

Exploring European Solutions to Solve Canadian Barley Lodging Problems

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INTRODUCTION

Lodging is a serious problem for barley growers in western Canada and this is contributing to declining barley acres. European malt cultivars have excellent stem strength and may be a good option for Canadian growers. However, European cultivars must have equal or better: disease ratings, standability, yield and quality to be viable options for Canadian growers.

MATERIALS AND METHODS

In 2016 and 2017, small plot research trials were conducted at two locations in Alberta and one location in Manitoba to evaluate the agronomic, yield and quality performance of European malt barley cultivars in comparison to three commonly grown Canadian cultivars: CDC Copeland, AC Metcalfe and CDC Austenson. Barley cultivars were tested from five European breeding institutions: Sejet Plant breeding, SaatZucht Josef Breun GmbH & Co. KG, Ackermann SaatZucht GmbH & Co KG, Nordic Seed A/S, Wiersum and KWS. In 2016, 13 cultivars were tested in a randomized complete block design replicated two times. Five poor performing cultivars were removed from the trial after assessment of the 2016 data. In 2017, the three Canadian cultivars were tested along with the top five cultivars from 2016 along with 12 new cultivars in 2017. In 2017, a randomized complete block design was used with three replicates. Trial locations, seeding dates, N fertilizer and growing season precipitation are reported in Table 1.

Table 1. Seeding dates, harvest dates, N fertilizer application at the time of seeding and growing season precipitation at Bon Accord, AB, Lethbridge, AB and Fort Whyte, MB in 2016 and 2017.

	Bon Accord 2016	Bon Accord 2017	Lethbridge 2016	Lethbridge 2017	Fort Whyte 2016	Fort Whyte 2017
N fertilizer (mm)	122 lbs	74 lbs	44 lbs	97 lbs	80 lbs	80 lbs
Growing Season Precip. (mm)	283 mm	191 mm	531 mm	531 mm	318 mm	130 mm
	11.1"	7.5"	20.9"	20.9"	12.5"	5.1"
Seeding Date	Apr 28	May 11	May 14	May 3	May 1	May 3
Harvest Date	Sept 7	Aug 29	Sept 10	Aug 22	Aug 9	Aug 11

Seeding rates targeted plant stands of 28-30 plants per sqft. Seeds were treated with Raxil PRO. Disease ratings, days to maturity, lodging ratings, yield and bushel weight data was collected. Years were analyzed separately with PROC GLM of SAS version 9.4 (SAS Institute Inc., 2014). Site and block(site) were considered random factors. Cultivar means were separated with a protected least significant difference at p<0.05. Malt quality testing is currently underway.

RESULTS

CANADIAN CULTIVARS: CDC Austenson was the best performing Canadian cultivar with lowest disease ratings, best standability, highest yields and highest test weights compared to AC Metcalfe and CDC Copeland. AC Metcalfe had the most disease, poorest standability (in 2017) and lowest yields of the Canadian cultivars.

DISEASE RATINGS: Most European cultivars had higher disease ratings compared to the Canadian cultivars. In 2016, there were no differences in disease ratings between cultivars. In 2017, disease rating data is from Bon Accord and Fort Whyte. WPB Amadé had the lowest ratings while Nousu had the highest ratings. The dominant disease appears to be net blotch, *Pyrenophora teres*, but there may be small amounts of spot blotch, *Cochliobolus sativus*, and scald, *Rhynchosporium secalis*.

DAYS TO MATURITY (DTM): In 2016, DTM data was collected at Bon Accord. CDC Austenson had the earliest maturity (112.5 d). Seven of the European cultivars had maturities similar to AC Metcalfe and CDC Copeland, while 3 cultivars were significantly later (data not shown). In 2017, DTM data was collected at Bon Accord and Fort Whyte. The three Canadian cultivars and Nousu were the earliest cultivars. On average, European cultivars were four days later than Canadian cultivars.

Table 2. Disease ratings, days to maturity, lodging, yield and bushel weight of the top six performing European cultivars and the three Canadian check cultivars. Data is only presented where there were significant ANOVA results.

Cultivar	2017 disease (0-11.5 scale)	2016 Days to Maturity	2017 Days to Maturity	2016 Lodging (1-9 scale)	2017 Lodging (1-9 scale)	2017 Yield (bu/ac) adjusted to 13.5% moisture	2017 Bushel Weight (lbs/bu)
Esma	8.6 cde		97.7 bcd		1.2 gh	174 a	51.9 cde
KWS Beckie	9.8 cde	116.7 abc	97.3 d	1.0 c	1.4 elgh	155 gh	49.7 ij
KWS Cantton	10.7 bcde	115.0 bcde	98.7 abc	1.2 bc	1.4 elgh	166 abc	51.6 cdef
KWS Fantex	10.2 cde	117.1 abc	98.9 ab	1.5 bc	1.3 gh	167 ab	51.1 elgh
WPB Amadé	8.1 e		99.1 a		1.7 delg	169 ab	53.2 b
WPB Lipizza	9.3 cde		98.0 abcd		1.0 h	174 a	51.5 cdef
AC Metcalfe	11.3 abc	114.6 cde	93.7	1.5 bc	3.4 a	135	52.3 c
CDC Copeland	9.8 cde	113.7 de	93.8	1.7 b	2.8 b	150 hi	52.2 c
CDC Austenson	8.3 e	112.5 e	95.2 e	1.5 bc	2.6 bc	165 bcd	54.4 a
Yearly Average	10.6 (0-11.5 scale)	116.2 days	97.3 days	1.6 1-9, 9=flat	2.0 1-9, 9=flat	160.3 bu ac ⁻¹	51.2 lbs bu ⁻¹
Min	8.1 WPB Amadé	112.5 CDC Austenson	93.7 AC Metcalfe	1.0 KWS Beckie	1.0 WPB Lipizza	135 AC Metcalfe	49.2 Cosmopolitan
Max	13.7 Nousu	118.4 KWS Josie	99.1 WPB Amadé	3.3 KWS13/2553	3.4 AC Metcalfe	174 WPB Lipizza	54.4 CDC Austenson
Adj CV%	23.0%	1.10%	1.14%	20.0%	31.5%	5.30%	1.74%
ANOVA	Variety Site x Variety	Variety Site x Variety	Variety Site x Variety	Variety Site x Variety	Variety Site x Variety	Variety Site x Variety	Variety Site x Variety
F Value	2.32	1.87	3.77	11.94	3.95	7.85	7.65
pr > F	0.0063	0.029	0.0148	<0.0001	<0.0001	<0.0001	<0.0001
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lsd	2.9	2.8 days	1.3 days	0.6 1-9, 9=flat	0.6 1-9, 9=flat	7.9 bu ac ⁻¹	0.83 lbs bu ⁻¹

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RESULTS

LODGING: In 2016, there was no lodging at Fort Whyte or Lethbridge and only minimal lodging at Bon Accord. In 2016, there were only small differences in standability between Canadian and European cultivars, but KWS Beckie and KWS Josie had consistent ratings of 1.0 at all 3 locations. In 2017, ten of the 17 European cultivars had better standability than the Canadian cultivars (data not shown). These were: Ellinor, Embrace, Esma, KWS Beckie, KWS Cantton, KWS Fantex, KWS Josie, Vanille, WPB Amadé and WPB Lipizza.

YIELD: In 2016, there were no significant differences in yield between cultivars. In 2017, ten European cultivars had yields (average yield of top ten European cultivars 168 bu/ac) equal to or better than CDC Austenson (165 bu/ac) and all European cultivars yielded better than AC Metcalfe (135 bu/ac). WPB Lipizza (174 bu/ac) and Esma (174 bu/ac) were the top yielding cultivars.

BUSHEL WEIGHT: In 2016, there were no significant differences in bushel weight between cultivars. In 2017, all European cultivars had a lower bushel weight than CDC Austenson (54.4 lbs/bu). However, seven European cultivars had bushel weights similar to AC Metcalfe (52.3 lbs/bu).

CONCLUSIONS

Esma, KWS Beckie, KWS Cantton, KWS Fantex, WPB Amadé and WPB Lipizza were the most impressive European barley cultivars and will be considered for entry into future co-op testing. In general, CDC Austenson had better disease resistance, earlier maturity and higher bushel weights compared to the European cultivars. However, European cultivars had better standability and equal or better yields compared to CDC Austenson. Below are the highlights of the top performing European cultivars:

- Esma (tested in 2017) has similar disease ratings to CDC Copeland and CDC Austenson, is 2.5 days later than CDC Austenson, has **improved standability** compared to all Canadian cultivars, **higher yields than all Canadian cultivars** and bushel weights similar to AC Metcalfe and CDC Copeland.
- KWS Beckie (tested in 2016 and 2017) has similar disease ratings to CDC Copeland, 2.1-4.2 days later maturity than CDC Austenson, **improved standability** compared to all Canadian cultivars, yields lower than CDC Austenson but similar to CDC Copeland, but lower bushel weights compared to all Canadian cultivars.
- KWS Cantton (tested in 2016 and 2017) has disease ratings similar to AC Metcalfe, 2.5-3.5 days later maturity than CDC Austenson, **improved standability** compared to all Canadian cultivars, similar yields to CDC Austenson and bushel weights similar to AC Metcalfe and CDC Copeland.
- KWS Fantex (tested in 2016 and 2017) has similar disease ratings to CDC Copeland and AC Metcalfe, 3.6-4.6 days later maturity than CDC Austenson, **improved standability** compared to all Canadian cultivars, **similar yields to CDC Austenson**, but lower bushel weights compared to all Canadian cultivars.
- WPB Amadé (tested in 2017) has **similar disease ratings to CDC Austenson**, 3.9 days later than CDC Austenson, **improved standability** compared to all Canadian cultivars, **similar yields to CDC Austenson**, and **similar bushel weights compared to all Canadian cultivars**.
- WPB Lipizza (tested in 2017) has similar disease ratings to CDC Copeland, 2.8 days later than CDC Austenson, **the best standing cultivar compared to Canadian or European cultivars**, **significantly higher yields than CDC Austenson** and bushel weights similar to AC Metcalfe and CDC Copeland.

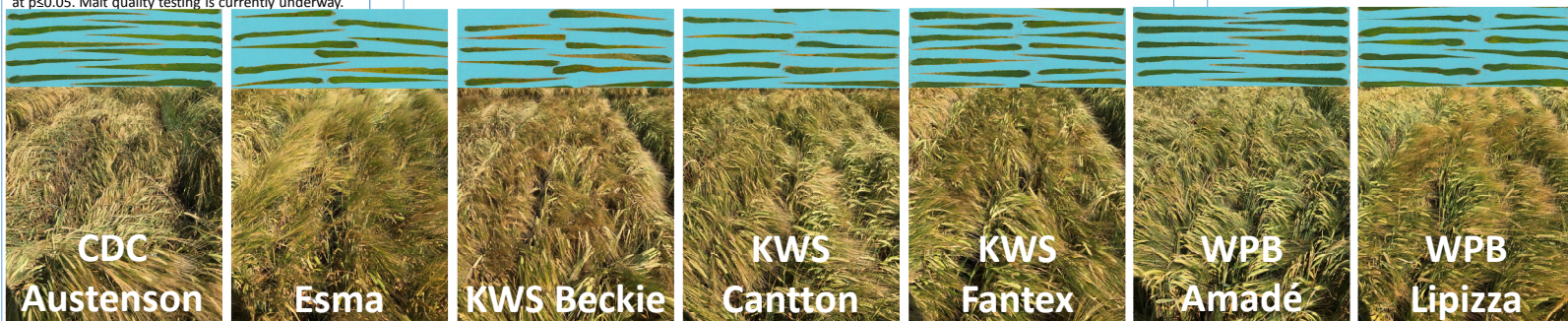


Figure 1. Photos of the top six performing European cultivars and the top performing Canadian cultivar, CDC Austenson from Bon Accord, AB in 2017. Flag leaf photos showing severity of leaf disease on August 3, 2017 at Bon Accord, AB.