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PROJECT TITLE: EVALUATION OF NO-TILL WINTER WHEAT, SPRING WHEAT, AND BARLEY VARIETY PERFORMANCE AT TWO OFF-STATION LOCATIONS IN NORTHERN MONTANA.

PROJECT LEADER: R. Berg; Havre, MT

PROJECT PERSONNEL:
T. Blake, Coordinator - Barley
L. Talbert, Coordinator - Spring Wheat
G. Taylor, Coordinator - Winter Wheat
D. Spicher, Cooperating Landowner
H. Sterrett, Cooperating Landowner

OBJECTIVES: To evaluate small grain varieties regarding their suitability for production under no-till conditions in northern Montana.

RESULTS:

Six small grain nurseries established in Hill County evaluated eight winter wheat, 20 spring wheat, and 12 spring barley varieties using two nurseries per crop to examine effects of soils on variety performance. One nursery (winter wheat) was planted on the Howard Sterrett farm west of Havre and five were established on two soils approximately 2 mi apart at the Daryl Spicher farm southwest of Hingham. These locations are similar to those used for no-till recrop trials conducted since the mid 1980s at NARC. The winter wheat nursery on Phillips soil near Hingham was abandoned because of technical problems with the cone attachments during seeding. Preliminary statistical analyses were conducted with MPEP for each trial. The SAS GLM procedure was utilized when missing values were encountered. Trials were combined by crop and analyzed with SAS (GLM or ANOVA) as split plot experiments when appropriate.

Soil, climatic, and management information, summarized in Table 1, indicate that approximately 9 and 12 inches of moisture were available for production of winter and spring grains, respectively. Half of this (5-6 inches) was stored in the soil profile with the remaining 4 to 6 inches accounted for as growing season precipitation. The winter wheat nursery had low to moderate levels of available P and less NO3-N in the profile than the spring grain nurseries. Available moisture status in the winter wheat nursery at Havre may be underestimated because growing season precipitation in Table 1 does not reflect winter precipitation (October to March) and soil moisture was not specifically monitored for this nursery in the spring.

Winter Wheat

Winter wheat varieties were typically 25 inches tall, produced 37 tillers/ft2, yielded 19 bu/ac with a test weight of 52 lb/bu, 16.6 % protein and had a total biomass of 2 tons/ac (Table 2). Statistical differences were observed among the eight varieties tested for every response except straw weight and total yield. Plant heights ranged from 24 (Agassiz) to 28 (Citation) inches and tillers from 31 (Neely) to 44 (Rocky) per square foot.

Citation, at 32 bu/ac, out yielded all other varieties by more than 10 bu/ac and Agassiz had the lowest yield (13 bu/ac). Test weights were very light, frequently 3 to 11 lb/bu less than the standard weight of 60 lb/bu. Citation had the heaviest test weight (56.7 lb/bu) and several enteries were around 50 lb/bu.

Spring Wheat

Spring wheat responses are shown for each site in Tables 3 and 4 and summarized across soils in Table 5. In general, spring wheat varieties were 26 inches tall, produced 27 tillers/ft2, yielded 34 bu/ac, with 60 lb/bu test weights, 16% protein, and had over 2 tons/ac of total biomass (Table 5). Statistical differences for plant height, grain yield, test weight, total yield, and protein among varieties (pooled across soils) and for tillers, grain yield, straw weight, total yield, and protein between soils (pooled across varieties) were noted. Plant heights averaged from 23 (Penawawa) to 29 (Alex and Lancer) inches tall. Grain yields were from nearly 40 bu/ac for soft whites to 28 bu/ac for Fortuna and Len. Total yields were just under 2 to nearly 2.5 tons/ac. Protein levels ranged from nearly 14 to just under 17%. The Phillips soil produced more tillers and greater crop yields but the Telstad soil had higher protein levels. Test weights were generally comparable to the standard weight of 60 lb/bu.

Protein production among varieties was the only response analyzed that differed depending on the soil type as indicated by a significant ($P < 0.05$) variety-by-soil interaction. Protein percentages for soft white varieties (13%) were consistently lower than for the hard red varieties (15-16%) at the Phillips soil. This trend was less obvious for the Telstad soil where Penawawa (14%) was the only soft white variety with lower protein than hard red lines (15-17%).

Spring Barley

Spring barley responses are shown for each site in Tables 6 and 7 and averaged across soils in Table 8. In general, barley varieties were about 21 inches tall, had 29 tillers/ft2, yielded 49 bu/ac, with 49 lb/bu test weight, 13% protein, 73% plumps, 11% thins, and produced slightly less than 1 ton/ac of straw with approximately 2 ton/ac of total biomass. Main effect of varieties pooled across soils was only significant for test weights where Steptoe consistently produced lighter test weights than the other varieties by 3 to 5 lb/bu. Main effect of soils pooled across varieties was statistically significant ($P < 0.05$) for plant height, test weight, straw weight, total yield, and percentages of plump and thin kernels. Barley raised on the Telstad site was taller, had heavier test weight, produced more biomass, and had a greater proportion of plump kernels than when grown on the Phillips soil.

Plant height and percentage of plump and thin kernels responded differently among the varieties depending on which soil they were planted on. Based soley on percentages of plump and thin kernels, ND 9866 was the only entry that qualified for malt market on the Phillips soil, whereas half of the

varieties tested on the Telstad soil had 80% or greater plump kernels.

SUMMARY:

Citation winter wheat performed especially well under no-till recrop conditions with good yield, relatively heavy test weight, and a good protein content. Winter wheat grain yielded 13 to 32 bu/ac, test weights were low, and protein levels were in the 16 to 17% range. Owens and Penawawa soft white spring wheat varieties yielded well (35-40 bu/ac) but had lower protein levels than hard red lines (13-14 vs. 15-17%). Fortuna and Len had among the lowest yields measured (26-30 bu/ac). Barley yields were around 40 to 50 bu/ac and yield differences among barley varieties were negligible.

Spring wheat production was generally better on the Phillips than the Telstad soil. Barley grain production was similar on both soils, however barley raised on the Telstad site produced more total biomass, had heavier test weights, and resulted in more varieties with at least 80% plump kernels. Each nursery had total yields of approximately 2 tons/ac.

FUTURE PLANS:

Continue evaluating variety performance of selected small grains under no-till cropping systems in northern Montana and statistically summarize variety tests results conducted since 1985 using specific contrasts designed to evaluate class distinctions like height, maturity, and origin.

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TABLE 1. SOIL, CLIMATIC, AND MANAGEMENT INFORMATION FOR NO-TILL RECROP SMALL GRAIN VARIETY NURSERIES. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

	HAVRE	HINGHAM	
	PHILLIPS	PHILLIPS	TELSTAD
DESCRIPTION	WW	SW / SB	SW / SB
SEEDING DATE	SEP 16	MAY 5	MAY 5
BUNDLE HARVEST DATE	JUL 30	AUG 24-27/ 13	AUG 22 / 13
GRAIN HRVST DATE	JUL 30	AUG 30 / 27	AUG 22 / 27
SOIL ANALYSIS (0-6" EXCEPT SOIL NO3-N & WATER ALSO @ 6-12", 12-24", & 24-36")			
PH	7.40	7.15	7.63
ORGANIC MATTER (%)	1.3	1.3	1.4
NO3-N (LB/AC)	58	193	126
AVAIL. P (PPM)	12	43	30
AVAIL. K (PPM)	341	383	283
SO4-S (PPM)	7.5	3.5	8.0
NA (MEQ/100 G)	0.15	0.69	0.09
EC (MMHOS/CM)	0.91	0.06	0.67
ZN (PPM)	ND	0.4	0.3
WATER STORED IN SOIL PROFILE TO 3 FT.			
AT PLANTING (INCH)	5.0	6.0	6.0
AT HARVEST (INCH)	4.2	3.7 / 3.1	2.2 / 2.4
GROWING SEASON PRECIPITATION	4.4	6.4	5.9 / 6.4
04-01-90 TO SOIL SAMPLE	ND	0.2	0.2
SOIL SAMPLE TO BUNDLE HARVEST	4.4	5.7 / 5.6	5.7 / 5.6
BUNDLE TO GRAIN HARVEST	0.0	0.5 / 0.6	0.0 / 0.6
GRAIN HARVEST TO SOIL SAMPLE	0.0	0.0	0.0

WW=WINTER WHEAT, SW=SPRING WHEAT, SB=SPRING BARLEY, ND=NOT DETERMINED
PREVIOUS CROP: SPRING WHEAT
SEEDING DEPTHS (INCHES): 1.00 SW AND WW; 0.75 SB
SEEDING RATES (LB/AC): 70 (WW), 60 (SW), AND 46 (SB)
GRAIN YIELD (BU/AC) STANDARDIZED TO 60 (WW/SW) OR 48 (SB) LB/BU TEST WEIGHT.
DRILL: USDA III YIELDER WITH PAIRED ROW SPACING (5" X 15")
FERTILIZER: 74 LB N/AC AS 46-0-0 DEEP BANDED AND 6 LB N/AC + 30 LB P2O5/AC AS 11-52-0 BANDED WITH SEED AT PLANTING.
WEED CONTROL: PREPLANT - GLYPHOSATE + 2,4-D (LANDMASTER) AT 54 OZ/AC;
POSTEMERGE - HINGHAM: METSULFURON (ALLY) AT 0.1 OZ/AC + 2,4-D AT 6 OZ/AC
HAVRE = 2,4-D AT 1 PT/AC
SOIL TAXONOMY: PHILLIPS = BOROLLIC PALEARGID (WW AND SECTION 21 AT HINGHAM)
TELSTAD = ARIDIC ARGIBOROLL (SECTION 28 AT HINGHAM)

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TABLE 2. NO-TILL RECROP WINTER WHEAT VARIETY TRIAL. HOWARD STERRETT FARM (SEC. 17, T32N, R15E) AT HAVRE, HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

VARIETY/SELECTION	PLANT HEIGHT	TILLERS	GRAIN YIELD	TEST WEIGHT	STRAW WEIGHT	TOTAL YIELD	PROTEIN
	INCH	NO/FT2	BU/AC	LB/BU	CWT/AC	CWT/AC	%
CITATION	28.00	34.43	31.63	56.70	21.93	40.90	16.38
ROCKY	24.87	43.70	21.10	53.60	31.05	43.73	16.60
TIBER	24.21	38.23	19.47	52.60	29.75	41.45	16.28
REDWIN	24.69	35.60	19.12	51.80	30.03	41.53	16.60
NEELY	21.85	30.93	17.33	50.00	26.08	36.48	17.02
NORSTAR	23.87	37.10	16.45	54.70	30.90	40.78	15.77
JUDITH	25.34	34.13	16.07	48.50	29.13	38.78	16.97
AGASSIZ	23.88	39.50	13.35	50.50	28.45	36.48	16.95
EXPERIMENTAL MEANS	24.59	36.70	19.32	52.30	28.41	40.01	16.57
F TEST FOR VAR.	4.67*	2.72*	23.78*	29.25*	1.65NS	0.99NS	3.05*
C.V. 2: (S OF MEAN/MEAN)*100	3.26	6.42	5.86	0.95	8.38	6.43	1.47
LSD (0.05)	2.36	6.93	3.33	1.46	7.00	7.57	0.72

* Significant at P < 0.05 probability level (NS = not significant).

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TABLE 3. NO-TILL RECROP SPRING WHEAT VARIETY TRIAL. DARYL SPICHER FARM (SEC. 21, T32N, R10E) AT HINGHAM, HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

VARIETY/SELECTION	PLANT HEIGHT	TILLERS	GRAIN YIELD	TEST WEIGHT	STRAW WEIGHT	TOTAL YIELD	PROTEIN
	INCH	NO/FT2	BU/AC	LB/BU	CWT/AC	CWT/AC	%
WA 6920 PENAWAWA-sft white	22.72	27.23	44.50	59.63	25.03	51.75	13.07
CI 17904 OWENS-sft white	25.75	32.17	43.55	60.63	30.10	56.25	12.68
MT 8402 MT7336/SHORTANA	24.02	26.95	41.40	60.88	21.15	45.98	15.60
CI 17910 ALEX	29.22	33.55	38.80	61.65	28.78	52.05	15.08
ND 626 GRANDIN	27.13	30.85	38.58	61.13	31.63	54.80	16.15
CI 17430 NEWANA	24.22	29.35	38.35	60.45	23.90	46.93	14.87
ND 606 AMIDON	27.93	27.85	38.28	59.80	19.92	42.93	15.63
NDCUT CUTLESS	25.01	34.43	37.85	59.63	24.58	47.25	16.43
WPB 926R WESTBRED 926R	22.80	22.33	36.35	60.72	26.33	48.13	15.70
PI483235 GLENMAN	27.47	31.90	36.15	59.55	34.75	56.45	15.07
ND 618 GUS	22.68	27.63	35.68	59.35	16.00	37.40	16.10
C982-324 RAMBO	22.69	24.40	35.48	61.25	22.85	44.15	15.82
CI 15930 OLAF	25.30	29.90	34.30	60.68	27.92	48.53	15.65
CI 17429 LEW	27.12	29.18	33.83	61.00	22.58	42.85	15.68
CANLANC LANCER	28.53	30.98	33.55	60.65	23.55	43.65	16.03
ND 582 STOA	26.03	26.05	33.45	58.55	23.68	43.78	15.32
WPB 906R WESTBRED 906R	24.14	25.13	32.93	60.08	30.53	50.28	15.87
CI 17828 PONDERA	24.41	24.63	32.68	60.85	24.73	44.33	15.57
CI 17790 LEN	24.48	27.07	29.98	59.47	22.02	40.00	15.82
CI 13596 FORTUNA	27.17	31.38	28.92	60.18	25.05	42.43	16.32
EXPERIMENTAL MEANS	25.44	28.65	36.23	60.31	25.25	46.99	15.42
F TEST FOR VAR.	3.34*	2.47*	2.40*	4.04*	1.68NS	2.06*	12.99*
C.V. 2: (S OF MEAN/MEAN)*100	4.42	7.26	7.24	0.64	13.40	7.84	1.73
LSD (0.05)	3.19	5.89	7.43	1.10	9.58	10.43	0.76

* Significant at P < 0.05 probability level (NS = not significant).

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TABLE 4. NO-TILL RECROP SPRING WHEAT VARIETY TRIAL. DARYL SPICHER FARM (SEC. 28, T32N, R10E) AT HINGHAM, HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

VARIETY OR SELECTION	PLANT HEIGHT	TILLERS	GRAIN YIELD	TEST WEIGHT	STRAW WEIGHT	TOTAL YIELD	PROTEIN
	INCH	NO/FT2	BU/AC	LB/BU	CWT/AC	CWT/AC	%
CI 17910 ALEX	29.16	30.13	36.91	61.31	23.89	16.32	16.32
ND 606 AMIDON	28.97	24.60	34.03	60.05	20.43	40.83	16.38
NDCUT CUTLESS	24.93	25.50	27.30	59.90	14.13	33.48	17.08
CI 13596 FORTUNA	28.79	25.68	26.12	59.87	24.93	40.58	16.60
PI483235 GLENMAN	24.51	25.70	34.23	58.70	25.48	46.00	15.17
ND 626 GRANDIN	26.36	22.90	33.35	61.10	20.28	40.30	16.85
ND 618 GUS	24.44	26.58	30.50	60.10	15.98	34.28	16.17
CANLANC LANCER	29.60	26.23	33.73	60.57	18.98	39.20	17.22
CI 17790 LEN	23.58	21.10	26.53	59.75	22.76	32.68	15.52
CI 17429 LEW	29.24	25.92	29.90	61.00	25.65	43.58	15.80
MT 8402 MT7336/SHORTANA	24.35	22.92	37.08	60.52	13.02	35.25	16.63
CI 17430 NEWANA	23.49	26.78	32.95	60.75	28.58	48.35	15.60
CI 15930 OLAF	26.51	27.60	33.83	60.65	24.20	44.50	15.70
CI 17904 OWENS-sft white	23.49	17.10	36.17	59.60	14.42	36.15	15.30
WA 6920 PENAWAWA-sft white	22.69	23.58	32.30	59.00	17.03	36.40	14.23
CI 17828 PONDERA	23.13	18.62	30.20	60.86	12.36	33.03	16.65
C982-324 RAMBO	25.03	26.23	31.95	61.08	27.18	46.38	15.90
ND 582 STOA	28.09	26.55	29.53	58.93	21.97	39.68	15.65
WPB 906R WESTBRED 906R	23.62	21.97	35.89	59.74	29.22	50.78	15.78
WPB 926R WESTBRED 926R	23.28	23.00	37.70	59.83	23.83	46.45	16.35
EXPERIMENTAL MEANS	25.67	24.42	32.45	60.15	21.35	40.63	16.03
F TEST FOR VAR.	4.25*	1.34*	1.10NS	2.71*	1.43NS	1.34NS	4.26*
C.V. 2:	6.38	10.66	9.83	0.75	19.48	11.52	2.14
LSD (0.05)	3.28	7.38	9.06	1.29	11.81	13.26	0.97

* Significant at 0.05 probability level (NS = not significant).

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TABLE 5. NO-TILL RECROP SPRING WHEAT VARIETY TRIAL (VARIETY MEANS POOLED ACROSS SOILS). DARYL SPICHER FARM AT HINGHAM, HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

VARIETY OR SELECTION	PLANT HEIGHT	TILLERS	GRAIN YIELD	TEST WEIGHT	STRAW WEIGHT	TOTAL YIELD	PROTEIN
	INCH	NO/FT2	BU/AC	LB/BU	CWT/AC	CWT/AC	%
ALEX	29.19	31.83	37.85	61.48	26.33	49.04	15.69
AMIDON	28.45	26.23	36.15	59.93	20.18	41.88	16.00
CUTLESS	24.97	29.96	32.58	59.76	19.35	40.36	16.75
FORTUNA	27.98	28.53	27.53	60.03	24.99	41.50	16.46
GLENMAN	25.99	28.30	35.19	59.13	30.11	51.22	15.13
GRANDIN	26.74	26.88	35.96	61.11	25.95	47.55	16.50
GUS	23.56	27.10	33.09	59.73	15.99	35.84	16.14
LANCER	29.06	28.60	33.64	60.61	21.26	41.43	16.63
LEN	24.03	24.09	28.25	59.61	22.39	36.34	15.68
LEW	28.18	27.55	31.86	61.00	24.11	43.21	15.74
MT8402	24.18	24.94	39.24	60.70	17.09	40.61	16.11
NEWANA	23.56	28.06	35.65	60.60	26.24	47.64	15.24
OLAF	25.90	28.75	34.06	60.66	26.06	46.51	15.68
OWENS	24.62	24.64	39.86	60.11	22.26	46.20	13.99
PENAWAWA	22.70	25.40	38.40	59.31	21.03	44.08	13.65
PONDERA	23.77	21.63	31.44	60.86	18.54	38.68	16.11
RAMBO	23.86	25.31	33.71	61.16	25.01	45.26	15.86
STOA	27.06	26.30	31.49	58.74	22.83	41.73	15.49
WESTBRED-906R	23.88	23.55	34.41	59.91	29.87	50.53	15.83
WESTBRED-926R	23.04	22.66	37.03	60.28	25.08	47.29	16.03
EXPERIMENT MEAN	25.55	26.56	34.39	60.23	23.67	43.85	15.72
SOURCE df	Pr>F						
VARIETY 19	<0.01	0.11	<0.01	<0.01	0.12	0.08	<0.01
SOILS 1	0.50	<0.01	<0.01	0.19	<0.01	<0.01	<0.01
VAR*SOILS 19	0.67	0.20	0.79	0.89	0.30	0.32	<0.01
V*S EMSa 19	4.27	28.37	24.26	0.42	65.85	81.46	0.87
POOLED EMSb 114	5.21	22.11	33.88	0.70	56.97	70.66	0.37
OBSERVATIONS	158	158	156	156	155	158	156

EMS=ERROR MEAN SQUARE (used a to test Variety and Soils, b for V*S interaction).

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TABLE 6. NO-TILL RECROP SPRING BARLEY VARIETY TRIAL. DARYL SPICHER FARM (SEC. 21, T32N, R10E) AT HINGHAM, HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

VARIETY OR SELECTION	PLANT HEIGHT	TILLER	GRAIN YIELD	TEST WEIGHT	STRAW WEIGHT	TOTAL YIELD	PROTEIN	PLUMPS	THINS
	INCH	NO/FT2	BU/AC	LB/BU	CWT/AC	CWT/AC	%	%	%
CLARK	20.92	29.65	53.93	48.33	20.11	40.83	13.02	71.58	13.00
HECTOR	22.72	37.05	52.80	48.10	19.90	45.25	12.35	58.85	17.58
ND 9866	22.18	26.45	50.13	50.08	16.20	40.25	12.25	86.50	5.38
LEWIS	19.26	32.17	50.10	48.78	13.65	37.70	12.85	65.38	15.80
PIROLINE	21.50	24.65	50.02	48.70	13.20	37.20	13.80	53.35	17.63
GALLATIN	20.91	33.00	49.55	49.10	19.30	43.08	12.58	69.53	12.17
BEARPAW	19.25	31.25	47.30	46.90	15.98	38.68	12.95	67.95	13.15
MT140523	20.31	28.33	47.30	47.65	13.52	36.23	13.15	55.92	19.87
BOWMAN	19.69	24.70	46.58	48.83	11.90	34.25	12.90	73.90	12.48
STEPTOE	17.18	19.33	44.23	43.78	10.80	32.00	11.98	75.90	10.20
HARRINGTON	17.14	28.98	42.03	47.58	17.43	37.60	13.20	65.85	13.93
CRYSTAL	17.47	28.45	38.28	47.60	17.25	35.60	13.75	48.08	22.10
EXPERIMENT MEANS	19.88	28.67	47.69	47.95	15.75	38.22	12.90	66.06	14.44
F TEST FOR VAR.	4.32*	2.16*	1.21NS	8.73*	0.81NS	1.16NS	1.80NS	3.57*	2.54*
C.V. 2	4.60	10.94	8.51	1.10	21.65	8.99	3.21	8.59	19.57
LSD (0.05)	2.63	9.02	11.68	1.52	9.85	9.88	1.19	16.32	8.13

* Significant at P < 0.05 probability level (NS = not significant).

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TABLE 7. NO-TILL RECROP SPRING BARLEY VARIETY TRIAL. DARYL SPICHER FARM (SEC. 28, T32N, R10E) AT HINGHAM, HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

VARIETY OR SELECTION	PLANT HEIGHT	TILLER	GRAIN YIELD	TEST WEIGHT	STRAW WEIGHT	TOTAL YIELD	PROTEIN	PLUMPS	THINS
	INCH	NO/FT2	BU/AC	LB/BU	CWT/AC	CWT/AC	%	%	%
HECTOR	24.75	29.18	52.70	50.13	22.68	48.00	13.27	77.48	8.50
PIROLINE	23.31	30.75	52.63	51.23	22.55	47.80	13.70	86.08	3.30
CRYSTAL	24.39	34.18	52.50	50.18	29.13	54.30	12.30	83.68	5.15
BEARPAW	21.20	26.98	51.60	49.40	23.63	42.75	13.42	76.78	8.90
BOWMAN	24.49	28.83	51.48	51.43	24.57	49.28	12.25	91.48	3.55
ND 9866	23.09	29.68	50.83	51.80	17.88	42.28	12.85	92.10	2.23
HARRINGTON	22.53	30.50	50.00	49.20	22.53	46.50	12.60	78.28	8.03
STEPTOE	19.73	22.98	49.95	45.10	15.78	39.78	11.62	83.92	6.10
GALLATIN	21.69	26.05	48.75	50.73	15.28	38.68	13.15	76.18	9.85
MT140523	21.25	31.38	47.48	49.13	17.82	40.60	12.90	70.68	12.95
CLARK	21.56	30.20	44.30	49.10	25.58	46.85	12.85	69.45	10.55
LEWIS	23.39	24.48	43.83	50.43	18.88	39.92	13.37	79.70	8.63
EXPERIMENT MEANS	22.62	28.76	49.67	49.82	21.36	44.73	12.86	80.48	7.31
F TEST FOR VAR.	5.00*	0.66NS	0.49NS	10.98*	0.89NS	1.26NS	1.57NS	3.27*	2.64*
C.V. 2	3.08	13.50	8.05	1.06	20.99	9.52	3.66	4.96	27.46
LSD (0.05)	2.00	11.17	11.31	1.52	12.90	12.25	1.35	11.50	5.78

* Significant at P < 0.05 probability level (NS = not significant).

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TABLE 8. NO-TILL RECROP SPRING BARLEY VARIETY TRIAL (VARIETY MEANS POOLED ACROSS SOILS). DARYL SPICHER FARM HINGHAM HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

VARIETY OR SELECTION		PLANT HEIGHT	TILLER	GRAIN YIELD	TEST WEIGHT	STRAW WEIGHT	TOTAL YIELD	PROTEIN	PLUMPS	THINS
		INCH	NO/FT2	BU/AC	LB/BU	CWT/AC	CWT/AC	%	%	%
BEARPAW		20.23	29.11	49.45	48.15	16.99	49.45	13.19	72.36	11.03
BOWMAN		22.09	26.76	49.03	50.13	18.24	49.03	12.58	82.69	8.01
CLARK		21.24	29.93	49.11	48.71	22.84	49.11	12.94	70.51	11.78
CRYSTAL		20.93	31.31	45.39	48.89	23.19	45.39	13.03	65.88	13.63
GALLATIN		21.29	29.53	49.15	49.91	17.29	49.15	12.86	72.85	11.01
HARRINGTON		19.83	29.74	46.01	48.39	19.98	46.01	12.90	72.06	10.98
HECTOR		23.74	33.11	52.75	49.11	21.29	52.75	12.81	68.16	13.04
LEWIS		20.78	28.33	46.96	49.60	16.26	38.81	13.11	72.54	12.21
MT140523		21.32	29.85	47.39	48.39	15.68	47.39	13.03	63.30	16.41
ND9866		22.64	28.06	50.48	50.94	17.04	50.48	12.55	89.30	3.80
PIROLINE		22.40	27.70	51.33	49.96	17.88	51.33	13.75	69.71	10.46
STEPTOE		18.45	21.15	47.09	44.44	13.29	47.09	11.80	79.91	8.15
EXPERIMENT MEAN		21.24	28.71	48.68	48.88	18.38	41.47	12.88	73.27	10.88
SOURCE	df	Pr>F								
VARIETY	11	0.17	0.38	0.87	<0.01	0.21	0.58	0.17	0.17	0.15
SOIL	1	<0.01	0.95	0.29	<0.01	<0.01	<0.01	0.84	<0.01	<0.01
VARIETY*SOIL	11	<0.01	0.35	0.28	0.81	0.68	0.25	0.31	0.01	0.08
V*S EMSa	11	55.63	55.64	78.90	0.67	42.17	77.72	0.93	236.27	42.74
POOLED EMSb	66	1124	49.81	63.92	73.81	56.35	59.86	51.90	6355	1586
OBSERVATIONS		96	96	96	96	95	96	96	96	96

EMS=ERROR MEAN SQUARE (used a to test Variety and Soils, b for V*S interaction).