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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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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 1995, but not as dramatic as that seen in 1994. 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 23 spring wheat cultivars grown in 1995, "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 a 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. Due to advancement of the MWBC report deadline, we were not yet able to make any economic comparisons. Such will be done after the last PNW market day in December. In the absence of 1995 economic analyses, 1994 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.

181

Agronomic performance data for 18 spring barley cultivars grown in 1995, "Unfertilized" are presented in Table 5. Performance data in an identical format for the same cultivars, "Fertilized" are presented in Table 6. Table 7. 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 8. 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.

TABLE 1. PERFORMANCE OF UNFERTILIZED SPRING WHEAT VARIETIES UNDER DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1995.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %
BZ684-23	VANNA (soft white)	92.37	28.10	52.53	61.73	8.27
WB 926	WESTBRED 926	86.80	26.25	44.73	61.47	11.00
ND 677	ERNST	93.07	34.95	44.60	62.00	11.73
TR983239	FERGUS	91.37	29.63	44.33	62.77	11.50
CI 17790	LEN	91.33	28.81	43.80	61.53	11.57
ND 606	AMIDON	96.90	36.25	43.13	61.70	11.57
WBEXPRES	WESTBRED EXPRESS	89.93	23.58	42.80	62.17	11.10
PNR 2375	PIONEER 2375	96.50	29.83	42.47	62.17	10.63
MTHW9406	MT8182/KLASIC (hard white)	96.53	29.11	41.87	61.07	9.73
PI574642	MCNEAL	93.77	28.35	41.07	61.97	11.23
ND 582	STOA	93.07	36.63	40.60	61.60	10.80
C982-324	RAMBO	93.40	25.52	40.50	62.90	10.23
CI 17430	NEWANA	93.40	27.78	40.43	62.70	10.97
WB 936	WESTBRED 936	85.77	24.11	40.43	61.13	11.83
MT 9354	MT7810/(SU73/LEW)	92.37	29.32	39.57	62.37	11.80
PI483235	GLENMAN	93.80	29.83	39.23	61.33	10.40
ND 626	GRANDIN	80.53	29.93	37.73	61.80	12.33
PI549275	HI-LINE	95.13	26.65	37.47	62.63	10.70
BZ984326	BORDER	96.17	26.88	36.10	61.60	12.63
MT 9360	LEW/PND	95.83	29.59	35.60	61.53	12.33
CI 17429	LEW	98.27	33.23	34.93	62.47	10.80
CI 17828	PONDERA	86.43	26.84	33.33	62.00	11.87
CI 13596	FORTUNA	96.90	30.58	29.60	61.00	11.67
EXPERIMENTAL MEANS		92.59	29.21	40.30	61.90	11.16
C.V. 2: (S OF MEAN/MEAN)*100		2.60	2.76	7.83	.48	4.18
LSD (0.05)		6.86	2.30	8.99	.84	1.33

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 95-9950-SW Field: OffSta Design: RCB # Bnts: 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: 108.38 W Elevation: 2900 ft.

Seeding Date: 05/11/95 Sd'g Depth: 1.50 in. Depth to Moisture @ Sd'g: 0.25 in. Moist Soil Depth @ Sd'g: 55.0+ in. Soil Temp @ Sd'g:     F @ 1 in. 70.0F @ 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: 1994 Fallow Season = 3x Tillage w/Sweeps & Harrows, 1x Tillage w/Sweeps, Rods & Harrows  
 Cropping History: 1 Yr Ago = 94 =     Fallow 2 Yrs Ago = 93 =     Spring Wheat 3 Yrs Ago = 92 =     Fallow  
 Fertilizer: 0#N, 0#P2O5, 0#K2O/ac            Herbicide: 'BanvelSGF'+LV6 @4.26+6.4oz/ac  
 Harvest Date: 09/13/95 Root Penetration Depth: 45 in. Comments:           

Depth in.	PRE-PLANT SOIL ANAL 04/27/95										POST-HVST SOIL ANAL 09/13/95 (Max Depth=48"												
	PAW	pH	OM	NO3	P	K	S	Text	C EC	CL	Text	PAW	pH	OM	NO3	P	K	S	Text	C EC	CL	Text	
0 -6"	.69	5.9	1.8	26	15	427	13	CL-	21.8			.54	6.0	1.8	6	15	444	9	SCL-	21.7			
6-24"	2.30			24			9	CL				1.50			6			15	CL				
24-36"	1.42			8				CL				.67			4				CL+				
36-48"	1.25			8				CL				.84			8				CL+				
TOTAL:	5.66			66								3.55			24								

Precipitation 04/27/95 to Sd'g: 0.42 in. ( 0.30 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 6.08 in. & Stored Soil 05/11/95 to Hvst: 9.55 in. ( 8.95 in events =>.1 in.) Measured Resid Soil Water @ Hvst: 3.55 in.  
 Water Summary: Growing Season (05/11/95 to 14 days prior to Harvest Maturity: 8.71 in.) ( 8.17 in events =>.1 in.)  
 Post-Grwg Seas (14 days prior to Harvest Maturity to 09/13/95: 0.84 in.) ( 0.78 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: 11.24 in.)

TABLE 2. PERFORMANCE OF FERTILIZED SPRING WHEAT VARIETIES UNDER DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1995.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %
BZ684-23	VANNA (soft white)	93.40	30.41	61.70	57.80	10.17
WB 936	WESTBRED 936	83.33	28.32	57.93	58.33	12.30
PI574642	MCNEAL	90.63	33.40	57.57	59.87	12.53
PI549275	HI-LINE	92.70	29.29	57.20	59.83	12.03
PI483235	GLENMAN	96.53	31.27	56.77	58.57	11.33
WBEXPRES	WESTBRED EXPRESS	91.33	26.10	56.43	59.60	12.43
CI 17828	PONDERA	85.40	31.42	55.97	60.03	12.33
CI 17430	NEWANA	93.43	29.82	55.80	59.53	11.23
WB 926	WESTBRED 926	92.03	29.07	54.30	57.77	12.23
PNR 2375	PIONEER 2375	95.50	35.49	54.03	59.97	11.63
ND 677	ERNEST	95.50	37.49	52.37	59.73	11.87
ND 606	AMIDON	94.10	39.79	52.10	59.57	11.60
TR983239	FERGUS	92.70	30.49	50.83	58.97	12.70
CI 17790	LEN	95.83	29.95	50.27	58.20	12.63
MT 9360	LEW/PND	94.77	33.33	49.67	60.23	11.87
BZ984326	BORDER	94.10	30.91	49.67	58.33	12.63
ND 626	GRANDIN	82.30	32.89	49.50	57.77	13.63
C982-324	RAMBO	93.73	29.42	49.27	59.80	12.03
ND 582	STOA	95.47	38.61	47.57	58.03	12.53
MTHW9406	MT8182/KLASIC (hard white)	98.27	32.36	47.30	57.47	12.17
MT 9354	MT7810/(SU73/LEW)	96.87	33.96	44.77	59.33	12.50
CI 13596	FORTUNA	96.90	39.89	42.73	60.47	12.33
CI 17429	LEW	96.53	40.68	40.03	60.87	11.63
EXPERIMENTAL MEANS		93.10	32.80	51.90	59.13	12.10
C.V. 2: (S OF MEAN/MEAN)*100		2.28	1.95	3.70	.53	2.72
LSD (0.05)		6.05	1.82	5.48	.89	.94

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 95-9951-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: 108.38 W Elevation: 2900 ft.

Seeding Date: 05/11/95 Sd'g Depth: 1.50 in. Depth to Moisture @ Sd'g: 0.25 in. Moist Soil Depth @ Sd'g: 55.0+ in. Soil Temp @ Sd'g: F @ 1 in. 66.0F @ 2 in. 59.0F @ 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: 1994 Fallow Season = 3x Tillage w/Sweeps & Harrows, 1x Tillage w/Sweeps, Rods & Harrows  
 Cropping History: 1 Yr Ago = 94 =        Fallow        2 Yrs Ago = 93 = Spring Wheat 3 Yrs Ago = 92 =        Fallow  
 Fertilizer: 66#N,33#P2O5, 0#K2O/ac via gran.blend bnd'd 1.5" below seed\_Herbicide: BanvelSGF+LV6 @4.26+6.4oz/ac  
 Harvest Date: 09/13/95 Root Penetration Depth: 43 in. Comments: Pre-Plant Soil Analysis was Pre-Fertilization

Depth in.	PRE-PLANT SOIL ANAL 04/27/95										POST-HVST SOIL ANAL 09/13/95									
	PAW	pH	OM	NO3	P	K	S	Text	CEC	PAW	pH	OM	NO3	P	K	S	Text	CEC		
0 -6"	.75	6.5	1.0	10	10	192	7	SCL	21.7	.48	6.3	0.9	6	5	248	8	SCL	21.7		
6-24"	1.51			24			13	SCL		1.13			6			15	CL+			
24-36"	1.18			8				SCL		.68			4				CL+			
36-48"	1.23			12				CL		.97			8				CL+			
TOTAL:	4.67			54						3.26			24							

Precipitation 04/27/95 to Sd'g: 0.42 in. ( 0.30 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 5.09 in. & Stored Soil 05/11/95 to Hvst: 9.55 in. ( 8.95 in events =>.1 in.) Measured Resid Soil Water @ Hvst: 3.26 in.  
 Water Summary: Growing Season (05/11/95 to 14 days prior to Harvest Maturity: 8.71 in.) ( 8.17 in events =>.1 in.)  
 Post-Grwg Seas (14 days prior to Harvest Maturity to 09/13/95: 0.84 in.) ( 0.78 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: 10.54 in.)

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TABLE 3. TWO-YEAR AGRONOMIC PERFORMANCE SUMMARY FOR 15 HARD RED SPRING WHEAT CULTIVARS 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.

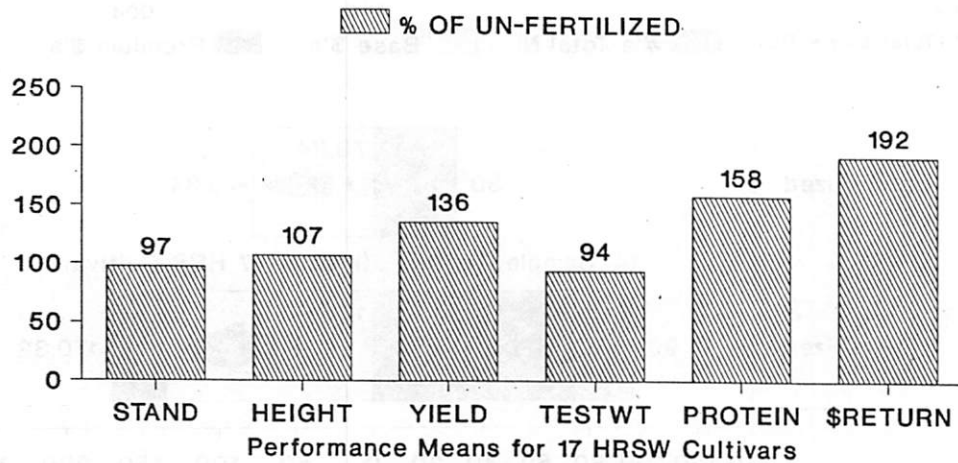
ID	FERTILITY	CULTIVAR	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %
19	FERTILIZED	GLENMAN	97.40	29.11	47.15	58.15	12.30
27	FERTILIZED	PONDERA	91.14	29.05	46.20	59.47	13.23
25	FERTILIZED	NEWANA	94.45	27.22	46.07	59.05	12.06
30	FERTILIZED	WESTBRED 926	91.68	26.76	44.95	57.77	13.38
24	FERTILIZED	McNEAL	93.58	29.90	43.95	58.50	13.60
21	FERTILIZED	HI-LINE	95.13	26.92	43.90	58.58	13.03
26	FERTILIZED	ERNEST	94.63	33.19	43.10	59.82	13.22
16	FERTILIZED	AMIDON	94.26	34.71	42.22	59.05	12.78
20	FERTILIZED	GRANDIN	88.55	30.23	42.05	58.27	13.91
28	FERTILIZED	RAMBO	96.00	27.03	41.74	59.75	13.13
22	FERTILIZED	LEN	95.15	28.21	40.97	57.83	13.78
29	FERTILIZED	STOA	94.95	34.74	40.75	57.88	13.45
17	FERTILIZED	BORDER	90.63	28.18	39.27	57.90	13.65
18	FERTILIZED	FORTUNA	96.89	34.67	37.75	60.28	13.33
23	FERTILIZED	LEW	97.40	35.88	35.78	60.24	13.05
11	UNFERTILIZED	ERNEST	96.02	31.61	34.63	62.42	10.40
15	UNFERTILIZED	WESTBRED 926	91.84	24.10	34.58	61.57	10.10
07	UNFERTILIZED	LEN	94.46	26.88	34.05	61.83	10.92
01	UNFERTILIZED	AMIDON	97.93	32.85	33.85	61.78	10.35
14	UNFERTILIZED	STOA	96.02	31.76	32.90	61.90	9.75
09	UNFERTILIZED	McNEAL	96.54	26.69	32.85	61.20	10.01
10	UNFERTILIZED	NEWANA	96.35	25.30	32.72	62.74	9.57
04	UNFERTILIZED	GLENMAN	96.39	28.17	32.68	61.25	9.46
13	UNFERTILIZED	RAMBO	96.37	24.42	31.78	63.19	9.68
06	UNFERTILIZED	HI-LINE	97.21	24.51	30.80	62.40	9.71
05	UNFERTILIZED	GRANDIN	89.75	26.98	30.63	62.10	10.85
08	UNFERTILIZED	LEW	99.13	31.02	29.58	62.30	9.58
02	UNFERTILIZED	BORDER	96.70	25.23	28.83	61.76	11.07
12	UNFERTILIZED	PONDERA	92.00	26.08	28.33	62.32	10.68
03	UNFERTILIZED	FORTUNA	98.45	29.80	27.94	61.40	10.35
STATISTICAL SUMMARY			STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %
OVERALL MEANS			94.90	29.04	37.07	60.42	11.68
F-RATIO, TMTS			1.12	7.71	5.85	14.37	2.07
P-VALUE, TMTS			.3811	.0000	.0000	.0000	.0270
CV (SE/MEAN) %			2.66	4.20	6.75	.77	9.67
LSD (0.05)			7.31	3.53	7.24	1.35	3.27

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

TABLE 4. AGRONOMIC PERFORMANCE SUMMARY FOR 15 HARD RED SPRING WHEAT CULTIVARS 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.

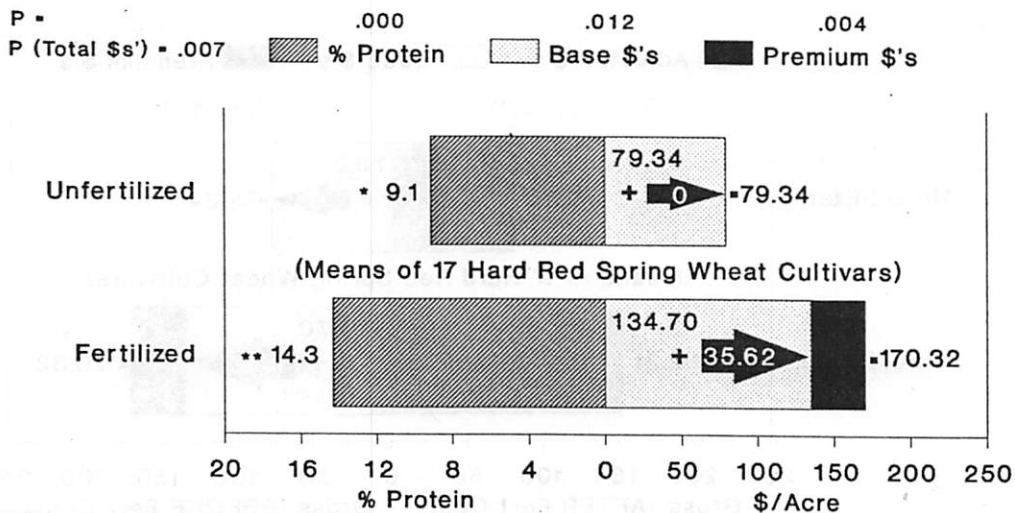
ID	YEAR/FERTILITY/CULTIVAR	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PROTEIN %
FACTOR ANALYSIS - FACTOR 1 = YEAR (across 2 fertility schemes & 15 cultivars)						
1	1994	96.99	26.33	28.85	60.28	11.63
2	1995	92.81	31.75	45.28	60.57	11.74
		**	**	**	**	ns
	F =	66.31	747.68	480.46	14.47	1.22
	P =	.0000	.0000	.0000	.0000	.2724
	LSD (.05) =	1.02	.39	1.48	.15	.20
FACTOR ANALYSIS - FACTOR 2 = FERTILITY SCHEME (across 2 years & 15 cultivars)						
1	UNFERTILIZED	95.68	27.69	31.74	62.01	10.17
2	FERTILIZED	94.12	30.39	42.39	58.84	13.20
		**	**	**	**	**
	F =	9.12	185.53	201.80	1707.54	903.47
	P =	.0031	.0000	.0000	.0000	.0000
	LSD (.05) =	1.02	.39	1.48	.15	.20
FACTOR ANALYSIS - FACTOR 3 = CULTIVAR (across 2 years & 2 fertility schemes)						
01	AMIDON	96.10	33.78	38.03	60.42	11.57
02	BORDER	93.67	26.71	34.05	59.83	12.36
03	FORTUNA	97.67	32.24	32.84	60.84	11.84
04	GLENMAN	96.89	28.64	39.92	59.70	10.88
05	GRANDIN	89.15	28.60	36.34	60.18	12.38
06	HI-LINE	96.17	25.72	37.35	60.49	11.38
07	LEN	94.81	27.54	37.51	59.83	12.35
08	LEW	98.27	33.45	32.68	61.27	11.32
09	MCNEAL	95.06	28.29	38.40	59.85	11.81
10	NEWANA	95.40	26.26	39.39	60.89	10.82
11	ERNEST	95.33	32.40	38.87	61.12	11.81
12	PONDERA	91.57	27.57	37.27	60.89	11.96
13	RAMBO	96.18	25.73	36.76	61.47	11.41
14	STOA	95.48	33.25	36.83	59.89	11.60
15	WESTBRED 926	91.76	25.43	39.77	59.67	11.74
		**	**	**	**	**
	F =	6.05	65.51	2.51	17.30	6.08
	P =	.0000	.0000	.0037	.0000	.0000
	LSD (.05) =	2.79	1.07	4.06	.42	.55
GRAND MEANS (180 obs)		94.90	29.04	37.07	60.42	11.68
Year x Fertility	Interactions (P)	.0000	.0000	.0336	.0000	.0000
Year x Cultivar	Interactions (P)	.0000	.0000	.0290	.0000	.2219
Fertility x Cultivar	Interactions (P)	.6940	.0130	.3368	.0000	.3240
Yr x Fert x Cultivar	Interactions (P)	.6118	.0004	.6484	.4794	.7772

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



**Figure 1.**  
MSU/AES/NARC-Havre

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



**Figure 2.**  
MSU/AES/NARC-Havre

\* @ Annual Ave. Feed Wheat Quote - PNW Delivery  
 \*\* @ Annual Ave. Bread Wheat Quote - PNW Delivery

187

## Fertilized vs Unfertilized Spring Wheat (Gross \$Rtn x Soil+Fert N Relationships) Leon Cederberg Farm, Turner - 1994

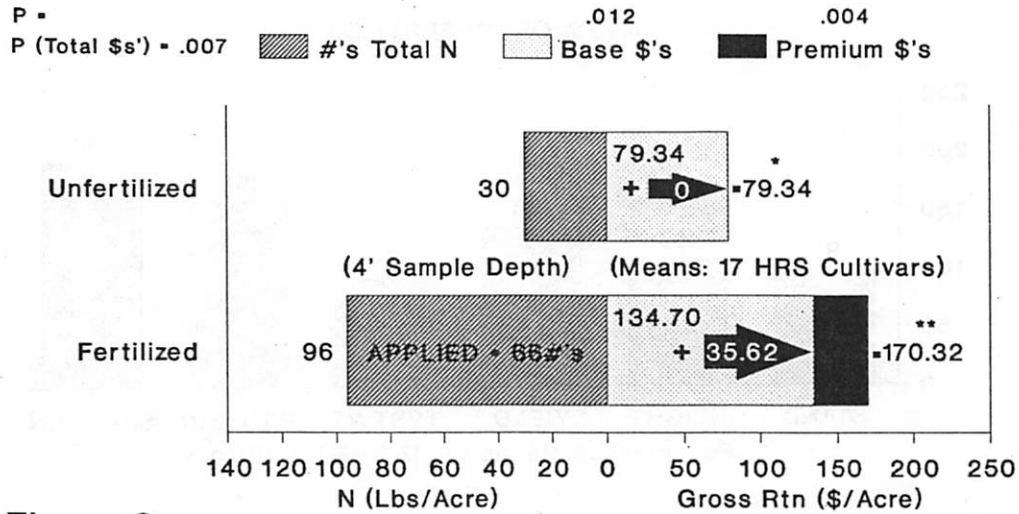


Figure 3.

MSU/AES/NARC-Havre

\* @ Annual Ave. Feed Wheat Quote - PNW Delivery  
\*\* @ Annual Ave. Bread Wheat Quote - PNW Delivery

## Fertilized vs Unfertilized Spring Wheat (Gross \$Rtn vs \$Rtn After Fert Costs) Leon Cederberg Farm, Turner - 1994

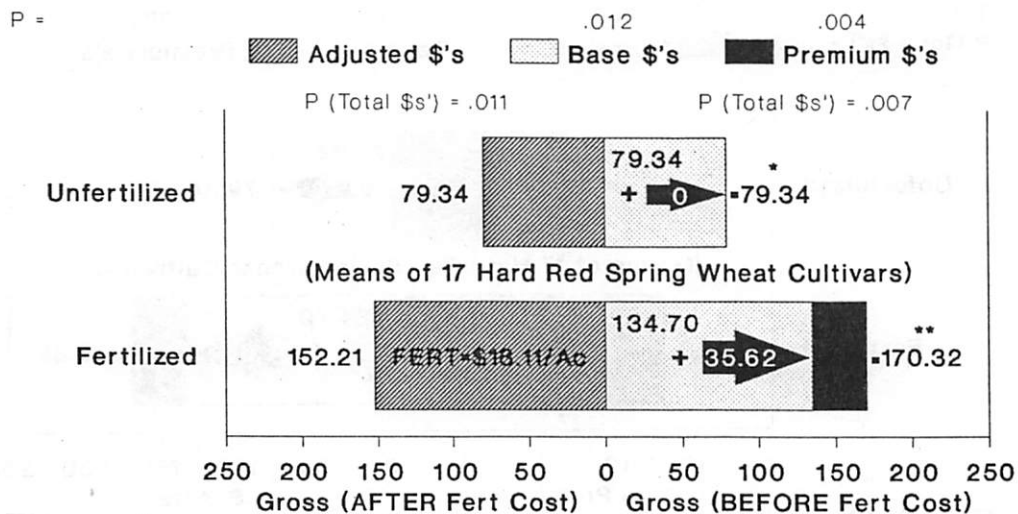


Figure 4.

MSU/AES/NARC-Havre

\* @ Annual Ave. Feed Wheat Quote - PNW Delivery  
\*\* @ Annual Ave. Bread Wheat Quote - PNW Delivery

TABLE 5. PERFORMANCE OF UNFERTILIZED SPRING BARLEY VARIETIES UNDER DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1995.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
NS 78054	Baronesse	86.47	26.52	63.77	49.90	95.57	1.60	8.97
PI537967	Colter	73.60	26.96	63.23	46.57	86.53	5.37	8.67
H3860224	H3860224	88.53	26.59	60.83	50.07	95.27	2.13	8.80
CI 15229	Steptoe	91.33	25.20	59.10	45.00	94.00	2.73	9.13
SK 76333	Harrington	83.33	26.90	58.50	49.97	95.73	1.80	9.20
21140523	Chinook	82.97	29.50	58.13	51.73	94.50	2.83	9.43
PI537438	Targhee	90.63	27.66	57.03	49.67	94.07	2.73	8.80
CI 15856	Lewis	76.73	29.00	56.30	51.80	93.53	3.27	9.00
CI 9558	Pirolina	89.57	26.90	55.10	51.93	95.20	1.50	8.87
MT886610	MT886610	83.37	27.93	54.67	50.70	92.43	3.47	8.93
H1851195	H1851195	83.33	28.70	54.53	49.67	94.93	2.60	9.37
PI483237	Bowman	81.60	28.88	53.47	51.37	96.53	1.53	9.87
MT890008	MT890008	90.27	26.68	53.13	48.63	91.80	4.10	8.83
MT890070	MT890070	89.23	28.48	52.17	51.10	96.77	1.50	9.20
CI 15514	Hector	87.50	27.74	51.87	50.57	91.80	3.83	9.47
PI491534	Gallatin	91.70	28.01	49.50	51.50	93.33	2.33	8.70
ND 9866	Stark	84.03	27.40	46.47	51.67	95.10	2.30	9.53
MT889106	MT889106	86.10	28.73	43.57	51.57	96.27	1.87	10.10
EXPERIMENTAL MEANS		85.57	27.65	55.08	50.19	94.08	2.64	9.16
C.V. 2: (S OF MEAN/MEAN)*100		4.32	3.76	5.37	.47	.71	13.76	2.00
LSD (0.05)		10.62	2.99	8.50	.68	1.92	1.04	.53

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 95-3650-SB Field: OffSta Design: RCB # Ents: 18 # Reps: 3 Plot-Obsrv: 54 sqft. Hvst-Obsrv: 48 sqft. Qtr: SE Section: 13 Twshp: 36 N Range: 25 E Latitude: 48.88 N Longitude: 108.38 W Elevation: 2900 ft.

Seeding Date: 05/11/95 Sd'g Depth: 1.50 in. Depth to Moisture @ Sd'g: 0.25 in. Moist Soil Depth @ Sd'g: 55.0+ in. Soil Temp @ Sd'g: F @ 1 in. 70.0F @ 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: 1994 Fallow Season = 3x Tillage w/Sweeps & Harrows, 1x Tillage w/Sweeps, Rods & Harrows

Cropping History: 1 Yr Ago = 94 = Fallow 2 Yrs Ago = 93 = Spring Wheat 3 Yrs Ago = 92 = Fallow

Fertilizer: 0#N, 0#P2O5, 0#K2O/ac \_\_\_\_\_ Herbicide: 'BanvelSGF'+LV6 @4.26+6.4oz/ac

Harvest Date: 09/13/95 Root Penetration Depth: 45 in. Comments: \_\_\_\_\_

Depth	PRE-PLANT SOIL ANAL 04/27/95										POST-HVST SOIL ANAL 09/13/95 (Max Depth=48"									
	in.	%	Lb/a	ppm	ppm	ppm	ppm	Soil	CEC	in.	%	Lb/a	ppm	ppm	ppm	ppm	Soil	CEC		
0-6"	.69	5.9	1.8	26	15	427	13	CL-	21.8	_____	_____	_____	_____	_____	_____	_____	_____	_____		
6-24"	2.30			24			9	CL		_____	1.23	6.2	1.2	4	11	289	8	SCL-	21.7	
24-36"	1.42			8				CL		_____	.83			4				SCL		
36-48"	1.25			8				CL		_____	.92			4				SCL		
TOTAL:	5.66			66						_____	3.47			18						

Precipitation 04/27/95 to Sd'g: 0.42 in. ( 0.30 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 6.08 in. & Stored Soil 05/11/95 to Hvst: 9.55 in. ( 8.95 in events =>.1 in.) Measured Resid Soil Water @ Hvst: 3.47 in.

Water Summary: Growing Season (05/11/95 to 14 days prior to Harvest Maturity: 8.71 in.) ( 8.17 in events =>.1 in.) Post-Grwg Seas (14 days prior to Harvest Maturity to 09/13/95: 0.84 in.) ( 0.78 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: 11.32 in.)

TABLE 6. PERFORMANCE OF FERTILIZED SPRING BARLEY VARIETIES UNDER DRYLAND FALLOW CROPPING CONDITIONS OFF-STATION AT THE LEON CEDERBERG FARM, TURNER. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1995.

ID	VARIETY or SELECTION	STAND %	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %
NS 78054	Baronesse	88.53	28.91	71.70	49.07	88.40	4.57	10.63
H3860224	H3860224	92.03	30.31	69.27	48.70	89.80	3.70	10.00
CI 15229	Steptoe	94.47	26.67	68.30	42.53	83.27	7.83	9.93
PI537438	Targhee	95.50	30.34	63.43	48.07	81.33	8.63	10.77
MT890070	MT890070	90.27	30.76	62.50	50.70	92.57	3.47	10.83
MT890008	MT890008	96.90	29.61	59.50	46.53	81.73	7.27	9.90
H1851195	H1851195	93.40	30.87	59.10	49.40	85.93	5.00	10.83
SK 76333	Harrington	93.03	29.63	58.20	46.70	83.40	6.53	10.27
CI 9558	Piroline	93.77	31.43	58.03	50.63	83.00	5.77	10.10
ND 9866	Stark	96.20	31.09	57.83	51.63	93.90	2.57	10.73
MT886610	MT886610	93.77	31.67	56.97	48.70	79.27	8.97	10.67
CI 15856	Lewis	90.27	30.93	55.87	49.47	79.90	9.00	10.93
PI537967	Colter	92.70	29.46	55.43	44.47	64.60	14.83	9.63
PI483237	Bowman	88.87	30.20	54.10	50.67	92.13	3.13	11.13
MT889106	MT889106	85.40	30.81	53.97	50.80	93.80	2.67	11.40
21140523	Chinook	92.73	30.71	52.50	48.67	78.73	9.53	11.00
PI491534	Gallatin	92.37	31.31	50.73	49.67	74.40	10.63	10.30
CI 15514	Hector	92.33	32.66	47.53	48.20	72.13	13.40	10.87
EXPERIMENTAL MEANS		92.36	30.41	58.61	48.59	83.24	7.08	10.55
C.V. 2: (S OF MEAN/MEAN)*100		2.42	2.72	5.35	.70	2.08	15.21	1.94
LSD (0.05)		6.42	2.38	9.01	.97	4.98	3.10	.59

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 95-3651-SB Field: OffSta Design: RCB # Ents: 18 # 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: 108.38 W Elevation: 2900 ft.

Seeding Date: 05/11/95 Sd'g Depth: 1.50 in. Depth to Moisture @ Sd'g: 0.25 in. Moist Soil Depth @ Sd'g: 55.0+ in.  
 Soil Temp @ Sd'g: P @ 1 in. 66.0F @ 2 in. 59.0F @ 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: 1994 Fallow Season = 3x Tillage w/Sweeps & Harrows, 1x Tillage w/Sweeps, Rods & Harrows  
 Cropping History: 1 Yr Ago = 94 = Fallow 2 Yrs Ago = 93 = Spring Wheat 3 Yrs Ago = 92 = Fallow  
 Fertilizer: 66#N,33#P2O5, 0#K2O/ac via gran.blend bnd'd 1.5" below seed\_Herbicide: 'BanvelSGF'+LV6 @4.26+6.4oz/ac  
 Harvest Date: 09/13/95 Root Penetration Depth: 34 in. Comments: Pre-Plant Soil Analysis was Pre-Fertilization

Depth in.	PRE-PLANT SOIL ANAL 04/27/95								Max Depth=48" in.	POST-HVST SOIL ANAL 09/13/95 (Max Depth=48" in.)
	PAW	pH	OM	Lb/a NO3	ppm P	ppm K	ppm S	CEC Text		
0-6"	.75	6.5	1.0	10	10	192	7	SCL 21.7	.48	
6-24"	1.51			24			13	SCL	1.27	
24-36"	1.18			8				SCL	.69	
36-48"	1.23			12				CL	.80	
TOTAL:	4.67			54					3.24	

Precipitation 04/27/95 to Sd'g: 0.42 in. ( 0.30 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 5.09 in.  
 & Stored Soil 05/11/95 to Hvst: 9.55 in. ( 8.95 in events =>.1 in.) Measured Resid Soil Water @ Hvst: 3.24 in.  
 Water Summary: Growing Season (05/11/95 to 14 days prior to Harvest Maturity: 8.71 in.) ( 8.17 in events =>.1 in.)  
 Post-Grw Seas (14 days prior to Harvest Maturity to 09/13/95: 0.84 in.) ( 0.78 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: 10.56 in.)

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TABLE 7. TWO-YEAR AGRONOMIC PERFORMANCE SUMMARY FOR 16 SPRING BARLEY CULTIVARS 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	CULTIVAR	STAND %	PLNT Inches	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	
1	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	
4	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	
2	UNFERTILIZED	BOWMAN	84.90	24.81	46.83	51.42	96.51	1.46	9.02	
3	UNFERTILIZED	CHINOOK	87.30	23.85	46.65	50.63	90.62	3.73	8.60	
6	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	
9	UNFERTILIZED	MT881195	89.76	23.97	45.03	49.25	94.67	2.48	8.58	
8	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	
7	UNFERTILIZED	HECTOR	90.96	23.69	41.52	49.35	85.30	6.98	8.93	
5	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 Inches	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.

191

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TABLE 8. AGRONOMIC PERFORMANCE SUMMARY FOR 16 SPRING BARLEY CULTIVARS 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/CULTIVAR	STAND %	PLNT Inches	HT Bu/Ac	YIELD Lbs/Bu	TEST WT %	PLUMP %	THIN %	PROTEIN %
FACTOR ANALYSIS - FACTOR 1 = YEAR (across 2 fertility schemes & 16 cultivars)									
1	1994	94.03	21.34	44.87	48.12	81.08	7.26	10.11	
2	1995	88.66	29.00	56.60	49.33	88.34	4.96	9.85	
		**	**	**	**	**	**	**	**
	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 cultivars)									
1	UNFERTILIZED	90.30	23.20	44.91	49.85	91.57	3.35	8.47	
2	FERTILIZED	92.39	27.13	56.56	47.60	77.85	8.86	11.49	
		**	**	**	**	**	**	**	**
	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 = CULTIVAR (across 2 years & 2 fertility schemes)									
01	BARONESSE	92.71	23.29	57.19	49.20	85.24	5.52	9.94	
02	BOWMAN	87.41	25.73	50.38	50.58	93.53	2.62	10.43	
03	CHINOOK	88.97	25.39	50.46	49.17	81.32	7.62	10.31	
04	COLTER	88.88	24.24	52.17	44.97	71.42	11.79	8.97	
05	GALLATIN	93.32	26.15	46.88	49.85	81.56	6.81	9.69	
06	HARRINGTON	90.79	24.50	49.48	47.52	83.38	6.37	10.12	
07	HECTOR	91.32	26.52	45.28	48.41	78.31	9.80	10.44	
08	LEWIS	87.59	26.00	49.24	49.63	83.30	6.92	10.19	
09	MT851195	91.76	25.69	51.73	48.75	88.48	4.32	10.25	
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	
12	MT890008	95.67	23.87	51.13	47.42	82.43	6.77	9.42	
13	H3860224	90.11	24.87	53.58	48.16	88.52	5.04	10.10	
14	PIROLINE	94.71	25.99	51.68	51.19	84.67	4.63	9.57	
15	STARK	92.46	25.79	49.32	51.54	93.55	2.72	10.13	
16	STEPTOE	93.68	23.02	57.02	43.54	84.08	6.25	9.58	
		**	**	**	**	**	**	**	**
	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 Cult Interactions (P)		.2465	.4284	.0268	.0053	.0129	.3559	.0000	
Fert x Cult Interactions (P)		.0962	.5987	.4565	.0236	.0000	.0000	.0000	
Yr x Fert x Cult Interact (P)		.7746	.6275	.8565	.0812	.0228	.0321	.0640	