2017 Annual Report

for the

Saskatchewan Barley Development Commission

Project Title: Strategies for Management of Feed and Malt Barley

(Adopt #20170027)

Principal Investigator:

Mike Hall[1]

[1]East Central Research Foundation, Yorkton, SK.

Project Identification

1. **Project Title:** Strategies for Management of Feed and Malt Barley
2. **Project Number:** Adopt #20170027
3. **Producer Group Sponsoring the Project:** Saskatchewan Barley Development Commission
4. **Project Location(s):** Indian Head, Saskatchewan. Yorkton, Saskatchewan. Scott, Saskatchewan
5. **Project start and end dates (month & year):** April 2017 to January 2018
6. **Project contact person & contact details:**

Jill McDonald, Executive Director
Saskatchewan Barley Development Commission
Bay 6A - 3602 Taylor Street East
Saskatoon, Saskatchewan
S7H 5H9

Mike Hall, Research Coordinator
East Central Research Foundation/Parkland College
Box 1939, Yorkton, SK, S3N 3X3
Phone: 306-621-6032

Objectives and Rationale

7. **Project objectives:**

The main objective of this project was to demonstrate how nitrogen management for malt and feed grade barley differ when seeded in early or late May. A secondary objective was to provide an economic analysis for feed and malt barley scenarios, including the scenario where a malt barley variety is sold as feed.

Project Rationale:

The decision to grow either malt or feed barley varieties requires a realistic expectation for achieving malt, and a clear understanding of the potential yield differences between the varieties. Across western Canada, approximately 40% of the barley grown are malting varieties. Yet according to the Canadian Grain Commission, only 20% of malting barley production is actually selected for malting each year. Metcalfe is a popular malting variety but yields considerably less than a number of feed varieties. The implication is that 80% of malt barley acres should have been grown for feed. Work by AgriProfits would suggest that feed varieties should be grown if the chance of making malt is less than 50%. This may change in the future if newer malt varieties, yielding as well as feed varieties, are accepted by the market. However, this is not currently the case.

When growing for malt, barley should be seeded early and nitrogen needs to be managed to limit the protein content of the grain. Research has shown that seeding malting barley relatively early in the growing season should result in less protein, greater plumpness, and reduced lodging, thus improving the likelihood of obtaining malting grade [1]. Moreover, early seeding increases the likelihood of harvesting during dry conditions, reducing the likelihood of weathering and pre-harvest sprouting. If barley cannot be seeded early or the chance of achieving malt is not sufficient, then the producer may be better off to manage a feed variety.

[1] O'Donovan, J. et al. (2012). Effect of seeding date and seeding rate on malting barley production in western Canada. Can J Plant Sci. 92:321-330.

Methodology and Results

8. Methodology:

Trials were established by ECRF, IHARF and WARC at Yorkton, Indian Head and Scott, respectively. Trials were established as a split-split plot design with 4 replicates. The main plot factor compared seeding dates of early and late May. The 2nd factor contrasted the malt variety "AC Metcalfe" against the feed variety "CDC Austenson". The 3rd factor evaluated nitrogen rates. The nitrogen rates tested by ECRF differed by accidentally using an earlier protocol. The nitrogen rates tested by IHARF and WARC were 40, 80 and 120 lbs/ac of actual nitrogen as proposed. ECRF tested nitrogen rates of 60, 80, 100 and 120 lbs/ac of actual nitrogen. Thus, 12 treatments were tested by IHARF and WARC and 16 treatments were tested by ECRF (Table 1).

Table 1. Treatment list conducted by IHARF, WARC and ECRF

Trt #	Seeding Date	Variety	N rate (lbs N/ac) for IHARF and WARC	N rate (lbs N/ac) for ECRF
1	Early May	AC Metcalfe (Malt)	40	60
2	Early May	AC Metcalfe (Malt)	80	80
3	Early May	AC Metcalfe (Malt)	120	100
4	Early May	AC Metcalfe (Malt)	Na	120
5	Early May	CDC Austenson (Feed)	40	60
6	Early May	CDC Austenson (Feed)	80	80
7	Early May	CDC Austenson (Feed)	120	100
8	Early May	CDC Austenson (Feed)	Na	120
9	Late May	AC Metcalfe (Malt)	40	60
10	Late May	AC Metcalfe (Malt)	80	80
11	Late May	AC Metcalfe (Malt)	120	100
12	Late May	AC Metcalfe (Malt)	Na	120
13	Late May	CDC Austenson (Feed)	40	60
14	Late May	CDC Austenson (Feed)	80	80
15	Late May	CDC Austenson (Feed)	120	100
16	Late May	CDC Austenson (Feed)	Na	120

Table 2. Dates of Operations for ECRF, IHARF and WARC in 2017			
Operations for "early May" seeded barley	ECRF	IHARF	WARC
Seeding	May 5	May 3	May 9
Emergence counts	May 23	May 30	May 31
In-crop Herbicide	June 1 (Axial + Frontline)	Axial + Curtail M	Axial iPak-June 12
In-crop Fungicide	June 28 (Twinline)	None	None
Lodging rating	August 8	No lodging	July 27& Aug 23
Tiller count	N/A	August 21-22	N/A
Harvest	August 21	August 29	August 28
Operations for "late May" seeded barley	ECRF	IHARF	WARC
Seeding	May 29	May 23	May 30
Emergence counts	June 13	None	June 13
In-crop Herbicide	June 20 (Axial + Frontline)	Trondus + Curtail M	Axial iPak (June 23rd)
In-crop Fungicide	July 12 (Twinline)	None	None
Lodging rating	August 8	No lodging	July 27& Aug 23
Tiller count	N/A	August 21-22	N/A
Harvest	Sept 12	August 31	September 12

9. Results:

Growing Season Weather

Mean monthly temperatures and precipitation amounts for Indian Head, Scott and Yorkton during the 2017 season are presented relative to the long-term averages in Table 3.

Table 3. Mean monthly temperatures and precipitation amounts along with long-term (1981-2010) normals for the 2017 growing seasons at Indian Head, Scott and Yorkton in Saskatchewan.

Location	Year	May	June	July	August	Avg. / Total
		-----------------------------*Mean Temperature (°C)* -----------------------------				
Indian Head	2017	11.6	15.5	18.4	16.7	15.6
	Long-term	***10.8***	***15.8***	***18.2***	***17.4***	***15.6***
Scott	2017	11.5	15.1	18.3	16.6	15.4
	Long-term	***10.8***	***14.8***	***17.3***	***16.3***	***14.8***
Yorkton	2017	11.1	15.5	19.0	17.4	15.8
	Long-term	***10.4***	***15.5***	***17.9***	***17.1***	***15.2***
		------------------------------- *Precipitation (mm)* -----------------------------				
Indian Head	2017	10.4	65.6	15.4	25.2	116.6
	Long-term	***49***	***77.4***	***63.8***	***51.2***	***241.4***
Scott	2017	69	34.3	22.4	53	178.7
	Long -term	***38.9***	***69.7***	***69.4***	***48.7***	***226.7***
Yorkton	2017	12.5	53.9	59.1	32.5	158
	Long-term	***51***	***80***	***78***	***62***	***272***

Barley emergence was good at all sites, ranging between 200 to 250 plants/m^2. At Yorkton, emergence did not differ significantly between seeding dates (Table 4). However, the emergence of AC Metcalfe was significantly lower than CDC Austenson (200 vs 246 plant/m^2) and emergence steadily declined from 242 to 202 plants/m^2 as nitrogen rate was increased from 60 to 120 lbs/ac. The nitrogen was side banded but obviously some of the nitrogen was making its way into the seed row and affecting germination. At Scott, there was a significant interaction between seeding date and variety with the emergence data (Table 5). When seeded early, the emergence of AC Metcalfe was significantly higher than CDC Austenson (Table 6). The opposite was true for the later seeding date. However, all plant populations were at adequate levels and differences would not greatly affect yield. Emergence was not affected by increasing nitrogen rate, inferring good separation between seed and fertilizer. At Indian Head, emergence counts were done on the early seeded treatments but were missed on the late seeded treatments. On average, the emergence for AC Metcalfe and CDC Austenson was 210 and 228 plants/m^2, respectively. Like Scott, emergence was unaffected by increasing nitrogen rate. Overall, good plant stands were established for every treatment at each location.

Table 4. Main effects of Seeding Date, Variety and Nitrogen Rate on Emergence, Lodging and Yield of Barley at Yorkton.

Seeding Date (A)	Emergence (plants/m^2)	Lodging (0-10)	Yield (kg/ha)
Early May	220.2 a	2.8 a	5773 a
Late May	226.7 a	3.8 a	5737 a
$Lsd_{0.05}$	NS	NS	NS
Barley Variety (B)	**Emergence (plants/m^2)**	**Lodging (0-10)**	**Yield (kg/ha)**
AC Metcalfe (Malt)	200.6 a	3.7 a	5322 a
CDC Austenson (Feed)	246.3 b	2.9 a	6188 b
$Lsd_{0.05}$	17	NS	445
Nitrogen Rate (lbs/ac of Actual) (C)	**Emergence (plants/m^2)**	**Lodging (0-10)**	**Yield (kg/ha)**
60	241.8 c	2 a	5784 a
80	230.3 bc	3.6 b	5813 a
100	219.8 ab	3.4 b	5705 a
120	201.9 a	4.1 b	5717 a
$Lsd_{0.05}$	19	0.84	NS
Significant interactions	None	None	None

Table 5. Main effects of Seeding Date, Variety and Nitrogen Rate on Emergence, Test Weight, Protein and Yield of Barley at Scott.				
Seeding Date (A)	Emergence (plants/m^2)	Test wt (kg/hl)	Protein (%)	Yield (kg/ha)
Early May	248.0 a	63.6 a	12.4 a	5941.3 a
Late May	225.2 b	66.9 b	11.3 b	5994.7 a
$Lsd_{0.05}$	7.2	0.41	0.47	NS
Barley Variety (B)	Emergence (plants/m^2)	Test wt (kg/hl)	Protein (%)	Yield (kg/ha)
AC Metcalfe (Malt)	236.9 a	64.5 a	12.2 a	5529.5 a
CDC Austenson (Feed)	236.3 a	65.9 b	11.5 a	6406.5 b
$Lsd_{0.05}$	NS	0.87	NS	389
Nitrogen Rate (lbs/ac of Actual) (C)	Emergence (plants/m^2)	Test wt (kg/hl)	Protein (%)	Yield (kg/ha)
40	245.9 a	65.6 b	10.5 a	5682.8 a
80	228.3 a	65.2 ab	11.8 b	6121.8 b
120	235.6 a	64.9 a	13.3 c	6099.4 b
$Lsd_{0.05}$	NS	0.49	0.47	278
Significant interactions	A by B	None	None	None

Table 6 Seeding Date by Variety Interaction for Barley Emergence at Scott.		
Seeding Date (A)	Barley Variety (B)	Emergence (plants/m^2)
Early May	AC Metcalfe (Malt)	259.7
Early May	CDC Austenson (Feed)	236.3
Late May	AC Metcalfe (Malt)	214.2
Late May	CDC Austenson (Feed)	236.3
Lsd for B1A1-B2A1		7.3
Lsd for B1A1-B1A2 or B1A1-B2A2		12.8

To compensate for the missing emergence data at Indian Head, tiller counts were done later in the summer (Table 7). The number of tillers was greater for the late May seeding date but was not quite statistically significant at the 5% level of confidence. The number of tillers was significantly greater for CDC Austenson and tiller number increased numerically with increasing nitrogen rate. Cereals typically tiller more with added nitrogen, which accounts for most of the yield response.

Table 7. Main effects of Seeding Date, Variety and Nitrogen Rate on Tiller # and Yield of Barley at Indian Head.		
Seeding Date (A)	Tillers/m^2	Yield (kg/ha)
Early May	587.6 a	5463.5 a
Late May	637.4 a	5547.9 a
$Lsd_{0.05}$	NS (p=0.13)	NS
Barley Variety (B)	Tillers/m^2	Yield (kg/ha)
AC Metcalfe (Malt)	597.0 a	5333.5 a
CDC Austenson (Feed)	628.0 b	5677.9 b
$Lsd_{0.05}$	20.7	109
Nitrogen Rate (lbs/ac of Actual) (C)	Tillers/m^2	Yield (kg/ha)
40	570.4 a	4952.2 a
80	602.6 a	5713.1 b
120	664.6 a	5851.8 b
$Lsd_{0.05}$	NS (p=0.054)	177
Significant interactions	None	A by C

Lodging was not an issue at Indian Head or Scott (data not shown). At Yorkton, lodging did not differ between seeding date or variety but it did significantly increase with added nitrogen (table 4). This may have limited the yield response to higher applications of nitrogen.

At Yorkton, yield did not significantly differ between early and late May seeding dates and CDC Austenson yielded 16% more than AC Metcalfe (Table 4). Yield did not respond to added nitrogen beyond 60 lbs/ac. As nitrogen rate was increased from 60 to 120 lbs/ac, percent protein for AC Metcalfe and CDC Austenson increased from 12.2 to 14.3 and from 13.8 to 15.4, respectively (Table 8). The lack of a yield response, lodging and high protein levels suggest high levels of residual soil nitrogen. This was unexpected, as soil testing found only 39 lbs/ac of Nitrogen in the top 12 inches and soil test recommendation for an 85 bu/ac malt barley crop was 93 lbs/ac of N. Clearly these recommendations were not appropriate in light of actual field results where 60 lbs/ac of N produced at 96 bu/ac crop. Barley is generally rejected for malt if protein levels exceed 12.5% because maltsters want barley with a high starch content and too much protein will "cloud" the beer. Only barley fertilized with 60 lbs/ac of N or less and seeded early had a protein level below 12.5% (table 8).

Table 8 Malt Barley Quality Measurements from the Yorkton Site (treatments bulked over 4 reps).

May Seeding	Nitrogen	Protein (%)	Moisture (%)	Plump (%)	Thin (%)	Peeled & Broken (%)	Chitted (%)	Test Weight (kg/hl)	Germination (%)
Early	60	12.2	12.7	94.6	0.4	1.4	0.6	68.4	98
Early	80	13.6	12.8	92.1	0.5	2.8	1.2	67.0	100
Early	100	14.1	12.4	93.2	0.5	2.2	1.4	68.0	100
Early	120	14.3	13.0	92.4	0.6	2.4	0.6	67.4	99
Late	60	13.8	13.3	93.4	0.6	5.2	0.0	69.9	98
Late	80	14.5	13.5	93.6	0.8	5.0	0.2	69.9	99
Late	100	14.9	13.7	90.0	1.3	1.8	0.4	69.0	96
Late	120	15.4	13.7	90.0	0.7	3.0	0.6	68.4	100

Similar to results from Yorkton, yields from Scott did not differ between seeding date and CDC Austenson significantly yielded 16% more than AC Metcalfe (table 5). Yield increased up to 80 lbs/ac of N (table 5). In addition to the bulked samples that were sent to Intertek (table 9), Scott went beyond protocol and tested protein "in house" for every plot (Table 5). Both data sets provide similar results. Barley protein content significantly increased with added nitrogen (table 5 and 9). Protein levels did not quite differ significantly between varieties at the 5% level (table 5) but were significantly higher for the earlier seeding date, which is not typically the case. While there was no interaction between seeding date and nitrogen rate for the protein data, individual treatment means have still been presented in table 9 to indicate when the maximum allowable limit of 12.5% protein was exceeded. When seeded in late May, protein levels for AC Metcalfe did not exceed the maximum allowable limit of 12.5% until 120 lbs/ac N had been applied (table 9). In contrast, the protein limit was exceeded with the application of only 40 lbs/ac of N when seeding was early. Usually protein levels are lower for barley when seeded early. It is difficult to explain these results particularly since yield did not differ between seeding dates, but the results are likely a response to environmental factors that were atypical for Scott.

Table 9 Malt Barley Quality Measurements from the Scott Site (treatments bulked over 4 reps).

May Seeding	Nitrogen	Protein (%)	Moisture (%)	Plump (%)	Thin (%)	Peeled & Broken (%)	Chitted (%)	Test Weight (kg/hl)	Germination (%)
Early	40	12.7	13.6	90.4	0.9	1.7	24.0	64.2	48
Early	80	13.4	13.6	89.6	1.0	1.2	22.9	63.6	56
Early	120	14.5	13.9	86.8	1.3	1.1	19.7	64.0	54
Late	40	10.9	11.4	95.8	0.3	0.6	0.6	67.9	97
Late	80	12.1	11.7	94.2	0.4	1.9	0.0	67.5	98
Late	120	13.9	11.6	94.6	0.4	1.1	0.0	67.2	98

CDC Austenson also yielded more than AC Metcalfe at Indian Head but the difference was only 6% (Table 7). Unlike Yorkton and Scott, there was a significant seeding date by nitrogen rate interaction with the yield data at Indian Head. Both barley varieties were more responsive to added nitrogen when seeded in early May (table 10) which is typically the case. As with all sites, protein increased with increasing nitrogen. The response did not differ substantially between seeding dates and the allowable limit of 12.5% protein wasn't exceeded until 120 lbs/ac of N had been applied.

Table 10 Seeding Date by Nitrogen Rate Interaction for Barley Yield at Indian Head.

Seeding Date (A)	Nitrogen Rate (lbs/ac of Actual) (C)	Yield (kg/ha)
Early May	40	4781.3
Early May	80	5680.4
Early May	120	5928.9
Late May	40	5123.1
Late May	80	5745.9
Late May	120	5774.6
Lsd for C means for same A		251
Lsd for A means for same or difference C		250

In addition to protein, there are many other criteria which barley must meet to be selected for malt. Criteria such as moisture and peeled and broken kernels are related to handling and can be easily managed by the producer. Moisture should be less than 13.5%, which was generally met by each treatment from every location (tables 8,9,11). High moisture grain is a storage issue, which can lead to reduced quality and germination. Peeled and broken kernels interfere with the uniformity of germination during malting and should be below 5%, which was met for nearly every treatment at each location. Plump and thins are of greater consideration to maltsters than test weight. Plump kernels have more starch to produce a greater volume of beer from a given weight of malt. Percent Plumpness is determined over a 6/64" sieve. Barley selected for malt typically has around 92% plump seed. This criteria was met for early seeded barley at Yorkton and Indian head regardless of nitrogen rate (tables 8 and 11). However, at the late seeding date, plumpness tended to fall below acceptable levels at high nitrogen rates. Again, the situation was reversed from expectations at Scott. Kernel plumpness was low for early seeded barley but was good for the late seeded barley (table 9). However, like the other locations, kernel plumpness decreased with added nitrogen at Scott. For barley to be selected for malt, germination needs to be above 95%. This was generally met across the board with the exception of the early seeded barley at Scott (table 9). Wet weather prior to harvesting the early seeded barley caused high levels of chitting in the grain and greatly reduced germination below acceptable levels.

Table 11 Malt Barley Quality Measurements from the Indian Head Site (treatments bulked over 4 reps).

May Seeding	Nitrogen	Protein (%)	Moisture (%)	Plump (%)	Thin (%)	Peeled & Broken (%)	Chitted (%)	Test Weight (kg/hl)	Germination (%)
Early	40	10.2	9.6	94.4	0.8	2.0	N/A	67.5	98
Early	80	12.0	9.7	92.4	0.7	2.6	N/A	66.9	98
Early	120	13.0	9.7	94.2	0.7	1.0	N/A	66.8	98
Late	40	10.0	9.7	94.8	0.7	3.8	N/A	69.7	99
Late	80	12.1	9.8	92.8	0.4	3.0	N/A	69.3	97
Late	120	12.9	9.7	91.6	0.5	1.5	N/A	68.8	96

The economic analysis for these studies are based on treatments, which successfully produced malt quality barley. Values of $5.44/bu for malt barley and $3.22/bu for feed barley were used in this economic analysis and these values were obtained from the Saskatchewan Crop Planning Guide 2017.

At Yorkton, seeding AC Metcalfe early with no more than 60 lbs/ac of N produced 96 bu/ac and was the only treatment to meet malt barley grade based on protein. If selected for malt this treatment would generate $522.24/ac in gross income (96 bu/ac * $5.44/bu). If this treatment sold for feed the gross income generated would have been only $309.12/ac (96 bu/ac * $3.22/bu). Seeding the Feed variety CDC Austenson early at 60N would generate $370.30/ac (115 bu/ac * $3.22/bu) as feed. Yield of CDC Austenson at higher rates of nitrogen were not used for comparison because yields were not increasing substantially with added nitrogen and the added cost of N was reducing the economic return. For the Yorkton study, growing the malt variety AC Metcalfe instead of the feed variety CDC Austenson was risking a feed loss of $61.18/ac ($370.3/ac-$309.12/ac) but if accepted as malt the benefit of growing a malt variety over feed would be $151.94/ac ($522.24/ac-$370.3/ac). Based on the Yorkon results, growing AC Metcalfe for Malt would be less economic than growing the feed variety

CDC Austenson if selection for malt would be less than once in 2.5 years ($151.94/ac divided by $61.18/ac).

At Scott, the early seeded barley did not make malt quality due to low plump kernels, chitting and low germination. However, late seeded barley did make malt quality up to 80 lbs/ac of N, which is also where yields were maximized for both the feed and malt varieties. When seeded in late May with 80 lbs/ac of N, AC Metcalfe and CDC Austenson yielded 107 and 121 bu/ac, respectively. AC Metcalfe would generate gross revenues of $582.05/ac (107 bu/ac * $5.44/bu) if accepted for malt and $318.78/ac (107 bu/ac * $3.22/bu) if taken for feed. CDC Austenson would generate $389.62/ac (121 bu/ac * $3.22/bu) in gross revenue as feed. Yield of CDC Austenson from higher rates of nitrogen were not used because yield was not increasing and the economics were getting worse with increasing nitrogen. For the Scott study, growing the malt variety AC Metcalfe was risking a feed loss of $45.08/ac ($389.62/ac-$344.54/ac) but if accepted as malt the benefit of growing a malt variety over feed would be $192.46/ac ($582.08/ac-$389.62/ac). Based on the Scott results, Growing AC Metcalfe would only prove less economical if the chance of being selected for malt was less than once in 4.3 years ($192.46/ac divided by $45.08/ac).

At Indian Head, achieving malt barley was possible with early and late seeding. The economics for growing malt were very similar between early and late seeding. Early seeding will be used for comparison. Yields were maximized for AC Metcalfe and CDC Austenson at 80 and 120 lbs/ac of N, respectively. AC Metcalfe produced 101 bu/ac at 80 lbs/ac of N whereas, CDC Austenson produced 110 and 115 bu/ac at 80 and 120 lbs/ac of N, respectively. Increasing N rate from 80 to 120 lbs/ac of N was only slightly more economical for the feed barley based on $0.42/ lb of N. So the 120 lbs/ac of N rate will not be used for comparison. When seeded in early May with 80 lbs/ac of N, AC Metcalfe and CDC Austenson yielded 101 and 110 bu/ac, respectively. AC Metcalfe would generate gross revenues of $549.44/ac (101 bu/ac * $5.44/bu) if accepted for malt and $325.22/ac (101 bu/ac * $3.22/bu) if taken for feed. CDC Austenson would generate $354.20/ac (110 bu/ac * $3.22/bu) in gross revenue as feed. For the Indian Head study, growing the malt variety AC Metcalfe was risking a feed loss of $28.98/ac ($354.20/ac-$325.22/ac) but if accepted as malt the benefit of growing a malt variety over feed would be $195.24/ac ($549.44/ac-$354.20/ac). Based on the Indian Head results, the approach of continuously growing AC Metcalfe for malt would only be less economical if the chance of being selected for malt was less than once in 6.7 years ($195.24/ac divided by $28.98/ac). The benefit of growing CDC Austenson for feed was not high because it did not yield substantially more than AC Metcalfe.

The economic analysis for each site favours the case for growing malt because the comparison uses the best malt producing treatment, which is only know after the fact. Also, the costs of production for malt and feed barley are considered to be equal. This is not really the case as production cost tend to be higher when producing malt. In other words, the real risk of growing malt will be greater than determined above. Having said that, the down side of growing the malting variety AC Metcalfe was not high. It was lowest at Indian Head were the yield differential between malt and feed was smallest. Newer lines of malt varieties have comparable yields to feed. As these lines are accepted by industry there will be little reason to grow a feed variety.

[1]Quality Factors in Malting Barley. Brewing and Malting Barley Research Institute.

[2]Quality of Western Canadian Barley 2017. Canadian Grain Commission.

Extension

This demonstration was a formal stop during 2017 ECRF Crop Management Field Days. The tours were well attended and signs were in place to acknowledge the support of the ADOPT program. Results from the project will be made available in the 2017 ECRF Annual Report (available online) and through a variety of other media (i.e. oral presentations, popular agriculture press, fact sheets, videos etc.) as opportunities arise. The results in the form of a report and factsheet will also be made available on the WARC website. IHARF will highlight results in their annual report and will also make the factsheet available on their website.

10. Conclusions and Recommendations

Despite the higher yield potential of the feed variety CDC Austenson, it would likely be more economical to grow the malt variety AC Metcalfe. Growing CDC Austenson would only prove to be more economical if the chance of achieving malt with AC Metcalfe was less than once in 2.5, 4.3 and 6.7 years based on the results from Yorkton, Scott and Indian Head, respectively. There may be little reason in the future to grow feed varieties as malt varieties with yields comparable to the best feed varieties are accepted by maltsters. Seeding barley early provided the highest yields and best chance of making malt at Yorkton. At Indian Head seeding early and late produced malt barley with similar economic results. At Scott, only later seeded barley made malt as early seeded barley was adversely affected by rain prior to harvest. Nitrogen management is key to producing malt barley. Excessive amounts of nitrogen often increased protein and decreased kernel plumpness past acceptable levels.

Supporting Information

11. Acknowledgements:

This project was funded through the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement.

Appendices

Table 12. Yield means for individual treatments from Yorkton, Scott and Indian Head					
Seeding date	**Variety**	**Nitrogen lbs/ac**	**Yorkton kg/ha (bu/ac)**	**Scott kg/ha (bu/ac)**	**Indian Head kg/ha (bu/ac)**
Early May	**AC Metcalfe**	**40**		5294 (98.4)	4835 (89.9)
		60	5171 (96.2)		
		80	5309 (98.7)	5542 (103.1)	5456 (101.5)
		100	5281 (98.2)		
		120	5383 (100.1)	5628 (104.7)	5655 (105.1)
	CDC Austenson	**40**		6130 (114.0)	4728 (87.9)
		60	6177 (114.9)		
		80	6187 (115.1)	6673 (124.1)	5905 (109.8)
		100	6334 (117.8)		
		120	6344 (118.0)	6382 (118.7)	6203 (115.4)
Late May	**AC Metcalfe**	**40**		5175 (96.2)	4972 (92.5)
		60	5288 (98.4)		
		80	5384 (100.1)	5742 (106.8)	5476 (101.8)
		100	5510 (102.5)		
		120	5247 (97.6)	5798 (107.8)	5608 (104.3)
	CDC Austenson	**40**		6133 (114.1)	5275 (98.1)
		60	6500 (120.9)		
		80	6373 (118.5)	6530 (121.5)	6016 (111.9)
		100	5697 (106.0)		
		120	5895 (109.6)	6591 (122.6)	5941 (110.5)

Abstract

12. Abstract/Summary:

Trials were established at Yorkton, Scott and Indian Head with the objective of demonstrating the importance of early seeding and nitrogen management when producing malt versus feed barley. The second object was to provide an economic analysis for feed and malt barley scenarios, including the scenario where a malt barley variety is sold as feed. The feed variety CDC Austenson was 16% higher yielding than the malt variety AC Metcalfe at Yorkton and Scott. It was only 6% higher yielding at Indian Head. Despite the higher yield potential of CDC Austenson, growing AC Metcalfe would be more economical if acceptance for malt was more than once in 2.5, 4.3 and 6.7 years based on the results from Yorkton, Scott and Indian Head, respectively. There may be little reason to grow feed varieties in the future as higher yielding malt varieties are selected by the market place. Seeding barley early provided the highest yields and best probability of making malt at Yorkton. At Indian Head seeding early and late produced malt barley with similar economic results. At Scott, only late seeded barley made malt as early seeded barley was adversely affected by rain prior to harvest. Nitrogen management appears to be key to producing malt barley. Excessive amounts of nitrogen often increased protein and decreased kernel plumpness beyond acceptable levels.