Forage & Livestock Research

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

Background:
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:

i. 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.
ii. 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.
iii. 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.

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. The project was seeded in a randomized complete block design (RCBD) with four replications of ten treatments. TAZA was seeded as check.

Table 3b-1. Treatment list for the project.

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 3b-2 for more details). The appropriate fertilizer was applied based on soil tests taken in the fall of 2024. Fertilizer was side banded at seeding. Hand weeding occurred 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.

Table 3b-2. Timeline for project activities.

Activity	Date
Early Seeding (soil temperature at 2°C)	April 23, 2025
Late Seeding (soil temperatures at 12°C)	May 08, 2025
First Harvest (Early Seeded Block-Cut 1)	June 09, 2025
First Harvest (Late Seeded Block-Cut 1)	June 18, 2025
Final Harvest (Early Seeded Block-Cut 4)	Sep 10, 2025
Final Harvest (Late Seeded Block-Cut 3)	Sep 12, 2025

Results & Discussion:

Overall, the late-seeded treatment produced higher total yields than the early-seeded treatment. Even though some early-seeded varieties were harvested four times during the grazing season, compared with only three for the late-seeded varieties, the late-seeded plots still produced more biomass. The early-seeded treatment was planted on April 23, 2025, but the site did not receive rainfall until May 12, 2025. In contrast, the late-seeded treatment was planted on May 8, 2025, and received rain later that same week, giving the varieties in the late-seeded treatment a better opportunity for establishment and growth.

All winter wheat, winter triticale, and fall rye varieties in both the early- and late-seeded treatments were harvested at least twice, with some winter triticale and fall rye varieties producing additional cuts. The first cut in the early-seeded treatment was taken on June 09, 2025, six weeks after seeding, with the final harvest on September 10, 2025, approximately three months later. In the late-seeded treatment, the first cut occurred on June 18, 2025, five weeks after seeding, and the final cut was taken on September 12, 2025, also around three months after the first cut. Thus, both treatments provided approximately three months of productive forage and repeated grazing opportunities from June through September.

In the early-seeded treatment, the check variety TAZA produced the highest biomass at 1.59 $t\,ac^{-1}$, but in the late-seeded treatment, it yielded the lowest at 1.25 $t\,ac^{-1}$, while AB Bronco led the late-seeded yields with 2.00 $t\,ac^{-1}$. Detailed values for all varieties are presented in Tables 3b-3 and 4.

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

Variety	Cut 1		Cut 2		Cut 3		Cut 4		Total
TAZA	0.28	bc	0.10	e	0.26	c	0.95	a	1.59
Tadeus	0.29	b	0.40	cd	0.20	c	0.25	b	1.14
AB Provider	0.47	a	0.60	a	-		-		1.07
AC Hazlet	0.22	bc	0.46	bcd	0.36	ab	-		1.04
KWS Serafino	0.13	c	0.54	ab	0.36	ab	-		1.03
SU Performer	0.19	bc	0.52	abc	0.27	bc	-		0.98
AB Bronco	0.29	b	0.16	e	0.42	a	-		0.87
Pintail	0.34	ab	0.39	cd	-		-		0.73
AAC Wildfire	0.33	ab	0.38	d	-		-		0.71
AAC Coldfront	0.29	b	0.36	d	-		-		0.65
Pr (>F)	0.01413*		7.271e-08***		0.001572**		0.008536**		

Note: Significance Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.'; -: No regrowth.

Table 3b-4. Total dry matter yield (ton/acre) by varieties in late seeded treatment.

Variety	Cut 1		Cut 2		Cut 3		Total
AB Bronco	0.57	a	1.43	a	-		2.00
Tadeus	0.54	a	0.78	c	0.65	a	1.97
KWS Serafino	0.15	cd	1.10	abc	0.52	b	1.77
AC Hazlet	0.25	cd	1.10	abc	0.39	cd	1.74
AB Provider	0.33	bc	1.38	ab	-		1.71
AAC Wildfire	0.28	bcd	1.33	ab	-		1.61
AAC Coldfront	0.46	ab	1.14	abc	-		1.60
SU Performer	0.13	d	1.02	bc	0.43	bc	1.58
Pintail	0.22	cd	1.32	ab	-		1.54
TAZA	0.20	cd	0.77	c	0.28	d	1.25
Pr(>F)	0.0002314***		0.01138*		7.901e-05***		

Note: Significance Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.'; - : No regrowth.

Crude protein (CP) levels in the early- and late-seeded treatments ranged from 13.21-16.6% and 12.95-19.67%, respectively, across all cuts (Table 3b-5). Both ranges are high enough to satisfy the nutritional requirements of lactating beef cows. For reference, dietary CP levels of 7%, 9%, and 11% are recommended to meet the nutrient requirements of beef cows during mid-gestation, late gestation, and lactation, respectively.

Similarly, total digestible nutrients (TDN), a common measure of feed energy, follow the 55-60-65 rule, where beef cows in mid-pregnancy, late pregnancy, and post-calving require 55%, 60%, and 65%, respectively. In both early- and late-seeded treatments, TDN was highest in the first two cuts and declined in subsequent cuts, ranging from 61.6-64.47% and 61.54-67.15%, respectively.

As expected, acid detergent fiber (ADF) and neutral detergent fiber (NDF) were lower in the first two cuts compared to subsequent cuts in both early- and late-seeded treatments. ADF ranged from 31.36-35.10% in the early-seeded and 27.92-35.12% in the late-seeded treatment, while NDF ranged from 47.24-56% and 46.61-55.56%, respectively (Table 3b-5).

Regarding other macro- and micro-nutrients (as detailed in the tables Table 3b-6 & 7 included in this report), the ranges observed in both early- and late-seeded treatments across all cuts met the nutritional requirements for various categories of beef cattle at different points during the growing season. The only exception was copper (Cu), which consistently remained below the recommended level of 10 mg kg^{-1}, the amount required by most beef cattle.

Overall, there was a notable difference in yields between treatments, but forage quality remained high in both early- and late-seeded plots. The yield differences observed between early- and late-seeded treatments highlight the importance of snowmelt coupled with timely rainfall for early growth and establishment in a rain-fed system. In the previous year, soil moisture from snowmelt, combined with early-season rainfall, favored strong growth in the early-seeded treatment, resulting in higher overall biomass than the late-seeded plots. This year's results differed: although some soil moisture was available from snowmelt, limited rainfall in the first few weeks after seeding likely reduced early growth, which could explain why the late-seeded treatment ultimately produced higher biomass once rain occurred. This suggests that, while snowmelt provides some early moisture, timely rainfall shortly after seeding is the key factor determining crop success in rain-fed systems.

In conclusion, early seeding can take advantage of snowmelt and extend the grazing season, but carries risks if soils are cold or early-season rainfall is limited. Growers should base seeding decisions on local soil conditions, expected rainfall, and variety characteristics to optimize both yield and forage quality.

Table 3b-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										Late									
	Brix		CP		TDN		ADF		NDF		Brix		CP		TDN		ADF		NDF	
	%		%		%		%		%		%		%		%		%		%	
Cut 1	4.95	c	16.6	a	64.47	a	31.36	b	47.24	c	5.45	a	19.67	a	67.15	a	27.92	a	46.61	c
Cut 2	5.85	c	14.61	b	64.2	a	31.71	b	51.19	b	4.33	ab	14.46	b	62.84	b	33.45	b	49.67	b
Cut 3	7.58	b	13.21	b	61.6	b	35.10	a	53.82	a	5.55	a	12.95	b	61.54	c	35.12	a	55.56	a
Cut 4	18.31	a	14.51	b	63.89	a	32.11	b	56.00	a	-		-		-		-		-	
Pr (>F)	<2.2e-16***				6.106e-05***		6.09e-05***		1.099e-07***				1.093e-13***		1.247e-15***		1.246e-15***		4.084e-10***	

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

Table 3b-6. Average calcium (Ca), phosphorus (P), potassium (K), and magnesium (Mg) by harvest number and seeding date treatment.

	Early								Late							
	Ca		P		K		Mg		Ca		P		K		Mg	
	%		%		%		%		%		%		%		%	
Cut 1	0.38	a	0.27	ab	2.15	a	0.24	a	0.37	a	0.27	b	2.46	a	0.27	a
Cut 2	0.28	b	0.30	a	2.17	a	0.19	b	0.30	b	0.30	a	2.59	a	0.23	ab
Cut 3	0.27	b	0.31	a	2.12	ab	0.18	b	0.24	b	0.27	b	2.19	b	0.21	b
Cut 4	0.25	b	0.31	a	1.77	b	0.16	b	-		-		-		-	
Pr (>F)	1.438-05***		0.06539		0.1302		0.0001216***		0.0001677***		0.01731*		0.008461**		0.04434*	

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

Table 3b-7. Average copper (Cu) and zinc (Zn) by harvest number and seeding date treatment.

	Early				Late			
	Cu		Zn		Cu		Zn	
	mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}	
Cut 1	6.00	b	31.32	ab	6.11	a	29.87	a
Cut 2	5.56	b	26.92	b	5.38	b	25.62	b
Cut 3	6.12	b	31.90	ab	5.76	ab	24.25	b
Cut 4	7.60	a	37.37	a	-		-	
Pr (>F)	0.004959**		0.05009.		0.06684.		0.01824*	

Note: Significance Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.'; -: missing value, mg kg^{-1}: milligram per kilogram.

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