LaBrie Bale Grazing Project Summary

For cow calf producers in the prairies area, overwintering of cows is a major cost to the production system. Time and machinery costs are a major component of those overwintering expenses. Many attempts to reduce those costs have been successfully used by producers, bale grazing being one of those techniques and the focus of this project.

If one is thinking about implementing a bale grazing program there are a few considerations that should be part of the planning process.

- The species in the pasture mix should have at least one rhizomatous grass present, such as smooth brome, quack grass, Kentucky bluegrass. Rhizomatous species have a greater ability to grow through the mat of forage residue remaining on the soil surface.
- Zones of productivity can vary throughout any give pasture. One of the objective should be to improve the nutrient and organic matter content of the soil in these least productive areas. Bales should be concentrated in these area.
- Water courses and riparian areas should be avoided in order to minimize nutrient leaching and or run off during snow melt.
- Cattle should not be allowed to take shelter in riparian areas.
- Are wind breaks necessary?
- A 30 – 40 foot separation of bales is considered ideal for nutrient distribution.
- Fiberglass or rebar speared into the bales is an alternative to drilling holes into frozen ground for electric fencing.

The most definitive research on the subject of bale grazing was done by Paul Jungnitsch for his Master's degree and published in 2008. He compared bale grazing with cattle being fed in a dry lot. He looked at nutrient distribution, nutrient recovery in soil and forage, pasture forage response, cattle performance and economics.

His results showed:

- The system by which cattle were overwintered had little influence on cattle weight and condition.
- Economic calculations favored winter feeding on pasture by 25% over dry lot, and by 56% when the value of additional nutrients were included.
- Soil distribution patterns of nitrogen and potash in the pasture feeding system were highly variable, with N varying from 10 to 558 lb./a. and K from 640 to 5644 lb./a.
- The average gain over the unmanured control was 104 lb/a. for nitrogen and 1078 lb./a. for potash.
- Soil phosphorous level did not increase significantly.

Plant nitrogen (N) which is almost totally in the form of protein, is highly digestible by the cow. Over 80% is initially absorbed by the cow. The non-digestible N is excreted in the dung. The N that is absorbed is used to make meat or milk protein and a small amount is rerouted to feed microbes in the gut, with the balance being excreted in the urine.

Dry lot feeding of cattle over winter can result in very high losses of N. A research project in Nebraska showed only 9 to 19% of the excreted N remained when the manure was removed. Low temperatures will limit volatilization until spring. N losses from winter feeding of cattle has not received much attention from the research community.

Phosphorous (P) has many functions in livestock. These include, cellular energy transfer and mainly teeth and bone structure which also act as a reservoir in times of deficiency. The phytase enzyme, produced in the rumen, aid in the digestion of phosphorous. Proper P utilization depends on an adequate supply of vitamin D. The remaining P is excreted 98% in the dung with remainder in urine. P does not volatilize and therefore remains in the manure.

Potassium (K) is required in the diet of beef cattle at about 0.6% being the major cation in the intracellular fluid and playing a major role in several bodily functions. It is involved in the acid-base regulation, osmotic pressure maintenance, nerve impulse transmission, muscle contraction and oxygen and carbon dioxide transport. Excess K is 91% removed from the body in the urine. It does not volatilize and moves slowly through the soil.

Calcium (Ca) is the most abundant mineral in the body and is an integral part of bone and nerve tissue. Most forages are a good source of calcium although some cereal forages and corn silage can be marginal to low. Grain is a poor source of Ca. The calcium to phosphorous ratio is important and should not be less than 1:5 to 1 and no greater than 7:1.

Sulphur (S) is found in adequate supply in most local feeds. Where there is high sulphate content in water, it can interfere with the absorption of other nutrients. Copper and selenium are particularly of concern. **Copper** plays a role in the functioning of the immune system and **selenium** deficiency can result in white muscle disease in calves. It can also reduce reproductive efficiency in cows, and lower the quality of colostrum available to the calf.

Project Description

This project took place on the farm of Holly and Sean LaBrie west of Didsbury in the black soil zone. Prior to beginning this project, the LaBries had been winter feeding their cows on pasture by take bales out to the cows on a one or two day program. The cows transitioned to the bales as the pasture grass became less palatable. This trial involved four permanent paddocks with the bales being placed out approximately every 21 days using a tractor and bale wagon. Hay, greenfeed and straw were utilized in the proportion of 1/3 each with a 15% molasses protein tub and loose mineral / salt mix available free choice. . Water was about ¼ mile away.

On average 100 pregnant cows were involved, with bale feeding starting late November and finishing mid-June.

Cattle condition was monitored on a regular basis with the ability to change the ration as needed. Cost based on a 1300 pound cow including yardage was calculated at $1.27/cow/day.

When asked about future winter feeding plans the LaBries replied "We have moved to a more traditional bale grazing system where all bales are placed in the fall and a single hot wire is moved every few days to provide access to the allotted amount of feed. We have also moved the bale grazing site to other pastures that were in need of rejuvenation. Bale grazing has given us control of our winter feeding just like our cell grazing has given us control of our summer grazing. Bale grazing is a time and money saver as well as an effective way to increase the productivity of our summer pastures. We will continue to utilize bale grazing in the future."

FORAGE ANALYSIS – SEPTEMBER 2015

Dry Matter Basis	**Control**	**Hay 2011**	**Hay 2012**	**Hay 2013**	**Green Feed 2011**	**Green Feed 2012**	**Green Feed 2013**
Average Yield (lbs./ac)	1,104	1,888	1,389	1,603	2,245	1,389	1,960
CP (%)	9.60	9.30	10.50	13.40	11.30	9.10	9.00
Ca (%)	0.69	0.62	0.57	0.84	0.45	0.69	1.00
P (%)	0.08	0.08	0.13	0.12	0.15	0.13	0.10
K (%)	1.13	1.11	1.36	1.24	1.14	1.36	1.01
Mg (%)	0.20	0.16	0.16	0.20	0.13	0.15	0.17
ADF (%)	41.10	37.10	41.00	39.00	40.50	39.10	39.70
NDF (%)	68.90	62.90	66.60	64.70	64.90	64.90	66.00
TDN (%)	57.00	58.00	53.00	55.00	55.00	57.00	56.00
Relative Feed Value	107.00	110.00	95.00	103.00	101.00	107.00	110.00

Forage Analysis Comments

- The crude protein content of the hay is indicative of late cutting. From the ideal harvest time 1% C. P. per week is lost as time advances.
- Availability of soil nitrogen, mineralized organically or provided by fertilizer, will affect the crude protein of hay.
- Straw was also used in the ration. One would expect a C.P. of 4.5 to 5.0%.
- The phosphorous numbers are low, should be 0.18 to 0.2%. This again could be reflective of low P availability from the soil.
- The greater than desirable ADF is indicative of late harvest. Sometimes we have to take what the weather allows us. Ideal ADF for an alfalfa grass hay would be 32 -35%. Cereal silage or greenfeed should have ADF levels between 35 and 40%
- On best quality forage one would expect an ADF to NDF spread of 15 points. The grater spread in this hay indicates an insufficient supply of nitrogen and sulphur. (Adequate soil Sulphur allows nitrogen to be used more efficiently.)

NB It is not our intent to imply that this hay was of poor quality, obviously the cows did well on this ration. We are attempting to demonstrate what the feed analysis can tell us.

Soil Analysis Oct 2015

0-6 inch depth

	Control	**Hay 2011**	**Hay 2012**	**Hay 2013**	**Straw 2011**	**Straw 2012**	**Straw 2013**
Organic Matter (%)	7.60	7.40	8.10	8.90	7.70	10.20	10.70
Nitrate (ppm)	<2	<2	<2	<2	<2	<2	<2
Phos (ppm)	<5	<5	<5	8.00	7.00	7.00	8.00
Potassium (ppm)	184.00	223.00	330.00	311.00	319.00	287.00	308.00
Sulfate (ppm)	5.00	4.00	4.00	5.00	4.00	6.00	10.00
Copper (ppm)	0.50	0.40	0.60	0.60	0.40	0.70	0.90
Iron (ppm)	67.00	30.00	49.00	49.00	41.00	37.00	63.00
Manganese (ppm)	5.60	3.60	6.70	5.50	4.40	4.90	7.40
Zinc (ppm)	3.80	2.20	2.70	2.40	2.80	2.20	2.30

6-12 inch depth

	Control	**Hay 2011**	**Hay 2012**	**Hay 2013**	**Straw 2011**	**Straw 2012**	**Straw 2013**
Organic Matter (%)	5.00	5.90	4.70	5.80	5.80	6.80	7.80
Nitrate (ppm)	3.00	<2	<2	<2	<2	<2	2.00
Phos (ppm)	<5	<5	<5	<5	<5	<5	<5
Potassium (ppm)	100.00	112.00	119.00	133.00	131.00	134.00	129.00
Sulfate (ppm)	3.00	3.00	2.00	3.00	4.00	8.00	13.00
Copper (ppm)	0.40	0.40	0.50	0.50	0.30	0.60	0.60
Iron (ppm)	54.00	28.00	30.00	24.00	37.00	25.00	23.00
Manganese (ppm)	3.90	2.70	3.80	2.80	3.70	2.70	3.00
Zinc (ppm)	2.10	1.00	0.90	0.80	2.10	1.00	1.00

Soil Analysis Comments

- The soil test were take each fall after the soil had started to cool down and bacterial mineralization of nutrients had slowed.
- Soil organic matter (SOM) is the cornerstone of soil health. SOM has been increasing for all treatments even to the extent that we are seeing a modest increase in the 6 – 12 inch profile. This is the means by which carbon is sequestered in our soils. Improved SOM content results in an increase in the ability of the soil to hold water and nutrients, (cation exchange capacity) and helps prevent those nutrients from leaching. Each 1% of SOM can be relied upon to supply 5 -10 pounds

of nitrogen per year through the process of mineralization. As much as half of this will tied up by the microbes in the soil.

- Nitrogen, according to Jim Gerrish, is usually the first limiting nutrient for plant growth in pastures. N is essential for plants to achieve optimum yields. It is also a critical component in the formation of protein by the production of amino acids. Nitrate nitrogen has been consistently low throughout the sampling each fall. It is a concern that yield and protein production are reduced due to an inadequate supply. NO3 is the composition of N. that plants access through their roots. There is also a certain amount of nitrate nitrogen tied up in the bacteria as they break down the organic matter to release the nutrients into the soil. In a previous article, the need for an ideal C: N ratio was discussed. It will take 35 – 45 pounds of N. to produce one ton of grass hay. A nitrogen deficiency can be indicated by a reduced crude protein in the forage. An adequate supply of nitrogen will also improve plant phosphorous uptake.
- Phosphorous (P) is essential for normal plant growth and maturity. P. plays a role in photosynthesis, respiration, energy storage and transfer, cell division and cell enlargement. A lack of soil P can manifest itself as reduced digestibility of the forage.
- Potassium (K) is an essential nutrient and is taken up in significant amounts. There is no other nutrient that can replace it. K. plays a vital role in photosynthesis, is essential in the manufacture of proteins, improves winter hardiness, activates over 80 enzyme systems, controls cell turgor and influences water use efficiency by controlling the stomata in the leaves. It also has a role in strengthening the plants natural resistance to diseases.
- Sulphur (S) is a constituent of proteins and is an enabler of nitrogen uptake. S also helps develop enzymes and vitamins in plants. It also promotes nodulation in legumes. It is also essential for chlorophyll formation although it is not a constituent of chlorophyll.
- Copper (Cu) is essential for the formation of chlorophyll and also acts as a catalyst for several enzymatic reactions.
- All other micronutrients have roles to play in the growth and health of plants, often essential at low rates and toxic at higher levels. It has been our attempt to focus on the nutrients that are most important to the health and production of forages.

In consultation with a forage and beef specialist and another plant nutrition professional we have produced (see below) an ideal soil nutrient profile for comparison with the actual results.

Nutrient	Reported /Actual	Recommended /Ideal
Nitrogen	2 to 3 ppm	25 to 45 lbs. / acre
Phosphorus	< 5 ppm	30 to 35 lbs. / acre
Potassium	100 to 300 ppm	Adequate
Sulphate	3 to 10 ppm	15 to 25 lbs. / acre
Copper	0.4 to 0.8 ppm	8 to 20 ppm
Iron	30 to 60 ppm	Adequate
Manganese	2.7 to 5 ppm	40 to 80 ppm
Zinc	0.8 to 4 ppm	25 to 50 ppm

Future considerations could include:

- The addition of fertilizer that would bring the soil analysis up to approaching the ideal levels. Nitrogen would improve pasture protein production and phosphorous would support legumes which have a tendency to diminish if nodulation is not supported by adequate phosphorous levels.
- Cicer milkvetch and Sainfoin could be added to the pasture as non-bloat legumes to help add additional protein to the grazing program and additional nitrogen to the soil. There are several non-invasive techniques that could be used to accomplish this, one of which would be adding untreated seed to the mineral mix another being the use of a hand held spreader in bale grazed areas. In the first year of a legume stand most if not all of the N that is fixed will be used to support the legume. Mature legumes will fix more N than needed and contribute to the non-legume component in the pasture.

"Using legumes in pastures can provide significant amounts of nitrogen to the total pasture ecosystem. This will contribute to lower operating costs by increasing the production of protein per acre. Legumes can also lead to increased animal performance." *J.Gerrish*

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