

Evaluation of early seeded multiple-cuts winter cereals for livestock feed as a drought management strategy in Alberta

The Lakeland region of Alberta experienced one of the driest years since 2002, leaving many agricultural producers scrambling for feed and water resources for livestock and harvesting crops that were yielding as low as 30% of normal yields. As a result, many pastures were overgrazed in the fall of 2021 as producers searched for ways of extending available feed sources. Overgrazed pastures tend to produce less the following year and require additional management strategies that include reduced grazing days to ensure long-term recovery.

Winter cereals seeded in fall have been shown to provide an early season grazing opportunity for livestock producers. This could allow for delayed turnout into stressed perennial pastures, thus providing more recovery time for those forages. A second option is to seed winter cereals in the spring, which prevents the cereals from entering a reproductive stage, meaning that these winter cereals would remain vegetative through summer and fall. Current research into spring seeded winter cereals has focused on seeding during typical seeding times when temperatures are over 10°C.

Recent research conducted by Agriculture and Agri-Food Canada in Lethbridge has shown that as long as soil temperatures are between 2-6°C, spring wheat can be sown and produce commendable yields when compared to spring wheat sown when soil temperatures are over 10°C. This research was replicated by seven Applied Research Associations (ARA) across Alberta over a four-year period and found similar results. Seeding early during drought conditions could allow these cereals to utilize early spring moisture from snow melt that might not be available later in the spring. However, this concept has not yet been evaluated for use in winter cereals for forage production.

Objectives:

- Provide unbiased, regional information regarding the establishment, dry matter yield and nutritional quality of early spring seeded winter cereals for production as livestock feed in Northeastern Alberta.
- To compare the establishment, dry matter yield and nutritional quality of early spring seeded winter cereals (soil temperatures between 2-6°C) with winter cereals seeded at soil temperatures above 10°C.
- To determine the additional forage yield achieved throughout the summer by seeding winter cereals early (soil temperatures between 2-6°C) in a simulated grazing environment.



Figure 1-1: early seeded trial (left), late seeded trial (right).

Materials and Methods:

The trial was carried out at the LARA research farm (54° 18'N, 110° 37'W; NE 25-61-5-W4) in Fort Kent, Alberta. For weed control, a pre-seed burnoff was carried out with one spray of glyphosate (540g ai/L). The project was seeded in a randomized complete block design (RCBD) with four replications of ten treatments. CDC Austenson was seeded as check.

Treatment list		
Winter wheat	Winter triticale	Fall rye
AAC Coldfront	AB Provider	AC Hazlet
AAC Wildfire	AB Bronco	KWS Serafino
Pintail	Tadeus	SU Performer

Plots were 1.15 m wide by 7.5 m in length and harvested area was a minimum of 6 m squared. Varieties were seeded to a depth 1.5 inches due to dry soil conditions (please see Table 2 for more details). The appropriate fertilizer was applied based on soil tests taken in the fall of 2023. Fertilizer was side banded at seeding. In crop spraying occurred approximately 3-4 weeks after seeding with 0.4L/ac of Buctril M. Hand weeding occur when necessary to control any weeds that were not killed by the herbicide, such as grassy weeds. Harvest took place when each plot was at least 30 cm tall on average. Forage shorter than this could not efficiently be harvested with the forage harvester due to the nature of the flail. Regrowth on the plots was harvested throughout the summer when regrowth was at least 30 cm tall. Total rainfall during the growing season was 241 mm.

Table 2. Project timeline	
Activity	Date
Early Seeding (soil temperature at 2°C)	April 19 th , 2024
Regular Seeding (soil temperatures at 12°C)	May 13 th , 2024
Harvest (Early block – cut 1)	June 20 th , 2024
Harvest (Regular block – cut 1)	July 4 th , 2024
Harvest (Early block – cut 2)	July 4 th , 2024
Harvest (Regular block – cut 2)	August 7 th , 2024
Harvest (Early block – cut 3)	July 22 nd , 2024
Harvest (Regular block – cut 3)	September 17 th , 2024
Harvest (Early block – cut 4)	August 26 th , 2024

Results and Discussion:

The early seeded treatment was harvested a total of four times throughout the grazing season while the regular seeded treatment was harvested three times. For early seeded treatment, the first, second, third and fourth cut occurred after four, six, eight, and twelve weeks of seeding, respectively. On the other hand, the first harvest for regular seeded treatment was after seven weeks of seeding and regrowth was harvested twice after four and nine weeks of first harvest.

Overall, the early seeded treatment yielded higher than the regular seeded treatment. In the early seeded treatment, the third cut was more productive than the first two cuts while in the regular seeded treatment, the second cut produced more biomass than the other two cuts (Figure 2). The presence of unexpectedly developed tillers in the second and third harvests of regular and early seeded treatments probably resulted in higher yield for these cuts compared with the other cuts. In early seeded treatment, the highest yielding variety was AAC Coldfront (2.26 t ac⁻¹) followed by AB Provider (1.77 t ac⁻¹), AB Bronco (1.76 t ac⁻¹), Tadeus (1.73 t ac⁻¹), SU Performer (1.71 t ac⁻¹), Hazlet (1.68 t ac⁻¹), Pintail (1.61 t ac⁻¹), KWS Serafino (1.58 t ac⁻¹) and AAC Wildfire (1.42 t ac⁻¹). While in regular seeded treatment, the highest yielding variety was AB Bronco (1.57 t ac⁻¹) followed by SU Performer (1.30 t ac⁻¹), AAC Wildfire (1.19 t ac⁻¹), AB Provider (1.19 t ac⁻¹), Hazlet (1.14 t ac⁻¹), KWS Serafino (1.03 t ac⁻¹), AAC Coldfront (0.97 t ac⁻¹), Pintail (0.97 t ac⁻¹) and Tadeus (0.36 t ac⁻¹) (Table 3 & 4).

Table 3. Total dry matter yield (ton/acre) by varieties in early seeded treatment.

Variety	Cut 1	Cut 2	Cut 3	Cut 4	Total
AAC Coldfront	1.52	0.74	-	-	2.26
AB Provider	0.29	0.54	0.94	-	1.77
AB Bronco	0.29	0.39	0.88	-	1.56
Tadeus	0.15	0.9	0.68	-	1.73
SU Performer	0.45	0.69	0.57	-	1.71
Hazlet	0.52	0.64	0.52	-	1.68
Pintail	1.13	0.32	0.16	-	1.61
KWS Serafino	0.15	0.37	0.97	0.49	1.98
AAC Wildfire	0.85	0.38	0.28	-	1.42
CDC Astmson (Check)	0.06	0.22	0.73	0.34	1.35
Pr (>F)	2.99e-11***	2.94e-06***	1.22e-08***	0.134	

Note: Significance Codes: 0 **** 0.001 *** 0.01 ** 0.05 *, - missing value.

Table 4. Total dry matter yield (ton/acre) by varieties in regular seeded treatment.

Variety	Cut 1	Cut 2	Cut 3	Total
CDC Astmson (Check)	1.07	0.6	-	1.67
AB Bronco	0.23	1.34	-	1.57
Su Performer	0.31	0.76	0.23	1.30
AAC Wildfire	0.57	0.62	-	1.19
AB Provider	0.38	1.01	-	1.39
Hazlet	0.40	0.75	0.39	1.54
KWS Serafino	0.34	0.41	0.28	1.03
AAC Coldfront	0.47	0.30	-	0.97
Pintail	0.49	0.30	-	0.79
Tadeus	0.19	-	0.17	0.36
Pr (>F)	2.55e-07***	1.73e-07***	0.0716	

Note: Significance Codes: 0 **** 0.001 *** 0.01 ** 0.05 *, - missing value.

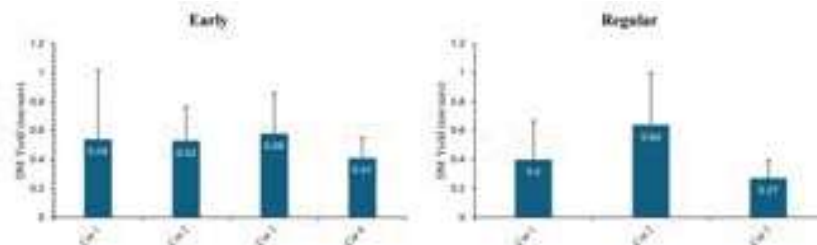


Figure 2. Average forage dry matter yield (ton/acre) by harvest number and seeding date.

When considering crude protein (CP), the early seeded treatment had higher CP content than the regular seeded treatment and the first harvest showed higher CP content than the subsequent harvests in both treatments. Similarly, the highest total digestible nutrients (TDN) were recorded in the early seeded treatment and the first cut contained higher concentrations of TDN than the other three cuts in that treatment. As expected, acid detergent fiber (ADF) and neutral detergent fiber (NDF) concentrations were lower in earlier cuts in both early and regular seeded treatments (Table 5).

Table 5. Average brix, crude protein (CP), total digestible nutrients (TDN), acid detergent fiber (ADF), and neutral detergent fiber (NDF) by harvest number and seeding date treatment.

	Early					Regular														
	Brix %	CP %	TDN %	ADF %	NDF %	Brix %	CP %	TDN %	ADF %	NDF %										
Cut 1	6.41	a	24.86	a	70.31	a	23.86	c	43.12	c	5.68	a	22.43	a	69.22	a	23.27	b	45.43	b
Cut 2	5.95	b	20.00	b	67.47	b	27.50	b	49.57	b	5.15	a	13.49	b	64.41	b	31.43	a	53.92	a
Cut 3	7.33	a	15.32	c	63.25	c	32.93	a	56.49	a	5.54	a	11.62	b	65.60	b	29.48	a	53.50	a
Cut 4	6.75	ab	14.41	c	64.48	c	31.34	a	56.95	a	-	-	-	-	-	-	-	-	-	-
Pr (>F)	0.0314*	7.91e-12***	4.59e-11***	4.58-11***	2.68-12***	0.661	<2e-16***	2.45e-07***	3.34e-07***	2.97e-12***										

Note: Significance Codes: 0 **** 0.001 *** 0.01 ** 0.05 *; - missing value.

Table 6. Average calcium (Ca), phosphorus (P), potassium (K), and magnesium (Mg) by harvest number and seeding date treatment.

	Early				Regular											
	Ca %	P %	K %	Mg %	Ca %	P %	K %	Mg %								
Cut 1	0.45	a	0.30	b	2.70	a	0.30	a	0.49	a	0.33	a	2.48	a	0.35	a
Cut 2	0.34	b	0.33	a	2.56	a	0.25	b	0.37	b	0.29	b	2.04	b	0.27	b
Cut 3	0.26	c	0.33	a	2.12	b	0.23	b	0.32	b	0.32	a	2.11	b	0.24	b
Cut 4	0.27	bc	0.31	ab	1.80	b	0.23	b	-	-	-	-	-	-	-	-
Pr (>F)	2.3e-09***	0.03*	3.74e-06***	2.97e-07***	3.42e-08***	0.000249***	0.00125**	7.68e-05***								

Note: Significance Codes: 0 **** 0.001 *** 0.01 ** 0.05 *; - missing value.

Table 7. Average sodium (Na), copper (Cu), and molybdenum (Mo) by harvest number and seeding date treatment.

	Early			Regular								
	Na	Cu	Mo	Na	Cu	Mo						
Cut 1	0.36	b	5.47	b	0.83	a	0.42	a	5.09	a	0.96	c
Cut 2	0.27	bc	6.43	a	0.92	a	0.25	b	5.25	a	1.33	b
Cut 3	0.02	c	6.56	a	0.89	a	0.01	b	5.60	a	1.89	a
Cut 4	0.10	a	7.19	a	1.04	a	-	-	-	-	-	-
Pr (>F)	2.77e-07***	4.89-05***	0.636	0.00338**	0.382	4.61e-07***						

Note: Significance Codes: 0 **** 0.001 *** 0.01 ** 0.05 *; - missing value.



Figure 1-2. A representative picture of trial; captured by Alyssa Krawchuk on July 25, 2024.

We may conclude that during the periods of dry conditions, early seeded winter cereals can be a viable alternative grazing resource. By seeding early, more grazing periods can be obtained with higher quality forage over regular seeding dates. This can be used as an alternative feed source during drought years reducing grazing pressure on perennial pastures, the need to buy dry feed or the need to rent alternative pasture. The year after a drought, this could be used as a method to defer grazing on drought-stressed pastures until later in the grazing season and provide more rest for these pastures throughout the summer. Furthermore, by seeding early the winter cereals can take advantage of any early growing season moisture that might occur before regular seeding dates.

Thank you for your support on this project:

