Barley Breeding Pipeline 2018

The Barley Breeding Pipeline is fully flowing with new crosses each year, inbreeding to F4 for initial field testing, F5 rows, PYT full plots, EYT, and Intrastate trials. All totaled, this is about 14,000 genotypes we evaluate each year. We are breeding for all end-uses of spring and winter barley including malt, feed, forage and food. Several of the trials reported below were grown at the Montana Ag Research Centers and we recognize those cooperators, including Pat Carr and Jed Eberly (CARC), Chengci Chen and Frankie Crutcher (EARC), Peggy Lamb (NARC), Ken Kephart and Kent McVay (SARC), and John Miller (WTARC).

Below we detail each stage in the breeding pipeline for 2018.

Crosses:

Crosses were made in both spring and fall of 2018 as detailed below. The 75 and 90 Heirloom crosses made in 2017 and 2018 are to satisfy the USDA-NIFA Rocky Mountain Barley Cooperative Grant. However, lines with unique malt quality characteristics will be incorporated into the breeding program.

Crosses		Year			
	Breeding Goals	2015	2016	2017	2018
Spring	High yield, high quality malt or feed	90	87	29	39
	Heirloom malt			75	90
	Food	19	21	23	
	Forage	12	12	11	14
	Lodging resistance	11	1		
	FHB resistance	14	22	13	12
	Extended grain-fill	31	12	7	
	Spot form of Net blotch	3	12		
	Nematode Resistance	4	10	1	
	Stripe Rust			2	
	Beer Stalling	6			
	Acid tolerance			20	11
Winter	Forage				8
	Feed				21
	Malt				45
	Food				1

Crosses made in 2017 consisting of 100 families were grown in 10,000 F4s head rows in 2018 and about 2,000 will be advanced to F5s in 2019 based on height, heading date, maturity, and protein. The F5s in 2018 originated from crosses made in 2016. About 200 of these lines will be advanced into the PYT in 2019.

Test advanced lines

209 Lines in F5s in 2017 were advanced into PYT in 2018. We grew the PYT in two locations, SARC (Ken Kephart) and Post farm (Liz Elmore). Reported below are the lines that yielded better than Hockett. Many had low protein and good plumps. We are in the process of doing malt quality analysis on these lines to determine what will be advanced into the EYT.

PYT agronomic data:

PYT 2018		Yield			Protein			Plump			Test Wt			Grain Fill
Pedigree	Name	Boz	Hun	Ave	Boz	Hun	Ave	Boz	Hun	Ave	Boz	Hun	Ave	Boz
MT070157x2B07-2278	MT17M08808	149	118	133	10.6	10.7	10.7	98	98	98	56	49	52	39
MERITxMT100120	MT17M09011	136	125	130	10.8	11.7	11.3	99	98	98	54	49	52	33
MT124688xHARRINGTON	MT17M07803	145	113	129	10.5	10.9	10.7	98	98	98	55	49	52	36
MT090180xMETCALFE	MT17M05312	142	117	129	10.7	11.9	11.3	95	97	96	54	48	51	35
HOCKETTx2B06-1157	MT17M07706	142	114	128	11.7	13.2	12.5	97	97	97	55	50	53	33
Concerto/Quench	Odyssey	149	105	127	10.6	11.4	11.0	99	99	99	53	47	50	34
METCALFExMT100130	MT17M04808	141	112	126	10.2	11.4	10.8	97	98	97	54	50	52	32
2AB07-X030091-34xCONLOI	MT17M07904	142	111	126	10.4	11.6	11.0	98	97	98	54	48	51	38
METCALFExMT124688	MT17M04904	128	124	126	10.8	12.3	11.6	98	99	98	55	48	52	35
HOCKETTx2B06-1157	MT17M07704	134	118	126	11.9	12.7	12.3	99	96	97	55	48	51	36
MT100120xND24388	MT17M01906	132	120	126	11.3	12.1	11.7	99	98	99	54	48	51	44
MT050002x2AB07-X04M120	MT17M08403	140	111	126	11.6	12.0	11.8	94	96	95	55	49	52	31
MT090190xND19119	MT17M00502	135	116	125	12.1	12.3	12.2	100	98	99	54	48	51	41
CONRADxMT090190	MT17M06201	130	119	125	10.4	11.3	10.9	99	99	99	55	49	52	35
2AB07-X030091-34xCONLOI	MT17M07910	117	131	124	11.2	11.9	11.6	97	94	96	53	47	50	34
ESLICKx2ND27572	MT17M08201	128	118	123	10.7	11.3	11.0	97	97	97	54	49	51	38
MT070157x2B07-2278	MT17M08809	135	110	122	11.5	12.4	12.0	99	98	98	55	49	52	40
ESLICKx2ND27572	MT17M08210	128	116	122	12.2	12.5	12.4	98	96	97	55	49	52	33
MT050051x07WA-664.1	MT17M08501	129	113	121	11.3	12.1	11.7	97	97	97	56	51	53	33
MERITxMT100120	MT17M09010	128	113	120	9.9	11.7	10.8	97	98	98	54	48	51	35
ESLICKx2ND27572	MT17M08208	129	111	120	11.6	13.0	12.3	96	98	97	55	49	52	31
MT090190xND24388	MT17M01801	134	106	120	10.9	11.8	11.4	99	98	99	55	50	53	38
MT070157xND19119	MT17M00301	123	117	120	11.7	12.8	12.3	100	99	99	54	48	51	35
MT124688xHARRINGTON	MT17M07801	131	109	120	10.4	11.2	10.8	97	97	97	55	49	52	35
METCALFExMT100130	MT17M04805	126	112	119	10.3	11.8	11.1	98	97	98	53	48	51	34
MT070157xND19119	MT17M00302	126	113	119	10.2	10.7	10.5	98	96	97	53	48	51	35
MT090190/ND24388	MT16M01820	126	112	119	10.3	11.6	11.0	98	97	98	54	48	51	41
2AB07-X030091-34xCONLOI	MT17M07901	131	107	119	10.1	10.4	10.3	98	93	95	54	47	50	35
MT100120xND24260	MT17M01402	124	113	119	11.1	12.6	11.9	99	98	99	53	47	50	38
2AB07-X030091-34/CONLOI	MT16M07910	129	108	119	10.1	11.2	10.7	90	95	93	54	48	51	34
HOCKETTxMETCALFE	MT17M05812	138	99	119	11.2	12.4	11.8	97	97	97	55	50	52	31
ESLICKx2ND27572	MT17M08203	137	100	118	11.5	12.3	11.9	94	97	95	55	49	52	37
HOCKETTx2B06-1157	MT17M07705	125	111	118	12.2	11.4	11.8	98	97	98	55	49	52	33
MT100120xMETCALFE	MT17M05508	122	114	118	10.6	12.8	11.7	95	97	96	54	50	52	35
METCALFExMT100130	MT17M04803	112	124	118	10.8	11.2	11.0	88	96	92	52	49	50	27
MT050051x07WA-664.1	MT17M08507	140	96	118	11.6	13.0	12.3	99	100	99	57	52	54	36
MT050051x07WA-664.1	MT17M08515	120	115	118	10.2	11.0	10.6	98	98	98	54	49	51	36
MT100132xND24388	MT17M02009	126	110	118	10.6	12.0	11.3	98	97	98	53	48	50	35
MT124688xHARRINGTON	MT17M07805	137	99	118	10.5	11.0	10.8	98	99	99	55	49	52	35
METCALFExMT100130	MT17M04801	116	118	117	10.9	12.1	11.5	97	99	98	54	50	52	34
MT090180xND19119	MT17M00402	124	109	117	11.3	12.2	11.8	100	99	99	54	49	51	40
MT050051x07WA-664.1	MT17M08509	115	118	116	11.1	12.2	11.7	98	98	98	55	49	52	35
MT100120xMETCALFE	MT17M05506	117	115	116	11.0	12.2	11.6	96	99	98	55	50	53	35
MT090180xND19119	MT17M00401	129	103	116	11.7	12.4	12.1	100	98	99	55	49	52	42
04WA-123.39xHOCKETT	MT17M07602	129	103	116	11.6	11.5	11.6	99	95	97	56	50	53	39
METCALFExGALLATIN	MT17M05111	140	92	116	12.4	14.0	13.2	98	97	97	55	50	53	42
2AB04-X01039-2xMT050002	MT17M08309	119	111	115	10.8	11.6	11.2	97	98	98	54	49	51	35
METCALFExMT124688	MT17M04919	122	108	115	11.0	12.4	11.7	99	97	98	56	50	53	38
BOWMANxMT070157	MT17M08702	126	104	115	10.6	11.5	11.1	98	98	98	55	49	52	44
MT090190xND19119	MT17M00504	122	107	115	11.0	11.5	11.3	98	100	99	54	48	51	39
MT100130xND19119	MT17M00609	123	106	115	12.1	13.2	12.7	100	99	99	54	49	52	44
METCALFExMT124688	MT17M04913	127	102	115	12.2	13.1	12.7	98	100	99	55	50	53	38
03WA-2084xMT080192	MT17M09108	128	101	115	11.5	12.7	12.1	98	97	98	55	50	53	35
04WA-123.39xHOCKETT	MT17M07610	119	110	115	10.4	11.6	11.0	93	93	93	53	49	51	31
MT124688xMETCALFE	MT17M06301	142	87	114	12.5	13.0	12.8	99	100	100	57	51	54	39
MT100120xMETCALFE	MT17M05502	142	86	114	11.0	12.0	11.5	99	98	99	55	49	52	36
HOCKETTxND24388	MT17M02101	122	107	114	10.7	11.6	11.2	97	95	96	54	47	50	36
2AB07-X030091-34xCONLOI	MT17M07912	128	100	114	10.2	11.7	11.0	97	91	94	53	46	50	37
MT124688xND19119	MT17M00710	115	113	114	11.2	12.0	11.6	99	98	99	55	49	52	42
MT090182xMETCALFE	MT17M05406	126	102	114	11.3	13.2	12.3	94	96	95	56	50	53	34
METCALFExMT124688	MT17M04903	122	106	114	11.5	11.5	11.5	98	98	98	54	49	51	35
2AB04-X01039-2xCRAFT	MT17M06505	128	99	114	11.4	12.5	12.0	99	100	100	55	49	52	36
CRAFTxCONRAD	MT17M06406	129	99	114	11.2	13.1	12.2	99	99	99	55	50	52	38
MT100132xND24260	MT17M01306	110	117	114	11.2	12.7	12.0	99	98	99	54	49	51	41
MT100130xND19119	MT17M00604	122	104	113	11.9	12.5	12.2	99	98	99	54	48	51	39
PINNACLE/HOCKETT	MT17M09601	122	104	113	11.6	12.6	12.1	99	96	98	55	49	52	42
07WA-664.1xCRAFT	MT17M06705	130	96	113	11.3	11.5	11.4	96	96	96	55	50	52	35
SCARLETTxCRAFT	MT17M07207	121	104	113	13.1	13.1	13.1	99	98	99	56	50	53	36
MT124688xMETCALFE	MT17M06303	115	109	112	12.1	12.8	12.5	97	97	97	54	50	52	33
2AB07-X030091-34xCONLOI	MT17M07902	119	105	112	10.4	11.4	10.9	95	95	95	55	50	52	38
ESLICKx2ND27572	MT17M08213	112	112	112	10.6	11.2	10.9	99	98	99	54	49	51	34
TRADITIONxMT124688	MT17M07505	125	99	112	11.4	11.0	11.2	99	100	100	55	48	51	37
MT100120xND24260	MT17M01404	108	115	112	12.4	13.3	12.9	99	98	99	55	49	52	38
MERITxMT100120	MT17M09007	113	110	112	10.8	13.0	11.9	99	97	98	54	48	51	36
MERITxMT100120	MT17M09001	115	108	111	10.2	12.0	11.1	98	98	98	55	48	51	32
MT050187xND19119	MT17M00210	119	103	111	12.0	12.7	12.4	99	98	99	56	49	52	47
MT050002x2AB07-X04M120	MT17M08408	115	106	111	12.8	13.1	13.0	96	99	98	55	49	52	30
MT070157x2B07-2278	MT17M08806	118	104	111	11.0	12.0	11.5	99	97	98	55	49	52	42
ND7293/Bearpaw	Hockett	121	100	110	11.7	12.2	12.0	97	97	97	55	50	52	31
	GRAND MEAN	114	100	107	11.6	12.6	12	98	98	98	55	49	52	37
	CV	7	6		2.7	2.7		1	1		1	1		4.8
	LSD	2	16		0.8	0.9		2	3		1	2		4.5

Early Yield Trial

The Early Yield trial was grown in seven locations in 2018. The experimental lines were advanced from the F5 single row plots in 2017. The best yielding named variety in dryland was Opera; while the best yielding named variety under irrigation was Sienna, both Limagrain lines. The best yielding of the dryland experimental lines was a cross between a female plant carrying the low protein gene and a stay green plant from North Dakota. Many experimental lines are within 1 LSD of the top yielding named varieties, rendering them statistically equal.

Early Yield Trial 2018 Agronomic Data

Entries from 2018 EYT		Yield	(bu/ac)						2018 EYT		PYT 2017 Boz Dry		Yield
		Bozeman	Bozeman	Huntley	Huntley	Sidney	Havre	Moccasin	Dry	Irr	SG	MF	Overall
Name	Pedigree	*Irr*	*Dry*	*Irr*	*Dry*	*Dry*	*Dry*	*Dry*	Mean	Mean			Mean
Champion	Baronesse/Camas	135	117	108	76	91	55	51	**80**	**121**		80	**89**
Haxby	Gallatin/Bellona//Cla	103	103	104	84	87	51	50	**77**	**104**			**83**
Hockett	ND7293/Bearpaw	135	120	104	91	84	55	52	**82**	**119**	70	82	**88**
Merit 57	Manley/2B80-350//M	141	128	121	83	83	69	53	**84**	**131**			**97**
Metcalfe	Oxbow/Manley	134	120	100	94	79	52	44	**80**	**117**			**89**
Opera	Overture/Tamtam	155	156	103	86	86	73	60	**94**	**129**			**103**
Sienna	Chronicle/Genie	162	128	103	79	82	55	60	**83**	**133**			**96**
MT080243	MT960101/MT981210	131	125	108	95	89	57	55	**86**	**120**			**94**
MT090202	MT910189//Lk644/Esli	119	118	114	85	96	62	52	**84**	**117**			**92**
MT124008	MT010158/MT070175	120	116	101	94	75	60	50	**80**	**110**			**88**
MT16M00209	MT050187/ND19119	137	115	98	92	89	56	49	**82**	**118**	67		**88**
MT16M00301	MT070157/ND19119	146	129	110	96	91	59	46	**86**	**128**	81		**95**
MT16M00406	MT090180/ND19119	146	130	113	95	98	62	55	**90**	**129**	75		**97**
MT16M00408	MT090180/ND19119	128	105	105	72	92	49	43	**74**	**117**	68		**83**
MT16M00504	MT090190/ND19119	146	124	116	99	82	58	49	**84**	**131**	78		**94**
MT16M00610	MT100130/ND19119	133	122	107	91	92	62	51	**85**	**120**	79		**92**
MT16M00709	MT124688/ND19119	149	142	112	101	92	56	65	**94**	**130**	82		**100**
MT16M00807	Craft/ND19119	138	104	100	90	71	57	48	**75**	**119**	65		**84**
MT16M01003	MT080370/ND24260	121	116	96	93	87	53	44	**80**	**109**	70		**85**
MT16M01206	MT100126/ND24260	127	101	93	81	77	53	57	**75**	**110**	62		**81**
MT16M01303	MT100132/ND24260	124	111	107	98	93	64	56	**86**	**115**	68		**90**
MT16M01405	MT100120/ND24260	131	121	112	104	87	61	52	**87**	**121**	78		**93**
MT16M01704	MT070157/ND24388	127	116	97	91	106	66	52	**88**	**112**	72		**91**
MT16M01803	MT090190/ND24388	132	111	92	78	89	56	52	**79**	**112**	68		**85**
MT16M01806	MT090190/ND24388	139	121	110	88	91	66	50	**85**	**124**	60		**91**
MT16M01819	MT090190/ND24388	130	100	93	84	83	45	46	**73**	**112**	62		**80**
MT16M01902	MT100120/ND24388	146	123	105	95	98	64	53	**88**	**125**	73		**94**
MT16M02002	MT100132/ND24388	136	113	93	88	88	62	54	**82**	**115**	70		**88**
MT16M02003	MT100132/ND24388	130	114	85	90	93	62	61	**86**	**107**	70		**88**
MT16M02008	MT100132/ND24388	137	109	94	87	86	59	48	**79**	**116**	65		**86**
MT16M02101	HOCKETT/ND24388	114	136	95	98	81	62	55	**88**	**105**	65		**88**
MT16M02103	HOCKETT/ND24388	142	113	90	77	86	62	49	**78**	**116**	69		**86**
MT16M02201	HOCKETT/ND24388	140	125	110	91	89	63	48	**84**	**125**	65		**91**
MT16M02610	ND24388//BlackLemm	108	94	79	78	81	50	36	**69**	**93**	56		**73**
MT16M05403	MT090182/METCALFE	122	132	96	93	85	59	55	**87**	**109**	70		**89**
MT16M05610	MT100126/METCALFE	129	124	108	94	83	58	56	**85**	**119**	66		**90**
MT16M05902	PINNACLE/MT050187	129	106	89	60	78	51	49	**70**	**109**		61	**78**
MT16M05904	PINNACLE/MT050187	132	111	98	64	82	61	44	**73**	**115**		72	**83**
MT16M05905	PINNACLE/MT050187	119	106	96	76	70	57	47	**72**	**108**		64	**79**
MT16M06001	MT050187/PINNACLE	134	111	87	66	76	63	56	**75**	**110**		68	**82**
MT16M06501	2AB04-X01039-2/CRAF	117	108	102	78	88	55	51	**78**	**110**		91	**86**
MT16M06604	CRAFT/HARRINGTON	116	118	100	97	81	49	52	**81**	**108**		79	**86**
MT16M06609	CRAFT/HARRINGTON	119	113	96	86	72	55	49	**76**	**108**		89	**85**
MT16M06709	07WA-664.1/CRAFT	134	108	107	93	80	58	53	**80**	**120**		97	**91**
MT16M06902	CRAFT/QUEST	103	103	82	68	85	43	48	**71**	**92**		62	**74**
MT16M07304	ND27572/SCARLETT	120	105	87	83	73	58	47	**74**	**103**		84	**82**
MT16M07702	HOCKETT/2B06-1157	126	125	119	101	85	70	52	**88**	**123**		65	**93**
MT16M08104	CONLON/GERALDINE	109	92	67	52	74	60	45	**65**	**88**		69	**71**
MT16M08301	2AB04-X01039-2/MT05	126	125	111	97	78	60	55	**85**	**118**		82	**92**
MT16M08503	MT050051/07WA-664.	136	123	104	100	79	60	58	**85**	**120**		66	**90**
MT16M08806	MT070157/2B07-2278	116	103	79	73	78	69	50	**75**	**97**	74		**80**
MT16M09503	HOCKETT/PINNACLE	124	105	83	86	86	60	51	**79**	**103**		84	**85**
MT16M09507	HOCKETT/PINNACLE	137	110	99	98	82	62	51	**82**	**118**		61	**87**
MT16M09602	PINNACLE/HOCKETT	125	112	100	89	71	61	56	**79**	**113**		67	**85**
MT16M09604	PINNACLE/HOCKETT	130	106	101	73	71	59	53	**74**	**115**		83	**85**
MT16M09610	PINNACLE/HOCKETT	129	104	112	92	79	52	56	**78**	**120**		73	**87**
MT16M09708	Craft/BlackBetzes	121	107	113	98	83	61	53	**82**	**117**		82	**90**
MT16M10204	MT124688 / BlackBetz	125	113	101	98	82	64	53	**83**	**113**	82		**90**
MT16Y00901	Eslick/ND19119	143	136	104	98	84	60	57	**89**	**124**		86	**96**
MT16Y00904	Eslick/ND19119	134	126	98	92	91	48	46	**83**	**116**		86	**90**
MT16Y02507	Haxby/ND24388	125	117	112	88	106	63	54	**87**	**118**		83	**93**
MT16Y08201	ESLICK/2ND27572	129	129	92	84	83	48	62	**84**	**110**		68	**87**
MT16Y08703	BOWMAN/MT070157	102	90	75	71	74	56	47	**68**	**89**		76	**74**
MT16Y08704	BOWMAN/MT070157	129	126	101	78	80	61	55	**81**	**115**		77	**88**
GRAND MEAN		129.4	115.9	99.8	86.6	84.2	58.3	51.6	80.8	114.6	64.6	70.7	84.6
CV		9.0	5.4	5.7	10.1	9.9	9.0	10.6			*Mean from		
LSD		18.8	10.2	9.2	14.2	13.5	10.3	8.9			entire 2017 expt		

Entries from 2018 EYT		Protein (%)							2018 EYT		PYT 2017 Boz Dry		Protein
		Havre	Bozeman	Bozeman	Moccasin	Sidney	Huntley	Huntley	Dry	Irr	SG	MF	Overall
Name	Pedigree	*Dry*	*Dry*	*Irr*	*Dry*	*Dry*	*Irr*	*Dry*	Mean	Mean			Mean
Champion	Baronesse/Camas	8.7	11.5	11.9		12.7	12.4	13.9	**12.0**	**12.2**		12.8	**12.0**
Haxby	Gallatin/Bellona//Clai	10.3	11.8	10.9		13.4	12.5	14.1	**12.6**	**11.7**			**12.2**
Hockett	ND7293/Bearpaw	9.1	11.4	11.9		12.3	12.4	13.0	**11.7**	**12.2**	13.1	13.0	**12.0**
Merit 57	Manley/2B80-350//Me	8.5	11.5	11.6		12.5	11.7	13.6	**11.8**	**11.7**			**11.6**
Metcalfe	Oxbow/Manley	9.4	11.7	12.1		13.3	13.6	13.9	**12.3**	**12.9**			**12.3**
Opera	Overture/Tamtam	8.5	9.9	9.8		11.5	10.9	12.5	**10.8**	**10.4**			**10.5**
Sienna	Chronicle/Genie	8.5	10.3	10.3		11.9	11.1	13.0	**11.1**	**10.7**			**10.9**
MT080243	MT960101/MT981210	9.2	11.1	11.5		12.0	12.7	14.0	**11.8**	**12.1**			**11.8**
MT090202	MT910189//Lk644/Esli	8.5	10.6	10.4		12.3	11.4	12.8	**11.3**	**10.9**			**11.0**
MT124008	MT010158/MT070175	8.9	10.5	11.0		11.8	11.4	13.1	**11.3**	**11.2**			**11.1**
MT16M00209	MT050187/ND19119	9.7	10.6	10.4		11.5	11.7	11.7	**11.0**	**11.1**	11.3		**11.0**
MT16M00301	MT070157/ND19119	9.0	11.0	11.0		12.3	12.0	12.1	**11.3**	**11.5**	11.8		**11.3**
MT16M00406	MT090180/ND19119	9.3	10.5	10.9		12.1	11.6	12.4	**11.2**	**11.3**	11.7		**11.2**
MT16M00408	MT090180/ND19119	10.2	11.4	11.4		12.6	12.7	12.6	**11.8**	**12.1**	12.5		**11.9**
MT16M00504	MT090190/ND19119	10.2	11.3	11.7		13.0	12.7	12.7	**11.9**	**12.2**	12.3		**12.0**
MT16M00610	MT100130/ND19119	10.0	11.0	11.3		12.7	12.9	12.6	**11.7**	**12.1**	12.8		**11.9**
MT16M00709	MT124688/ND19119	8.6	10.2	10.5		10.8	11.0	11.9	**10.5**	**10.8**	11.3		**10.6**
MT16M00807	Craft/ND19119	9.7	11.5	11.3		12.3	12.2	12.7	**11.7**	**11.8**	12.3		**11.7**
MT16M01003	MT080370/ND24260	10.3	12.6	12.8		13.6	14.1	14.6	**13.0**	**13.5**	13.7		**13.1**
MT16M01206	MT100126/ND24260	10.0	11.4	11.2		12.4	13.0	13.1	**11.9**	**12.1**	12.4		**11.9**
MT16M01303	MT100132/ND24260	9.6	12.0	11.8		12.5	12.9	13.1	**12.0**	**12.4**	13.2		**12.2**
MT16M01405	MT100120/ND24260	9.4	10.6	10.7		12.1	12.3	12.4	**11.3**	**11.5**	11.2		**11.2**
MT16M01704	MT070157/ND24388	8.8	11.1	10.9		13.0	12.5	12.8	**11.7**	**11.7**	11.0		**11.4**
MT16M01803	MT090190/ND24388	9.8	10.7	10.6		12.1	12.2	12.3	**11.4**	**11.4**	12.6		**11.5**
MT16M01806	MT090190/ND24388	9.1	10.1	9.7		11.5	11.6	11.7	**10.7**	**10.7**	11.4		**10.7**
MT16M01819	MT090190/ND24388	10.9	11.5	11.1		13.0	13.3	12.9	**12.2**	**12.2**	12.7		**12.2**
MT16M01902	MT100120/ND24388	9.4	10.6	10.6		11.5	11.6	12.2	**11.1**	**11.1**	12.5		**11.2**
MT16M02002	MT100132/ND24388	9.3	10.2	10.6		12.0	12.0	11.8	**11.0**	**11.3**	12.0		**11.1**
MT16M02003	MT100132/ND24388	9.4	10.6	10.1		11.5	11.6	11.9	**11.0**	**10.9**	12.2		**11.0**
MT16M02008	MT100132/ND24388	10.0	10.9	10.8		12.4	12.6	12.2	**11.5**	**11.7**	12.5		**11.6**
MT16M02101	HOCKETT/ND24388	9.2	10.4	10.1		11.1	10.8	11.6	**10.7**	**10.5**	10.4		**10.5**
MT16M02103	HOCKETT/ND24388	9.1	11.1	10.6		12.6	11.8	12.0	**11.4**	**11.2**	11.9		**11.3**
MT16M02201	HOCKETT/ND24388	8.9	10.6	11.3		11.7	11.9	12.2	**11.0**	**11.6**	11.6		**11.2**
MT16M02610	ND24388//BlackLemma/Titan										12.7		**12.7**
MT16M05403	MT090182/METCALFE	8.5	10.5	11.1		11.8	11.7	12.4	**11.0**	**11.4**	12.6		**11.2**
MT16M05610	MT100126/METCALFE	9.9	10.7	11.0		12.6	12.2	12.4	**11.5**	**11.6**	11.4		**11.5**
MT16M05902	PINNACLE/MT050187	9.6	10.8	10.4		11.9	12.0	12.0	**11.2**	**11.2**		11.5	**11.2**
MT16M05904	PINNACLE/MT050187	9.5	12.0	11.3		12.7	12.5	13.7	**12.2**	**11.9**		12.8	**12.1**
MT16M05905	PINNACLE/MT050187	10.1	11.1	10.5		12.0	12.0	12.3	**11.5**	**11.3**		12.1	**11.4**
MT16M06001	MT050187/PINNACLE	9.4	11.7	11.6		12.7	12.4	13.8	**12.1**	**12.0**		13.5	**12.2**
MT16M06501	2AB04-X01039-2/CRAF	9.6	11.7	12.6		13.9	13.4	15.0	**12.8**	**13.0**		13.6	**12.8**
MT16M06604	CRAFT/HARRINGTON	9.9	10.6	11.0		12.3	11.9	13.3	**11.7**	**11.5**		12.4	**11.6**
MT16M06609	CRAFT/HARRINGTON	10.0	12.3	12.5		14.2	14.0	15.1	**13.2**	**13.3**		13.4	**13.1**
MT16M06709	07WA-664.1/CRAFT	10.4	12.4	12.5		13.0	13.9	14.8	**12.9**	**13.2**		15.1	**13.2**
MT16M06902	CRAFT/QUEST	10.7	13.1	13.2		13.2	14.4	14.9	**13.2**	**13.8**		13.8	**13.3**
MT16M07304	ND27572/SCARLETT	10.0	12.9	12.3		13.0	13.5	13.9	**12.7**	**12.9**		12.8	**12.6**
MT16M07702	HOCKETT/2B06-1157	9.3	12.4	12.7		12.5	13.1	13.7	**12.2**	**12.9**		13.8	**12.5**
MT16M08104	CONLON/GERALDINE	10.0	12.1	12.2		12.9	13.7	13.9	**12.4**	**13.0**		13.6	**12.6**
MT16M08301	2AB04-X01039-2/MT05	9.8	11.9	12.4		12.8	12.4	13.7	**12.3**	**12.4**		14.1	**12.4**
MT16M08503	MT050051/07WA-664.	9.8	12.0	12.6		13.0	12.0	13.8	**12.4**	**12.3**		13.4	**12.4**
MT16M08806	MT070157/2B07-2278	8.9	11.7	11.2		12.3	12.2	13.2	**11.8**	**11.7**	10.8		**11.5**
MT16M09503	HOCKETT/PINNACLE	9.5	11.9	12.1		12.2	13.1	13.8	**12.1**	**12.6**		12.6	**12.2**
MT16M09507	HOCKETT/PINNACLE	9.1	10.9	11.0		12.5	12.1	13.1	**11.6**	**11.6**		13.2	**11.7**
MT16M09602	PINNACLE/HOCKETT	9.3	10.6	10.9		11.7	11.7	12.2	**11.1**	**11.3**		11.5	**11.1**
MT16M09604	PINNACLE/HOCKETT	10.0	11.7	12.0		12.7	12.4	13.0	**12.0**	**12.2**		12.2	**12.0**
MT16M09610	PINNACLE/HOCKETT	9.8	11.6	11.6		12.6	13.1	13.6	**12.1**	**12.4**		13.5	**12.3**
MT16M09708	Craft/BlackBetzes											11.3	**11.3**
MT16M10204	MT124688 / BlackBetzes										12.0		**12.0**
MT16Y00901	Eslick/ND19119	10.2	11.6	11.7		13.0	12.6	13.7	**12.3**	**12.2**		12.9	**12.2**
MT16Y00904	Eslick/ND19119	10.6	12.8	13.3		13.8	14.0	14.5	**13.1**	**13.7**		13.6	**13.2**
MT16Y02507	Haxby/ND24388	10.2	11.7	11.4		13.5	13.2	13.8	**12.5**	**12.3**		12.2	**12.3**
MT16Y08201	ESLICK/2ND27572	10.0	11.9	12.7		13.3	13.0	14.8	**12.7**	**12.9**		13.5	**12.7**
MT16Y08703	BOWMAN/MT070157	10.3	12.5	12.5		14.0	14.0	14.9	**13.2**	**13.3**		13.7	**13.1**
MT16Y08704	BOWMAN/MT070157	9.4	12.1	12.2		12.6	13.0	14.0	**12.3**	**12.6**		13.2	**12.4**
GRAND MEAN		9.6	11.3	11.4		12.4	12.5	13.1	11.8	11.9	12.4	13.3	12.0
CV		3.1	2.0	3.4		4.7	2.4	2.4			*Mean from		
LSD		0.6	0.4	0.6		1.0	0.5	0.5			entire 2017 expt		

Entries from 2018 EYT		Plump	(% 6/64)						2018 EYT		PYT 2017 Boz Dry		Plump
		Huntley	Bozeman	Bozeman	Huntley	Sidney	Havre	Moccasin	Dry	Irr	SG	MF	Overall
Name	Pedigree	*Irr*	*Dry*	*Irr*	*Dry*	*Dry*	*Dry*	*Dry*	Mean	Mean	*Boz Dr*	*Boz Dr*	Mean
Champion	Baronesse/Camas	98	98	98	94	93	80	69	**87**	**98**		74	**88**
Haxby	Gallatin/Bellona//Cla	98	94	94	96	93	86	59	**86**	**96**			**89**
Hockett	ND7293/Bearpaw	98	96	97	96	96	94	82	**93**	**97**	79	79	**91**
Merit 57	Manley/2B80-350//M	98	95	95	94	87	85	74	**87**	**96**			**89**
Metcalfe	Oxbow/Manley	98	96	96	97	93	94	75	**91**	**97**			**93**
Opera	Overture/Tamtam	96	97	95	87	88	91	63	**85**	**95**			**88**
Sienna	Chronicle/Genie	98	98	98	89	90	95	80	**90**	**98**			**93**
MT080243	MT960101/MT981210	98	97	94	96	88	80	65	**86**	**96**			**88**
MT090202	MT910189//Lk644/Esli	99	98	98	95	93	93	82	**92**	**98**			**94**
MT124008	MT010158/MT070175	99	98	97	97	93	93	74	**91**	**98**			**93**
MT16M00209	MT050187/ND19119	99	99	99	98	99	99	96	**98**	**99**	99		**99**
MT16M00301	MT070157/ND19119	99	99	100	98	99	99	95	**98**	**99**	97		**98**
MT16M00406	MT090180/ND19119	99	99	99	98	97	98	95	**97**	**99**	98		**98**
MT16M00408	MT090180/ND19119	99	99	100	99	98	98	93	**97**	**100**	94		**97**
MT16M00504	MT090190/ND19119	99	99	100	99	98	99	95	**98**	**99**	93		**98**
MT16M00610	MT100130/ND19119	99	99	99	98	98	99	84	**95**	**99**	95		**96**
MT16M00709	MT124688/ND19119	99	99	98	97	96	94	85	**94**	**99**	94		**95**
MT16M00807	Craft/ND19119	99	99	99	99	97	98	94	**98**	**99**	96		**98**
MT16M01003	MT080370/ND24260	99	99	99	98	97	97	89	**96**	**99**	90		**96**
MT16M01206	MT100126/ND24260	99	98	100	98	97	98	93	**97**	**99**	96		**97**
MT16M01303	MT100132/ND24260	99	99	99	99	97	98	88	**96**	**99**	91		**96**
MT16M01405	MT100120/ND24260	99	99	99	97	96	99	93	**97**	**99**	98		**97**
MT16M01704	MT070157/ND24388	98	96	94	96	96	92	75	**91**	**96**	95		**93**
MT16M01803	MT090190/ND24388	99	98	98	98	97	98	81	**94**	**98**	89		**95**
MT16M01806	MT090190/ND24388	99	98	97	99	97	97	89	**96**	**98**	91		**96**
MT16M01819	MT090190/ND24388	99	98	99	97	98	97	89	**96**	**99**	92		**96**
MT16M01902	MT100120/ND24388	97	98	97	97	96	96	82	**94**	**97**	94		**95**
MT16M02002	MT100132/ND24388	98	99	99	96	98	98	91	**96**	**98**	91		**96**
MT16M02003	MT100132/ND24388	97	96	94	95	96	96	80	**92**	**95**	89		**93**
MT16M02008	MT100132/ND24388	99	99	99	98	98	98	88	**96**	**99**	94		**97**
MT16M02101	HOCKETT/ND24388	98	95	92	98	93	93	74	**90**	**95**	92		**92**
MT16M02103	HOCKETT/ND24388	99	98	96	98	99	98	91	**97**	**98**	96		**97**
MT16M02201	HOCKETT/ND24388	99	99	98	98	97	98	83	**95**	**99**	96		**96**
MT16M02610	ND24388//BlackLemm	97	97	97	93	94	93	86	**92**	**97**	94		**94**
MT16M05403	MT090182/METCALFE	98	96	93	96	87	89	82	**90**	**96**	89		**91**
MT16M05610	MT100126/METCALFE	98	98	97	99	94	96	93	**96**	**98**	95		**96**
MT16M05902	PINNACLE/MT050187	98	98	97	95	97	96	85	**94**	**98**		94	**95**
MT16M05904	PINNACLE/MT050187	97	96	96	96	96	96	82	**93**	**96**		83	**93**
MT16M05905	PINNACLE/MT050187	98	99	98	97	96	97	88	**95**	**98**		92	**96**
MT16M06001	MT050187/PINNACLE	97	96	98	95	93	95	83	**92**	**98**		89	**93**
MT16M06501	2AB04-X01039-2/CRAF	99	98	97	91	95	95	83	**93**	**98**		90	**94**
MT16M06604	CRAFT/HARRINGTON	96	96	96	94	91	92	80	**91**	**96**		82	**91**
MT16M06609	CRAFT/HARRINGTON	98	98	97	96	94	97	83	**93**	**98**		80	**93**
MT16M06709	07WA-664.1/CRAFT	98	98	98	94	96	98	82	**93**	**98**		89	**94**
MT16M06902	CRAFT/QUEST	99	99	99	97	94	95	72	**91**	**99**		88	**93**
MT16M07304	ND27572/SCARLETT	99	99	97	97	96	97	83	**94**	**98**		88	**94**
MT16M07702	HOCKETT/2B06-1157	99	99	96	98	96	94	85	**95**	**98**		57	**91**
MT16M08104	CONLON/GERALDINE	99	98	98	97	97	99	88	**96**	**99**		90	**96**
MT16M08301	2AB04-X01039-2/MT0	94	93	93	95	78	83	64	**82**	**94**		76	**84**
MT16M08503	MT050051/07WA-664.	98	98	98	97	92	93	70	**90**	**98**		64	**89**
MT16M08806	MT070157/2B07-2278	97	96	93	95	96	93	69	**90**	**95**	93		**92**
MT16M09503	HOCKETT/PINNACLE	98	99	97	95	96	95	79	**92**	**98**		94	**94**
MT16M09507	HOCKETT/PINNACLE	98	96	97	96	92	91	82	**92**	**98**		77	**91**
MT16M09602	PINNACLE/HOCKETT	99	98	97	96	97	98	87	**95**	**98**		84	**95**
MT16M09604	PINNACLE/HOCKETT	97	98	97	93	94	93	85	**93**	**97**		91	**94**
MT16M09610	PINNACLE/HOCKETT	97	97	96	96	95	93	87	**93**	**97**		82	**93**
MT16M09708	Craft/BlackBetzes	99	96	96	95	92	94	76	**90**	**97**		82	**91**
MT16M10204	MT124688 / BlackBetz	99	94	94	97	80	87	72	**86**	**97**	78		**88**
MT16Y00901	Eslick/ND19119	99	98	99	96	96	98	86	**94**	**99**		93	**95**
MT16Y00904	Eslick/ND19119	99	99	98	96	97	98	90	**96**	**99**		87	**95**
MT16Y02507	Haxby/ND24388	99	97	96	99	97	98	82	**94**	**98**		87	**94**
MT16Y08201	ESLICK/2ND27572	97	97	97	94	91	80	69	**87**	**97**		73	**87**
MT16Y08703	BOWMAN/MT070157	97	98	97	95	98	72	85	**91**	**97**		94	**92**
MT16Y08704	BOWMAN/MT070157	99	97	96	96	98	96	89	**95**	**97**		87	**95**
GRAND MEAN		98.2	97.4	97.1	96.1	94.6	94.0	82.3	92.8	97.6	91.3	81.9	92.5
CV		0.7	0.7	1.3	1.9	2.1	2.1	6.0			*Mean from		
LSD		1.1	1.1	2.1	2.9	3.1	3.9	7.9			entire 2017 expt		

Entries from 2018 EYT		Test Wt (lb/bu)							2018 EYT		PYT 2017 Boz Dry		Test Wt
		Moccasin	Sidney	Bozeman	Bozeman	Havre	Huntley	Huntley	Dry	Irr	SG	MF	Overall
Name	Pedigree	*Dry*	*Dry*	*Dry*	*Irr*	*Dry*	*Dry*	*Irr*	Mean	Mean			Mean
Champion	Baronesse/Camas	57	55	56	55	53	51	50	**54**	**52**		52	**54**
Haxby	Gallatin/Bellona//Cla	57	57	56	55	54	53	52	**55**	**53**			**55**
Hockett	ND7293/Bearpaw	57	56	56	54	52	52	50	**55**	**52**	51	52	**53**
Merit 57	Manley/2B80-350//Me	56	52	54	52	51	49	47	**53**	**50**			**52**
Metcalfe	Oxbow/Manley	56	55	56	53	52	52	50	**54**	**51**			**53**
Opera	Overture/Tamtam	55	51	54	51	51	48	46	**52**	**49**			**51**
Sienna	Chronicle/Genie	56	52	55	53	51	49	48	**53**	**50**			**52**
MT080243	MT960101/MT981210	56	54	56	54	52	52	49	**54**	**51**			**53**
MT090202	MT910189//Lk644/Esli	57	55	55	53	52	51	49	**54**	**51**			**53**
MT124008	MT010158/MT070175	56	54	54	53	52	52	49	**54**	**51**			**53**
MT16M00209	MT050187/ND19119	55	54	55	52	49	49	47	**53**	**49**	53		**52**
MT16M00301	MT070157/ND19119	56	55	56	54	51	50	48	**54**	**51**	53		**53**
MT16M00406	MT090180/ND19119	56	53	54	53	51	50	48	**53**	**51**	52		**52**
MT16M00408	MT090180/ND19119	54	54	53	52	50	49	47	**52**	**50**	50		**51**
MT16M00504	MT090190/ND19119	55	54	54	52	51	51	49	**53**	**51**	52		**52**
MT16M00610	MT100130/ND19119	57	56	55	54	53	52	50	**55**	**52**	53		**54**
MT16M00709	MT124688/ND19119	56	55	55	54	52	51	49	**54**	**51**	52		**53**
MT16M00807	Craft/ND19119	53	52	54	52	50	50	46	**52**	**49**	54		**51**
MT16M01003	MT080370/ND24260	56	55	55	54	52	51	49	**54**	**51**	52		**53**
MT16M01206	MT100126/ND24260	56	56	55	54	53	52	49	**54**	**51**	54		**53**
MT16M01303	MT100132/ND24260	57	56	56	54	53	52	49	**55**	**52**	52		**54**
MT16M01405	MT100120/ND24260	55	55	55	54	52	52	49	**54**	**52**	53		**53**
MT16M01704	MT070157/ND24388	56	53	54	51	50	50	48	**53**	**49**	51		**52**
MT16M01803	MT090190/ND24388	56	55	55	53	53	52	50	**54**	**52**	52		**53**
MT16M01806	MT090190/ND24388	56	55	55	53	53	52	49	**54**	**51**	51		**53**
MT16M01819	MT090190/ND24388	57	56	55	53	51	51	49	**54**	**51**	53		**53**
MT16M01902	MT100120/ND24388	57	54	54	52	50	50	47	**53**	**50**	52		**52**
MT16M02002	MT100132/ND24388	55	54	54	53	51	51	48	**53**	**50**	53		**52**
MT16M02003	MT100132/ND24388	56	54	55	52	51	51	48	**54**	**50**	51		**52**
MT16M02008	MT100132/ND24388	54	55	52	52	51	50	48	**53**	**50**	52		**52**
MT16M02101	HOCKETT/ND24388	56	52	55	49	50	50	48	**53**	**49**	51		**51**
MT16M02103	HOCKETT/ND24388	56	55	55	52	51	50	48	**54**	**50**	52		**52**
MT16M02201	HOCKETT/ND24388	57	54	53	51	51	49	48	**53**	**49**	50		**52**
MT16M02610	ND24388//BlackLemm	54	52	53	52	51	51	49	**52**	**51**	52		**52**
MT16M05403	MT090182/METCALFE	57	54	56	54	53	52	49	**54**	**51**	53		**53**
MT16M05610	MT100126/METCALFE	54	53	55	54	51	51	48	**53**	**51**	51		**52**
MT16M05902	PINNACLE/MT050187	58	57	56	52	54	52	50	**55**	**51**		56	**54**
MT16M05904	PINNACLE/MT050187	58	57	55	53	54	51	49	**55**	**51**		54	**54**
MT16M05905	PINNACLE/MT050187	58	57	55	54	54	52	49	**55**	**52**		54	**54**
MT16M06001	MT050187/PINNACLE	57	56	55	54	54	51	50	**55**	**52**		54	**54**
MT16M06501	2AB04-X01039-2/CRAF	57	55	56	54	52	50	50	**54**	**52**		54	**54**
MT16M06604	CRAFT/HARRINGTON	57	55	55	54	53	53	50	**55**	**52**		53	**54**
MT16M06609	CRAFT/HARRINGTON	58	55	56	54	53	53	50	**55**	**52**		54	**54**
MT16M06709	07WA-664.1/CRAFT	55	55	55	53	53	51	50	**54**	**51**		54	**53**
MT16M06902	CRAFT/QUEST	58	57	56	53	52	51	50	**55**	**52**		56	**54**
MT16M07304	ND27572/SCARLETT	56	54	55	53	52	52	50	**54**	**51**		53	**53**
MT16M07702	HOCKETT/2B06-1157	57	54	56	53	52	51	49	**54**	**51**		50	**53**
MT16M08104	CONLON/GERALDINE	56	56	55	54	53	51	49	**54**	**52**		53	**53**
MT16M08301	2AB04-X01039-2/MT05	56	52	55	54	52	52	50	**54**	**52**		52	**53**
MT16M08503	MT050051/07WA-664.	57	55	56	55	53	53	51	**55**	**53**		50	**54**
MT16M08806	MT070157/2B07-2278	57	54	53	52	52	51	49	**54**	**51**	52		**53**
MT16M09503	HOCKETT/PINNACLE	56	56	56	54	53	52	50	**55**	**52**		53	**54**
MT16M09507	HOCKETT/PINNACLE	56	55	55	54	52	52	49	**54**	**52**		50	**53**
MT16M09602	PINNACLE/HOCKETT	57	56	55	54	53	52	49	**55**	**51**		52	**54**
MT16M09604	PINNACLE/HOCKETT	57	56	56	54	52	50	48	**54**	**51**		54	**53**
MT16M09610	PINNACLE/HOCKETT	56	56	56	55	54	52	51	**55**	**53**		53	**54**
MT16M09708	Craft/BlackBetzes	56	52	55	54	53	52	50	**54**	**52**		53	**53**
MT16M10204	MT124688 / BlackBetz	57	52	56	55	54	54	51	**55**	**53**	53		**54**
MT16Y00901	Eslick/ND19119	56	54	54	53	52	51	49	**54**	**51**		52	**53**
MT16Y00904	Eslick/ND19119	57	56	55	54	52	51	49	**55**	**52**		54	**54**
MT16Y02507	Haxby/ND24388	57	55	56	53	53	51	50	**55**	**52**		53	**54**
MT16Y08201	ESLICK/2ND27572	56	56	55	53	52	52	50	**54**	**52**		53	**53**
MT16Y08703	BOWMAN/MT070157	58	56	56	54	53	51	49	**55**	**52**		55	**54**
MT16Y08704	BOWMAN/MT070157	58	56	57	54	53	51	50	**55**	**52**		53	**54**
GRAND MEAN		56.2	54.6	55.0	53.2	52.0	51.2	49.0	53.9	51.1	51.9	52.5	52.8
CV		1.7	1.0	1.5	1.7	1.0	1.4	0.7			2.6	2.9	
LSD		1.5	0.9	1.4	1.4	1.0	1.2	0.6			3.7	4.2	

The E Y T from Bozeman and Havre has been malted. Six of the experimental lines are the top performing for malt extract. High Beta glucans have been a problem for MT lines in the past. Here there are several lines with Beta glucans lower than the 100ppm cutoff. Another problem now corrected by these new lines is lower FAN (below 200ppm).

Early Yield Trial 2018 Quality Data

Entries from 2018 EYT		Grain Fill (days)				PYT 2017 Boz Dry			Extract (%)			PYT 2017 Boz Dry		
		Havre	Bozeman	Bozeman	EYT Mean	SG	MF	Overall	Bozeman	Huntley	EYT Mean	SG	MF	Overall
Name	Pedigree	*Dry*	*Dry*	*Irr*	**Mean**			Mean	*Dry*	*Dry*	**Mean**			Mean
MT16M02201	HOCKETT/ND24388	30	38	39	**36**	28		**32**	84.9	83.7	**84.3**	72.1		**80.2**
MT16M02101	HOCKETT/ND24388	39	35	38	**37**	31		**35**	83.7	83.6	**83.7**	76.8		**81.4**
MT16M09602	PINNACLE/HOCKETT	37	40	44	**40**		35	**37**	82.1	81.5	**81.8**		59.7	**74.4**
MT16M01704	MT070157/ND24388	29	38	38	**35**	30		**32**	82.5	80.8	**81.7**	77.3		**80.2**
MT16M02103	HOCKETT/ND24388	32	39	43	**38**	31		**34**	81.8	81.4	**81.6**	69.3		**77.5**
MT16M00504	MT090190/ND19119	29	42	40	**37**	30		**34**	81.3	81.8	**81.6**	71.4		**78.2**
Opera	Overture/Tamtam	33	37	38	**36**			**35**	82.6	80.4	**81.5**			**81.5**
MT16M02003	MT100132/ND24388	33	38	39	**37**	31		**34**	81.7	81.1	**81.4**	70.6		**77.8**
MT16M05610	MT100126/METCALFE	29	33	35	**33**	26		**29**	82.0	80.5	**81.3**	71.9		**78.1**
MT16M09604	PINNACLE/HOCKETT	30	34	37	**34**		34	**33**	81.9	80.3	**81.1**		68.5	**76.9**
MT16M07702	HOCKETT/2B06-1157	32	33	36	**34**		30	**32**	81.5	80.2	**80.9**		59.4	**73.7**
Metcalfe	Oxbow/Manley	29	33	36	**33**			**31**	81.4	80.3	**80.9**			**80.9**
MT16M00301	MT070157/ND19119	32	40	42	**38**	31		**34**	80.8	80.7	**80.8**	71.1		**77.5**
MT16M06001	MT050187/PINNACLE	31	37	39	**36**		34	**34**	81.4	80.0	**80.7**		82.8	**81.4**
MT080243	MT960101/MT981210	27	31	34	**31**			**29**	81.7	79.7	**80.7**			**80.7**
MT16M00610	MT100130/ND19119	32	39	42	**38**	30		**34**	81.0	80.2	**80.6**	69.4		**76.9**
MT124008	MT010158/MT070175	33	35	37	**35**			**34**	81.4	79.8	**80.6**			**80.6**
MT16M01206	MT100126/ND24260	32	38	41	**37**	40		**37**	81.4	79.7	**80.6**	86.5		**82.5**
MT16M01819	MT090190/ND24388	33	40	43	**39**	31		**35**	81.2	79.8	**80.5**	70.4		**77.1**
MT16M00709	MT124688/ND19119	32	38	41	**37**	33		**34**	80.2	80.7	**80.5**	88.3		**83.1**
Hockett	ND7293/Bearpaw	29	31	35	**31**	26	28	**28**	80.7	80.2	**80.5**	70.2	71.3	**75.6**
Merit 57	Manley/2B80-350//M	28	36	37	**34**			**32**	80.8	80.1	**80.5**			**80.5**
MT16M02002	MT100132/ND24388	38	42	41	**40**	35		**38**	80.2	80.5	**80.4**	71.0		**77.2**
MT16M00807	Craft/ND19119	37	38	41	**39**	31		**35**	80.7	80.0	**80.4**	71.0		**77.2**
MT16M06604	CRAFT/HARRINGTON	29	33	37	**33**		28	**30**	81.4	79.3	**80.4**		68.5	**76.4**
MT16M01803	MT090190/ND24388	34	41	42	**39**	29		**35**	80.9	79.7	**80.3**	69.6		**76.7**
MT16M01902	MT100120/ND24388	35	39	41	**38**	38		**37**	80.9	79.7	**80.3**	85.4		**82.0**
MT16M05904	PINNACLE/MT050187	34	39	41	**38**		29	**34**	81.0	79.5	**80.3**		54.4	**71.6**
MT16M05403	MT090182/METCALFE	34	37	39	**37**	35		**35**	80.9	79.6	**80.3**	84.5		**81.7**
MT16M01806	MT090190/ND24388	35	38	39	**37**	26		**33**	80.5	79.9	**80.2**	70.7		**77.0**
MT16M09507	HOCKETT/PINNACLE	31	36	39	**35**		31	**33**	80.2	79.9	**80.1**		64.2	**74.8**
MT16M00209	MT050187/ND19119	33	41	40	**38**	30		**34**	80.3	79.6	**80.0**	69.1		**76.3**
MT16M05905	PINNACLE/MT050187	39	42	45	**42**		29	**37**	79.5	80.3	**79.9**		53.9	**71.2**
MT16M08806	MT070157/2B07-2278	28	33	37	**33**	26		**29**	80.0	79.6	**79.8**	74.1		**77.9**
MT16M00408	MT090180/ND19119	34	37	40	**37**	32		**34**	80.2	79.2	**79.7**	72.2		**77.2**
Sienna	Chronicle/Genie	27	35	37	**33**			**31**	80.1	79.3	**79.7**			**79.7**
MT16M01405	MT100120/ND24260	36	38	42	**39**	35		**36**	79.7	79.6	**79.7**	69.5		**76.3**
MT16M02008	MT100132/ND24388	36	37	38	**37**	29		**34**	79.5	79.8	**79.7**	69.1		**76.1**
MT16Y08704	BOWMAN/MT070157	30	35	38	**34**		28	**31**	80.3	78.9	**79.6**		66.7	**75.3**
MT16M05902	PINNACLE/MT050187	40	44	45	**43**		36	**40**	79.5	79.6	**79.6**		55.8	**71.6**
MT16M08104	CONLON/GERALDINE	31	35	37	**34**		27	**31**	80.0	78.8	**79.4**		69.1	**76.0**
MT16Y00904	Eslick/ND19119	27	33	37	**32**		30	**30**	79.6	79.0	**79.3**		67.3	**75.3**
MT16M00406	MT090180/ND19119	34	36	39	**37**	38		**36**	79.5	79.0	**79.3**	70.2		**76.2**
MT090202	MT910189//Lk644/Esli	36	36	37	**36**			**36**	79.9	78.5	**79.2**			**79.2**
MT16M01303	MT100132/ND24260	34	40	39	**38**	30		**35**	79.9	78.4	**79.2**	75.1		**77.8**
MT16Y00901	Eslick/ND19119	29	33	37	**33**		30	**31**	79.4	78.3	**78.9**		68.6	**75.4**
MT16Y02507	Haxby/ND24388	32	36	37	**35**		31	**33**	79.7	77.9	**78.8**		68.8	**75.5**
MT16M10204	MT124688 / BlackBetz	31	32	33	**32**	27		**30**	78.9	78.6	**78.8**	73.2		**76.9**
MT16M09610	PINNACLE/HOCKETT	31	37	39	**36**		30	**33**	79.3	78.1	**78.7**		48.6	**68.7**
MT16M09708	Craft/BlackBetzes	30	34	34	**33**		30	**31**	79.3	78.1	**78.7**		65.1	**74.2**
MT16M01003	MT080370/ND24260	30	35	36	**34**	29		**31**	79.5	77.6	**78.6**	68.8		**75.3**
MT16Y08201	ESLICK/2ND27572	31	34	35	**33**		33	**33**	79.0	77.9	**78.5**		56.4	**71.1**
MT16M07304	ND27572/SCARLETT	31	36	39	**35**		32	**33**	78.6	78.0	**78.3**		83.6	**80.1**
MT16M09503	HOCKETT/PINNACLE	31	36	36	**34**		33	**33**	78.0	78.5	**78.3**		64.3	**73.6**
MT16M08503	MT050051/07WA-664.	29	35	37	**33**		28	**30**	78.0	77.3	**77.7**		59.3	**71.5**
MT16M06501	2AB04-X01039-2/CRAF	28	33	36	**32**		26	**29**	79.5	75.7	**77.6**		72.4	**75.9**
MT16M02610	ND24388//BlackLemm	28	33	32	**31**	31		**31**	77.6	76.7	**77.2**	71.3		**75.2**
MT16M06709	07WA-664.1/CRAFT	30	37	39	**35**		40	**36**	77.9	76.2	**77.1**			**77.1**
MT16M08301	2AB04-X01039-2/MT0	30	32	37	**33**		28	**30**	76.9	76.6	**76.8**		65.2	**72.9**
MT16M06902	CRAFT/QUEST	29	33	36	**33**		31	**31**	76.1	75.6	**75.9**		64.7	**72.1**
Champion	Baronesse/Camas	34	35	37	**35**		31	**34**						
MT16Y08703	BOWMAN/MT070157	30	36	40	**35**		29	**32**					69.7	**69.7**
MT16M06609	CRAFT/HARRINGTON	30	35	35	**33**		30	**31**					69.4	**69.4**
Haxby	Gallatin/Bellona//Cla	28	33	34	**31**			**30**						
GRAND MEAN		31.7	36.3	38.4	35.5	31.4	31	32.5	80.3	79.3	79.8	70.2	66.3	74.0
CV		8.4	3.9			6.9	8.1		MSU lab	USDA lab		3.1		

Entries from					PYT 2017					
2018 EYT		**Beta Glucan** (ppm)			Boz Dry			**S/T Protein** (%)		
		Bozeman	**Huntley**	**EYT Mean**	SG	MF	**Overall**	**Bozeman**	**Huntley**	EYT Mean
Name	**Pedigree**	*Dry*	*Dry*	**Mean**			Mean	*Dry*	*Dry*	Mean
MT16M02201	HOCKETT/ND24388	56	182	**119**	68		**102**	45	55	**50**
MT16M02101	HOCKETT/ND24388	52	82	**67**	50		**62**	49	57	**53**
MT16M09602	PINNACLE/HOCKETT	24	265	**144**		127	**138**	47	49	**48**
MT16M01704	MT070157/ND24388	121	210	**166**	33		**121**	44	47	**45**
MT16M02103	HOCKETT/ND24388	184	431	**307**	55		**223**	45	50	**48**
MT16M00504	MT090190/ND19119	80	430	**255**	63		**191**	41	47	**44**
Opera	Overture/Tamtam	32	190	**111**			**111**	42	43	**42**
MT16M02003	MT100132/ND24388	60	402	**231**	86		**182**	40	44	**42**
MT16M05610	MT100126/METCALFE	50	156	**103**	44		**84**	52	51	**51**
MT16M09604	PINNACLE/HOCKETT	31	297	**164**		82	**137**	51	47	**49**
MT16M07702	HOCKETT/2B06-1157	26	322	**174**		75	**141**	43	44	**43**
Metcalfe	Oxbow/Manley	10	115	**62**			**62**	50	46	**48**
MT16M00301	MT070157/ND19119	240	517	**379**	188		**315**	44	43	**43**
MT16M06001	MT050187/PINNACLE	32	178	**105**		26	**79**	52	44	**48**
MT080243	MT960101/MT981210	11	175	**93**			**93**	47	41	**44**
MT16M00610	MT100130/ND19119	97	295	**196**	71		**154**	40	44	**42**
MT124008	MT010158/MT070175	25	192	**109**			**109**	53	47	**50**
MT16M01206	MT100126/ND24260	89	328	**208**	199		**205**	45	44	**45**
MT16M01819	MT090190/ND24388	114	292	**203**	55		**154**	35	37	**36**
MT16M00709	MT124688/ND19119	196	299	**247**	271		**255**	34	42	**38**
Hockett	ND7293/Bearpaw	69	195	**132**	62	152	**119**	41	44	**42**
Merit 57	Manley/2B80-350//M	11	165	**88**			**88**	53	47	**50**
MT16M02002	MT100132/ND24388	244	426	**335**	88		**253**	38	43	**40**
MT16M00807	Craft/ND19119	108	237	**172**	69		**138**	46	43	**44**
MT16M06604	CRAFT/HARRINGTON	39	224	**131**		72	**112**	44	42	**43**
MT16M01803	MT090190/ND24388	62	218	**140**	55		**112**	40	43	**41**
MT16M01902	MT100120/ND24388	71	293	**182**	81		**148**	38	42	**40**
MT16M05904	PINNACLE/MT050187	41	410	**225**		3	**151**	48	45	**46**
MT16M05403	MT090182/METCALFE	37	318	**177**	185		**180**	44	43	**44**
MT16M01806	MT090190/ND24388	64	153	**108**	81		**99**	35	44	**39**
MT16M09507	HOCKETT/PINNACLE	73	418	**246**		71	**187**	43	42	**42**
MT16M00209	MT050187/ND19119	112	339	**225**	93		**181**	41	43	**42**
MT16M05905	PINNACLE/MT050187	88	213	**150**		96	**132**	44	50	**47**
MT16M08806	MT070157/2B07-2278	75	355	**215**	39		**156**	43	43	**43**
MT16M00408	MT090180/ND19119	73	287	**180**	71		**144**	49	49	**49**
Sienna	Chronicle/Genie	327	267	**297**			**297**	46	43	**44**
MT16M01405	MT100120/ND24260	82	125	**104**	228		**145**	38	40	**39**
MT16M02008	MT100132/ND24388	109	315	**212**	83		**169**	43	41	**42**
MT16Y08704	BOWMAN/MT070157	51	507	**279**		88	**215**	39	42	**40**
MT16M05902	PINNACLE/MT050187	101	238	**170**		107	**149**	34	44	**39**
MT16M08104	CONLON/GERALDINE	74	290	**182**		61	**142**	46	43	**44**
MT16Y00904	Eslick/ND19119	91	355	**223**		139	**195**	45	45	**45**
MT16M00406	MT090180/ND19119	97	290	**193**	142		**176**	45	46	**46**
MT090202	MT910189//Lk644/Esli	32	285	**159**			**159**	38	40	**39**
MT16M01303	MT100132/ND24260	293	481	**387**	107		**294**	37	34	**35**
MT16Y00901	Eslick/ND19119	29	220	**125**		244	**165**	39	40	**39**
MT16Y02507	Haxby/ND24388	345	535	**440**		255	**378**	32	33	**33**
MT16M10204	MT124688 / BlackBetz	124	413	**268**	152		**230**	0	37	**18**
MT16M09610	PINNACLE/HOCKETT	223	476	**349**		168	**289**	34	35	**35**
MT16M09708	Craft/BlackBetzes	70	367	**218**		386	**274**	0	34	**17**
MT16M01003	MT080370/ND24260	225	476	**350**	185		**295**	36	35	**35**
MT16Y08201	ESLICK/2ND27572	49	340	**194**		571	**320**	46	46	**46**
MT16M07304	ND27572/SCARLETT	161	280	**220**		214	**218**	35	36	**36**
MT16M09503	HOCKETT/PINNACLE	205	470	**338**		334	**336**	35	35	**35**
MT16M08503	MT050051/07WA-664.	163	692	**428**		234	**363**	29	33	**31**
MT16M06501	2AB04-X01039-2/CRAF	109	315	**212**		208	**211**	39	33	**36**
MT16M02610	ND24388//BlackLemm	72	354	**213**	42		**156**	0	35	**18**
MT16M06709	07WA-664.1/CRAFT	61	425	**243**			**243**	38	35	**37**
MT16M08301	2AB04-X01039-2/MT0	695	758	**726**		1130	**861**	27	32	**30**
MT16M06902	CRAFT/QUEST	66	370	**218**		20	**152**	33	37	**35**
Champion	Baronesse/Camas									
MT16Y08703	BOWMAN/MT070157					296	**296**			
MT16M06609	CRAFT/HARRINGTON					228	**228**			
Haxby	Gallatin/Bellona//Clark/Lamont									
GRAND MEAN		109.1	328.0	218.6	147	185	192.3	41.7	41.9	41.8
CV		MSU lab	USDA lab		15			MSU lab	USDA lab	
LSD					64.2					

Entries from 2018 EYT		Soluble Protein (%)			PYT 2017 Boz Dry			Alpha Amylase (20˚DU)			PYT 2017 Boz Dry		
		Bozeman	Huntley	EYT Mean	SG	MF	Overall	Bozeman	Huntley	EYT Mean	SG	MF	Overall
Name	Pedigree	*Dry*	Dry	Mean			Mean	*Dry*	*Dry*	Mean			Mean
MT16M02201	HOCKETT/ND24388	5.0	6.4	**6**	5		**5**	68	98	**83**	86		**84**
MT16M02101	HOCKETT/ND24388	5.0	6.5	**6**	5		**5**	88	104	**96**	104		**99**
MT16M09602	PINNACLE/HOCKETT	4.8	5.9	**5**		4	**5**	104	101	**103**		90	**98**
MT16M01704	MT070157/ND24388	4.7	5.8	**5**	5		**5**	91	81	**86**	105		**92**
MT16M02103	HOCKETT/ND24388	4.9	5.9	**5**	5		**5**	80	90	**85**	124		**98**
MT16M00504	MT090190/ND19119	4.7	5.9	**5**	5		**5**	89	85	**87**	104		**93**
Opera	Overture/Tamtam	4.0	5.5	**5**			**5**	69	73	**71**			**71**
MT16M02003	MT100132/ND24388	4.1	5.1	**5**	5		**5**	79	76	**77**	85		**80**
MT16M05610	MT100126/METCALFE	5.2	6.4	**6**	5		**6**	102	111	**107**	126		**113**
MT16M09604	PINNACLE/HOCKETT	5.6	6.2	**6**		6	**6**	103	127	**115**		112	**114**
MT16M07702	HOCKETT/2B06-1157	4.8	6.0	**5**		5	**5**	87	117	**102**		123	**109**
Metcalfe	Oxbow/Manley	5.5	6.4	**6**			**6**	98	77	**88**			**88**
MT16M00301	MT070157/ND19119	4.8	5.5	**5**	5		**5**	62	68	**65**	77		**69**
MT16M06001	MT050187/PINNACLE	5.6	6.3	**6**		6	**6**	100	100	**100**		114	**105**
MT080243	MT960101/MT981210	5.0	5.9	**5**			**5**	102	74	**88**			**88**
MT16M00610	MT100130/ND19119	4.4	5.5	**5**	5		**5**	59	83	**71**	92		**78**
MT124008	MT010158/MT070175	5.1	6.1	**6**			**6**	103	106	**105**			**105**
MT16M01206	MT100126/ND24260	5.1	6.0	**6**	6		**6**	73	85	**79**	60		**73**
MT16M01819	MT090190/ND24388	4.0	4.8	**4**	5		**4**	58	55	**57**	88		**67**
MT16M00709	MT124688/ND19119	3.5	5.0	**4**	5		**5**	43	77	**60**	77		**65**
Hockett	ND7293/Bearpaw	4.6	5.7	**5**	5	5	**5**	83	130	**106**	107	90	**102**
Merit 57	Manley/2B80-350//M	5.6	6.2	**6**			**6**	120	101	**111**			**111**
MT16M02002	MT100132/ND24388	4.1	5.3	**5**	5		**5**	44	59	**51**	82		**62**
MT16M00807	Craft/ND19119	5.2	5.8	**6**	6		**6**	49	77	**63**	86		**71**
MT16M06604	CRAFT/HARRINGTON	4.5	5.5	**5**		5	**5**	82	87	**85**		86	**85**
MT16M01803	MT090190/ND24388	4.2	5.2	**5**	4		**5**	62	75	**69**	94		**77**
MT16M01902	MT100120/ND24388	4.1	5.2	**5**	5		**5**	72	76	**74**	86		**78**
MT16M05904	PINNACLE/MT050187	5.2	6.2	**6**		5	**5**	98	104	**101**		109	**104**
MT16M05403	MT090182/METCALFE	4.5	5.5	**5**	6		**5**	81	87	**84**	86		**84**
MT16M01806	MT090190/ND24388	3.7	5.1	**4**	4		**4**	44	62	**53**	63		**56**
MT16M09507	HOCKETT/PINNACLE	4.7	5.5	**5**		5	**5**	105	108	**106**		117	**110**
MT16M00209	MT050187/ND19119	4.3	5.1	**5**	4		**5**	61	63	**62**	72		**65**
MT16M05905	PINNACLE/MT050187	4.8	6.1	**5**		4	**5**	64	75	**70**		92	**77**
MT16M08806	MT070157/2B07-2278	4.7	5.7	**5**	5		**5**	85	88	**86**	106		**93**
MT16M00408	MT090180/ND19119	5.3	6.2	**6**	6		**6**	63	77	**70**	92		**77**
Sienna	Chronicle/Genie	4.6	5.6	**5**			**5**	46	108	**77**			**77**
MT16M01405	MT100120/ND24260	3.8	5.0	**4**	5		**4**	50	73	**62**	78		**67**
MT16M02008	MT100132/ND24388	4.7	5.2	**5**	5		**5**	44	67	**55**	73		**61**
MT16Y08704	BOWMAN/MT070157	4.4	5.5	**5**		5	**5**	79	78	**79**		114	**91**
MT16M05902	PINNACLE/MT050187	3.8	5.5	**5**		4	**4**	53	66	**59**		76	**65**
MT16M08104	CONLON/GERALDINE	5.4	6.2	**6**		6	**6**	76	112	**94**		104	**98**
MT16Y00904	Eslick/ND19119	5.4	6.3	**6**		5	**6**	92	98	**95**		98	**96**
MT16M00406	MT090180/ND19119	4.6	5.6	**5**	5		**5**	82	94	**88**	85		**87**
MT090202	MT910189//Lk644/Esli	3.9	5.1	**5**			**5**	63	75	**69**			**69**
MT16M01303	MT100132/ND24260	4.2	4.8	**5**	5		**5**	59	72	**65**	87		**73**
MT16Y00901	Eslick/ND19119	4.4	5.2	**5**		5	**5**	66	76	**71**		80	**74**
MT16Y02507	Haxby/ND24388	3.7	4.6	**4**		4	**4**	55	57	**56**		68	**60**
MT16M10204	MT124688 / BlackBetz	3.6	4.9	**4**	5		**4**	44	56	**50**	73		**58**
MT16M09610	PINNACLE/HOCKETT	3.9	4.8	**4**		3	**4**	65	70	**67**		79	**71**
MT16M09708	Craft/BlackBetzes	4.0	4.7	**4**		4	**4**	60	64	**62**		71	**65**
MT16M01003	MT080370/ND24260	4.4	5.1	**5**	5		**5**	66	68	**67**	86		**73**
MT16Y08201	ESLICK/2ND27572	5.1	6.3	**6**		4	**5**	79	81	**80**		67	**75**
MT16M07304	ND27572/SCARLETT	4.5	5.3	**5**		6	**5**	79	69	**74**		96	**81**
MT16M09503	HOCKETT/PINNACLE	4.0	4.8	**4**		4	**4**	38	50	**44**		51	**46**
MT16M08503	MT050051/07WA-664.	3.6	4.6	**4**		4	**4**	49	55	**52**		76	**60**
MT16M06501	2AB04-X01039-2/CRAF	4.4	5.1	**5**		5	**5**	66	58	**62**		71	**65**
MT16M02610	ND24388//BlackLemm	4.9	5.8	**5**	5		**5**	51	54	**53**	75		**60**
MT16M06709	07WA-664.1/CRAFT	4.5	5.3	**5**			**5**	65	72	**68**			**68**
MT16M08301	2AB04-X01039-2/MT0	3.1	4.4	**4**		4	**4**	34	45	**39**		50	**43**
MT16M06902	CRAFT/QUEST	4.2	5.4	**5**		5	**5**	92	83	**87**		100	**91**
Champion	Baronesse/Camas												
MT16Y08703	BOWMAN/MT070157					5	**5**					128	**128**
MT16M06609	CRAFT/HARRINGTON					5	**5**					64	**64**
Haxby	Gallatin/Bellona//Clark/Lamont												
GRAND MEAN		4.5	5.5	5.0	4.8	4.8	4.9	72.0	80.8	76.4	86.8	89	82.2
CV		MSU lab	USDA lab		4.6			MSU lab	USDA lab		7.7		
LSD					0.6						19.5		

Entries from					PYT 2017						PYT 2017		
2018 EYT		**FAN**	(ppm)		Boz Dry			**DP**	(˚ASBC)		Boz Dry		
		Bozeman	**Huntley**	**EYT Mean**	SG	MF	**Overall**	**Bozeman**	**Huntley**	**EYT Mean**	SG	MF	**Overall**
Name	**Pedigree**	*Dry*	*Dry*	**Mean**			Mean	*Dry*	*Dry*	**Mean**			Mean
MT16M02201	HOCKETT/ND24388	244	287	**266**	189		**240**	140	125	**132**	188		**151**
MT16M02101	HOCKETT/ND24388	233	289	**261**	181		**234**	142	140	**141**	151		**144**
MT16M09602	PINNACLE/HOCKETT	228	246	**237**		155	**210**	152	118	**135**		160	**143**
MT16M01704	MT070157/ND24388	235	250	**242**	224		**236**	144	118	**131**	113		**125**
MT16M02103	HOCKETT/ND24388	229	270	**250**	202		**234**	166	127	**146**	223		**172**
MT16M00504	MT090190/ND19119	245	235	**240**	207		**229**	160	145	**152**	199		**168**
Opera	Overture/Tamtam	195	224	**210**			**210**	118	145	**132**			**132**
MT16M02003	MT100132/ND24388	205	195	**200**	180		**193**	208	178	**193**	264		**216**
MT16M05610	MT100126/METCALFE	270	292	**281**	204		**255**	185	187	**186**	227		**200**
MT16M09604	PINNACLE/HOCKETT	294	254	**274**		223	**257**	198	202	**200**		223	**208**
MT16M07702	HOCKETT/2B06-1157	249	268	**258**		211	**243**	191	181	**186**		267	**213**
Metcalfe	Oxbow/Manley	255	278	**267**			**267**	166	124	**145**			**145**
MT16M00301	MT070157/ND19119	223	224	**224**	147		**198**	126	103	**114**	137		**122**
MT16M06001	MT050187/PINNACLE	275	285	**280**		281	**280**	173	166	**169**		223	**187**
MT080243	MT960101/MT981210	249	238	**243**			**243**	163	189	**176**			**176**
MT16M00610	MT100130/ND19119	196	215	**206**	180		**197**	151	178	**164**	242		**190**
MT124008	MT010158/MT070175	254	263	**259**			**259**	165	194	**179**			**179**
MT16M01206	MT100126/ND24260	251	245	**248**	217		**238**	129	161	**145**	153		**147**
MT16M01819	MT090190/ND24388	168	156	**162**	151		**158**	180	164	**172**	212		**186**
MT16M00709	MT124688/ND19119	150	165	**157**	197		**170**	148	155	**151**	140		**148**
Hockett	ND7293/Bearpaw	201	227	**214**	190	194	**203**	170	156	**163**	237	215	**194**
Merit 57	Manley/2B80-350//M	287	270	**279**			**279**	168	144	**156**			**156**
MT16M02002	MT100132/ND24388	175	203	**189**	163		**180**	145	142	**143**	208		**165**
MT16M00807	Craft/ND19119	242	234	**238**	214		**230**	144	133	**139**	171		**149**
MT16M06604	CRAFT/HARRINGTON	231	197	**214**		192	**207**	133	132	**132**		170	**145**
MT16M01803	MT090190/ND24388	185	197	**191**	172		**185**	179	192	**185**	267		**212**
MT16M01902	MT100120/ND24388	201	206	**203**	198		**201**	177	177	**177**	195		**183**
MT16M05904	PINNACLE/MT050187	275	272	**273**		188	**245**	151	137	**144**		182	**157**
MT16M05403	MT090182/METCALFE	211	212	**211**	258		**227**	178	199	**189**	252		**210**
MT16M01806	MT090190/ND24388	151	181	**166**	141		**158**	158	165	**161**	188		**170**
MT16M09507	HOCKETT/PINNACLE	217	218	**218**		195	**210**	149	129	**139**		217	**165**
MT16M00209	MT050187/ND19119	186	190	**188**	159		**178**	117	102	**110**	156		**125**
MT16M05905	PINNACLE/MT050187	220	256	**238**		172	**216**	129	131	**130**		211	**157**
MT16M08806	MT070157/2B07-2278	246	236	**241**	216		**233**	132	119	**125**	155		**135**
MT16M00408	MT090180/ND19119	264	263	**263**	156		**228**	152	133	**142**	173		**152**
Sienna	Chronicle/Genie	215	207	**211**			**211**	98	176	**137**			**137**
MT16M01405	MT100120/ND24260	176	174	**175**	165		**172**	131	140	**136**	144		**138**
MT16M02008	MT100132/ND24388	193	188	**190**	166		**182**	155	153	**154**	265		**191**
MT16Y08704	BOWMAN/MT070157	226	217	**222**		210	**218**	155	126	**140**		178	**153**
MT16M05902	PINNACLE/MT050187	162	207	**185**		131	**167**	146	132	**139**		164	**147**
MT16M08104	CONLON/GERALDINE	271	251	**261**		244	**255**	165	163	**164**		214	**180**
MT16Y00904	Eslick/ND19119	254	270	**262**		244	**256**	148	137	**142**		212	**166**
MT16M00406	MT090180/ND19119	207	226	**217**	186		**207**	160	193	**176**	214		**189**
MT090202	MT910189//Lk644/Esli	179	182	**180**			**180**	168	207	**188**			**188**
MT16M01303	MT100132/ND24260	171	154	**162**	194		**173**	158	131	**144**	208		**166**
MT16Y00901	Eslick/ND19119	197	192	**194**		176	**188**	161	160	**161**		168	**163**
MT16Y02507	Haxby/ND24388	137	137	**137**		124	**133**	77	74	**76**		101	**84**
MT16M10204	MT124688 / BlackBetz	160	160	**160**	169		**163**	119	141	**130**	246		**168**
MT16M09610	PINNACLE/HOCKETT	187	150	**168**		116	**151**	150	166	**158**		203	**173**
MT16M09708	Craft/BlackBetzes	154	140	**147**		136	**143**	105	115	**110**		155	**125**
MT16M01003	MT080370/ND24260	185	171	**178**	210		**188**	125	94	**109**	166		**128**
MT16Y08201	ESLICK/2ND27572	239	257	**248**		183	**226**	164	159	**161**		195	**172**
MT16M07304	ND27572/SCARLETT	216	188	**202**		249	**218**	138	154	**146**		154	**148**
MT16M09503	HOCKETT/PINNACLE	153	139	**146**		135	**142**	203	197	**200**		234	**212**
MT16M08503	MT050051/07WA-664.	147	134	**140**		138	**140**	155	140	**147**		190	**162**
MT16M06501	2AB04-X01039-2/CRAF	168	163	**166**		158	**163**	172	165	**168**		184	**174**
MT16M02610	ND24388//BlackLemm	235	200	**217**	162		**199**	213	202	**207**	213		**209**
MT16M06709	07WA-664.1/CRAFT	189	156	**173**			**173**	195	208	**202**			**202**
MT16M08301	2AB04-X01039-2/MT0	112	125	**119**		113	**117**	130	138	**134**		188	**152**
MT16M06902	CRAFT/QUEST	183	197	**190**		206	**195**	193	216	**204**		239	**216**
Champion	Baronesse/Camas												
MT16Y08703	BOWMAN/MT070157					255	**255**					196	**196**
MT16M06609	CRAFT/HARRINGTON					162	**162**					202	**202**
Haxby	Gallatin/Bellona//Clark/Lamont												
GRAND MEAN		210.9	212.4	211.7	196	188	201.9	154.4	151.9	153.2	196	195	174.4
CV		MSU lab	USDA lab		9.3			MSU lab	USDA lab		17		
LSD					53						97		

Intrastate

The Intrastate also originated from the 2017 PYT and several out yield Hockett across all environments and have lower protein. This may in part be due to the low protein gene plus a stay green genotype that increase grainfill time. The average grainfill for Hockett is ~31 days while new lines range from 30-40 days. These new lines tend to mature around the same time as Hockett, but generally feature earlier heading dates that enable grain filling prior to summer stress.

Entries from 2018 Intrastate		Yield	(bu/ac)	high → low							2018 Intrastate				Yield
		Bozemar	Sidney	Bozemar	Huntley	Conrad	Sidney	Huntley	Havre	Moccasir	Dry	Irr	PYT SG	PYT MF	Overall
Name	Pedigree	*Irr*	*Irr*	*Dry*	*Irr*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	Mean	Mean	*7 Boz Dr*	*7 Boz Dr*	Mean
Bow	SM04261/TR05285	105	138	101	102	114	81	64	49	48	**76**	**115**			**89**
Fraser	TR04280/SM04261	139	140	138	104	110	90	84	54	55	**89**	**128**			**102**
Genie	NSL07-8424	148	134	141	103	107	92	73	61	53	**88**	**128**			**101**
Hockett	ND7293/Bearpaw	116	128	131	104	96	91	87	63	57	**87**	**116**	70	82	**93**
Merit 57	Manley/2B80-350//M	151	144	133	115	75	88	93	55	58	**84**	**137**			**101**
Metcalfe	Oxbow/Manley	112	126	130	93	115	71	84	54	51	**84**	**111**			**93**
Odyssey	Concerto/Quench	161	143	149	109	87	88	83	62	59	**88**	**137**	79		**102**
Synergy	TR02267/Newdale	141	144	136	105	118	97	87	56	46	**90**	**130**			**103**
2B11-4949	Merit 57/MT050118	155	127	135	109	94	73	91	55	51	**83**	**130**			**99**
2B11-5166	2B03-3604/2B06-1161	119	132	128	103	112	81	88	61	53	**87**	**118**			**98**
MT16M00105	MT050002/ND19119	116	119	136	113	105	72	85	66	50	**86**	**116**	81		**94**
MT16M00202	MT050187/ND19119	127	104	113	100	120	83	87	53	46	**84**	**110**	78		**91**
MT16M00305	MT070157/ND19119	140	131	130	100	100	96	75	51	50	**84**	**124**	82		**96**
MT16M00307	MT070157/ND19119	137	111	124	96	89	87	81	56	40	**80**	**115**	75		**90**
MT16M00407	MT090180/ND19119	132	131	132	106	91	83	92	55	50	**84**	**123**	78		**95**
MT16M00508	MT090190/ND19119	139	128	124	99	99	88	88	52	50	**83**	**122**	90		**96**
MT16M00603	MT100130/ND19119	145	116	129	105	97	90	81	53	55	**84**	**122**	73		**94**
MT16M00707	MT124688/ND19119	125	119	130	106	101	90	88	61	60	**88**	**117**	86		**96**
MT16M00801	Craft/ND19119	125	141	137	101	94	92	82	52	59	**86**	**122**	89		**97**
MT16M00806	Craft/ND19119	130	145	137	110	76	88	89	58	56	**84**	**128**	76		**97**
MT16M01106	MT090182/ND24260	143	134	128	109	97	99	91	60	53	**88**	**129**	83		**100**
MT16M01204	MT100126/ND24260	135	110	130	91	98	81	76	50	38	**79**	**112**	79		**89**
MT16M01409	MT100120/ND24260	136	140	123	100	91	107	83	56	49	**85**	**126**	80		**97**
MT16M01701	MT070157/ND24388	100	143	120	99	92	88	88	63	59	**85**	**114**	78		**93**
MT16M01705	MT070157/ND24388	106	114	101	81	118	76	73	56	53	**79**	**100**	85		**86**
MT16M01709	MT070157/ND24388	120	126	119	102	110	87	91	57	52	**86**	**116**	71		**93**
MT16M01801	MT090190/ND24388	143	146	138	120	80	100	97	60	55	**88**	**136**	80		**102**
MT16M01804	MT090190/ND24388	139	150	124	104	101	103	88	51	51	**86**	**131**	84		**99**
MT16M01805	MT090190/ND24388	146	133	136	100	95	97	83	60	51	**87**	**126**	80		**98**
MT16M01809	MT090190/ND24388	144	138	127	95	118	86	81	55	53	**87**	**125**	86		**98**
MT16M01812	MT090190/ND24388	120	124	114	91	95	86	79	53	51	**80**	**112**	75		**89**
MT16M01901	MT100120/ND24388	137	123	113	113	93	98	83	54	49	**82**	**125**	85		**95**
MT16M01903	MT100120/ND24388	127	133	118	106	97	91	87	57	54	**84**	**122**	71		**94**
MT16M01904	MT100120/ND24388	129	93	132	103	93	97	87	57	54	**87**	**108**	74		**92**
MT16M02004	MT100132/ND24388	153	150	142	103	84	97	82	59	53	**86**	**135**	75		**100**
MT16M02106	HOCKETT/ND24388	122	129	133	100	81	101	74	63	55	**84**	**117**	74		**93**
MT16M02107	HOCKETT/ND24388	123	141	117	97	94	91	95	59	54	**85**	**121**	83		**96**
MT16M02204	HOCKETT/ND24388	134	129	147	106	93	78	88	57	51	**86**	**123**	87		**97**
MT16M05909	PINNACLE/MT050187	119	119	114	106	90	77	80	49	49	**76**	**115**		97	**90**
MT16M06110	MT100120/PINNACLE	118	107	121	105	95	70	90	57	49	**80**	**110**	75		**89**
MT16M06402	CRAFT/CONRAD	138	140	138	104	92	96	99	60	63	**91**	**127**		84	**101**
MT16M06404	CRAFT/CONRAD	125	112	130	107	100	76	97	56	58	**86**	**115**		94	**95**
MT16M06409	CRAFT/CONRAD	122	103	130	103	92	86	92	57	55	**85**	**109**		80	**92**
MT16M07108	SCARLETT/CRAFT	103	136	105	101	100	98	83	54	54	**82**	**113**		80	**91**
MT16M07706	HOCKETT/2B06-1157	115	136	125	105	93	80	99	60	53	**85**	**119**		96	**96**
MT16M07806	MT124688/HARRINGT	148	127	131	112	87	86	85	59	49	**83**	**129**	90		**97**
MT16M08502	MT050051/07WA-664.	139	141	140	108	89	90	101	62	63	**91**	**129**		84	**102**
MT16M08601	MT050187/2AB08X04I	129	126	118	103	92	97	71	59	46	**81**	**120**		87	**93**
MT16M08808	MT070157/2B07-2278	110	110	115	95	80	91	83	60	56	**81**	**105**	83		**88**
GRAND MEAN		130.3	128.8	127.4	103.1	96.7	88.3	85.4	56.8	52.6	84.5	120.7	64.6	70.7	91.3
CV		8.8	6.8	6.1	5.8	19.3	10.3	8.6	5.5	11.4	**11.5**		11.7	17.7	
LSD		18.7	14.2	12.7	9.7	30.3	14.8	12.0	5.1	9.8	**6.3**		20.6	34.7	
													*Mean/CV/LSD from entire 2017 expt		

Entries from 2018 Intrastate		Protein (%)		low → high							2018 Intrastate		PYT 2017 Boz Dry		Protein
		Havre	Bozeman	Bozeman	Huntley	Sidney	Huntley	Sidney	Conrad	Moccasi	Dry	Irr	SG	MF	Overall
Name	Pedigree	Dry	Dry	Irr	Irr	Irr	Dry	Dry	Dry	Dry	Mean	Mean			Mean
Bow	SM04261/TR05285	10.1	11.7	11.5	12.4	12.9	13.4	13.6	13.1	9.0	**12.4**	**12.3**			**12.3**
Fraser	TR04280/SM04261	10.1	10.7	11.0	11.7	12.8	12.8	13.2	14.7	9.0	**12.3**	**11.8**			**12.1**
Genie	NSL07-8424	9.1	11.0	10.5	11.3	12.5	13.0	13.6	15.3	8.5	**12.4**	**11.4**			**12.0**
Hockett	ND7293/Bearpaw	9.8	12.1	13.0	11.7	12.4	12.4	13.0	15.0	9.2	**12.5**	**12.4**	13.1	13.0	**12.5**
Merit 57	Manley/2B80-350//M	9.5	11.1	12.1	12.4	13.3	13.5	12.6	16.3	9.2	**12.6**	**12.6**			**12.6**
Metcalfe	Oxbow/Manley	10.4	11.8	12.6	13.5	13.6	13.7	14.2	13.2	9.6	**12.7**	**13.2**			**12.9**
Odyssey	Concerto/Quench	8.7	10.8	10.9	11.1	12.1	13.0	11.8	15.4	9.4	**11.9**	**11.4**	12.8		**11.8**
Synergy	TR02267/Newdale	9.7	11.8	12.0	12.4	12.6	12.5	12.8	13.6	9.0	**12.1**	**12.3**			**12.2**
2B11-4949	Merit 57/MT050118	9.3	11.4	12.1	11.6	12.6	13.3	11.7	14.4	8.9	**12.0**	**12.1**			**12.1**
2B11-5166	2B03-3604/2B06-1161	9.3	11.7	12.2	11.8	12.6	13.3	12.6	13.5	9.0	**12.1**	**12.2**			**12.1**
MT16M00105	MT050002/ND19119	9.3	10.7	11.1	11.0	12.0	12.4	11.4	13.6	8.5	**11.5**	**11.4**	12.5		**11.6**
MT16M00202	MT050187/ND19119	10.8	11.9	12.0	12.1	13.1	13.0	12.6	13.8	9.8	**12.4**	**12.4**	12.8		**12.5**
MT16M00305	MT070157/ND19119	9.9	11.9	11.4	11.8	12.5	12.1	12.5	14.6	9.4	**12.2**	**11.9**	12.4		**12.1**
MT16M00307	MT070157/ND19119	9.9	12.2	12.2	12.3	13.3	13.1	13.0	15.1	9.5	**12.7**	**12.6**	12.8		**12.7**
MT16M00407	MT090180/ND19119	10.1	11.8	11.5	11.9	12.9	12.7	13.4	14.3	9.3	**12.5**	**12.1**	13.2		**12.4**
MT16M00508	MT090190/ND19119	10.3	12.1	12.2	12.6	13.3	13.1	13.0	14.4	9.8	**12.6**	**12.7**	12.3		**12.6**
MT16M00603	MT100130/ND19119	10.3	11.4	11.4	12.1	12.8	12.8	12.5	14.7	9.6	**12.3**	**12.1**	12.4		**12.3**
MT16M00707	MT124688/ND19119	9.6	11.1	11.3	11.5	12.6	12.4	12.1	14.5	8.4	**11.9**	**11.8**	12.1		**11.9**
MT16M00801	Craft/ND19119	10.1	12.5	12.4	13.2	13.5	13.7	13.0	14.3	10.0	**12.7**	**13.0**	12.4		**12.8**
MT16M00806	Craft/ND19119	9.2	11.8	12.3	11.8	12.9	13.1	12.3	15.5	8.7	**12.4**	**12.3**	13.0		**12.4**
MT16M01106	MT090182/ND24260	9.7	10.5	10.2	11.3	12.0	11.7	12.9	14.4	9.0	**11.8**	**11.2**	11.9		**11.6**
MT16M01204	MT100126/ND24260	10.2	11.2	11.1	11.5	12.0	12.4	12.5	14.6	9.4	**12.2**	**11.5**	12.0		**11.9**
MT16M01409	MT100120/ND24260	10.3	12.5	13.0	12.6	12.3	13.3	13.1	13.8	9.9	**12.6**	**12.6**	12.8		**12.6**
MT16M01701	MT070157/ND24388	9.7	11.2	11.6	12.0	12.4	12.7	12.8	14.0	8.8	**12.1**	**12.0**	11.6		**12.0**
MT16M01705	MT070157/ND24388	9.4	11.6	11.4	11.6	12.3	12.2	11.7	14.0	9.6	**11.8**	**11.8**	12.6		**11.9**
MT16M01709	MT070157/ND24388	9.3	11.6	10.8	12.2	13.3	13.0	13.4	14.7	9.7	**12.4**	**12.1**	11.8		**12.2**
MT16M01801	MT090190/ND24388	9.1	10.4	10.4	10.8	11.8	11.4	12.6	16.3	8.8	**12.0**	**11.0**	11.8		**11.6**
MT16M01804	MT090190/ND24388	9.9	11.5	11.2	12.0	13.3	12.8	13.3	15.0	9.7	**12.5**	**12.2**	11.9		**12.3**
MT16M01805	MT090190/ND24388	9.6	10.9	10.6	11.1	12.1	11.9	12.6	15.3	9.6	**12.1**	**11.3**	11.3		**11.7**
MT16M01809	MT090190/ND24388	9.7	10.4	10.3	11.4	12.3	11.6	12.1	14.2	8.6	**11.6**	**11.3**	12.4		**11.6**
MT16M01812	MT090190/ND24388	9.9	11.4	11.5	12.3	12.8	12.7	13.3	14.1	9.5	**12.3**	**12.2**	12.2		**12.2**
MT16M01901	MT100120/ND24388	9.4	10.4	10.4	11.2	11.8	11.1	11.2	13.9	9.0	**11.2**	**11.1**	11.4		**11.2**
MT16M01903	MT100120/ND24388	9.9	10.4	10.4	11.3	11.7	11.9	12.9	14.7	9.0	**12.0**	**11.1**	10.9		**11.6**
MT16M01904	MT100120/ND24388	9.4	11.0	11.1	11.7	12.6	11.7	12.4	14.7	9.0	**11.8**	**11.8**	12.2		**11.9**
MT16M02004	MT100132/ND24388	9.1	10.7	10.4	11.1	12.0	11.7	12.0	15.1	8.5	**11.7**	**11.2**	11.2		**11.5**
MT16M02106	HOCKETT/ND24388	9.3	10.3	11.0	11.0	11.6	11.1	11.8	14.8	8.1	**11.5**	**11.2**	11.3		**11.4**
MT16M02107	HOCKETT/ND24388	10.0	11.9	11.7	12.1	13.0	12.9	13.0	15.7	9.4	**12.7**	**12.3**	12.5		**12.5**
MT16M02204	HOCKETT/ND24388	9.8	10.5	11.1	11.3	11.7	11.4	11.4	14.8	9.1	**11.6**	**11.4**	11.8		**11.5**
MT16M05909	PINNACLE/MT050187	10.6	12.9	13.3	13.2	13.8	15.6	13.2	14.3	10.0	**13.3**	**13.4**		14.4	**13.5**
MT16M06110	MT100120/PINNACLE	9.1	10.2	10.1	11.1	11.4	11.5	11.1	14.8	8.2	**11.3**	**10.9**	12.1		**11.3**
MT16M06402	CRAFT/CONRAD	9.5	11.4	11.9	12.3	13.4	13.6	13.2	16.1	8.8	**12.8**	**12.5**		13.4	**12.8**
MT16M06404	CRAFT/CONRAD	10.3	11.8	12.3	13.0	13.3	13.0	12.8	13.8	9.0	**12.3**	**12.9**		13.3	**12.6**
MT16M06409	CRAFT/CONRAD	10.6	13.1	13.4	13.7	14.2	14.8	13.7	15.2	9.9	**13.5**	**13.8**		14.6	**13.7**
MT16M07108	SCARLETT/CRAFT	10.4	13.2	13.6	13.6	13.9	14.4	14.8	14.7	9.3	**13.5**	**13.7**		13.9	**13.6**
MT16M07706	HOCKETT/2B06-1157	9.7	12.1	12.6	12.2	13.0	13.2	12.5	14.7	9.4	**12.4**	**12.6**		12.4	**12.5**
MT16M07806	MT124688/HARRINGT	9.0	11.0	10.8	11.1	12.3	12.4	12.7	15.3	9.0	**12.1**	**11.4**	12.7		**11.9**
MT16M08502	MT050051/07WA-664	9.6	11.8	11.7	12.0	12.9	13.1	12.3	15.4	9.4	**12.4**	**12.2**		14.0	**12.5**
MT16M08601	MT050187/2AB08X04	10.2	11.7	12.0	12.1	13.2	13.7	13.5	15.7	9.7	**13.0**	**12.4**		13.6	**12.9**
MT16M08808	MT070157/2B07-2278	9.4	11.6	11.8	12.0	12.6	12.6	11.9	14.7	9.1	**12.0**	**12.1**	13.2		**12.2**
GRAND MEAN		9.7	11.4	11.6	11.9	12.7	12.7	12.7	14.7	9.2	12.3	12.1	12.4	13	12.3
CV		3.6	2.9	3.7	2.0	2.8	2.8	4.8	9.0	4.8			6.6	3.4	
LSD		0.6	0.5	0.7	0.4	0.6	0.6	1.0	2.1	0.7			2.2	1.2	
													*Mean/CV/LSD from entire 2017 expt		

Entries from 2018 Intrastate		Plump (% 6/64 high → low									2018 Intrastate		PYT 2017 Dry Boz		Plump
		Bozeman	Huntley	Bozeman	Huntley	Sidney	Havre	Sidney	Moccasin	Conrad	Dry	Irr	SG	MF	Overall
Name	Pedigree	*Dry*	*Irr*	*Irr*	*Dry*	*Dry*	*Dry*	*Irr*	*Dry*	*Dry*	Mean	Mean			Mean
Bow	SM04261/TR05285	98	98	98	93	96	86	96	83	98	**92**	**98**			**94**
Fraser	TR04280/SM04261	99	99	97	98	93	89	95	80	95	**92**	**97**			**94**
Genie	NSL07-8424	99	95	98	76	83	94	91	92	67	**85**	**95**			**88**
Hockett	ND7293/Bearpaw	98	97	94	97	97	94	86	84	71	**90**	**92**	79	79	**89**
Merit 57	Manley/2B80-350//M	96	97	96	96	88	79	84	75	48	**80**	**92**			**84**
Metcalfe	Oxbow/Manley	98	97	95	97	94	93	92	83	95	**93**	**95**			**94**
Odyssey	Concerto/Quench	99	99	98	92	94	96	96	86	73	**90**	**97**	89		**92**
Synergy	TR02267/Newdale	99	99	97	96	96	95	94	86	92	**94**	**97**			**95**
2B11-4949	Merit 57/MT050118	99	97	99	95	87	84	84	75	80	**86**	**93**			**89**
2B11-5166	2B03-3604/2B06-1161	98	96	91	95	91	88	81	58	85	**86**	**89**			**87**
MT16M00105	MT050002/ND19119	100	98	96	97	95	98	92	96	91	**96**	**95**	98		**96**
MT16M00202	MT050187/ND19119	100	99	100	99	98	99	97	96	93	**98**	**99**	97		**98**
MT16M00305	MT070157/ND19119	99	98	97	96	96	98	96	92	79	**93**	**97**	97		**95**
MT16M00307	MT070157/ND19119	100	99	99	98	98	97	97	94	66	**92**	**98**	95		**94**
MT16M00407	MT090180/ND19119	100	100	99	97	98	99	95	95	79	**95**	**98**	94		**96**
MT16M00508	MT090190/ND19119	100	100	99	99	98	99	96	95	90	**97**	**98**	98		**97**
MT16M00603	MT100130/ND19119	100	99	99	97	98	99	95	95	78	**94**	**98**	97		**96**
MT16M00707	MT124688/ND19119	99	99	97	97	97	96	94	87	80	**93**	**97**	98		**94**
MT16M00801	Craft/ND19119	100	97	98	94	96	97	93	89	80	**93**	**96**	97		**94**
MT16M00806	Craft/ND19119	100	99	97	98	96	98	95	91	61	**91**	**97**	92		**93**
MT16M01106	MT090182/ND24260	99	99	98	98	98	97	94	80	79	**92**	**97**	95		**94**
MT16M01204	MT100126/ND24260	100	98	98	96	98	99	97	95	77	**94**	**97**	99		**96**
MT16M01409	MT100120/ND24260	100	99	99	98	99	99	98	95	91	**97**	**99**	99		**98**
MT16M01701	MT070157/ND24388	98	96	97	97	95	95	91	81	83	**92**	**94**	95		**93**
MT16M01705	MT070157/ND24388	99	97	96	97	95	95	94	89	83	**93**	**96**	96		**94**
MT16M01709	MT070157/ND24388	98	96	95	95	97	97	95	90	67	**91**	**95**	95		**92**
MT16M01801	MT090190/ND24388	99	100	97	96	98	97	94	90	68	**91**	**97**	89		**93**
MT16M01804	MT090190/ND24388	98	97	98	95	98	97	96	93	69	**92**	**97**	93		**93**
MT16M01805	MT090190/ND24388	99	99	96	98	97	98	93	88	69	**91**	**96**	96		**93**
MT16M01809	MT090190/ND24388	98	97	97	95	93	95	91	81	95	**93**	**95**	90		**93**
MT16M01812	MT090190/ND24388	99	98	98	96	98	98	94	88	81	**93**	**97**	97		**95**
MT16M01901	MT100120/ND24388	99	99	98	97	98	97	95	91	87	**95**	**97**	93		**95**
MT16M01903	MT100120/ND24388	99	99	98	96	97	98	95	90	87	**94**	**97**	97		**96**
MT16M01904	MT100120/ND24388	99	98	98	97	98	98	91	94	86	**95**	**96**	89		**95**
MT16M02004	MT100132/ND24388	99	98	97	95	97	95	95	84	79	**92**	**97**	93		**93**
MT16M02106	HOCKETT/ND24388	98	98	94	96	92	95	93	81	79	**90**	**95**	91		**92**
MT16M02107	HOCKETT/ND24388	97	99	92	96	97	97	92	91	57	**89**	**94**	91		**91**
MT16M02204	HOCKETT/ND24388	99	99	98	98	96	98	93	87	68	**91**	**97**	97		**93**
MT16M05909	PINNACLE/MT050187	98	96	98	92	94	92	92	86	90	**92**	**95**		94	**93**
MT16M06110	MT100120/PINNACLE	99	97	98	96	96	97	91	86	83	**93**	**95**	95		**94**
MT16M06402	CRAFT/CONRAD	96	98	94	98	95	96	90	84	61	**88**	**94**		79	**89**
MT16M06404	CRAFT/CONRAD	99	99	97	98	96	97	91	86	91	**94**	**96**		94	**95**
MT16M06409	CRAFT/CONRAD	99	99	98	97	94	96	92	93	70	**91**	**96**		86	**92**
MT16M07108	SCARLETT/CRAFT	100	99	99	98	98	97	97	86	78	**93**	**98**		91	**94**
MT16M07706	HOCKETT/2B06-1157	99	99	98	98	93	97	95	94	77	**93**	**97**		83	**93**
MT16M07806	MT124688/HARRINGT	99	99	98	98	97	96	94	89	76	**93**	**97**	94		**94**
MT16M08502	MT050051/07WA-664.	99	99	98	98	94	93	94	80	74	**90**	**97**		74	**90**
MT16M08601	MT050187/2AB08X04I	94	93	93	94	92	85	88	74	72	**85**	**91**		80	**86**
MT16M08808	MT070157/2B07-2278	99	98	97	98	97	96	94	81	83	**92**	**96**	89		**93**
GRAND MEAN		98.7	98.0	97.0	96.0	95.4	95.2	92.9	86.8	78.8	91.8	96.0	91.3	81.9	92.0
CV		0.5	0.7	2.0	1.2	2.4	1.4	2.5	3.9	22.8			5.7	10.6	
LSD		0.8	1.2	3.1	1.8	3.7	2.2	3.8	5.5	29.2			14.1	24.2	
													*Mean/CV/LSD from entire 2017 expt		

Entries from 2018 Intrastate		Test Wt (lb/bu)		high → low							2018 Intrastate		PYT 2017 Boz Dry		Test Wt
		Moccasin	Bozeman	Bozeman	Sidney	Conrad	Sidney	Huntley	Huntley	Havre	Dry	Irr	SG	MF	Overall
Name	Pedigree	*Dry*	*Dry*	*Irr*	*Dry*	*Dry*	*Irr*	*Irr*	*Dry*	*Dry*	Mean	Mean			Mean
Bow	SM04261/TR05285	57	54	54	53	56	53	51	50	49	**53**	**53**			**53**
Fraser	TR04280/SM04261	56	53	53	51	55	52	50	50	49	**52**	**52**			**52**
Genie	NSL07-8424	58	54	55	51	53	52	51	48	52	**53**	**53**			**53**
Hockett	ND7293/Bearpaw	57	55	54	56	54	52	53	53	52	**54**	**53**	51	52	**54**
Merit 57	Manley/2B80-350//M	56	54	54	51	50	51	51	51	48	**52**	**52**			**52**
Metcalfe	Oxbow/Manley	57	55	53	55	55	54	52	53	51	**54**	**53**			**54**
Odyssey	Concerto/Quench	55	53	52	52	52	52	51	49	50	**52**	**52**	50		**52**
Synergy	TR02267/Newdale	55	54	54	54	55	53	51	52	50	**53**	**53**			**53**
2B11-4949	Merit 57/MT050118	57	55	55	52	52	52	52	52	50	**53**	**53**			**53**
2B11-5166	2B03-3604/2B06-1161	56	55	52	52	54	50	51	51	49	**53**	**51**			**52**
MT16M00105	MT050002/ND19119	55	54	52	52	55	52	51	51	48	**53**	**52**	53		**52**
MT16M00202	MT050187/ND19119	57	55	55	55	56	53	53	53	51	**55**	**54**	55		**54**
MT16M00305	MT070157/ND19119	55	55	54	52	54	51	50	50	50	**53**	**52**	51		**52**
MT16M00307	MT070157/ND19119	55	53	53	54	50	52	51	51	49	**52**	**52**	50		**52**
MT16M00407	MT090180/ND19119	56	54	54	54	52	52	51	51	49	**53**	**52**	52		**52**
MT16M00508	MT090190/ND19119	55	53	53	53	55	52	51	51	49	**53**	**52**	53		**52**
MT16M00603	MT100130/ND19119	55	54	53	53	53	52	51	50	49	**52**	**52**	52		**52**
MT16M00707	MT124688/ND19119	57	55	55	55	54	54	52	53	51	**54**	**53**	54		**54**
MT16M00801	Craft/ND19119	57	55	54	54	53	53	53	52	51	**54**	**53**	54		**54**
MT16M00806	Craft/ND19119	58	55	54	54	50	53	52	52	51	**53**	**53**	51		**53**
MT16M01106	MT090182/ND24260	57	55	54	55	54	54	53	53	51	**54**	**53**	55		**54**
MT16M01204	MT100126/ND24260	55	55	53	54	53	53	51	51	50	**53**	**52**	54		**53**
MT16M01409	MT100120/ND24260	57	55	55	55	54	53	52	52	51	**54**	**53**	55		**54**
MT16M01701	MT070157/ND24388	57	54	53	52	55	52	51	52	51	**53**	**52**	53		**53**
MT16M01705	MT070157/ND24388	55	55	54	53	55	53	52	52	51	**54**	**53**	53		**53**
MT16M01709	MT070157/ND24388	55	54	53	52	53	51	50	50	50	**52**	**51**	51		**52**
MT16M01801	MT090190/ND24388	55	54	54	54	53	53	52	51	51	**53**	**53**	50		**53**
MT16M01804	MT090190/ND24388	55	54	53	53	52	53	51	51	50	**53**	**52**	52		**52**
MT16M01805	MT090190/ND24388	55	53	53	53	50	52	51	51	49	**52**	**52**	51		**52**
MT16M01809	MT090190/ND24388	55	54	54	54	56	53	52	52	50	**54**	**53**	52		**53**
MT16M01812	MT090190/ND24388	58	54	54	54	53	52	51	51	51	**54**	**52**	53		**53**
MT16M01901	MT100120/ND24388	55	55	54	55	53	53	53	52	51	**54**	**53**	53		**53**
MT16M01903	MT100120/ND24388	56	55	55	54	54	53	52	52	51	**54**	**54**	54		**54**
MT16M01904	MT100120/ND24388	56	54	53	54	54	52	51	51	50	**53**	**52**	51		**53**
MT16M02004	MT100132/ND24388	56	55	55	54	52	54	52	51	50	**53**	**53**	53		**53**
MT16M02106	HOCKETT/ND24388	56	55	52	52	52	51	51	51	50	**53**	**52**	53		**52**
MT16M02107	HOCKETT/ND24388	57	56	54	55	51	53	53	54	52	**54**	**54**	53		**54**
MT16M02204	HOCKETT/ND24388	56	56	55	55	52	54	53	53	52	**54**	**54**	55		**54**
MT16M05909	PINNACLE/MT050187	58	55	56	56	53	56	54	53	53	**55**	**55**		56	**55**
MT16M06110	MT100120/PINNACLE	57	55	54	55	52	53	52	52	52	**54**	**53**	54		**54**
MT16M06402	CRAFT/CONRAD	57	55	54	54	51	54	52	53	51	**54**	**53**		52	**53**
MT16M06404	CRAFT/CONRAD	58	55	54	55	54	53	53	53	52	**55**	**54**		54	**54**
MT16M06409	CRAFT/CONRAD	58	55	55	55	51	54	53	54	52	**54**	**54**		53	**54**
MT16M07108	SCARLETT/CRAFT	58	56	55	56	53	54	54	54	53	**55**	**54**		54	**55**
MT16M07706	HOCKETT/2B06-1157	57	55	55	52	52	54	52	53	51	**53**	**53**		54	**53**
MT16M07806	MT124688/HARRINGT	57	56	55	56	53	54	53	53	53	**54**	**54**	54		**54**
MT16M08502	MT050051/07WA-664.	58	57	56	55	54	55	54	54	52	**55**	**55**		53	**55**
MT16M08601	MT050187/2AB08X04I	57	56	54	54	52	53	53	52	51	**54**	**53**		54	**54**
MT16M08808	MT070157/2B07-2278	58	55	55	54	52	53	52	53	52	**54**	**53**	51		**53**
GRAND MEAN		56.3	54.6	53.9	53.7	53.0	52.8	51.7	51.7	50.6	53.3	52.8	51.9	52.5	53.0
CV		1.4	0.8	1.4	1.2	4.8	1.1	0.5	0.8	0.8			2.6	2.9	
LSD		1.3	0.7	1.3	1.1	4.1	0.9	0.5	0.7	0.6			3.7	4.2	

Entries from 2018 Intrastate		Grain Fill (days)		long → short				
		Havre	Bozeman	Bozeman	2018 Intra	PYT SG	PYT MF	Overall
Name	Pedigree	*Dry*	*Irr*	*Dry*	Mean	*17 Boz Dry*	*17 Boz Dry*	Mean
Bow	SM04261/TR05285	26	35	33	**31**			**31**
Fraser	TR04280/SM04261	33	35	31	**33**			**33**
Genie	NSL07-8424	31	37	34	**34**			**34**
Hockett	ND7293/Bearpaw	29	37	33	**33**	26	28	**31**
Merit 57	Manley/2B80-350//M	31	39	35	**35**			**35**
Metcalfe	Oxbow/Manley	31	36	34	**34**			**34**
Odyssey	Concerto/Quench	27	41	34	**34**	34		**34**
Synergy	TR02267/Newdale	29	36	35	**33**			**33**
2B11-4949	Merit 57/MT050118	32	37	33	**34**			**34**
2B11-5166	2B03-3604/2B06-1161	36	38	33	**36**			**36**
MT16M00105	MT050002/ND19119	36	38	34	**36**	32		**35**
MT16M00202	MT050187/ND19119	44	44	44	**44**	35		**42**
MT16M00305	MT070157/ND19119	33	39	42	**38**	31		**36**
MT16M00307	MT070157/ND19119	41	45	44	**43**	34		**41**
MT16M00407	MT090180/ND19119	40	43	43	**42**	30		**39**
MT16M00508	MT090190/ND19119	36	42	42	**40**	36		**39**
MT16M00603	MT100130/ND19119	36	40	40	**39**	40		**39**
MT16M00707	MT124688/ND19119	33	37	38	**36**	33		**35**
MT16M00801	Craft/ND19119	30	38	39	**35**	32		**35**
MT16M00806	Craft/ND19119	38	40	38	**39**	30		**37**
MT16M01106	MT090182/ND24260	38	41	41	**40**	42		**40**
MT16M01204	MT100126/ND24260	43	45	44	**44**	42		**43**
MT16M01409	MT100120/ND24260	37	41	40	**39**	33		**37**
MT16M01701	MT070157/ND24388	31	38	36	**35**	28		**33**
MT16M01705	MT070157/ND24388	35	41	39	**39**	34		**37**
MT16M01709	MT070157/ND24388	35	36	35	**35**	28		**33**
MT16M01801	MT090190/ND24388	28	38	37	**34**	31		**33**
MT16M01804	MT090190/ND24388	31	40	42	**38**	31		**36**
MT16M01805	MT090190/ND24388	35	40	40	**38**	33		**37**
MT16M01809	MT090190/ND24388	34	41	40	**38**	31		**36**
MT16M01812	MT090190/ND24388	33	41	43	**39**	30		**37**
MT16M01901	MT100120/ND24388	34	42	42	**39**	32		**37**
MT16M01903	MT100120/ND24388	37	44	41	**40**	34		**39**
MT16M01904	MT100120/ND24388	33	41	43	**39**	31		**37**
MT16M02004	MT100132/ND24388	34	40	40	**38**	34		**37**
MT16M02106	HOCKETT/ND24388	30	40	39	**36**	30		**35**
MT16M02107	HOCKETT/ND24388	34	38	38	**37**	28		**35**
MT16M02204	HOCKETT/ND24388	33	42	42	**39**	33		**38**
MT16M05909	PINNACLE/MT050187	36	42	38	**39**		36	**38**
MT16M06110	MT100120/PINNACLE	34	41	40	**38**	33		**37**
MT16M06402	CRAFT/CONRAD	37	36	36	**36**		33	**35**
MT16M06404	CRAFT/CONRAD	29	38	36	**34**		33	**34**
MT16M06409	CRAFT/CONRAD	30	37	34	**34**		31	**33**
MT16M07108	SCARLETT/CRAFT	30	38	34	**34**		28	**32**
MT16M07706	HOCKETT/2B06-1157	33	36	35	**35**		31	**34**
MT16M07806	MT124688/HARRINGT	28	37	35	**33**	33		**33**
MT16M08502	MT050051/07WA-664.	27	35	34	**32**		26	**31**
MT16M08601	MT050187/2AB08X04I	32	37	36	**35**		30	**34**
MT16M08808	MT070157/2B07-2278	34	39	36	**37**	28		**34**
GRAND MEAN		33.3	39.2	37.9	36.8	31.4	30.6	34.5
CV		6.2	3.4	3.9		6.9	8.1	
LSD		3.3	2.2	2.4		5.9	6.9	

Several of the lines have lower beta glucan and higher extract than Hockett.

Entries from 2018 Intrastate		Beta Glucan		(ppm)	Extract	(%)		S/T Protein		(%)
		Bozeman	Huntley	2018 Intra	Bozeman	Huntley	2018 Intra	Bozeman	Huntley	18 Intra Dry
Name	Pedigree	Dry	Dry	Mean	Dry	Dry	Mean	Dry	Dry	Mean
Bow	SM04261/TR05285	100	47	**73**	80.2	77.4	**78.8**	53	44	**49**
Fraser	TR04280/SM04261	73	24	**49**	80.9	79.3	**80.1**	51	48	**49**
Genie	NSL07-8424	85	50	**68**	81.9	79.1	**80.5**	40	44	**42**
Hockett	ND7293/Bearpaw	89	436	**263**	81.1	79.6	**80.4**	45	39	**42**
Merit 57	Manley/2B80-350//Merit/2E	117	136	**127**	81.6	79.2	**80.4**	49	45	**47**
Metcalfe	Oxbow/Manley	108	41	**75**	81.5	79.1	**80.3**	40	48	**44**
Odyssey	Concerto/Quench	76	27	**51**	81.4	78.5	**80.0**	48	40	**44**
Synergy	TR02267/Newdale	30	20	**25**	81.0	79.9	**80.5**	49	52	**50**
2B11-4949	Merit 57/MT050118	41	69	**55**	82.9	80.7	**81.8**	46	44	**45**
2B11-5166	2B03-3604/2B06-1161	74	15	**44**	82.3	81.2	**81.8**	48	52	**50**
MT16M00105	MT050002/ND19119	77	600	**338**	82.3	79.6	**81.0**	51	44	**47**
MT16M00202	MT050187/ND19119	426	558	**492**	80.6	78.6	**79.6**	48	47	**47**
MT16M00305	MT070157/ND19119	89	89	**89**	79.8	79.5	**79.7**	47	49	**48**
MT16M00307	MT070157/ND19119	76	417	**247**	81.0	79.2	**80.1**	50	46	**48**
MT16M00407	MT090180/ND19119	189	176	**182**	79.8	78.2	**79.0**	37	41	**39**
MT16M00508	MT090190/ND19119	160	174	**167**	79.9	78.9	**79.4**	45	42	**44**
MT16M00603	MT100130/ND19119	72	140	**106**	80.5	79.4	**80.0**	45	46	**45**
MT16M00707	MT124688/ND19119	202	200	**201**	81.3	79.9	**80.6**	48	43	**46**
MT16M00801	Craft/ND19119	239	422	**330**	79.6	76.9	**78.3**	37	38	**38**
MT16M00806	Craft/ND19119	235	183	**209**	80.0	78.6	**79.3**	38	38	**38**
MT16M01106	MT090182/ND24260	315	224	**269**	81.5	80.5	**81.0**	47	42	**45**
MT16M01204	MT100126/ND24260	153	127	**140**	79.1	78.1	**78.6**	45	46	**45**
MT16M01409	MT100120/ND24260	203	274	**238**	80.0	77.9	**79.0**	42	39	**40**
MT16M01701	MT070157/ND24388	173	281	**227**	80.2	78.0	**79.1**	47	39	**43**
MT16M01705	MT070157/ND24388	68	184	**126**	80.7	80.2	**80.5**	46	46	**46**
MT16M01709	MT070157/ND24388	309	91	**200**	79.3	77.5	**78.4**	38	40	**39**
MT16M01801	MT090190/ND24388	102	390	**246**	82.6	80.9	**81.8**	50	44	**47**
MT16M01804	MT090190/ND24388	246	277	**261**	80.7	79.3	**80.0**	43	43	**43**
MT16M01805	MT090190/ND24388	339	206	**273**	79.5	78.4	**79.0**	41	41	**41**
MT16M01809	MT090190/ND24388	394	394	**394**	80.9	79.9	**80.4**	42	42	**42**
MT16M01812	MT090190/ND24388	243	174	**209**	81.6	80.0	**80.8**	42	44	**43**
MT16M01901	MT100120/ND24388	33	140	**86**	81.0	79.8	**80.4**	50	46	**48**
MT16M01903	MT100120/ND24388	144	423	**283**	83.0	80.9	**82.0**	48	44	**46**
MT16M01904	MT100120/ND24388	241	299	**270**	80.7	79.2	**80.0**	46	40	**43**
MT16M02004	MT100132/ND24388	363	619	**491**	80.6	79.3	**80.0**	42	40	**41**
MT16M02106	HOCKETT/ND24388	202	147	**175**	82.9	81.5	**82.2**	48	44	**46**
MT16M02107	HOCKETT/ND24388	127	147	**137**	80.3	79.1	**79.7**	45	42	**43**
MT16M02204	HOCKETT/ND24388	282	802	**542**	82.2	77.3	**79.8**	46	41	**43**
MT16M05909	PINNACLE/MT050187	459	256	**357**	80.5	77.3	**78.9**	45	45	**45**
MT16M06110	MT100120/PINNACLE	222	168	**195**	81.5	79.8	**80.7**	45	39	**42**
MT16M06402	CRAFT/CONRAD	239	231	**235**	80.8	77.8	**79.3**	41	39	**40**
MT16M06404	CRAFT/CONRAD	59	89	**74**	81.6	79.9	**80.8**	46	51	**48**
MT16M06409	CRAFT/CONRAD	44	60	**52**	79.1	77.9	**78.5**	47	47	**47**
MT16M07108	SCARLETT/CRAFT	195	251	**223**	77.9	75.8	**76.9**	38	35	**36**
MT16M07706	HOCKETT/2B06-1157	160	194	**177**	81.2	79.3	**80.3**	49	44	**46**
MT16M07806	MT124688/HARRINGTON	118	161	**140**	81.9	80.4	**81.2**	55	50	**52**
MT16M08502	MT050051/07WA-664.1	227	457	**342**	79.7	76.8	**78.3**	41	33	**37**
MT16M08601	MT050187/2AB08X04F02	459	347	**403**	79.9	76.9	**78.4**	43	39	**41**
MT16M08808	MT070157/2B07-2278	544	374	**459**	80.0	78.2	**79.1**	47	38	**42**
GRAND MEAN		188.1	236.8	212.5	80.8	79.0	79.9	45.2	43.1	44.1
CV		USDA lab	MSU lab		USDA lab	MSU lab		USDA lab	MSU lab	
LSD										

Entries from 2018 Intrastate	Soluble Protein		(%)	FAN	(ppm)		Alpha Amylase		(20°DU)
	Bozeman	Huntley	18 Intra Dry	Bozeman	Huntley	18 Intra Dry	Bozeman	Huntley	18 Intra Dry
Name	*Dry*	*Dry*	Mean	*Dry*	*Dry*	Mean	*Dry*	*Dry*	Mean
Bow	6.3	5.2	**4.0**	261	273	**267**	100	48	**74**
Fraser	5.5	4.8	**4.0**	221	286	**254**	101	82	**91**
Genie	4.4	4.2	**4.0**	133	273	**203**	53	69	**61**
Hockett	5.3	4.7	**4.0**	197	227	**212**	119	58	**89**
Merit 57	5.7	4.9	**4.0**	226	289	**258**	101	70	**85**
Metcalfe	4.3	4.2	**4.0**	125	295	**210**	54	92	**73**
Odyssey	5.3	4.5	**3.7**	207	236	**221**	109	71	**90**
Synergy	5.5	4.6	**3.7**	201	297	**249**	111	96	**103**
2B11-4949	5.4	4.7	**4.0**	244	303	**273**	95	60	**78**
2B11-5166	5.6	4.8	**4.0**	221	337	**279**	114	124	**119**
MT16M00105	5.6	4.7	**3.7**	210	277	**244**	97	32	**64**
MT16M00202	5.7	4.9	**4.0**	250	284	**267**	92	74	**83**
MT16M00305	5.5	4.6	**3.7**	241	299	**270**	97	95	**96**
MT16M00307	6.1	5.1	**4.0**	291	301	**296**	102	76	**89**
MT16M00407	4.7	4.2	**3.7**	158	238	**198**	59	56	**58**
MT16M00508	5.5	4.8	**4.0**	206	266	**236**	69	63	**66**
MT16M00603	5.3	4.5	**3.7**	200	271	**236**	66	51	**59**
MT16M00707	5.2	4.5	**3.7**	190	234	**212**	79	71	**75**
MT16M00801	4.8	4.4	**4.0**	159	253	**206**	84	60	**72**
MT16M00806	4.6	4.3	**4.0**	141	214	**178**	65	59	**62**
MT16M01106	5.1	4.4	**3.7**	163	247	**205**	70	68	**69**
MT16M01204	5.0	4.4	**3.7**	173	249	**211**	63	47	**55**
MT16M01409	5.1	4.6	**4.0**	154	216	**185**	60	54	**57**
MT16M01701	5.1	4.6	**4.0**	175	268	**221**	72	63	**68**
MT16M01705	5.4	4.6	**3.7**	211	314	**262**	81	72	**77**
MT16M01709	4.6	4.3	**4.0**	138	245	**191**	58	63	**60**
MT16M01801	5.2	4.5	**3.7**	208	265	**237**	88	62	**75**
MT16M01804	4.9	4.5	**4.0**	173	293	**233**	77	67	**72**
MT16M01805	4.5	4.1	**3.7**	133	256	**194**	53	55	**54**
MT16M01809	4.4	4.1	**3.7**	135	244	**190**	60	50	**55**
MT16M01812	4.9	4.5	**4.0**	165	259	**212**	78	82	**80**
MT16M01901	5.2	4.5	**3.7**	188	269	**229**	88	68	**78**
MT16M01903	5.1	4.4	**3.7**	180	252	**216**	81	45	**63**
MT16M01904	5.0	4.5	**4.0**	162	252	**207**	77	78	**78**
MT16M02004	4.6	4.3	**4.0**	139	244	**192**	65	45	**55**
MT16M02106	4.9	4.3	**3.7**	175	246	**210**	100	93	**97**
MT16M02107	5.3	4.7	**4.0**	184	249	**216**	86	75	**81**
MT16M02204	4.8	4.3	**3.7**	149	186	**167**	65	41	**53**
MT16M05909	5.9	5.0	**4.0**	232	302	**267**	97	92	**94**
MT16M06110	4.7	4.2	**3.7**	139	209	**174**	55	67	**61**
MT16M06402	4.5	4.3	**4.0**	147	226	**187**	73	67	**70**
MT16M06404	5.6	4.7	**3.7**	215	298	**257**	106	90	**98**
MT16M06409	6.2	5.1	**4.0**	187	295	**241**	86	77	**81**
MT16M07108	5.1	4.7	**4.3**	101	235	**168**	58	55	**57**
MT16M07706	5.8	4.9	**4.0**	188	268	**228**	102	95	**98**
MT16M07806	6.2	5.0	**3.7**	199	269	**234**	92	92	**92**
MT16M08502	4.9	4.6	**4.3**	106	205	**155**	66	40	**53**
MT16M08601	5.2	4.6	**4.0**	138	243	**190**	59	62	**61**
MT16M08808	5.4	4.7	**4.0**	136	229	**182**	69	84	**77**
GRAND MEAN	5.2	4.6	3.9	181.0	260.8	220.9	80.6	68.5	74.5
CV	USDA lab	MSU lab		USDA lab	MSU lab		USDA lab	MSU lab	
LSD									

Variety Release

We are nominating MT124112 for variety release in 2019.

Pedigree: MT124112 = Hockett/MT070174
MT070174= LK644///Hockett F5
LK644 = Lewis/Karl
Hockett = ND7293/Bearpaw

Recommendation: Public, protected **Name:** To be determined

Selection history: MT124112 is a spring, 2-row, hulled barley developed as malt barley for production in Montana. MT124112 has a lax head type, rough awns, white aleurone and long rachilla hairs. MT124112 is an F4 derived selection from backcrossing *GPC6H* into Hockett (ND7293/Bearpaw) four times. The original donor for *GPC6H* was Karl through an RIL from a Karl by Lewis cross (line number LK644). MT124112 was advanced by single seed descent from the F1 thru F4 generations. It was increased from a F4 plant to produce seed for preliminary yield testing in 2011. MT124112 was tested for agronomic and malt traits beginning in 2012. MT124112 was confirmed to carry the low protein allele for GPC6H via marker assisted selection (See et al., 2002).

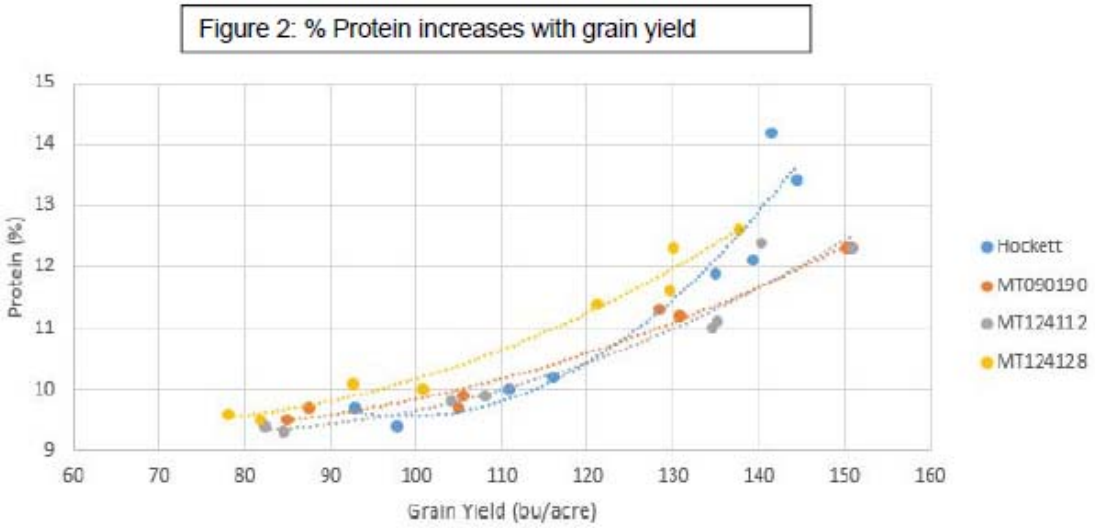
General performance and characteristics:

MT124112 has lower protein and higher plumps than Hockett, with similar heading date, height, test weight and yield (Table 1). MT124112 was included in a trial testing performance with different nitrogen treatments. Figure 2 reports protein levels as yield increases along the X axis due to increasing nitrogen. Note that the grain protein level for MT124112 grown at the highest yield potential was still acceptable, as were other malt quality parameters (not shown).

Table 1. Agronomic trait comparisons of MT124112 and check cultivars over several station years in Montana from 2012-2018.

Dryland Agronomic Traits	Variety	Variety Mean	MT124112 Mean	Percent of Variety		Locations
YIELD bu/ac	Growler	85.59	84.75	99%	0.4589	17
	Harrington	88.99	85.97	97%	0.0012 *	11
	Hockett	84.05	84.94	101%	0.0352 *	37
	Metcalfe	80.77	85.38	106%	0.0000 *	21
	Odyssey	112.78	84.89	75%	0.0000 *	4
	Synergy	86.24	84.75	98%	0.0374 *	18
PROTEIN %	Growler	12.83	11.22	87%	0.0000 *	18
	Harrington	12.8	11.11	87%	0.0000 *	11
	Hockett	12	10.98	92%	0.0000 *	37
	Metcalfe	12.97	11.1	86%	0.0000 *	21
	Odyssey	11.65	11.68	100%	0.8198	4
	Synergy	12.3	11.22	91%	0.0000 *	18
PLUMP %	Growler	85.34	93.03	109%	0.0000 *	18
	Harrington	87.63	94.07	107%	0.0000 *	11
	Hockett	88.94	93.62	105%	0.0000 *	37
	Metcalfe	85.95	93.47	109%	0.0000 *	21
	Odyssey	95.94	94.73	99%	0.0141 *	4
	Synergy	87.87	93.03	106%	0.0000 *	18
TEST WT lb/bu	Growler	50.18	52.67	105%	0.0000 *	18
	Harrington	52.16	52.81	101%	0.0000 *	11
	Hockett	53.22	52.84	99%	0.0000 *	37
	Metcalfe	52.26	52.7	101%	0.0000 *	21
	Odyssey	52.68	53.05	101%	0.0006 *	4
	Synergy	51.5	52.67	102%	0.0000 *	18
HEIGHT cm	Growler	68.67	69.5	101%	0.0213 *	18
	Harrington	72.47	71.09	98%	0.0003 *	11
	Hockett	71.66	70.24	98%	0.0000 *	37
	Metcalfe	73.38	69.91	95%	0.0000 *	21
	Odyssey	65.73	72.78	111%	0.0001 *	4
	Synergy	71.08	69.5	98%	0.0000 *	18
HEADING julian	Growler	173.94	170.85	98%	0.0000 *	11
	Harrington	171.94	169.06	98%	0.0000 *	11
	Hockett	175.81	173.51	99%	0.0000 *	30
	Metcalfe	172.19	170.62	99%	0.0000 *	14
	Odyssey	172.17	166.58	97%	0.0000 *	4
	Synergy	168.15	170.85	102%	0.1029	11
MATURITY julian	Growler	211.56	214	101%	0.0049 *	3
	Harrington	210.67	212.67	101%	0.0011 *	3
	Hockett	212.34	214.67	101%	0.0000 *	15
	Metcalfe	210.38	214.33	102%	0.0000 *	4
	Odyssey	209	205.33	98%	0.0000 *	3
	Synergy	211.22	214	101%	0.0000 *	3

Irrigated Agronomic Traits	Variety	Variety Mean	MT124112 Mean	Percent of Variety	p .05	Locations
YIELD bu/ac	Growler	112.94	107.05	95%	0.0001 *	13
	Harrington	96.66	96.96	100%	0.7598	15
	Hockett	104.13	101.06	97%	0.0000 *	19
	Metcalfe	100.84	101.06	100%	0.7739	19
	Odyssey	122.92	102.26	83%	0.0000 *	4
	Synergy	109.71	107.05	98%	0.0054 *	13
PROTEIN %	Growler	11.46	11.08	97%	0.0001 *	13
	Harrington	12.26	11.18	91%	0.0000 *	14
	Hockett	12.01	11.28	94%	0.0000 *	18
	Metcalfe	12.28	11.28	92%	0.0000 *	18
	Odyssey	9.78	10.19	104%	0.0035 *	4
	Synergy	11.78	11.08	94%	0.0000 *	13
PLUMP %	Growler	94.95	96.52	102%	0.0000 *	12
	Harrington	91.54	95.06	104%	0.0000 *	13
	Hockett	93.52	95.57	102%	0.0000 *	17
	Metcalfe	92.27	95.57	104%	0.0000 *	17
	Odyssey	96.32	96.65	100%	0.2132	3
	Synergy	95.57	96.52	101%	0.0035 *	12
TEST WT lb/bu	Growler	51.15	52.49	103%	0.0000 *	13
	Harrington	52.06	51.91	100%	0.139	14
	Hockett	52.54	51.85	99%	0.0000 *	18
	Metcalfe	52.06	51.85	100%	0.0227 *	17
	Odyssey	52.41	52.96	101%	0.0000 *	4
	Synergy	51.8	52.49	101%	0.0000 *	13
HEIGHT cm	Growler	75	75.19	100%	0.615	13
	Harrington	76.91	73.98	96%	0.0000 *	15
	Hockett	77.37	75.11	97%	0.0000 *	19
	Metcalfe	78.85	75.11	95%	0.0000 *	19
	Odyssey	67.86	77.96	115%	0.0000 *	4
	Synergy	80.36	75.19	94%	0.0000 *	13
HEADING julian	Growler	180.83	175.33	97%	0.0000 *	10
	Harrington	176.95	172.4	97%	0.0000 *	14
	Hockett	176.71	174	98%	0.0000 *	16
	Metcalfe	177.54	174	98%	0.0000 *	16
	Odyssey	174.89	167.22	96%	0.0000 *	3
	Synergy	179.43	175.33	98%	0.0000 *	10
MATURITY julian	Growler	215.33	217.67	101%	0.0111 *	3
	Harrington	213.33	214.42	101%	0.0010 *	4
	Hockett	213.13	215.4	101%	0.0000 *	5
	Metcalfe	212.63	215.4	101%	0.0000 *	5
	Odyssey	214.67	208.67	97%	0.0000 *	1
	Synergy	215.11	217.67	101%	0.0000 *	3
LODGING	Growler	28.89	18.89	65%	0.0004 *	4
	Harrington	74.17	22.5	30%	0.0000 *	2
	Hockett	52.78	18.89	36%	0.0000 *	4
	Metcalfe	31.11	18.89	61%	0.0000 *	4
	Odyssey	25	11.67	47%	0.0000 *	1
	Synergy	31.67	18.89	60%	0.0000 *	4



MT124112 has better malt quality than Hockett. Based on 9 trials in Montana from 2012 to 2017, MT124112 has higher malt extract and alpha amylase; while lower in diastatic power and beta glucan than the other varieties (Table 2).

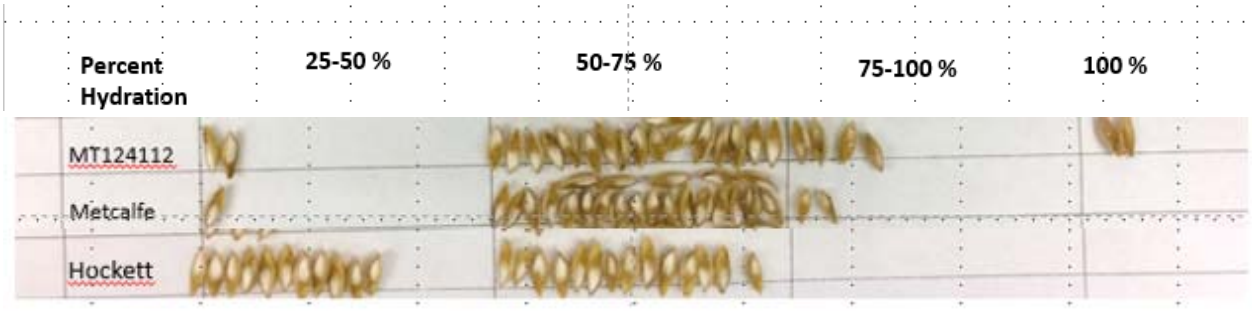
Table 2. Malt quality of MT124112 and check cultivars using data from analyses of barley samples grown in Montana based on trials from 2015-2017. Data courtesy of the USDA-ARS Cereal Crops Research Unit, Madison, WI and the MSU Malt Quality Lab

Dryland Malt Quality Traits	Variety	Variety Mean	MT124112 Mean	Percent of Variety	p .05	Locations
EXTRACT %	Growler	78.6	82.17	105%	0.0263 *	3
	Harrington	78.97	82.17	104%	0.0199 *	3
	Hockett	79.81	81.46	102%	0.0004 *	7
	Metcalfe	80.4	82.17	102%	0.0129 *	3
	Odyssey	79	81.5	103%	0.0000 n/a	1
	Synergy	80.7	82.17	102%	0.0533 *	3
B GLUCAN ppm	Growler	120.2	85.47	71%	0.4388	3
	Harrington	256.33	85.47	33%	0.0155 *	3
	Hockett	178.48	72.22	40%	0.0012 *	7
	Metcalfe	52.8	85.47	162%	0.2961	3
	Odyssey	189.7	124.4	66%	0.0000 n/a	1
	Synergy	32	85.47	267%	0.0961	3
A AMYLASE °DU	Growler	106.83	119.03	111%	0.2036	3
	Harrington	84.8	119.03	140%	0.0905	3
	Hockett	90.41	120.69	133%	0.0000 *	7
	Metcalfe	105.33	119.03	113%	0.2435	3
	Odyssey	44.7	102.6	230%	0.0000 n/a	1
	Synergy	97.57	119.03	122%	0.0798	3
DIASTATIC POWER °ASBC	Growler	195.3	133	68%	0.0123 *	3
	Harrington	163.67	133	81%	0.0091 *	3
	Hockett	183.39	147.78	81%	0.0000 *	7
	Metcalfe	171.03	133	78%	0.0156 *	3
	Odyssey	126.6	139.6	110%	0.0000 n/a	1
	Synergy	145.83	133	91%	0.2135	3
FAN ppm	Growler	206.27	212.73	103%	0.576	3
	Harrington	193.8	212.73	110%	0.2041	3
	Hockett	175.29	220.57	126%	0.0002 *	7
	Metcalfe	219.53	212.73	97%	0.6259	3
	Odyssey	104.7	217	207%	0.0000 n/a	1
	Synergy	196.5	212.73	108%	0.337	3
SOLUBLE PROTEIN %	Growler	4.63	4.67	101%	0.7418	3
	Harrington	4.4	4.67	106%	0.0572 *	3
	Hockett	4.41	4.88	111%	0.0000 *	7
	Metcalfe	4.77	4.67	98%	0.0000 *	3
	Odyssey	3.6	4.8	133%	0.0000 n/a	1
	Synergy	4.6	4.67	102%	0.1835	3
S/T PROTEIN %	Growler	32.57	40.33	124%	0.0204 *	3
	Harrington	32.13	40.33	126%	0.0065 *	3
	Hockett	34.28	41.92	122%	0.0000 *	7
	Metcalfe	35.77	40.33	113%	0.0175 *	3
	Odyssey	27.5	39.1	142%	0.0000 n/a	1
	Synergy	37.57	40.33	107%	0.0104 *	3

Irrigated Malt Quality Traits	Variety	Variety Mean	MT124112 Mean	Percent of Variety	p .05	Locations
EXTRACT %	Growler	79.9	80.6	101%	0.5378	4
	Harrington	80.13	80.98	101%	0.277	6
	Hockett	80.72	80.98	100%	0.5646	6
	Metcalfe	80.8	80.98	100%	0.7642	6
	Odyssey	81.2	83.1	102%	0.0000 n/a	1
	Synergy	80.48	80.6	100%	0.8627	4
B GLUCAN ppm	Growler	142.25	184.48	130%	0.1731	4
	Harrington	287.95	166.48	58%	0.0874	6
	Hockett	220.78	166.48	75%	0.3691	6
	Metcalfe	123.97	166.48	134%	0.2581	6
	Odyssey	51.1	119.6	234%	0.0000 n/a	1
	Synergy	131.25	184.48	141%	0.0540 *	4
A AMYLASE °DU	Growler	98.4	110.73	113%	0.2699	4
	Harrington	81.22	109.88	135%	0.0070 *	6
	Hockett	93.32	109.88	118%	0.1579	6
	Metcalfe	103.48	109.88	106%	0.4489	6
	Odyssey	59.5	133.9	225%	0.0000 n/a	1
	Synergy	100.75	110.73	110%	0.2897	4
DIASTATIC POWER °ASBC	Growler	148.3	123.53	83%	0.0794	4
	Harrington	140.17	130.32	93%	0.3651	6
	Hockett	158.67	130.32	82%	0.0008 *	6
	Metcalfe	152.3	130.32	86%	0.1593	6
	Odyssey	136.9	118.4	86%	0.0000 n/a	1
	Synergy	149.23	123.53	83%	0.0741	4
FAN ppm	Growler	208.55	222.23	107%	0.1658	4
	Harrington	196.3	232.82	119%	0.0021 *	6
	Hockett	217.35	232.82	107%	0.3426	6
	Metcalfe	239.42	232.82	97%	0.7219	6
	Odyssey	124.8	224.9	180%	0.0000 n/a	1
	Synergy	202.2	222.23	110%	0.0847	4
SOLUBLE PROTEIN %	Growler	4.98	5.05	101%	0.3836	7
	Harrington	4.88	5.25	108%	0.0001 *	9
	Hockett	5.08	5.25	103%	0.0191 *	9
	Metcalfe	5.15	5.25	102%	0.108	9
	Odyssey	4.1	5	122%	0.0000 n/a	1
	Synergy	5.05	5.05	100%	1.0000n/a	7
S/T PROTEIN %	Growler	38.25	41.98	110%	0.0703	4
	Harrington	40.37	44.37	110%	0.0472 *	6
	Hockett	40.57	44.37	109%	0.0143 *	6
	Metcalfe	42.22	44.37	105%	0.2273	6
	Odyssey	36.7	47.7	130%	0.0000 n/a	1
	Synergy	40.48	41.98	104%	0.3131	4

MT124112's improved quality is in part due to faster hydration of the endosperm during malting. The Chapon Test, which steeps seeds for 48 hours, boils seed for 1 minute, and observes seed after splitting longitudinally, reveals the difficulty in hydrating Hockett's endosperm (Fig 2). Non-hydrated endosperm is white and chalky, while hydrated endosperm is gray and more translucent. We visually scored seeds for percent hydrated endosperm. In Fig 2, seeds from each line were grouped by percent hydrated endosperm. MT124112 has higher endosperm hydration than Hockett or Metcalfe after 48 hour steep under MSU malting conditions. Maltsters that use Hockett have requested a faster hydrating line, because slow hydration requires the addition of hormones for germination to proceed at an acceptable rate, costing time and money.

Figure 2: Percent hydration after 48 hours steep



Disease resistance: Fusarium head blight severity and DON scores are provided by Brueggeman at NDSU.

Screening for Fusarium head blight resistance in ND						
	Langdon2015		Fargo2016		Langdon2016	
ID	% Severity	DON ppm	% Severity	DON ppm	% Severity	DON ppm
Craft	16.5	20.5	27.7	35.4	30.0	83.7
Haxby	23.3	12.4	30.0	11.6	36.7	74.3
Hays	30.0	19.0	30.0	8.1	60.0	69.9
Hockett	10.0	14.9	30.0	9.7	50.0	59.3
MT124112	30.0	15.4	36.7	29.5	53.3	43.7

Purification/seed stocks: We purified MT1124112 in 2017 when 100 F_9-derived F_{10} headrows were grown at Bozeman Post farm with evaluation for phenotypic uniformity before bulking all 100 linerows for planting in 2018 to make breeder seed.

Summary:

Agronomic Strengths

- Low grain protein in dry land and with higher N
- Can be grown at higher yield potential without damaging quality

Quality Strengths

- High Malt Extract
- Low DP value
- Low Beta glucan
- Faster hydration
- More stable quality

Marker assisted selection

We continue to use marker assisted selection where helpful. We confirmed lines with the low protein gene using the HvNam1 markers. We also used molecular markers to determine the genetic makeup for a gene thought to be involved in drought or heat tolerance (HvGrRBP1) developed by a student of Andreas Fischer. In collaboration with USDA ARS, we have created a breeder friendly genotyping platform that has been used to genotype a mapping population that will help us map plump stability and malt quality traits.

Identifying new genes

In 2018, research was advanced to identify unique malt quality traits, genes related to forage production and forage quality, and genes involved in abiotic stress tolerance.

Winter Barley

The table below reports data from the 2018 Post Farm winter trial of the Vavilov collection. Here we record soft dough date, height, and dry weight in grams. The highest biomass lines are being used as parents for winter forage.

Line	Soft Date	Height	Dry Weight
L20449	11-Jul	83.5	62
L13033	12-Jul	106.5	72
L19917	11-Jul	87.5	73
L29353	11-Jul	84.5	75
Dicktoo	11-Jul	93	76
L28140	11-Jul	88	79
L13060	11-Jul	92.5	80
L21828	16-Jul	93.5	80
L4482	12-Jul	86.5	82
Dicktoo	11-Jul	76	83
L13814	11-Jul	99.5	86
L18035	11-Jul	92.5	86
L22026	16-Jul	93.5	86
L23609	12-Jul	84.5	87
L13592	11-Jul	85.5	88
L13838	11-Jul	83.5	88
L13839	11-Jul	97.5	90
L22436	11-Jul	87	90
L13644	16-Jul	94.5	92
L20251	16-Jul	96.5	95
L23769	16-Jul	96.5	95
L13593	11-Jul	99	99
L17779	11-Jul	96.5	99
L17985	16-Jul	92	99
L22484	11-Jul	78	101
L25814	11-Jul	95.5	101
L19069	11-Jul	93	106
L27093	11-Jul	100	107
L29979	16-Jul	83.5	107
Charles	16-Jul	74.5	109
L29621	12-Jul	81	109
L14962	11-Jul	102	111
L18783	16-Jul	101	111
L13168	16-Jul	100	113
L19070	11-Jul	90.5	113
L13092	11-Jul	98.5	114
L13061	11-Jul	90	117
L23513	16-Jul	91	117
L13894	16-Jul	99.5	118
L20442	12-Jul	73	118
L22707	16-Jul	93	118
L12901	11-Jul	105	119
L18409	11-Jul	97	119
L13976	16-Jul	99	120
L30904	11-Jul	68.5	120
L13841	16-Jul	108.5	121
L17632	16-Jul	90	122
L19059	16-Jul	94	124
L13968	12-Jul	106	126
L19921	11-Jul	85	127
L18040	12-Jul	89.5	128
L23089	16-Jul	104	128
L13031	11-Jul	94.5	133
L22607	12-Jul	87.5	139
L13837	11-Jul	103	142
L14015	11-Jul	79	143
L13849	12-Jul	103.5	148
L18302	16-Jul	91	148
L23770	16-Jul	72.5	148
L13905	16-Jul	102.5	149
L13971	16-Jul	103	154
L6358	11-Jul	87	161
L13906	17-Jul	93.5	162
L13095	11-Jul	90.5	178
L13038	16-Jul	110	184
L23689	11-Jul	101	187
L14026	16-Jul	106.5	207

The table below reports the data for the same material grown at CARC where winter survival was better. We speculate this was due to no-till planting. Some of the Vavilov lines had better winter survival than the winter check Dicktoo. Some of the Vavilov lines also had better yield and plumps as well as lower protein than the malt check Charles. However, most of these lines are 6 row.

	% Survival	Heading date	Height	Lodging Score		Plot	Test	Plumps
Line		Julian	(inches)	Score (1-5)	% Plot	weight (g)	weight (g)	%
13976	82%	165	23	3	40%	1297.1	54.5	49
13492	75%	165	24	1	10%	977.7	49.2	59
Dicktoo	74%	162	18	0	0%	878.9	53.4	63
25814	74%	165	23	2	25%	586.9	51.3	56
23770	73%	165	21	0	0%	1151.0	54.6	73
13587	72%	165	27	2	30%	1293.0	55.9	51
17779	72%	162	19	0	0%	507.5	54.3	87
20251	67%	171	26	1	10%	846.5	53.5	44
27093	67%	162	15	2	25%	655.4	53.7	83
13060	66%	162	18	1	10%	629.7	53.5	83
16455	66%	166	21	0	0%	946.5	55.4	84
13651	66%	171	24	4	85%	1292.3	55.4	44
22436	65%	162	17	4	80%	637.1	50.6	78
4482	64%	162	19	0	0%	986.6	50.5	89
13968	64%	156	18	0	0%	454.3	50.9	87
30209	64%	163	18	0	0%	1272.6	53.6	79
25592	64%	165	17	0	0%	1036.4	53.3	74
22026	64%	163	21	1	10%	1202.5	54.8	78
19059	64%	171	20	1	10%	569.1	53.8	76
13837	64%	165	26	0	0%	1207.0	56.3	57
23513	64%	166	21	2	25%	1049.7	53.4	85
30075	63%	171	20	4	80%	460.4	49.8	64
14015	62%	163	25	1	10%	528.6	48.4	60
6358	61%	162	19	1	10%	949.1	53.3	87
15604	61%	158	16	0	0%	385.9	53.3	86
13814	61%	166	25	0	0%	1239.5	54.6	63
17642	60%	176	19	0	0%	361.0	51.2	61
13906	60%	166	25	2	25%	1282.9	54.9	59
13167	60%	166	21	1	10%	1243.4	52.9	65
29979	59%	162	16	0	0%	1225.9	51.2	74
13038	59%	165		0	0%	1355.7	48.9	53
13894	57%	171	27	4	80%	524.4	48.9	47
29621	56%	166	17	0	0%	555.7	47.6	74
28140	56%	157	18	0	0%	561.3	52.4	67
18035	56%	162		0	0%	786.6	48.2	89
22607	56%	165		0	0%	1708.9	53.1	64
18302	55%	162	20	2	0%	626.6	51.1	87
13971	55%	165		0	0%	1535.7	49.8	59
Dicktoo	54%	165	16	0	0%	1055.5	53.3	67
22707	54%	165	22	0	0%	604.5	52.6	67
13838	53%	158	18	0	0%	605.2	51.6	90
13644	53%	166	22	1	10%	1083.8	54.8	47
13905	53%	171	25	2	25%	1246.3	50.7	46
13849	53%	171	23	3	50%	849.0	51.8	58
19070	52%	171	17	0	0%	531.5	53.4	91
19069	52%	166		0	0%	1101.1	55.9	90
18790	52%	171	20	2	30%	781.3	51.2	64
13841	52%	171	27	3	50%	1127.6	51.4	59
13095	51%	162	18	1	10%	747.3	51.6	93
13061	50%	157	16	0	0%	275.1	47.4	88
13470	50%	NA	29	2	30%	1130.8	50.4	44
Dicktoo	50%	163	17	0	0%	1228.9	45.7	75
13840	50%	171	26	2	25%	1018.4	54.5	42
13031	50%	171	23	0	0%	931.3	49.8	69
23609	49%	162	22	0	0%	786.3	54.3	77
23192	47%	156	17	0	0%	756.5	54.7	61
30904	46%	156	14	0	0%	589.6	49.2	73
14026	45%	166	21	0	0%	910.6	51.3	70
13109	44%	162	22	0	25%	660.1	53.7	80
19921	43%	156	18	2	25%	557.6	46.2	84
23089	43%	171	24	1	10%	760.2	51.6	53
17985	42%	162	17	0	0%	905.4	53.1	81
25827	41%	165		0	0%	816.1	49.7	85
14962	41%	163	18	0	0%	274.2	50.9	82
20449	41%	165	18	0	0%	641.3	49.2	80
13168	40%	162		0	0%	414.6	45.0	91
18409	40%	165	22	0	0%	777.1	54.2	86
20840	40%	171	22	0	0%	1154.8	54.9	76
Charles	39%	171	18	0	0%	1196.6	51.7	79
17635	39%	171	20	0	0%	737.4	53.2	73
19917	38%	158		0	0%	655.1	51.2	83
15566	38%	165		0	0%	707.5	55.0	81
Charles	37%	171		0	0%	1468.9	51.7	72
17632	32%	174	21	0	0%	808.6	51.8	64
22484	31%	162	18	0	0%	859.4	53.4	77
Charles	31%	173	20	0	0%	798.3	53.4	78
Dicktoo	31%	162	18	1	10%	1133.1	52.9	61
19051	27%	157	18	0	0%	821.7	54.7	89
Charles	21%	174	18	0	0%	192.2	37.0	79

The table below provides malt quality data for the winter nursery. Although the Vavilov lines have low protein, they require malt improvement for a number of traits, including water sensitivity, extract, turbidity, beta glucan, and alpha amylase.

	Germination							Gallery					
Line	4mL germ	Germ Capacity	Water sensitivity	Malt protein	Time (min) to filter 160mL	Extract (CG db)%	Turbidity	S. Protein	FAN	B-Glucan	AA	DP	S/T
18035	98	98	0	12.90	80	82.1	25.9	3.67	164	670	29.5	103	28%
6358	94	94	1	12.80	105	71.1	30.7	3.80	169	753	25.9	102	30%
22607	96	97	6	10.40	122	74.0	11.4	4.35	185	489	41.4	120	42%
13470	99	99	12	10.80	93	70.0	54.7	3.07	127	925	23.8	85	28%
13840	95	95	13	10.80	128	70.7	46.0	3.16	135	809	27.2	84	29%
29621	95	99	13	10.60	179	74.9	51.7	4.13	182	921	36.5	96	39%
13644	92	95	14	10.60	128	73.4	56.9	2.99	128	953	18.5	82	28%
4482	87	96	15	13.00	186	73.1	26.3	3.89	165	996	31.6	94	30%
13971	91	96	16	12.30	137	72.8	43.0	3.70	158	902	26.4	97	30%
13651	96	98	16	10.10	35	72.8	52.7	3.04	127	676	21.2	78	30%
13849	94	98	16	11.20	84	69.3	44.8	2.96	130	941	18.5	85	26%
19051	96	98	20	13.30	108	73.6	8.5	4.91	244	443	61.7	145	37%
13095	93	93	21	11.90	90	71.0	39.3	3.61	152	726	32.5	97	30%
13587	97	98	22	10.90	114	69.8	54.5	2.74	117	1110	21.1	81	25%
13976	97	98	23	11.00	99	71.5	49.3	3.24	135	874	25.0	86	29%
13837	88	94	23	11.40	76	69.2	42.8	3.12	135	920	22.1	82	27%
13905	96	97	24	10.20	63	70.9	6.0	3.11	127	673	25.5	85	30%
13841	99	99	24	12.00	117	67.9	45.7	3.09	123	1114	18.6	84	26%
13031	91	91	25	11.90	121	70.7	48.2	3.53	143	787	25.4	96	30%
13492	93	93	28	12.10	128	68.6	55.6	2.99	126	1398	23.1	81	25%
13906	86	92	35	10.5	137	72.1	56.3	3.10	133	961	21.2	85	30%
23770	97	97	34	11.20	35	72.8	56.8	3.57	150	855	34.1	90	32%
18409	93	96	34	12.30	328	71.3	64.8	3.51	138	1199	20.7	111	29%
22484	86	94	36	12.10	85	69.8	40.6	2.91	151	1205	26.7	9	24%
29979	92	96	40	12.40	91	71.0	40.3	3.06	152	1226	26.6	75	25%
22026	93	98	42	11.70	273	68.3	56.0	2.44	109	1136	17.9	9	21%
25592	90	93	45	12.70	117	69.2	42.0	3.19	155	1203	25.5	74	25%
14026	84	95	45	11.90	523	67.2	...	2.59	122	1254	13.8	63	22%
30209	92	95	56	13.70	205	71.0	42.0	3.16	145	1379	22.6	17	23%
23513	94	98	56	11.90	596	69.4	...	2.96	113	1303	14.5	69	25%
16455	94	100	61	12.10	690	68.7	...	2.67	118	1371	18.3	29	22%
13038	84	89	25	12.2	324	67.6	...	2.25	103	1436	17.7	61	18%
19069	75	81	55	12.60	81	67.7	38.6	2.59	118	1470	18.8	70	21%
20840	74	87	36	11.90	370	69.7	...	2.67	89	1481	10.0	72	22%
13814	80	86	21	11.00	69	69.9	47.8	2.86	119	1121	20.3	76	26%
13167	76	89	29	11.00	361	68.5	...	2.56	100	1463	11.6	57	23%
17985	72	89	34	13.30	312	72.5	...	3.14	130	1402	18.6	117	24%
Charles	99	99	2	11.30	44	81.7	7.0	6.03	316	57	98.9	181	53%
Charles	99	99	3	9.80	49	81.7	6.2	5.70	302	65	97.6	163	58%
Charles	94	96	4	10.70	77	80.1	9.4	5.72	304	77	86.8	171	53%
				10.60	56.7	81.1	7.6	5.81	307.07	66.4	94.45	172	55%
				0.75	17.8	0.92	1.7	0.19	7.61	10.4	6.62	8.95	0.03
				0.07	0.31	0.01	0.2	0.03	0.02	0.16	0.07	0.05	0.05
Dicktoo	104	106	68	12.10	246	69.3	16.1	3.84	163	1040	35.1	118	32%
Dicktoo	90	90	69	11.6	411	71.1	34.5	2.70	118	1432	20.6	24	23%
				11.85	328.33	70.22	25.30	3.27	140.32	1235.90	27.82	70.97	27%
				0.35	116.44	1.26	13.01	0.81	31.61	277.24	10.28	66.37	0.06
				0.03	0.35	0.02	0.51	0.25	0.23	0.22	0.37	0.94	0.22
QC Odyssey				11.20	32	79.3	3.9	4.75	220	45	61.3	160	42%
QC Odyssey				11.80	65	80.1	4.6	4.29	219	53	67.9	159	36%
QC Odyssey				11.70	60	78.6	3.9	3.7	156	185	45.9	125	31%
				11.57	52.3	79.4	4.1	4.23	198.17	94.1	58.36	148	37%
				0.32	17.8	0.72	0.4	0.55	36.60	78.9	11.29	20.03	0.06
				0.03	0.34	0.01	0.1	0.13	0.18	0.84	0.19	0.14	0.15

We have made crosses using the most cold tolerant of the Vavilov material and other European winter families, resulting in one new family for food, 8 families for forage, 21 families for feed, 1 family for food and 45 families for malt. We have planted these crosses at the Bozeman Post Farm to test for winter survival in 2019.

2018 Barley and Malt Quality Lab work summary:

Research:

Completed analysis for the MSU breeding program:

2017 Training: 16 Full samples
2018 Intra: 49 Full samples
2018 NAM 61: 90 Full samples, 92 TB, and 90 Chapon tests
2018 Winter: 45 Full samples
2018 Heirloom: 180 Full samples
2018 EYT: 64 Full samples
PYT: 150 TB
F5s – malted 321 TB samples, testing to be completed
LOX – malted 30 TB, testing to be completed
NAM 123: 60 Full samples

Totals:
596 Full samples
443 TB samples
90 Chapon tests

Collaborative Research:

Glycosidic Nitrile – Hartwick College: 32 Full samples, research presented at the 2018 ASBC conference
B-Glucan – USDA: 60 Full samples, research pending publication

Outreach:

Tours given: 12

This includes several brewers from around the state, peer programs from local and regional groups, local maltsters and potential start up maltsters, the Farmers Union and MSU Alumni, as well as international groups.

Our successful application to the national Craft Maltster's Guild will be bringing both a week long Advanced Course in Craft Malting as well as the Guild's annual conference to MSU at the end of January. These events put a very positive spotlight on our program and brings in potential new clientele to support the lab.

Service:

Active clients: 16

Clientele include Maltsters, brewers, and peer research programs such as Cornell. Clients are both local, regional, and international including Canada and 10 states.

Third Party samples
tested: Malt: 167 samples
Barley: 56 samples