

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
MIDWEST AREA
CEREAL CROPS RESEARCH UNIT

WESTERN REGIONAL SPRING BARLEY NURSERY - 2006 Crop
Preliminary Quality Report

A. Budde, C. Martens, M. Schmitt and Staff

Detailed Data:

Aberdeen, ID
Twin Falls, ID
Fairfield, MT

Idaho Falls, ID
Conrad, MT

Appendix:

Methods
Criteria for Quality Score

This is a joint progress report of cooperative investigations being conducted in the Agricultural Research Service of the U.S. Department of Agriculture and State Agricultural Experiment Stations. It contains preliminary data that have not been sufficiently confirmed to justify general release; interpretations may be modified with additional experimentation. Confirmed results will be published through established channels. The report is primarily a tool available to cooperators and their official staffs and for those persons who have a direct and special interest in the development of improved barleys.

This report includes data furnished by the Agricultural Research Service as well as by the State Agricultural Experiment Stations. The report is not intended for publication and should not be referred to in literature citations nor quoted in publicity or advertising. Use of the data may be granted for certain purposes upon written request to the agency or agencies involved.

Samples malted and analyzed by the Cereal Crops Research Unit, Madison, WI

August, 2007
CCRU-MWA-126

Western Regional Spring Barley Nursery – 2006 Crop

Nursery samples were received for malting quality evaluation from five experimental stations located in Idaho and Montana. The parentages of the nursery entries are listed in Table 1. Nine of the 36 entries were new in this year's nursery.

These samples were germinated for four days in Joe White micro-malters under conditions that should have generated malts having modification levels similar to those produced by industry. Detailed descriptions of the malting conditions and analytical methods employed are listed in Appendix A. The criteria and value assignments used to calculate quality scores are listed in Appendix B.

The mean values for sixteen quality factors are listed over the five stations located in the Western Region (Table 2) and over all varieties (Table 3). Individual station data are reported in Tables 4 through 8. Evaluations of data from individual locations and overall performance evaluations, derived primarily from Tables 2 and 3, are presented below.

A quarter of the submissions grown at Aberdeen, ID (Table 4) were too thin, while two-thirds of the lines had unacceptably low protein contents. Extract values were generally good, with a location average of 81.5%. Nearly half of the soluble protein levels were too low, affected strongly by the low total protein contents. The majority of these malts were poorly modified by our malting protocol. As a result, most F – C, β -glucan and viscosity values were too high. Over half of the S/T and free amino nitrogen (FAN) values were too low and a third of the turbidities exceeded the upper limit. Most diastatic power values were too low, affected by the low total protein contents. The best performers were 2B99-2763-10, 01Ab10055, AC Metcalfe, 2B99-2771-1 and 01Ab10062. All of these lines were a bit too thin to meet “ideal” standards (<http://www.ambainc.org/ni/Guidelines%202004.pdf>), but all had excellent extract values including an 83.0% from 2B99-2771-1. The F – C differences for 2B99-2771-1 and 01Ab10055 were above the desired limit. The FAN values for 2B99-2771-1 and 2B99-2763-10 fell below the desired limit. 01Ab10062 had low protein contents, and elevated viscosity and turbidity values. AC Metcalfe was an addition to the nursery, only grown at this location. This line had performed well in previous nurseries and did so again

nically falling within the “ideal” range for all assessed parameters, except plumpness and kernel weight.

Most of the barleys grown at Idaho Falls, ID (Table 5) were plump, but nearly a third of the protein contents were too high. A quarter of the extract values were too low, while soluble protein levels ranged from five that were too low to eight that exceeded the upper limit. The samples from this location did not modify well. Over half of the viscosities, F – C, and β -glucan values exceeded upper limits. Over half of the S/T and nearly half of the FAN values fell below desired limits, while a third of the turbidities were too high. The best performers were 2B99-2316, WA10701-99, 2B99-2763-10, ND21863 and 2B99-2771-1. 2B99-2316 was plump, with very good extract, F – C, β -glucan, FAN, viscosity and turbidity values. This line has a “hot” amyolytic package. WA10701-99 had a very good malting quality profile, except for elevated F – C and β -glucan values. 2B99-2763-10 and 2B99-2771-1 showed good quality, except that both had elevated F – C differences and 2B99-2771-1 had an elevated β -glucan level. ND21863 was plump and had lower protein contents than the experimental checks. Carbohydrate modification was poor resulting in elevated viscosity, F – C and β -glucan values.

Over half of the submissions received from Twin Falls, ID (Table 6) had unacceptably low protein contents. Extract values were generally good and most F – C differences were excellent. A third of the soluble protein values were too low and half of the S/T ratios fell below the minimum limits. Two thirds of the diastatic power values were too low, but α -amylase levels were good. Over half of the β -glucan and viscosity values exceeded desired limits, while a third of the turbidities were high. The best performers were 2B99-2316, Morex, Harrington, MT000138, 2B99-2763-10, 01Ab10055, 01Ab10062 and 2B99-2771-1. 2B99-2316 had excellent quality, similar to that of the Harrington experimental check; however, this line had a lot more amyolytic activity and a lower viscosity. Morex had a good quality profile at this location; however, it was a bit thin and its soluble protein level was slightly low. MT000138 showed excellent quality, except for elevated β -glucan and viscosity values. The total protein and FAN values of 2B99-2763-10 were slightly low, but the amyolytic values were still higher than those of Harrington. 01Ab10055 was a bit thin, but otherwise had a nice

quality profile. This line had slightly higher total protein, wort protein, FAN and diastatic power values than Harrington. 01Ab10062 had a similar amount of protein, when compared to Harrington, but had lower soluble protein, FAN and diastatic power values. 2B99-2771-1 generally showed good malting quality, with higher α -amylase, FAN, β -glucan and extract values than Harrington.

Most of the barleys grown at Conrad, MT (Table 7) were plump, but over half had unacceptably high protein contents. Extract values ranged widely, from seven that were too low, to two hull-less lines (01ID435H and 01ID451H) that were over 83%. A quarter of the soluble protein values fell below the lower limits and most of the S/T ratios were too low. The amyolytic values were generally good, but over half of the F – C and β -glucan values were too high. Eighteen FAN values were below desired limits, while thirteen viscosity and six turbidity values exceeded the desired limits. The best performers were 2B99-2657, 00ID1550 and Harrington. 2B99-2657 performed very well, but was a bit thin. It had higher extract, FAN and amyolytic values than Harrington. 00ID1550 was plump and had an extract value similar to that of Harrington. This line had much lower protein content than the experimental check. The low total protein negatively affected the diastatic power and FAN values, which were too low. Note the elevated viscosity for this line.

Protein contents of a fourth of the very plump barleys grown at Fairfield, MT (Table 8) fell below desired limits. Extract values were generally good, but nearly half of the F – C differences exceeded the upper limit. Poor modification was evident, with over half of the S/T ratios falling below the minimum limit. Fourteen soluble protein and fifteen FAN values were too low, while twenty-five viscosities and seventeen β -glucan values were above the desired limits. Amyolytic activity was generally low at this location. Fourteen diastatic power and even five α -amylase values were below the desired limits. Lines that performed very well were 01Ab10062, MT000047, 2B99-2316, 2B99-2763-10, 01Ab10055, Harrington, WA10701-99, 2B99-2657, 2B99-2771-1, MT000138, 01NZ706, MT000125 and ND22996. All of these lines had excellent malt quality profiles, with only minor deviations from "Ideal". 01Ab10062 and MT000047 had maximum scores, however both of their F – C differences were a tenth of a per cent above the upper desired limit. 2B99-2316, 2B99-2763-10 and 01Ab10055 had kernel

weight values just below “Ideal”. Harrington, WA10701-99 and 2B99-2771-1 had slightly elevated β -glucan levels. 2B99-2771-1 also had slightly low diastatic power and kernel weight values. The protein contents of 2B99-2657 were a bit low, but soluble protein, S/T and FAN levels were good. This line had a phenomenal extract value of 83.4%, exceeded only by the hull-less lines. The soluble protein and β -glucan levels for MT000138 were slightly elevated. 01NZ706 had an unacceptably high S/T ratio. The S/T ratio for MT000125 was just below the minimum limit, while its β -glucan value was slightly elevated. ND22996 had a slightly elevated soluble protein level, which contributed to the unacceptably high S/T ratio. Note also the elevated turbidity.

The nursery performed best overall in barleys grown at Fairfield, MT (Table 2), where they generally grew plump and had very good protein contents. The average extract, soluble protein and FAN values were very good. The average β -glucan contents were lowest at this location, however, on the negative side, viscosity and turbidity values were highest. Submissions from Twin Falls followed, with the next highest quality score. The lines were a bit thinner than those from Fairfield, but the average protein was a half percent lower. The diastatic power, viscosity, FAN and turbidity values were slightly lower than those of Fairfield, while β -glucan levels were higher. Aberdeen, ID, Idaho Falls, ID and Conrad, MT followed in scoring. Aberdeen had the highest average extract values, but the barleys were thin and had the lowest average protein content. The low protein content negatively affected diastatic power levels. Average soluble protein and FAN values were a bit low, while average β -glucan and turbidity values were high. Idaho Falls and Conrad had lower extract values than found at the other locations as might be expected, because of the higher protein contents. Though the average β -glucan, viscosity and turbidity values were too high, several individual lines at each of these locations performed very well, while many performed poorly and a few very poorly, thus negatively inflating the averages.

The best overall performers in the nursery include 2B99-2763-10, 2B99-2316, 01Ab10062, 2B99-2771-1, Morex, MT000125, ND21863, 01Ab10055, Harrington, 2B99-2657 and WA10701-99. 2B99-2763-10 had the highest average score. This line demonstrated similar plumpness and protein content to the experimental check. Unfortunately, the extract values were consistently lower than Harrington, although F –

C and β -glucan values were lower. Wort soluble protein was consistently lower than the check, resulting in a S/T ratio that was good, but 3.5% lower. 2B99-2763-10 had more enzymatic activity than Harrington, while viscosities and turbidities were similar and very good. 2B99-2316 was plump, although a bit thinner than the check, and had similar protein contents. This line had more amylolytic activity than Harrington and lower F – C and β -glucan values. 01Ab10062 was a bit thinner than Harrington, but otherwise very similar in almost all quality parameters, except for consistently higher diastatic power values and slightly lower β -glucan levels. 2B99-2771-1 had remarkably similar values to the check, except for consistently more α -amylase activity. Morex performed well as the 6-rowed check sample and better than any of the other 6-rowed submissions. MT000125 averaged slightly higher protein contents than Harrington; however it consistently had lower soluble protein, resulting in an S/T ratio that averaged 6% lower. The average β -glucan and viscosity values were higher than those found in the experimental check. ND21863 was consistently one of the plumpest barleys. This line had lower protein contents than Harrington, but also lower extract values. The β -glucan and viscosity values were higher than the check. 01Ab10055 was a bit thinner than the check, and averaged 0.5% higher protein content. Its extract value was a bit lower than that of Harrington, while most of the other parameters were similar. 2B99-2657 was thinner than the check and averaged 0.6% higher protein. This line averaged 1.0% more extract than Harrington and had lower β -glucan levels. The enzyme activities were higher than the experimental check, while the remaining parameters were similar and very good. WA10701-99 was thinner than Harrington, but had lower protein contents. Extract and S/T values were similar, while β -glucan, viscosity and turbidity values were a bit higher. The amylolytic activity for WA10701-99 was slightly lower than that of Harrington.

Western Regional Spring Barley Nursery - 2006 Crop

Table 1. WRSBN Submission Descriptions

Seed Source	Entry No.	Entry	Parentage	Type	Grade	Years Tested	Cooperator
WSU	1	Steptoe	CI 15229	6 row	feed		Check, Ullrich, Vitkov
WPB	2	Baronesse	PI 568246	2 row	feed		Check, Clark, Cook
USDA-ARS	3	Morex	CI 15773	6 row	malting		Check, Erickson
USDA-ARS	4	Stander	PI 564743	6 row	malting		Check, Erickson
USDA-ARS	5	Harrington		2 row	malting		Check, Erickson
BARI	6	2B99-2316	2B91-4947//2B91-4947/2B95-8129	2 row	malting	2	Cooper, Selmer
BARI	7	2B99-2657	2B91-4947//2B91-4947/2B94-5744	2 row	malting	2	Cooper, Selmer
BARI	8	2B99-2763-10	MERIT/2B92-5065	2 row	malting	1	Cooper, Selmer
BARI	9	2B99-2771-1	MERIT // MERIT / 2B95-8129	2 row	malting	1	Cooper, Selmer
USDA-ARS	10	99Ab11073	Colter/M75	2 row	malting	1	Obert
USDA-ARS	11 *	01Ab10055	86Ab2617/2B91-4947	2 row	malting	0	Obert
USDA-ARS	12 *	01Ab10062	86Ab2617/2B91-4947	2 row	malting	0	Obert
USDA-ARS	13 *	00ID1550	Colter*2/pmut422	2 row	feed, low PA	0	Bregitzer
USDA-ARS	14	01ID435H	Baronesse*2/pmut882//HB317	2 row	feed, low PA, hullless	0	Bregitzer
USDA-ARS	15	01ID451H	Baronesse*2/pmut882//HB317	2 row	feed, low PA, hullless	0	Bregitzer
USDA-ARS	16	01ST1587	Baronesse*4/STARS 9301B	2 row	feed, RWA	1	Bregitzer
USDA-ARS	17	01ST1758	Baronesse*4/STARS 9577B	2 row	feed, RWA	1	Bregitzer
WPB	18 *	YU501-312	Heran/Camas	2 row	feed	0	Clark, Cook
WPB	19	YU501-385	Baronesse/Camas	2 row	feed	1	Clark, Cook
WPB	20 *	BZ502-532	Nishino Hoshi/Xena	2 row	feed	0	Clark, Cook
MSU	21	MT000047	Chinook/MT920161	2 row	feed/malting	1	Blake/Hensleigh
MSU	22	MT000125	MT910189/Lewis	2 row	feed/malting	1	Blake/Hensleigh
MSU	23	MT000138	MT920041/Stark	2 row	feed/malting	1	Blake/Hensleigh
NDSU	24	ND21863	ND19119-1/ND19931	2 row	malting	1	Franckowiak
NDSU	25 *	ND22927	ND19119-1/ND19931	2 row	malting	0	Franckowiak
NDSU	26 *	ND22996	ND19922/ND18172-1	2 row	malting	0	Franckowiak
USU	27	UT99B1669-3243	UT91B706-A-259 X BU585-82	6 row	feed	1	Roche
USU	28	UT99B1670-3458	UT91B706-A-259 X DA587-170	6 row	feed	1	Roche
WSU	29	WA 10701-99	Clivia/9448-83(WA 7758-89)//Logan	2 row	feed/malting	2	Ullrich, Jitkov
WSU	30	WA 7330-00	WA 7642-92/Baronesse	2 row	feed	1	Ullrich, Jitkov
WSU	31	WA 15279-00	WA 9361-94/Baronesse	2 row	feed	1	Ullrich, Jitkov
WSU	32 *	02WNZ-1015	Camas/Baronesse	2 row	feed	0	Ullrich, Jitkov
WSU	33 *	02WNZ-1821	WA7478-97/Baronesse	2 row	feed	0	Ullrich, Jitkov
WSU	34	99NZ102	12697-94/ant643//939331-91	6 row	feed/malting	2	Wettstein
WSU	35	01NZ392	16230-95/ant643//BA6B-95-8253	6 row	feed/malting	1	Wettstein
WSU	36	01NZ706	ant643/9130-87//BA6B-95-8253	6 row	feed/malting	1	Wettstein

* new entries

WESTERN REGIONAL SPRING BARLEY NURSERY - 2006 Crop

Table 2 - Station Means* of Barley and Malt Quality Factors for 36 Varieties or Selections**

Location	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agtron)	Malt Extract (%)	F-C	Wort Color	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Viscosity (Relative)	Turbidity (Hach)	Quality Score															
Aberdeen, ID	40.4	C	84.3	B	69.4	C	81.5	A	1.5	B	2.18	BC	10.70	E	4.48	C	43.2	A	88.7	C	54.1	AB	236	BC	178	B	1.54	B	19.2	AB	36
Idaho Falls, ID	42.0	B	91.9	A	66.7	D	79.2	D	1.8	A	2.39	B	13.10	B	5.13	A	40.1	C	127.1	A	56.8	A	271	A	219	A	1.54	B	16.7	AB	36
Twin Falls, ID	40.6	C	84.3	B	67.6	CD	80.7	C	1.1	D	2.29	B	11.20	D	4.55	BC	41.9	B	92.0	C	55.3	AB	213	CD	186	B	1.54	B	18.2	AB	40
Conrad, MT	41.8	B	85.8	B	72.5	B	78.6	E	1.5	B	2.04	C	13.6	A	4.62	B	34.5	D	128.3	A	52.2	B	253	AB	168	B	1.55	B	14.4	B	33
Fairfield, MT	43.1	A	93.3	A	76.0	A	81.2	B	1.3	C	2.64	A	11.70	C	4.57	BC	40.0	C	115.2	B	53.3	B	198	D	205	A	1.57	A	21.0	A	43

* Within each column, means followed by the same letter are not significantly different (alpha=0.05), according to Duncan's Multiple Range Test

** Steptoe, Baronesse, Morex, Stander, Harrington, 2B99-2316, 2B99-2657, 2B00-2763-10, 2B99-2771-1, 99Ab11073, 01Ab10055, 01Ab10062, 00ID1550, 01ID435H, 01ID451H, 01ST1587, 01ST1758, YU501-312, YU501-385, BZ502-532, MT000047, MT000125, MT000138, ND21863, ND22927, ND22996, UT99-B1669-3243, UT99B1670-3458, WA 10701-99, WA 7330-00, WA 15279-00, 02WNZ-1015, 02WNZ-1821, 99NZ102, 01-NZ392, 01NZ706

WESTERN REGIONAL SPRING BARLEY NURSERY - 2006 Crop

Table 3. Varietal Means* of Barley and Malt Quality Factors for all Stations**

Variety or Selection	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agron)	Malt Extract (%)	F-C (%)	Wort Color	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Visc. (Rel.)	Turb. (Hach)	Quality Score															
Stephoe	43.1	DE	92.4	ABCD	69	FGHIJ	75.7	N	3.3	A	3.41	ABC	10.6	M	3.50	O	34.6	KLM	51	O	29.3	L	827	A	111	K	1.83	A	44.4	ABCDE	18
Baronesse	42.9	DE	93.8	ABC	73	BCDEFGH	77.9	LM	1.6	CDEFG	2.61	DEF	12.2	CDEFGH	3.85	N	32.5	MN	85	JKLMN	39.3	JK	225	EFGHIJK	120	K	1.55	FGHIJKL	31.6	CDEFG	27
Morex	36.0	N	79.6	G	80	A	79.7	HIJK	1.5	DEFGH	1.91	FGHI	12.7	BCDE	5.08	FGHI	41.2	HIJ	145	ABC	55.8	GH	199	FGHIJKL	230	DEFG	1.52	GHIJKLMN	11.1	JKL	49
Stander	36.5	N	88.6	ABCDEF	75	ABCDEF	81.5	CD	1.2	EFGHI	2.35	EFGH	11.7	FGHIJ	5.58	ABCD	49.3	ABC	117	EFGH	72.2	BC	207	FGHIJK	305	AB	1.51	HUJKLMN	11.4	JKL	40
Harrington	41.2	FGH	93.2	ABCD	73	BCDEFGH	81.6	CD	1.6	CDEFG	1.77	GHI	12.1	DEFGHIJ	5.38	BCDEF	45.3	DEFG	116	FGH	67.5	CDE	129	JKLMN	223	DEFG	1.48	JKLMN	5.7	L	47
2B99-2316	40.8	FGHI	91.7	ABCDEF	75	ABCDEF	81.6	CD	1.0	GHI	1.86	GHI	12.1	DEFGHIJ	5.13	FGH	43.9	EFGH	153	AB	78.6	B	77	MN	247	CDE	1.47	N	5.4	L	50
2B99-2657	38.9	JKL	86.6	CDEFG	77	ABC	82.6	B	0.9	HI	1.88	GHI	11.5	HIJK	5.22	EFG	46.5	CDEF	138	BCDE	89.7	A	66	N	230	DEFG	1.47	MN	5.0	L	46
2B99-2763-10	40.4	GHIJ	93.1	ABCD	73	BCDEFGH	80.7	EFG	1.0	GHI	1.82	GHI	12.3	CDEFG	5.04	FGHI	41.8	HIJ	161	A	70.5	BCD	73	MN	204	EFGH	1.48	LMN	5.6	L	53
2B99-2771-1	40.0	HIJK	89.7	ABCDEF	71	CDEFGHI	81.7	C	1.2	EFGHI	2.03	FGHI	11.9	DEFGHIJ	5.00	GHI	43.4	GHI	120	DEFGH	77.9	B	132	JKLMN	238	CDEF	1.49	IJKLMN	5.2	L	49
99Ab11073	38.5	KLM	88.2	BCDEF	68	HIJK	80.4	FGH	1.6	CDEF	1.97	FGHI	10.6	LM	4.13	LMN	40.7	IJ	92	IJKLMN	45.5	IJK	390	D	162	HIJK	1.59	CDEFG	8.1	KL	36
01Ab10055	41.2	FGH	88.7	ABCDEF	70	DEFGHIJ	81.2	CDEF	1.2	EFGHI	2.19	FGHI	12.6	BCDE	5.51	ABCDE	45.0	DEFG	140	BCD	67.2	CDE	101	LMN	248	CDE	1.49	JKLMN	8.0	KL	47
01Ab10062	41.9	EFG	89.8	ABCDEF	72	CDEFGHI	81.6	CD	1.0	GHI	2.18	FGHI	11.9	EFGHIJ	5.15	FG	44.0	EFGH	125	CDEFG	63.2	CDEFG	85	MN	225	DEFG	1.49	JKLMN	10.4	JKL	50
00ID1550	38.9	JKL	84.2	EFG	79	AB	80.2	GHI	1.1	EFGHI	2.37	EFGH	10.8	KLM	4.62	JK	43.7	FGH	82	JKLMN	56.3	FGH	150	HIJKLMN	228	DEFG	1.57	EFGHI	10.2	JKL	40
01ID435H	37.2	LM	62.1	H	50	M	85.0	A	1.3	EFGH	1.70	HI	13.8	A	4.79	IJ	35.7	KL	103	HIJKL	44.4	IJK	249	EFGH	183	FGHI	1.61	CDEF	5.8	L	33
01ID451H	38.0	MN	39.7	I	53	M	84.6	A	2.2	BC	1.68	HI	13.2	AB	4.06	MN	31.5	N	73	N	36.6	KL	278	EF	137	IJK	1.65	C	8.5	KL	26
01ST1587	45.5	BC	96.5	A	68	FGHIJK	77.4	M	1.4	EFGH	2.98	BCDE	12.6	BCDE	3.84	N	31.6	N	104	GHIJK	41.2	IJK	138	JKLMN	111	K	1.53	GHIJKLMN	29.1	EFGHI	32
01ST1758	43.2	DE	93.4	ABCD	72	BCDEFGH	78.4	L	1.5	EFGH	2.90	CDE	12.1	DEFGHI	3.87	N	33.4	LMN	108	GHI	43.9	IJK	139	JKLMN	112	K	1.52	GHIJKLMN	34.6	BCDEF	29
YU501-312	39.0	JKL	81.4	FG	74	ABCDEF	81.3	CDE	2.5	B	2.49	EFG	11.4	IJK	3.82	N	34.2	JKLMN	90	IJKLMN	37.4	JKL	323	DE	122	JK	1.55	FGHIJKL	17.5	GHIJKL	27
YU501-385	43.0	DE	91.0	ABCDEF	80	A	80.2	GHI	1.5	DEFGH	1.86	GHI	12.0	DEFGHIJ	4.25	LM	36.4	K	92	IJKLMN	46.7	IJ	264	EFG	154	HIJK	1.56	FGHIJ	9.1	JKL	38
BZ502-532	44.3	CD	93.7	ABC	74	ABCDEF	79.7	HIJK	1.1	EFGHI	2.32	EFGH	11.5	HIJK	3.96	MN	35.6	KL	93	IJKLMN	43.0	IJK	198	FGHIJKL	124	JK	1.56	EFGHIJ	15.2	HIJKL	35
MT000047	41.8	EFG	89.7	ABCDEF	70	DEFGHIJ	80.4	FGH	1.2	EFGHI	2.06	FGHI	12.7	BCDE	5.36	BCDEF	43.4	GHI	141	BCD	65.7	CDEF	166	GHIJKLMN	206	EFGH	1.48	LMN	7.6	KL	44
MT000125	45.8	BC	93.9	ABC	69	FGHIJ	80.8	DEFG	1.2	EFGHI	1.82	GHI	12.4	CDEF	4.80	HU	39.4	J	132	BCDEF	62.6	DEFG	283	EF	201	EFGH	1.50	IJKLMN	7.5	KL	48
MT000138	46.5	B	96.3	AB	66	IJKL	81.4	CDE	1.0	FGHI	2.40	EFGH	12.9	BC	5.69	AB	45.1	DEFG	132	BCDEF	60.0	EFG	247	EFGHI	322	A	1.55	FGHIJKL	11.8	JKL	42
ND21863	48.0	A	96.6	A	69	EFGHIJ	81.0	CDEF	1.0	FGHI	1.79	GHI	11.3	IJKL	4.43	KL	40.0	J	100	HIJKLM	50.2	HI	252	EFGH	166	HIJK	1.54	FGHIJKLMN	8.0	KL	48
ND22927	48.9	A	96.6	A	76	ABCD	81.6	CD	1.0	FGHI	3.64	AB	11.6	FGHIJ	5.30	CDEFG	47.1	BCD	94	IJKLMN	60.6	EFG	292	EF	255	BCDE	1.58	DEFGH	47.0	ABC	40
ND22996	45.5	BC	96.3	AB	68	GHIJK	81.0	CDEF	1.0	FGHI	2.38	EFGH	12.7	BCD	5.79	A	46.9	BCDE	107	GHIJ	57.3	FGH	145	IJKLMN	275	ABCD	1.50	IJKLMN	13.8	IJKL	39
UT99B1669-3243	40.0	HIJK	90.3	ABCDEF	60	L	77.4	M	2.1	BCD	3.55	ABC	11.3	IJKL	4.00	MN	36.4	K	103	HIJK	36.9	KL	484	C	129	IJK	1.59	CDEFG	45.0	ABCD	24
UT99B1670-3458	39.4	IJKL	89.1	ABCDEF	62	KL	77.2	M	2.4	B	3.51	ABC	11.3	IJKL	3.96	MN	35.9	KL	102	HIJKL	40.6	JK	573	B	140	IJK	1.64	CD	47.8	AB	23
WA 10701-99	41.2	FGH	85.3	DEFG	73	BCDEFGH	81.6	CD	1.3	EFGHI	1.70	HI	11.6	GHIJ	5.05	FGHI	45.3	DEFG	106	GHIJ	59.1	EFGH	173	GHIJKL	178	GHIJ	1.50	IJKLMN	8.0	KL	46
WA 7330-00	40.3	FGHIJ	90.1	ABCDEF	70	CDEFGHI	79.4	JK	1.6	DEFGH	2.25	EFGH	11.3	HIJK	3.96	MN	36.0	KL	79	LMN	42.8	IJK	186	FGHIJKL	120	K	1.52	HIJKLMN	25.3	FGHIJ	33
WA 15279-00	45.0	C	91.6	ABCDEF	68	GHIJK	79.5	IJK	2.2	BC	2.08	FGHI	11.8	FGHIJ	3.95	MN	34.8	KLM	80	MN	41.6	IJK	256	EFG	126	JK	1.54	FGHIJKL	24.0	FGHIJK	32
02WVNZ-1015	41.8	EFG	90.6	ABCDEF	76	ABCDEF	80.6	EFG	1.5	EFGH	1.48	I	11.3	IJKL	4.00	MN	36.4	K	91	IJKLMN	40.3	JK	239	EFGHIJ	141	IJK	1.53	GHIJKLMN	7.7	KL	36
02WVNZ-1821	42.1	EF	94.1	ABC	64	JKL	80.0	GHIJ	1.7	CDE	2.31	EFGH	11.4	IJKL	3.90	MN	35.9	KL	83	JKLMN	41.7	JK	195	FGHIJKL	131	IJK	1.51	HUJKLMN	30.5	DEFGH	32
99NZ102	39.5	IJKL	81.7	FG	71	DEFGHIJ	79.1	K	1.2	EFGHI	3.19	ABCD	11.4	IJK	5.61	ABC	50.2	A	112	FGHI	65.8	CDEF	191	FGHIJKL	286	ABC	1.63	CDE	32.4	BCDEFG	33
01NZ392	39.9	HIJK	89.9	ABCDEF	75	ABCDEF	81.8	C	1.3	EFGHI	3.84	A	11.5	HIJK	5.60	ABC	49.6	AB	106	GHIJ	64.9	CDEFG	223	EFGHIJK	308	AB	1.77	B	57.2	A	40
01NZ706	40.7	FGHI	86.7	CDEFG	76	ABCD	79.3	JK	0.6	I	1.95	FGHI	11.5	HIJK	5.25	DEFG	47.8	ABCD	138	BCDE	64.8	CDEFG	125	JKLMN	275	ABCD	1.48	JKLMN	7.8	KL	43

* Within each column, means followed by the same letter are not significantly different (alpha=0.05), according to Duncan's Multiple Range Test

** Aberdeen, ID, Idaho Falls, ID, Twin Falls, ID, Conrad, MT and Fairfield, MT

2006 WESTERN REGIONAL SPRING BARLEY NURSERY AND ADDITIONS - ABERDEEN, ID

Table 4

Lab No.	Variety or Selection	Rowed	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agtron)	Malt Extract (%)	F-C (%)	Wort Color	Wort Clarity	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Viscosity Relative	Turbidity (Hach)	Quality Score	Overall Rank
5316	Steptoe	6	41.2	89.2	59	76.5	3.3	n.d.	3	9.8	3.44	37.2	48	29.8	*784	119	*1.73	67	15	40
5317	Baronesse	2	42.9	93.5	70	79.8	1.9	n.d.	3	10.4	3.67	36.5	74	41.0	239	108	1.52	40	26	29
5318	Morex	6	35.8	80.5	77	80.9	1.5	1.8	1	11.4	4.81	44.6	118	59.9	193	198	1.50	8.5	42	14
5319	Stander	6	35.2	80.6	83	81.4	1.5	2.7	2	10.8	4.58	45.0	112	58.6	170	199	1.52	28	41	20
5320	Harrington	2	40.3	90.3	73	82.5	1.3	1.7	1	10.6	4.83	47.0	99	70.4	150	222	1.49	7.5	43	13
5321	2B99-2316	2	39.8	88.3	75	83.4	1.4	1.9	1	10.2	4.73	47.4	121	79.4	108	191	1.50	7.0	46	6
5322	2B99-2657	2	37.0	80.4	73	84.0	0.9	1.9	1	10.0	4.88	51.3	117	90.2	91	229	1.48	7.2	42	14
5323	2B99-2763-10	2	39.3	88.0	66	81.7	1.1	1.9	1	11.3	4.82	44.1	142	71.3	97	165	1.50	7.7	60	1
5324	2B99-2771-1	2	39.3	86.8	69	83.0	1.8	1.8	1	11.2	4.73	44.0	113	81.6	131	169	1.50	6.6	53	4
5325	99Ab11073	6	37.0	84.5	64	81.4	2.0	1.7	1	10.2	4.17	43.2	88	46.4	418	158	1.57	7.3	39	21
5326	01Ab10055	2	39.4	84.1	72	81.9	1.4	2.1	1	11.7	5.20	47.0	132	67.0	100	216	1.50	10.4	57	2
5327	01Ab10062	2	40.0	85.3	72	82.4	1.1	2.3	1	10.4	4.72	45.9	113	61.4	113	235	1.52	19.7	50	5
5328	01ID1550	6	37.8	83.1	81	81.2	1.4	2.2	1	10.3	4.71	46.8	85	61.1	151	262	1.55	7.6	42	14
5329	01ID435H	2	36.2	*54.7	51	86.9	1.3	1.2	1	11.8	4.32	37.3	85	43.8	304	187	1.62	5.2	29	27
5330	01ID451H	2	37.0	*30.0	53	85.5	2.5	1.2	2	12.5	3.77	31.1	58	35.3	442	113	*1.75	12.4	21	37
5331	01ST1587	2	44.7	95.2	67	78.6	1.3	n.d.	3	11.4	3.82	34.1	85	42.5	146	112	1.52	40	31	24
5332	01ST1758	2	43.7	92.7	70	80.3	0.9	n.d.	3	10.3	3.84	39.0	73	39.2	154	118	1.51	42	22	33
5333	YU501-312	2	36.7	77.1	73	82.6	3.4	1.5	1	10.4	3.66	36.6	75	35.1	409	108	1.54	15.0	17	38
5334	YU501-385	2	41.0	83.5	82	80.7	1.2	1.4	1	10.7	3.96	37.6	74	46.2	285	132	1.56	9.6	25	30
5335	BZ502-532	2	43.3	91.7	74	81.0	0.9	2.0	2	10.0	3.81	39.0	72	42.3	224	117	1.56	22	30	25
5336	MT000047	2	41.0	86.0	70	81.5	0.9	1.7	1	10.9	5.15	47.6	113	62.7	193	223	1.48	5.6	42	14
5337	MT000125	2	45.3	91.1	72	82.5	1.3	1.6	1	10.7	4.60	44.1	97	62.3	260	184	1.52	5.5	46	6
5339	MT000138	2	45.8	93.9	67	82.6	0.4	2.5	1	11.5	5.50	49.9	98	58.1	308	260	*1.67	22	46	6
5340	ND21863	2	48.4	95.9	63	82.3	1.1	1.6	1	10.3	4.60	45.1	83	45.1	277	163	1.56	8.9	46	6
5341	ND22927	2	47.3	93.2	77	82.4	0.7	3.0	2	11.1	5.49	50.9	72	57.2	230	253	1.55	37	45	11
5342	ND22996	2	43.6	93.7	66	82.3	1.1	2.1	1	11.3	5.58	51.8	80	66.3	190	261	1.49	7.7	46	6
5343	UT99B1669-3243	6	37.5	84.4	56	78.7	2.0	n.d.	3	9.9	4.12	41.9	75	38.5	433	130	1.57	66	22	33
5344	UT99B1670-3458	6	37.5	82.3	59	78.7	2.5	n.d.	3	9.9	3.92	40.2	75	39.6	472	125	1.59	61	22	33
5345	WA 10701-99	2	38.4	*68.6	69	81.4	1.8	1.6	2	11.3	4.94	45.0	89	59.9	203	192	1.48	5.4	42	14
5346	WA 7330-00	2	39.7	87.2	65	79.9	1.6	2.1	2	10.8	3.88	37.1	74	43.9	157	121	1.51	25	22	33

Table 4

Lab No.	Variety or Selection	Rowed	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agtron)	Malt Extract (%)	F-C (%)	Wort Color	Wort Clarity	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Viscosity Relative	Turbidity (Hach)	Quality Score	Overall Rank
5347	WA 15279-00	2	46.5	92.5	68	81.0	2.5	1.5	1	10.4	3.88	37.9	59	39.0	141	120	1.53	10.8	30	25
5348	02WVNZ-1015	2	40.3	87.1	77	82.2	2.0	1.4	1	9.6	3.72	39.6	68	39.9	194	128	1.51	5.9	24	32
5349	02WVNZ-1821	2	40.7	90.4	62	81.2	1.7	2.3	2	10.2	3.69	38.5	66	41.4	163	116	1.50	32	29	27
5350	99NZ102	2	37.7	77.2	68	79.4	1.4	2.4	1	10.8	5.42	51.8	81	63.8	199	241	1.53	10.6	25	30
5351	01NZ392	2	38.8	87.8	78	82.2	1.5	2.5	2	10.8	5.45	50.8	74	64.4	243	296	*1.70	13.9	35	23
5352	01NZ706	2	40.0	83.8	79	80.3	0.5	1.7	1	10.1	4.72	49.1	105	63.8	115	223	1.48	4.4	37	22
5353	Merit	2	37.4	84.6	76	83.3	1.0	2.1	1	10.1	4.75	50.0	107	78.1	88	197	1.45	5.5	42	14
5354	Conrad	2	39.7	92.3	71	82.5	1.3	1.7	1	10.8	4.76	47.1	107	67.1	110	199	1.48	5.9	45	11
5355	ACMetcalfe	2	39.8	84.7	74	81.9	0.6	2.2	1	12.4	5.50	44.7	122	78.3	89	254	1.50	9.0	57	2
5356	98Ab11720	2	40.2	83.0	79	79.5	2.6	n.d.	3	10.6	3.68	37.2	75	38.1	331	130	1.55	35	16	39
5338	HARRINGTON MALT CHECK	2	38.0	86.5	79	82.1	0.7	1.9	1	13.0	5.84	46.8	108	67.4	93	243	1.56	10.8	48	
5357	MOREX MALT CHECK	6	34.5	86.4	80	81.3	1.0	2.3	1	12.0	6.02	52.5	123	66.9	119	320	1.49	5.0	50	
Minima			35.2	77.1	51	76.5	0.4	1.2		9.6	3.44	31.1	48	29.8	88	108	1.45	4.4	15	
Maxima			48.4	95.9	83	86.9	3.4	3.0		12.5	5.58	51.8	142	90.2	472	296	1.62	67.0	60	
Means			40.3	87.2	70	81.5	1.5	1.9		10.7	4.50	43.4	90	55.2	213	179	1.52	18.7	36	
Standard Deviations			3.3	5.0	8	1.9	0.7	0.4		0.7	0.64	5.5	22	15.3	108	55	0.04	17.4	12	
Coefficients of Variation			8.2	5.8	11	2.3	45.3	22.3		6.4	14.21	12.7	25	27.8	51	31	2.40	93.2	34	

Malt Check Data are Excluded from Rank Sorting and Statistics

Table Data Flagged by an Asterisk Exceed the Mean by +/- 3 Standard Deviations and are Excluded from Statistics

For Wort Clarity - 1 = clear, 2 = slightly hazy, 3 = hazy; Wort Colors were not determined (n.d.) on hazy samples

Samples Submitted by D. Obert, USDA/ARS - Aberdeen

2006 WESTERN REGIONAL SPRING BARLEY REGIONAL NURSERY - IDAHO FALLS, ID

Table 5

Lab No.	Variety or Selection	Rowed	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agtron)	Malt Extract (%)	F-C (%)	Wort Color	Wort Clarity	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Viscosity Relative	Turbidity (Hach)	Quality Score	Overall Rank
5207	Step toe	6	42.6	92.8	57	74.6	*4.5	2.8	2	11.7	3.66	33.1	54	31.3	*964	128	*1.84	34	21	32
5208	Baronesse	2	42.7	95.1	70	76.9	2.0	2.3	2	13.0	4.23	33.0	87	40.8	256	172	1.51	22	23	30
5209	Morex	6	36.3	89.4	76	78.5	1.9	2.0	1	13.8	5.64	41.7	157	60.9	290	324	1.50	6.6	45	10
5210	Stander	6	37.4	93.0	67	81.3	1.7	2.6	1	12.5	6.44	52.8	119	80.5	295	461	1.50	5.6	39	16
5211	Harrington	2	42.8	96.9	72	81.5	2.0	2.1	1	13.0	6.18	47.6	116	71.9	130	264	1.47	4.9	41	14
5203	2B99-2316	2	41.9	95.4	72	81.0	0.9	1.8	1	12.8	5.68	45.7	192	92.9	56	318	1.45	4.7	60	1
5204	2B99-2657	2	39.1	89.2	75	80.9	1.5	1.9	1	13.3	5.96	44.8	187	104.3	51	219	1.46	5.1	48	6
5205	2B99-2763-10	2	40.7	96.3	79	80.4	1.7	2.2	1	12.7	5.79	45.8	171	78.7	72	223	1.46	4.5	57	3
5206	2B99-2771-1	2	42.2	96.5	64	80.7	1.9	2.4	1	12.9	5.86	46.0	128	83.8	189	357	1.48	4.6	51	5
5175	99Ab11073	6	38.2	88.6	59	79.4	1.8	2.2	1	11.6	4.54	41.9	112	48.1	441	180	1.54	11.2	39	16
5176	01AB10055	2	43.3	94.0	60	79.8	1.2	2.5	1	14.5	6.30	44.2	169	70.1	152	231	1.51	11.1	38	19
5177	01AB10062	2	43.8	93.9	64	80.3	1.1	2.3	1	13.6	5.91	43.6	151	63.0	94	200	1.47	8.3	48	6
5178	00ID1550	6	38.5	85.0	71	77.8	1.6	2.5	1	12.1	4.52	37.6	89	44.0	254	184	1.62	12.7	30	26
5179	01ID435H	2	38.2	79.4	52	84.0	1.7	1.7	1	14.5	5.35	37.6	118	45.1	167	180	1.56	5.2	32	24
5180	01ID451H	2	40.2	*64.4	50	83.2	2.6	1.5	1	14.0	4.29	31.1	83	37.0	264	125	1.61	6.5	19	35
5181	01ST1587	2	44.7	96.7	64	76.1	1.5	2.5	2	13.8	4.24	31.0	118	42.3	205	109	1.50	24	22	31
5182	01ST1758	2	42.0	91.8	69	76.7	2.0	2.3	2	13.6	4.16	32.2	110	36.2	102	103	1.48	20	20	33
5183	YU501-312	2	39.2	80.5	73	79.9	3.2	3.0	1	12.7	4.12	32.5	115	37.7	366	120	1.50	13.9	28	27
5184	YU501-385	2	44.5	96.6	75	78.5	1.7	2.0	1	14.3	4.87	34.2	125	47.9	286	179	1.51	7.4	37	21
5185	BZ502-532	2	45.6	96.8	71	77.0	1.3	2.1	1	13.9	4.32	31.4	123	43.0	277	138	1.54	9.9	26	28
5186	MT000047	2	41.4	93.3	68	79.7	1.5	2.4	1	13.3	5.83	44.1	169	69.5	205	203	1.47	9.7	45	10
5187	MT000125	2	45.7	95.5	70	79.8	1.8	2.2	1	13.4	5.00	37.6	141	60.2	358	168	1.49	10.6	45	10
5188	MT000138	2	47.7	97.7	65	81.3	1.9	2.7	1	13.7	6.13	46.1	172	64.9	324	441	1.55	12.6	41	14
5189	ND21863	2	48.7	97.4	67	79.9	1.6	2.0	1	11.6	4.69	40.4	113	48.4	395	203	1.55	10.0	52	4
5190	ND22927	2	49.9	97.5	72	80.5	1.7	3.2	2	12.8	5.47	44.2	93	54.4	384	262	1.54	35	47	8
5191	ND22996	2	45.3	96.5	61	80.0	1.2	3.2	2	13.6	6.14	45.7	118	68.2	223	298	1.52	28	34	22
5192	UT99B1669-3243	6	38.9	89.6	51	76.2	2.6	n.d.	3	12.0	4.23	36.1	120	36.5	578	150	1.59	39	20	33
5193	UT99B1670-3458	6	39.6	92.9	53	76.5	3.1	n.d.	3	12.2	4.36	36.5	123	38.3	*655	157	1.62	54	24	29
5194	WA 10701-99	2	42.0	92.6	72	80.4	1.5	1.6	1	12.5	5.37	44.8	142	66.4	142	162	1.47	7.2	58	2
5195	WA 7330-00	2	39.6	91.1	77	77.8	2.6	1.6	1	12.7	4.32	35.3	100	45.4	202	125	1.51	12.6	33	23

Table 5

Lab No.	Variety or Selection	Rowed	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agtron)	Malt Extract (%)	F-C (%)	Wort Color	Wort Clarity	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Viscosity Relative	Turbidity (Hach)	Quality Score	Overall Rank
5196	WA 15279-00	2	44.2	88.6	65	77.8	1.7	2.5	2	13.5	4.18	32.7	82	40.1	278	120	1.51	32	16	36
5197	02WVNZ-1015	2	40.7	89.8	75	79.0	1.7	1.6	1	12.8	4.43	35.8	108	41.8	288	171	1.51	9.7	38	19
5199	02WVNZ-1821	2	42.8	96.6	61	78.2	2.3	1.8	2	13.3	4.20	32.5	108	43.5	211	145	1.50	22	31	25
5200	99NZ102	6	40.5	88.7	66	77.8	1.4	3.5	2	13.0	6.11	47.9	141	66.6	225	333	*1.69	36	39	16
5201	01NZ392	6	40.9	96.2	73	80.6	1.2	3.8	2	13.1	6.32	49.1	144	68.7	270	369	*1.77	52	45	10
5202	01NZ706	6	41.5	93.3	66	77.8	0.9	2.0	1	13.5	6.01	46.5	178	71.1	117	373	1.48	9.8	47	8
5198	HARRINGTON MALT CHECK	2	37.6	86.0	76	81.8	0.8	1.6	1	13.0	5.66	45.4	146	79.9	79	284	1.49	5.0	54	
Minima			36.3	79.4	50	74.6	0.9	1.5		11.6	3.66	31.0	54	31.3	51	103	1.45	4.5	16	
Maxima			49.9	97.7	79	84.0	3.2	3.8		14.5	6.44	52.8	192	104.3	578	461	1.62	54.0	60	
Means			42.0	92.7	67	79.2	1.8	2.3		13.1	5.13	40.1	127	56.8	240	219	1.51	16.7	37	
Standard Deviations			3.1	4.6	8	2.1	0.5	0.5		0.8	0.85	6.3	32	17.9	116	96	0.05	13.6	12	
Coefficients of Variation			7.5	4.9	11	2.6	30.6	23.8		5.8	16.54	15.6	25	31.6	49	44	3.03	81.1	32	

Malt Check Data are Excluded from Rank Sorting and Statistics

Table Data Flagged by an Asterisk Exceed the Mean by +/- 3 Standard Deviations and are Excluded from Statistics

For Wort Clarity - 1 = clear, 2 = slightly hazy, 3 = hazy; Wort Colors were not determined (n.d.) on hazy samples

Samples Submitted by A. Meisner, BARI - Ft. Collins

2006 WESTERN REGIONAL SPRING BARLEY REGIONAL NURSERY - TWIN FALLS, ID

Table 6

Lab No.	Variety or Selection	Rowed	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agtron)	Malt Extract (%)	F-C (%)	Wort Color	Wort Clarity	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (*ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Viscosity Relative	Turbidity (Hach)	Quality Score	Overall Rank
5241	Steptoe	6	40.9	89.0	60	*74.6	2.5	n.d.	3	10.3	3.58	36.3	51	31.0	*760	113	1.66	33.0	15	36
5242	Baronesse	2	41.9	93.9	72	79.1	1.4	n.d.	3	11.1	3.82	35.2	65	40.7	145	114	1.52	25.0	30	26
5243	Morex	6	35.4	73.1	76	80.1	0.8	1.8	1	11.9	5.05	42.5	141	54.5	105	197	1.48	5.7	59	2
5244	Stander	6	36.7	88.5	68	81.6	0.6	2.1	1	11.1	5.47	50.7	114	73.7	158	261	1.48	4.9	44	13
5245	Harrington	2	40.4	88.9	68	82.0	0.9	1.8	1	11.2	5.10	46.0	103	65.4	85	208	1.47	7.8	59	2
5246	2B99-2316	2	39.8	90.1	74	81.9	0.5	2.0	1	11.5	4.91	44.4	131	78.0	51	222	1.45	5.8	62	1
5247	2B99-2657	2	38.0	81.1	76	83.3	0.9	2.0	1	10.9	4.99	47.6	102	80.0	64	177	1.47	5.7	44	13
5248	2B99-2763-10	2	39.2	90.5	73	81.4	0.7	1.8	1	10.8	4.71	43.9	138	68.1	52	169	1.47	5.3	57	5
5249	2B99-2771-1	2	39.6	90.7	68	82.5	1.0	2.0	1	11.0	4.89	47.0	101	76.2	142	235	1.48	4.6	55	7
5250	01Ab11073	6	38.3	83.8	61	80.8	1.7	1.8	1	9.9	4.18	44.6	79	48.9	276	174	1.51	5.5	39	17
5251	01Ab10055	2	40.7	84.2	69	81.5	0.9	2.1	1	12.0	5.34	45.8	114	66.8	82	257	1.47	6.2	56	6
5252	01Ab10062	2	40.6	85.1	71	81.5	0.3	2.1	1	11.6	4.94	44.9	100	62.6	55	189	1.48	9.1	55	7
5253	01ID1550	6	37.6	74.0	73	80.2	1.1	2.3	1	10.0	4.59	45.7	78	61.7	141	255	1.55	12.7	40	16
5254	01ID435H	2	37.1	*56.0	49	85.5	0.9	1.5	1	12.3	4.43	36.2	81	46.3	239	163	1.60	6.9	36	22
5255	01ID451H	2	36.4	*21.2	51	85.5	1.9	1.2	1	11.9	3.86	33.6	62	37.2	217	143	1.63	8.9	22	32
5257	01ST1587	2	45.5	95.3	68	77.9	1.2	2.8	1	11.8	3.67	32.4	88	41.8	86	119	1.53	6.7	33	25
5258	01ST1758	2	43.1	92.7	70	79.4	1.4	2.6	2	10.7	3.82	36.0	76	42.6	123	123	1.49	31.0	27	29
5259	YU501-312	2	36.7	72.5	69	81.0	1.1	2.3	2	11.0	3.94	36.5	73	42.5	123	152	1.51	31.0	20	35
5260	YU501-385	2	42.2	89.3	78	80.5	1.9	1.5	1	11.1	4.13	38.2	80	48.5	229	155	1.52	10.1	37	19
5261	BZ502-532	2	42.3	87.7	73	80.0	1.2	2.0	1	10.9	3.90	37.1	83	44.9	119	118	1.50	14.2	29	27
5262	MT000047	2	41.0	84.8	66	81.4	1.1	1.9	1	11.5	5.09	45.8	119	68.3	137	186	1.45	7.7	52	9
5263	MT000125	2	43.8	90.7	68	81.0	0.2	1.6	1	11.5	4.34	38.7	108	63.2	316	207	1.53	11.0	43	15
5264	MT000138	2	43.9	93.9	63	81.5	0.5	2.1	1	12.0	5.25	43.8	121	61.4	289	295	1.55	11.9	58	4
5265	ND21863	2	46.2	94.0	67	80.8	0.5	1.6	1	10.9	4.22	39.2	76	55.7	302	177	1.55	8.7	34	24
5266	ND22927	2	48.4	96.6	75	81.0	0.6	n.d.	3	11.0	4.83	45.0	112	75.8	366	230	1.64	*72	45	11
5267	ND22996	2	46.1	95.2	69	81.1	0.5	1.9	1	12.4	5.48	45.8	95	42.2	145	315	1.51	10.4	51	10
5268	UT99B1669-3243	6	39.3	86.7	53	77.8	1.9	*3.9	2	11.3	4.25	39.8	86	40.0	416	134	1.54	48.0	21	33
5269	UT99B1670-3458	6	38.8	87.4	54	77.5	1.7	*3.6	2	10.7	3.93	37.5	88	57.0	*559	162	1.62	51.0	24	31
5270	WA 10701-99	2	40.7	84.3	72	81.9	1.0	1.8	1	11.2	4.94	46.1	69	45.4	212	133	1.51	5.5	45	11
5271	WA 7330-00	2	39.6	88.8	67	79.4	0.8	n.d.	3	11.0	4.00	37.1	52	40.5	237	118	1.52	34.0	21	33

Table 6

Lab No.	Variety or Selection	Rowed	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agtron)	Malt Extract (%)	F-C (%)	Wort Color	Wort Clarity	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Viscosity Relative	Turbidity (Hach)	Quality Score	Overall Rank
5272	WA 15279-00	2	43.3	90.3	65	80.1	1.6	2.5	2	10.7	4.09	38.6	104	53.2	218	129	1.53	24.0	37	19
5273	02WVNZ-1015	2	40.5	87.9	74	80.7	1.0	1.7	1	10.7	4.05	38.2	74	42.4	293	125	1.54	7.0	28	28
5274	02WVNZ-1821	2	41.1	92.1	65	80.1	1.2	2.5	2	11.0	3.93	37.0	69	44.6	208	129	1.52	26.0	26	30
5275	99NZ102	6	38.9	74.0	68	79.4	1.2	n.d.	3	11.0	5.51	51.3	88	62.7	244	295	*1.76	47.0	37	19
5276	01NZ392	6	39.4	84.3	66	82.2	1.2	n.d.	3	11.0	5.43	51.4	77	65.0	281	296	*1.84	42.0	39	17
5277	01NZ706	6	39.3	77.0	74	79.3	0.3	2.1	1	10.9	5.05	47.9	114	60.7	207	230	1.50	7.8	35	23
5256	HARRINGTON MALT CHECK	2	38.4	85.8	78	82.2	0.9	1.5	1	12.9	5.44	42.8	133	74.7	86	284	1.50	6.6	60	
Minima			35.4	72.5	49	77.5	0.2	1.2		9.9	3.58	32.4	51	31.0	51	113	1.45	4.6	15	
Maxima			48.4	96.6	78	85.5	2.5	2.8		12.4	5.51	51.4	141	80.0	416	315	1.66	51.0	62	
Means			40.6	87.0	68	80.9	1.1	2.0		11.2	4.55	41.9	92	55.3	187	186	1.52	16.6	39	
Standard Deviations			3.0	6.6	7	1.7	0.5	0.4		0.6	0.60	5.3	23	13.3	95	60	0.05	14.3	13	
Coefficients of Variation			7.4	7.6	10	2.2	49.7	18.0		5.0	13.22	12.5	25	24.0	51	32	3.52	85.7	34	

Malt Check Data are Excluded from Rank Sorting and Statistics

Table Data Flagged by an Asterisk Exceed the Mean by +/- 3 Standard Deviations and are Excluded from Statistics

For Wort Clarity - 1 = clear, 2 = slightly hazy, 3 = hazy; Wort Colors were not determined (n.d.) on hazy samples

Samples Submitted by A. Meisner, BARI - Ft. Collins

2006 WESTERN SPRING BARLEY REGIONAL NURSERY AND ADDITIONS - CONRAD, MT

Table 7

Lab No.	Variety or Selection	Rowed	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agron)	Malt Extract (%)	F-C (%)	Wort Color	Wort Clarity	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Viscosity Relative	Turbidity (Hach)	Quality Score	Overall Rank
5212	Morex	6	35.7	71.1	82	78.3	1.7	1.7	1	14.2	5.00	35.4	165	54.0	130	233	1.50	7.8	34	16
5213	Legacy	6	36.0	80.7	87	77.1	0.0	1.8	1	13.4	5.16	40.2	170	61.8	191	241	1.49	8.2	39	10
5214	Steptoe	2	44.1	94.2	85	75.0	*3.8	2.7	1	11.2	3.31	30.2	50	26.3	*884	75	*1.93	35.0	22	24
5215	B1202	2	41.1	87.5	77	79.0	1.9	1.6	1	13.9	4.73	35.2	122	53.1	156	124	1.51	6.5	34	16
5216	Harrington	2	40.5	92.3	76	79.6	3.3	1.7	1	13.4	5.42	40.7	139	65.2	155	171	1.47	4.4	49	3
5217	Merit	2	39.4	84.4	74	80.0	1.0	2.0	1	13.8	5.60	42.1	164	75.7	123	266	1.45	4.2	40	8
5218	Conrad	2	37.9	83.8	74	78.3	1.4	1.6	1	15.3	5.04	34.9	164	67.5	132	230	1.45	4.6	30	20
5219	Baronesse	2	42.7	90.2	75	75.0	1.5	n.d.	3	14.4	3.78	26.6	107	36.3	269	84	1.56	33.0	14	28
5220	Conlon	2	48.7	98.7	73	78.9	1.1	1.8	2	14.2	4.58	32.6	124	51.0	276	125	1.51	11.9	36	15
5221	2B99-2316	2	41.2	92.0	74	79.3	0.9	1.9	1	14.4	5.09	35.8	171	70.0	104	265	1.47	5.2	39	10
5222	2B99-2657	2	39.4	88.5	80	81.2	1.0	1.9	1	12.8	5.37	42.7	154	97.0	63	296	1.46	3.4	60	1
5223	2B99-2763-10	2	41.9	94.2	70	78.7	0.6	1.6	1	14.4	4.96	34.8	186	69.4	52	232	1.47	5.0	43	6
5224	2B99-2771-1	2	38.4	80.7	81	79.9	0.5	1.7	1	13.0	4.82	37.0	144	77.9	79	153	1.47	4.9	44	5
5225	99Ab11073	6	39.9	92.8	74	79.1	1.6	1.6	1	11.4	3.83	33.8	93	40.0	491	114	1.66	7.9	31	19
5226	00ID1550	2	40.6	91.7	83	80.1	0.5	2.2	1	11.1	4.63	42.3	87	53.3	123	162	1.53	8.9	50	2
5228	01ID435H	2	36.2	*38.7	48	83.3	1.3	1.5	1	16.3	5.10	31.7	124	43.4	299	179	1.59	4.6	30	20
5229	01ID451H	2	38.2	*30.1	51	83.1	2.2	1.4	1	15.2	4.22	28.7	89	33.1	308	146	1.63	6.7	17	26
5230	01ST1587	2	46.5	96.9	71	74.9	1.4	n.d.	3	14.7	3.75	26.3	124	37.1	188	78	1.54	42.0	17	26
5231	01ST1758	2	43.3	93.0	75	76.3	1.7	n.d.	3	13.9	3.77	27.3	175	63.2	179	100	1.54	47.0	24	22
5232	MT000047	2	41.4	87.5	77	78.3	1.3	1.6	1	14.9	5.34	36.3	132	61.7	208	168	1.49	4.6	34	16
5233	MT000125	2	46.7	93.5	64	79.4	1.5	1.6	1	13.8	5.09	37.0	166	62.1	353	228	1.48	3.5	37	14
5234	MT000138	2	46.8	97.3	65	79.6	1.1	2.0	1	14.7	5.91	40.2	120	49.2	164	321	1.48	4.3	38	12
5235	ND21863	2	48.4	97.3	75	79.6	1.2	1.5	1	13.0	4.36	35.2	114	48.5	215	114	1.52	4.1	43	6
5236	ND21867	2	47.3	96.5	66	79.7	1.2	1.5	1	13.9	4.91	36.3	121	47.9	199	165	1.46	4.3	40	8
5237	ND22895	2	45.6	99.6	73	79.9	1.2	1.5	1	13.2	4.69	35.9	136	74.6	213	153	1.49	7.2	45	4
5238	ND22996	2	45.7	97.2	72	79.5	1.1	2.0	1	14.3	5.96	42.2	116	37.7	79	206	1.46	6.4	38	12
5239	UT99B1669-3243	6	42.0	95.5	70	75.8	1.7	n.d.	3	12.4	3.62	29.9	120	34.9	441	102	1.61	32.0	24	22
5240	UT99B1670-3458	6	39.0	88.0	75	75.2	2.0	n.d.	3	12.6	3.74	30.5	116	35.3	528	101	1.65	31.0	20	25
5227	MOREX MALT CHECK	6	35.0	87.7	78	81.1	0.8	2.3	1	12.1	5.84	50.4	119	64.4	195	340	1.53	4.8	42	
Minima			35.7	71.1	48	74.9	0.0	1.4		11.1	3.31	26.3	50	26.3	52	75	1.45	3.4	14	
Maxima			48.7	99.6	87	83.3	3.3	2.7		16.3	5.96	42.7	186	97.0	528	321	1.66	47.0	60	
Means			41.9	91.0	73	78.7	1.3	1.7		13.7	4.71	35.1	132	54.5	212	173	1.52	12.5	35	
Standard Deviations			3.8	6.7	9	2.2	0.6	0.3		1.2	0.72	4.9	32	16.7	125	69	0.06	13.3	11	
Coefficients of Variation			9.2	7.3	12	2.8	46.7	16.6		9.0	15.30	13.9	24	30.7	59	40	4.08	106.8	32	

Malt Check Data are Excluded from Rank Sorting and Statistics

Table Data Flagged by an Asterisk Exceed the Mean by +/- 3 Standard Deviations and are Excluded from Statistics

For Wort Clarity - 1 = clear, 2 = slightly hazy, 3 = hazy; Wort Colors were not determined (n.d.) on hazy samples

Samples Submitted by A. Meisner, BARI - Ft. Collins

2006 WESTERN REGIONAL SPRING BARLEY REGIONAL NURSERY - FAIRFIELD, MT

Table 8

Lab No.	Variety or Selection	Rowed	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agtron)	Malt Extract (%)	F-C (%)	Wort Color	Wort Clarity	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Viscosity Relative	Turbidity (Hach)	Quality Score	Overall Rank
5278	Steptoe	6	46.8	97.0	84	77.6	2.6	n.d.	3	9.9	3.51	36.1	50	28.0	*742	123	*2.01	53.0	15	36
5279	Baronesse	2	44.0	96.4	76	78.5	1.0	n.d.	3	12.2	3.76	31.0	93	37.7	216	123	1.63	38.0	24	32
5280	Morex	6	36.7	83.9	89	80.8	1.7	2.3	2	12.0	4.91	41.7	144	49.9	280	201	1.62	27.0	48	15
5281	Stander	6	36.9	92.1	82	81.8	0.8	2.1	1	12.4	5.84	48.7	124	76.0	205	299	1.55	7.0	46	18
5282	Harrington	2	42.2	97.6	75	82.2	0.7	1.5	1	12.1	5.38	45.4	123	64.8	128	248	1.51	3.8	61	6
5284	2B99-2316	2	41.2	92.6	78	82.5	1.2	1.7	1	11.4	5.26	46.4	149	72.9	65	242	1.47	4.3	64	3
5285	2B99-2657	2	41.2	93.7	83	83.4	0.3	1.6	1	10.8	4.89	46.1	128	77.2	63	231	1.48	3.7	59	8
5286	2B99-2763-10	2	41.1	96.3	75	81.1	0.8	1.7	1	12.5	4.95	40.6	165	64.8	91	233	1.48	5.4	64	3
5287	2B99-2771-1	2	40.5	93.9	75	82.1	0.7	2.3	1	11.6	4.70	42.8	115	69.9	120	278	1.53	5.2	57	9
5288	99Ab11073	6	39.1	91.1	80	81.5	1.2	2.6	1	9.9	3.95	39.8	88	44.2	328	184	1.65	8.4	31	26
5289	01Ab10055	2	41.5	92.3	79	81.6	1.1	2.2	1	12.3	5.20	42.8	146	65.0	71	289	1.48	4.4	64	3
5290	01Ab10062	2	43.0	94.7	79	82.0	1.3	2.1	1	12.1	5.04	41.6	137	65.6	78	278	1.48	4.6	65	1
5291	01ID1550	6	40.2	87.0	85	81.5	0.8	2.6	1	10.4	4.66	46.0	72	61.6	82	278	1.57	8.9	46	18
5292	01ID435H	2	38.4	*81.5	*52	85.2	1.4	2.7	1	13.9	4.75	35.8	105	43.4	236	206	1.66	6.9	29	30
5293	01ID451H	2	38.2	*52.8	58	85.8	1.7	3.2	1	12.6	4.17	33.2	75	40.3	160	157	1.63	7.9	31	26
5294	01ST1587	2	46.2	98.4	71	79.2	1.5	n.d.	3	11.4	3.71	34.5	105	42.5	67	137	1.56	33.0	39	21
5295	01ST1758	2	44.2	96.6	78	79.2	1.4	n.d.	3	12.0	3.76	32.3	103	38.5	136	113	1.57	33.0	31	26
5296	YU501-312	2	43.4	95.6	79	81.6	2.4	3.2	1	11.5	3.57	31.1	98	34.3	394	109	1.64	10.0	32	24
5297	YU501-385	2	44.3	94.7	83	81.0	1.4	2.5	1	11.6	4.02	35.4	88	44.3	256	150	1.64	9.4	36	22
5298	BZ502-532	2	46.2	98.5	78	80.6	1.1	3.2	2	11.3	3.80	35.1	93	41.5	172	125	1.64	14.6	32	24
5299	MT000047	2	44.5	96.8	70	81.3	1.3	2.8	1	12.8	5.37	43.2	169	66.5	85	249	1.49	10.5	65	1
5300	MT000125	2	47.3	98.6	69	81.3	1.2	2.2	1	12.6	4.98	39.7	150	65.4	127	216	1.49	7.0	56	13
5301	MT000138	2	48.5	98.6	68	82.1	1.1	2.8	1	12.6	5.67	45.5	150	66.2	148	293	1.50	8.4	57	9
5302	ND21863	2	48.3	98.4	75	82.4	0.7	2.3	1	10.8	4.27	39.9	112	53.6	69	175	1.49	8.1	48	15
5303	ND22927	2	50.1	99.0	81	82.4	1.1	n.d.	3	11.7	5.42	48.1	99	55.0	187	275	1.57	44.0	44	20
5304	ND22996	2	47.1	98.8	72	82.1	1.1	2.8	2	12.0	5.80	48.8	125	72.0	87	294	1.50	16.7	55	14
5305	UT99B1669-3243	6	42.2	95.1	70	78.5	2.4	n.d.	3	11.1	3.79	34.4	114	34.4	*553	131	1.65	40.0	22	33
5306	UT99B1670-3458	6	42.2	95.1	70	78.3	2.6	n.d.	3	11.4	3.84	35.0	107	33.0	*650	155	1.71	42.0	22	33
5307	WA 10701-99	2	43.9	95.5	77	82.6	0.9	1.8	1	11.3	4.95	45.3	123	64.8	134	226	1.54	14.0	61	6
5308	WA 7330-00	2	42.9	96.0	76	79.9	1.3	n.d.	3	11.4	3.71	33.7	98	40.0	176	117	1.53	30.0	31	26

Table 8

Lab No.	Variety or Selection	Rowed	Kernel Weight (mg)	on 6/64" (%)	Barley Color (Agron)	Malt Extract (%)	F-C (%)	Wort Color	Wort Clarity	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	FAN (ppm)	Viscosity Relative	Turbidity (Hach)	Quality Score	Overall Rank
5309	WA 15279-00	2	45.9	94.8	74	79.1	2.9	1.9	2	12.4	3.64	29.9	74	34.3	388	134	1.61	29.0	25	31
5310	02WVNZ-1015	2	45.6	97.5	78	80.7	1.2	1.3	1	12.1	3.80	31.9	114	37.0	180	140	1.55	8.2	33	23
5311	02WVNZ-1821	2	43.5	97.4	69	80.6	1.5	n.d.	3	10.9	3.78	35.6	88	37.2	197	135	1.54	42.0	22	33
5313	99NZ102	2	41.0	86.7	80	79.9	0.7	n.d.	3	10.9	5.38	49.8	137	70.3	98	276	1.54	36.0	47	17
5314	01NZ392	2	40.5	91.2	82	82.3	1.2	n.d.	3	11.2	5.23	47.0	131	61.6	99	270	1.76	*121	57	9
5315	01NZ706	2	42.0	92.8	86	79.9	0.9	1.9	1	11.3	5.23	47.8	154	63.7	63	275	1.47	9.0	57	9
5283	MOREX MALT CHECK	6	35.2	86.7	80	81.4	0.7	2.4	1	12.5	6.21	52.0	114	66.8	177	336	1.54	5.7	39	
5312	HARRINGTON MALT CHECK	2	38.4	85.9	77	82.1	0.8	1.9	1	12.9	5.91	46.1	134	80.6	68	286	1.50	7.3	56	
Minima			36.7	83.9	58	77.6	0.3	1.3		9.9	3.51	29.9	50	28.0	63	109	1.47	3.7	15	
Maxima			50.1	99.0	89	85.8	2.9	3.2		13.9	5.84	49.8	169	77.2	394	299	1.76	53.0	65	
Means			43.1	94.8	77	81.2	1.3	2.3		11.7	4.57	40.0	115	53.3	157	205	1.56	18.1	44	
Standard Deviations			3.3	3.7	6	1.8	0.6	0.5		0.8	0.74	6.1	28	14.9	91	66	0.07	14.9	15	
Coefficients of Variation			7.6	3.8	8	2.2	46.3	23.4		7.1	16.26	15.3	24	28.0	58	32	4.79	82.5	35	

Malt Check Data are Excluded from Rank Sorting and Statistics

Table Data Flagged by an Asterisk Exceed the Mean by +/- 3 Standard Deviations and are Excluded from Statistics

For Wort Clarity - 1 = clear, 2 = slightly hazy, 3 = hazy; Wort Colors were not determined (n.d.) on hazy samples

Samples Submitted by A. Meisner, BARI - Ft. Collins

Appendix A:

METHODS

Cleaning All samples were cleaned on a Carter Dockage Tester and any material not retained on a 5/64" screen was discarded.

Barley Mill Ground barley was prepared with a Labconco Burr mill that was adjusted so that only 35% of the grist remained on a 525 µm sieve after 3 min of shaking and tapping.

Kernel Weight The number of kernels in a 20 g aliquot of each sample was counted electronically and the '1000 kernel weight' was calculated.

Plumpness Samples were sized on a Eureka-Niagra Barley Grader and the percentage of the seeds retained on a 6/64" screen was determined.

Barley Color The brightness of the grains was measured using an Agron M45-D analyzer.

Barley Moisture Content (Barley 5B) Five g of ground sample was dried for 3 h at 104°C. The percentage of weight loss that occurred during this drying was calculated.

Barley Protein Content Total nitrogen values were obtained using an automated Dumas combustion procedure with a LECO FP-528 analyzer. Nitrogen values were converted to protein percentages by multiplication by 6.25.

Malting Conditions 170 g (db) aliquots of barley were processed in Joe White micro-malters. Samples were hydrated to 47% moisture via a 31 h steep at 19°C: 8 h wet, 8 h air, 4 h wet, 5 h air, 2 h wet, 2 h air, 2 h wet. (Larger barleys, > 42 mg/kernel, received a continuous, wet pre-steep (16°C) of between 2 and 7 h). The samples were germinated for 48 h (18°C), 24 h (17°C), and 24 h (16°C), with moisture adjustment to 47% at 0, 24, and 48 h. The samples received 4 full turns every 2 h. The germinated grain was kilned for 24h as follows: 49°C, 10 h; 54°C, 4 h; 60°C, 3 h; 68°C, 2 h; and 85°C, 3 h, with 30 min. ramps between stages. All stages received 40% total flow, with 0% recirculation for stages 1-3, 50% for stage 4, and 75% for stage 5.

Malt Mill Fine-grind malts were prepared with a Miag laboratory cone mill that was adjusted so that 10% of the grist remained on a 525 µm sieve after 3 min of shaking, with tapping. Coarse-grind malts were prepared with a corrugated roller mill that was adjusted so that 75% of the grist remained on a 525 µm sieve. Malts to be used for moisture, protein and amyolytic activity analyses were ground in a Labconco Burr mill (see Barley Mill).

Malt Moisture Content Determined by Malt 3 (Methods of Analysis of the ASBC, 8th ed, 1992) See Barley Moisture Content.

Malt Protein Content See Barley Protein Content.

Malt Extract Samples were extracted using the Malt-4 procedure (Methods of Analysis of the ASBC, 8th ed, 1992), except that all weights and volumes specified for the method were halved. The specific gravity of the filtrate was measured with an Anton/Parr DMA5000 density meter. The density data were used to calculate the amount of soluble material present in the filtrate, and thus the percentage that was extracted from the malt. **F-C** represents the difference in extract % between the finely ground malts and the coarsely ground malts.

Wort Color was determined on a Skalar SAN plus analyzer by measuring the absorbance at 430nm and dividing by a factor determined by collaborative testing.

Wort Clarity was assessed by visual inspection.

β-Glucan Levels were determined on a Skalar SAN plus analyzer by using the Wort-18 fluorescence flow injection analysis method with calcofluor as the fluorescent agent (Methods of Analysis of the ASBC, 8th ed, 1992).

Free Amino Nitrogen Levels were determined on a Skalar SAN plus analyzer using an automated version of the Wort-12 protocol (Methods of Analysis of the ASBC, 8th ed, 1992).

Soluble (Wort) Protein Levels were determined on a Skalar SAN plus analyzer using the Wort-17 UV-spectrophotometric method (Methods of Analysis of the ASBC, 8th ed, 1992).

S/T Ratio was calculated as Soluble Protein / Total Malt Protein

Diastatic Power Values were determined on a Skalar SAN plus analyzer by the automated ferricyanide procedure Malt-6A (Methods of Analysis of the ASBC, 8th ed, 1992).

α-Amylase activities were measured on a Skalar SAN plus analyzer by heating the extract to 73°C to inactivate any β-amylase present. The remaining (α-amylase) activity was measured as described for Diastatic Power Values.

Turbidities were determined in Nephelometric Turbidity Units (NTU) on a Hach Model 18900 Ratio Turbidimeter.

Quality Scores were calculated by using a modification of the method of Clancy and Ullrich (Cereal Chem. 65:428-430, 1988). The criteria used to quantify individual quality factors are listed in Table A1.

Overall Rank Values were ordered from low to high based on their Quality Scores. A rank of '1' was assigned to the sample with the best quality score.

Appendix B

2006 Crop Year

Quality Score Parameters for 2- and 6-rowed barleys

Quality parameter	2-rowed		6-rowed		
	condition	score	condition	score	
Kernel Weight (mg)	> 42.0	5	> 32.0	5	
	40.1–42.0	4	30.1–32.0	4	
	38.1–40.0	2	28.1–30.0	2	
	≤ 38.0	0	≤ 28.0	0	
on 6/64 " (%)	≥ 90.0	5	≥ 80.0	5	
	85.0–89.9	3	73.0–79.9	3	
	< 85.0	0	< 73.0	0	
Malt Extract (% db)	≥ 81.0	10	≥ 79.0	10	
	79.4–81.0	7	78.2–78.9	7	
	78.0–79.4	4	77.7–78.2	4	
	< 78.0	0	< 77.7	0	
Wort Clarity	= 3	0	= 3	0	
	3=hazy	= 2	1	= 2	1
	2=slightly hazy	= 1	2	= 1	2
	1=clear				
Barley Protein (% db)	≥ 13.5	0	≥ 14.0	0	
	13.0–13.5	5	13.5–13.9	5	
	11.0–13.0	10	11.5–13.5	10	
	≤ 11.0	5	≤ 11.5	5	
Wort Protein (% db)	> 6.0	0	> 6.0	0	
	5.6–6.0	3	5.7–6.0	3	
	4.4–5.6	7	5.2–5.7	7	
	4.0–4.4	3	4.8–5.2	3	
	< 4.0	0	< 4.8	0	
S/T (Soluble/Total Protein, % db)	>47	0	>47	0	
	40–47	5	42–47	5	
	< 40	0	< 42	0	
DP (Diastatic Power, ° ASBC)	>120	7	>140	7	
	100–120	4	120–140	4	
	< 100	0	< 120	0	
Alpha-amylase (20° DU)	>45	7	>45	7	
	40–45	4	40–45	4	
	< 40	0	< 40	0	
Beta-glucan (ppm)	< 100	7	<120	7	
	100–150	3	120 – 170	3	
	> 150	0	> 170	0	