Parkland Crop Diversification Foundation

2024 ANNUAL REPORT

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Introduction

The Parkland Crop Diversification Foundation (PCDF) is located in Roblin, in the Parkland region of Manitoba and has a close liaison with Manitoba Agriculture. PCDF works alongside three other Diversification Centres in the province: Manitoba Crop Diversification Centre (MCDC) in Carberry, Prairies East Sustainability Agricultural Initiative (PESAI) in Arborg, and Westman Agricultural Diversification Organization (WADO) in Melita.

The Parkland Crop Diversification Foundation owes its success to excellent cooperation with ARD, the PCDF board of directors and staff, producers, industry, and cooperating research institutions.

The 2024 season was full of hard work and dedication from the staff to execute all the research activities that came with an ambitious project list. A thank-you goes out to James Frey and all the staff: Jessica Frey, Sara Marzoff, Brooklyn Bartel, Kyler Kitsch, and Jaden Bartel.

Funding is essential for the Parkland Crop Diversification Foundation's everyday activities to occur. This year PCDF received core funding and support from the Canadian Agricultural Partnership (CAP) and Agriculture Sustainability Initiative (ASI) programs, as well as from trial cooperators, producers, and members of the local community. PCDF is always open to project ideas and learning about the production concerns of local producers, so please feel free to contact us with any project proposals. For project submissions or additional information, please refer to the Contact info supplied on this website.

Parkland Crop Diversification Foundation (PCDF)
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Ducks Unlimited
FP Genetics
Linseed Coop
Manitoba Agriculture
Manitoba Crop Variety Evaluation Team
Manitoba Diversification Centres
Manitoba Crop Alliance
Parkland Coop
Pepsi-co/Quaker Oats
Saskatchewan Pulse Growers
Saskatchewan Variety Performance Group
University of Alberta
University of Manitoba
University of Saskatchewan
Verve Seed Solutions

Meteorological Data

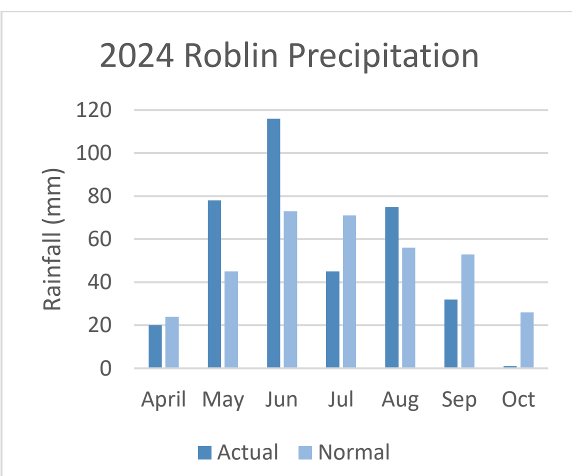
Table 1: Roblin 2024 Season Report by Month (based on 30-year average)

Month	Precipitation		Crop Heat Units		Growing Degree Days	
	Actual	Normal	Actual	Normal	Actual	Normal
April	20	24	97	33	32	7
May	78	45	254	321	152	172
Jun	116	73	409	530	242	314
Jul	45	71	695	645	427	392
Aug	75	56	575	587	347	354
Sep	32	53	517	292	319	163
Oct	1	26	146	42	59	11

Information gathered from Manitoba Agriculture Growing Season Report website at https://web43.gov.mb.ca/climate/SeasonalReport.aspx

Table 2: Roblin 2023 Season Summary April 1 – October 31

	Actual	Normal	% of Normal
Number of Days	214	-	-
Growing Degree Days	1518	1415	112
Corn Heat Units	2697	2452	110
Total Precipitation	369	350	105



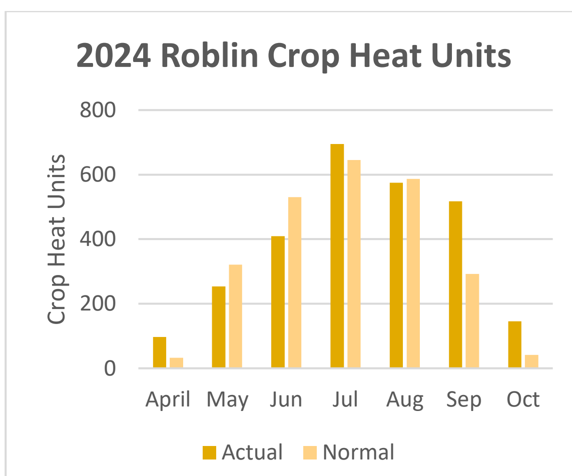


Figure 1: (left) Roblin 2023 monthly precipitation; (right) monthly crop heat units

Extension Activities

Table 3: PCDF 2024 Extension Activities

Name	Medium	Date	Location
Ag Days	Diversification Centre Booth	Jan 16-18	Brandon
Crop Connect	Diversification Centre Booth	Feb 14-15	Winnipeg
MCDC Field Day	Guest Speaker Jessica Frey	Aug 7	Carberry
PCDF Field Day	Site Tour	Aug 8	Roblin
CANVAS Agronomist Conference	MSc Presentation Jessica Frey	Nov 12	San Antonio
Federated Co-op Agronomist Training	Presentation	Jan 9	Winnipeg

PCDF Field Trials

Plot information

At seeding: 9m x 1.2m
Trimmed: 7m x 1.2m
Plot Area: 8.4m^2 harvested
Alleyways: 2m

Equipment

5-Row Fabro Disc Seeder
Plot Sprayer
Wintersteiger Plot Combine

Table 4: Summary of 2024 PCDF Trials

Crop Type	Collaborators	Purpose	# Plots
Barley	MCVET	Evaluate barley varieties	39
	Saskatchewan Variety Performance Group	2-row barley variety trial	87
Canola	Jessica Frey, PCDF, University of Manitoba	Evaluate nitrogen dynamics and potential for seeding canola into cover crops	28
Fababean	Saskatchewan Pulse Growers	White and coloured variety evaluation	36
	University of Saskatchewan	Low tannin fababean variety evaluation	30
	University of Saskatchewan	Tannin fababean variety evaluation	21
Fall Rye	MCVET	Evaluate fall rye varieties	12
Flax	Linseed Coop	Variety trial	36
	Manitoba Crop Alliance	Seed treatment	32
Forage	Ducks Unlimited	Hay establishment evaluation to determine best practices	54
	Ducks Unlimited	"Living Library" forage demonstration	58
	MCVET	Evaluate annual forage varieties	45
	PCDF	Grazing fall rye	3
Fruit	PCDF	Sour cherry and haskap	10
Hemp	Verve Seed Solutions	Hybrid hemp variety trial	76
Hops	PCDF	Variety evaluation	24
Intercropping	University of Manitoba, MCA	Establish spring wheat with forage crops	28

	University of Manitoba, MCA	Establish canola in a living mulch	28
Oats	Murphy et al.	Variety trial	144
	Murphy et al.	Variety trial	72
	Saskatchewan Variety Performance Group	Variety trial	39
	Quaker Oats	Variety trial	88
	University of Saskatchewan	Variety trial	108
	University of Saskatchewan	Variety trial	24
Peas	FP Genetics	Variety trial	69
	Assiniboine Community College & Manitoba Pulse and Soybean Growers	Comparative fungicide efficacy testing for managing mycosphaerella blight and white mould in peas	24
	Manitoba Pulse and Soybean Growers	Pea seed treatment	16
	Saskatchewan Pulse Growers	Variety trial	72
	University of Manitoba	Evaluation of impact of stubble, tillage, and phosphorus on pea production (Year 2)	48
Quinoa	Phillex	Variety trial	18
Soybean	Saskatchewan Pulse Growers	Long-season variety trial	60
	Saskatchewan Pulse Growers	Short-season variety trial	66
Spring wheat	Parkland Coop	Variety trial	63
	Saskatchewan Variety Performance Group	Variety trial (A)	117
	Saskatchewan Variety Performance Group	Variety trial (B)	42
	University of Manitoba	Measure NO_2 emissions from different rates and forms of nitrogen fertilizer	28
Teff	PCDF	Fertility evaluation	28
	PCDF	Variety trial	44
Winter wheat	Ducks Unlimited	Evaluate management practices for high yielding winter wheat	42
	Ducks Unlimited	Evaluate GHG emissions by fertility	
Total plots			**1988**

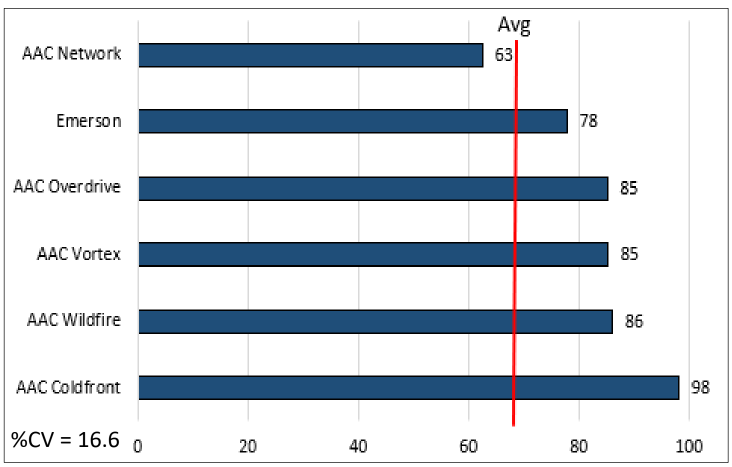
SEED MANITOBA

PCDF conducted trials for the Manitoba Crop Variety Evaluation Team. The results were published in SEED Manitoba and summarized below.

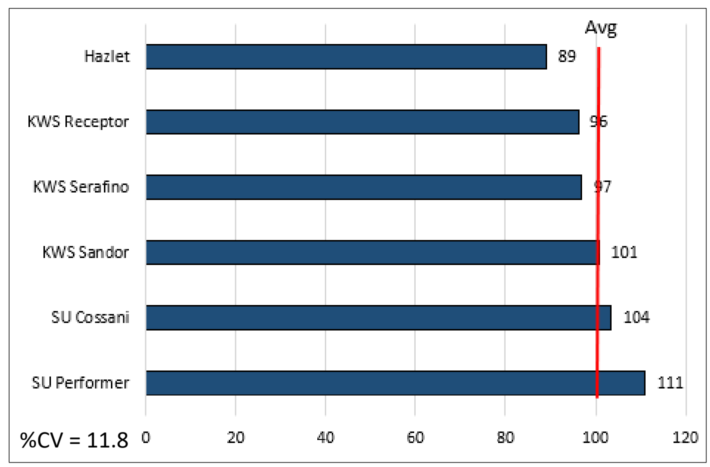
Table 5: 2024 MCVET Trials

Crop type	Seeding Date	N-P-K (lb/ac)	In Crop Weed/Insect Control (rate/acre)	Harvest Date
Barley	May 8	101-15-0	Axial, 480 ml/ac + Infinity, 330 ml/ac, June 14	Aug 28
Oats	May 9	69-15-0	Buctril M, 400 ml/ac, June 14	Sep 3
Flax	May 15	120-15-0	Buctril M, 400 ml/ac, June 14	Sep 13
Fababean	May 6	0-15-0	Basagran, 700 ml/ac, June 14	Sep 29
Fall Rye	Sep 26	145-15-0	None	Aug 21
Forage	May 15	120-15-0	None	Jul 30, Sep 3
Peas	May 6	0-15-0	Viper ADV, 400 ml/ac + UAN 28%, 810 ml/ac, June 14	Aug 27
Winter Wheat	Sep 26	145-15-0	None	Aug 21

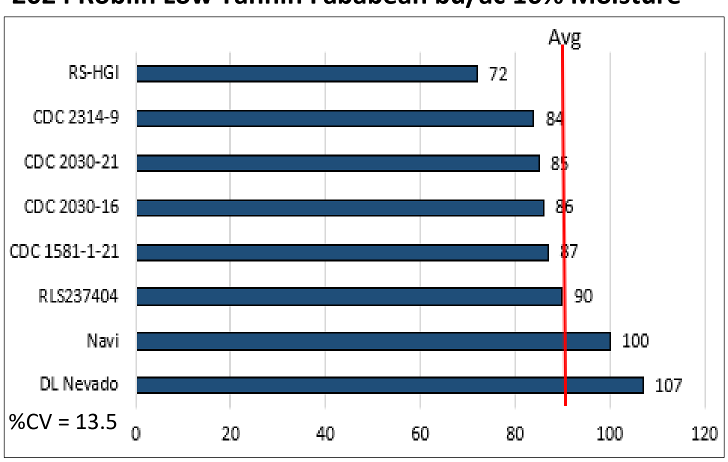
2024 Roblin Winter Wheat bu/ac 10% Moisture



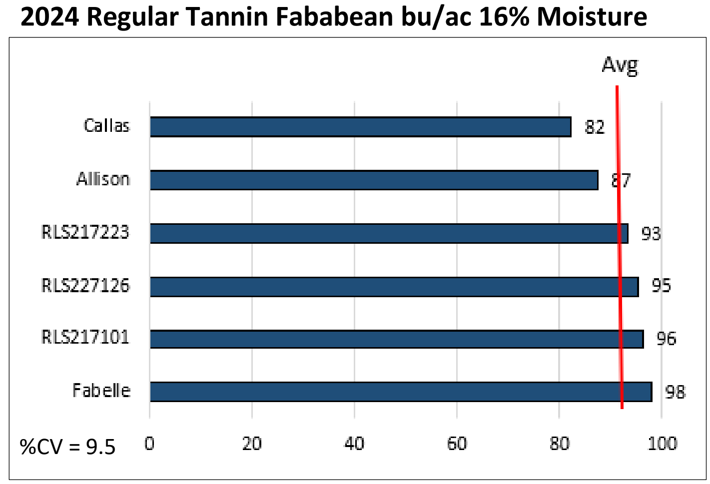
2024 Roblin Fall Rye bu/ac 10% Moisture



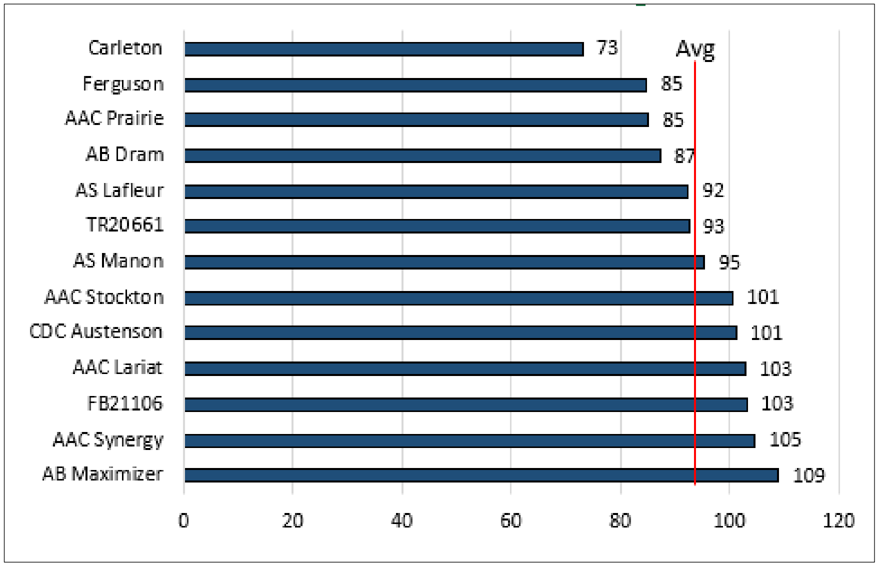
2024 Roblin Low Tannin Fababean bu/ac 16% Moisture



2024 Regular Tannin Fababean bu/ac 16% Moisture

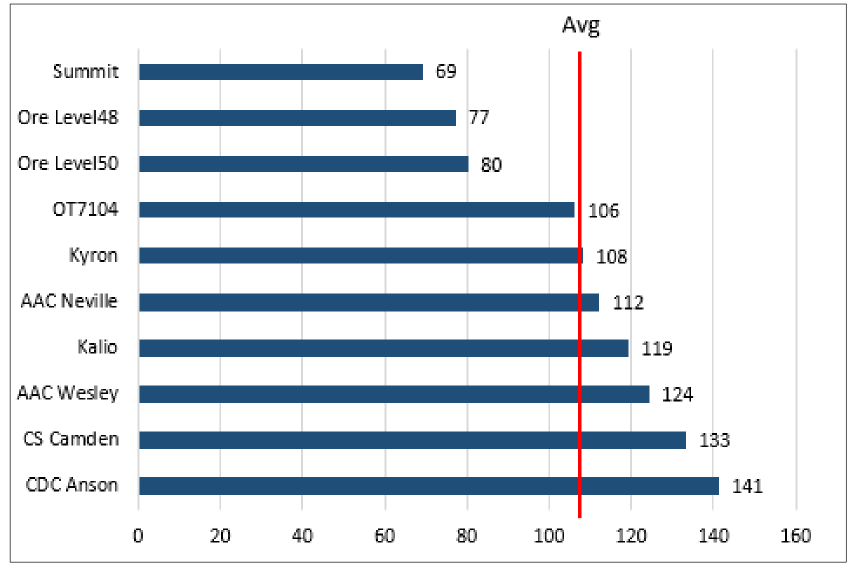


2024 Roblin MCVET Barley bu/ac 12% Moisture



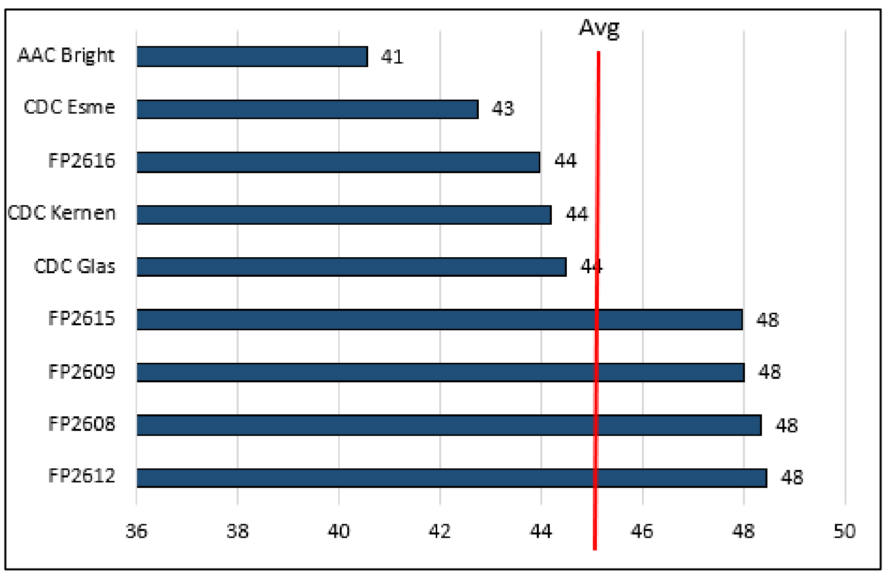
%CV = 12.3

2024 Roblin MCVET Oats bu/ac 10% Moisture



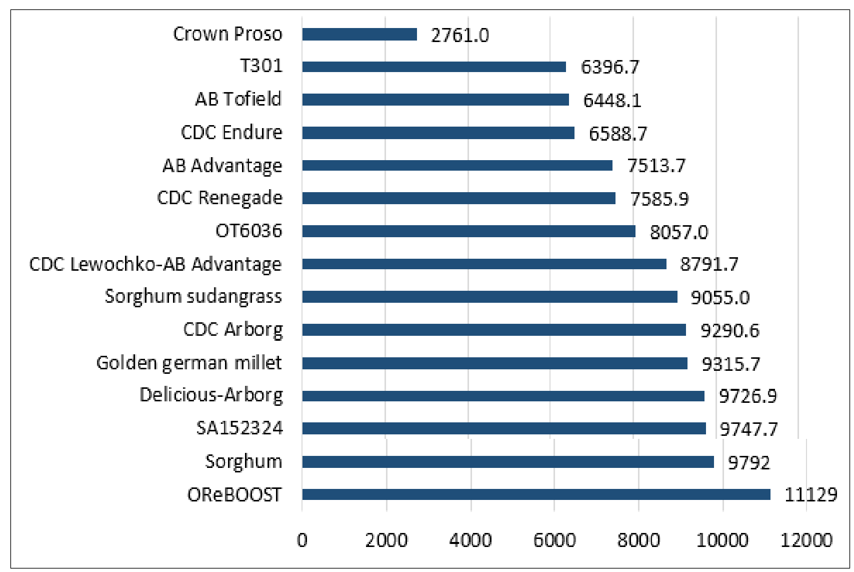
%CV = 23.1

2024 Roblin MCVET/Linseed Flax bu/ac 8% Moisture



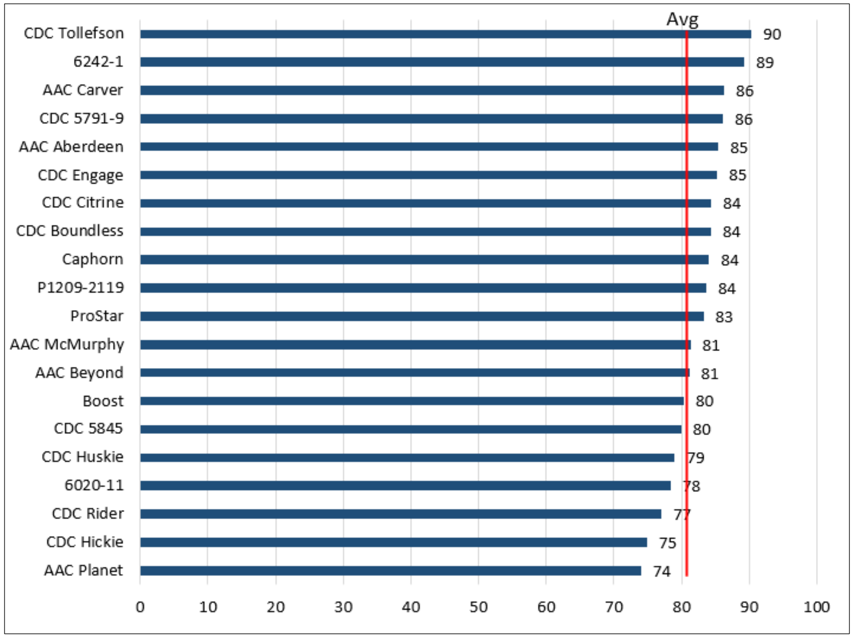
%CV = 7.5

2024 MCVET Forage lb/ac 15% moisture



%CV = 34.1

2024 Roblin MCVET Peas bu/ac 14% Moisture



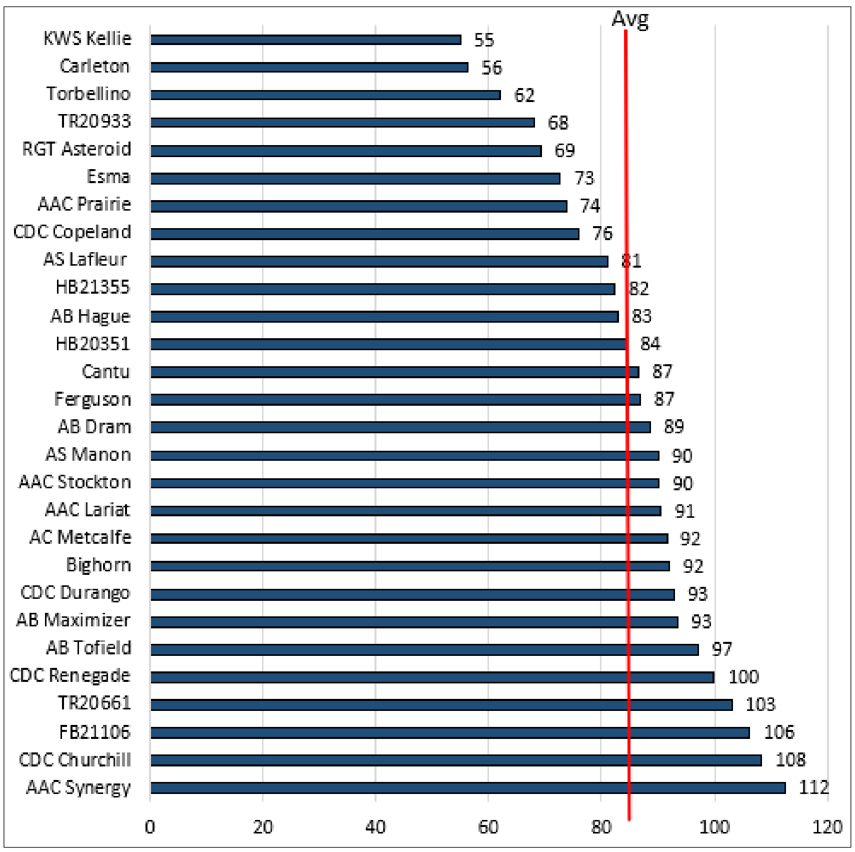
%CV = 7.1

PCDF conducted trials for the Saskatchewan Variety Performance Group. The results were published in the SaskSeed Guide and summarized below.

Table 6: 2024 SVPG Trials

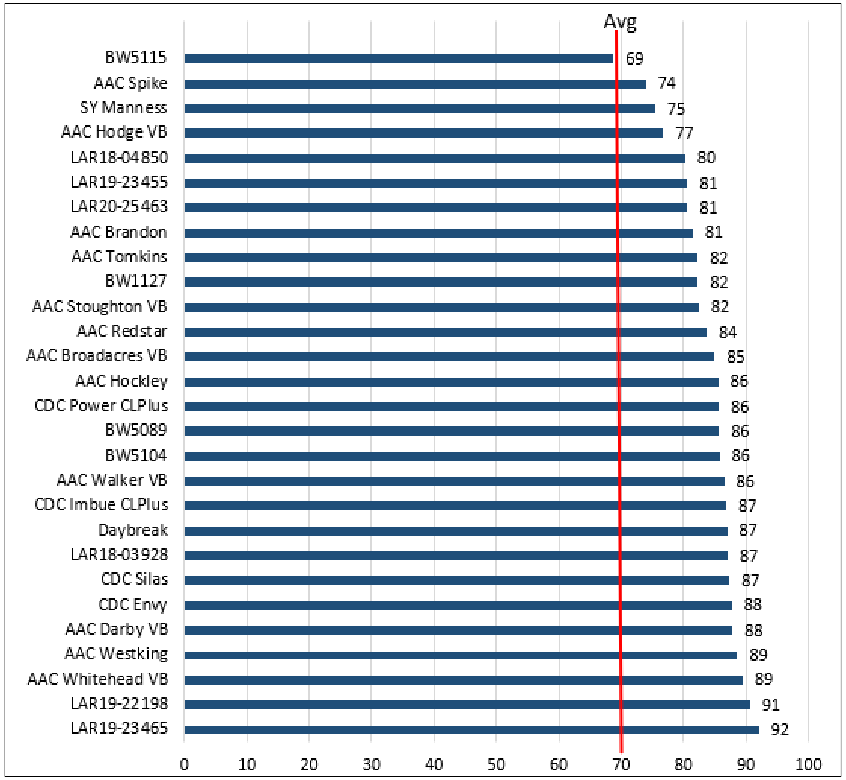
Crop type	Seeding Date	Fertility Applied N-P-K in lb/ac	In Crop Weed/Insect Control (rate/acre)	Harvest Date
2Row Barley	May 8	101-15-0	Axial @ 480 ml/ac + Infinity @330 ml/ac on June 14	Aug 28
Oats	May 9	69-15-0	Buctril M @400 ml/ac on June 14	Sep 3
Wheat A and B	May 8	138-15-0	Axial @ 480 ml/ac and Infinity @ 330 ml/ac on June 14	Sep 3 and 10

2024 Roblin SVPG 2Row Barley bu/ac 12% Moisture



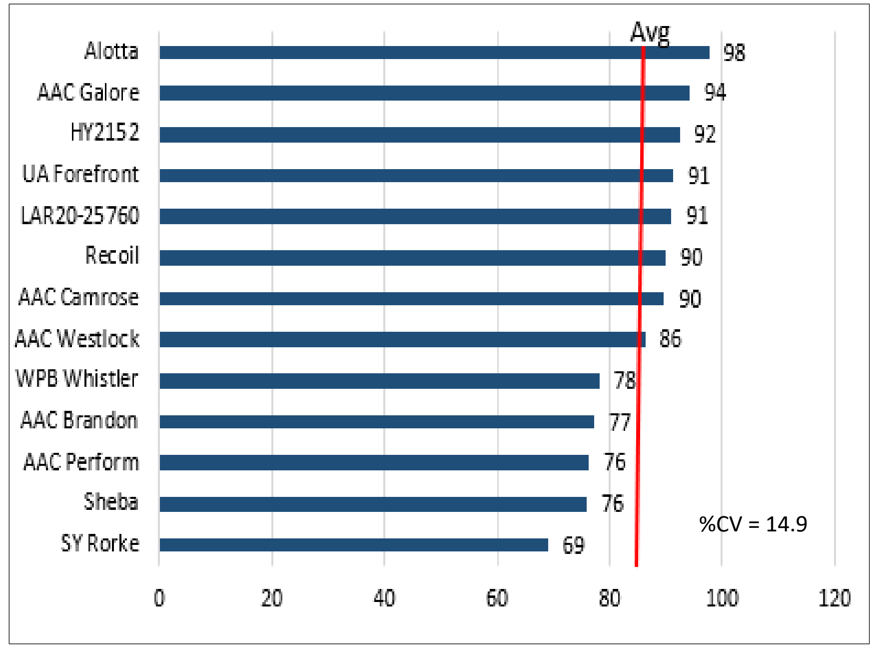
%CV = 23.1

2024 Roblin SVPG Wheat 1 bu/ac 13.5% Moisture

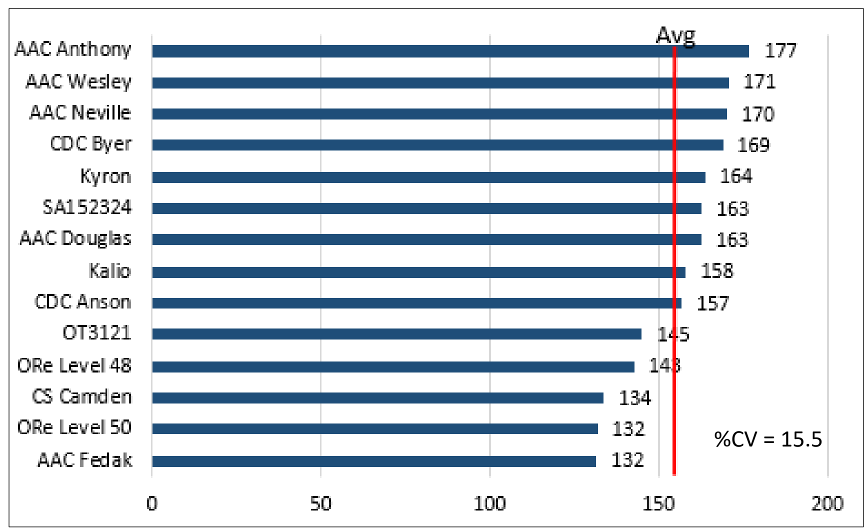


%CV = 13.5

2024 Roblin SVPG Wheat 2 bu/ac 13.5% Moisture



2024 Roblin SVPT Oats bu/ac 10% moisture

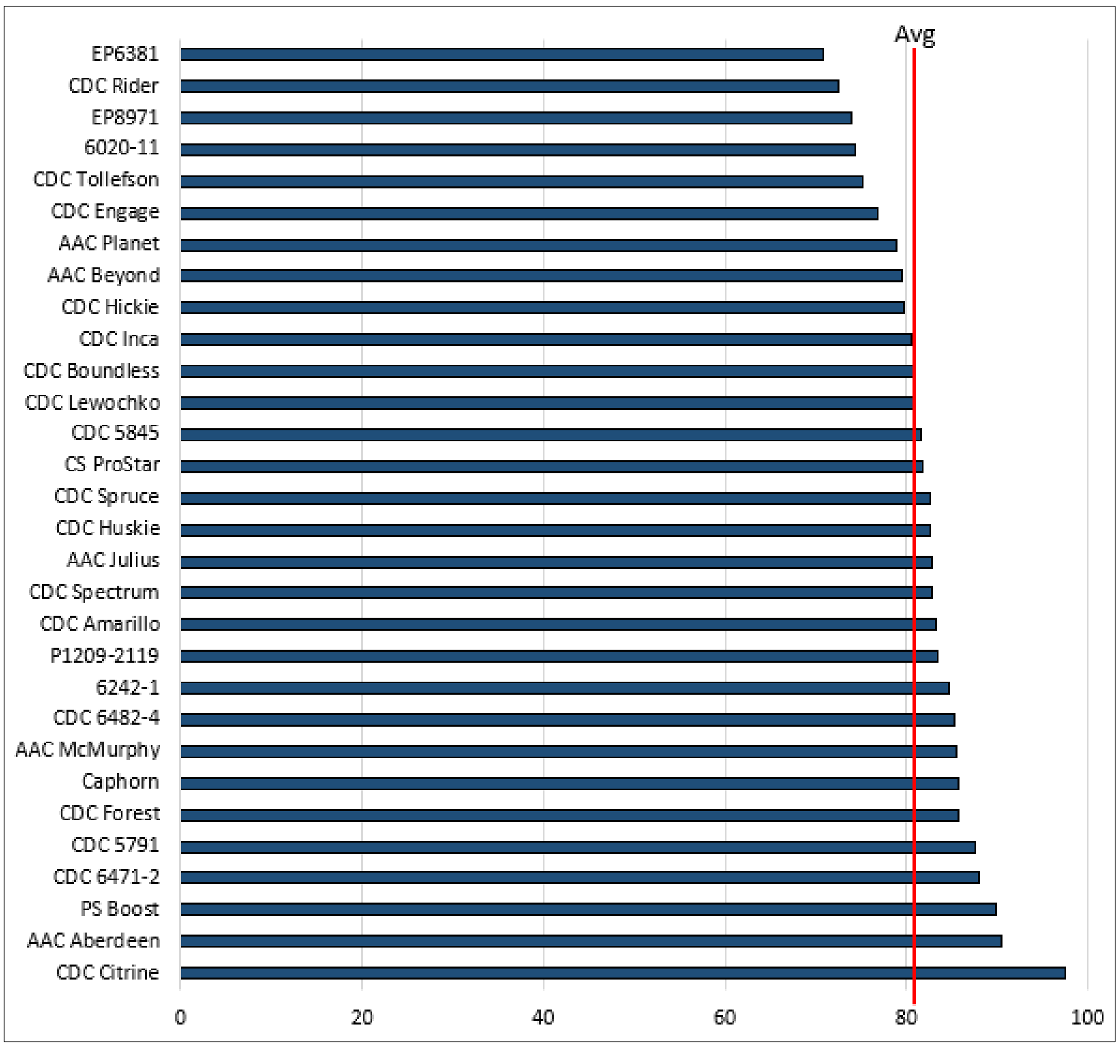


PCDF conducted trials for the Saskatchewan Pulse Growers. The results were published in the SaskSeed Guide and summarized below.

Table 7: 2024 Sask Pulse Trials

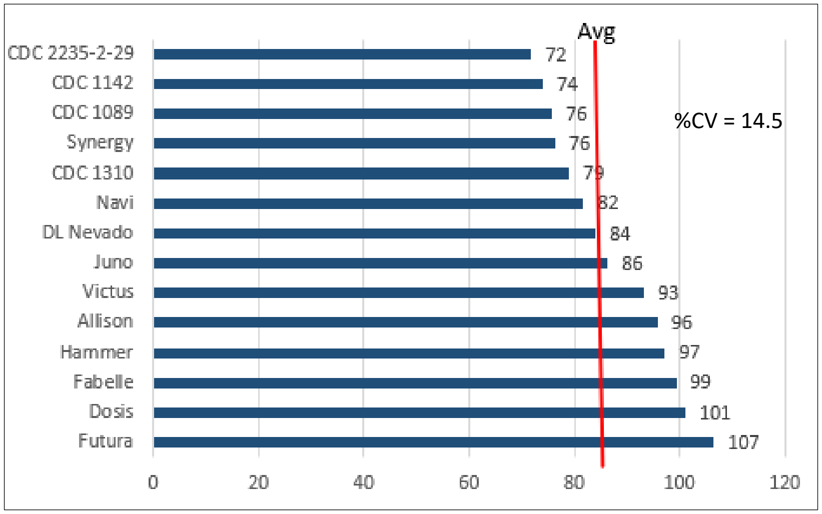
Crop type	Seeding Date	Fertility Applied N-P-K in lb/ac	In Crop Weed/Insect Control (rate/acre)	Harvest Date
Fababean	May 6	0-15-0	Basagran @ 700 ml/ac on June 14	Sep 29
Peas	May 6	0-15-0	On June 14: Viper ADV @ 400 ml/ac + UAN 28% @ 810 ml/ac	Aug 27

2024 Roblin Sask Pulse Peas bu/ac 14% Moisture

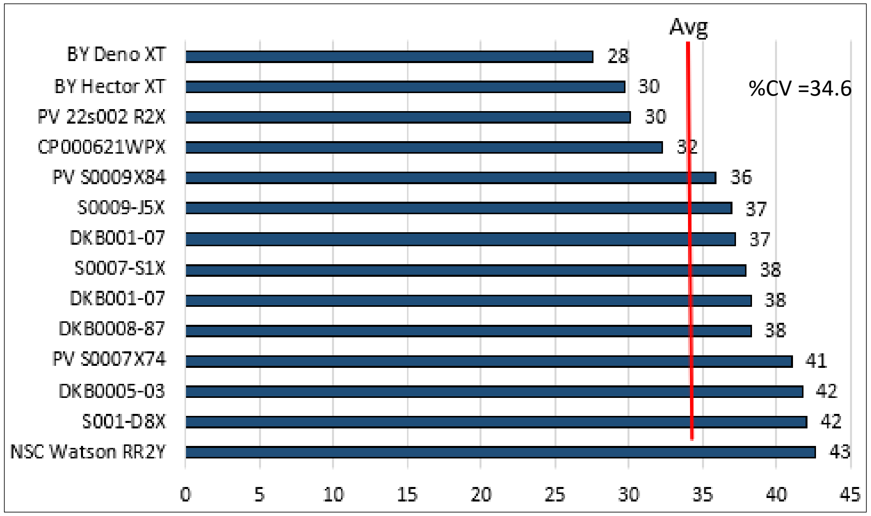


%CV = 10

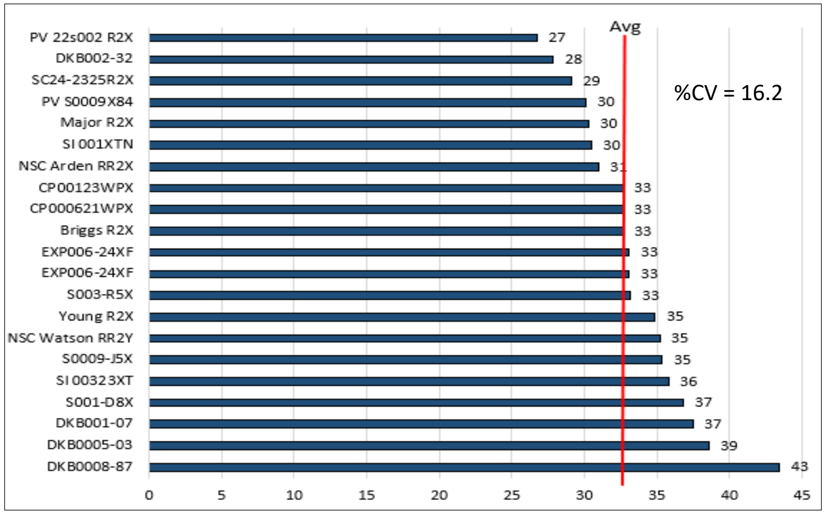
2024 Roblin Sask Pulse Fababeans bu/ac 16% Moisture



MCVET 2024 Sask Pulse Short Season Soybeans bu/ac 13% Moisture



MCVET 2024 Sask Pulse Long Season Soybeans bu/ac 13% Moisture



Ducks Unlimited Hay Establishment Evaluation

Project Duration: June 2023 – October 2024
Objectives: To evaluate the establishment of a hay crop with different rates of phosphorous and an oat nurse crop.
Collaborators: Ducks Unlimited Canada

Background
When establishing a perennial forage crop, a common practice is to plant it with a cereal "nurse crop", such as oats or barley. The nurse crop is typically cut for greenfeed mid-summer, after which the perennial forage grows with full access to sunlight, water, and soil nutrients. Alternatively, the nurse crop may be harvested for grain, often used to feed livestock. The benefit of these practices to producers is to provide a harvestable crop in the year of establishment, even when the nurse crop is seeded at a reduced rate, as compared to normal seeding rates for greenfeed or feed grain.

Nevertheless, observations by staff at Ducks Unlimited Canada suggest that the use of a nurse crop can have a negative impact on the perennial forage crop, leading to reduced hay yields in Year 2. Although this effect may be less pronounced for oats than for barley (which can be highly competitive against other crops), observations suggest that establishing a perennial forage without a nurse crop will result in a better stand, leading to higher forage yields in Year 2 and beyond.

The current study was initiated to examine the effect of a nurse crop on perennial forage establishment, as well as to examine the effect of using starter phosphorous at a rate of 25 lb/ac (actual).

Materials and Methods
The hay seed was provided by Ducks Unlimited Canada and is an alfalfa-brome-timothy mix. The oat nurse crop was Haymaker, a tall variety with wide leaves and large seed size. This variety was used with the expectation that the "quarter rate" oat nurse crop would be cut for greenfeed. However, due to delays in cutting the treatment, all the oats were harvested for grain at maturity.

*Table 1: M*aterials and methods.

Overview	
Design	RCBD
Entries	18 (see Table 2)
Reps	4
Harvest area	19.2 m2
2023	
Seeding date	June 15
Seeding depth	1/2-inch into adequate moisture
Preparation	Glyphosate (0.64 L/ac, May 26); tillage (June 7 and June 15)
Grain harvest date	Oct 19
2024	
Species count date	June 12
Swathing date	July 10
Hay collection date	July 17

Table 2: Treatments*

Treatment	Rate
Nurse crop (Haymaker oat)	2 bu/ac (full rate)
	0.5 bu/ac (quarter rate)
	None
Hay mix (alfalfa-brome-timothy)	8 lb/ac
	12 lb/ac
	15 lb/ac
Phosphate (seed-placed)	No added
	25 lb/ac

* No added nitrogen; 57 lb/ac available in soil.

Observations

<u>Year 1</u>

Timely rains in late June resulted in good growing conditions for all treatments. In general, hay mix-only treatments established well and competed adequately with any weeds that were present. Treatments with oats resulted in vigorous growth for oats, with varying levels of growth for the hay crops. The treatment with a full rate of oats and 8 lb/ac of hay mix showed the least growth for hay crops.

Figure 1: (left) Hay mix at 15 lb/ac without oats; (right) hay mix at 8 lb/ac with a full rate of oats.

Figure 2: (left) 12 lb/ac hay mix with full rate of oats; and (right) 8 lb/ac hay mix with quarter rate of oats

<u>Year 2</u>

Figure 3, clockwise from top left: (a) Sara Marzoff counts hay species, June 12; (b) weedier hay establishment (July 10); (c) good hay establishment (July 10); (d) regrowth at Field Day (August 8).

The season began with cool weather and generally moist conditions. The hay treatments showed differences in establishment and early season growth. Plants in treatments that had a nurse crop in 2024 were visibly smaller and took longer to grow vigorously, whereas plants without a nurse crop appeared to be better established and grew more biomass earlier in the season. Later in the season, this difference in growth resulted in generally higher number of weeds in the treatments that had been grown with a cover crop. However, when the plots were swathed for hay harvest in mid-July, all treatments regrew quickly and the differences in weediness were less visible.

Hay yield is shown in Figure 4. The species breakdown is shown in Figure 5 and counts are in Figure 6. The hay yield was compared against the treatment of no nurse crop with 15 lb/ac of hay blend and 25 lb/ac of phosphorous ("No oat, high hay, P-25"). Yields were significantly lower for all "full oat" treatments except for "low hay, zero P" (which had a P value of 0.054). Two treatments seeded with a quarter rate of oats yielded significantly less ("low hay, zero P" and "high hay, zero P). There were no significant differences in yield for treatments that were seeded without oats.

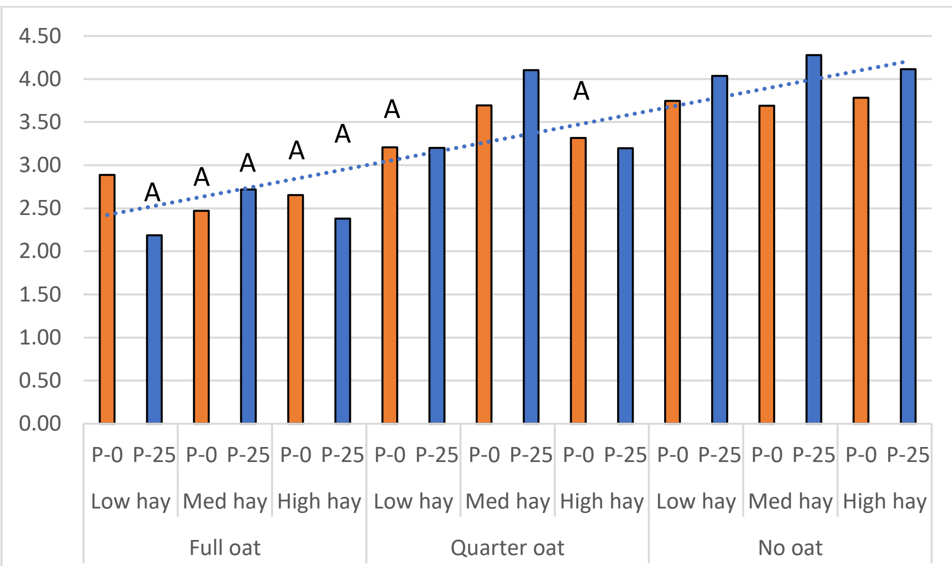


Figure 4: Hay yield by treatment (July 10, tons/acre) with statistical significance*†
* P-0 = no added P; P-25 = 25 lb/ac
† "A" signifies that the yield for that treatment differed significantly from the yield for the "No oat, high hay, P-25" treatment.

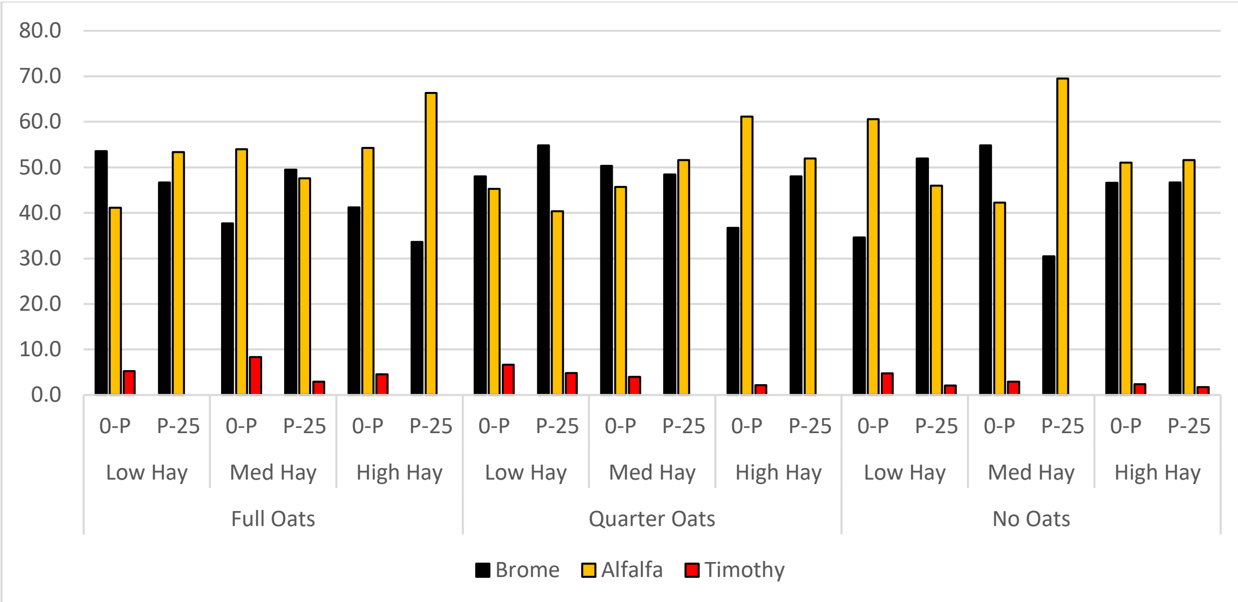


Figure 5: Species breakdown by treatment (%)

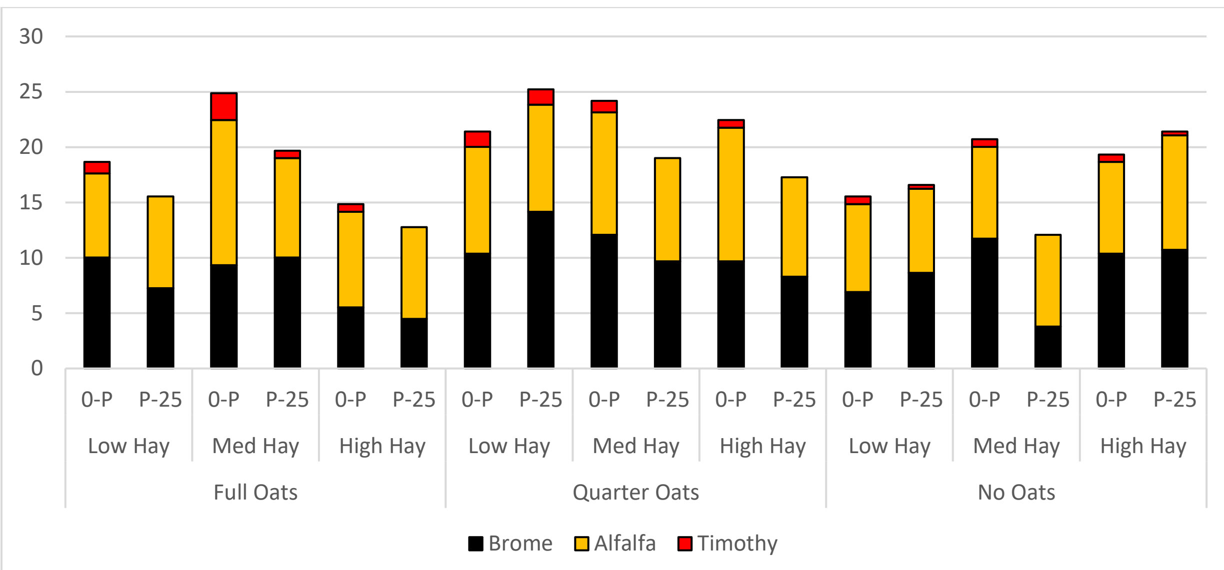


Figure 6: Plant counts by treatment (plants/m2)

Discussion

Observations from the 2023 growing season suggested that the plots established without an oat nurse crop achieved better plant growth and establishment for the hay species (brome, alfalfa, and Timothy). Plant counts occurred for each plot in early June 2024. Although the hay plants in treatments that were established with oats were noticeably smaller, the number of plants did not appear to be strongly related to whether they had been established with or without oats (Figure 6). Nevertheless, the plants in the plots that were established without oats were larger and more vigorous than plants in plots that were established with oats. Additionally, the extra vigour of these plants appeared to make them more competitive against weeds.

Hay yield in 2024 for treatments that were established without oats was significantly greater than for treatments without oats, except for the “full oat, low hay, zero P” treatment (P-value = 0.054). Nevertheless, the yields for that treatment were 30% lower than the yields for the “no oat, high hay, 25 lb P/ac” comparison. Yields for treatments including a quarter rate of oats did not differ statistically, except for the “quarter oat, high hay, zero P” and “quarter oats, low hay, zero P” treatments. Notably, average yields for the “quarter oat, medium hay, 25 lb P/ac” treatment were nearly the same as for the comparison treatment. The overall lack of differences in these treatments suggests that with good growing conditions in the year after establishment, such as were observed in 2024, hay yields may not differ significantly between crops established without oats and with a quarter rate of oats. However, the results may have shown starker differences between treatments if the growing conditions had not been as favourable. Even in a favourable year, the results show that a full rate of oats will have an adverse effect on hay yields in the year after establishment.

In general, species composition did not appear to be strongly associated with any treatment (Figure 5), but plant stand differed between treatments. Plots that received a full rate of oats in 2023 showed higher weed populations in 2024, which reduced yield. Timothy did not establish many plants across the treatments, or emerged later in the season, after the plant counts.

Agronomic information

Previous year’s crop:	Barley-oat silage (2022)
Soil Type:	Erickson Clay Loam
Landscape:	Rolling with trees to the east

Fertility Information (2023)

	Available		Added (actual)
N	66	lb/ac	None
P	48	ppm	According to treatment
K	194	ppm	None

Ducks Unlimited Living Library Demonstration

Project Duration: June 2023 – October 2025

Objectives: To demonstrate perennial forages.

Collaborators: Ducks Unlimited Canada, Manitoba Beef and Forage Initiatives

Background

Perennial forage species abound, providing farmers with a wealth of options to produce high quality feed for livestock. The Living Library was established to demonstrate several dozen unique species of grasses and legumes, as well as native species and commercially available blends. Also included in the demonstration are nine entries intended to demonstrate the effect of different agronomic practices on hay establishment. In total, the demonstration comprises 56 entries.

Materials and Methods

The plots were seeded with a small-plot seeder and mowed during the growing season to control weeds.

Table 1: 2023 materials and methods.

Design	Demonstration
Entries	56 (see Table 2)
Plot area	24.0 m2
Target Fertility	N: No added (available in soil = 38 lb/ac) P: 20 lb/ac (placed with seed)
Seeding rate	See Table 2
Seeding date	June 15
Seeding depth	1/2-inch into adequate moisture
Preparation	Glyphosate (0.64 L/ac, May 26); tillage (June 7 and June 15)

Table 2: Entries by type with seeding rates

Name	Rate (lb/ac)
Grasses	
AC Killarney Orchardgrass	7
Boreal Creeping Red Fescue	5
Carlton Smooth Brome	12
Creeping Foxtail	17
Creeping Red Fescue	5
Crested Wheatgrass	12
Eschelon Orchard grass	12
Fleet Brome	12
Hybrid Brome	12
Hybrid Brome	20
Intermediate Wheatgrass	5
Kentucky Blue	6
Mahulena Festulolium	20
Meadow Fescue	12

Pubescent Wheatgrass	18
Russian Wildrye	8
Saltlander	5
Saltlander + Green Wheatgrass	5
Tall Fescue Rough	18
Tall Fescue Satin	8
Tall Wheatgrass	12
Tall Wheatgrass	20
Tetrax Meadow Fescue	8
Timothy	10
Tored Meadow Fescue	12
Valerio Perennial Ryegrass	8
Legumes	
Ace Alfalfa tap root variety	12
Alsike Clover	5
Birdsfoot Trefoil	8
Exceed Alfalfa - Branch Root	12
Foothold Alfalfa creeping root variety	12
Red Clover	8
Revolution Alfalfa - low lignin/tap root	12
Sainfoin	20
Torrent Alfalfa	12
White Clover	5
Native species	
Blue Grama	10
Canada Milkvetch	10
Purple Prairie Clover	10
Side-oats Grama	10
Slender Wheatgrass	10
Commercial Blends	
#1 Super Hay Blend	12
#11 Super Grassland Pasture Blend	12
#20 Super Pasture Hay Dual Purpose Blend	12
Exceed Alfalfa & AC Knowlges HB	13
Premium Hay Max	10
Agronomic Blends	
DUC MAP* (+58 lb/ac P)	15
DUC RLCP** (no oats, no added P)	12
DUC RLCP (no oats, +58 lb/ac P)	12
DUC RLCP (+0.5 bu/ac oat, no added P)	12
DUC RLCP (+0.5 bu/ac oats, +58 lb/ac P)	12
DUC RLCP (+2.0 bu/ac oat, no added P)	12
DUC RLCP (+2.0 bu/ac oat, +58 lb/ac P)	12
DUC RLCP (no added P)	15
DUC RLCP (+58 lb/ac P)	15

** Marginal Areas Program*

*** Revolving Lands Conservation Program*

Teff Grain Variety Evaluation

Project Duration: May – October 2025

Objectives: To evaluate varieties for grain production

Collaborators: PCDF

Background

Teff *(Eragrostis tef)* is a warm-season annual grass that originates in northeast Africa, where it is grown for grain and forage production. The grain is very small, about the size of a poppy seed, with approximately 1.2 million seeds per pound. The flour is used to produce a traditional flatbread called *injera*, which is naturally gluten-free. Teff straw retains high protein content, digestibility and palatability, making it useful for livestock feed.

A growing market for teff flour exists in North America, fueled in part by immigration from northeast Africa, as well as the inclusion of teff into non-traditional foods. A mill in Headingley, Manitoba, specializes in milling teff flour. Currently, the mill imports large amounts of teff grain from Africa, but hopes to purchase the grain from Manitoba growers as production increases.

This report builds upon previous tests in Roblin beginning in 2022. In 2023, six new varieties were acquired from the Saskatoon Research and Development Centre and were grown in a nursery to increase seed supply. These varieties, as well as one variety from Union Forage, were included in this trial.

Figure 1: (a) "Nebiri" (114392) variety, Aug 29, 2023; (b) "Nebiri", showing ripening seed heads, Aug 29, 2023; and (c) seed size in comparison to a 10-cent piece.

Table 1: 2024 materials and methods.

Overview	
Design	RCBD, four replications
Entries	11 (8 brown, 3 white)
Brown Entries	Imperial Red Imperial Yellow Teferi Red Nebiri (114392) Anibesa (114690) Red Dabi Gea-Lamie Moxie
White Entries	Teferi White Tullu Nasy Beten

Agronomic info	
Seeding date	May 9
Harvest date	October 4
Seeding rate	5 lb/ac
Nitrogen	110 lb/ac actual (27 soil plus 93 side banded)
Phosphorous	15 lb/ac (25 ppm soil)
Potassium	None added (204 ppm soil)
Herbicide	Glyphosate (0.64 L/ac, pre-seed) Buctril M (0.4 L/ac, June 10) Dicamba (117 mL/ac, July 18) Bromoxynil (0.4 L/ac, July 18)

Results

The teff was planted early into good soil moisture and emergence was uniform. However, after seeding, a flush of round-leaved mallow emerged in the plots. This weed proved difficult to control and resulted in yield losses for all plots. Consequently, the reported yields do not represent the potential yields for the varieties.

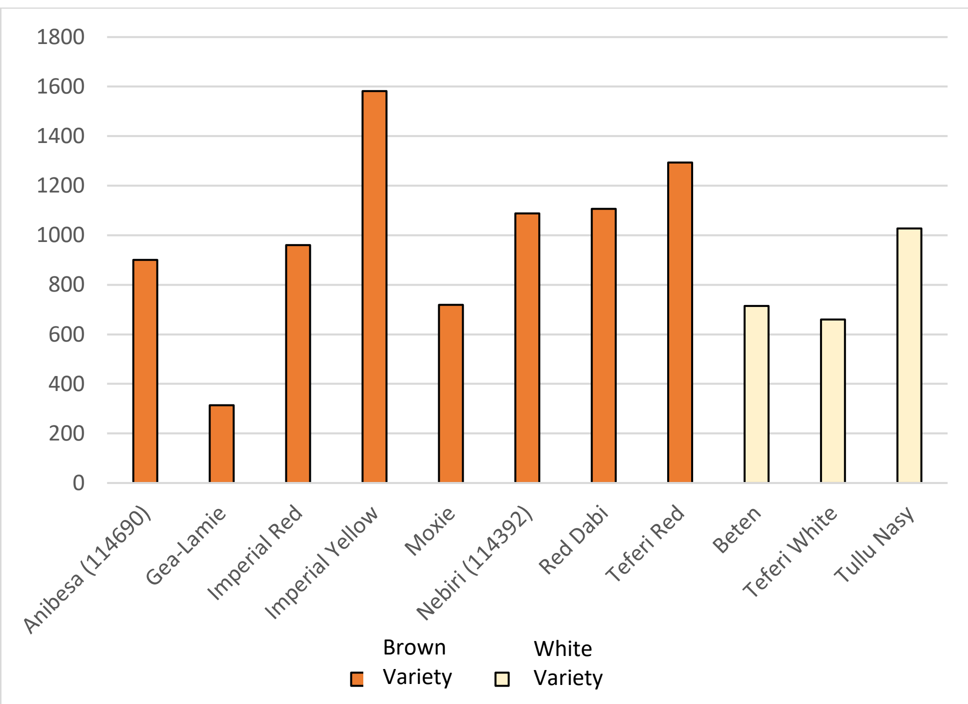


Figure 2: Grain yield (lb/ac) by location for teff varieties.

Discussion

As noted above, the trial results were negatively impacted by the presence of round-leaved mallow in the plots. This short-lived, perennial weed produces long (100 cm) stems with thick foliage that can smother other plants (Figure 3). Herbicide options are limited and the few that would have been effective were not compatible with teff. Bromoxynil/MCPA ester (Buctril M) was applied to the crop at about the 2-3 leaf stage, and although this helped to reduce other weed pressure, it did not meaningfully control the round-leaved mallow. Consequently, yields for all varieties are assumed to be lower than the potential.

Figure 3: Round-leaved mallow (Malva pusilla) plant. Credit: Wikipedia.

Nevertheless, even within plots with high weed pressure, it was possible to observe the differences between varieties. Growth and yield for some varieties was better than anticipated, especially for Red Dabi and Tullu Nasy. The latter is a white variety that seems well adapted to the Manitoba climate.

The early planting date (May 9) contributed to the challenge of controlling weeds in the test plots. As a warm-season crop, teff does not germinate meaningfully until the soil has reached about 10-15 °C. However, the seed is planted at or near the surface of the soil. This delay in germination and emergence provided the round-leaved mallow with the opportunity to emerge after planting, when it was not longer possible to apply herbicide. Ideally, planting should have been delayed until the soil had warmed sufficiently. This would have allowed a later application of a broad-spectrum herbicide or a tillage operation that would have controlled weeds like round-leaved mallow.

It may be helpful to compare the results of this trial with the eight-acre block of teff that was planted immediately to the south of the variety trial. The block was seeded on May 30, following an application of glyphosate. The varieties planted in the block were Imperial Red and Imperial Yellow. The yield for these varieties was estimated to be about 2000 lb/ac , based on an area of 25m x 50m that was harvested with the small-plot combine. This demonstrates the much higher yield potential for those varieties where weeds have been controlled adequately.

Varietal differences

With the limitations noted above, the results of this trial allow for some comparison between varieties. Most importantly, because six of the varieties were propagated from seed in a greenhouse in 2023, we did not know how the varieties would perform when the seed was planted in the field with a seeder. In 2024, all varieties produced ample plant material and some seed. However, teff plants produce tillers which flower and set seed later than the main stem. In Manitoba's relatively short growing season, the tillers of later-maturing varieties are likely to contain more immature seed or will not have set seed at harvest. Yield for these varieties will therefore be lower than for earlier-maturing varieties.

Additional testing is needed to determine which varieties are best suited for cultivation in Manitoba. To date, Imperial Red and Imperial Yellow are good contenders, with consistently high yields in field trials. Teferi Red performed will in this trial and in 2023. Despite its shorter height (60 cm) Red Dabi appears to have high yield potential. Tullu Nasy, a white variety, shows promise, but seed supply remains limited.

General observations

Heat and precipitation data for the season are shown in Table 2.

Table 2. Precipitation, crop heat units and growing degree days for trial locations (% normal) for April 15 to September 30.

	% Normal
Precipitation	118
Crop Heat Units	105
Growing Degree Days	108

Plans are in place to continue testing for a total of 13 varieties in 2025.

Commercial Teff Grain Production

Project Duration: May – October 2025

Objectives: To produce teff grain for sale to a specialty flour mill

Collaborators: PCDF, Brothers Milling (Headingley, MB), GM Seed Cleaning (Roblin)

Background

Teff *(Eragrostis tef)* is a warm-season annual grass that originates in northeast Africa. The grain is very small, with approximately 1.2 million seeds per pound. The flour is used to produce a traditional flatbread called *injera*, which is naturally gluten-free. Teff straw retains high protein content, digestibility and palatability, making it useful for livestock feed.

A growing market for teff flour exists in North America, fueled in part by immigration from northeast Africa, as well as the inclusion of teff into non-traditional foods. Brothers Milling in Headingley, Manitoba, specializes in milling teff flour. Currently, the mill imports large amounts of teff grain from Africa but hopes to purchase the grain from Manitoba growers as production increases.

In 2024, PCDF harvested teff on eight acres and sold the grain to Brothers Milling. To our knowledge, this is the first time that teff has been produced and sold in Manitoba on this scale.

Figure 1: (a) Teff at maturity (Sept 26); (b) at combining (Oct 3); and (c) closeup of seeds.

Table 1: 2024 materials and methods.

Overview	
Design	8-acre demonstration
Varieties	Imperial Red/Yellow blend
Equipment details	
Seeding	Great Plains disc drill
Fertilizer	Valmar
Herbicide	Plot sprayer
Swather	Versatile
Combine	JD S680
Seed cleaner Top screen Bottom	Air screen 4-4.5/64 round hole 3/64 round hole

Agronomic info	
Seeding date	May 30
Swathing date	September 26
Combining date	October 3
Seeding rate	5 lb/ac
Seeding depth	Surface
Nitrogen	110 lb/ac actual (27 soil plus 93 broadcast)
Phosphorous	15 lb/ac (25 ppm soil)
Potassium	None added (204 ppm soil)
Herbicide	Glyphosate (0.64 L/ac, pre-seed)
	Dicamba (117 mL/ac, July 18)
	Bromoxynil (0.4 L/ac, July 18)

Results

A pre-planting application of glyphosate was applied on May 9. The fertilizer was broadcast and the seed was planted on the same day. Although the seed was correctly placed on the surface, the pressure of the seed drill's packer wheels created furrows in the soil that were about one inch deep. About two inches of rain fell in the days after seeding, which caused the soil to shift and fill in the furrows. As a result, the seed was buried, reducing emergence to about 10%.

A second herbicide application occurred on May 28, and the teff was replanted on May 30 into good soil moisture. Relatively warmer weather resulted in quick, even emergence, although some low areas in the field suffered due to excessive rainfall and periods of standing water.

The crop was sprayed on July 18 (Table 1), and was swathed on September 26, using an 18-foot machine. The weather conditions were warm and favourable for quick drying of the swaths. The swaths were combined on October 3 using a John Deere S680 and collected in a gravity wagon. The harvested seed was cleaned using an industrial air screen cleaner by GM Seed Cleaning and stored in tote bags. The clean seed was then delivered and sold to Brothers Milling in Headingley.

To better understand the yield potential, a 25m x 50m block of the planted area was harvested using PCDF's small-plot combine. Very little seed was lost due to fine-tuning the machine settings and taking in a high amount of chaff. A comparison of yield results is shown in Table 2.

Table 2: Harvested area and teff grain yield

	JD S680 combine	Small-plot combine
Harvested area (ac)	7.5	0.3
Rough yield (lb/ac)	1478	2153
Clean yield (lb/ac)	1280	1687
Screenings and losses* (lb/ac)	198	466
Clean/Rough Yield (%)	86.6	78.4
Estimated in-field losses (%)	25-30	5-10
Teff straw yield (bales/ac)	3	3

* Losses during the cleaning process

Discussion

It was necessary to reseed the crop in late May, following a heavy rainfall event immediately after planting that buried the seed. Care should be taken not to create an uneven soil surface during planting, or to roll the field after planting. Nevertheless, reseeding had the unintended benefit of allowing a later application of broad-spectrum herbicide that helped to control early season weeds. Further, the later planting date did not appear to seriously affect crop yield. As a warm-season crop, teff does not germinate meaningfully until the soil has reached about 10-15 °C. We speculate that, in Roblin, the ideal planting date for teff will fall between May 15 and May 30, with an earlier date for years that are warm or dry, and a later date on years that are cooler or wetter.

The difference in yield from the areas harvested with the small-plot combine and the JD S680 shows that it is important to achieve the correct harvest settings for teff. Matching the swath width to the combine will help to ensure that the combine is running at full capacity, which will make it easier to control the airflow within the machine and to minimize losses in the field. It is also likely that increasing the amount of chaff that is collected will help to reduces losses. Provided that the chaff does not contain large amounts of short straw, the harvest material will move through augers and can be separated easily in a seed cleaner.

There were several strong (80-100 km/h) wind events during the growing season that caused widespread lodging in nearby cereals and canola fields. Although teff is highly prone to lodging at higher fertility rates, the wind events did not cause the crop to lie flat, as it did for other cereals. This is likely due to the very flexible stem of the plant. However, the wind caused the plants to have a northwest orientation, which made it more challenging to swath the crop. Another strong (90 km/h) wind event occurred after swathing. Thankfully, the wind did not damage the swaths, perhaps because the plants are smooth, and the swaths were relatively flat. Shattering losses from the wind, as well as during swathing, appeared to be minimal.

Teff straw has relatively high feed values compared with other straw, and has good palatability, making it a potential source of feed for livestock. Post-harvest or swath grazing options may exist for mixed grain-livestock producers with fencing.

Figure 2: (a) Unloading teff grain from PCDF at Brothers Milling, Headingley; (b) injera flatbread made with flour milled from PCDF's grain, showing good colour and "eye" (dimpled texture) formation.

The milling quality of the seed produced at PCDF was high and the bakeries that receive flour from the mill reported that the quality of the flour was equal to or better than that of imported teff.

Plans are in place to grow teff on a similar scale at PCDF in 2025. PCDF will also be working with farmers who have expressed interest in growing teff on their farms. The collaboration will help to validate the suitability of teff to the region and will allow for the development of general cost of production guidelines. Currently, the vast majority of the teff milled at Brothers Milling is imported from Ethiopia and South Africa. Based on the results of this project and from test plots in previous years, the mill is very interested to work with local producers to develop production in Manitoba.

General observations

Heat and precipitation data for the season are shown in Table 3.

Table 3. Precipitation, crop heat units and growing degree days for trial locations (% normal) for April 15 to September 30.

	% Normal
Precipitation	118
Crop Heat Units	105
Growing Degree Days	108

Fall Rye for Extended Grazing of Livestock

Project Duration: Sept 2023 – Sept 2024
Objectives: To evaluate the suitability of fall rye for early-season grazing by cattle to alleviate pasture stress.
Collaborators: PCDF, FP Genetics, Covers & Co.

Background
One of the keys to maintaining healthy pasture is deciding when to move animals onto pasture in spring. Hugo Gross, a forage researcher with Agriculture and Agri-Food in Brandon, is credited with a well-established rule of thumb: for every day that a pasture is grazed too early in the spring, three days of grazing are lost in the fall. Stated slightly differently, if animals are moved onto pasture one week too soon in spring, three weeks of grazing may be lost in the fall. Grazing before pasture plants have grown 3 to 3.5 new leaves can result in degraded pasture, loss of plant species, and higher weed pressure (Wheatland Country Connector, December 2021, page 17).

Fall rye produces large amounts of leafy growth in May and early June, and can be a good source of early-season grazing for livestock, allowing producers to delay moving animals onto seasonal pasture. Building on projects at PCDF in 2022 and 2023, which grazed sheep on fall rye, this project explored the crop's potential as a source of early-season grazing for cattle.

Materials and Methods
Two varieties of fall rye (donated by FP Genetics) planted in the last week of September 2023 (Table 1). Emergence was even, with sufficient growth in the fall to allow for good overwinter survival. The cattle were introduced at immediately prior to tillering and were permitted to graze until virtually all leafy material had been removed from the plants. The cattle were then relocated to summer pasture. Most of the rye was then sprayed with glyphosate and planted to a barley-oat greenfeed, buckwheat, and a warm-season blend. A check strip was also retained and harvested for grain in late August.

Table 1: 2024 materials and methods

Design	Demonstration
Entries	SU Cossani fall rye (hybrid grain type) SU Performer fall rye (hybrid grain and forage type)
Total area	1 acre
Animals	4 cows, 5 calves, = 5000+ pounds of animal (5 animal units total)
Grazing period	June 3 - June 10
Animal unit/day	5/day for 7 days
Target Fertility	N: 160 lb/ac actual (109 side-banded plus 51 available in soil) P: 15 lb/ac (seed-placed)
Seeding rate	1.2 million seeds/acre
Seeding date	Sept 25, 2023
Seeding depth	1/2-inch into good moisture
Herbicide	Glyphosate (0.64 L/ac) pre-emergence, Sept 27, 2023 Glyphosate (0.64 L/ac) after grazing, June 11, 2024
Post-graze seeding date	June 20, 2024
Rye harvest date	August 25, 2024

Observations
The season began with good soil moisture, but cooler weather resulted in slower maturity. In contrast to 2023, when warm, dry conditions had caused the rye to head out before the sheep were introduced, in 2024, the rye was still booting when the cattle were introduced. The plants were 10-12 inches tall, with an estimated 1000-1200 lb/acre of dry matter. The cattle readily ate the fall rye, and were removed seven days later, when most of the leaves and emerging heads had been eaten (Figure 1D).

Figure 1: (A) Fall rye before graze, May 20; (B) cattle grazing fall rye, June 3; (C) cattle on final day on fall rye, June 10; (D) fall rye after grazing, with damaged heads emerging.

The fall rye was sprayed with glyphosate after the cattle were removed, except for a check strip to assess how much grain could be harvested from the regrowth (Figure 2E). The sprayed portion was seeded to a warm-season blend from Covers & Co (2F), buckwheat (2G), and barley-oat greenfeed blend (2H). The warm-season blend and the buckwheat established quickly, but the barley-oat blend appeared to struggle until heading. This may have been due to inadequate seeding rates or may have been caused by the suppressive nature of rye stubble.

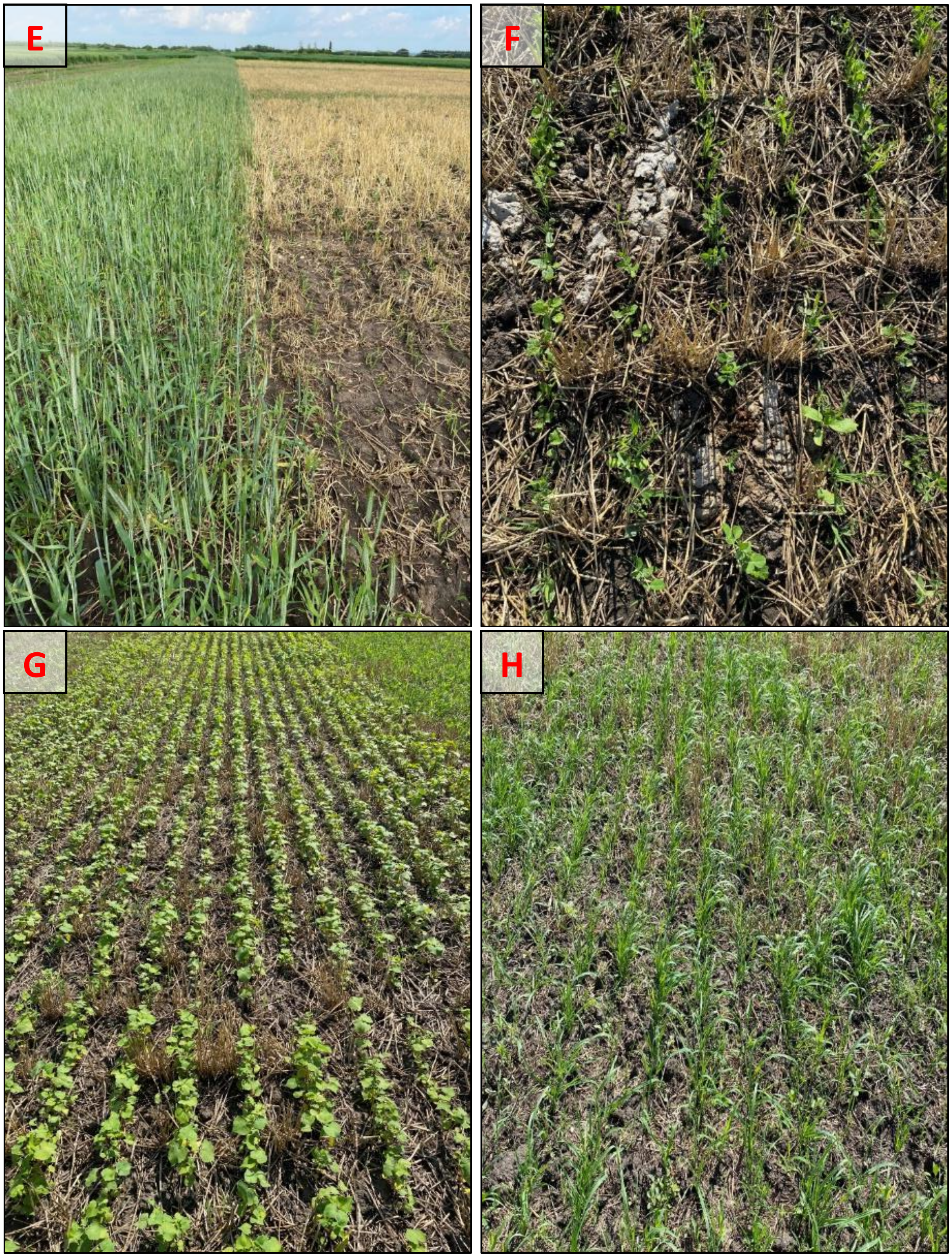


Figure 2: (E) Fall rye heading out (left) and sprayed out before planting (right); (F) warm-season blend seeded into rye stubble (July 5); (G) buckwheat seeded into rye stubble (July 15); (H) barley-oat blend seeded into fall rye stubble (July 15).

The check strip of fall rye that was grazed and allowed to regrow (Figure 3I) did not fully recover, in comparison to the fall rye that was not grazed. The grazed plants headed out quickly after the cattle were removed and did not produce important amounts of new leaves. Although fall rye can produce a large amount of the energy it requires in the head and stem, the heads were smaller, and the stems were about 20-25 cm shorter than the ungrazed plants. At harvest, yield for the fall rye that was grazed was about half of that for the ungrazed plants.

Figure 3: (I) Regrowth of fall rye after grazing (July 15); (J) fall rye, no grazing (July 15); (K) buckwheat (left) and warm season blend (right), August 13; (L) buckwheat, August 13.

The warm-season blend includes sorghum sudangrass, German millet, sunflower, fenugreek and buckwheat, which are all warm-season plants. In addition to baling for hay, the blend may be kept in the field as stockpiled forage (Figure 4N).

To explore the potential for the crops seeded after the fall rye to serve as nurse crops for a perennial forage, a [light land perennial hay blend from Covers & Co](#) was seeded crosswise on about one third of the area. The blend appeared to establish well in all three crops but produced less growth in the warm-season blend. This was likely due to increased competition between the two blends. Nevertheless, we expect that the perennial blend will perform equally well in 2025, regardless of the nurse crop.

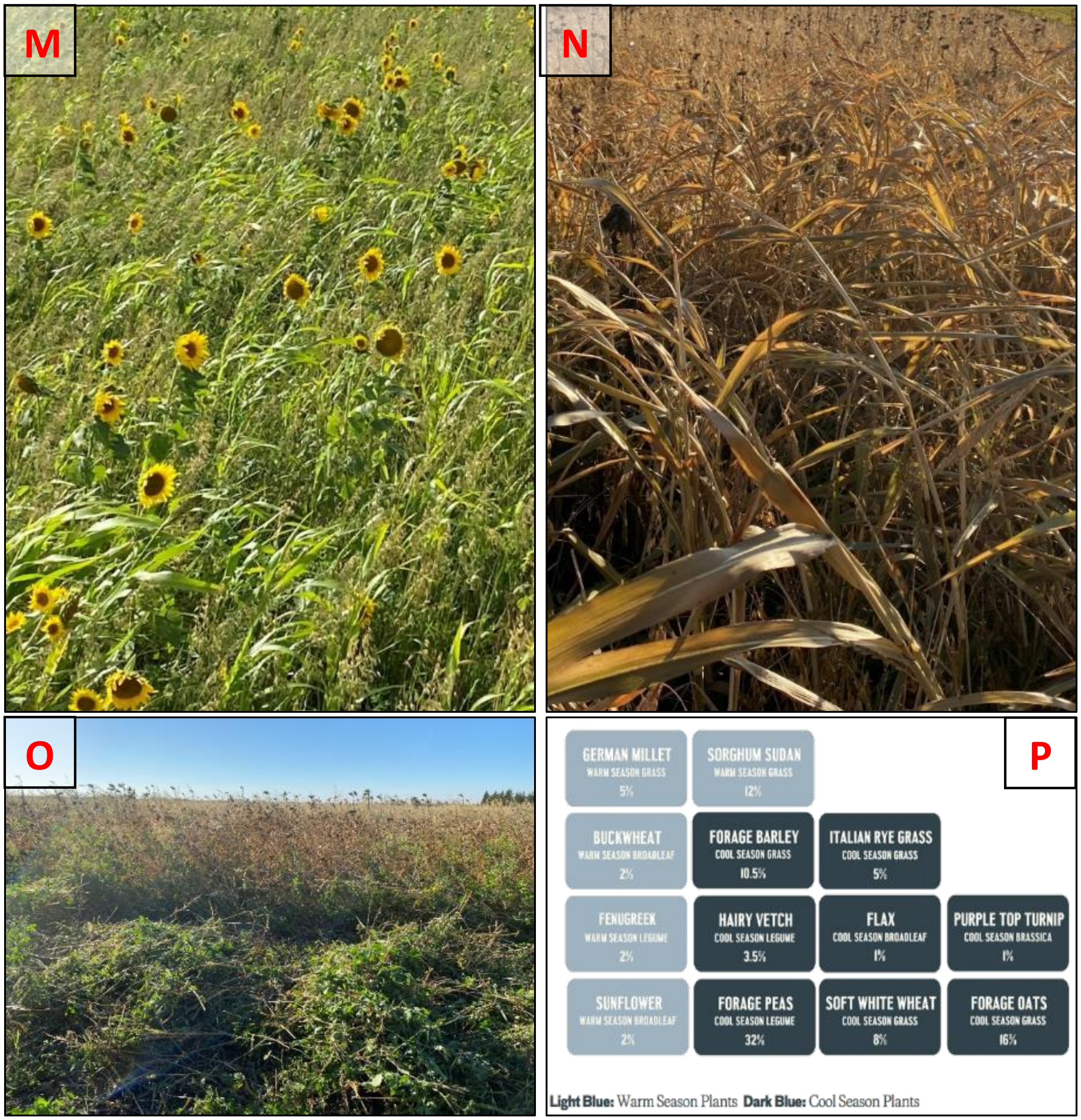


Figure 4: (M) Warm-season cover (September 13); (N) warm-season blend after frost (October 21); (O) "light land" perennial hay blend with buckwheat as a nurse crop (October 8); (P) the composition of the [warm-season blend from Covers & Co](#).

Discussion

Perennial pastures are at their most vulnerable state in early spring, with grasses requiring 3 to 3.5 new leaves to recover nutrients after the winter. Nevertheless, both livestock producers and livestock are eager to access green forages. The observations detailed in this report support the use of fall rye as an early-season grazing option for both cattle and sheep.

Spring weather conditions will affect the amount of plant growth: warmer, drier conditions favouring early tillering, which may reduce forage quantity and quality. Some trampling of the forage is inevitable, but good growth provided about one week of grazing for cattle in 2024. Table 2 shows the potential stocking rates and seed requirements, based on amount of forage and number of animals at PCDF. The table also shows the estimated savings in winter feed costs.

Table 2: Stocking rates and cost details for grazing fall rye for one week

Animals	Area	Rye seed (Units*)	Cost/unit ($)	Cost/acre ($)	Winter Feed Cost ($)**
4 cows, 5 calves (5000+ lbs)	1 acre	1.2	80†	96	96.25
40 cows, 50 calves	10 acres	12		960	962.50
100 cows, 125 calves	25 acres	30		2400	2406.25

* 1 unit = 1 million seeds
** Based on $2.75 per head for 7 days
† Hybrid fall rye cost was $74-80/ac in 2024

Interestingly, the costs for hybrid fall rye seed and for winter feed were roughly equal. Other costs, such as moving the animals twice (once onto fall rye and again onto summer pasture) may be weighed against the costs of manure handling if the animals remained in the yard. It is more difficult to assign a dollar value to the losses in grazing potential if the livestock are moved onto the pasture too early.

The project demonstrates that the land where fall rye has been grazed can also be used productively in the same growing season. These uses include growing annual cereals for greenfeed or silage, warm-season blends for hay or late-season grazing, and annual crops such as buckwheat. The latter tolerates very late planting (with a June 20 crop insurance deadline) and has good marketability.

The fall rye regrowth may also be harvested for seed, although yields may be reduced by up to 50% when compared to ungrazed fall rye. For open-pollinated varieties, the seed may be used to establish future grazing areas. However, hybrid varieties such as SU Performer have been developed for their application as forage, with more leafy growth than is typical for open-pollenated varieties.

Finally, the crop planted after fall rye may also serve as a nurse crop when establishing a perennial hay crop. The light land perennial hay blend from Covers & Co established well in each of the three crops that were planted into the fall rye residue. With this option in mind, a generalized crop rotation is presented in Figure 5.

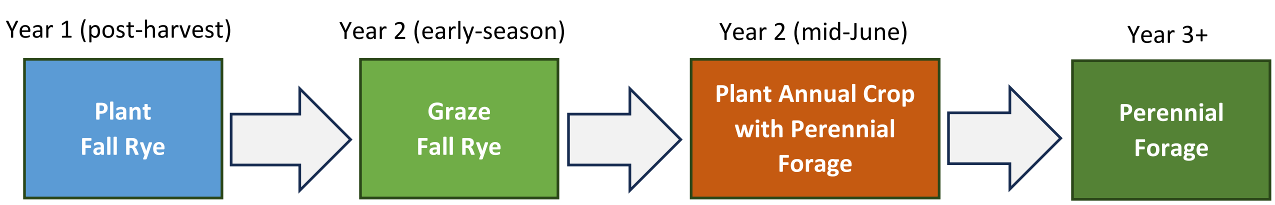


Figure 5: Idealized crop rotation system including fall rye for grazing of livestock.

Verve Seeds Hybrid Hemp Evaluation

Project duration: May 2024 – September 2024
Objectives: To evaluate yield potential of hybrid hemp varieties for Verve Seeds.
Collaborators: Verve Seeds

Background
Verve Seeds specializes in high-performance hemp varieties. Working with small-plot research sites across the Canadian prairie provinces, the company is developing and examining the yield potential and plant characteristics of hybrid hemp varieties. These are some of the first varieties of hybrid hemp to be tested in Canada.

The development of new varieties plays an important role in keeping the industry competitive and ensuring that hemp remains an attractive option for growers. Currently, the cost of protein from hemp is about 200-400% higher than protein from other plant-sourced alternatives, such as soy and peas. Identifying high-yielding hemp varieties is key in reducing the cost of hemp protein and making the industry more competitive.

Materials and Methods
At Roblin, the trial examined 16 varieties, including 10 experimental hybrid hemp varieties. Open-pollinated, dual-purpose varieties from Health Canada's List of Approved Cultivars (LOAC) were included to provide comparisons.

Table 1: Open-pollinated varieties from LOAC

CFX-2 (check and entry)
CRS-1
EL1-140
Indigo
Rak

Previous year's crop: Barley-oat silage
Soil Type: Erickson Clay Loam
Landscape: Rolling with trees to the west
Seedbed preparation: Direct seeded

Table 2: Fertility Information

	Available		Added (actual)	Type
N	27	lb/ac	133 lb/ac	46-0-0
P	25	ppm	15 lb/ac	11-52-0-0
K	204	ppm	-	-

P banded with seed; N side-banded


Figure 1: Hybrid hemp entries at flowering

Results
As expected, the hybrid hemp varieties produced consistently higher yields over the open-pollinated varieties. The mean yields for hybrids across all the locations with acceptable CVs ranged between 145% and 187% of the CFX-2 check variety.

Discussion
Hemp and other food processors identify the relatively high cost of the grain as a key limitation to incorporating it more widely into consumer products. Maximizing the yield of hemp varieties is a key step in reducing the cost of the grain and enabling processors to competitively use hemp protein, oil and other fractions. Increased yield will also ensure that farmgate incomes remain stable, even as the cost to processors is lowered. The higher yields from hybrid varieties seen at multiple locations across the prairie provinces demonstrate their strong potential to meet the evolving needs of the Canadian hemp industry.

CDC Linseed and Flax Coop Variety Evaluation

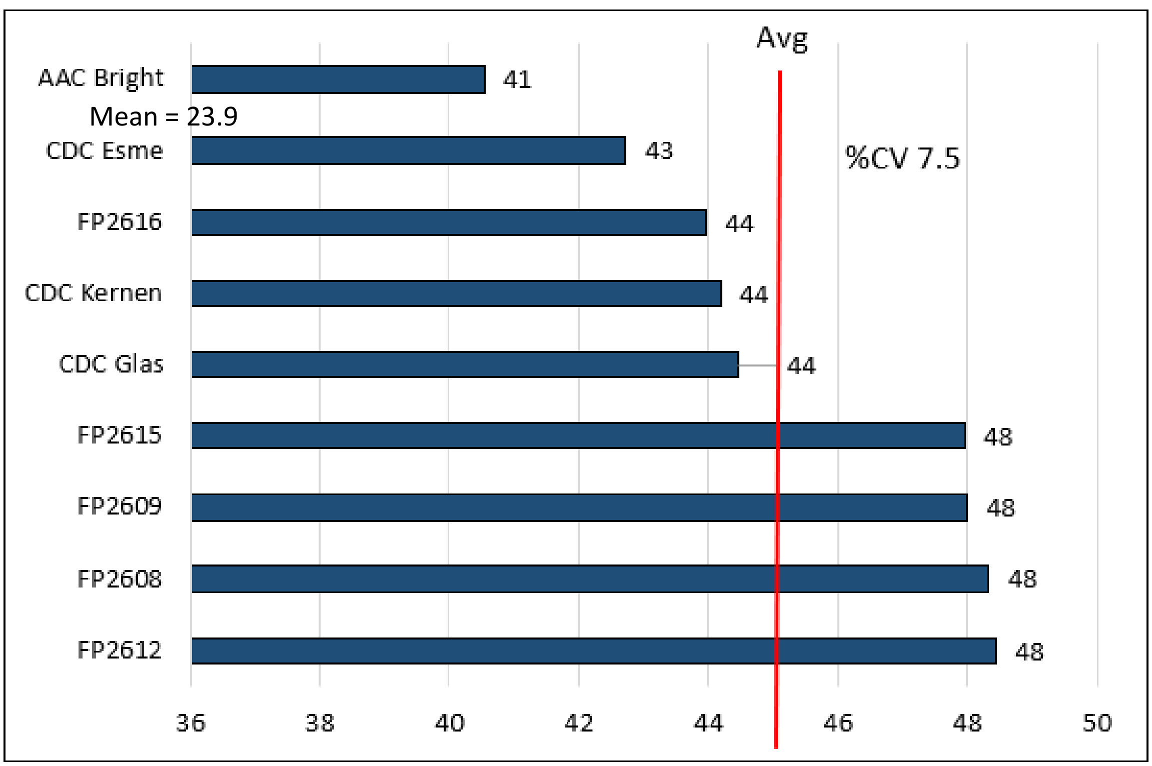
Project duration: May 2024 – September 2024
Objectives: To evaluate pre-registration varieties for the Linseed Coop.
Collaborators: Helen Booker – University of Saskatchewan Plant Sciences Flax Breeder
Ken Jackle – Crop Development Centre Flax Breeding Program

Background
Linseed and flax are both names of the species *Linum usitatissisum*. In North America, the term *flax* is typically used to refer to varieties that produce seeds that may be eaten, whereas *linseed* is used to refer to varieties that will be pressed for oil. However, in practice, names may be used interchangeably. Flax varieties have seeds that are dark to reddish brown, whereas linseed varieties have paler, yellow seeds.

The trial was conducted in partnership with Helen Booker and the Prairie Recommending Committee for Oilseeds (PRCO). The For further information, contact Ken Jackle: ken.jackle@usask.ca.

Results
The mean yields for named and unnamed varieties are shown in Figure 1. The mean heights by variety are shown in Figure 2.

2024 Linseed Flax Coop yield (bu/ac) at 8% moisture



Materials and methods
Experimental Design: Random Complete Block Design

Entries:	9
Seeding:	May 15
Harvest:	Sept 13

Previous year's crop:	Barley-oat silage
Soil Type:	Erickson Clay Loam
Landscape:	Rolling with trees to the east
Seedbed preparation:	Direct seeded

Table 3: Fertility Information

	Available		Added (actual)	Type
N	47	lb/ac	73 lb/ac	46-0-0
P	22	ppm	10 lb/ac	11-52-0-0
K	313	ppm	-	

P banded with seed; N side-banded

Integrating legume cover crops in winter wheat – Interim report

Adapted from a report prepared by Anne Kirk, MB Agriculture

Project duration: May 2024 – September 2024

Objectives: To evaluate 1) the establishment and dry matter production of legume cover crops in winter wheat;
2) the effects of these cover crops on grain yield of the winter wheat;
3) the nitrogen fixation potential of the legume cover crops;
4) the effect of legume cover crops on performance of canola in the following year

Collaborators: Manitoba Agriculture Diversification Centres

Background

There is increased interest in cover crops for soil health benefits, nitrogen contribution, and the potential for grazing or silage. Relay cropping provides an opportunity to incorporate legume crops into a cropping system without sacrificing a whole season of grain production. Relay cropping may have a good fit with winter wheat since winter wheat is typically harvested in late July to early August, leaving time for cover crop growth prior to frost. The success of the relay crop is dependent on the ability of the cover crop to establish in the winter wheat crop, and to produce enough biomass in the fall to provide a benefit to the soil and main crops.

Materials and Methods

This study was established at Arborg, Carberry, Melita and Roblin in September 2023. The experimental design is a randomized complete block design with four replicates. Winter wheat was planted in September 2023, with cover crop treatments seeded in the fall and spring. Fall seeded cover crops were seeded in the same row and depth as the winter wheat, while spring seeded cover crops were broadcast as early as possible. Established cover crops will continue to grow in 2025 when canola will be direct seeded into the trial area.

Treatments include four different legume cover crops, a non-legume cover crop, and no cover crop. See Table 1 for a complete treatment list. Data collection in year one includes winter wheat and legume plant populations, winter wheat yield and protein, dry matter production of the legume crop, and nitrate nitrogen (N) in late fall. Protein and nitrate N were measured on composite samples and therefore do not have any statistical analysis associated with these results.

Table 1: Treatment list

Trt	Cover crop	Cover crop timing	Fertilizer rate in year 2 (% of recommended rate)
1	No cover crop	n/a	0%
2	No cover crop	n/a	100%
3	No cover crop	n/a	60%
4	Sweet clover	Fall	60%
5	Alfalfa	Fall	60%
6	Red clover	Fall	60%
7	White clover	Fall	60%
8	Sweet clover	Spring	60%
9	Alfalfa	Spring	60%
10	Red clover	Spring	60%
11	White clover	Spring	60%
12	Perennial ryegrass	Fall	60%

Table 2: Agronomic information

	Arborg	Carberry	Melita	Roblin
Soil Series	Peguis Clay	Wellwood Loam	Waskada Loam	Erickson Loamy Clay
Winter wheat/fall legume seeding date	Sept 19, 2023	Sept 15, 2023	Sept 6, 2023	Sept 27, 2023
Legume spring seed date	May 14, 2024	May 14, 2024	April 15, 2024	April 25, 2024
Fertility (lb/ac)	Background N topped up to 150 lb/ac, 30 lb/ac P2O5			
Herbicides	May 10, 2024 – Refine SG @ 12 g/acre	Sept 12, 2023 – Glyphosate @ 0.7 L/ac; June 20, 2024 – Gasagran Forte @ 0.9 L/ac	Sept 2023 – Glyphosate @ 0.67 L/ac, Heat LQ @ 40 ml/ac; May 2, 2024 – Achieve @ 0.2 L/ac, Basagran @ 0.91 L/ac	Sept 25, 2023 – Glyphosate @ 0.64 L/ac
Winter wheat harvest date	Aug 12, 2024	Sept 19, 2024	Aug 6, 2024	Sept 4, 2024
Legume biomass sampling	October 3, 2024	n/a	n/a	n/a

Table 3: Seeding rate by crop type

Crop Type (Variety)	Seeding Rate
Winter wheat (AAC Wildfire)	323 pl/m^2
Alfalfa (Stellar II)	12 lb/ac
Red clover (single cut, common)	10 lb/ac
White clover (Bombus)	6 lb/ac
Sweetclover (common)	10 lb/ac
Perennial ryegrass (Melpetra)	12 lb/ac

Table 4: Seasonal precipitation and growing degree days from September 1 to November 15, 2023. Data from Manitoba Agriculture Growing Season Report web43.gov.mb.ca/climate/SeasonalReport.aspx

	Arborg	Carberry	Melita	Roblin
Precipitation (mm)	116	64	100	69
% of Normal precipitation[1]	136	84	126	77
Growing degree days (GDD)	379	388	362	358
% of Normal GDD[1]	178	179	143	205

Table 5: Monthly and growing season (April 1 - October 31, 2024) precipitation and growing degree days for Arborg, Carberry, Melita, and Roblin. Data from Manitoba Agriculture Growing Season Report web43.gov.mb.ca/climate/SeasonalReport.aspx

	Arborg							
	Apr	May	June	July	Aug	Sept	Oct	Apr – Oct
Precipitation (mm)	33	74	120	62	39	7	10	347
% of Normal precipitation[1]	116	139	154	104	49	15	34	92
Growing degree days (GDD)	36	177	320	468	416	359	80	1860
% of Normal GDD[1]	201	86	95	108	108	189	360	117
	Carberry							
	Apr	May	June	July	Aug	Sept	Oct	Apr - Oct
Precipitation (mm)	65	121	163	21	30	48	8	459
% of Normal precipitation[1]	181	251	233	32	44	99	41	126
Growing degree days (GDD)	57	181	318	461	384	369	102	1876
% of Normal GDD[1]	464	98	95	108	99	194	400	120
	Melita							
	Apr	May	June	July	Aug	Sept	Oct	Apr - Oct
Precipitation (mm)	29	91	109	64	27	10	4	337
% of Normal precipitation[1]	101	169	108	93	35	30	15	85
Growing degree days (GDD)	69	203	307	466	372	345	110	1874
% of Normal GDD[1]	286	99	87	103	90	163	270	110
	Roblin							
	Apr	May	June	July	Aug	Sept	Oct	Apr - Oct
Precipitation (mm)	20	78	116	45	75	32	1	369
% of Normal precipitation[1]	86	174	157	63	134	60	5	105
Growing degree days (GDD)	32	152	242	427	347	319	59	1581
% of Normal GDD[1]	415	89	77	109	98	195	533	112

[1]Based on 30-year averages

Results and Discussion

Cover Crop Establishment

At all locations cover crop establishment was better with spring broadcast compared to fall seeding. Method of planting likely had an effect on establishment of spring and fall seeded cover crops. Fall seeded cover crops were planted at the same depth as the winter wheat. Deep seeding may have aided emergence if the fall had been dry, but in a year with adequate precipitation likely hindered emergence. All locations had higher than normal precipitation in May and June (Table 5), which would have aided legume establishment in the spring broadcast treatments.

Fall planted alfalfa had the best establishment of the fall planted cover crops at Arborg and Melita (Table 6). In Roblin there was no significant difference in the establishment of any fall seeded cover crops.

Cover crops established better in Arborg than the other locations. This may have been the result of timing of seeding and precipitation, surface residue and soil conditions.

Table 6: Cover crop establishment (pl/m^2) measured in the spring and after winter wheat harvest in the fall. Least significant difference (LSD) values are shown for sites where there is a significant difference (Pr<0.05) between treatments. Means within the same site year followed by the same letter within a column are not significantly different.

		Arborg		Melita		Roblin	
Cover Crop	Timing	Spring (pl/m^2)	Fall (pl/m^2)	Spring (pl/m^2)	Fall (pl/m^2)	Spring (pl/m^2)	Fall (pl/m^2)
Sweet clover	fall	3d	3d	0b	1d	76b	0b
Alfalfa	fall	111c	73c	16b	26c	12b	4b
Red clover	fall	13d	26d	2b	7d	18b	1b
White clover	fall	5d	7d	0b	1d	2b	1b
Sweet clover	spring	298b	149a	77a	67a	98a	18b
Alfalfa	spring	487a	160a	72a	43b	45b	20b
Red clover	spring	344b	120b	60a	8d	103a	44b
White clover	spring	527a	127ab	63a	13cd	155a	94a
Perennial ryegrass	fall	52cd	63c	0b	10d	5b	2b
LSD		*95*	*33*	*21*	*14*	*77*	*24*

<u>Cover Crop Biomass</u>
Cover crop biomass was collected in the fall, after winter wheat harvest. Due to poor cover crop growth at Melita, Carberry and Roblin, biomass was collected at the Arborg location only.

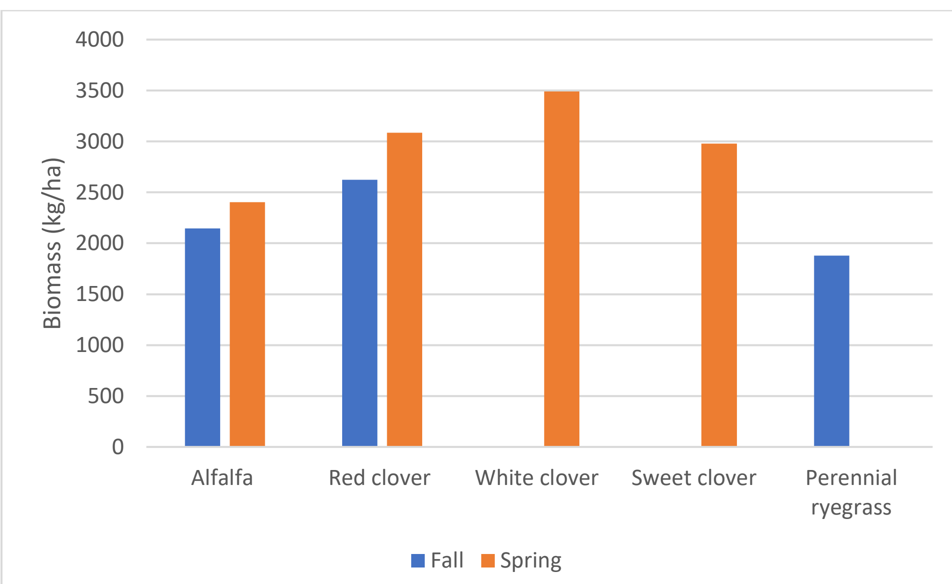


Figure 1: Fall cover crop biomass (kg/ha) at Arborg. Treatments with the same letter above the bars are not significantly different.

Wheat Yield and Protein

Cover crops did not affect winter wheat grain yield. There were no significant differences in wheat yield across all treatments or protein trends between legume and non-legume treatments (Table 7).

Table 7: Winter wheat yield (bu/ac) and protein (%) content. Least significant difference (LSD) values are not shown since there were no significant differences (Pr<0.05) between treatments at any location.

		Arborg		**Melita**		**Roblin**	
Cover Crop	Timing	Yield (bu/ac)	Protein (%)	Yield (bu/ac)	Protein (%)	Yield (bu/ac)	Protein (%)
No cover crop	n/a	66	9.6	92	11.5	87	11.6
No cover crop	n/a	64	9.4	94	10.6	84	11.4
No cover crop	n/a	66	9.3	97	10.9	85	11.6
Sweet clover	fall	68	10.1	90	11.1	86	11.5
Alfalfa	fall	63	9.0	99	11.6	86	11.6
Red clover	fall	62	9.5	101	11.0	87	11.7
White clover	fall	61	9.0	96	10.3	90	11.7
Sweet clover	spring	62	10.0	92	10.5	90	11.7
Alfalfa	spring	63	9.5	96	10.9	85	11.8
Red clover	spring	66	9.9	103	10.7	85	11.3
White clover	spring	60	9.2	98	11.3	82	11.1
Perennial ryegrass	fall	67	9.2	94	10.7	84	11.4
Mean		*64*	*9.5*	*96*	*10.9*	*86*	*11.5*
LSD		-	*n/a*	-	*n/a*	-	*n/a*

Fall Soil Fertility

Nitrate N varied across treatments, but there was no trend towards high N levels in legume treatments or in treatments with higher legume biomass (Table 8). Soil samples were not collected at the Melita location.

Table 8: Nitrate nitrogen (lb/acre) measured in the in the top 0-24" of soil in late fall 2024.

		Nitrate N (lb/acre)	
Cover crop	**Timing**	**Roblin**	**Arborg**
No cover crop	n/a	24	4
No cover crop	n/a	20	4
No cover crop	n/a	16	4
Sweet clover	fall	8	4
Alfalfa	fall	28	8
Red clover	fall	28	8
White clover	fall	24	4
Sweet clover	spring	20	4

Alfalfa	spring	12	8
Red clover	spring	24	4
White clover	spring	16	4
Perennial ryegrass	fall	20	4

Summary
Fall seeded cover crops did not establish well at Carbery, Melita, and Roblin (Carberry data not shown). Poor establishment may have been related to planting time and depth. Spring seeded cover crops had better establishment, which was in part related to the wet spring conditions at all locations. Wheat yield was not impacted by cover crops. Cover crop biomass production was poor at Carberry, Melita, and Roblin, this may have been due to the winter wheat out competing the cover crops. Cover crop biomass production was excellent at Arborg, with the exception of fall seeded white clover and sweet clover. Soil nitrate N levels at Arborg did not reflect the high biomass production but may be evident in year two of the project.

This an interim project report. Year 2 of the experiment will be conducted at Arborg only in 2025.

Optimizing Nitrogen Fertility in Winter Wheat Varieties

Adapted from a report prepared by WADO

Project Duration:	2022-2024 (Reporting 2024)
Collaborators:	Ducks Unlimited Canada (Ken Gross, Alex Griffiths, Elmer Kaskiw), Manitoba Agriculture (John Heard), Western Ag & Professional Agronomy (Edgar Hammermeister)
Objectives	1) Update the winter wheat fertility recommendations in the Manitoba Soil Fertility Guide; 2) Compare spring broadcast only application to fall and split applications of nitrogen for yield and protein; 3) Examine varietal differences in nitrogen use efficiency between Wildfire and Vortex varieties.

Background

Following decades of extensive work in winter wheat production in North America, many researchers and producers have begun to implement best management practices to obtain higher grain yield and improve profitability in the crop. Management practices presently being implemented to improve winter wheat production include increasing seeding rate, application of starter fertilizer by banding during seeding, variety selection, pest control and split application, during planting in fall and at tillering or stem elongation in spring (Anderson, 2008; Schulz et al., 2015). Fertility management, in particular nitrogen and phosphorus fertility, remains an integral part of the overall management package aimed at achieving higher yields in winter wheat (Halvorson et al. 1987). Recommended fertilizer management, particularly nitrogen management, differs widely in winter wheat production, but the crop's nitrogen demand is correlated to yield potential and availability of moisture in dryland production systems (Beres et al., 2018). Compared to spring wheat, winter wheat presents more challenges in development because of its higher nitrogen demand during the long vegetative phase, hence the reason why it requires 25 to 50% more N than spring wheat in the Prairies (Fowler et al., 1989). The ideal fertility management package would help counteract the escalating cost of winter wheat production per unit area, which is the main goal of winter wheat producers. There is still a knowledge gap on the rates and timing of nitrogen fertilizer application, particularly in Western Canada, that result in improved yield without compromising grain quality and economic returns. Morris et al. (2018) suggested the implementation of adaptive use of nitrogen to help augment and improve nitrogen application rate decision making by farmers. Therefore, there is a great need to continue with research on the best management practices which can be adopted by producers to improve economic returns in winter wheat production. This study aims to understand varietal demand to nitrogen as well as whether fall/spring split applications of nitrogen are more effective than single spring applications.

Materials & Methods

This study was established at Melita, Roblin, Carberry and Arborg, Manitoba. The trial design consisted of two varieties and 7 nitrogen treatments replicated three times, that were laid out factorially in a complete randomized block design.

Plot Treatments

1. Wildfire – Highest yielding winter wheat on the market
2. Vortex – New Emerson replacement with great disease resistance and winter hardiness

Subplot Plot

1. Check – No fertility except starter phosphorus
2. 60 kg/ha (54 lbs/ac) nitrogen, split 50:50
3. 90 kg/ha (80 lbs/ac) nitrogen, split 50:50
4. 120 kg/ha (107 lbs/ac) nitrogen, split 50:50
5. 150 kg/ha (134 lbs/ac) nitrogen, split 50:50
6. 180 kg/ha (161 lbs/ac) nitrogen, split 50:50
7. 120 kg/ha (107 lbs/ac) nitrogen all applied in spring

The soil test results, and the applied fertilizer amounts are listed for each site in Table 9.1. All 5 split applications had 50% of the rate applied in the fall, and 50% of the rate applied the following spring. Specific nitrogen rates using granular ESN/urea (50:50 blend) were placed at approximately 1.25-inch depth in a separate pass before seeding the wheat. Plant target density was 325 plants/m and germination were 95% for both varieties. Treatment-specific nitrogen rates were top-dressed in the early spring, as urea coated with Agrotain. The spring nitrogen application of 120 kg/ha (107 lbs/ac) is the current producer fertility practice when growing winter wheat representing treatment 7. Each site where this trial was carried out used slightly different agronomic practices and had different field conditions which are outlined in the following Tables 9.1. through 9.3.

Data collected throughout the growing season included soil tests at time of seeding, emergence counts, lodging scores, heights, yield, grain moisture, test weight, and protein. Data was analyzed with Minitab 18.1 statistical software using a general linear model (GLM) ANOVA with Fishers Least Significant Difference at a 0.05 level of significance. A test for equal variance was used to determine if data could be combined.

Table 1. Fall soil test results by site and fertilizer treatments for winter wheat in the 2023/2024 season.

Fall Soil Test and Fertilizer Application (Actual lbs/ac)				
		Soil Supply	Applied*	Total
Melita	N	78	130	208
	P	16	30	46
	K	74	22	96
	S	93	16	109
	Zn	0.49	1	1
Roblin	N	44	124	168
	P	18	15	33
	K	175	10	185
	S	62	5	67
	Zn	3.39	0	3
Arborg	N	13	136	149
	P	5	59	64
	K	156	10	166
	S	52	0	52
	Zn	0	0	0
Carberry	N	12	130	142
	P	24	35	59
	K	67	20	87
	S	25	0	25
	Zn	0.67	0	1

*Note: Applied nitrogen value is the soil test recommended value for treatments 4 & 7 as a baseline and took into account nitrogen sources from phophorous products.

Table 2. Description of site fields in the 2024 Ducks Unlimited Winter Wheat Fertility Trial in Melita, Roblin, Arborg, and Carberry.

Location	Melita	Roblin	Arborg	Carberry
Cooperator	WADO	PCDF	PESAI	MCDC
Legal	SW 11-4-26W1	NE 20-25-28W1	RL37-22-2E	SE/SW 8-11-14W1
Rotation	Wheat, Canola	Millet, Oat/Barley	Canola, Wheat	Soybean, Canola
Soil Series	Waskada Loam	Erickson Clay Loam	Fyala (Heavy Clay)	Ramada Clay Loam
Soil Test	Yes	Yes	Yes	Yes
Field Prep	Heavy Harrow	None	None	Heavy Harrow
Stubble	Canola	Oat, Barley	Canola	Canola
Burn off	Yes	Yes	No	Yes

Table 3. Agronomic practices and description of sites in the 2024 Ducks Unlimited Winter Wheat Fertility Trial in Melita, Roblin, Arborg, and Carberry.

Location	Melita	Roblin	Arborg	Carberry
(Date/Rate per acre/Products)	Glyphosate (0.67L/ac) + Heat (34mL/ac) 06-Sep-23	Glyphosate (0.64L/ac 27-Sep-23	No Burnoff	Glyphosate (0.67L/ac) + Heat (29mL/ac) 13-Sep-23
Moisture at Seeding	Good	Poor	Good	Good
Seed Date	06-Sep-23	27-Sep-23	19-Sep-23	19-Sep-23
Seed depth (in)	0.5	0.75	0.5	1
Seeder	Air Drill	Disc Drill	Disc Drill	Disc Drill
Seeding Errors	None	None	None	None
Topdressing Date	15-Apr-24	25-Apr-24	30-Apr-24	29-Apr-24
Herbicides: (Date, Rate/ ac, Name)	Achieve (0.2L/ac) + Mextrol (0.5L/ac) 02-May-24	None	Refine SG (12g/ac) 10-May-24	Fitness (120mL/ac) / Buctril M (0.4L/ac) + Axial (0.5L/ac) 18-Jun / 24-Jun-24
Fungicides	Prosaro (325mL/ac) 27-Jun-24	None	None	None
Insecticides	None	None	None	None
Desiccation	Glyphosate (0.67L/ac) 02-Aug-24	Reglone (0.69L/ac) + LI700 (0.25%) + Glyphosate (0.67L/ac) 15-Aug-24	None	Glyphosate (0.67L/ac) + Heat (29mL/ac) 23-Aug-24
Harvest Date	06-Aug-24	21-Aug-24	12-Aug-24	29-Aug-24
Total Precip. (Seeding to Harvest)	424mm	450mm	443mm	504mm

Results & Discussion

The 2024 trial was successfully completed at all the Diversification Centers and agronomic characteristics that were evaluated included test weight, protein, and yield. In Melita, variety had a significant effect ($p < 0.001$) on test weight while in Arborg, the combined effects of variety and fertility significantly influenced ($p = 0.031$) test weight. In Melita, Vortex had a greater test weight (83.7 kg/hL) than Wildfire (82.9 kg/hL). This trend was consistent amongst the other sites, but the difference was not significant. Test weight was not found to be significantly influenced by variety or fertility at either the Roblin or Carberry sites.

The significant interaction of variety and fertility at Arborg suggests that the effect of fertility was dependent on which variety was used. In fact, when nitrogen rates were 90 kg/ha and below Wildfire had greater test weights than Vortex and as nitrogen rates increased to 120 kg N/ha and above, Vortex had higher test weights. This trend appeared to be specific to Arborg. While test weight has been found to be significant in some situations, it was not particularly affected by the treatments in the 2023-2024 growing season.

Table 4. Test weight results from 2024 in Melita, Roblin, Arborg, and Carberry.

Treatment		Factor	2024 Ducks Unlimited Winter Wheat TWT (kg/hL)			
			Melita	Roblin	Arborg	Carberry
Variety	Wildfire	1	82.9 **b**	74.8	73.1	70.8
	Vortex	2	83.7 **a**	75.8	73.3	71.5
Fertility	Check 0N	1	83.6	77.4	73.2	71.6
	60 Split	2	83.4	73.1	72.8	70.5
	90 Split	3	83.6	74.8	72.6	68.9
	120 Split	4	83.2	74.7	73.6	72.3
	150 Split	5	83.0	75.9	73.3	72.6
	180 Split	6	83.1	75.9	73.5	71.1
	120 Spring	7	83.1	75.3	73.2	71.1
Variety x Fertility		1,1	82.9	77.8	73.8 **ab**	71.8
		1,2	83.0	74.5	73.1 **ab**	68.9
		1,3	82.9	74.4	72.7 **b**	68.5
		1,4	82.9	72.8	73.2 **ab**	74.7
		1,5	82.5	75.9	72.9 **b**	72.1
		1,6	83.1	74.3	73.1 **ab**	71.4
		1,7	82.8	74.1	72.6 **b**	68.5
		2,1	84.3	77.1	72.6 **b**	71.5
		2,2	83.7	71.8	72.5 **b**	72.1
		2,3	84.3	75.1	72.5 **b**	69.2
		2,4	83.6	76.6	74.0 **a**	69.8
		2,5	83.5	75.8	73.8 **ab**	73.0
		2,6	83.0	77.5	73.8 **ab**	70.8
		2,7	83.3	76.5	73.7 **ab**	73.7
P-Values	Variety		**< 0.001**	0.164	0.225	0.671
	Fertilty		0.309	0.063	0.133	0.858
	V x F		0.205	0.127	**0.031**	0.655
	CV %		0.6	2.2	0.9	6.6
Values followed by the same letter are not significantly different by Fisher's mean separation at 95% confidence.						

In Melita, protein was found to be significant ($p < 0.001$) between the varieties. Vortex had a higher protein (11.8%) than Wildfire (10.9%). Fertility was also found to have a significant effect ($p < 0.001$) on protein in Melita; 150 kg N/ha split applied produced the highest protein (12.3%) but it was not significantly higher than the split application of 180 kg N/ha (12.1%). The check treatment with no additional nitrogen applied had the lowest protein (10.4%) in Melita.

In Roblin, protein was found to be significant (p < 0.001) between varieties; Vortex being higher (9.7%) than Wildfire (9.1%). Fertility treatment was also found to be significant (p < 0.001) in Roblin. The 180 kg/ha nitrogen split application produced the highest protein (10.6%) while 90 kg/ha nitrogen split application produced the lowest protein (8.5%) in Roblin, but it was not significantly lower than the check treatment with no additional nitrogen applied (8.9%).

In Arborg, protein was only found to be significantly affected (p = 0.025) by fertility. The 180 kg N/ha split application produced the highest protein grain (10.9%), and it was significantly greater than the proteins achieved by split applications of 60 kg N/ha (9.5%) and 90 kg N/ha (9.6%).

Variety and fertility were found to significantly influence protein in Carberry (p < 0.001). Again, Vortex produced the higher protein (11.1%), and Wildfire had lower protein grain (10.3%). The fertility treatment that produced the highest protein grain was the split application of 180 kg N/ha (11.7%), but it was not significantly different from the protein than that of of split applied 150 kg N/ha (11.2%) or 120 kg N/ha applied in the spring (11.1%).

In Melita, grain yield was found to be significantly different (p = 0.010) between varieties; Wildfire was the higher yielding variety (6283 kg /ha) compared to Vortex (5919 kg/ha). Fertility was also found to have a significant effect (p < 0.001) on yield. When nitrogen was split applied at the 150 kg N/ha rate the highest yield (6607 kg/ha) was achieved, though it was not significantly different from the yield of 180 kg N/ha and 120 kg N/ha split applications or spring applied 120 kg N/ha nitrogen (6541 kg/ha, 6464 kg/ha, and 6198 kg/ha respectively). The lowest yield (4943 kg/ha) was observed for check treatment where no additional nitrogen was applied.

Grain yield was significantly affected by variety (p = 0.034) and fertility treatment (p < 0.001) in Roblin. Vortex produced the highest yield (4866 kg/ha) and Wildfire the lowest (4500 kg/ha). The 180 kg N/ha split applied had the greatest yield (5865 kg/ha) and was statistically the same as both 120 kg N/ha treatments and 150 kgN/ha split applied. The check treatment with no additional nitrogen applied had the lowest yield (2400 kg/ha).

In Arborg, only fertility treatment had a significant effect (p < 0.001) on yield. The split application of 180 kg N/ha achieved the highest yield (6371 kg/ha), though it was not significantly higher than the yields produced by 150 kg N/ha split applied (6264 kg/ha) or 120 kg N/ha applied in the spring (6028 kg/ha).

In Carberry, yield was not affected by variety or fertility enough to result in a significant p-value. However, trends were similar to the other three sites. Vortex had a greater yield than Wildfire by just over 200 kg/ha. The greatest yields were observed for the split applications of 120 kg N/ha (5982 kg/ha) and 150 kg N/ha (6231 kg/ha) treatments.

Table 9.6. Protein results from 2024 in Melita, Roblin, Arborg, and Carberry.

Treatment		Factor	2024 Ducks Unlimited Winter Wheat Protein (%)			
			Melita	Roblin	Arborg	Carberry
Variety	Wildfire	1	10.9 b	9.1 b	10.3	10.3 b
	Vortex	2	11.8 a	9.7 a	10.1	11.1 a
Fertility	Check 0N	1	10.4 d	8.9 cd	10.1 ab	9.9 cd
	60 Split	2	10.3 d	8.5 d	9.5 b	9.7 d
	90 Split	3	10.8 cd	9.0 cd	9.6 b	10.6 b
	120 Split	4	11.4 bc	9.8 b	10.3 ab	10.6 b
	150 Split	5	12.3 a	9.7 b	10.5 a	11.2 a
	180 Split	6	12.1 a	10.6 a	10.9 a	11.7 a
	120 Spring	7	11.9 ab	9.6 b	10.6 a	11.1 ab
Variety x Ferility		1,1	10.0	8.5	10.1	9.2
		1,2	9.6	8.3	9.7	9.5
		1,3	10.3	8.5	9.7	10.0
		1,4	11.0	9.3	10.1	10.5
		1,5	11.7	9.4	10.9	10.6
		1,6	12.1	10.4	11.2	11.1
		1,7	11.3	9.3	10.3	10.9
		2,1	10.9	9.2	10.1	10.6
		2,2	10.9	8.7	9.3	9.9
		2,3	11.3	9.5	9.4	11.2
		2,4	11.7	10.2	10.4	10.7
		2,5	12.8	10.0	10.2	11.8
		2,6	12.1	10.7	10.5	12.3
		2,7	12.6	9.9	10.8	11.3
P-Values	Variety		< **0.001**	< **0.001**	0.392	< **0.001**
	Fertility		< **0.001**	< **0.001**	**0.025**	< **0.001**
	V x F		0.554	0.587	0.701	0.064
	CV %		5.7	3.5	7.3	3.9

Values followed by the same letter are not significantly different by Fisher's mean separation at 95% confidence.

Table 6. 2024 grain yield results in Melita, Roblin, Arborg, and Carberry

Treatment		Factor	2024 Ducks Unlimited Winter Wheat Yield (kg/ha) Melita	Roblin	Arborg	Carberry
Variety	Wildfire	1	6283 a	4500 b	5382	5774
	Vortex	2	5919 b	4866 a	5476	5566
Fertility	Check 0N	1	4943 d	2400 d	3505 c	4784
	60 Split	2	5856 c	3455 c	4806 bc	6073
	90 Split	3	6095 bc	4843 b	5126 b	5751
	120 Split	4	6464 ab	5570 a	5904 b	5982
	150 Split	5	6607 a	5265 ab	6264 ab	6231
	180 Split	6	6541 ab	5865 a	6371 a	5686
	120 Spring	7	6198 abc	5382 ab	6028 ab	5181
Variety x Fertility		1,1	5089	2255 e	3506	4635
		1,2	5953	3637 c	4801	6020
		1,3	6216	4847 b	5029	6043
		1,4	6623	5107 b	5675	6211
		1,5	6825	5425 ab	6228	6148
		1,6	6873	5557 ab	6560	6308
		1,7	6399	4672 b	5877	5051
		2,1	4796	2545 de	3505	4934
		2,2	5759	3273 cd	4811	6126
		2,3	5974	4839 b	5223	5458
		2,4	6304	6033 a	6134	5753
		2,5	6389	5105 b	6299	6314
		2,6	6210	6172 a	6183	5065
		2,7	5998	6092 a	6178	5311
P-Values	Variety		**0.010**	**0.034**	0.329	0.496
	Fertility		**< 0.001**	**< 0.001**	**< 0.001**	0.164
	V x F		0.972	0.060	0.372	0.786
	CV %		6.9	11.3	5.6	17.2

Values followed by the same letter are not significantly different by Fisher's mean separation at 95% confidence.

When the data from all four sites were combined from the 2024 season, fertility had a significant effect on yield and protein ($p < 0.001$), and variety significantly affected ($p < 0.001$) protein. Results indicate that the split application of 180 kg N/ha produced the greatest yield (6115.9 kg/ha), though it was not significantly higher than the 150 and 120 kg N/ha split applied, or spring applied 120 kg N/ha (6091.6 kg/ha, 5980.0 kg/ha, and 5697.3 kg/ha, respectively). While not significant ($p = 0.623$), the combination of variety and fertility that produced the highest yield was when Vortex was grown with the fertility treatment of 150 kg/ha split nitrogen (6324.4 kg/ha). The variety Vortex produced higher protein (10.7%) across all the sites. As well as the highest yield, the split application of 180 kg N/ha also produced the highest protein grain (11.3%) across all four sites and was significantly higher than the protein produced by all other fertility treatments in the trial. Test weight was not found to be significant between the sites in 2024.

Table 7. Results including yield, protein, and test weight from all sites included combined for the 2024 season.

Treatment		Factor	2024 Sites Combined		
			Yield (kg/ha)	Protein (%)	TWT (kg/hL)
Variety	Wildfire	1	5458.7	10.1 **b**	75.4
	Vortex	2	5456.5	10.7 **a**	76.0
Fertility	Check 0N	1	3908.1 **d**	9.8 **de**	76.5
	60 Split	2	5047.5 **c**	9.5 **e**	75.0
	90 Split	3	5453.7 **cb**	10.0 **de**	75.0
	120 Split	4	5980.0 **a**	10.5 **c**	75.9
	150 Split	5	6091.6 **a**	10.9 **b**	76.2
	180 Split	6	6115.9 **a**	11.3 **a**	75.9
	120 Spring	7	5697.3 **ab**	10.8 **bc**	75.7
Variety x Fertility		1,1	3871.3	9.4	76.6
		2,1	5102.9	9.3	74.8
		1,2	5533.8	9.6	74.4
		2,2	5904.1	10.2	75.9
		1,3	6156.5	10.7	75.9
		2,3	6324.4	11.2	75.5
		1,4	5499.7	10.5	75.2
		2,4	3944.9	10.2	76.4
		1,5	4992.1	9.7	75
		2,5	5373.6	10.3	74.1
		1,6	6055.9	10.8	76
		2,6	6026.6	11.2	76.5
		1,7	5907.4	11.4	76.3
		2,7	5894.8	11.2	74.3
P-Values		Site	0.119	0.114	0.112
		Variety	0.807	**< 0.001**	0.133
		Fertility	**< 0.001**	**< 0.001**	0.392
		V x F	0.623	0.791	0.798
		CV %	4.6	2.0	1.7

To gain a broader sense of the results from this research, data was combined from all four sites for the 2022, 2023, and 2024 growing seasons. Statistical results indicated that fertility treatment had an influence on yield and protein while variety had an effect on protein and test weight (Table 9.7.). Winter wheat that received 150 kg N/ha split between fall and spring had the highest yield (5933 kg/ha), though it was not significantly higher than the yield produced by most of the other treatments except when nitrogen rates were reduced to 90 kg/ha and less. The check treatment with no nitrogen applied produced the lowest yield (4510 kg/ha) which was expected and shows that there was a strong yield response to nitrogen fertilization. Variety and fertility had a significant effect ($p < 0.001$) on protein. Vortex had the highest protein (12.1%) and Wildfire had a marginally lower protein (11.4%). The fertility treatment, 180 kg N/ha split produced the highest grain protein (12.5%), though it was not significantly higher than the protein produced when all nitrogen was spring applied (12.4%) or 150 kg N/ha split applied (12.1%). The check treatment with no additional nitrogen and 60 kg N/ha split applied produced the lowest protein (11.1%). Variety had a significant effect ($p = < 0.001$) on grain test weight whereby Vortex had a slightly greater test weight (74 kg/hL) than Wildfire (73 kg/hL). No statistical differences were observed between fertility treatments for test weight. Trends amongst fertility treatments regarding test weight indicated that when no nitrogen fertilizer was applied, test weight was highest (94 kg/hL). Results of this trial across three growing seasons and multiple sites were similar as indicated by a non-significant p-value for site and year.

Table 8. Combined results for grain yield, protein, and test weight, all sites, 2022-2024

2022, 2023 & 2024 Site Years Combined					
Treatment		**Factor**	**Yield (kg/ha)**	**Protein (%)**	**TWT (kg/hL)**
Variety	**Wildfire**	**1**	5640	11.4 **b**	73 **b**
	Vortex	**2**	5423	12.1 **a**	74 **a**
Fertility	**Check 0N**	**1**	4511 **d**	11.1 **d**	74
	60 Split	**2**	5346 **c**	11.1 **d**	73
	90 Split	**3**	5512 **bc**	11.4 **c**	74
	120 Split	**4**	5825 **ab**	11.8 **b**	74
	150 Split	**5**	5933 **a**	12.1 **ab**	74
	180 Split	**6**	5827 **ab**	12.4 **a**	73
	120 Spring	**7**	5770 **ab**	12.4 **a**	74
Variety*Fertility		**1,1**	4660	10.6	74
		1,2	5478	10.8	71
		1,3	5698	11.0	73
		1,4	5872	11.4	73
		1,5	6049	11.8	73
		1,6	5987	12.2	73
		1,7	5740	12.0	73
		2,1	4362	11.6	74
		2,2	5214	11.3	74
		2,3	5326	11.9	74
		2,4	5778	12.2	74
		2,5	5818	12.4	74
		2,6	5668	12.6	74
		2,7	5800	12.8	74
Year		**2022**	6534	11.9	72
		2023	4591	13.0	73
		2024	5471	10.4	76
Site		**Arborg**	5457	12.6	70
		Carberry	6046	11.7	70
		Melita	5282	11.5	80
		Roblin	5343	11.2	74
P-Values		**Year**	0.161	0.159	0.167
		Site	0.138	0.115	0.112
		Variety	0.051	**< 0.001**	**0.014**
		Fertility	**< 0.001**	**< 0.001**	0.582
		V x F	0.954	0.672	0.959
		CV%	22.0	8.1	6.2

Table 9 Seasonal precipitation and growing degree days from the fall seeding date to November 15th, 2023, in Melita, Roblin, Arborg, and Carberry sites.

		Normal Precipitation (mm)	Actual Precipitation (mm)	% of Normal Precipitation	Normal GDD	Actual GDD	% of Normal GDD
Site	Arborg	53	83	168	70	205	292
	Carberry	46	46	100	73	201	275
	Melita	71	89	126	200	285	142
	Roblin	40	54	137	23	102	440
Information obtained from: https://web43.gov.mb.ca/climate/SeasonalReport.aspx							

Nitrogen use efficiency (NUE) as a function of yield over amount fertilizer was evaluated over the course of the study from 2022 to 2024. There were no differences between Vortex and Wildfire in NUE ($p = 0.091$) or an interaction effect when looking at variety and fertility together proving that the NUE response was consistent across varieties. Furthermore, while fertility had a significant effect on NUE ($p < 0.001$), both Vortex and Wildfire responded similarly to changes in fertility ($p = 0.823$). Nitrogen use efficiency decreased as nitrogen fertilizer increased which is a typical NUE trend as nitrogen rates increase. When comparing the 100% spring applied nitrogen to the same rate that was split applied, NUE is the same indicating that in this study year, split application of N at this rate did not improve NUE.

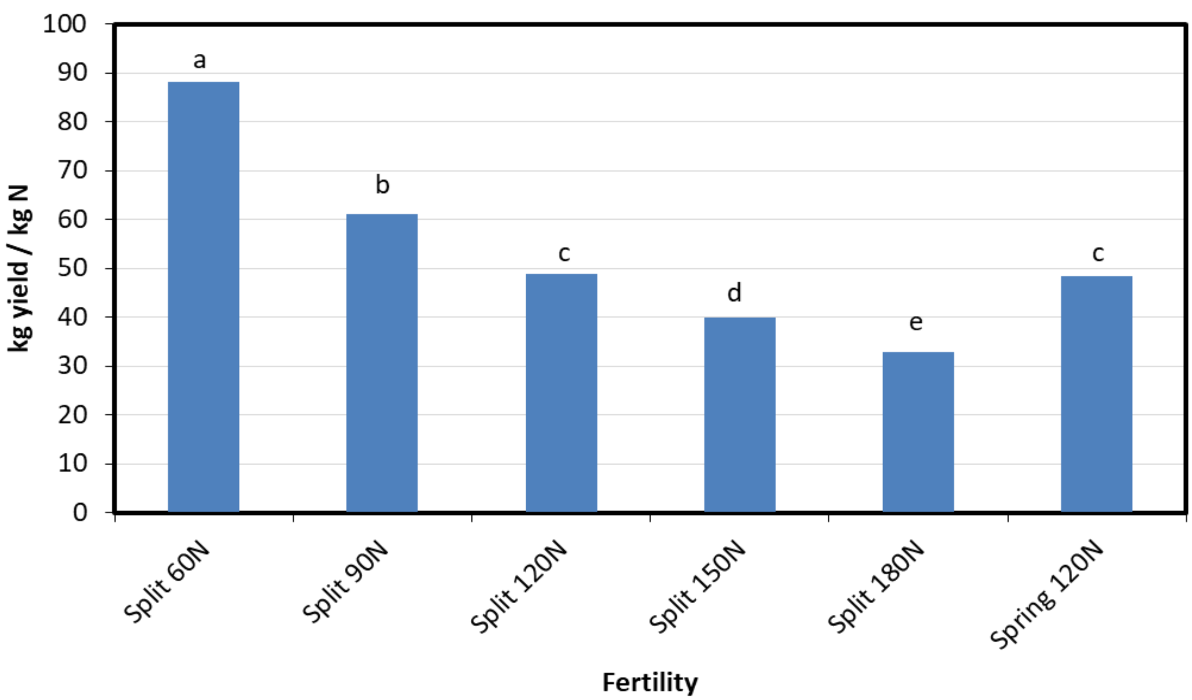


Figure 1. The relationship between nitrogen treatment and nitrogen use efficiency (NUE = seed yield (kg/ha) / fertilizer N (kg/ha). Letters above bars indicate significant differences between treatments.

References

Anderson, R. L. 2008. Growth and Yield of Winter Wheat as Affected by the Preceding Crop and Crop Management. Agronomy Journal 100 (4) 977-980.

Beres, B. L., Graf, R. J., Irvine, R. B., O'Donovan, J. T., Harker, K.N., Johnson, E. N., Brandt, S., Hao, X., Thomas, B. W., Turkington, T. K., and Stevenson, F. C. 2018. Enhanced Nitrogen Management Strategies for Winter Wheat Production in the Canadian Prairies. Canadian Journal of Plant Science 98:3. https://doi.org/10.1139/cjps-2017-0319

Fowler, D. B., Brydon, J., and Baker, R. J. 1989. Nitrogen fertilization of no-till winter wheat and rye. I. Yield and agronomic responses. Agron. J. 81: 66–72.

Halvorson, A.D., Alley, M. M., and Murphy, L. S. 1987. Nutrient Requirements and Fertilizer Use: In Wheat and Wheat Improvement – Agronomy Monograph (13) 2nd Edition. Madison, WI 53711, USA.

Morris, T.F., Murrell, T. S., Beegle, D. B., Camberato, J., Ferguson, R., Ketterings, Q. 2018. Strengths and limitations of nitrogen recommendations, tests, and models for corn. Agron. J. 110:1–37. doi:10.2134/agronj2017.02.0112

Schulz, R., Makary, T., Hubert, S., Hartung, K., Gruber, S., Donath, S., Dohler, J., Weiss, K., Ehrhart, E., Claupein, W., Piepho, H. P., Pekrun, C., and Müller, T. 2015. Is it necessary to split nitrogen fertilization for winter wheat? On-farm research on Luvisols in South-West Germany. J. Agric. Sci. 153(4): 575–587.

Winter Wheat GHG Emissions Evaluation

Adapted from a report prepared by WADO

Project Duration: 2023-2024
Collaborators: Ducks Unlimited Canada, Manitoba Diversification Centres
Objectives: Evaluate greenhouse gas emissions for winter wheat fertility regimes

Materials & Methods

The trial was established near Melita (SW11-4-26 W1) in Waskada Loam soil with excellent moisture. On September 12th, 2023, winter wheat was seeded into canola stubble at a depth of 0.5-inches. All plots received chemical burn off as Roundup Transorb (0.67 L/ac) and Heat LQ (40mL/ac) before seeding on September 6th. Nitrogen fertilizer was applied as variable treatments; plot treatments can be found below in Table 10.1. Each plot also received 11-35-21-19-1 actual lbs/ac (N-P-K-S-Zn) at a depth of 1.25-inches. Certain treatments needed to be top dressed; fall top dressing was applied on November 17th, 2023, while spring top dressing was applied on April 15th, 2024. In-crop herbicide was needed to control weeds; Achieve (0.2 L/ac) and Mextrol (0.5 L/ac) were applied on May 2nd. All plots were desiccated on August 2nd with Roundup Transorb (0.67 L/ac) and were harvested on August 6th.

Table 1. List of fertilizer treatments that were applied to winter wheat in 2024 for evaluation of green house gas emission measurements.

2024 Winter Wheat GHG Emissions Seeded Treatments
Untreated Check
100% Fall Urea (SB)
60% Fall Urea (SB) + 40% Spring Agrotain Urea (BC)
60% Fall Urea (SB) + 40% Spring Agrotain UAN (BC)
100% SuperU Late Fall (BC)
SB = Seed Bed Placement BC = Broadcast

Results & Discussion

In 2024, when the data from this winter wheat green house gas emissions evaluation were analyzed, there was multiple significant effects found across the four sites where this trial was grown (Table 10.2.)

In Arborg, yield ($p < 0.001$), protein ($p = 0.005$), and test weight ($p = 0.011$) were found to be significantly affected by N fertilizer application (Table 10.2.). the greatest yield resulted when 100% of the nitrogen was applied in the fall during seeding (5467 kg/ha). Though higher, that yield was not significantly different from the yield produced by either of the split nitrogen applications, whether UAN was broadcasted (5369 kg/ha) or urea (5268 kg/ha). The untreated check produced the lowest yield at Arborg (2396 kg/ha). When 100% of the nitrogen was applied as broadcasted SuperU late in the fall, it resulted in the highest protein at Arborg (11.3%), though it was not significantly higher than when 100% of the nitrogen was applied at seeding (11.0%) or when the nitrogen application was split using urea in the spring (10.8%). The untreated check produced the lowest protein at Arborg (10.0%), though it was not significantly lower than the protein produced when the nitrogen application was split using UAN in the spring (10.4%). When 100% of the nitrogen was applied in the fall at seeding, it resulted in the highest test weight (73.6 kg/hL). Though, the test weights produced by any other nitrogen application where not significantly lower. The untreated check produced the lowest test weight at Arborg (71.5 kg/hL).

In Carberry, yield was the only factor found to be significantly affected ($p = 0.039$) by fertilizer application (Table 10.2.). the highest yield was produced when all of the nitrogen fertilizer was applied at seeding (3940 kg/ha), though the yield was not significantly different from the yield produced when the nitrogen application was split using UAN in the spring (3643 kg/ha). The lowest yields were observed when all nitrogen was broadcasted in late fall (3037 kg/ha), though not significantly different from the yield produced by the untreated check (3564 kg/ha) or when nitrogen was split using urea in the spring (3516 kg/ha). While not significant, the highest protein was produced at Carberry when the nitrogen application was split using UAN in the spring (13.4%) and the lowest was produced by the untreated check (12.2%). While not found to be significant, the highest test weight was produced when all the nitrogen was applied in the fall during seeding (73.2 kg/hL), and the lowest was produced when the nitrogen application was split using urea in the spring (66.7 kg/hL).

In Melita, yield was found to be significantly affected ($p < 0.001$) by fertilizer treatment (Table 10.2.). The highest yield was produced when all nitrogen was applied in the fall at seeding (5691 kg/ha), though it was not significantly higher than the yield of any other fertilizer application evaluated except for the untreated check which had the lowest yield (3681 kg/ha). Protein was also found to be significantly affected ($p < 0.001$) by N fertilizer application at Melita. When all the nitrogen was broadcasted as SuperU in the late fall, the highest protein was produced (13.2%). The untreated check produced the lowest protein grain at Melita (10.9%). Though not significant, the highest test weight was produced at Melita when no nitrogen was applied in the untreated check (82.9 kg/hL), and the lowest was produced when the nitrogen application was split using UAN in the spring (81.4 kg/hL).

In Roblin, yield was found to be significantly influenced ($p < 0.001$) by fertilizer application (Table 10.2.). When nitrogen was applied as a split application broadcasting urea in the spring, the greatest yield was produced (5372 kg/ha), though it was not significantly higher yielding than when nitrogen was applied in a split application using UAN in the spring (5051 kg/ha). The untreated check produced the lowest yield at Roblin (3108 kg/ha). Protein was found to be significant (P < 0.001) at Roblin. When nitrogen was split applied using UAN in the spring, the highest protein was produced (11.8%), though it was not significantly higher than the protein when all the nitrogen was applied in the fall at seeding (11.3%). The untreated check produced the lowest protein grain at Roblin (9.9%). Though not significant, the highest test weight was produced at Roblin when nitrogen was split using urea in the spring (80.4 kg/hL), and the lowest was produced when all nitrogen was applied in the fall at seeding (77.5 kg/hL).

2024 Winter Wheat Green House Gas Emissions								
Factor	**Site**	**Untreated Check**	**100% Fall Urea (SB)**	**60% Fall Urea (SB) + 40% Spring Urea (BC)**	**60% Urea Fall (SB) + 40% Spring UAN (BC)**	**100% SuperU Late Fall (BC)**	**P-Value**	**CV%**
Yield (kg/ha)	Arborg	2396**c**	5467**a**	5369**a**	5268**ab**	4892**b**	**< 0.001**	5.7
	Carberry	3564**b**	3940**a**	3516**b**	3643**a**	3037**b**	**0.039**	9.8
	Melita	3681**b**	5691**a**	5416**a**	5545**a**	5380**a**	**< 0.001**	7.8
	Roblin	3108**c**	4585**b**	5372**a**	5051**ab**	4562**b**	**< 0.001**	8.1
Protein (%)	Arborg	10.0**c**	11.0**a**	10.8**ab**	10.4**bc**	11.3**a**	**0.005**	3.6
	Carberry	12.2	12.4	13.1	13.4	13.3	0.320	7.2
	Melita	10.9**c**	12.1**b**	12.3**b**	12.4**b**	13.2**a**	**< 0.001**	3.1
	Roblin	9.9**c**	11.3**ab**	11.0**b**	11.8**a**	10.8**b**	**< 0.001**	3.5
Test Weight (kg/hL)	Arborg	71.5**b**	73.6**a**	73.2**a**	73.5**a**	72.9**a**	**0.011**	1.0
	Carberry	70.0	73.2	66.7	70.8	73.0	0.330	6.6
	Melita	82.9	82.2	81.7	81.4	81.5	0.054	0.8
	Roblin	78.1	77.5	80.4	78.6	78.3	0.150	2.0
*Values that do not share a letter are signficantly different SB = Seed Bed Placed, BC = Broadcast								

Table 2. Results of the 2024 winter wheat green house gas evaluation at four sites including yield, protein, and test weight.

When the data from all four sites were combined, it was found that both yield and protein were significantly influenced ($p < 0.001$) by fertilizer application, while test weight was not (Table 10.3.) when all the nitrogen was applied at seeding, the highest yield was produced (4920.7 kg/ha), though it was not significantly more than the yield produced by either split nitrogen applications. The untreated check produced the lowest yield overall (3187.2 kg/ha). When all nitrogen was applied as a fall broadcast of SuperU, the highest protein was produced (12.2%), though it was not significantly higher than the protein achieved by the two split nitrogen treatments. The untreated check produced the lowest protein (10.8%).

Between the sites, while not found to be statistically significant, Melita produced the highest average yield (5119.3 kg/ha) and the highest average test weight (81.9 kg/hL). Carberry produced the highest average protein (12.9%), but produced the lowest average yield (3572.5 kg/ha) and the lowest average test weight (70.8 kg/hL). Arborg produced the lowest protein on average (10.7%).

Table 3. Results of all four sites combined for the 2024 winter wheat green house gas evaluation including yield, protein, and test weight.

		2024 Winter Wheat GHG Emissions Sites Combined		
		Yield (kg/ha)	Protein (%)	Test Weight (kg/hL)
Untreated Check		3187.2**c**	10.8**c**	75.6
100% Fall Urea (SB)		4920.7**a**	11.7**b**	76.6
60% Fall Urea (SB) + 40% Spring Urea (BC)		4918.3**a**	11.8**ab**	75.5
60% Urea Fall (SB) + 40% Spring UAN (BC)		4876.8**a**	12.0**ab**	76.1
100% SuperU Late Fall (BC)		4467.9**b**	12.2**a**	76.4
Arborg		4671.5	10.7	72.9
Carberry		3572.5	12.9	70.8
Melita		5119.3	12.2	81.9
Roblin		4533.3	11.0	78.6
P-Values	Site	0.119	0.115	0.114
	Treatment	**< 0.001**	**0.001**	0.791
CV%		5.1	2.3	1.6

Flax Seed Treatment Evaluation

Adapted from a report prepared by WADO

Project duration: May 2023 – September 2025

Objectives: 1) To evaluate the efficacy of Manitoba registered flax seed treatments against soil borne diseases in two flax types (brown & yellow);
2) To evaluate the relationship between the seed treatment on germination, emergence, and ultimately yield in both types of flax.

Collaborators: Manitoba Crop Alliance

Background

Little recent testing has been done to evaluate commercially available seed treatments for flax in Manitoba. The project will evaluate commercially available seed treatments using labelled rates in both brown and yellow seeded flax varieties. The trial was planted at all 4 of the Manitoba Diversification Centres. This trial will be continued until 2026.

Materials and Methods

The seed of both flax varieties were seed treated in a jar. The flax seed treatment trial was established at all 4 Diversification Centres in 2023. A two-factorial plot design was used based upon the variety and seed treatment used (Table 1).

Table 1: Treatments

Variety	Seed Treatment
AAC Bright	untreated
	Insure Pulse (low)
	Insure Pulse (high)
	Vitaflo
CDC Rowland	untreated
	Insure Pulse (low)
	Insure Pulse (high)
	Vitaflo

Results

The seed treatment used was found to have a significant effect ($P = 0.005$) on flax plant stands at Roblin. When Insure Pulse was used at the high rate, it resulted in the highest plant stands. When the flax seed was left untreated, it resulted in the lowest plant stands, although the stands were not significantly lower than for the low rate of Insure Pulse or Vita Flo.

The number of days to flower was significantly different between the flax varieties grown at Roblin. CDC Rowland flowered earlier, while AAC Bright took longer to flower. There were no significant influences on plant heights or maturity of the flax at Roblin. Variety was the only factor found to have a significant effect on flax yield at Roblin, with CDC Rowland yielding higher than AAC Bright. There were no significant effects found on grain moisture at harvest.

Table 3: Results from the 2024 MCA Flax Seed Treatment trial at Roblin.

Roblin 2024 MCA Flax Seed Treatment Results									
Factor	Treatment	Factor	Plant Stand	Days to Flower	Height (cm)	Days to Maturity	Yield (bu/ac)	Moisture (%)
Variety	AAC Bright	1	131	58 **a**	72	107	38 **b**	7.3
	CDC Rowland	2	139	57 **b**	72	107	45 **a**	7.6
Seed Treatment	Untreated	1	114 **b**	58	72	107	39	7.7
	Insure Pulse - Low	2	135 **b**	58	71	107	42	7.5
	Insure Pulse - High	3	163 **a**	58	71	107	43	7.4
	Vita Flo	4	128 **b**	58	74	107	41	7.1
Variety x Seed Treatment		1,1	96	58	72	107	35	7.3
		1,2	144	58	71	107	39	7.8
		1,3	162	58	71	107	39	7.0
		1,4	122	58	75	107	38	7.0
		2,1	131	57	73	107	43	8.1
		2,2	126	57	71	107	46	7.2
		2,3	164	57	71	107	47	7.8
		2,4	133	57	73	107	44	7.2
P-Value	Variety		0.374	**0.008**	0.731	-	**< 0.001**	0.159
	Seed Treatment		**0.005**	0.412	0.149	-	0.236	0.151
	Variety x Seed Treatment		0.143	0.412	0.602	-	0.933	0.065
	C.V.%		18.0	0.3	3.9	0.0	10.2	7.5

Table 2: Fertility Information

	Available	Added (actual)	Type
N	43 lb/ac	73 lb/ac	46-0-0
P	22 ppm	15 lb/ac	11-52-0-0
K	313 ppm	None	

P banded with seed; N side-banded

Table 3: Pesticide Application

Crop stage	Date	Product	Rate
Pre-emerge	May 16	Glyphosate	640 ml/ac
		Authority	85 ml/ac
		Aim	29.3 ml/ac
In-season	June 21	Buctil M	400 ml/ac

University of Saskatchewan:
Standard Oat Yield & Oat Yield Variety Trials

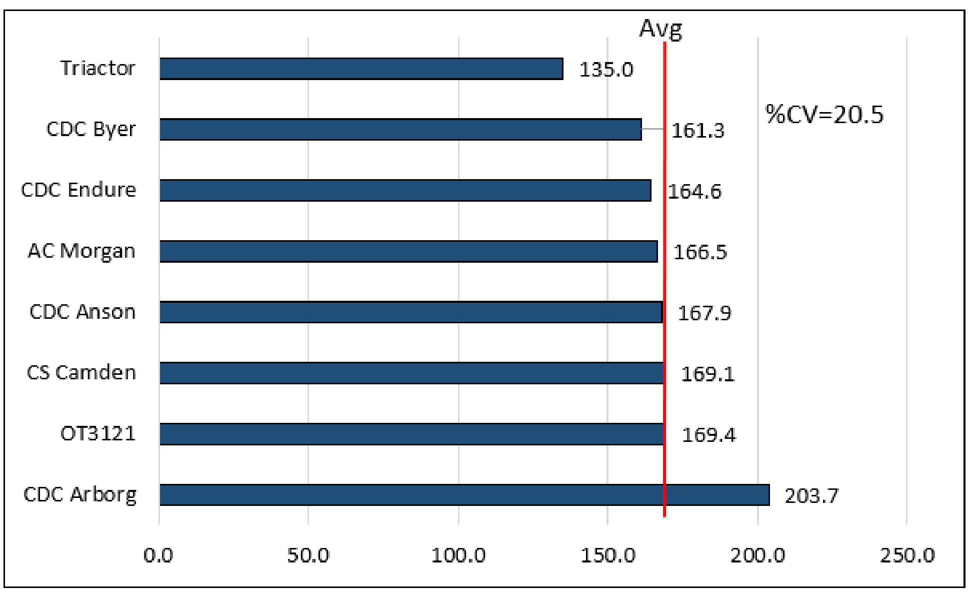
Project duration: May 2024 – September 2024
Objective: To evaluate oat entries for the Crop Development Centre, University of Saskatchewan
Collaborators: Aaron Beattie Crop Development Centre University of Saskatchewan

Background
Adapted from the Crop Development Centre (CDC) website: The CDC was established in 1971 to improve economic returns for farmers and the agriculture industry in western Canada by improving existing crops, creating new uses for traditional crops, and developing new crops.

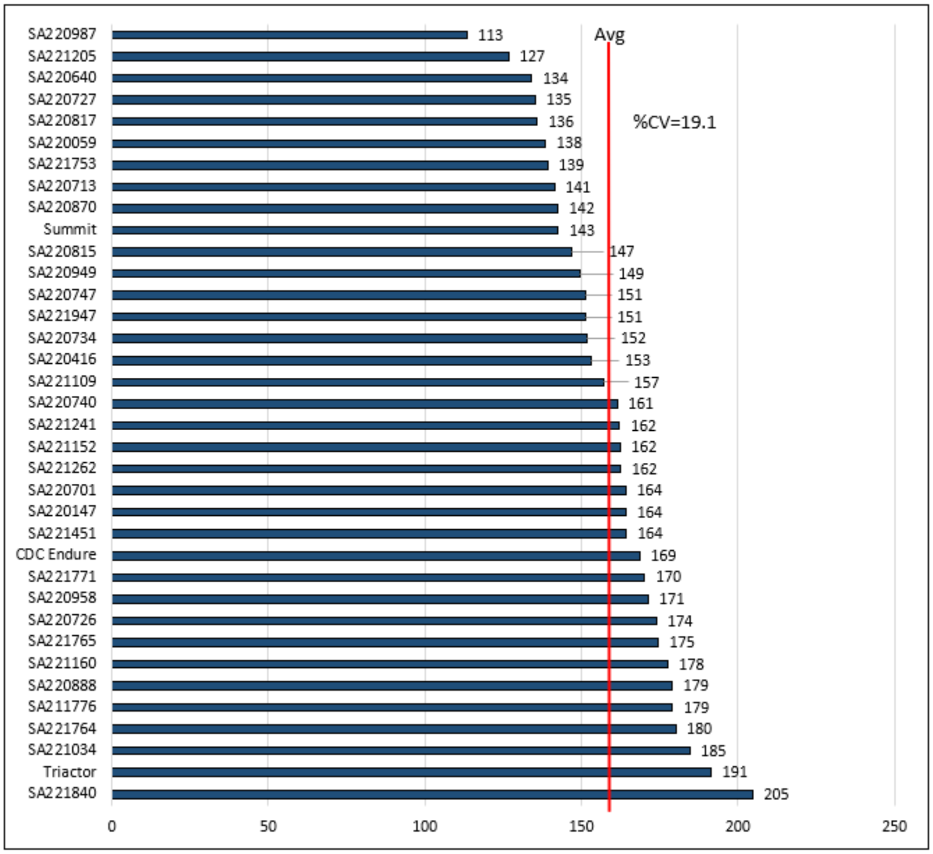
Results
The average yields for oat entries grown for the Standard Oat Yield trial are shown in Figure 1. Average yields for entries grown for the Oat Yield Variety trial are shown in Figure 2. Numbered, non-registered varieties are provided for tracking purposes only. The results are for one site-year only and should be interpreted with caution. Consult a seed guide for multi-site-year data for available varieties.

Seeding: May 9
Harvest: Sept 3

2024 Oat Yield Variety Trial bu/ac 10% Moisture



2024 CDC Standard Oat Yield Trial bu/ac 10% Moisture



Agronomic info

Previous year's crop:	Barley-oat silage
Soil Type:	Erickson Clay Loam
Landscape:	Rolling with trees to the south
Seedbed preparation:	Direct seeded

Table 1: Fall 2023 Soil Test

	Available		Added (actual)	Type
N	23	lb/ac	97 lb/ac	46-0-0
P	23	ppm	15 lb/ac	11-52-0-0
K	215	ppm	None	

Table 2: Spraying Information

Crop stage	Date	Product	Rate
Pre-emerge	May 08	Heat	50 ml/ac
		Merge	500 ml/ac
		Glyphosate	640 ml/ac
In-crop	Jun 19	Buctril M	400 ml/ac

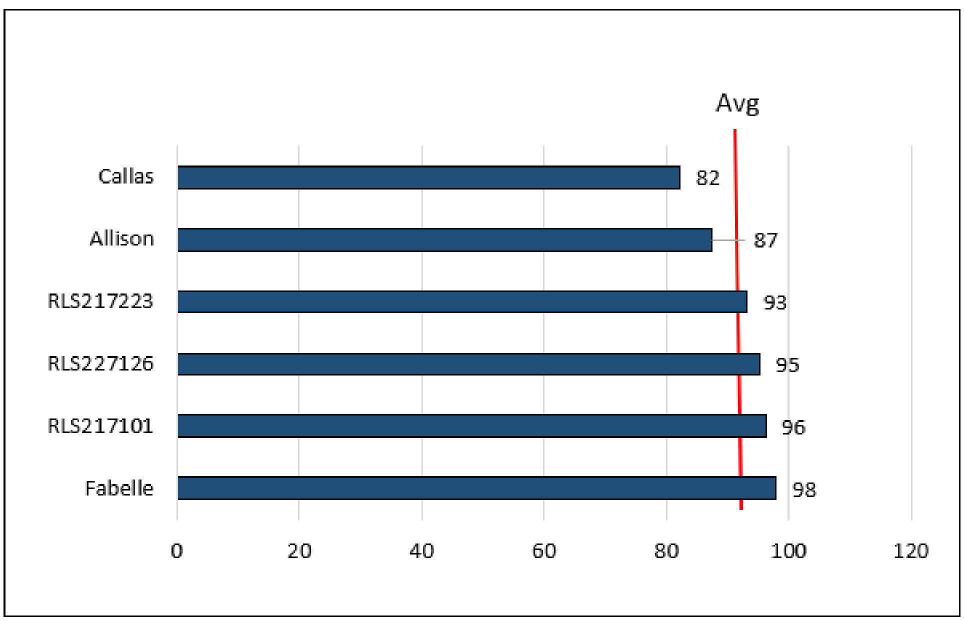
Fababean High and Low Tannin Variety Evaluation

Project duration: May 2024 – September 2024
Objectives: Evaluate
Collaborators: Jaret Horner, Crop Development Centre, University of Saskatchewan

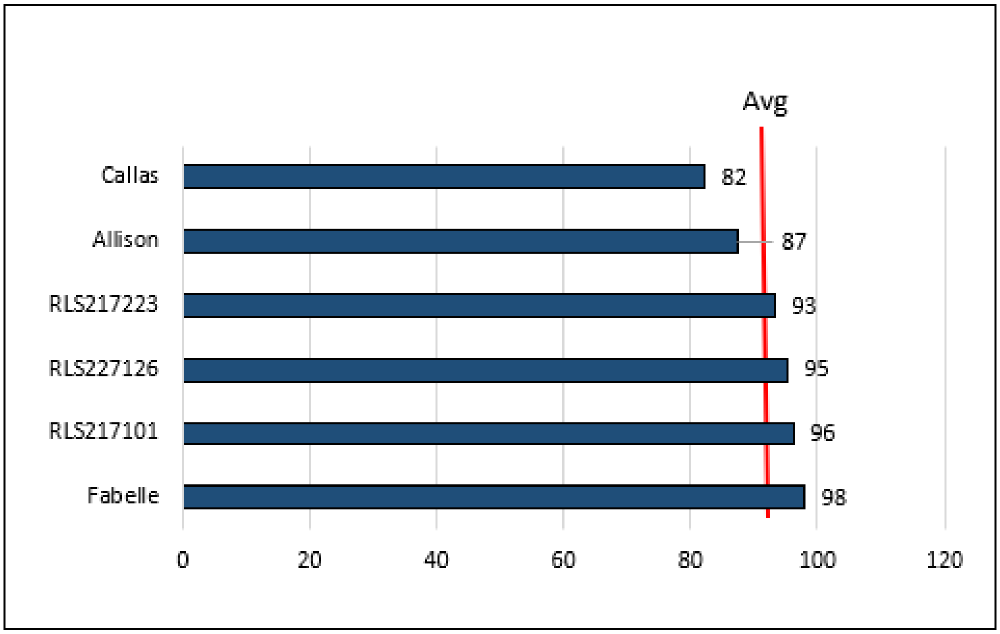
Background (adapted from *Historical review of faba bean improvement in western Canada*)
Faba bean (Vicia faba L.) was considered a minor crop in the Canadian prairies until recently, but its potential for cultivation is increasing due to its positive environmental impact and economic value. Although traditional breeding methods have proved useful, in the last decade, faba bean improvement has benefited from advances in genetics, biochemistry and molecular breeding tools. The overall breeding goal is to develop high yielding germplasm with improved agronomic characteristics that will be of economic value to the emerging faba bean sectors, including the plant protein industry. To maximize value and acceptance by producers, processors and the food industry as a source of protein and dietary fibre, future faba bean varieties need to be high-yielding, have diverse seed size classes, disease resistance, genetically low vicine–convicine concentration, and have wider adaptation to different agro-ecological zones of Canada.

Results
The yield results (bu/ac) for the Roblin site are shown in Figures 1 and 2.

2024 High tannin fababean yields by entry (bu/ac) at 16% moisture



2024 Regular tannin fababean yields by entry (bu/ac) at 16% moisture



Yields adjusted to 16% moisture

Materials and methods

Seeding:	May 6
Harvest:	Sept 25

Agronomic information

Previous year's crop:	Barley-oat silage
Soil Type:	Erickson Clay Loam
Landscape:	Rolling with trees to the east
Seedbed preparation:	Direct seed

Table 1: Fertility Information

	Available	Added (actual)	Type
N	51 lb/ac	None	
P	29 ppm	15 lb/ac	11-52-0-0
K	393 ppm	None	

Inoculated with Nodulator FB Pea; P banded with seed

Table 2: Pesticide Application

Crop stage	Date	Product	Rate
Pre-emerge	May 9	Glyphosate	640 ml/ac
In season	June 14	Basagran	700 ml/ac

Evaluating Insecticide Pea Seed Treatments for Pea Leaf Weevil Management

Adapted from a report by Laura Schmidt, Production Specialist – West, MPSG

Project duration: May 2023 – October 2023

Objectives: To evaluate the efficacy of pea seed treatments in controlling pea leaf weevil in field peas.

Collaborators: Manitoba Pulse and Soybean Growers (MPSG)

Background

Pea leaf weevils (PLW) were first confirmed in Manitoba in 2019. Since then, they have quickly become established in western Manitoba and are found further east every year (Figure 1).

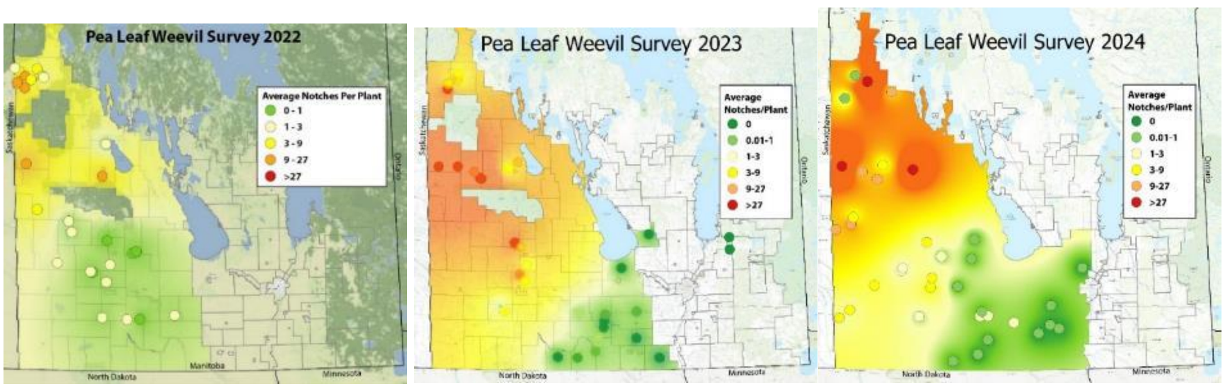


Figure 1. Pea leaf weevil distribution in Manitoba in spring 2022 (left), 2023 (middle) and 2024 (right).

PLW adults overwinter in perennial legumes and shelterbelts. In the spring they emerge and fly to their host crops, peas and faba beans. Adult PLW feed on the leaf edges of these crops leaving behind a distinct notching shape (Figure 2).

Figure 2. Adult pea leaf weevil feeding on pea leaf edges, with distinct leaf notches. This defoliation does not cause yield loss.

Once PLW adults have begun feeding on the crop, they lay eggs on the soil surface. Those eggs hatch and their larvae burrow below ground to the root nodules of the crop to feed. Larvae hollow out root nodules, robbing the plant of biological nitrogen fixation (Figure 3). These feeding wounds also often result in an increase in root rot infections, further damaging the plant.

Figure 3. Pea leaf weevil larvae feed on root nodules, robbing the plant of nitrogen fixation and creating wounds for root rots to infect.

Economic thresholds are available for foliar insecticide applications, however, foliar applications do not prevent yield loss since eggs have already been laid in the field and there are multiple migrations of PLW adults into the field. As a result, foliar applications are considered 'revenge sprays' since they do not actually prevent the larvae from feeding.

Previous research has indicated that preventative insecticide seed treatments are a more effective option to managing PLW. However, it is uncertain at what PLW population level we can expect to see a return on investment to using an insecticide seed treatment in peas. The goal of this research is to compare existing registered insecticide pea seed treatments for PLW control (Table 1) and to compare results with PLW population pressure to determine when we may see a return on investment to these products.

Table 1. Available registered seed treatments for pea leaf weevil control in peas.

Trade Name	Active Ingredient	Rate (mL/100 kg seed)
Cruiser 5FS	thiamethoxam	83
Stress Shield 600	imidacloprid	208
Lumivia CPL	chlorantraniliprole	96

Results

In 2023 and 2024, small-plot trials were established at Roblin with PCDF and Swan River with New Era Ag comparing untreated peas to peas treated with Cruiser 5FS (thiamethoxam), Stress Shield 600 (imidacloprid) or Lumivia CPL (chlorantraniliprole). One field-scale on-farm trial was also established each year through MPSG's On-Farm Network. In 2023, near Roblin a farmer compared untreated peas to those treated with imidacloprid and Rancona trio (a fungicide seed treatment). In 2024, an on-farm trial near Minitonas compared untreated peas to those treated with Cruiser (thiamethoxam) and Vibrance Max (fungicide seed treatment).

Results presented here are preliminary and these trials are planned to continue for another year.

At V6, total leaf notches per plant were counted on 10 plants in each plot to provide an indication of pea leaf weevil predation and population (Figure 4). There were no differences in PLW predation among seed treatments and the untreated check at Roblin or at the on-farm trial in 2023. At Swan River in 2023, PLW predation was reduced with Cruiser (thiamethoxam) seed treatment compared to untreated peas.

Figure 4. Average total leaf notches per plant at V6 at Roblin PCDF, Swan River and at an on-farm trial near Roblin in 2023. Within each site-year, bars followed by different letters are significantly different at *$p < 0.05$.*

In 2024, total leaf notches per plant were recorded at V9 in Roblin, at V6 and R1 in Swan River and at V6 at the on-farm trial near Minitonas. There were no significant difference among treatments regarding PLW feeding damage in 2024.

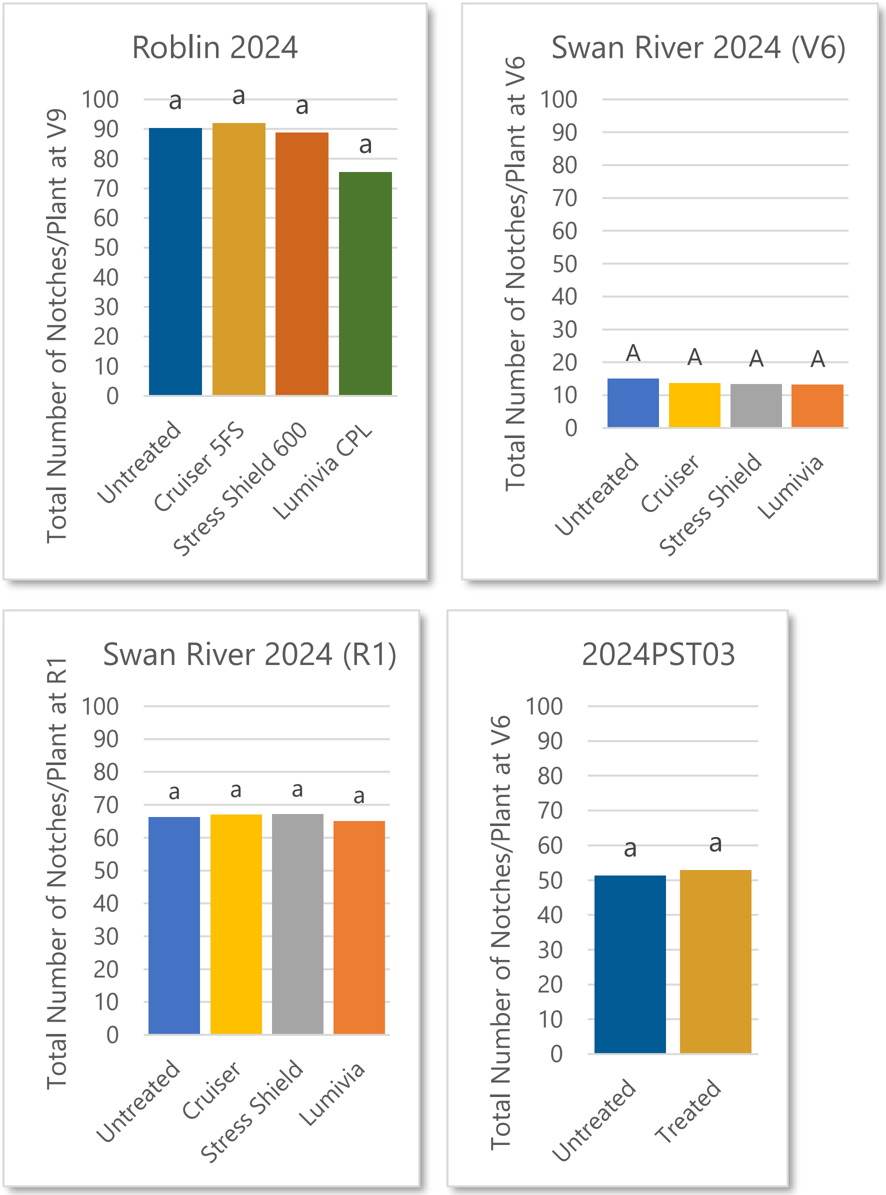


Figure 5. Average total leaf notches per plant at Roblin PCDF, Swan River (at V6 and R1) and at an on-farm trial near Minitonas in 2024. Within each site-year, bars followed by different letters are significantly different at *p <0.05.*

There were no statistically significant yield differences among pea seed treatments and the untreated check at either Roblin or Swan River in 2023 (Figure 6) or 2024 (Figure 7). Yields were poor at Roblin in 2023 due to late seeding into dry soils followed by challenging growing season conditions.

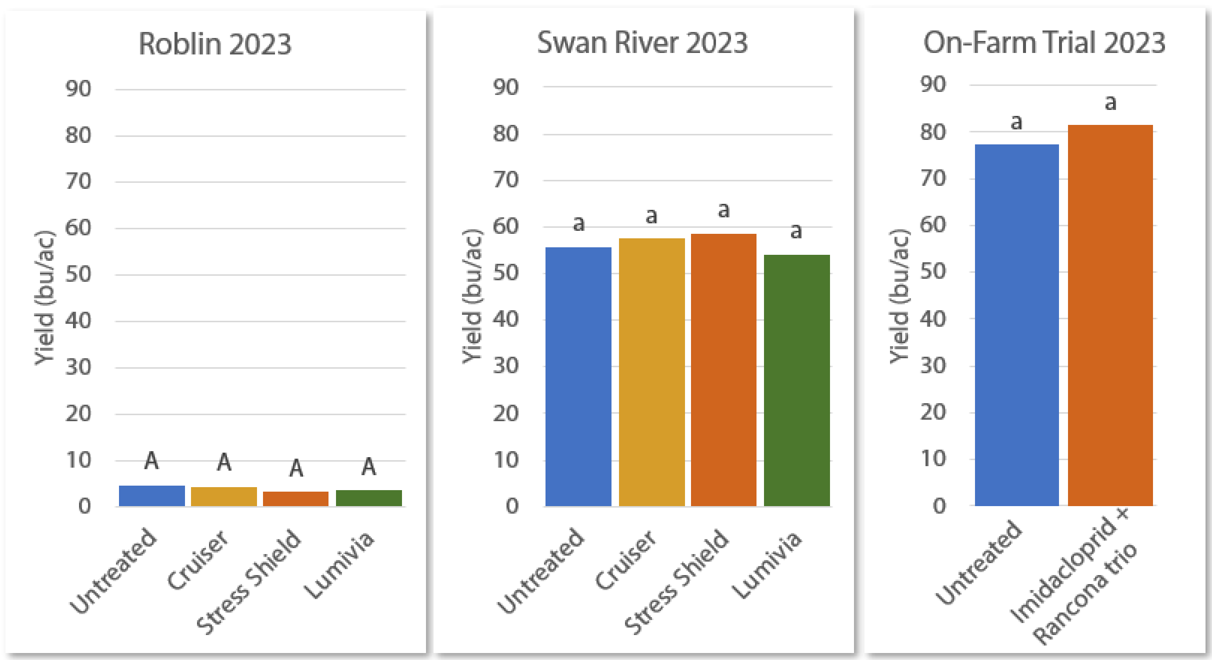


Figure 6. Average pea yield (bu/ac at Roblin PCDF, Swan River and at an on-farm trial near Roblin in 2023. Within each site-year, bars followed by different letters are significantly different at *p <0.05.*

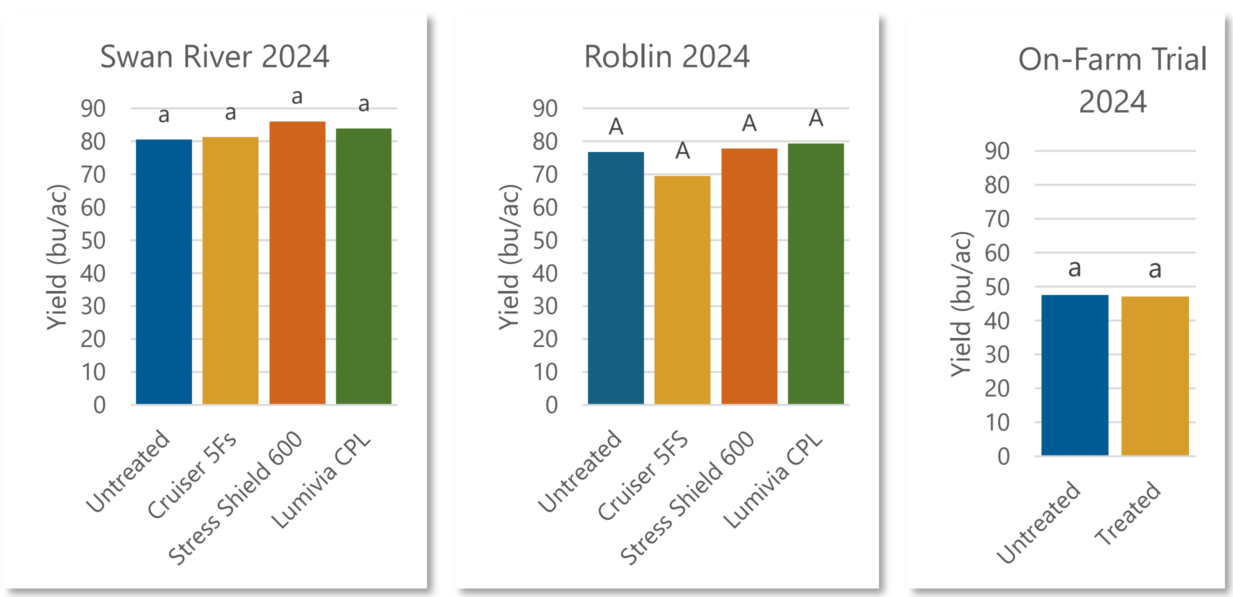


Figure 7. Average pea yield (bu/ac at Roblin PCDF, Swan River and at an on-farm trial near Minitonas in 2024. Within each site-year, bars followed by different letters are significantly different at *p <0.05.*

These results are preliminary. There was a trend of reduced PLW predation with Cruiser (thiamethoxam) and Stress Shield (imidacloprid) seed treatments, but this did not translate to any yield improvements. PLW populations may be so great in these areas that any seed treatment effects are masked by excessive pest pressure.

Small-plot trials are planned to continue for another year at Roblin (PCDF), Swan River (New Era Ag) and Melita (WADO). On-farm trials will continue with any interested farmers who would like to test insecticide seed treatments in peas. Please reach out to MPSG's On-Farm Network if you would like to participate.

Phillex Quinoa Variety Trial

Project duration:	May 2024 – September 2024
Objectives:	To evaluate varieties of quinoa for Phillex Ltd.
Collaborators:	Percy Philips, Phillex Ltd Westman Agricultural Diversification Organisation (Melita) Parkland Crop Diversification Foundation (Roblin) Prairies East Agricultural Sustainability Initiative (Arborg)

Background

Quinoa is an ancient grain of the amaranth family, prized as a high-protein, gluten-free food. Originating in the Andean region, the crop has been successfully introduced to Manitoba. The Manitoba Diversification Centres collaborated with Phillex Ltd to grow six varieties of quinoa, evaluating their suitability to Manitoba's growing conditions.

Due to its adaptation to cool, dry environments, the crop is tolerant to early planting. In Manitoba, where quinoa is threatened by a host of insects that are not present in its native environments, early planting can also help the crop to reach key developmental stages before it is damaged by pests. Key insect pests include the diamondback moth, goosefoot groundling moth, lygus bugs, bertha armyworm, and grasshoppers.

The trial was established at Arborg, Melita and Roblin. However, this report only provides yield data for Melita. The trial was discontinued at Arborg due to critically low moisture at seeding, resulting in poor establishment. At Roblin, severe weed pressure reduced yields and resulted in high % CV. Agronomic information is provided for both Melita and Roblin. However, yield results are only shown for Melita.

Materials and methods

Experimental Design:	Random Complete Block Design
Entries:	6
Seeding rate:	10 lb/ac

	Roblin
Seeding date	May 9
Harvest date	Oct 17
Herbicide	(Pre-emerge) Glyphosate @ 640 ml/ac Jun 21 Clethodim @ 75 ml/ac + Amigo @ 500 ml/ac Jul 10 Clethodim @ 75 ml/ac + Merge @ 500 ml/ac
Insecticide	None
Desiccation	None

Table 1: Fertility information

	Roblin	
	Available	Added
N	23 lb/ac	131 lb/ac
P	23 ppm	15 lb/ac
K	215 ppm	-

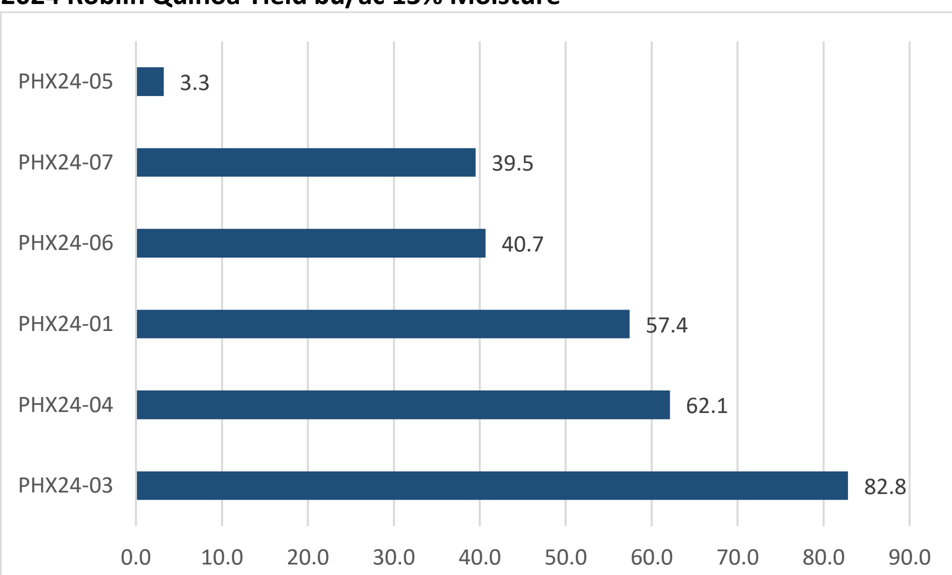
P banded with seed; N side-banded

Table 2: Agronomic summary

	Roblin
Soil series	Erickson Clay Loam
Previous crops	(2022) millet silage, (2023) oat barley silage
Soil moisture at seeding	Good
Seeding depth	0.5 inch
Seedbed prep	Direct seeded

Results

2024 Roblin Quinoa Yield bu/ac 13% Moisture



One variety (PHX24-02) did not emerge across all reps

Discussion

Quinoa has developed a small, but valuable niche within the crop rotations of Manitoba producers. Strong demand from consumers remains a strong driver; however, first-time producers interested in growing quinoa should seek out agronomic advice to address the challenges associated with the crop, including field preparation, pest management and harvest strategies.

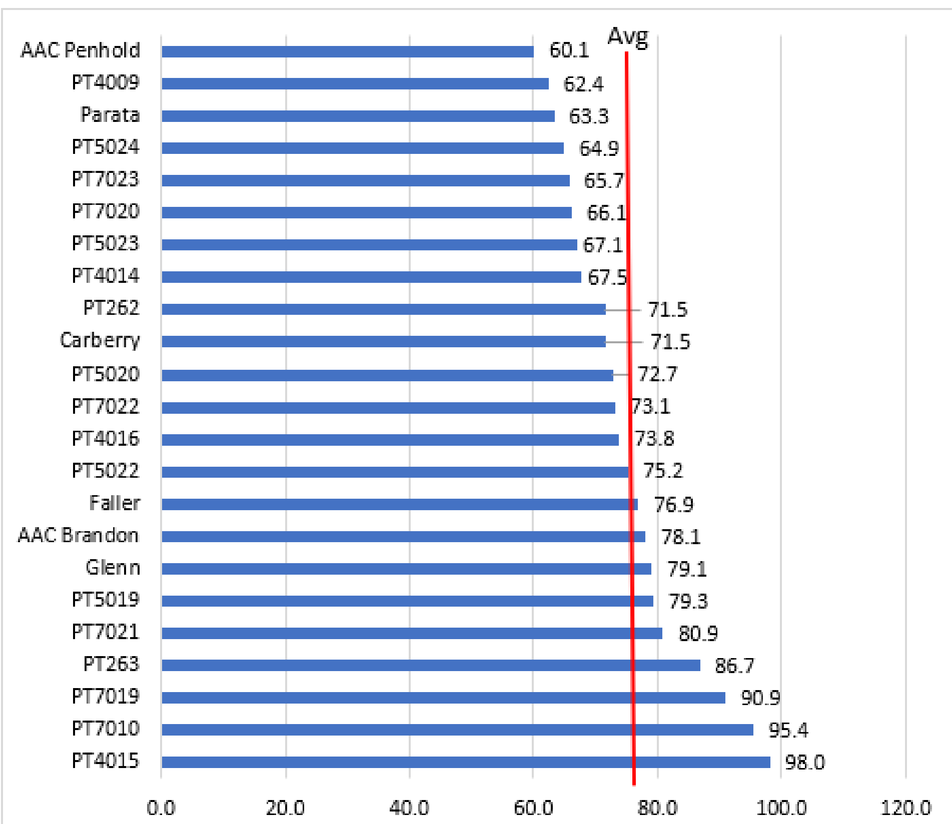
Parkland Coop Wheat Variety Evaluation

Project duration: May 2024 – August 2024
Objectives: To evaluate spring wheat varieties for the Parkland Coop
Collaborators: Dean Spanner – Coordinator, University of Alberta Research Station
Klaus Strenzke – Research Technician, University of Alberta Research Station

Background
The Parkland Cooperative wheat trial is conducted across the Prairies as a resource for wheat breeders to generate data in support of registration of new Canada Western Red Spring varieties. Additional samples taken to test for wheat midge were sent away at the end of July.

Results
The average yield for wheat entries is shown in Figure 1. Numbered (coded) entries are provided for reference only. For more information on the Parkland Coop trial, contact Klaus Strenzke, University of Alberta. The results are for one site-year only, and should be interpreted with caution. Consult a seed guide for multi-site-year data for available varieties.

2024 Roblin Parkland Coop Wheat Yield bu/ac at 13.5% moisture



PT 7014 and 7015 not included because of seeding errors

Materials and methods

Experimental Design: Lattice
Entries: 25 varieties
Repetitions: 3
Seeding: May 8
Harvest: Sep 5

Agronomic information

Previous year's crop: Barley-oat silage
Soil Type: Erickson Clay Loam
Landscape: Rolling with trees to the east
Seedbed preparation: Direct Seeded

Table 2: 2024 Fertility Information

	Available		Added (actual)	Type
N	66	lb/ac	138 lb/ac	46-0-0
P	48	ppm	15 lb/ac	11-56-0-0
K	194	ppm	-	-

Table 3: 2024 Pesticide Application

Crop stage	Date	Product	Rate
Pre-emerge	May 8	Glyphosate	640 ml/ac
		Heat	50 ml/ac
		Merge	500 ml/ac
		Authority	118 ml/ac
In-crop	Jun 14	Axial	480 ml/ac
		Infinity	330 ml/ac

Fruit Demonstration

Established: May 2009
Objectives: To demonstrate varieties of fruits being developed by the University of Saskatchewan
Collaborator: PCDF

Overview

Dwarf sour cherries are the product of crosses, initially begun by Dr. Les Kerr of the University of Saskatchewan, of a cold-hardy cherry from Siberia (*Prunus fruiticosa*) and a sour cherry originating in Europe (*Prunus cerasus*). The use of dwarfing root stock, as well as crosses with other cherry cultivars, has further improved sour cherry lines. The advantage of dwarfing root stock is to force earlier fruiting and to create a more workable tree when harvesting, for both manual and mechanical pickers. The tartness and rich flavour of sour cherries make them ideal for pie filling.


Figure 1: a) dwarf sour cherries (photo credit); b) haskap berries (photo credit).

The haskap berry was introduced to Canada in the late 1960s. New varieties have been developed by the University of Saskatchewan Fruit Program. The berries are similar in taste and texture blueberry, with a tartness closer to raspberry, making them an excellent choice for baking. Haskap plants attract fewer pests than many other prairie fruit crops and require little maintenance. Further, the crop thrives in cold climates, making it a natural fit for our growing region. Haskap is one of the first berries to ripen, and pickers can enjoy the berry beginning in the mid-June.

Results

Both dwarf sour cherries and haskaps can yield prolifically, especially if fertility is maintained and weeds are controlled. However, the fruit is attractive to birds, which can reduce yields. Sour cherries tend to producer more every other year.

Table 1: Dwarf sour cherry and haskap varieties grown at PCDF

Haskap	Cherry
Borealis	Valentine
Tundra	Romeo
9-92	Juliet
9-15	Carmine Jewel
	Cupid

PCDF
Parkland Crop Diversification Foundation

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