Project Identification

1. **Project Title:** Demonstration of Suitable Forage Options for North Central Saskatchewan
2. **Project Number:** 20190377
3. **Producer Group Sponsoring the Project:** Conservation Learning Centre
4. **Project Location(s):** SW 20-46-26 W2 RM #461 (Prince Albert)
5. **Project Start and End Dates (Month & Year):** August 2019 to February 2022

6. Project Contact Person & Contact Details:

A. Brooke Howat
Temporary Manager
Box 1903
Prince Albert, SK
S6V 6J9
info@conservationlearningcentre.com
306-960-1834
*Robin Lokken (manager) is on maternity leave.

B. Ryan Scragg
BOD Chair
ryan_scragg@hotmail.com
306-961-2240

Objectives and Rationale

7. Project objectives:

To provide a demonstration for local producers that allows them to observe and compare different species of forages side by side. To test the suitability of perennial ryegrass for use in north-central Saskatchewan, which could help to reduce clubroot levels where present.

8. Project Rationale:

Five years ago, the Conservation Learning Centre seeded a forage demonstration. This demonstration generated interest from local producers, most notably at the CLC 2018 Field day. On multiple occasions, local farmers returned to observe the demonstration, which helped inform their seeding decisions. This demonstration was one of the most visited trials in recent years. Due to the age of the demonstration, there was a need to replace it with a new forage demonstration on site.

In addition to serving as a variety demonstration for forage and livestock producers, this demonstration could help inform canola farmers of solutions to help manage clubroot if it were detected. Seeding grass forages, such as perennial ryegrass, in field entranceways and clubroot-infested patches is recommended in Saskatchewan to help reduce the spread of clubroot. Perennial ryegrass is a non-host plant that could reduce the spore levels of the pathogen responsible for causing clubroot, *Plasmodiophora brassicae.* The root exudates of perennial ryegrass are believed to stimulate germination of clubroot-causing spores but do not allow for multiplication or formation of new spores, effectively 'baiting' the spores. This forage grass could help decrease soil spore levels, which is a significant benefit as spores can remain dormant in the soil for over 15 years without the presence of a host species (Ahmed et al., 2011 and Friberg et al., 2006). Perennial ryegrass could be a good forage to include in an integrated

clubroot management program, where it would be used to seed entrance ways and patches where clubroot has been present. With the increasing spread of clubroot within the province, perennial ryegrass was a forage of interest to include in this demonstration.

Friber H., Largerlof, J., and B. Ramert. 2006. Usefulness of nonhost plants in managing *Plasmodiophora brassicae.* Plant Pathology, 55: 690-695.

Ahmed, H.U., Hwang, S.F., Strelkov, S.E., Gossen, B.D., Peng, G., Howard, R.J., and G.D. Turnbull. 2011. Assessment of bait crops to reduce inoculum of clubroot (*Plasmodiophora brassicae*) of canola. Can J. Plant Sci. 91:545-551.

Methodology and Results

9. Methodology:

This trial was arranged as a randomized complete block design with two replicates of 33 treatments, consisting of various forage species and varieties. The grasses and legumes were split into blocks. A full treatment list can be found in table 1.

Table 1. Treatment list of different forage species and varieties in the forage demo.

Trt #	Grass Crops	Trt #	Legume Crops
1	Perennial ryegrass - Tetrasweet	16	Alfalfa (Algonquin)
2	Perennial ryegrass - Toronto	17	Alfalfa (Vision)
3	Meadow Bromegrass (AAC Maximus)	18	Alfalfa (AC Grazeland)
4	Meadow Bromegrass (Common Meadow)	19	Alfalfa (Robust)
5	Meadow Bromegrass (MBA)	20	Alfalfa (Perfection)
6	Hybrid Bromegrass (AC Knowles)	21	Alfalfa (Response WT)
7	Timothy (PS LMT)	22	Alfalfa (Rugged)
8	Hybrid Bromegrass (Succession Hybrid Brome)	23	Alfalfa (Instinct)
9	Timothy (Climax)	24	Alfalfa (Assalt)
10	Smooth Bromegrass (Carleton)	25	Alfalfa (Able)
11	Smooth Bromegrass (AC Rocket)	26	Birdsfoot trefoil (Bull)
12	Crested wheatgrass (Kirk)	27	Cicer milkvetch (Oxley II)
13	Crested wheatgrass (common crested wheatgrass)	28	Alfalfa (VR Total)
14	Timothy (Barpenta)	29	Sainfoin (Nova)
15	Tall fescue (Coutenay)	30	Sainfoin (AC Mountainview)
		31	Annual (Crimson clover)
		32	Annual (Berseem clover)
		33	Annual (Beehappy Phacelia)

Table 2. Additional information for forage demonstration.

Legal Land Location	SE 19-46-26-W2 RM 461
Coordinates of Corners	N53°01.745' W105°45.369' N53°01.755' W105°45.376' N53°01.734' W105°45.420' N53°01.745' W105°45.427'
Soil Temperature at Seeding	8.4°C
Soil Type	Clay loam
Soil Zone	Black

Glyphosate was applied to prepare the site of the trial in the fall of 2019. The trial area was disced in the fall of 2019 and rototilled prior to seeding in the spring of 2020. The plots were 2 m by 10 m and seeded by a Fabro plot seeder with 10-inch row spacing. All plots were seeded May 18, 2020 at a depth of 0.5-0.75 inches. Based on soil tests, nitrogen was mid-row banded at 70 lb/ac and phosphorous seed placed at 40 lb/ac on grass plots. No seed treatments or pre-emergent herbicides were used. The grassy forages were mowed and a weed stamper was used to spot apply Glyphosate mid-season. Percent cover was determined by measuring one meter in the front and back of each plot on July 21, 2020, and again on Aug 14, 2020.

10. Results

Soil Test Results

Soil tests indicated that N levels were medium, and P levels were very low (Table 3). Sulfur levels were high with over 120 lb/ac available in the top 15 cm. Ca and Mg levels were high and Na levels were medium. Salts were high with 1.13 mm ho/cm available in the top 15 cm.

Table 3. September 9, 2019 soil test results.

Depth	N	P	K	Cl	S	B	Zn	Fe	Mn	Cu	Mg	Ca	Na	OM	pH	CCE	Salts
cm	lb/ac	ppm	ppm	lb/ac	lb/ac	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%		%	mm ho/cm
0 – 15	20	4	227	4	120+	0.7	1.25	66.1	4.6	0.37	791	3103	113	5.8	6.3	0.1	1.13
15 – 30	16			9	120+										6.6		1.12
0 – 30	36																

Weather

The spring and summer at the CLC saw adequate precipitation compared to past years (Table 4). Temperatures throughout the growing season were slightly cooler than in past years but similar to 2019. May and June were colder than the historical average. The first fall frost occurred earlier than normal on September 8th (-3.6°C), and another hard frost occurred on September 16th (-5.3°C). Precipitation was lower in the fall months relative to the 2019 growing season.

Table 4. Weather conditions in the 2020 growing season at the Saskatchewan Conservation Learning Centre.

	May	June	July	August	September	October	Average/Total
				--- Temperature (°C) ---			
2020	9.2	13.4	17.6	16.1	10.9	1.0	11.4
2019	9.5	15.8	17.4	15.1	11.6	1.0	11.7
2012-2018	11.8	16.1	18.5	17.3	11.6	3.5	13.1
				--- Precipitation (mm) ---			
2020	68.4	91.4	32.2	33.2	31.6	10.1	266.9
2019	30.0	54.4	57.4	16.8	59.6	11.6	229.8
2012-2018	36.4	80.6	96.1	48.0	25.8	26.0	310.5

Stand coverage was higher in the legume forages compared to the grass forages (Table 5). Emergence and growth in the grasses may have been impacted by weed pressure and/or cool spring temperatures. Stand coverage of many of the grassy forages decreased between July 21st and August 14th. Weed stamping glyphosate between the rows in the grassy forage block in an attempt to manage dandelion and thistle populations resulted in some crop death and reduced stand coverage. The legumes were more established at the time of weed stamping and were not as negatively impacted by the glyphosate.

Both perennial ryegrass varieties performed reasonably well in the first year of the demonstration (Table 5). Tetrasweet perennial ryegrass had the highest stand coverage of the grasses on July 21st. Toronto perennial ryegrass was among the highest percent cover in the grasses on July 21st and on August 14th. Coutenay tall fescue had the highest stand coverage of the grasses on August 14th. However, it is difficult to draw conclusions from the August 14th stand coverage assessment given the significant negative impact of the glyphosate weed stamping on the crops. Carleton smooth bromegrass and PS LMT timothy had the poorest coverage overall. All varieties of timothy and smooth bromegrass had poor establishment.

Overall, the legumes had fairly good stand coverage and the impact of the mid-season weed stamping was minimal (Table 5). The annual forages, crimson and berseem clover and beehappy phacelia, had high stand coverage. The clover varieties were the only forages with 100% coverage on August 14th. Several varieties of alfalfa also had high stand coverage, including perfection, response and assalt. Bull birdsfoot trefoil and Oxley III cicer milkvetch had the lowest coverage of the legumes.

Table 5. Stand coverage of forage crops demonstrated.

TRT #	Crop	Mean Forage Stands (% coverage)	
		July 21	Aug 14
1	Perennial ryegrass - Tetrasweet	100	60
2	Perennial ryegrass - Toronto	70	57.5
3	Meadow Bromegrass (AAC Maximus)	50	50
4	Meadow Bromegrass (Common Meadow)	70	47.5
6	Hybrid Bromegrass (AC Knowles)	75	35
7	Timothy (PS LMT)	23	12.5
8	Hybrid Bromegrass (Succession Hybrid Brome)	25	32.5
9	Timothy (Climax)	30	12.5
10	Smooth Bromegrass (Carleton)	23	5
11	Smooth Bromegrass (AC Rocket)	28	12.5
12	Crested wheatgrass (Kirk)	30	15
13	Crested wheatgrass (common crested wheatgrass)	40	25
14	Timothy (Barpenta)	30	22.5
15	Tall fescue (Coutenay)	68	65
16	Alfalfa (Algonquin)	80	87.5
17	Alfalfa (Vision)	70	72.5
18	Alfalfa (AC Grazeland)	70	75
19	Alfalfa (Robust)	78	80
20	Alfalfa (Perfection)	88	90
21	Alfalfa (Response WT)	85	87.5
22	Alfalfa (Rugged)	63	60
23	Alfalfa (instinct)	75	95
24	Alfalfa (Assalt)	75	97.5
25	Alfalfa (Able)	53	77.5
26	Birdsfoot trefoil (Bull)	30	37.5
27	Cicer milkvetch (Oxley II)	23	30
28	Alfalfa (VR Total)	73	87.5
29	Sainfoin (Nova)	60	62.5
30	Sainfoin (AC Mountainview)	73	77.5
31	Crimson clover	95	100
32	Berseem clover	85	100
33	Beehappy Phacelia	95	97.5

11. Conclusions and Recommendations

Establishment in the grass forages suffered from cool spring temperatures, significant weed pressure, and herbicide damage from a mid-season spot application of glyphosate. Application of a post-emergent herbicide may have helped manage weed populations. Both varieties of perennial ryegrass performed well in the first year of this demonstration. Establishment of the timothy and smooth bromegrass in particular was poor. The grasses will likely become more established and compete better with weeds next year, allowing us to produce more meaningful data.

The legume forages had good stand coverage overall and seemed less affected by weed pressure and herbicide damage. The annual forages in particular had good establishment. Perfection, response, and assalt alfalfa performed especially well. Bull birdsfoot trefoil and Oxley III cicer milkvetch had the worst establishment of the legumes.

12. Acknowledgements:

The Conservation Learning Centre graciously acknowledged the Ministry's support through signage directly in field with the project, verbally during the Field Day and on the Field Day agenda handed out to all visitors.

13. Abstract:

This trial aims to demonstrate a variety of different forage crops available in the region and test the suitability of perennial ryegrass for growth in north-central Saskatchewan – a crop that could help manage the spread of clubroot. In the first year of the demonstration, establishment of the forages suffered from cool spring temperatures, weed pressure, and herbicide damage from a mid-season spot application of glyphosate. Stand coverage was good for the perennial ryegrass, several varieties of alfalfa, and the annual forages. The timothy, smooth bromegrass, bull birdsfoot trefoil and oxley III cicer milkvetch had poor coverage.