Project Identification

1. **Project Title:**
    - 4R Nitrogen Use in Mixed Forage Stands Part 2
2. **Project Number:**
    - 20200493
3. **Producer Group Sponsoring the Project:**
    - Saskatchewan Forage Council
4. **Project Location(s):**
    - Site 1 – Aneroid, SK, RM Auvergne No. 76, LL NW31-09-10-W3, cooperating landowner Richard Marleau
    - Site 2 – Moose Jaw, SK, RM Baildon No. 131, SW19-15-26-W2, cooperating landowner Murray Andrews
    - Site 3 –Spiritwood, SK, RM Spiritwood No. 496, SW23-50-12-W3, cooperating landowner Jonathan Baynes
5. **Project start and end dates (month & year):**
    - Fertilizer spread in May 2021, hay was cut in June/July 2021, soil sampling was completed at one site in November 2021. Due to the dry conditions, two of the soil samples could not be completed in the fall and will need to be done in the spring 2022.
6. **Project contact person & contact details:**
    - Catherine Lang, 306-694-3492, Moose Jaw, SK

Objectives and Rationale

7. **Project objectives:**
    - This projects intention was to demonstrate and compare the benefits of fertilizing old hay stands with both bare urea and nitrogen loss inhibitors (as part of a complete fertility blend). This project is a continuation of Project #20190450 (carried out in the summer of 2020) where we did see a positive response to the nitrogen loss inhibitor products. This project's goal was to see the impact that different soil zones and moisture could have on the stand's response.
8. **Project Rationale:**
    - This project is of interest to Saskatchewan producers since livestock producers are looking to make the most feed with the lowest economic burden. With land prices increasing, it is becoming more important than ever to maximize productivity on the producer's existing land base. Using nitrogen loss inhibitors is not typical in forage fertilizer blends but has shown increased use and positive response in annual grain crop production. If this project demonstrates that the use of these products results in a higher yield and better forage quality, without an economic burden of investing in nitrogen loss inhibitors, the uptake of these products could become the industry standard. The products have a good fit in forage fertilization blends because fertilizer applications on forage stands are almost always applied by broadcasting. In addition, nitrogen loss inhibitors produce less greenhouse gasses than traditional bare urea, so they are better for the environment.

Methodology and Results

9. **Methodology:**

- The project was set up at three sites – Aneroid, Moose Jaw, and Spiritwood. At each site, we were provided with 40 acres of the hay stand that was consistent in terms of topography and plant establishment. These 40 acres were then divided into 10-acre treatments – control (no fertilizer), bare urea, a urease inhibitor product, and a nitrification and urease inhibitor combination product.
- One composite soil test per 40-acre site was completed when the ground thawed (beginning of May) and were sent to A&L labs to be analysed. The complete fertilizer blends were calculated using the soil tests, to target the nutrient removal rate for two tonnes per acre. The recommended fertilizer blend for this removal rate on a mainly grass stand is 75-22-94-10. This calculation was done so that the nutrients that were being removed from the field and the nutrients that were getting returned was on a 1:1 scale. The Spiritwood site was formulated for a slightly higher yield of two and a half tonnes per acre, since the average production in this area is typically higher than 2 tonnes per acre. A blend request was sent to a local Ag retailer and was then spread on the site when conditions allowed (Aneroid – May 6, Moose Jaw – May 18, Spiritwood - May 28).
- Rainfall was recorded in Aneroid and Spiritwood sites using weather data from Saskatchewan Crop Insurance's weather stations in the area, but the Moose Jaw site was recorded in a rain gauge after every rainfall.
- The sites were then monitored until the crop was ready to cut. Some of this monitoring was done by satellite imagery provided by Farmer's Edge. The producers then cut and baled the field when it was ready (Aneroid – cut June 29, baled July 1, Moose Jaw – cut July 12, baled July 14, Spiritwood – cut July 20, baled July 24). Once bales were made, they were weighed to determine the forage yield.
- Forage samples were taken to determine forage quality, and these samples were sent to Central Testing Laboratory in Winnipeg.
- At the Spiritwood site, when the soil had cooled enough (in November) composite soil samples were taken again, but for each 10-acre treatment this time to compare any effects that the nitrogen protected fertilizer had on the soil nutrients. The Aneroid and Moose Jaw sites were too dry to take soil samples and will be tested in the spring of 2022.
- Once the trial was completed and the analysis results were received, an economic analysis was completed.

10. **Results**

- The parameters of this project that we collected were rainfall, forage yield, forage quality, soil composition, and an economic analysis.

    i. In terms of rainfall, there was very low rainfall on all three sites (Aneroid 4.6 inches, Moose Jaw 5.3 inches, and Spiritwood 8.1 inches) so the dry conditions severely impacted plant growth. This explains the results we found regarding low crop yield.

    ii. Satellite imagery was gathered throughout the growing season and measured three metrics on each of the sample sites. Imagery consisted of NDVI (a measure of healthy green vegetation), Scouting (showing areas of high and low NDVI relative to the field average for that day), and Variation (showing all present image bands, including soil, water, and vegetation). Imagery was taken early in the spring, either the day the fertilizer was applied, or the day after, to show the fields were consistent in vegetative biomass. As imagery was gathered into mid-June it was apparent that the control plot was far behind the fertilized treatments in all imagery metrics. On the final imagery pictures, taken days before the fields were cut, there were extremely noticeable difference between the amount of healthy green vegetation of the fertilized treatments as compared to the control plot. Even variations such as when the spreader applied the fertilizer crooked or the borders of the plots between treatments, were clearly shown on these maps. See Appendix A for a summary of these photos.

iii. Forage yield was determined two ways. The Aneroid site was in an extreme drought zone and therefore was not going to produce a viable hay crop. The producer decided that he needed to convert this hay field into pasture for his cattle to have a feed source. Before moving the cattle on, one strip was cut and baled in each trial and the distance between was measured and the resulting bale was weighed. The strips were each 16 ft wide and 2,550 ft long to equal 0.94 of an acre.

The Moose Jaw and Spiritwood sites were calculated differently. The total number of bales per treatment were counted. Four bales per treatment were weighed (approximately 25% of the bales). Weights of the bales were averaged, and that weight was multiplied by the number of bales in the trial. In some cases, the last bale of the trial did not form a complete "normal" sized bale. These smaller bales were each weighed and added onto the total weight calculated for that treatment. The total weight was then divided by the acres of the trial to calculate pounds per acre. To compare these sites appropriately, all values were converted to a dry matter basis.

At the Aneroid site, the control plot yielded 809 lbs/ac, the urea treatment yielded approximately 1,156 lbs/ac (in increase of 43%), the urease inhibitor treatment yielded 1,297 lbs/ac (an increase of 60%), and the urease and denitrification inhibitor treatment yielded 1,254 lbs/ac (an increase of 55%). The bare urea treatment is listed as "approximate" since the bale fell apart while being weighed and they were unable to get an accurate weight.

At the Moose Jaw site, the control plot yielded 1,345 lbs/ac, the urea treatment yielded 2,063 lbs/ac (in increase of 53%), the urease inhibitor treatment yielded 2,062 lbs/ac (an increase of 53%), and the urease and denitrification inhibitor treatment yielded 1,839 lbs/ac (an increase of 37%).

At the Spiritwood site, the control plot yielded 996 lbs/ac, the urea treatment yielded 2,273 lbs/ac (in increase of 128%), the urease inhibitor treatment yielded 2,336 lbs/ac (an increase of 135%), and the urease and denitrification inhibitor treatment yielded 2,343 lbs/ac (an increase of 135%).

The results of forage yield show that no matter what, the yield increased by applying fertilizer. The Spiritwood site showed a high yield response to the additional fertilizer, whereas the Aneroid and Moose Jaw sites saw a response, but not to the same calibre. This is likely due to the extreme drought conditions that were present in these areas. See Appendix B for yield comparison graphs.

iv. Forage samples were collected and sent to Central Testing Laboratory for analysis. This analysis looked at: dry matter (DM), crude protein (CP), calcium (Ca), phosphorus (P), magnesium (Mg), potassium (K), sodium (Na), copper (Cu), iron (Fe), manganese (Mn), zinc (Zn), acid detergent fibre (ADF), neutral detergent fibre (NDF), total digestible nutrients (TDN), net energy lactation, maintenance, and gain, and relative feed value.

At the Aneroid site, the feed quality reports showed some interesting changes between treatments. The bale quality parameters of DM, ADF, and NDF hardly changed. However, there were noticeable changes in the CP with the control at 7% and the fertilized plots ranging from 10.5% to 13%. This is an exponentially high rise in CP which is extremely valuable for animal nutrition. In addition, the TDN rose from 58% in the control to a range of 61.6% to 65% in the fertilized plots. This is also a very dramatic increase and encouraging to see, as many lab results of hay this year displayed lower than average TDN. The increase in both CP and TDN could indicate that the application of fertilizer caused additional alfalfa to grow. The macronutrients of Ca, Mg, P, K, and Na stayed relatively the same. The microminerals of Cu, Fe, Mn, and Zn also stayed unchanged.

At the Moose Jaw site, the feed quality again showed changes between treatments. The bale quality parameters of DM remained unchanged. The CP showed an increase from 9.3% on the control and ranged from 10% to 12% on the fertilized trials. The ADF and NDF changed slightly and inversely, with the NDF rising, but the ADF decreasing. It is speculated that this is a result of more plant material being present and a change in the composition of the plant material. Visibly the fertilized plots contained more alfalfa than the control – there is structural NDF associated with the stems, but there is also less lignin in the leaves. The differences in overall plant composition could explain the inverse, non-typical relationship of ADF and NDF at this site. The TDN also showed an increase from 55.8% in the control to a range of 57.4% to 60% in the fertilized plots. This again could have been due to some additional alfalfa growing from the fertilizer application. The macronutrients of Ca, Mg, P, K, and Na stayed relatively the same. The microminerals of Cu, Fe, Mn, and Zn also stayed unchanged.

The Spiritwood site also followed the same trends, but to a lesser degree. The DM, CP, ADF, NDF, and TDN all showed relatively small changes but not to the same extent as the other two sites. The macronutrients of Ca, Mg, P, K, and Na also stayed relatively the same. The microminerals of Cu, Fe, Mn, and Zn also stayed unchanged.

These results are interesting. In the previous year's trial, all the feed quality results showed very small changes, similar to the trends observed at the Spiritwood site. These results show a huge increase in feed quantity, but a lesser response to feed quality. However, this year both the Aneroid site and the Moose Jaw site saw a positive response to feed quality with the addition of fertilizer, but a lesser response to feed quantity. This may have been due to the timing of cutting at these sites, and that the control plot matured faster than the fertilized plots. The fertilized plots had an observed thicker and healthier plant stand that matured slower than the control, that appeared to go dormant faster in the drought conditions. Overall, these samples are all testing adequate for livestock nutrition. See appendix C for a summary of the feed analysis for all three sites.

v. Soil testing was completed both pre- and post-trial at the Spiritwood site, and only pre-trial at the Moose Jaw and Aneroid sites. Once the ground thaws in the spring of 2022, the post-trial samples will be taken and analysed. The soil samples that were collected before the trial provided the information needed to make the fertilizer blends. Samples were collected as 40-acre composites as there was expected to be no spatial variability on nutrient levels within that 40-acre site. In addition, they gave a baseline of how deficient the soil was in nutrients.

Interestingly, all the sites showed similar values in their pre-trial soil sampling results averaging 3.9% organic matter, 3 ppm Nitrate-Nitrogen, 7 ppm Phosphorus Bicarbonate, 207 ppm Potassium, and 6 ppm Sulphur. These soil test results showed that potassium was sufficient at all the sites, and therefore none was added into the fertilizer blends. Nitrogen, phosphorus, and sulphur results were all low for what the crop needed. The blend was made to use full rates of removal of phosphorus and sulphur and full rate of nitrogen, less the estimated nitrogen release from the organic matter.

Once the trial was completed, repeat composite soil tests were done at the Spiritwood site on each of the 10-acre treatments to determine if the nutrients were all taken up by the crop, or if some built up a bank in the soil for the next year’s crop to access. There was a noticeable increase in phosphorus in the post-trial samples. This is likely because phosphorus is immobile and will be tied up in the soil. The nitrate-nitrogen had the greatest decrease and showed no differences between the treatments. These soils would be extremely deficient in nitrogen for the next growing season. This could be due to no release of nitrogen from the organic matter due to the dry conditions and the microbes unable to break the organic matter down. It also could be due to the Birch effect of the fall moisture causing regrowth to use up available nitrogen later in the year, after the trial was completed but before end of seasons soil samples were taken. See Appendix D for the cumulative soil analysis, both pre and post fertilizing.

vi. The economic component of these results may be the most valuable to producers. If it doesn’t make economic sense to fertilize an existing hay stand, it may be more beneficial to take that stand out of production and re-establish it instead. These economic comparisons are looking at the total costs per acre to apply that fertilizer, the additional pounds of forage that fertilizer produced, and what that works out to as a cost per pound. This can then be compared to the cost of purchasing hay. In the fall of 2020, it was common for the price of hay to be around $0.11/lb, but could range much higher, especially in the south where some reports were $0.18/lb. Please refer to appendix E for the full calculation breakdown.

At the Aneroid site, the costs of fertilizing the forages ranged from $68.53/ac to $71.34/ac. The additional pounds of forage produced caused the cost to be $0.20/lb for the urea, $0.15/lb for the urease inhibitor, and $0.16/lb for the denitrification and urease inhibitor.

The Moose Jaw site had much higher application costs, causing the total costs of fertilizing to range from $92.37/ac to $96.02/ac. The additional pounds of forage produced cost $0.13/lb for urea, $0.13/lb for the sulphur enriched urea, and $0.19/lb for the polymer coated urea.

The Spiritwood site did not show a change in the cost of fertilizer per pound between the different fertilizer products, with all trials resulting in $0.06/lb of additional forage. The costs per acre ranged from $79.72/ac to $83.73/ac, but the increased forage production from the nitrogen loss inhibitors compensated for the increased cost per acre.

Although the economic component did not show the same result, they did however show the same trend; that applying the nitrogen stabilizing products during dry conditions either slightly lowered, or remained the same, for the cost of producing additional pounds of forage.

There were also a few other key takeaways from this analysis. For much of the province, grass hay was selling for $0.11/lb or more. Although some of the sites did have fertilizer costs that were more than $0.11/lb, in those areas the cost of purchasing hay was as high as $0.18/lb due to the extreme drought conditions. It’s also important to remember that the costs of purchasing additional feed does not always include other expenses like: trucking, bringing unwanted noxious weeds onto your land, the costs and time associated with forage re-establishment, and/or the unknown if you will be able to find feed that you can afford. However, since it was a dry year, it is likely that there would have been more yield if there was rain, and therefore more pounds of feed to divide the costs across, bringing the total cost per pound of additional feed down. Also, we are speculating that there will be lots of residual nitrogen at the Aneroid and Moose Jaw sites for the next growing season and are expecting to see that reflected in the soil tests taken in the spring.

11. Conclusions and Recommendations

- From this demonstration we were able to see that fertilizing established forage stands following 4R practices (right source, rate, time, place) can lead to increased forage yields that provide a net positive economic benefit with no negative effects on feed quality. Producers that are looking to maximize productivity on their established forage stands can use these results to build a fertilizer blend that will suit the yield increase they wish to achieve. Let it be noted that the exceptionally dry conditions during this trial likely lessened the difference between the control and the fertilized treatments. If more precipitation was received during the first half of the growing season there would have likely been larger differences between the bare urea and treated urea plots due to increased rates of urea hydrolysis.

- An application has been submitted to continue this project in 2022 at North Battleford/Prince Albert, Saskatoon, Swift Current, Weyburn, and Yorkton, to further expand on these results and demonstrate these practices in other soil zones and precipitation areas. The Agri-Environmental specialists have taken this project on and will look at more environmental effects that 4R fertilizing can have on forage crops.

Supporting Information

12. Acknowledgements

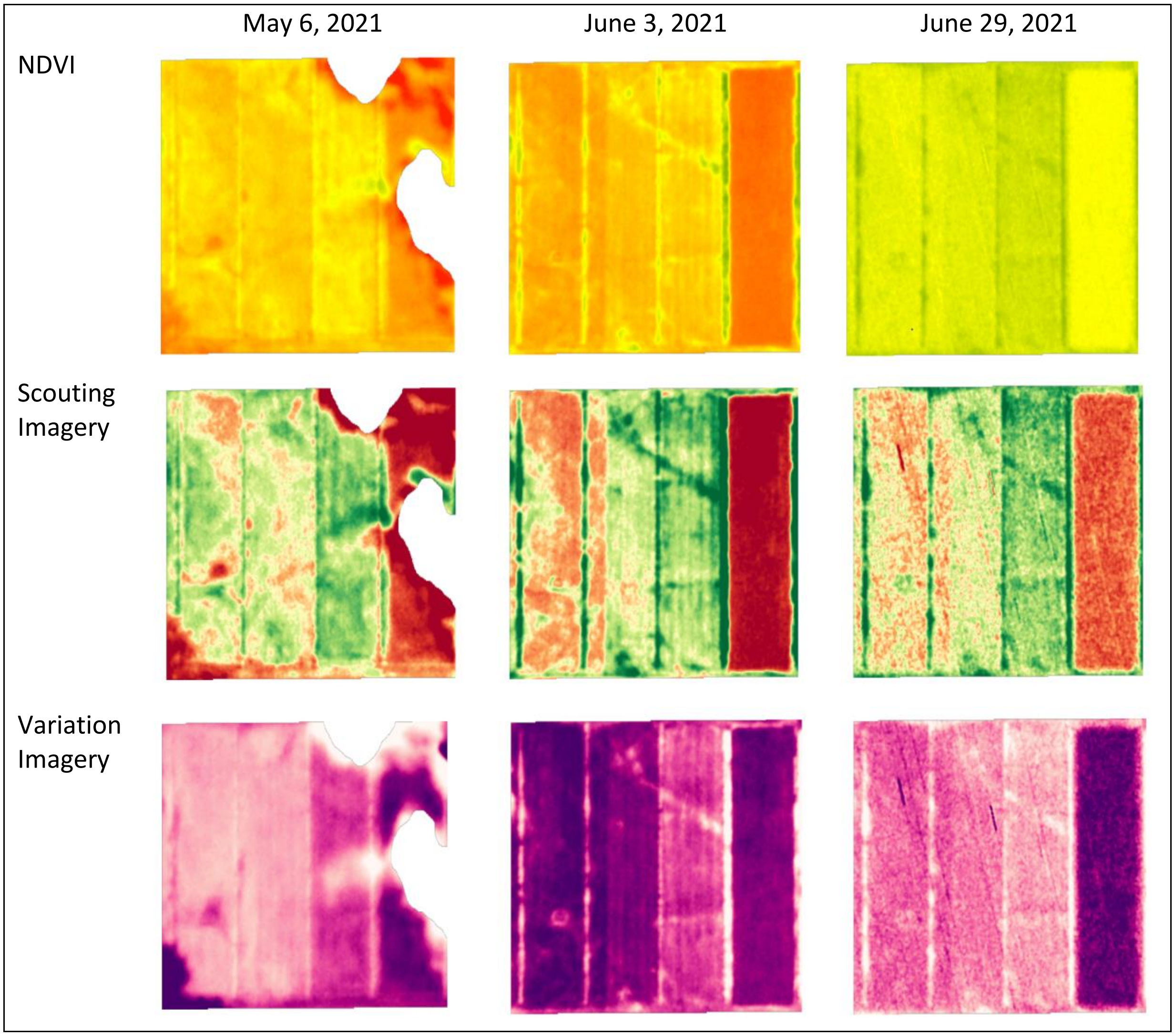
- We would like to acknowledge the Saskatchewan Forage Council, for its partnership on this project, and the Saskatchewan Cattlemen's Association Industry Development Fund for its financial support.

13. Appendices

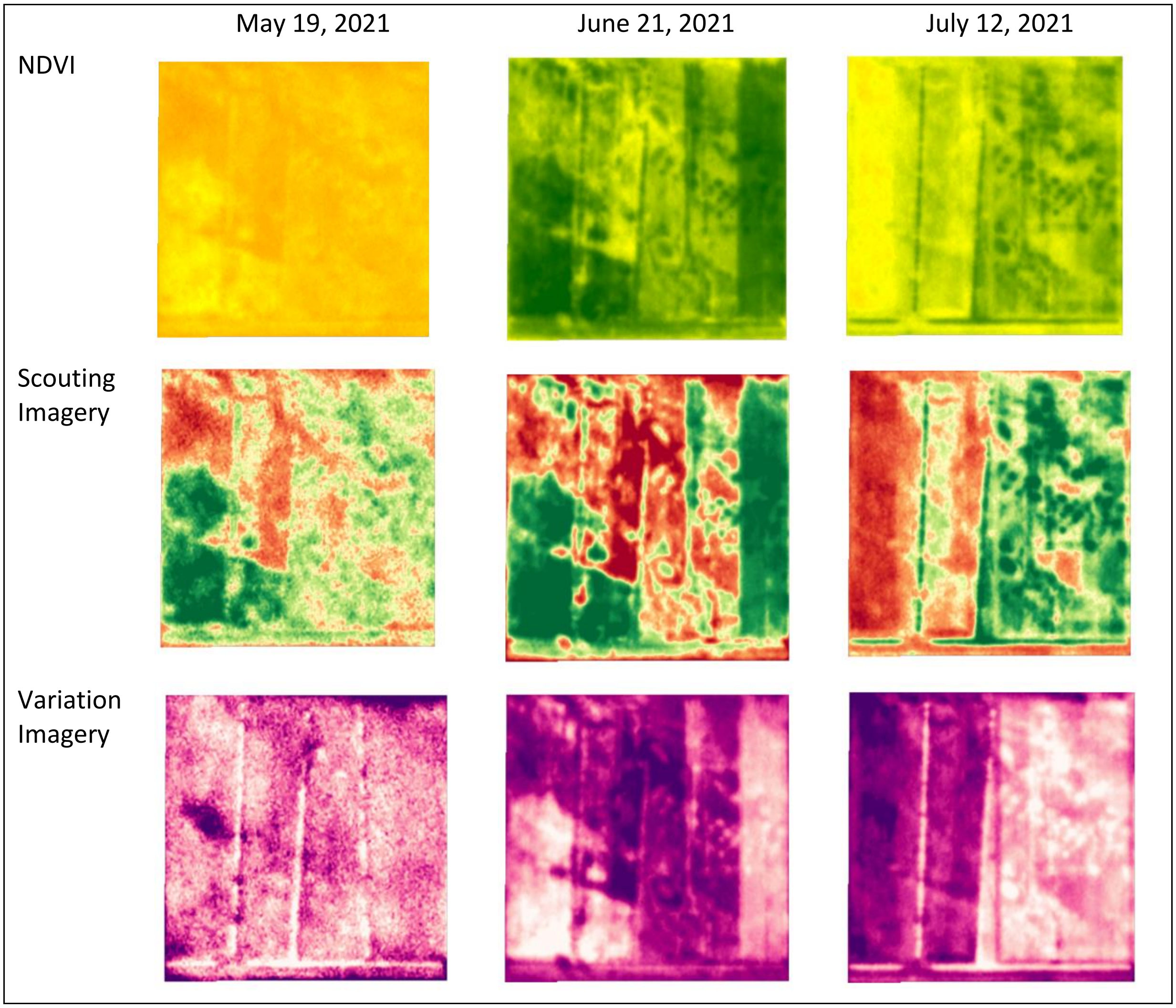
- Each appendices are on their own page below

Appendix A – Satellite Imagery:

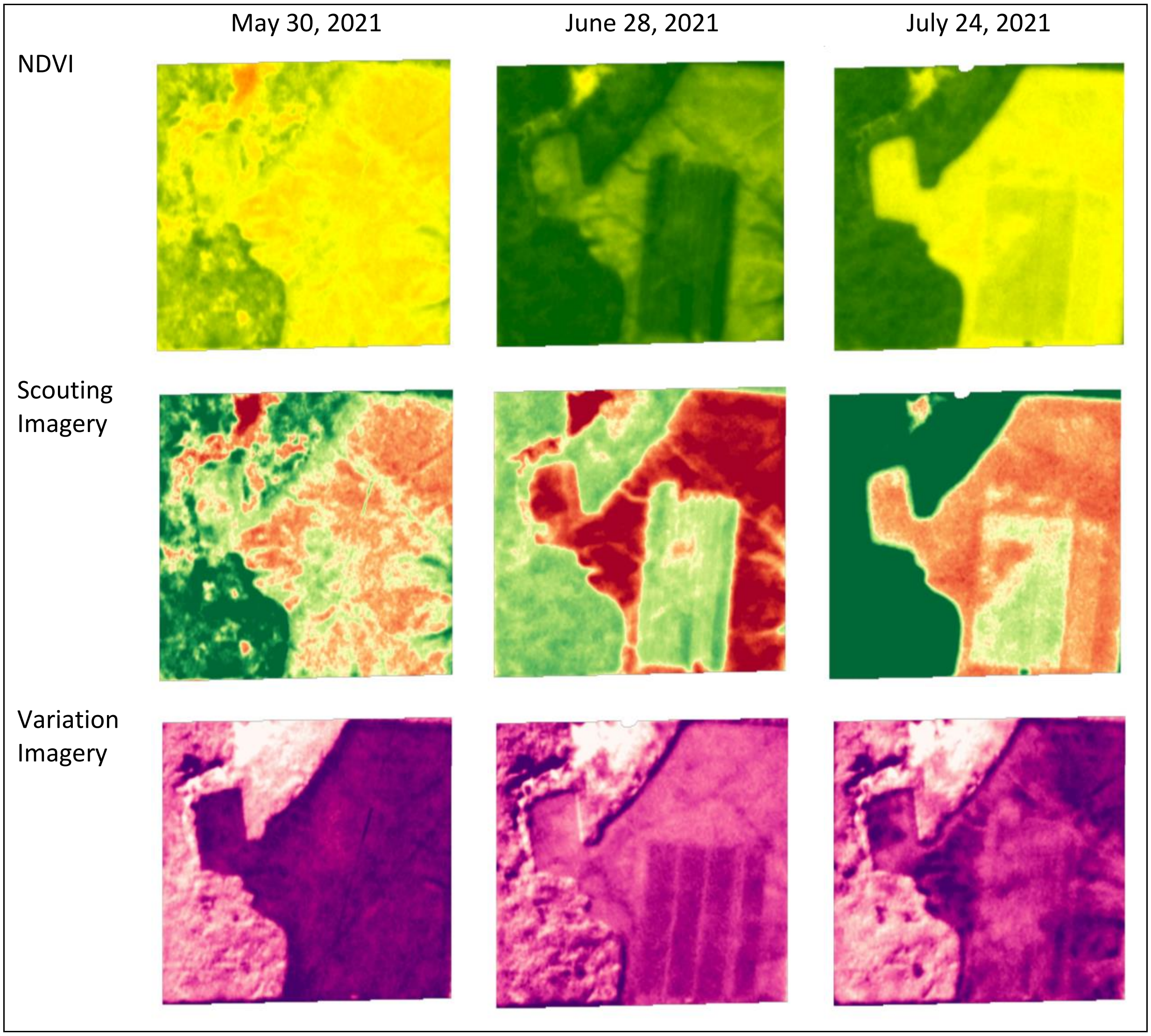
Aneroid Imagery. Treatment order (left to right): Control, urease inhibitor, urease and denitrification inhibitor, and bare urea



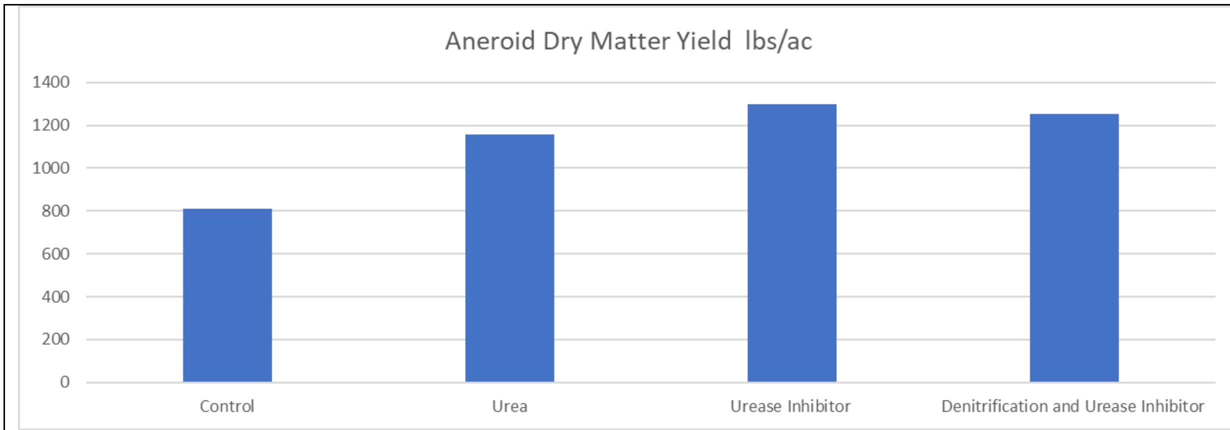
Moose Jaw Imagery. Treatment order (left to right): Control, urease and denitrification inhibitor, urease inhibitor, and bare urea

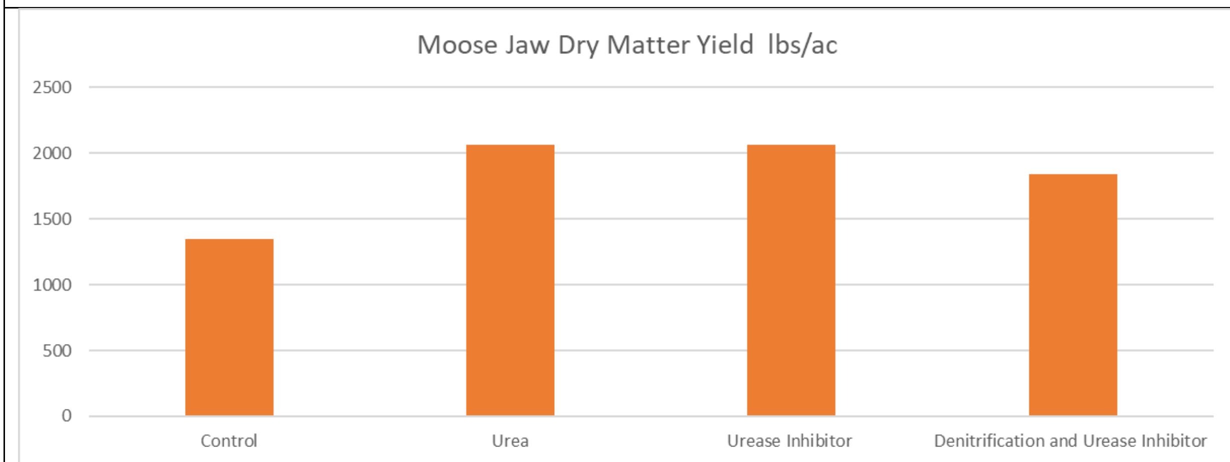


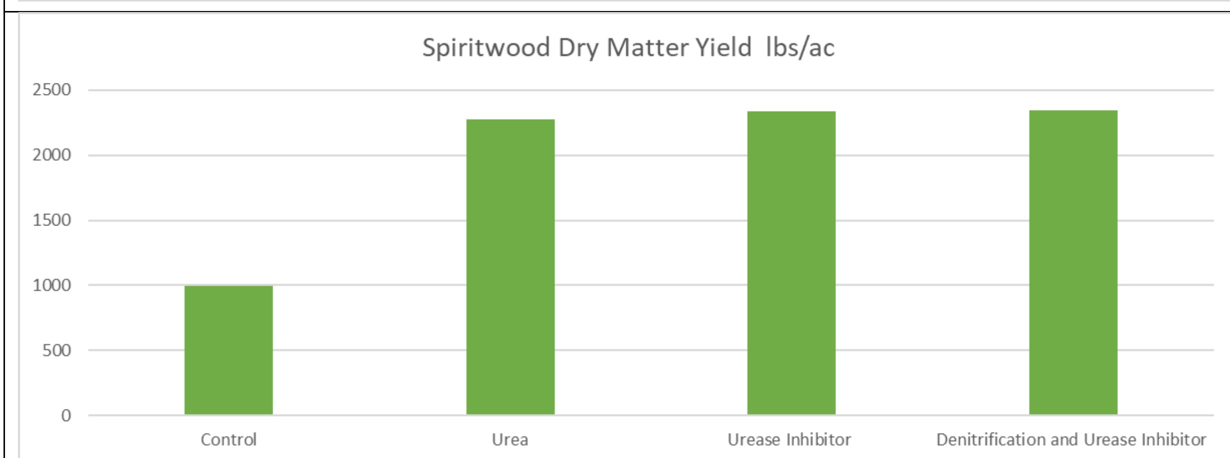
Spiritwood Imagery. Treatment order (left to right): Bare urea, urease inhibitor, urease and denitrification inhibitor, and control



Appendix B – Yield Comparison:







Appendix C – Summary of Feed Quality:

Aneroid Feed Analysis Results. All values (except dry matter) are reported in a Dry Matter basis

	Control	Urea	Urease Inhibitor	Denitrification and Urease Inhibitor
Dry Matter (DM) (%)	91.10	91.03	91.09	91.23
Crude Protein (CP) (%)	7.13	12.96	10.47	12.00
Calcium (Ca) (%)	0.23	0.30	0.28	0.30
Phosphorus (P) (%)	0.13	0.15	0.12	0.13
Potassium (K) (%)	1.05	1.27	1.17	1.23
Magnesium (Mg) (%)	0.08	0.12	0.10	0.11
Sodium (Na) (%)	0.01	0.01	0.00	0.01
Copper (Cu) (mg/kg)	2.05	3.63	2.66	3.16
Iron (Fe) (mg/kg)	88.21	85.22	100.24	106.23
Manganese (Mn) (mg/kg)	24.30	36.53	34.98	33.84
Zinc (Zn) (mg/kg)	12.80	22.57	17.73	17.14
Acid Detergent Fiber (ADF) (%)	37.90	31.30	34.64	33.55
Neutral Detergent Fiber (NDF) (%)	63.17	57.41	58.40	60.06
Total Digestible Nutrient (TDN) (%)	58.15	65.20	61.63	62.79

Moose Jaw Feed Analysis Results. All values (except dry matter) are reported in a Dry Matter basis

	Control	Urea	Urease Inhibitor	Denitrification and Urease Inhibitor
Dry Matter (DM) (%)	93.25	93.31	93.26	93.43
Crude Protein (CP) (%)	9.30	11.24	11.98	10.13
Calcium (Ca) (%)	0.84	0.69	0.75	0.57
Phosphorus (P) (%)	0.11	0.14	0.13	0.12
Potassium (K) (%)	1.84	2.24	2.15	2.10
Magnesium (Mg) (%)	0.16	0.15	0.16	0.14
Sodium (Na) (%)	0.01	0.01	0.01	0.01
Copper (Cu) (mg/kg)	3.71	5.25	4.80	3.86
Iron (Fe) (mg/kg)	71.55	87.92	94.37	82.11
Manganese (Mn) (mg/kg)	53.05	60.99	63.07	70.11
Zinc (Zn) (mg/kg)	11.52	14.76	14.94	14.97
Acid Detergent Fiber (ADF) (%)	40.07	36.98	36.29	38.58
Neutral Detergent Fiber (NDF) (%)	56.57	58.01	58.39	60.17
Total Digestible Nutrient (TDN) (%)	55.83	59.13	59.87	57.42

Spiritwood Feed Analysis Results. All values (except dry matter) are reported in a Dry Matter basis

	Control	**Urea**	**Urease Inhibitor**	**Denitrification and Urease Inhibitor**
Dry Matter (DM) (%)	88.34	87.36	89.45	86.92
Crude Protein (CP) (%)	7.37	8.11	8.54	8.58
Calcium (Ca) (%)	0.31	0.29	0.29	0.29
Phosphorus (P) (%)	0.09	0.10	0.13	0.13
Potassium (K) (%)	1.15	1.34	1.35	1.38
Magnesium (Mg) (%)	0.10	0.11	0.11	0.10
Sodium (Na) (%)	0.00	0.00	0.00	0.01
Copper (Cu) (mg/kg)	3.66	3.71	3.66	3.78
Iron (Fe) (mg/kg)	99.77	112.67	72.71	92.84
Manganese (Mn) (mg/kg)	28.18	27.06	30.50	36.18
Zinc (Zn) (mg/kg)	21.27	20.76	22.39	21.57
Acid Detergent Fiber (ADF) (%)	35.40	34.82	34.13	32.90
Neutral Detergent Fiber (NDF) (%)	56.46	58.84	57.64	55.98
Total Digestible Nutrient (TDN) (%)	60.82	61.44	62.17	62.42

Appendix D – Summary of Soil Analysis

Aneroid soil test report, condensed.

	Spring (Pre-Fertilizer)	Control	Urea	Urease Inhibitor	Denitrification and Urease Inhibitor
Organic Matter (%)	2.3				
Phosphorus Bicarbonate (ppm)	12				
Potassium (K) (ppm)	334				
Magnesium (Mg) (ppm)	648				
Calcium (Ca) (ppm)	1610				
pH	6.6				
Sulfur (S) (ppm)	6				
Nitrate Nitrogen (ppm)	6				
Sodium (Na) (ppm)	25				

Moose Jaw soil test report, condensed.

	Spring (Pre-Fertilizer)	Control	Urea	Urease Inhibitor	Denitrification and Urease Inhibitor
Organic Matter (%)	1.5				
Phosphorus Bicarbonate (ppm)	6				
Potassium (K) (ppm)	154				
Magnesium (Mg) (ppm)	220				
Calcium (Ca) (ppm)	1000				
pH	6.4				
Sulfur (S) (ppm)	5				
Nitrate Nitrogen (ppm)	1				
Sodium (Na) (ppm)	7				

Spiritwood soil test report, condensed.

	Spring (Pre-Fertilizer)	Control	Urea	Urease Inhibitor	Denitrification and Urease Inhibitor
Organic Matter (%)	4	4.5	5.3	4.4	3.9
Phosphorus Bicarbonate (ppm)	4	7	7	6	8
Potassium (K) (ppm)	132	140	115	112	113
Magnesium (Mg) (ppm)	380	259	338	339	234
Calcium (Ca) (ppm)	1800	1390	1750	1610	1330
pH	6.3	6.3	6.3	6.4	6.5
Sulfur (S) (ppm)	6	7	7	7	8
Nitrate Nitrogen (ppm)	3	1	1	1	1
Sodium (Na) (ppm)	10	17	16	17	16

Appendix E – Economic Analysis:

Aneroid economic analysis

	Fertilizer	Additive	Equipment Rental	Total costs	Difference from no fertility	Cost/additional pound
Control	$0	$0	$0	$0		
Urea	$58.53/ac	$0	$10/ac	$68.53/ac	347 lbs	$0.20/lb
Urease Inhibitor (Agrotain)	$58.53/ac	0.8 L total $2.37/ac	$10/ac	$70.90/ac	488 lbs	$0.15/lb
Urease and Denitrification Inhibitor (Neon Air)	$58.53/ac	0.8 L total $2.81/ac	$10/ac	$71.34/ac	445 lbs	$0.16/lb

Moose Jaw economic analysis

	Fertilizer	Additive	Equipment Rental	Total costs	Difference from no fertility	Cost/additional pound
Control	$0	$0	$0	$0		
Urea	$71.28/ac	$0	$21.09/ac	$92.37/ac	718 lbs	$0.13/lb
Urease Inhibitor (Nitrolizer)	$71.28/ac	0.9 L total $3.65/ac	$21.09/ac	$96.02/ac	717 lbs	$0.13/lb
Urease and Denitrification Inhibitor (Neon Air)	$71.28/ac	0.9 L total $3.26/ac	$21.09/ac	$95.63/ac	494 lbs	$0.19/lb

Spiritwood economic analysis

	Fertilizer	Additive	Equipment Rental	Total costs	Difference from no fertility	Cost/additional pound
Control	$0	$0	$0	$0		
Urea	$68.34/ac	$0	$11.38/ac	$79.72/ac	1,277 lbs	$0.06/lb
Urease Inhibitor (Agrotain)	$68.34/ac	0.9 L total $4.01/ac	$11.38/ac	$83.73/ac	1,340 lbs	$0.06/lb
Urease and Denitrification Inhibitor (Anvol)	$68.34/ac	0.7 L total $3.63/ac	$11.38/ac	$83.35/ac	1,347 lbs	$0.06/lb

Abstract

14. Abstract/Summary

- Rejuvenating an established forage stand with a fertilizer application (instead of terminating and reseeding) can prove to be an economically feasible practice. This project aimed to demonstrate that fertilizing for a yield goal of two bales per acre using 4R practices (right source, rate, time, place) with bare urea or enhanced efficiency fertilizers could increase yields and have positive economic benefit without sacrificing any nutritional quality. Soil samples showed all sites were deficient in soil nutrients and fertilizer application rates targeting the two bale per acre yield goal showed yield increases in a range of 43-128% (mean 75, n=3) for bare urea and 37-135% (mean 79, n=6) with enhanced efficiency products.

Finances

15. Expenditure Statement

- Expenditure Statement included in Excel Spreadsheet.