



Plot2
Farm

2021

PROTOCOL RESULTS



Alberta
Barley

The 2021 growing season marked the second year of Plot2Farm. The completed trials compared a wide variety of agronomic management practices on both wheat and barley, including seeding rate, plant growth regulators, enhanced efficiency fertilizers, and row spacing. Although the significant lack of rainfall in Alberta made for an atypical growing season, the data collected offered participating growers interesting insights.

Completion of each Plot2Farm trial requires time, patience and strong communication between cooperating agronomists, the Alberta Wheat and Barley Commissions and the participating farmers. The Commissions would like to thank everyone involved in the Plot2Farm program over the 2021 growing season. The desire to understand on-farm impacts of management practices by all parties involved is a fundamental factor in the success of this program. This speaks to the passion woven within Alberta agriculture.

In addition to a Research Guide that provides a manual for successful trial implementation, the following document contains a summary of each harvested trial from the 2021 growing season. The summaries include metadata on the trial location, the management practices implemented on the crop, the treatments compared, and statistical analysis of data collected through the season.

Sincerely,



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B001 – Barley seeding rates

Introduction

Partnering with Triple H Farms in Carstairs, Alberta, this trial compared three different seeding rates on the malt barley variety CDC Copeland. The trial was seeded using a 60-ft wide drill with 10" row spacings and 3" openers. Seeding rates to target plant stand treatments were determined using thousand kernel weight, germination percentage and farm-specific emergence mortality estimates. Seeding rates to attain the treatment target plant stands of 22 (treatment 1), 27.5 (treatment 2) and 33 plants/ft² (treatment 3) were 120.5, 150.6, and 180.7 lbs of seed per acre, respectively. Treatments were replicated and randomized.

Protocol #: B001

Closest Town: Carstairs, Alberta

Soil type: Medium textured Orthic Black Chernozem

Seeding Date: May 14, 2021

Harvest Date: August 31, 2021

Row Spacing(cm): 25.4cm (10"), 3" paired row

Variety(s): CDC Copeland

Reps: 4

Previous Crop: Canola

Tillage: Spring harrowed

Herbicides:

Pre: None

In-Crop: Express SG followed

by Axial + Pixxaro

Seed Treatment: Vibrance Quattro

Foliar Insecticides: None

Foliar Fungicides: Trivapro

Fertilizer:

46-0-0 @ 130lbs/ac

6-30-10-0 @ 93lbs/ac with seed

Total fertilizer applied: 65.5 lbs actual N/ac;

27.9 lbs P₂O₅/ac; 9.3 lbs actual K₂O/ac

Irrigation: None

Rainfall: Between May 1 and August 1: 185.4mm (7.3")

Treatments

Treatment 1: Target 22 plants/ft²

Treatment 2: Target 27.5 plants/ft²

Treatment 3: Target 33 plants/ft²

Goal:

To determine the yield and grain quality impacts of seeding rates on barley production.

In-crop assessment results:

Although seeding rates were adjusted to achieve target protocol plant stands, treatments 2 and 3 saw no difference in plant stand counts 21 days after seeding. However, treatment 1 was significantly lower than both treatment 2 and 3 (Table 1).

Yield results:

No significant differences were seen between target plant stand treatments (Table 1).

Grain quality results:

No significant differences in grain protein, thins, chitting, greens, or germination were observed. Significant differences were seen for plump with treatment 1 displaying the lowest plump percentage (Table 1).



Figure 1: Visual plant stand density differences between treatment 1 (Left) and treatment 3 (Right). 22 plants/ft² target on left and 33 plants/ft² target on right.

Table 1: Plant stand counts, yield, and quality results comparing three target plant stands (22 plants/ft², 27.5 plants/ft², and 33 plants/ft²) on the malt barley variety, CDC Copeland, in Carstairs, Alberta, 2021.

Target Plant Stand	Plant stand count at 21 days after seeding (plants/ft ²)	Yield at 14.5% seed moisture content (bu/ac)	Protein %	Test Weight (kg/hL)	Plump %
Target 22 plants/ft ²	19.8 a	72.05 a	12.2 a	62.4 a	89.25 a
Target 27.5 plants/ft ²	27.6 b	72.3 a	11.9 a	62.8 a	91.95 b
Target 33 plants/ft ²	28.1 b	73.8 a	12.5 a	62.8 a	91.88 b
<i>p</i> -value	0.0079	0.5807	0.5319	0.0844	0.0011
CV%	18.44%	3.23%	3.27%	0.595%	1.564%

Values with the same letter within a column are not significantly different. Significant difference if $p \leq 0.05$.

Summary

Overall, no significant differences were seen in yield or quality with the exception of decreased plump at the 22 plants/ft² treatment. This contrasts research seen by O'Donovan, 2012 which showed an increase in yield up to 30 seed/ft² and decreasing plump at higher seeding rates.

W005 – Wheat seeding rates

Introduction

Partnering with Triple H Farms in Carstairs, Alberta, this trial compared three different seeding rates on the CPSR wheat variety, SY Rorke. The trial was seeded using a 56 ft drill with 3" paired openers at 12" row spacings. Seeding rates to target plant stand treatments were determined using thousand kernel weight, germination percentage and estimated emergence mortality. Seeding rates to attain the treatment target plant stands of 25 (treatment 1), 30 (treatment 2) and 35 plants/ft² (treatment 3) were 88.9, 106.7, and 124.4 pounds of seed per acre, respectively. Treatments were replicated and randomized.

Protocol #: W005

Closest Town: Carstairs, Alberta

Soil type: Medium textured Orthic Black Chernozem

Seeding Date: May 4, 2021

Harvest Date: Sept 6, 2021

Row Spacing(cm): 30cm (12")

Variety(s): SY Rorke

Reps: 4

Previous Crop: Canola

Tillage: Disked in the spring

Herbicides:

Pre: None

In-Crop: Pardner herbicide followed application of Infinity herbicide + Axial Extreme

Seed Treatment: Vibrance Quattro

Foliar Insecticides: None

Foliar Fungicides: TiLMOR

Fertilizer:

46-0-0 @ 179lbs/ac

6-30-10-0 @ 90lbs/ac with the seed

Total fertilizer applied: 87.5 lbs actual N/ac;

27 lbs P₂O₅/ac; 9 lbs actual K₂O/ac

Irrigation: None

Rainfall: Between May 1 and August 1: 185.4mm (7.3")

Table 1: Plant stand counts, yield, and quality results comparing three target plant stands (25 plants/ft², 30 plants/ft², and 35 plants/ft²) on CPSR wheat variety SY Rorke in Carstairs, Alberta, 2021.

Target Plant Stand	Plant stand count at 21 days after seeding (plants/ft ²)	Yield at 14.5% seed moisture content (bu/ac)	Protein %	Test Weight (kg/hL)	Fusarium %
Target 22 plants/ft ²	23.3 a	67.15 a	12.63 a	83.0 a	0.13 a
Target 27.5 plants/ft ²	29.2 b	64.25 a	12.80 a	82.7 a	0.13 a
Target 33 plants/ft ²	32.5 b	67.05 a	12.35 a	83.1 a	0.13 a
p-value	0.0005	0.3692	0.1083	0.1964	0.729
CV%	14.91%	4.65%	2.90%	0.38%	7.12%

Values with the same letter are not significantly different. Significant difference if $p \leq 0.05$.

Results Summary

Significant differences in plant stand were seen with the lowest seeding rate, treatment 1, having a significantly lower plant stand than the two higher seeding rates. Overall, no significant differences were seen in yield or quality.

Treatments

Treatment 1: Target 25 plants/ft²

Treatment 2: Target 30 plants/ft²

Treatment 3: Target 35 plants/ft²

Goal:

To determine the yield and grain quality impacts of seeding rates on CPSR wheat production.

In-crop assessment results:

Although seeding rates were adjusted to target specific plant stands, treatment 2 and 3 displayed no difference in plant stands at 21 days after seeding. However, treatment 1 was significantly lower than both treatments 2 and 3 (Table 1).

Yield results:

No significant differences were seen in yield between target plant stand treatments (Table 1).

Grain quality results:

No significant differences in grain protein, test weight, or fusarium were observed (Table 1).

B002 – Trinexapac-ethyl (Moddus) plant growth regulator application on barley

Introduction

Partnering with Gordon Ellis of Ellis Agriculture Ltd. (near Olds, AB), this protocol compared application of trinexapac-ethyl (Moddus) at BBCH 31-32 to an untreated check on the malt barley variety AAC Synergy. The trial was seeded using a 50-foot Bourgault 3320 paralink drill with 3" paired openers on 10" row spacings. Treatments were replicated and randomized.

Protocol #: B002

Closest Town: Olds, Alberta

Soil type: Medium textured Orthic Black Chernozem

Seeding Date: May 6, 2021

Harvest Date: August 30, 2021

Row Spacing(cm): 25.4cm (10") with 3" paired rows

Variety(s): AAC Synergy

Reps: 5

Previous Crop: Canola

Tillage: Harrowed

Herbicides:

Pre: Prepass + Glyphosate

In-Crop: Achieve + Infinity + AMS

Seed Treatment: Insure Cereal FX

Foliar Insecticides: None

Foliar Fungicides: Tilmore applied at heading

Fertilizer:

Midrow Band: 35.8 – 0 – 13.2 @225lbs/ac

Seed Placed: 8.9 – 42.2 – 11.7 @ 80lbs/ac

Total fertilizer applied: 87.5 lbs actual N/ac; 33 lbs P₂O₅/ac; 39.1 lbs actual K₂O/ac

Irrigation: None

Rainfall: Between May 1 and August 1: 158.7mm (6.25")

Treatments

Treatment 1: No trinexapac-ethyl (Moddus) applied

Treatment 2: Trinexapac-ethyl (Moddus) applied at 0.42L/ac at BBCH 31-32

Note: Treatment application was made at BBCH 31 on June 11th, 2021.

Goal:

To determine the lodging, yield and grain quality impacts of trinexapac-ethyl (Moddus) application on malt barley.

In-crop assessment results:

At physiological maturity, the crop was assessed for lodging differences between treatments. At the time of inspection, no crop lodging had occurred. This is likely due to the well below average rainfall for the 2021 growing season.

Yield results:

Significant yield differences were seen between treatments. Application of trinexapac-ethyl (Moddus) at BBCH 31 resulted in a yield of 88.2 bu/ac, a 5.13% increase over the check (83.9 bu/ac) (Table 1).

Grain quality results:

No significant differences in grain protein, test weight, chitting, greens, or germination was observed. Significant differences were seen for plump, thins, and broken & peeled (Table 1).



Figure 1: Visual plant height difference between trinexapac-ethyl (Moddus) application and the check treatment. Image taken 15 days after application of trinexapac-ethyl (Moddus) on June 26th.



Figure 2: Visual height differences between the untreated check and trinexapac-ethyl (Moddus) treatment. Image taken July 7 N difference in height between treatments were seen at this stage.

Table 1: Yield, and quality results comparing application of trinexapac-ethyl (Moddus) to an untreated check on AAC Synergy near Torrington, Alberta, 2021.

Cultivar	Yield at 14.5% seed moisture content (bu/ac)	Protein %	Test Weight (kg/hL)	Plump (%)	Thins (%)	Peeled & Broken (%)
Untreated Check	83.9 a	13.6 a	63.3 a	97.6 a	0.36 a	1.04 a
Trinexapac-ethyl (Moddus) applied at 0.42L/ac at BBCH 31-32	88.2 b	13.4 a	63.3 a	96.7 b	0.5 b	1.24 b
<i>p-value</i>	0.0031	0.01533	0.9236	0.0321	0.0249	0.089
CV%	4.29%	1.88%	0.61%	0.84%	22.06%	18.59%

Values with the same letter are not significantly different. Significant difference if $p \leq 0.05$.



Figure 3: Drone imagery of trinexapac-ethyl (Moddus) trial area near Torrington Alberta in 2021. "R1", "R2", "R3", "R4", and "R5" represent replication 1, replication 2, replication 3, and replication 4. "T" and "C" represent trinexapac-ethyl (Moddus) treated area and check area, respectively. No lodging was seen in this trial.

Results Summary

Although application of trinexapac-ethyl (Moddus) did not cause any height or lodging differences, a yield increase of 5.13% was observed. The application of trinexapac-ethyl also led to a statistically significant decrease in plumps from 97.6% to 96.7% (0.92% decrease), increase in thins from 0.36% to 0.5% (38.8% increase), and an increase in peeled and broken kernels from 1.04% to 1.24% (19.2% increase). However, the quality impacts seen are not large enough to affect malt acceptance.

W004 – Enhanced efficiency fertilizer effects on yield and protein of CPSR wheat

Introduction

Partnering with Luke Adam of Rolling Acres Farm (near Stony Plain, AB), this protocol compared application of two urea:ESN nitrogen fertilizer blends with urea. All treatments were applied at the time of seeding on the CPSR variety AAC Penhold. The trial was seeded using a 32-foot, double shoot Flexicoil 820 drill with 2320 cart, and Dutch openers on 7.5" row spacings. Treatments were replicated and randomized.

Protocol #: W004

Closest Town: Stony Plain, Alberta

Soil type: Medium textured Dark Gray Luvisol

Seeding Date: May 15, 2021

Harvest Date: September 9, 2021

Row Spacing(cm): 19.05 cm (7.5")

Variety(s): AAC Penhold

Reps: 6

Previous Crop: Canola

Tillage: Zero till

Herbicides:

Pre: Priority and RoundUp

In-Crop: Tundra + AMS

Seed Treatment: Raxil Pro

Foliar Insecticides: None

Foliar Fungicides: None

Fertilizer:

Total fertilizer applied: 95 lbs actual N/ac; 5.8 lbs P₂O₅/ac; 5.8 lbs K₂O/ac; 4.9 lbs S/ac; 0.8 lbs C/ac; 0.8 lbs B/ac

Seed Placed: 8-18-18-5 @32 lbs/ac

Irrigation: None

Rainfall: Between May 1 and August 30: 121.8 mm (4.8")

September 1-2: 44 mm (1.7")

Treatments

Treatment 1: 100% of total required nitrogen as urea applied at time of seeding

Treatment 2: Total nitrogen required applied as 25% ESN + 75% urea at time of seeding

Treatment 3: Total nitrogen required applied as 50% ESN + 50% urea at time of seeding

Goal:

To determine the yield and grain quality impacts of increasing ratios of ESN as a percentage of the total nitrogen applied, at time of seeding in spring wheat production.

Plant stand count and tiller number results:

The rates of ESN did not cause any significant differences in plant stand counts or tiller number between treatments (Table 1).

Yield results:

Treatments did not have an effect on final yield (Table 1).

Grain quality results:

Treatments did not have an effect on grain protein, test weight, or fusarium infection.

Table 1: Plant stand counts, tiller number, yield, and quality results comparing two ratios of ESN:urea with straight urea (100% of total required nitrogen as urea applied at time of seeding, total nitrogen required applied as 25% ESN + 75% urea at time of seeding and total nitrogen required applied as 50% ESN + 50% urea at time of seeding) on AAC Penhold in Stony Plain, Alberta, 2021.

Starter fertilizer ratio between ESN and urea	Plant stand count at 21 days after seeding (plants/ft ²)	Yield at 14.5% seed moisture content (bu/ac)	Number of tillers per plant	Protein %	Test Weight (kg/hL)	Fusarium %
100% urea	28 a	29.4 a	1.3 a	15.4 a	79.6 a	0.10 a
50% ESN/50% urea	27.1 a	27.4 a	1.3 a	15.3 a	79.7 a	0.10 a
75% urea/25% ESN	27.8 a	27.3 a	1.3 a	15.4 a	79.6 a	0.10 a
<i>p-value</i>	<i>0.8146</i>	<i>0.4133</i>	<i>0.9508</i>	<i>0.7997</i>	<i>0.5064</i>	<i>0.2811</i>
CV%	8.47%	37.45%	9.99%	1.49%	0.55%	13.17%

Values with the same letter are not significantly different. Significant difference if $p \leq 0.05$.

Results Summary

A lack of moisture was the largest factor limiting growth. The yields were half of typical for the area. Soil test recommendations were based on a yield target of 60 bu/ac, since less than 30 bu/ac were harvested, nutrients were not a limiting growth factor in this trial. There were no statistical differences between the urea:ESN treatments for plant stand, number of tillers per plant, yield, protein, test weight or fusarium.

W006 – Wheat row spacing

Introduction

Partnering with Antler Valley Farms (Innisfail, AB), this trial compared two row spacings on the CPSR variety AAC Penhold. The trial was seeded using a 50-foot SeedMaster ultraSR drill with 38 cm (15") and 19 cm (7.5") row spacings. The 19 cm (7.5") row spacings were implemented by making two passes and seeding between the first pass rows using RTK. To adjust for two passes, seed and fertilizer rates were applied at half rates for each pass. To account for the compaction caused by the extra pass required on the 19 cm (7.5") treatment, a non-working pass was made on each 38 cm (15") row treatment to increase compaction uniformity between treatments. Treatments were replicated and randomized.

Protocol #: W006

Closest Town: Innisfail, Alberta

Soil type: Medium textured Eluviated Black Chernozem

Seeding Date: May 3, 2021

Harvest Date: August 30, 2021

Row Spacing(cm): 38cm (15") and 19cm (7.5")

Variety(s): AAC Penhold

Reps: 4

Previous Crop: Barley

Tillage: Harrowed fall 2020

Herbicides:

Pre: Prepass + Glyphosate

In-Crop: Axial & Cirpreme

Seed Treatment: Raxil Pro

Foliar Insecticides: None

Foliar Fungicides: TILMOR

Fertilizer:

46 – 0 – 0 @198lbs/ac

11 – 52 – 0 @129lbs/ac

Total fertilizer applied: 105.2 lbs actual N/ac; 67.1 lbs P₂O₅/ac

Irrigation: None

Rainfall: Between May 1 and August 1: 152.4mm (6")

Treatments

Treatment 1: 19 cm (7.5") rows

Treatment 2: 38 cm (15") rows

Goal:

To determine the yield and grain quality impacts of 38 cm (15") and 19 cm (7.5") row spacing on spring wheat.

Plant stand count results:

At 21 days after seeding, the crop was assessed for emergence rates and plant stands were counted. At the 7.5" row spacing, plant stand was (non-significantly) lower than the 38 cm (15") row spacing treatment (Table 1).

Yield results:

Significant yield differences were seen between treatments. The 38 cm (15") row spacing treatment resulted in a yield of 87.6 bu/ac, a 3.5% decrease compared to the 19 cm (7.5") row spacing treatment (90.8 bu/ac) (Table 1).

Grain quality results:

No significant differences in grain protein, test weight, or fusarium infection were seen (Table 1).



Figure 1: Visual plant stand differences between the 39 cm (15") (left) row spacing and 19 cm (7.5") (right) row spacing. Image taken 33 days after seeding on June 8th.



Figure 2: Visual plant stand difference between the 38 cm (15") (left) row spacing and 19 cm (7.5") (right) row spacing. Image taken July 6 at early anthesis (BBCH 60).

Table 1: Plant stand count, yield, and quality results comparing the 19 cm (7.5") and 38 cm (15") row spacing on AAC Penhold CPSR wheat in Innisfail, Alberta, 2021.

Row Spacing (in)	Plant stand count at 21 days after seeding (plants/ft ²)	Yield at 14.5% seed moisture content (bu/ac)	Protein %	Test Weight (kg/hL)	Fusarium (%)
7.5" rows	33.3 a	90.8 a	11.0 a	73.8 a	0.10 a
15" rows	38.2 a	87.6 b	10.7 a	73.9 a	0.11 a
p-value	0.1685	0.0108	0.1597	0.882	0.495
CV%	12.17%	2.88%	4.01%	0.80%	15.43%

Values with the same letter are not significantly different. Significant difference if $p \leq 0.05$.

Summary

The wider row spacing of 38 cm (15") with CPSR AAC Penhold wheat resulted in a 3.5% decrease (3.2 bu/ac) yield as compared with the 19 cm (7.5") row spacing. Row spacing had no effect of final grain quality.

Notes



