

Table 1. Agronomic trait means of the 2021-2022 Winter Malting Barley Trial (WMBT)^a at 18 locations.

Trial location	Winter Survival (%)	Yield (Bu/A)	Heading date (Julian day)	Height (cm)	Lodging degree (0-9)	Straw breakage (%)	Test Weight (lb/Bu)	Grain Protein-breeder measure (%)	Plump-breeder measure (%)	Thin grain (%)	Deoxynivalenol content (ppm)	Leaf Scald severity (%)	Leaf Rust susceptibility (0-9)	Leaf Scald reaction (0-9)	Spot Blotch reaction (0-9)
Georgetown, DE	100.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aberdeen, ID	100.0	.	147.0	.	.	.	.	.	.	.	.	.	.	.	.
Schochoh, KY	100.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Versailles, KY	100.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
South Deerfield, MA	80.0	23.2	.	.	.	.	.	.	.	.	.	.	.	.	.
Hickory Corners, MI	100.0	115.3	147.4	79.4	.	.	43.7	10.0	97.1	0.2	0.3	.	.	.	.
Crookston, MN	30.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saint Paul, MN	58.7	68.1	156.5	68.0	.	12.7	.	.	.	.	.	.	.	.	.
Mead, NE	80.6	27.0	.	60.4	.	.	.	.	.	.	.	.	.	.	.
Farmington, NM	92.5	21.4	134.4	.	.	.	.	.	.	.	.	.	.	.	.
Ithaca, NY	80.9	85.2	145.2	63.5	.	.	50.3	.	.	.	.	.	0.3	2.1	2.3
Custar, OH	6.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Wooster, OH	100.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Corvallis, OR	100.0	81.4	120.6	103.8	1.4	11.4	50.0	12.2	83.5	.	.	39.3	.	.	.
Blacksburg, VA	100.0	126.1	118.0	81.3	0.5	.	49.9	.	.	.	.	.	.	.	.
Warsaw, VA	100.0	127.8	115.7	72.3	0.6	.	49.5	.	.	.	.	.	.	.	.
Alburgh, VT	96.5	92.0	.	77.4	1.7	.	45.2	9.6	94.1	.	.	.	.	.	.
Pullman, WA	100.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GRAND MEAN	81.2	76.6	135.2	75.8	1.0	12.0	47.9	10.2	92.6	0.2	0.3	39.3	0.3	2.1	2.3

^a Agronomic data reported for 18 of 19 locations planted

Table 2. Winter Survival (%) line means for 2021-2022 Winter Malting Barley Trial (WMBT) entries at 18 locations.

Line	Line Mean	Georgetown, DE	Aberdeen, ID	Schochoh, KY	Versailles, KY	South Deerfield, MA	Hickory Corners, MI	Crookston, MN	Saint Paul, MN	Mead, NE	Farmington, NM	Ithaca, NY	Custar, OH	Wooster, OH	Corvallis, OR	Blacksburg, VA	Warsaw, VA	Alburgh, VT	Pullman, WA
CHARLES	81.1	100	100	100	100	93.3	100	33.3	63.3	66.7	100.0	68.3	15.0	100	100	100	100	83.3	100
THOROUGHbred	83.8	100	100	100	100	70.0	100	23.3	55.0	96.7	93.3	90.0	10.0	100	100	100	100	100.0	100
ENDEAVOR	76.4	100	100	100	100	86.7	100	10.0	17.3	80.0	95.0	63.3	5.0	100	100	100	100	96.7	100
WINTMALT	81.1	100	100	100	100	90.0	100	30.0	53.3	80.0	91.7	83.3	1.7	100	100	100	100	93.3	100
KWS_FARO	85.8	100	100	100	100	81.7	100	36.7	80.0	90.0	93.0	93.3	16.7	100	100	100	100	100.0	100
KWS_SOMERSET	81.4	100	100	100	100	90.0	100	30.0	46.7	80.0	95.0	85.0	0.0	100	100	100	100	100.0	100
KWS_DONAU	78.6	100	100	100	100	70.0	100	23.3	41.7	76.7	93.3	83.3	1.7	100	100	100	100	96.7	100
KWS_ORBIT	82.1	100	100	100	100	70.0		50.0	70.0	83.3	86.7	81.7	15.0	100	100	100	100	98.3	100
13ARS503-1	73.0	100	100	100	100	76.7	100	10.0	36.7	20.0	86.7	85.0	5.0	100	100	100	100	83.3	100
13ARS506-8	75.8	100	100	100	100	85.0	100	33.3	18.3	50.0	94.7	58.3	5.0	100	100	100	100	100.0	100
13ARS514-5	83.5	100	100	100	100	88.3	100	13.3	76.7	93.3	95.0	80.0	11.7	100	100	100	100	100.0	100
AVALON	78.0	100	100	100	100	83.3	100	33.3	31.7	63.3	93.3	67.0	5.0	100	100	100	100	100.0	100
VA19M-16DH2261	84.8	100	100	100	100	73.3	100	53.3	70.0	96.7	86.3	86.7	10.0	100	100	100	100	100.0	100
VA20MFHB-18DH541	79.5	100	100	100	100	66.7	100	46.7	46.7	86.7	93.3	85.0	1.7	100	100	100	100	73.3	100
VA17M-13DH1720	79.5	100	100	100	100	83.3	100	43.3	35.0	76.7	83.3	78.3	0.0	100	100	100	100	100.0	100
FLAVIA	80.9	100	100	100	100	81.7	100	33.3	73.3	73.3	88.0	68.3	1.7	100	100	100	100	100.0	100
HIRONDELLA	82.7	100	100	100	100	78.3	100	20.0	70.0	100.0	94.7	78.3	5.0	100	100	100	100	100.0	100
MARQUETTA	81.4	100	100	100	100	63.3	100	23.3	73.3	83.3	95.0	83.3	5.0	100	100	100	100	100.0	100
DH141222	84.5	100	100	100	100	90.0	100	30.0	70.0	93.3	88.3	90.0	11.7	100	100	100	100	100.0	100
DH141225	81.7	100	100	100	100	70.0	100	16.7	63.3	96.7	93.3	83.3	10.0	100	100	100	100	98.3	100
DH141917	84.9	100	100	100	100	93.3	100	26.7	80.0	76.7	94.7	78.3	28.3	100	100	100	100	100.0	100
DH150683	82.4	100	100	100	100	76.7		73.3	53.3	66.7	90.0	85.0	16.7	100	100	100	100	98.3	100
PIXEL	81.8	100	100	100	100	61.7	100	30.0	66.7	96.7	93.3	81.7	3.3	100	100	100	100	100.0	100
DEMENTIEL	77.5	100	100	100	100	91.7	100	10.0	23.3	80.0	90.0	75.0	1.7	100	100	100	100	98.3	100
SC_104865	82.5	100	100	100	100	93.3	100	10.0	61.7	96.7	96.7	80.0	5.0	100	100	100	100	100.0	100
SC_113669	78.4	100	100	100	100	86.7	100	23.3	30.0	66.7	86.7	83.3	6.7	100	100	100	100	100.0	100
DH0214-007	82.2	100	100	100	100	91.7	100	13.3	61.7	83.3	95.0	86.7	13.3	100	100	100	100	93.3	100
RIL02WI-013	79.1	100	100	100	100	75.0	100	10.0	73.3	80.0	93.3	85.0	1.7	100	100	100	100	75.0	100
DH02FL-028	82.3	100	100	100	100	88.3	100	43.3	53.3	70.0	95.0	88.3	1.7	100	100	100	100	100.0	100
RIL02FL-029	80.2	100	100	100	100	60.0	100	13.3	73.3	86.7	95.0	81.7	0.0	100	100	100	100	100.0	100
MN-EQUINOX	86.3	100	100	100	100	66.7	100	60.0	93.3	100.0	95.0	83.3	0.0	100	100	100	100	100.0	100
2MW18_4462-008	85.5	100	100	100	100	83.3	100	66.7	61.7	90.0	95.0	90.0	0.0	100	100	100	100	100.0	100
GRAND MEAN	81.2	100	100	100	100	80.0	100	30.4	57	80.6	92.5	80.9	6.7	100	100	100	100	96.5	100

Table 3. Yield (Bu/A) line means for 2021-2022 Winter Malting Barley Trial (WMBT) entries at 10 locations.

Line	Line Mean	South Deerfield, MA	Hickory Corners, MI	Saint Paul, MN	Mead, NE	Farmington, NM	Ithaca, NY	Corvallis, OR	Blacksburg, VA	Warsaw, VA	Alburgh, VT
CHARLES	63.4	8.1	113.4	57.4	17.4	24.5	69.5	42.9	103.6	115.5	82.0
THOROUGHBRED	91.0	39.0	125.7	98.9	34.3	17.6	90.5	105.3	152.5	132.7	116.2
ENDEAVOR	72.0	25.9	121.1	52.1	20.0	25.5	60.9	54.4	119.2	131.4	96.3
WINTMALT	67.2	22.8	110.3	61.9	19.6	11.7	78.2	39.2	108.5	121.6	96.2
KWS_FARO	86.9	9.0	121.8	71.2	40.0	28.0	117.7	63.0	138.7	151.4	102.5
KWS_SOMERSET	72.5	29.9	111.8	31.9	20.8	23.7	88.7	79.5	118.3	125.0	81.7
KWS_DONAU	74.1	13.5	122.6	33.5	15.4	13.4	80.2	94.7	120.2	126.5	107.5
KWS_ORBIT	78.9	16.7	.	86.4	29.2	17.5	86.7	101.9	155.2	133.5	85.4
13ARS503-1	65.4	17.2	127.9	58.4	3.1	11.5	93.1	47.5	94.7	127.0	71.1
13ARS506-8	68.0	27.0	128.0	30.1	8.4	21.3	70.4	61.9	109.0	132.6	79.0
13ARS514-5	71.3	28.9	97.1	58.8	32.3	23.4	94.0	41.2	84.1	129.4	113.6
AVALON	73.2	27.2	105.2	59.4	29.3	11.7	79.5	80.7	136.6	118.9	78.7
VA19M-16DH2261	79.9	24.7	100.4	99.5	37.3	10.4	76.4	88.7	145.9	119.0	96.7
VA20MFHB-18DH541	76.7	27.2	114.8	69.7	33.1	28.5	75.7	88.4	124.6	127.7	77.1
VA17M-13DH1720	78.8	27.7	116.4	56.3	28.8	10.6	85.4	100.6	123.9	138.6	91.9
FLAVIA	68.2	29.5	105.0	62.6	21.0	15.6	70.4	45.8	111.5	131.8	101.2
HIRONDELLA	90.5	19.1	104.7	67.0	39.6	22.9	94.7	156.9	157.3	126.6	116.2
MARQUETTA	94.6	29.0	125.5	78.6	41.2	42.4	90.9	125.1	166.4	133.6	113.7
DH141222	78.7	19.4	117.4	61.8	34.3	28.0	86.2	90.0	110.4	126.1	113.2
DH141225	77.5	19.6	113.3	60.5	34.7	37.5	86.1	113.9	106.2	121.0	75.1
DH141917	69.8	11.5	121.3	48.7	20.9	19.4	79.7	89.6	99.0	116.8	83.6
DH150683	78.8	22.7	.	51.5	8.5	12.5	93.9	145.3	133.8	123.3	117.5
PIXEL	90.9	18.8	133.1	100.5	34.1	20.5	90.4	101.5	149.4	151.3	112.9
DEMENTIEL	76.0	43.3	134.7	19.7	31.5	29.5	84.8	18.1	123.4	136.9	101.0
SC_104865	92.2	26.0	112.3	96.4	37.6	25.4	95.8	134.0	159.3	144.5	92.4
SC_113669	78.4	28.4	110.8	58.2	23.2	15.2	82.2	114.3	151.8	138.3	65.8
DH0214-007	68.6	25.1	107.2	71.7	20.3	13.1	82.0	74.6	111.9	106.7	74.4
RIL02WI-013	66.1	19.5	107.2	61.5	29.1	19.2	79.1	46.0	112.6	118.6	68.5
DH02FL-028	79.8	20.6	103.5	51.9	18.9	36.8	95.6	102.3	136.2	123.8	99.3
RIL02FL-029	68.7	14.2	110.5	51.3	30.1	28.0	86.1	63.3	113.1	114.6	75.5
MN-EQUINOX	75.7	13.1	122.2	102.4	32.1	13.4	94.0	35.4	120.5	128.8	74.0
2MW18_4462-008	76.3	30.7	108.7	95.3	38.5	26.1	88.7	58.2	122.0	117.2	84.4
GRAND MEAN	76.6	23.0	115.1	64.5	27.0	21.4	85.2	81.4	125.6	127.8	92.0

Table 4. Agronomic trait line means for 2021-2022 Winter Malting Barley Trial (WMBT) entries.

Line	Winter Survival (%)	Yield (Bu/A)	Heading date (Julian day)	Height (cm)	Lodging degree (0-9)	Straw breakage (%)	Test weight (lb/Bu)	Grain Protein-breeder (%)	Plump-breeder measure (%)	Thin grain (%)	Deoxynivalenol content (ppm)	Leaf Scald severity (%)	Leaf Rust susceptibility (0-9)	Leaf Scald reaction (0-9)	Spot Blotch reaction (0-9)
CHARLES	81.1	63.4	134.3	65.1	3.0	27.0	44.5	10.6	87.0	0.2	0.17	91.7	2.3	2.0	1.7
THOROUGHbred	83.8	91.0	132.1	81.0	1.2	13.0	49.3	9.7	88.1	0.1	0.58	41.7	0.0	0.0	7.0
ENDEAVOR	76.4	72.0	134.8	76.9	2.0	40.0	48.6	10.1	83.1	1.1	0.17	91.7	0.0	0.7	1.7
WINTMALT	81.1	67.2	140.0	72.0	0.1	4.0	47.7	10.6	95.2	0.3	0.21	80.0	0.0	4.7	0.3
KWS_FARO	85.8	86.9	134.2	75.2	0.1	20.0	47.8	9.3	96.1	0.2	0.51	35.0	0.0	0.0	3.3
KWS_SOMERSET	81.4	72.5	137.0	75.4	0.3	1.0	47.3	9.9	95.7	0.1	0.14	16.7	0.0	6.3	0.0
KWS_DONAU	78.6	74.1	137.5	74.8	0.2	4.0	48.4	9.9	96.5	0.1	0.19	10.0	0.0	4.3	2.0
KWS_ORBIT	82.1	78.9	135.7	83.5	0.1	0.0	48.3	9.4	96.5	.	.	18.3	0.0	3.0	1.0
13ARS503-1	73.0	65.4	129.3	71.0	2.7	42.0	48.7	10.3	87.2	0.3	0.30	86.7	0.0	0.3	1.7
13ARS506-8	75.8	68.0	132.5	65.7	2.7	37.5	46.8	10.2	85.8	0.3	0.17	91.7	1.7	1.7	1.3
13ARS514-5	83.5	71.3	145.0	62.4	0.8	2.0	47.5	9.9	85.3	1.1	0.14	71.7	0.0	2.0	2.3
AVALON	78.0	73.2	135.0	86.6	1.6	18.0	50.4	10.7	94.8	0.1	0.33	68.3	0.7	0.0	2.3
VA19M-16DH2261	84.8	79.9	133.9	79.1	1.8	15.0	48.5	11.2	96.5	0.0	0.10	36.7	0.3	0.3	3.7
VA20MFHB-18DH541	79.5	76.7	135.8	69.6	0.2	4.0	47.9	9.9	88.9	0.1	0.29	63.3	0.0	4.7	3.0
VA17M-13DH1720	79.5	78.8	134.3	75.8	3.0	16.0	47.6	9.4	87.8	0.4	0.60	11.7	0.0	3.3	3.3
FLAVIA	80.9	68.2	136.4	65.8	0.3	0.0	47.6	10.2	93.9	0.0	0.20	70.0	0.0	5.3	0.7
HIRONDELLA	82.7	90.5	136.0	76.8	1.0	24.0	47.3	9.9	96.7	0.1	0.41	5.0	0.3	1.7	1.3
MARQUETTA	81.4	94.6	133.3	85.4	0.8	21.0	48.1	9.8	97.1	0.1	0.57	10.0	0.0	1.3	2.3
DH141222	84.5	78.7	134.5	74.9	0.4	0.0	49.2	10.6	97.0	0.0	0.24	31.7	0.0	0.0	3.7
DH141225	81.7	77.5	138.3	77.7	0.9	5.0	49.2	9.9	95.0	0.0	0.51	5.0	0.0	2.3	1.7
DH141917	84.9	69.8	137.3	72.9	0.1	5.0	48.2	11.0	97.1	0.1	0.13	16.7	0.0	0.7	2.3
DH150683	82.4	78.8	130.4	75.9	1.5	11.0	49.3	10.1	97.1	.	.	1.7	0.0	0.0	2.7
PIXEL	81.8	90.9	135.6	73.1	0.9	12.0	46.8	9.4	95.7	0.1	0.66	13.3	1.0	1.0	2.0
DEMENTIEL	77.5	76.0	136.5	75.7	0.1	0.0	44.6	10.3	95.9	0.2	0.48	21.7	0.0	2.0	2.0
SC_104865	82.5	92.2	133.0	76.4	0.7	6.0	48.1	9.7	94.2	0.1	0.78	15.0	0.0	4.0	1.0
SC_113669	78.4	78.4	135.7	77.6	0.5	2.5	48.8	11.0	92.5	0.1	0.73	8.3	0.0	3.3	2.7
DH0214-007	82.2	68.6	130.9	75.0	1.6	9.0	49.4	10.7	92.0	0.1	0.20	30.0	0.0	4.7	3.7
RIL02WI-013	79.1	66.1	136.7	77.0	0.4	1.0	47.4	10.9	86.8	0.1	0.08	78.3	0.0	5.7	0.3
DH02FL-028	82.3	79.8	136.0	80.4	0.8	8.0	48.3	9.9	92.9	0.2	0.16	8.3	0.0	0.3	5.0
RIL02FL-029	80.2	68.7	140.2	82.7	1.0	2.0	47.8	10.1	90.5	0.3	0.13	21.7	0.7	0.0	3.0
MN-EQUINOX	86.3	75.7	130.9	85.8	1.9	26.0	47.2	10.9	93.8	0.4	0.28	41.7	2.3	0.0	3.3
2MW18_4462-008	85.5	76.3	132.4	78.6	0.9	8.0	47.6	10.6	89.9	0.1	0.34	65.0	0.0	2.7	1.7
GRAND MEAN	81.2	76.6	135.2	75.8	1.0	12.0	47.9	10.2	92.6	0.2	0.33	39.3	0.3	2.1	2.3
# of Env.	18	10	8	8	4	2	6	3	3	1	1	1	1	1	1

Table 5. Malt quality^a trait line means for 2021-2022 Winter Malting Barley Trial (WMBT) entries at St. Paul, MN.

Line	Malt extract (%)	Malt Protein (%)	Wort Protein (%)	S/T (%)	Diastatic Power °ASBC	Alpha Amylase (20°DU)	Beta Glucan (ppm)	Free Amino Nitrogen (ppm)	Viscosity (mPa)	Wort color °ASBC
CHARLES	78.7	12.3	5.5	44.9	165	67.6	264	251	1.6	2.1
THOROUGHbred	77.1	13.5	4.0	29.8	150	48.5	626	141	1.8	1.6
ENDEAVOR	77.5	15.1	5.3	35.4	198	68.9	246	225	1.5	1.7
WINTMALT	77.2	12.8	4.5	35.2	148	54.7	139	184	1.5	1.9
KWS_FARO	76.3	12.9	4.9	37.7	138	51.7	128	195	1.5	1.9
KWS_SOMERSET	75.5	12.8	4.6	36.0	178	52.0	126	178	1.5	1.7
KWS_DONAU	74.9	15.2	4.5	29.5	190	49.7	203	168	1.5	1.8
KWS_ORBIT	74.5	11.4	3.8	33.2	133	44.1	638	132	1.8	1.8
13ARS503-1	78.6	12.4	4.7	37.9	126	55.2	396	192	1.7	2.0
13ARS506-8	75.5	13.8	5.2	37.8	155	51.7	486	220	1.7	2.0
13ARS514-5	75.8	14.1	6.0	42.8	195	64.8	230	265	1.5	3.5
AVALON	75.4	15.8	4.5	28.4	168	50.3	445	179	1.6	2.0
VA19M-16DH2261	75.3	13.8	3.9	28.0	196	46.8	422	139	1.7	1.3
VA20MFHB-18DH541	77.0	13.1	4.2	32.0	213	47.7	201	146	1.5	1.9
VA17M-13DH1720	75.1	13.0	4.2	31.8	191	47.9	332	153	1.6	1.5
FLAVIA	77.1	12.7	4.3	34.1	210	51.2	142	167	1.5	2.0
HIRONDELLA	73.4	14.3	4.9	34.4	314	52.1	214	199	1.5	1.7
MARQUETTA	77.3	10.9	4.3	39.3	164	51.9	380	181	1.7	1.2
DH141222	78.4	11.8	4.3	36.6	221	49.1	113	161	1.5	1.7
DH141225	76.3	15.0	4.9	32.6	313	55.2	325	180	1.5	1.4
DH141917	76.9	14.7	5.6	38.2	206	53.7	97	221	1.5	1.7
DH150683	78.1	13.7	5.8	42.3	216	60.7	75	253	1.5	1.9
PIXEL	77.4	10.6	4.6	43.0	151	58.0	495	179	1.6	2.0
DEMENTIEL	74.2	14.5	4.9	33.5	115	47.7	645	185	1.7	2.4
SC_104865	78.9	12.1	4.6	38.3	188	52.5	574	179	1.7	1.5
SC_113669	76.9	12.7	4.7	37.0	205	50.6	610	180	1.7	1.5
DH0214-007	75.8	13.6	4.5	33.2	177	53.6	663	149	1.8	1.9
RIL02WI-013	75.3	13.0	4.3	33.3	217	55.0	183	157	1.5	1.6
DH02FL-028	73.7	15.0	4.6	30.3	284	53.3	129	158	1.4	1.1
RIL02FL-029	75.2	14.7	4.8	33.0	265	51.8	430	173	1.5	1.4
MN-EQUINOX	76.8	10.7	3.6	33.9	106	39.8	846	122	2.3	1.7
2MW18_4462-008	76.2	12.9	4.9	38.2	193	55.6	516	199	1.7	1.4
GRAND MEAN	76.3	13.3	4.7	35.4	190.3	52.9	353.7	181.6	1.6	1.8

^a Malt quality data courtesy of Rahr Malting Co., Shakopee, MN

Table 6. Line entry details available for submissions to the 2021-2022 Winter Malting Barley Trial (WMBT).

Entry	Line	Row type	Submitter
1	CHARLES	2	
2	THOROUGHBRED	6	
3	ENDEAVOR	2	
4	WINTMALT	2	
5	KWS_FARO	6	KWS
6	KWS_SOMERSET	2	KWS
7	KWS_DONAU	2	KWS
8	KWS_ORBIT	6	KWS
9	13ARS503-1	2	USDA-ARS Aberdeen
10	13ARS506-8	2	USDA-ARS Aberdeen
11	13ARS514-5	2	USDA-ARS Aberdeen
12	AVALON	2	Virginia Tech
13	VA19M-16DH2261	2	Virginia Tech
14	VA20MFHB-18DH541	2	Virginia Tech
15	VA17M-13DH1720	6	Virginia Tech
16	FLAVIA	2	Ackermann Saatzucht GmbH
17	HIRONDELLA	6	Ackermann Saatzucht GmbH
18	MARQUETTA	6	Ackermann Saatzucht GmbH
19	DH141222	2	Oregon State U
20	DH141225	2	Oregon State U
21	DH141917	2	Oregon State U
22	DH150683	2	Oregon State U
23	PIXEL	6	Secobra
24	DEMENTIEL	6	Secobra
25	SC_104865	6	Secobra
26	SC_113669	6	Secobra
27	DH0214-007	2	Ohio State U
28	RIL02WI-013	2	Ohio State U
29	DH02FL-028	2	Ohio State U
30	RIL02FL-029	2	Ohio State U
31	MN-EQUINOX	6	U of Minnesota
32	2MW18_4462-008	2	U of Minnesota