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PROJECT TITLE: EVALUATION OF SMALL GRAIN VARIETY PERFORMANCE UNDER NO-TILL CONDITIONS IN NORTHERN MONTANA.

PROJECT LEADER: R. Berg; Havre, MT

PROJECT PERSONNEL: T. Blake, Coordinator - Barley
L. Talbert, Coordinator - Spring Wheat
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OBJECTIVES: To evaluate small grain varieties regarding their suitability for production under no-till conditions with and without applied fertilizer in northern Montana.

RESULTS:

Four small grain nurseries were established in Hill County to evaluate 15 spring wheat and 14 spring barley varieties using two nurseries per crop to measure the effects of fertilizer addition on variety performance. All nurseries were established at the Rob and Daryl Spicher farm southwest of Hingham. These locations are similar to those used for no-till recrop trials conducted since the mid 1980s by Northern Agricultural Research Center. Results from each nursery can be combined by crop to determine main effects of varieties, fertilizer application, and interactions that might suggest which germplasm is best suited for low (or medium) and high nutrient environments.

Soil, climatic, and management information are summarized in Table 1. Total measured precipitation from late March to mid September was 11.3 inches. The soil profile contained 4.8 inches of stored water to a depth of 3 ft at planting plus the precipitation from May through early August of 7.8 inches resulted in a total of 12.6 inches available for production of spring grains during the 1991 growing season. There was 34 lb N/ac as NO3-N in the profile at the spring soil sample along with high levels of available soil P and K. According to the Crop Management Handbook for Wheat and Barley Production in Montana (MSU/MCES Bulletin 1291, 1983), grain yields of 17 (wheat) and 23 (barley) bu/ac could be expected from the residual soil N without the addition of fertilizer. Similarly, yield potentials anticipated at planting for fertilized crops based on stored soil moisture (4.8 inches) and expected precipitation (4.5 inches) were 25 (wheat) and 33 (barley) bu/ac. Because summer rainfall exceeded amounts typically received in this area these anticipated potentials were adjusted to 42 and 61 bu/ac for wheat and barley, respectively. The level of stored soil moisture also exceeded the threshold level of 3 to 4 inches needed to consider recrop as a practical flexible dryland cropping management option for 1991.

Variety results reported in Tables 2 to 5 are ranked by crop yield (above-ground biomass) production. These rankings were the same as if ranked based on grain yield in bushels per acre except for the spring wheat nursery that was fertilized.

SPRING WHEAT

WITHOUT FERTILIZER

Spring wheat responses without application of fertilizer are shown in Table 2. Under these conditions, the average pooled across all varieties in the nursery indicates that these lines were around 30 inches tall, had 25 tillers/ft2, produced 1.7 tons/ac of above-ground dry matter, 27 bu/ac of grain with a test weight of 57.4 lb/bu, 11.1% protein, and a kernel hardness ranking of 70 (out of 100).

All varieties tested yielded at least as well as the 17 bu/ac potential expected based on the amount of soil N available in the profile at planting. In fact, 60% of these (Amidon, Cutless, Fortuna, Glenman, MT140523, Owens, Rambo, Stoa, and Westbred 926) exceeded this potential by at least the 9 bu/ac LSD value needed to distinguish between variety means in this trial. None of these varieties reached the yield potential expected based on stored soil moisture and actual precipitation received without additional fertilizer.

Protein and kernel hardness varied significantly among the varieties tested. Cutless and MT8402 (Hiline) had protein levels greater than 12% and MT8402 had 0.5% more protein in the grain than any other selection tested. Rambo, Amidon, Glenman, and Penawawa had grain protein levels of around 10%. The two soft white varieties, Owen and Penawawa, had kernel hardness rankings of 13 compared to rankings from 70 (MT8402) to 93 (Amidon) for the other entries.

Greatest yields without fertilizer were observed for Westbred 926, Rambo, and Fortuna (approximately 30 bu/ac), whereas, Lew, Olaf, Penawawa, and Pondera yielded in the low 20 bu/ac range. Test weights were less than the standard 60 lb/bu for Lew, Owens, and Stoa by at least 3.5 lb/bu (LSD value).

WITH FERTILIZER

Wheat responses to fertilizer were evident as summarized in Table 3. When fertilized, the average pooled across all varieties in the nursery generally increased. These varieties were around 33 inches tall, had 31 tillers/ft2, produced over 2.4 tons/ac of above-ground dry matter, 38 bu/ac of grain with a test weight of 58.6 lb/bu, 12.2% protein, and a kernel hardness ranking of 67.

Westbred 926's yield of 49 bu/ac easily met the expected yield potential of 48 bu/ac based on amount of soil N in the profile at planting plus the 60 lb N/ac added in the fertilizer, for a total of 94 lb N/ac available during 1991. In fact, almost half (47%) of the selections (Amidon, MT8402, Olaf, Owens, Penawawa, Rambo, and Westbred 926) exceeded this potential by at least the 9 bu/ac LSD value. All varieties, except Lew and Pondera, met the yield potential based on stored soil moisture plus observed precipitation (42 $\pm$ 9 bu/ac).

Plant height, yield, protein, and kernel hardness varied significantly among the varieties tested when the nursery received fertilizer. The tallest varieties were Amidon, Fortuna, and Lew at 37 to 38 inches tall and MT8402, Penawawa, and Pondera were among the shorter varieties measured (29 inches tall). The spread from the highest to lowest average variety protein was 2.32%. Out of the 15 varieties tested, six had 11% protein (Amidon, Glenman, Newana, Olaf, Owens, and Penawawa); five had 12% protein (Lew, Len, Pondera, Rambo, and Westbred 926); and four contained nearly 13% protein (Cutless, Fortuna, MT8402, and Stoa). Tiller production ranged from 27 to 36 tillers/ft2. The two soft white varieties had very soft kernel rankings of 2 to 5 when fertilized, compared to 65 to 99 for the other varieties, and 13 for soft white varieties without fertilizer.

BARLEY

WITHOUT FERTILIZER

Barley responses without added fertilizer are shown in Table 4, where the average pooled across all varieties gave a plant height of 27 inches tall, 33 tillers/ft2, produced 1.95 tons/ac of above-ground dry matter, 52 bu/ac of grain with a test weight of 49.0 lb/bu, 10.9% protein, and a kernel hardness ranking of 67, 63% plumps, 17% thins, 80.2% malt extract, 9.2% malt moisture, viscosity of 5.1 g/cm per second, and 1.9% grain fat content.

All varieties tested yielded at least as well as the 23 bu/ac potential expected based on the amount of soil N available in the profile at planting and many varieties did so by two-fold or more. In fact, 64% of these (Baronesse, Bowman, Harrington, Hector, Lewis, MT140523, Piroline, Stark, and Steptoe) even achieved the yield potential of 61 $\pm$ 9 bu/ac based on stored soil moisture and actual rainfall received during the growing season. The five varieties that did not meet the yield potential were Bearpaw, Clark, Excell, Gallatin, and Shonkin.

Statistically, every response measured in Table 4, except total dry matter and straw weight were influenced significantly by the varieties tested in this trial. Plant heights ranged from a low of 22 to 25 inches for Baronesse, Bearpaw, Excell, and Gallatin to 29 or 30 inches tall for Bowman, Clark, Hector, Shonkin, and Stark. Tillers ranged from about 21 tillers/ft2 for Excell and Steptoe to nearly twice that many for Harrington and others. Steptoe's test weight 44 lb/bu was significantly less and Shonkin's was considerably heavier than the standard test weight. These two varieties also had the lowest and highest levels of grain protein at 10.2 and 12.8%, respectively. Steptoe had the softest kernel ranking (44) and Bearpaw, Clark, and Gallatin had the hardest harness rankings. Bowman produced the most plump kernels (85%) and Shonkin the least (16%).

WITH FERTILIZER

Barley responses to fertilizer were evident as summarized in Table 5. When fertilized, the average pooled across all varieties in the nursery

generally increased to around 30 inches tall, with 43 tillers/ft2, produced 2.5 tons/ac of above-ground dry matter, 63 bu/ac of grain with a test weight of 48.0 lb/bu, 10.9% protein, and a kernel hardness ranking of 64, 51% plump and 24% thin kernels, 80.3% malt extract, viscosity ranking of 5.1 g/cm per second, 9.1% malt moisture, and 1.8% grain fat.

All barley varieties tested exceeded the predicted yield goals of 64 (± 16) bu/ac with 94 lb N/ac available from a combination of soil profile and fertilizer N, as well as the yield goal expected based on stored soil moisture and observed precipitation (61 ± 16)bu/ac. Westbred 926's yield of 49 bu/ac easily met the expected yield potential of 48 bu/ac based on amount of soil N in the profile at planting plus the 60 lb N/ac added in the fertilizer. In fact, almost half (47%) of these (Amidon, MT8402, Olaf, Owens, Penawawa, Rambo, and Westbred 926) exceeded this potential by at least the 9 bu/ac LSD value. All varieties, except Lew and Pondera, met the yield potential based on stored soil moisture plus observed precipitation (42 ± 9 bu/ac).

Plant height, yield, protein, and laboratory kernel trends were generally very similar to those observed in the barley nursery without fertilizer added only larger.

SUMMARY:

These nurseries show that growing conditions were generally favorable for recropping many spring wheat and barley varieties under no-till conditions in northcentral Montana during 1991. Spring wheat varieties often did not reach their yield potential based on the amount of stored soil moisture plus the precipitation actually received during the growing season unless they were fertilized, however this limitation was less noticeable for the barley varieties tested and both crops demonstrated their abilities to either achieve or exceed the yield potentials predicted based on N carried over in the soil profile from the previous crop. Westbred 926, MT8402, Amidon, Rambo, and other spring wheat varieties performed particularly well in these trials as did Lewis, Baronesse, and Piroline barley.

General estimates of the economic feasibility associated with this design based on grain markets of $3.50/bu for wheat and $2.00/bu for barley coupled with the $28.34/ac cost for fertilizer materials when applied indicate that three varieties of spring wheat (Cutless, Fortuna, and Stoa) may not respond enough to fertilizer to repay the cost of fertilizing and Len and Lew seemed to just break even, whereas 67% of the spring wheat varieties responded to fertilizer enough to more than recover the cost of materials (data not shown). Olaf, Owens, Penawawa, Rambo, and Westbred 926 recovered the cost of fertilizer plus an additional $20 to 44/ac. On the other hand, only three of the 14 barley varieties (21%) evaluated demonstrated a fertilizer response large enough to recover the cost of nutrients applied.

FUTURE PLANS:

Additional analyses are pending from data obtained in these trials to examine more closely a few simple economic impacts possible with the design of

these trials and more detailed evaluation of variety * fertilizer interactions before this effort is published in popularized and technical media. This research needs to be continued at additional sites and environments to better evaluate these preliminary results. I intend to repeat this research on small grain variety trials during the coming year.

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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. 1991.

ITEM	DESCRIPTION
SOIL ANALYSIS (0-6" EXCEPT SOIL NO3-N & WATER ALSO @ 6-12", 12-24", & 24-36"):	
PH	8.0
ORGANIC MATTER (%)	1.2
NO3-N (LB/AC)	34
OLSEN P (PPM)	20
AVAIL. K (PPM)	361
SO4-S (PPM)	20
NA (MEQ/100 G)	0.05
EC (MMHOS/CM)	0.96
ZN (PPM)	0.3
SOIL TAXONOMY: TELSTAD/JOPLIN (FINE-LOAMY, MIXED ARIDIC ARGIBOROLL)	
PRECIPITATION (INCH)	11.3
03-20-91 TO SOIL SAMPLE	1.9
SOIL SAMPLE TO BUNDLE HARVEST	9.1
BUNDLE TO GRAIN HARVEST	0.1
GRAIN HARVEST TO SOIL SAMPLE	0.2
WATER STORED IN SOIL PROFILE TO 3 FT.	
AT PLANTING (INCH)	4.8
AT HARVEST (INCH)	3.5 (WHEAT), 2.2 (BARLEY)
PREVIOUS CROP:	SPRING BARLEY
SEEDING DEPTH:	1.00 INCHES
SEEDING RATES (LB/AC):	65 (WHEAT), 55 (BARLEY)
GRAIN YIELD (BU/AC) STANDARDIZED TO:	60 (WHEAT)/48 (BARLEY) LB/BU TEST WEIGHT
DRILL:	USDA III YIELDER WITH PAIRED ROW SPACING (5" X 15")
FERTILIZER:	60 LB N/AC (46-0-0, DEEP BANDED), 40 LB P2O5/AC (0-45-0, BANDED WITH SEED), AND 60 LB K2O/AC (0-0-62, DEEP BANDED) AT PLANTING FOR TRIALS THAT RECEIVED FERTILIZER
WEED CONTROL:	PREPLANT = GLYPHOSATE (16 OZ/AC)/2,4-D (0.25 LB AE/AC POSTEMERGE = METSULFURON (0.1 OZ/AC)/DICAMBA (4 OZ/AC)
SOIL SAMPLE/PRE-EMERGENCE HERBICIDE DATE	MAY 02
SEEDING DATE	MAY 08
POST-EMERGENCE HERBICIDE DATE	MAY 27
BUNDLE HARVEST DATE	AUG. 07 (BARLEY), AUG 15 (WHEAT)
GRAIN HARVEST DATE	AUG. 19 (BARLEY), AUG 17 (WHEAT)
FALL SOIL SAMPLE DATE	SEPT. 13

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TABLE 2. NO-TILL RECROP SPRING WHEAT VARIETY TRIAL WITHOUT FERTILIZER. ROB AND DARYL SPICHER FARM, HILL COUNTY (S 1/2, SEC 28, T32N, R10E). NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1991

VARIETY OR SELECTION	PLANT HEIGHT	TILLER	YIELD	TEST WEIGHT	PROTEIN	HARD NESS	CROP YIELD	GRAIN WEIGHT	STRAW WEIGHT
	INCHES	NO/FT2	BU/AC	LB/BU	%	%	CWT/AC	CWT/AC	CWT/AC
WPB 926 Westbred 926	28.23	19.83	32.33	58.10	11.13	73.93	34.78	19.40	15.38
C982-324 Rambo	28.16	26.38	30.97	57.55	9.85	81.13	35.25	18.58	16.67
CI 13596 Fortuna	32.45	27.28	30.80	58.60	11.57	79.10	37.48	18.48	19.00
ND 582 Stoa	32.81	26.50	29.17	55.85	11.80	82.85	41.20	17.50	23.70
ND 606 Amidon	32.63	21.35	28.67	58.15	10.05	92.88	29.40	17.20	12.20
CI 17904 Owens - sft white	28.97	24.12	27.72	53.40	11.13	13.25	36.75	16.63	16.28
MT 8402 MT7336/Shortana	27.76	25.42	28.33	56.85	12.58	71.25	35.13	17.00	18.13
NDCUT Cutless	31.17	27.45	27.38	58.15	12.10	79.88	36.05	16.43	19.62
PI483236 Glenman	28.88	21.95	26.92	58.00	10.05	81.18	30.40	16.15	14.25
CI 17430 Newana	28.23	23.38	26.20	57.95	10.85	73.98	30.23	15.72	14.50
CI 17790 Len	28.59	24.80	24.67	57.35	10.90	72.00	32.03	14.80	17.22
CI 17429 Lew	30.95	23.22	24.45	56.15	11.13	76.60	26.73	14.67	12.05
WA 6920 Penawawa-sft white	27.89	24.63	22.92	57.85	10.03	13.88	30.25	13.75	16.50
CI 15930 Olaf	28.26	25.18	22.67	57.70	11.25	78.03	29.00	13.60	15.40
CI 17828 Pondera	30.43	26.63	21.45	58.55	11.35	73.37	33.65	12.87	20.77
EXPERIMENTAL MEANS	29.69	24.54	26.97	57.35	11.05	69.55	33.22	16.18	16.78
C.V. 2: (S OF MEAN/MEAN)*100	5.14	11.62	11.91	2.11	4.60	5.02	13.75	11.99	23.58
LSD (0.05)	4.35	8.14	9.23	3.46	1.45	9.97	13.04	5.54	11.29

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TABLE 3. NO-TILL RECROP SPRING WHEAT VARIETY TRIAL WITH FERTILIZER. ROB AND DARYL SPICHER FARM, HILL COUNTY (S 1/2, SEC 28, T32N, R10E). NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1991

VARIETY OR SELECTION	PLANT HEIGHT	TILLER	YIELD	TEST WEIGHT	PROTEIN	HARD-NESS	CROP YIELD	GRAIN WEIGHT	STRAW WEIGHT
	INCHES	NO/FT2	BU/AC	LB/BU	%	%	CWT/AC	CWT/AC	CWT/AC
C982-324 Rambo	29.91	32.45	44.55	58.95	11.93	91.00	54.80	26.73	28.08
CI 17430 Newana	29.94	34.03	37.58	59.55	11.18	71.50	53.43	22.55	30.88
WA 6920 Penawawa-sft white	28.92	28.07	43.47	58.50	11.10	1.93	53.03	26.08	26.95
WPB 926 Westbred 926	31.70	29.45	48.92	59.20	12.15	72.53	52.65	29.35	23.30
CI 17790 Len	30.52	33.00	33.08	58.95	12.12	72.30	49.78	19.85	29.93
CI 15930 Olaf	33.68	36.03	39.03	58.35	11.60	75.20	49.60	23.42	26.18
ND 606 Amidon	37.82	30.83	39.33	59.40	11.65	99.15	48.85	23.60	25.25
CI 13596 Fortuna	37.43	32.80	32.45	57.65	13.42	67.90	48.38	19.47	28.90
ND 582 Stoa	36.27	31.88	35.30	57.70	13.10	79.62	48.00	21.18	26.83
CI 17904 Owens - sft white	32.00	26.85	42.08	56.05	11.35	5.00	47.58	25.25	22.33
NDCUT Cutless	34.68	34.10	33.63	59.20	13.40	80.65	47.00	20.18	26.83
PI483236 Glenman	31.25	32.90	38.20	58.95	11.33	79.65	46.88	22.92	23.95
CI 17429 Lew	37.86	29.80	32.83	59.45	12.35	78.03	45.05	19.70	25.35
CI 17828 Pondera	29.31	26.70	31.78	59.60	12.40	71.78	43.50	19.07	24.42
MT 8402 MT7336/Shortana	29.31	28.38	40.17	58.05	13.17	65.35	42.95	24.10	18.85
EXPERIMENTAL MEANS	32.71	31.15	38.17	58.64	12.15	67.44	48.76	22.90	25.87
C.V. 2: (S OF MEAN/MEAN)*100	3.73	9.62	7.95	1.25	4.14	5.79	8.51	7.97	16.13
LSD (0.05)	3.48	8.55	8.68	2.09	1.44	11.14	11.84	5.21	11.90

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TABLE 4. NO-TILL RECROP SPRING BARLEY VARIETY TRIAL WITHOUT FERTILIZER. ROB AND DARYL SPICHER FARM, HILL COUNTY (S 1/2, SEC 28, T32N, R10E). NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1991

VARIETY OR SELECTION	PLANT HEIGHT	TILLER	YIELD	TEST WEIGHT	PROTEIN	HARD-NESS	CROP YIELD	GRAIN WEIGHT	PLUMPS	THINS	MALT EXTRACT	VISCO-SITY	MALT HOH	FAT	STRAW WEIGHT
	INCHES	NO/FT2	BU/AC	LB/BU	%	%	CWT/AC	CWT/AC	%	%	%	g/cm/s	%	%	CWT/AC
NS 78054 Baronesse	21.95	37.30	59.58	48.40	10.58	62.45	36.17	28.60	58.00	14.92	80.55	5.00	9.28	1.75	7.58
CI 15514 Hector	29.43	37.28	58.40	48.90	11.65	63.15	47.45	28.03	56.18	20.30	79.33	5.48	9.20	1.78	19.43
CI 9558 Piroline	27.69	33.65	57.60	50.70	11.45	57.83	36.80	27.65	66.90	16.78	79.30	5.33	9.23	1.85	9.15
PI483237 Bowman	28.50	34.15	56.77	50.70	11.40	64.75	38.68	27.25	85.48	5.78	79.78	5.05	9.15	1.85	11.43
MT140523 MT140523	26.64	37.70	55.73	49.88	11.10	63.78	39.30	26.75	64.88	14.10	80.00	2.75	9.35	1.95	12.55
ND 9866 Stark	29.90	29.85	53.85	51.08	10.65	62.68	38.25	25.85	78.03	9.07	80.58	3.85	9.23	1.78	12.40
CI 15229 Steptoe	26.07	24.33	53.29	44.35	10.15	44.28	38.55	25.58	74.93	11.40	80.25	4.95	9.08	1.85	12.97
SK 76333 Harrington	26.55	39.73	52.60	46.23	10.20	65.53	44.20	25.25	68.38	16.20	81.15	4.20	9.35	1.90	18.95
CI 15856 Lewis	26.88	38.88	52.19	49.65	10.90	67.30	41.48	25.05	60.48	17.72	80.35	6.00	9.40	1.78	16.43
MN 52 Excel	25.32	21.28	48.75	45.80	10.33	65.33	34.88	23.40	51.63	24.28	81.07	4.75	9.05	1.78	11.48
CI 15857 Clark	28.87	36.80	48.33	48.05	10.42	82.35	39.03	23.20	60.78	15.98	81.48	5.30	9.40	1.72	15.82
MTSU 247 Shonkin	28.59	36.78	47.15	55.98	12.82	48.70	39.33	22.63	15.50	48.30	77.50	7.48	8.98	2.65	16.70
PI531228 Bearpaw	24.68	28.83	46.25	46.55	10.72	73.70	34.58	22.20	73.22	11.70	80.90	5.82	9.28	1.88	12.38
PI491534 Gallatin	24.68	29.43	42.96	49.25	10.60	79.48	37.50	20.62	62.80	16.18	81.13	5.08	9.32	1.75	16.87
EXPERIMENTAL MEANS	26.84	33.28	52.36	48.96	10.93	64.38	39.01	25.15	62.65	17.34	80.24	5.07	9.23	1.88	13.87
C.V. 2:	5.66	13.12	6.06	1.51	3.75	5.43	11.97	6.13	8.00	21.46	0.69	17.41	0.63	3.06	29.39
LSD (0.05)	4.35	12.49	9.19	2.12	1.17	10.01	13.36	4.41	14.34	10.64	1.58	2.53	0.17	0.16	11.66

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TABLE 5. NO-TILL RECROP SPRING BARLEY VARIETY TRIAL WITH FERTILIZER. ROB AND DARYL SPICHER FARM, HILL COUNTY (S 1/2, SEC 28, T32N, R10E). NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1991

VARIETY OR SELECTION	PLANT HEIGHT	TILLER	YIELD	TEST WEIGHT	PROTEIN	HARD-NESS	CROP YIELD	GRAIN WEIGHT	PLUMPS	THINS	MALT EXTRACT	VISCO-SITY	MALT HOH	FAT	STRAW WEIGHT
	INCHES	NO/FT2	BU/AC	LB/BU	%	%	CWT/AC	CWT/AC	%	%	%	g/cm/s	%	%	CWT/AC
CI 15856 Lewis	26.70	54.38	70.63	49.70	10.85	65.93	53.48	33.90	54.53	21.43	80.53	5.50	9.23	1.70	19.58
NS 78054 Baronesse	32.94	44.73	70.27	48.93	10.30	58.28	57.75	33.73	53.90	17.30	80.75	4.63	9.03	1.83	24.03
CI 9558 Piroline	32.17	40.25	69.02	50.00	11.90	57.25	55.40	33.13	47.08	26.53	78.80	5.98	9.20	1.83	22.28
CI 15514 Hector	31.59	43.80	67.40	49.90	10.85	73.30	54.75	32.35	58.05	20.13	80.75	5.20	9.23	1.70	22.40
CI 15229 Steptoe	30.07	45.48	66.98	43.93	9.53	53.97	49.85	32.15	65.53	14.47	81.48	3.80	8.93	1.73	17.70
CI 15857 Clark	29.52	45.23	65.17	48.83	10.67	71.88	54.67	31.28	53.43	20.40	80.95	4.90	9.05	1.80	23.40
ND 9866 Stark	30.51	50.67	64.17	50.18	11.15	64.55	55.23	30.80	70.30	13.52	80.12	4.40	9.28	1.78	24.43
PI491534 Gallatin	32.15	49.22	62.08	48.73	10.88	72.35	49.22	29.80	37.28	29.57	80.65	4.68	9.05	1.75	19.42
PI483237 Bowman	28.07	26.80	62.15	50.83	10.67	64.78	53.20	29.83	87.25	5.08	80.62	4.55	9.23	1.73	23.38
SK 76333 Harrington	32.28	42.93	60.42	46.15	11.13	73.48	47.23	29.00	65.98	15.70	80.48	4.80	9.08	1.83	18.22
MN 52 Excel	25.79	45.78	58.65	44.28	10.85	64.25	43.80	28.15	32.58	35.03	80.43	5.48	9.02	1.73	15.65
MTSU 247 Shonkin	31.00	24.55	58.23	49.30	12.12	47.80	52.95	27.95	7.58	61.55	78.40	6.80	8.75	2.40	25.00
MT140523 MT140523	28.72	43.80	55.79	46.85	11.15	61.55	42.73	26.78	37.08	34.95	79.90	5.85	9.20	1.80	15.95
PI531228 Bearpaw	24.40	45.10	49.65	43.68	10.65	61.55	39.63	23.83	42.03	27.07	80.50	4.65	8.95	1.88	15.80
EXPERIMENTAL MEANS	29.71	43.05	62.85	47.95	10.91	63.64	50.71	30.19	50.90	24.48	80.31	5.09	9.09	1.82	20.52
C.V. 2:	3.95	9.03	8.74	1.79	2.88	5.84	7.30	8.74	11.31	19.24	0.50	5.35	0.86	3.31	20.64
LSD (0.05)	3.36	11.12	15.73	2.45	0.90	10.64	10.59	7.55	16.46	13.48	1.15	0.78	0.22	0.17	12.11