	61.2	60.3	99.0
CI 17904 OWENS(sft wht)	1	28.1	-	-	-	-	28.1	28.1	106.9	60.9	-	-	-	-	60.9	60.0	98.5
BZ984326 WB BORDER (P+)	2	21.6	36.1	-	-	-	28.8	27.1	103.2	61.9	61.6	-	-	-	61.8	61.3	100.6
CI 17828 PONDERA	2	23.3	33.3	-	-	-	28.3	26.6	101.4	62.6	62.0	-	-	-	62.3	61.8	101.5
CI 13596 FORTUNA	5	26.3	29.6	20.7	25.5	29.2	26.3	26.3	100.0	61.8	61.0	61.3	58.8	61.6	60.9	60.9	100.0
PI486139 KLASIC (hrd wh	1	23.3	-	-	-	-	23.3	23.3	88.7	62.0	-	-	-	-	62.0	61.1	100.3
NDCUT CUTLESS	1	23.1	-	-	-	-	23.1	23.1	87.9	62.8	-	-	-	-	62.8	61.9	101.6
CANLANC LANCER	1	23.1	-	-	-	-	23.1	23.1	87.8	62.0	-	-	-	-	62.0	61.1	100.4
MEAN (ENTRIES LISTED)		24.6	40.3	23.4	32.1	34.9	-	30.9	-	62.0	61.9	61.2	60.3	61.6	-	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	6.07	5.97										
Total Plant Avail. Water (in.)		10.77	14.79	9.69	15.25		12.65										
Soil NO3 (lbs.) to SD at Plntng.		28.0	66.0	44.0	44.0	96.0	55.6										
SD (Sampling Depth in inches)		48.0	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 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/ 5-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 = 5-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.

TABLE 9. FIVE-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. 1994-1998.

2/ VARIETY OR SELECTION	NO. OF YEARS TESTED	1/ YIELD (BUSHELS PER ACRE) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	5-YR. COMPAR. AVERAGE YIELD 3/	PERCENT OF HECTOR YIELD 4/	TEST WEIGHT (POUNDS PER BUSHEL) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	5-YR. COMPAR. AVERAGE TEST WT 3/	PERCENT OF HECTOR TEST WT 4/
MT890070 MT890070	1	-	62.5	-	-	-	62.5	68.6	131.5	-	50.7	-	-	-	50.7	51.2	105.2
CI 15229 STEPTOE	4	65.6	68.3	42.5	60.4	-	59.2	62.9	120.6	42.0	42.5	42.1	44.4	-	42.7	43.4	89.0
MTLB 5 MTLB 5	1	-	-	-	-	77.3	77.3	62.4	119.7	-	-	-	-	52.0	52.0	49.1	100.9
MTLB 32 MTLB 32	1	-	-	-	-	76.9	76.9	62.1	119.1	-	-	-	-	50.5	50.5	47.7	98.0
MT890008 MT890008	2	56.6	59.5	-	-	-	58.1	61.7	118.3	45.8	46.5	-	-	-	46.2	47.3	97.2
NS 78054 BARONESSE (P+)	5	55.2	71.7	43.4	56.7	74.1	60.2	60.2	115.4	47.0	49.1	48.9	46.6	49.3	48.2	48.2	98.9
MT920073 MT920073	1	-	-	-	-	73.9	73.9	59.7	114.5	-	-	-	-	51.5	51.5	48.7	100.1
PI537967 COLTER	2	56.7	55.4	-	-	-	56.1	59.6	114.3	42.2	44.5	-	-	-	43.3	44.4	91.3
MT910150 MT910150	1	-	-	-	-	73.7	73.7	59.6	114.2	-	-	-	-	52.7	52.7	49.8	102.3
MT889106 APEX/LEWIS	2	57.1	54.0	-	-	-	55.6	59.1	113.3	48.9	50.8	-	-	-	49.9	51.1	105.0
MTLB 57 MTLB 57	1	-	-	-	-	72.7	72.7	58.7	112.5	-	-	-	-	51.2	51.2	48.4	99.5
MTLB 6 MTLB 6	1	-	-	-	-	72.6	72.6	58.7	112.5	-	-	-	-	51.3	51.3	48.5	99.6
ND 9866 STARK	5	58.2	57.8	39.3	62.8	75.0	58.6	58.6	112.4	50.2	51.6	49.7	49.9	52.4	50.8	50.8	104.2
PI483237 BOWMAN	5	53.8	54.1	49.4	65.1	69.8	58.4	58.4	112.0	48.8	50.7	50.0	51.3	52.0	50.6	50.6	103.8
H3860224 LEWIS/APEX	4	50.8	69.3	38.7	60.4	-	54.8	58.3	111.7	45.1	48.7	47.7	47.8	-	47.3	48.0	98.6
PI537438 TARGHEE	3	-	63.4	41.2	57.3	-	54.0	58.0	111.1	-	48.1	47.5	47.5	-	47.7	48.0	98.5
N1123111 LOGAN	3	-	-	38.9	64.4	66.4	56.6	58.0	111.1	-	-	48.5	50.4	51.3	50.1	49.2	101.1
MT851195 MT851195	4	57.7	59.1	42.6	58.4	-	54.5	57.9	111.0	47.1	49.4	47.8	48.3	-	48.1	48.8	100.3
MT861596 LEWIS/MT41549	1	55.8	-	-	-	-	55.8	57.5	110.3	48.3	-	-	-	-	48.3	50.4	103.4
MT910189 MT910189	1	-	-	-	-	69.3	69.3	56.0	107.3	-	-	-	-	52.1	52.1	49.2	101.1
CI 9558 PIROLINE	3	58.1	58.0	34.5	-	-	50.2	55.4	106.2	50.3	50.6	48.0	-	-	49.6	50.8	104.2
PI491534 GALLATIN	5	54.1	50.7	36.5	59.4	70.7	54.3	54.3	104.0	47.8	49.7	48.4	48.5	51.0	49.1	49.1	100.8
PI591823 CHINOOK (+)	5	56.0	52.5	39.0	54.8	68.7	54.2	54.2	103.9	46.7	48.7	47.8	47.7	51.3	48.4	48.4	99.5
CI 15856 LEWIS	5	51.6	55.9	40.9	54.9	66.6	54.0	54.0	103.5	47.6	49.5	49.1	48.4	52.3	49.4	49.4	101.4
SK 76333 HARRINGTON	5	48.7	58.2	32.1	57.0	72.5	53.7	53.7	102.9	45.2	46.7	47.2	47.2	48.7	47.0	47.0	96.5
MT860756 GALLATIN/BELLO	1	51.4	-	-	-	-	51.4	53.0	101.6	47.5	-	-	-	-	47.5	49.5	101.7
MT886610 MT81143/LEWIS	4	50.2	57.0	33.9	58.1	-	49.8	52.9	101.5	46.3	48.7	48.7	47.7	-	47.8	48.5	99.6
CI 15514 HECTOR	5	50.6	47.5	43.8	54.4	64.6	52.2	52.2	100.0	46.7	48.2	47.9	49.1	51.5	48.7	48.7	100.0
H5860219 LEWIS/APEX	1	48.4	-	-	-	-	48.4	50.0	95.8	45.5	-	-	-	-	45.5	47.4	97.4
MN 56 STANDER	2	-	-	41.6	48.8	-	45.2	48.1	92.2	-	-	45.9	48.7	-	47.3	47.4	97.4
ND 11055 FOSTER	1	-	-	-	45.7	-	45.7	43.8	84.0	-	-	-	45.8	-	45.8	45.4	93.2
WPB92 1 MEDALLION (P+)	1	42.2	-	-	-	-	42.2	43.6	83.5	42.1	-	-	-	-	42.1	43.9	90.2
MEANS (ENTRIES LISTED)		53.9	58.6	39.9	57.4	71.6	-	56.6	-	46.6	48.6	47.8	48.1	51.3	-	48.4	-
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	5.41	5.46										
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	176.0	74.4										
SD (Sampling Depth in inches)		48.0	48.0	48.0	48.0	48.0											
Fertilizer Applied (# N)		66.0	66.0	66.0	66.0	66.0											
(# P2O5)		33.0	33.0	33.0	33.0	33.0											

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/ 5-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 = 5-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.

TABLE 10. FIVE-YEAR YIELD AND TEST WEIGHT SUMMARY ON SELECTED ENTRIES FROM AN UNFERTLIZED FALLOW SPRING BARLEY VARIETY NURSERY GROWN OFF-STATION AT THE LEON CEDERGERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1994-1998.

2/ VARIETY OR SELECTION	NO. OF YEARS TESTED	1/ YIELD (BUSHELS PER ACRE) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	5-YR. COMPAR. AVERAGE YIELD 3/	PERCENT OF HECTOR YIELD 4/	TEST WEIGHT (POUNDS PER BUSHEL) 1994	1995	1996	1997	1998	AVERAGE FOR YEARS TESTED	5-YR. COMPAR. AVERAGE TEST WT 3/	PERCENT OF HECTOR TEST WT 4/
PI537438 TARGHEE	3	-	57.0	40.7	50.4	-	49.4	47.9	119.3	-	49.7	48.1	48.7	-	48.8	48.6	97.5
MT851195 MT851195	4	35.5	54.5	42.6	48.3	-	45.2	46.7	116.5	48.8	49.7	48.5	49.5	-	49.1	49.3	99.1
MT886610 MT81143/LEWIS	4	34.4	54.7	40.4	51.2	-	45.2	46.7	116.4	49.8	50.7	48.5	49.8	-	49.7	49.9	100.3
PI537967 COLTER	2	33.3	63.2	-	-	-	48.3	46.7	116.2	46.7	46.6	-	-	-	46.6	47.0	94.5
H3860224 LEWIS/APEX	4	33.4	60.8	37.1	45.0	-	44.1	45.6	113.6	48.8	50.1	48.5	50.2	-	49.4	49.6	99.6
NS 78054 BARONESSE (P+)	5	38.1	63.8	36.9	45.6	41.3	45.1	45.1	112.5	50.9	49.9	49.2	49.6	48.5	49.6	49.6	99.7
MT861596 LEWIS/MT41549	1	34.8	-	-	-	-	34.8	44.8	111.6	50.8	-	-	-	-	50.8	52.6	105.6
MT860756 GALLATIN/BELLO	1	34.7	-	-	-	-	34.7	44.7	111.4	50.6	-	-	-	-	50.6	52.3	105.1
MT920073 MT920073	1	-	-	-	-	50.1	50.1	44.4	110.5	-	-	-	-	52.8	52.8	51.9	104.3
MT910189 MT910189	1	-	-	-	-	49.6	49.6	43.9	109.4	-	-	-	-	53.3	53.3	52.4	105.2
PI483237 BOWMAN	5	40.2	53.5	35.5	46.1	43.8	43.8	43.8	109.2	51.5	51.4	49.6	52.0	52.5	51.4	51.4	103.2
CI 9558 PIROLINE	3	35.5	55.1	37.1	-	-	42.5	43.6	108.6	51.9	51.9	49.8	-	-	51.2	51.9	104.2
CI 15229 STEPTOE	4	35.1	59.1	31.2	43.0	-	42.1	43.5	108.4	44.7	45.0	44.4	45.4	-	44.9	45.1	90.5
PI591823 CHINOOK (+)	5	35.2	58.1	36.5	37.8	48.4	43.2	43.2	107.7	49.5	51.7	48.2	51.6	52.8	50.8	50.8	102.0
SK 76333 HARRINGTON	5	32.5	58.5	35.3	44.2	44.6	43.0	43.0	107.2	48.2	50.0	49.4	50.3	50.1	49.6	49.6	99.7
MT890008 MT890008	2	35.3	53.1	-	-	-	44.2	42.7	106.5	48.7	48.6	-	-	-	48.7	49.1	98.6
ND 9866 STARK	5	34.8	46.5	37.7	45.4	46.5	42.2	42.2	105.1	52.6	51.7	50.6	51.0	52.6	51.7	51.7	103.9
CI 15856 LEWIS	5	33.2	56.3	34.1	42.6	43.5	42.0	42.0	104.5	49.7	51.8	49.9	50.6	52.0	50.8	50.8	102.0
N1123111 LOGAN	3	-	-	33.8	40.5	47.9	40.7	41.7	103.9	-	-	48.5	51.9	52.5	50.9	50.7	101.8
PI491534 GALLATIN	5	33.2	49.5	32.0	43.3	49.9	41.6	41.6	103.6	50.4	51.5	49.7	50.7	51.7	50.8	50.8	102.0
MT910150 MT910150	1	-	-	-	-	46.1	46.1	40.8	101.6	-	-	-	-	52.0	52.0	51.1	102.6
MT890070 MT890070	1	-	52.2	-	-	-	52.2	40.4	100.6	-	51.1	-	-	-	51.1	50.3	101.0
CI 15514 HECTOR	5	31.2	51.9	34.5	37.8	45.3	40.1	40.1	100.0	48.1	50.6	48.8	50.8	50.6	49.8	49.8	100.0
MTLB 5 MTLB 5	1	-	-	-	-	44.9	44.9	39.8	99.1	-	-	-	-	53.1	53.1	52.2	104.9
MTLB 6 MTLB 6	1	-	-	-	-	44.9	44.9	39.8	99.1	-	-	-	-	53.0	53.0	52.1	104.7
H5860219 LEWIS/APEX	1	30.5	-	-	-	-	30.5	39.3	97.9	49.1	-	-	-	-	49.1	50.8	102.0
MTLB 32 MTLB 32	1	-	-	-	-	43.9	43.9	38.8	96.8	-	-	-	-	50.5	50.5	49.7	99.8
MTLB 57 MTLB 57	1	-	-	-	-	42.8	42.8	37.9	94.5	-	-	-	-	51.9	51.9	51.0	102.5
MT889106 APEX/LEWIS	2	34.1	43.6	-	-	-	38.8	37.5	93.5	52.0	51.6	-	-	-	51.8	52.2	104.9
WPB92 1 MEDALLION (P+)	1	28.5	-	-	-	-	28.5	36.7	91.5	46.7	-	-	-	-	46.7	48.3	97.1
MN 56 STANDER	2	-	-	29.2	35.6	-	32.4	36.0	89.6	-	-	47.9	49.7	-	48.8	48.8	98.0
ND 11055 FOSTER	1	-	-	-	30.2	-	30.2	32.1	79.9	-	-	-	47.8	-	47.8	46.8	94.0
MEANS (ENTRIES LISTED)		34.2	55.1	35.9	42.9	45.8	-	42.0	-	49.5	50.2	48.7	50.0	51.9	-	50.3	-
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	6.07	5.97										
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	96.0	55.6										
SD (Sampling Depth in inches)		48.0	48.0	48.0	48.0	48.0											
Fertilizer Applied (# N)		0.0	0.0	0.0	0.0	0.0											
(# P205)		0.0	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/ 5-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 = 5-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.