

## ADOPT FINAL REPORT - Project #20090440

### Project Identification

1. **Project Title:** Nutrient and Yield Effect of Bale Grazing on Hay Fields
  2. **Project Number:** 20090440
  3. **Producer Group Sponsoring the Project:** Saskatchewan Forage Council (SFC)
  4. **Project Location(s):**
    - Biggar/Herschel area, SK – Leam Craig
  5. **Project start and end dates:**
    - October 2009 - October 2011
  6. **Project contact person & contact details:**
    - Janice Bruynooghe – Saskatchewan Forage Council  
PO Box 1715, Outlook, SK S0L 2N0  
p 306.867.8126      e [jbruynooghe@saskforage.ca](mailto:jbruynooghe@saskforage.ca)
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### Objectives and Rationale

#### 7. **Project objectives:**

The objective of this project was to demonstrate and quantify anecdotal evidence that bale grazing can improve the nutrient profile and forage yield of hay stands by measuring forage yield before and after bale grazing as well as looking at the length of time effects may persist.

#### 8. **Project Rationale:**

Many forage/livestock producers have hay stands that lack nutrients and consist mostly of smooth brome grass. These hay stands are generally poor yielding. Producers are always interested in cost effective ways to improve the yield of these stands. In recent years, some livestock producers have been using bale grazing as a cost-effective winter feeding option and have noticed that subsequent hay yields on the area where bale grazing took place are greatly improved.

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### Methodology and Results

#### 9. **Methodology:**

The demonstration was set up in October of 2009 using a grid of brome/alfalfa large round bales set out every 40 feet (see picture of site, on November 4, 2009 in Appendix A). This placement coincides with recommendations suggested by Saskatchewan Agriculture. The treatment was set up in a hay field as described below:

- A ten year old stand of smooth brome grass with very little alfalfa (4 acres) with an adjacent site (6 acres) where bale grazing did not take place

Although soil sampling and analysis costs were not approved for this ADOPT project, the project leaders were able to have soil samples analyzed by a lab at the University of Saskatchewan for no cost. For this reason, soil sample analysis will be included in the results for this project. Initial soil samples were collected on November 4, 2009 prior to bale grazing in the winter of 2009/2010. Soil samples (depth of 0-6 inches) were taken from three locations in the hay field (lower, mid and upper slope locations) to be used as a baseline comparison for post-bale grazing soil samples.

The site was bale grazed from April 4 - 21, 2010 by 318 yearlings. This site was not bale grazed during the winter of 2010-2011, so that the nutrient level and yield effects can be measured following only one year of bale grazing.

Grab samples of forage material were taken from two locations in the bale grazed area and two locations in the non-bale grazed area on July 15, 2010 for plant tissue testing. Forage clippings were also taken on July 27, 2010 at three locations (upper, mid and lower slope) on the bale grazing area and the non-bale grazed area for forage yield estimates and quality analysis. On the bale grazed area, additional clippings were taken from areas that corresponded to centres of two bales, perimeter of two bales and two between-bale locations. All clippings were taken prior to any defoliation by haying or grazing in 2010. Forage clippings were taken again in July of 2011 for forage yield and quality estimates. In 2011 it was less apparent where bales had been placed, so rather than taking samples from the bale centre, perimeter and between bale locations, an average yield from three locations was used as a sampling method.

Soil samples were conducted in the same manner as previously described (for November, 2009) on July 15, 2010, October 22, 2010 and July 21, 2011 on the bale grazed area. A cost/benefit analysis of this production system was also compiled as part of the final results for this demonstration project.

## 10. Final Results

### Soil Results

#### ADOPT Bale Grazing Demo - Soil Samples

Sampling Date	N			P		
	Lower	Mid	Upper	Lower	Mid	Upper
Nov 4/09*	12.8	17.7	22.7	6.2	6.6	2.7
July 15/10	56	21	73	19	31	48
Oct 22/10	48	43	64	17	11	20
July 21/11	5	5	11	17	9	22

\*Prior to bale grazing. Other samples are all post-bale grazing on the site.

Potassium and sulfur were also monitored as part of the soil testing analysis. Through all sampling dates there was a surplus of potassium (>600 lbs/acre). There were no changes noted in sulfur content over the period of this project.

### Plant Tissue tests

#### ADOPT Bale Grazing Demo Site – Plant Nutrient Levels

Nutrient	Bale Grazed*	No Bale Grazing*	Sufficient**
N (%)	3.87	2.34	2.5
P (%)	0.29	0.18	0.3
K (%)	2.48	1.31	2.5

S (%)	0.26	0.12	0.2
Ca (%)	0.34	0.31	0.3
Mg (%)	0.19	0.16	0.2
Cu (ppm)	13.51	8.38	6
Fe (ppm)	98.04	144.5	50
Mn (ppm)	58.70	63.33	40
Zn (ppm)	38.67	17.84	25
B (ppm)	7.37	3.57	2

\* Based on clippings taken July 15, 2010

\*\*Based on recommendations from ALS Labs

### Forage Quality

#### ADOPT Bale Grazing Demo Site – Forage Quality

Nutrient	2010*		2011**	
	Bale Grazed	No Bale Grazing	Bale Grazed	No Bale Grazing
CP (%)	15.0	8.3	15.5	6.9
ADF (%)	35.5	32.1	31.9	32.7
NDF (%)	59.7	55.3	57.5	58.9
TDN (%)	60.4	62.1	62.3	61.8
Ca	0.27	0.40	0.56	0.23
P	0.19	0.21	0.17	0.14
Mg	0.15	0.21	0.24	0.11
K	2.33	1.28	2.17	1.27
Na	0.01	0.02	0.05	0.03

\* Based on clippings taken July 27, 2010

\*\*Based on clippings taken July 21, 2011

### Forage Yield

#### ADOPT Bale Grazing Demo Site – Forage Yield

Area	2010 Yield (kg/ha)	2011 Yield (kg/ha)
No Bale Grazing	1267	1319
Bale Grazed (average of 3 locations)	5094	5155
<i>Centre of bale</i>	6385	-
<i>Perimeter of bale</i>	5073	-
<i>Between bales</i>	3825	-

Based on these results, it appears that bale grazing does indeed affect the soil and plant nutrients of an area post bale grazing. Soil analysis results showed that major soil nutrients (N and P) were increased on the bale grazed area through the summer and fall of 2010. By July of 2011, soil N was lower than pre-bale grazing levels. This is likely due to the lush growth of the forage on the site during 2010 and 2011 and the ability of the smooth brome grass to utilize soil nitrogen. Potassium levels were still above pre-bale grazing levels in July of 2011.

Plant tissue testing conducted during the summer following bale grazing (2010) revealed that plant nutrient levels for several elements were deficient or marginal where no bale grazing had occurred. For example nitrogen was marginal and phosphorus, potassium and sulphur were deficient on the non-bale grazed area. Magnesium and zinc were also deficient in the plant tissue from the non-bale grazed area.

By comparison, the plant tissue sample from the bale grazed area showed an increase in most plant nutrients with all classified as sufficient, or very nearly sufficient. Increased levels of zinc and magnesium in the plant tissue samples from the baled grazed areas are not explained by additions from the manure or bale residues but rather may be a result of healthy plants with more vigorous roots that were better able to absorb these micro nutrients from the soil.

Both 2010 and 2011 were wet growing seasons. For example by mid-July of 2010, more than 17 inches of rain had been received at this site therefore moisture would not have been a limiting factor for forage growth. Forage clippings showed that yield on the bale grazed area was greater than the non-bale grazed area. This effect was noted at all three sampling locations (bale centre, perimeter of bales and between bales) in 2010. On average in 2010 there was a four-fold yield increase on the area that was bale grazed compared to the area that had no bale grazing. Increased yield on the bale grazed area carried through to 2011 where average yield on the bale grazed area was 5155kg/ha as compared to only 1319 kg/ha on the area that was not bale grazed.

In addition to the increased yield, protein levels from the forage in the bale grazed area in 2010 were 15%, while protein levels on the area where no bale grazing occurred were 8.3%. This positive effect on forage quality carried through to 2011 where protein levels on the bale grazed area average 15.5% while protein levels on the area where no bale grazing occurred were 6.9%.

Please refer to Appendix A for pictures from this demonstration site.

### **Cost/Benefit Analysis**

To look at the cost/benefit of bale grazing on a hay field, the cost associated with placing bales and grazing in the area was compared to the benefit of improved yields. The table below shows the estimate of costs associated with this practice and the expected revenues associated with hay yields experienced at this demonstration site. Information provided by the producer cooperator regarding time and logistics of setting up this bale grazing site was combined with rates from the Farm Machinery Custom Rate Guide (published by Saskatchewan Ministry of Agriculture) to compile these costs. This scenario include a 2 mile haul of bales to the site, bale management of cutting strings and taking them off the site during the feeding period and a price of 2.5 cents per lb of forage.

#### **Economic Analysis of bale grazing on hay field**

##### ***Bale Hauling***

Truck and labour	\$437.44
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##### ***Bale set up in field***

Tractor, loader and labour	\$146.86
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##### ***Bale management***

Equipment and labour	\$40.00
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<b>Total Costs*</b>	<b>\$624.30</b>
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Area	4 acres
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<b>Cost per acre</b>	<b>\$156.08/acre</b>
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##### **Animals**

Calves (600 lbs/calf average)	318
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Grazing days	17
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<b>Cost per calf per day</b>	<b>\$0.12</b>
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##### **Forage Yield**

Increase in yield 2010	3,406 lbs/acre (3827 kg/ha)
Increase in yield 2011	3,414 lbs/acre (3836 kg/ha)
<b>Revenue**</b>	
Additional revenue 2010	\$85.15/acre
Additional revenue 2011	\$85.35/acre
<b>Total additional revenue</b>	<b>\$170.50/acre</b>

\* total costs for 4-acre demo area

\*\* assuming forage yield valued at 2.5 cents/lb

One reason that producers may be interested in bale grazing, are the reduced costs and labour requirements associated with this type of feeding system. As shown in the table above, estimates provided by the producer cooperator result in a cost of \$0.12/calf/day to feed using this project's bale grazing system. Producers should be aware that individual operation costs are unique and should be calculated on an individual farm basis to best reflect actual costs. Those interested in calculating their cost to bale graze may visit the Saskatchewan Ministry of Agriculture website and enter their operation's information into the [Bale Grazing Calculator](#).

Work done by the Western Beef Development Centre over a three year period (2002-2004) showed a cost of \$0.92/cow/day when animals are fed in a yard site. This cost takes into account fuel, machinery repairs and depreciation, labour (paid and unpaid), etc. Over this same period, costs averaged \$0.57 once unpaid labor was removed. This cost may be a better comparison to the cost estimated by the producer cooperator in this project (\$0.12). However, even when leaving out unpaid labor, it is clear that in this demonstration bale grazing had a distinct advantage as a winter feeding system when compared to feeding in the yard. For more information on how WBDC costs were calculated, please refer to the [Saskatchewan Cowherd Yardage Costs](#) Factsheet on the WBDC website.

This economic analysis shows that the producer's cost of setting up this bale grazing project has been recovered in the form of additional revenue (from increased hay yields) and in fact provided an extra \$14.42/acre (total additional revenue = \$170.50/acre less total costs = \$156.08/acre). As this project was monitored for two years, we are able to show there was a positive effect on forage yield for the two year period following bale grazing when compared to an ungrazed site. Due to the timeframe for this project, we are unable to predict how long these effects will continue. Any additional yield increases in subsequent years would also create economic benefits for this producer.

#### **Extension/Promotion Activities:**

Extension activities completed included:

- Sign placed at the site
- Co-operator presentation regarding this project at a Beef and Forage Day held on December 2, 2009 in North Battleford (flyer was included with progress report)
- Field day at the site on August 4, 2010, held in conjunction with the Southern Eagle Creek Watershed group with approximately 25 in attendance (see Appendix B for field day flyer)
- This site was also included in a field day held on August 9, 2011, held in conjunction with the Southern Eagle Creek Watershed group (approximately 30 in attendance) (see Appendix B for field day flyer).
- Article on this demonstration site was included in a number of local northern SK newspapers in August, 2010 (was included with progress report)
- Article on this demonstration site was included in the Saskatchewan Forage Council's [December 20, 2010 issue of the Forage and Livestock eNews](#).

- Article on this demonstration site was included in a number of local northern SK newspapers in September, 2011 (see Appendix B)
- Information regarding this project has been included on the Saskatchewan Forage Council website (average hits of 1100+ per month).
- Co-operator will be presenting results of this project at an upcoming conference (“Capturing Feed Grain and Forage Opportunities”) in Strathmore, AB on November 22-23, 2011.

It must be noted that the most valuable aspect of this demonstration project has been the peer-to-peer discussions that were facilitated at field days, presentations and through extension materials. It is anticipated that this information will continue to be of value to producers into the future. With this demonstration of how bale grazing can improve the yield and nutrients on existing hay fields, producers will be better equipped to evaluate the potential of this practice on their own operation.

## 11. Conclusions and Recommendations

The purpose of this project was to look at the nutrient and yield effects of bale grazing on an existing smooth bromegrass hay field. Yield and nutrient effects were monitored for two growing seasons following one winter of bale grazing to determine the effect on the yield and soil nutrient profile in the area. A general cost comparison between bale grazing and yard site feeding was also included.

The project was successful in comparing the effects of bale grazing on the yield and nutrient profile of the hay field. Forage yields on the bale grazed demonstration site were approximately four times greater than those on the adjacent non-bale site in both 2010 and 2011. Plant tissue testing conducted during the summer following bale grazing (2010) revealed that plant nutrient levels for several elements were deficient or marginal where no bale grazing had occurred. By comparison, the plant tissue sample from the bale grazed area showed an increase in most plant nutrients with all classified as sufficient, or very nearly sufficient. Soil nutrients were also positively affected with both nitrogen and phosphorus increasing in the year following bale grazing. Nitrogen levels were back to pre-bale grazing levels (measured in 2009) or slightly below following two growing seasons. This is likely due to the fact that the smooth bromegrass on this site was very effective in using the soil nitrogen to support the lush, vigorous growth noted in both years.

Forage quality on the bale grazed area was also improved when compared to the non-bale grazed area. In particular, crude protein from forage on the bale grazed area was nearly double in 2010 and was more than double that of the non-bale grazed area in 2011.

An economic comparison shows some of the potential advantages of bale grazing as a feeding system when compared to feeding in a yard site. Bale grazing costs for this project (as estimated by the producer co-operator) were estimated at \$0.12/animal/day. This is in contrast to \$0.92/cow/day (with paid and unpaid labour accounted for) or \$0.57/cow/day (with unpaid labour not included in the cost) for yard site feeding. Before considering bale grazing as a method of feeding animals, producers must consider a number of factors including accessibility of the site, type of animals to be fed, access to shelter, etc. Producers interested in further information on bale grazing as a winter feeding method should visit the [Saskatchewan Ministry of Agriculture](#) website. It was also shown that the full cost of setting up this bale grazing site was recovered in the form of additional revenue from two years of increased forage yield. In fact, a comparison of costs and revenue also showed there was a profit of \$14.42/acre following two years post-bale grazing on the area.

Reduced productivity is a major concern with older grass stands and this project has demonstrated that bale grazing on an older hay stand may be an effective way to improve yields. Forage quality was also

improved on the area where bale grazing took place. In addition to the forage yield and quality improvements following bale grazing, there was a cost advantage to feeding cattle with this type of system.

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## **Supporting Information**

### **12. Acknowledgements**

The Ministry's support for the project was acknowledged on signage displayed at each site and in all communication/extension materials.

Producer co-operator support has also been noted all project site signage and in all communication/extension materials.

In-Kind support was provided by Saskatchewan Ministry of Agriculture Regional Forage Specialists to oversee the demonstration site.

### **13. Appendices**

Appendix A – Site Photos

Appendix B – Project Field Days and Communications

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## **Abstract**

### **14. Abstract/Summary**

With the assistance of ADOPT funding, the Saskatchewan Forage Council collaborated with a producer co-operator to demonstrate the effects of bale grazing on an existing hay stand, providing producers with a practical look at a potential method to increase forage productivity and reduce wintering costs. At the project site located near Biggar, SK, bale grazing occurred on a predominantly smooth brome grass hay field with an adjacent non-bale grazed area as comparison. Bale grazing took place during April of 2010 by 318 calves followed by no bale grazing on this site during the winter of 2010-2011. Forage quality and yield as well as soil nutrients were monitored during 2010 and 2011. Forage yields on the bale grazed site were approximately four times those of the adjacent non-bale grazed site in both 2010 and 2011. Plant tissue testing conducted during the summer following bale grazing (2010) revealed that plant nutrient levels for several elements were deficient or marginal where no bale grazing had occurred. By comparison, the plant tissue sample from the bale grazed area showed an increase in most plant nutrients with all classified as sufficient, or very nearly sufficient. Soil nutrients were also positively affected with both nitrogen and phosphorus increasing in the year following bale grazing. Nitrogen levels returned to pre-bale grazing levels (measured in 2009) or slightly below following two growing seasons. Forage quality on the bale grazed area was also improved when compared to the non-bale grazed area. Bale grazing costs for this project were estimated at \$0.12/animal/day, showing an advantage over average yard site winter feeding costs. This demonstration project site was included in two field days with a total of approximately 55 in attendance. As well, articles and producer presentations facilitated dissemination of results. Before utilizing bale grazing as a method of feeding animals, producers must consider their own unique circumstances including factors such as accessibility of the site, type of animals to be fed, and access to shelter.

## **Finances**

### **15. Expenditure Statement**

Project expenditures are reported in the attached Excel spreadsheet.



**Appendix A – Site Photos**



Bale grazing field and adjacent non-bale grazed field - November 4, 2009



Forage growth in area with no bale grazing – July 21, 2011



Forage growth on bale grazed  
area – July 21, 2011

**Appendix B – Project Field Days and Extension Material**



**Invites you to  
Southern Eagle Creek Watershed / ADOPT  
Field Day**

**When** – Wednesday August 4<sup>th</sup>, 2010

**Time** – 9 am (finish mid afternoon)

**Location** – Starting at Leam Craig’s Farm

From Rosetown: 22 miles North on Highway 4 & 8 miles West on Ruthilda Road

From Biggar: 14 miles South on Highway 4 & 8 miles West on Ruthilda Road

**Tour will include:**

Nutrient and Yield Effects of Bale Grazing

Annual Forage Species Demonstration

Eco Buffer Demonstration Site

Aerial Mapping Presentation

Guest Speaker

Lunch will be provided

Please RSVP to Lexie Adamson by Monday August 2<sup>nd</sup>

[eaglecreekwatershed@hotmail.com](mailto:eaglecreekwatershed@hotmail.com) (email)

463-2748 (w)

831-6009 (c)

For more information on field day or Southern Eagle Creek Watershed  
call Lexie or Leam Craig (948-2801)



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Agricultural Demonstration of Practises and Technologies





# **SOUTHERN EAGLE CREEK WATERSHED AND SASKATCHEWAN FORAGE COUNCIL INVITE YOU TO A SUMMER FIELD DAY**

**When** – Tuesday, August 9<sup>th</sup>, 2011

**Time** – 9 am to 5pm

**Location** – Starting at Rosetown, Sk. – Be there by 9am  
(Meeting at the Rosetown Rink, North side on town on Highway 4)

### **Tour will include:**

Establishing Cicer Milkvetch Using Trampling from Bale Grazing Adopt Project  
Nutrient and Yield Effect of Bale Grazing on Hay Fields Adopt Project  
Modifying and Revegetating Waterway (water run) Demo  
Eco Buffer Demonstration Adopt Project  
A Comparison of Chemical and Biological Control of Scentless Chamomile in  
Mixed Alfalfa/Grass Hay and Pasture Stands Adopt Project  
There will also be guest speakers throughout the day

### **Lunch will be provided**

\*\*Please dress accordingly as we will be walking through demo sites

**Please RSVP to Lexie Adamson by Tuesday August 2<sup>nd</sup>  
eaglecreekwatershed@hotmail.com (email)**

**463-2748 (w)**

**831-6009 (c)**



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**Agricultural Demonstration of Practises and Technologies**

## **Bale Grazing Project Update – Sept 2011**

**By Glenn Barclay PAg, Regional Forage Specialist**

For two years Saskatchewan Agriculture forage specialists have conducted a demonstration project looking at the impact bale grazing has on old smooth brome grass fields. This demonstration project is not a true scientific project as it would require much more sampling and testing than we could accomplish. However, we did find some interesting trends.

The project co-operators were Leam and Nathan Craig who ranch south west of Biggar. The site is on sandy loam soil in the dark brown soil zone. They set up brome-alfalfa bales in the fall of 2009 on a four acre paddock. These bales were set approximately 40 feet apart which works out to about 25 bales per acre. 318 yearlings grazed the bales from April 4<sup>th</sup> to April 21<sup>st</sup> of 2010.

The components we looked at on this site were the yield, soil nutrient levels and forage quality.

2010 was a wet year. Our site had over 17 inches of rain. Our mid July yield from the non bale grazed area was 1,129 lbs per acre. The lush areas of bale grazing produced 6,058 lbs per acre. We then took an average of the entire area using weights from the center of the bale, the perimeter of the bale and between the bales to produce an average for the field as a whole. We found this yield was 4,362 lbs per acre.

2011 rainfall was over 9 inches at this site. On July 21<sup>st</sup> 2011 we sampled the site. We decided to divide the plot into two different yield areas. The estimated area unaffected by bale grazing was 42% while 58% had increased forage volume due to the bales. The unaffected area had a yield of 1,178 lbs per acre. The bale grazed areas had an average yield of 4,603 lbs/acre.

Soil macro nutrients (Nitrogen, Phosphorus, Potassium and Sulphur) showed some interesting changes. We soil sampled at the upper, mid and lower slope positions for all four macronutrients. In October 2009 before any bale grazing occurred Nitrogen averaged 17.7 lbs per acre at these three positions. It changed to 50 lbs per acre in July 2010 as the Nitrogen was released by the manure and bale residues. In October 2010 the Nitrogen levels averaged 51.6 lbs per acre. In July 2011 the levels had dropped to 7 lbs per acre. The reason for this is that Smooth brome is very efficient at using up nitrogen in the soil. Nitrogen release for 2012 will be weather dependent but a yield drop from 2010 and 2011 would be expected since there would be less residual nitrogen entering the system. Our co-operators observed on their other old bale grazing sites wet weather stimulated extra grass growth. They were surprised in 2010 when seven year old bale grazing sites had noticeable yield increases again when they thought old residual soil nutrients were used up. They did not notice yield increases on these same sites in drier years prior to 2010.

Phosphorus levels were 5.2 lbs per acre initially and have remained relatively stable at 16 lbs per acre since October 2010. Potassium soil levels were at sufficient levels before bale grazing. There are quite large supplies of potassium in bales and manure so these levels were maintained. Soil Sulphur levels remained the in 2010 and 2011 since there is little sulphur in bales and manure and grass does not use much sulphur.

In mid July 2010 we collected brome tissue samples from lush areas where bales stood and from areas of the pasture where no bale grazing occurred. The plant nutrient levels for several elements were deficient or marginal where no bale grazing had occurred. Fresh tissue samples from bale grazing areas showed we had more vigorous plants as all plant nutrient levels had increased and all nutrients were classified as sufficient. This test was not conducted in 2011.

The last component we looked at was feed quality. Brome grass protein level from lush bale grazed areas was 15.0% and from non bale grazed areas 8.3% in 2010. This trend continued in 2011; 15.5%

protein in the bale grazed area compared to 6.9% in the non grazed area. It was also observed these feed samples had 20% more moisture than the non treated areas even though they were sampled the same day. It is no wonder animals are attracted to these areas. For both years fibre levels and energy levels in the feed tests stayed similar regardless if there was bale grazing or not. Nutrients such as calcium, phosphorus, Magnesium and Sodium in feed samples fluctuated but no specific trends were observed.

The project was funded by the ADOPT (Agricultural Demonstration of Practices and Technologies) Program. If you want further information on this project contact Glenn Barclay, Forage specialist at North Battleford 446 – 7650 or John Hauer, Forage Specialist at Kindersley 463 – 5507. Our co-operators, Leam and Nathan Craig, can be reached at 948 – 2801.