New Brunswick Soil & Crop Improvement Association Inc.
2-150 Woodside Lane Fredericton, NB E3C 2R9
Tel: 506-454-1736 Fax: 506-453-1985 www.nbscia.ca

Tantramar Community Pasture to Demonstrate the Benefits of Improved Pasture Management C2021-0034-Y3

Objectives

The main objective of the project is to demonstrate the pasture productivity gains that can be achieved with the use of rotational grazing in New Brunswick on the degraded soils that dominate the majority of the land base managed by the New Brunswick beef sector. The secondary objective is to validate increases in soil health on New Brunswick pastures as a result of rotational grazing management.

Summary

As part of the project, the Tantramar pasture has been able to establish six paddocks for rotational grazing and install four new ponds as cattle water sources. The data collected as part of this project indicated that neither of the two treatments applied on the Tantramar pasture resulted in consistently improved yield, quality or revenue. This indicates that a permanent rest period set by time may not be the best way to manage your pastures. Rest and graze periods in an ideal situation should be determined by forage production, with cattle moves and clipping being performed in response to forage growth. This project did not result in any significant changes in soil health parameters and illustrates the need for a better understanding of how we should monitor changes in soil health parameters.

Conclusion

As a result of this project, the Tantramar pasture has been able to establish six paddocks for rotational grazing and install four new ponds as cattle water sources. The data collected as part of this project indicated that neither of the two treatments applied on the Tantramar pasture resulted in consistently improved yield, quality or revenue. This indicates that a permanent rest period set by time may not be the best way to manage your pastures. Rest and graze periods in an ideal situation should be determined by forage production, with cattle moves and clipping being performed in response to forage growth. This project did not result in any significant changes in soil health parameters and illustrates the need for a better understanding of how changes in soil health parameters should be monitored. If this project were to be repeated, I would recommend a third treatment where forage within the grazing cages was clipped in response to forage growth each time forage reaches a height of 8-12 inches.

Pâturage communautaire de Tantramar pour démontrer les avantages d'une meilleure gestion des pâturages C2021-0034-Y3

Objectifs

L'objectif principal du projet est de démontrer les gains de productivité des pâturages qui peuvent être réalisés grâce à l'utilisation du pâturage tournant au Nouveau-Brunswick sur les sols dégradés qui dominent la majorité des terres gérées par le secteur bovin du Nouveau-Brunswick. L'objectif secondaire est de valider l'amélioration de la santé des sols dans les pâturages du Nouveau-Brunswick grâce à la gestion du pâturage tournant.

Résumé

Dans le cadre du projet, le pâturage Tantramar a pu établir six enclos pour le pâturage tournant et installer quatre nouveaux étangs comme sources d'eau pour le bétail. Les données recueillies dans le cadre de ce projet n’indiquent qu’aucun des deux traitements appliqués au pâturage de Tantramar ne s'est traduit par une amélioration constante du rendement, de la qualité ou des revenus. Cela indique qu'une période de repos permanente fixée dans le temps n'est peut-être pas la meilleure façon de gérer vos pâturages. Dans une situation idéale, les périodes de repos et de pâturage devraient être déterminées par la production de fourrage, les déplacements du bétail et le fauchage étant effectués en fonction de la croissance du fourrage. Ce projet n'a pas entraîné de changements significatifs dans les paramètres de santé du sol et illustre la nécessité de mieux comprendre comment nous devrions surveiller les changements dans les paramètres de santé du sol.

Conclusion

Grâce à ce projet, le pâturage de Tantramar a pu établir six parcelles pour le pâturage tournant et installer quatre nouveaux étangs comme sources d'eau pour le bétail. Les données recueillies dans le cadre de ce projet n’indiquent qu’aucun des deux traitements appliqués au pâturage de Tantramar ne s'est traduit par une amélioration constante du rendement, de la qualité ou des revenus. Cela indique qu'une période de repos permanente fixée dans le temps n'est peut-être pas la meilleure façon de gérer vos pâturages. Dans une situation idéale, les périodes de repos et de pâturage devraient être déterminées par la production de fourrage, les déplacements du bétail et le fauchage étant effectués en fonction de la croissance du fourrage. Ce projet n'a pas entraîné de changements significatifs dans les paramètres de santé du sol et illustre la nécessité de mieux comprendre comment les changements dans les paramètres de santé du sol devraient être surveillés.

C2021-0034-Y3: Tantramar Community pasture to demonstrate the benefits of improved pasture management.

Submitted By: New Brunswick Soil and Crop Improvement Association

Submitted To: New Brunswick Department of Agriculture Enabling Agricultural Research and Innovation Program

Date: February 11, 2021

1. Project Title

Tantramar Community pasture to demonstrate the benefits of improved pasture management.

2. Project Team

The project team will consist of the following individuals:

1. Zoshia Fraser, New Brunswick Soil and Crop Improvement Association: Project Oversight
2. Matt Beal, Tantramar Community Pasture: Manager
3. Joseph Folkins and Mallareigh Coffin Summer Students
4. Cedric MacLeod, Canadian Forage and Grassland Association: Project Oversight support to NBSCIA
5. Adam Campbell, Ducks Unlimited Canada: Head Conservation Delivery Atlantic Region
6. John Duynisveld, AAFC: Contract Technical Advisor

3. Summary

The main objective of the project is to demonstrate pasture productivity changes as a result of rotational grazing in New Brunswick on the degraded soils that dominate the majority of the land base managed by the New Brunswick beef sector. The secondary objective is to validate ant short term changes in soil health on New Brunswick pastures as a result of rotational grazing management. As part of the project, the Tantramar pasture has been able to establish six paddocks for rotational grazing and install four new ponds as cattle water sources. The data collected as part of this project indicated that neither of the two treatments applied on the Tantramar pasture resulted in consistently improved yield, quality or revenue. This indicates that a permanent rest period set by time may not be the best way to manage your pastures. Rest and graze periods in an ideal situation should be determined by forage production, with cattle moves and clipping being performed in response to forage growth. This project did not result in any significant changes in soil health parameters and illustrates the need for a better understanding of how we should monitor changes in soil health parameters.

4. Introduction

The Maritime Beef Sector Growth Strategy has identified a significant opportunity to grow the size and profitability of the Maritime Beef Sector using enhanced herd and forage management practices. While the region boasts a significant land base available for grazing and forage production, the adoption of high-performance, sustainable management practices have been lacking due to several factors including an ageing demographic and holdover fallout from the discovery of Bovine spongiform encephalopathy. A new generation of beef farm operators have increasingly populated Maritime beef sector meetings in recent years, and have shown a desire and willingness to adopt new management practices that can simultaneously enhance productivity, profitability and sustainability. One of these management practices is the implementation of rotational grazing systems.

Friesen, 2014., in a review of pasture management research conducted in Manitoba showed that total dry matter production increased from 942 lb DM/acre/year under continuous grazing to 2462 lb DM/acre/year under intensive rotational grazing, a 261% increase in productivity. While this represents an extreme case, it exemplifies the productivity increases that can be achieved with managed intensive grazing over

continuously grazed pastures, which is typically pegged at 25-100% depending on the ecozone (arid versus temperate).

The Tantramar Community pasture encompasses roughly 1800 acres of marshland soils, 750 acres of which are generally available for use throughout the grazing season. The remaining 1050 acres are generally available for grazing in mid-late summer and could be upgraded to season-long grazing with investment in enhanced drainage and grazing management infrastructure. During the summer of 2019, the pasture accommodated 400-head of livestock with the majority of the dry matter intake coming from the 750 acres of higher productivity land. Assuming a moderate increase in stocking density achieved in year-1 following the implementation of a rotational grazing management regime, the pasture could accommodate an additional 112 animals. If the increased carrying capacity were assumed to be mature cows, the total increased economic activity from the pasture in year-1 would be: 112 calves @ $1,000/head = $112,000. If the 1050 acres of low productivity pasture could be enhanced to provide another 25% increase in carrying capacity, this increase in economic output could be effectively doubled. Given the 1,000s of acres of marshland soils across the Maritime region that are currently being continuously grazed without consideration of management intensive grazing the opportunity to enhance the profitable production of high-quality beef products is significant.

In addition to the direct economic growth opportunities afforded by the results of the project, the quantification of soil health benefits from the adoption of advanced grazing management principles will create a powerful narrative for the Provincial agriculture sector and the Governments of Canada and New Brunswick. Consumers are increasingly aware of the impact that agriculture has on the environment and seeking empirical evidence that agricultural producers are doing what they say and saying what they do. This project will highlight the significant economic and environmental benefits that can be accrued with expansion in the beef herd and increased productive sustainability in the management of New Brunswick marshland grasslands.

5. Objectives of Project

1. The main objective of the project is to demonstrate the pasture productivity gains that can be achieved with the use of rotational grazing in New Brunswick on the degraded soils that dominate the majority of the land base managed by the New Brunswick beef sector.

2. The secondary objective is to validate increases in soil health on New Brunswick pastures as a result of rotational grazing management.

6. Project Deliverables

1. Demonstration of the seasonal forage yield and quality changes that can be achieved on New Brunswick grazing lands with the use of Rotational Grazing

2. Quantification of changes in soil health parameters in New Brunswick marshland grassland soils as a result of applying rotational grazing

3. A report, which provides the results and necessary information to support the defined objectives and deliverables.

7. Material and Methods:

The project ran through 2020-2023, with pasture subdivision beginning in the spring of 2020. All field activities took at the Tantramar Community Pasture near Sackville, New Brunswick. To accomplish this

project five cross fences and four ponds were installed between 2020 and 2022 along with a solar fencing system. Allowing for the move from continuous to rotational grazing. Cattle moves were carried out once per week in 2021 and 2022 unless movement was required in response to forage and water availability. No data relevant was collected in 2020.

Eight grazing cages were established on the pasture four each in paddocks 1 and 4 their locations are illustrated in figure 1.

Figure 1: Georeferenced locations of the eight grazing cages on the Tantramar pasture used for monitoring forage production and soil health.

Forage yield and quality samples were gathered throughout the summers of 2021 and 2022 beginning in June and ending in September from within grazing cages. Samples were taken weekly in the continuous treatment (Cages 2,4,6,8) and every six weeks in the rotational treatment (Cages 1, 3, 5, 7) to match the pastures' six-paddock system as it was in the spring of 2021. Samples were collected using 1/4 m^2 samples with continuous grazing samples being pooled every six weeks. Samples were stored frozen and shipped every six weeks in 2021, and dried and ground at the Nappan research farm in 2022 before being shipped to A&L laboratories for forage analysis. Forage analysis included %DM used to determine dry matter yields from sample fresh weights and beef/tonne used to calculate potential beef produced in Kg/Ha and $/Ha.

Following the removal of cattle from the pasture, soil samples were collected from geo-referenced locations, close to the grazing cages in 2021 and 2022, to assess the change in soil health that may have resulted from the application of the grazing management. Soil samples were shipped to the PEI analytical lab where they underwent both chemical (pH, OM, P2O5, K2O, Ca, Mg, Cu, Zn, Fe, Mn, S, B, Al, Na, Buffer Lime Requirement, CEC, (%) Base Saturation) and soil health analysis (Soil Respiration, Aggregate Stability, Active Carbon, Biological Nitrogen Availability, Soil Texture).

Data collected was then used to assess the pasture's productivity in terms of forage yield, potential cattle gains and forage quality. Data analysis will be completed by the staff of NBSCIA.

8. Results

8.1 2020 Season

Starting the first week of June 2020, the pasture team began installing cross fences on the Tantramar community pasture. The team successfully installed one cross fence per week leading to the establishment of 6 large paddocks. Yield data was taken before the first grazing pass with botanical separations being completed on second-cut samples, as shown in table 1. This data set was intended to serve as a baseline for pasture production. However, given the 2020 drought, yield data collected during the growing season may not accurately reflect the yield potential of the pasture before rotational grazing. Due to the drought, this data was not used as a baseline and continuous grazing was simulated by weekly clippings in subsequent years.

Table 1: Average forage yield of the Tantramar Community Pasture and botanical composition based on regrowth samples.

Season Yield (tonnes/ha)	% Grass	% Weeds	% Dead	% Legume
2.87	55	24	17	3

The major challenge of 2020 was the season-long drought experienced throughout the province. The severity of the drought led to reduced water levels in ponds throughout the pasture, with some paddocks being left without water. While the mud in the pond beds of other paddocks posed a real danger to grazing cattle with several becoming lodged in the mud. As a result, the rotational grazing plan was abandoned partway through the second grazing cycle, in lieu of getting the cattle where water could be made available. This challenge was also addressed with the help of Ducks Unlimited, who installed two new watering systems on the pasture in the fall of 2020. These watering systems will allow the further subdividing of paddocks one three and four.

8.2 2021 Season

In the first week of July 2021, the pasture team installed eight grazing cages on the Tantramar community pasture. The team also successfully installed fences around new watering systems installed by ducks unlimited in the fall of 2020 and continued maintaining all cross fences and perimeter fencing resulting in the maintenance of the six large paddocks established in 2020. Yield data was collected from four grazing cages weekly to simulate continuous grazing while the remaining cages were sampled every six weeks to simulate the rotation pattern that could be achieved in the Tantramar Pasture's six paddock system with weekly cattle movement. On July 7, 2021, when sampling began forage dry matter yield per hectare was similar in both treatments with yields of 1.88 tonne/Ha under continuous grazing and 2 tonne/Ha under rotational grazing. However, at season end rotational grazing (5.31 tonne/Ha) yielded 0.8 more tonnes of dry matter per hectare than continuous grazing (4.51 tonne/Ha). Although variation between sample sites was too high to yield statistically significant results ($p=1.0$). Results are illustrated below in Figure 2.

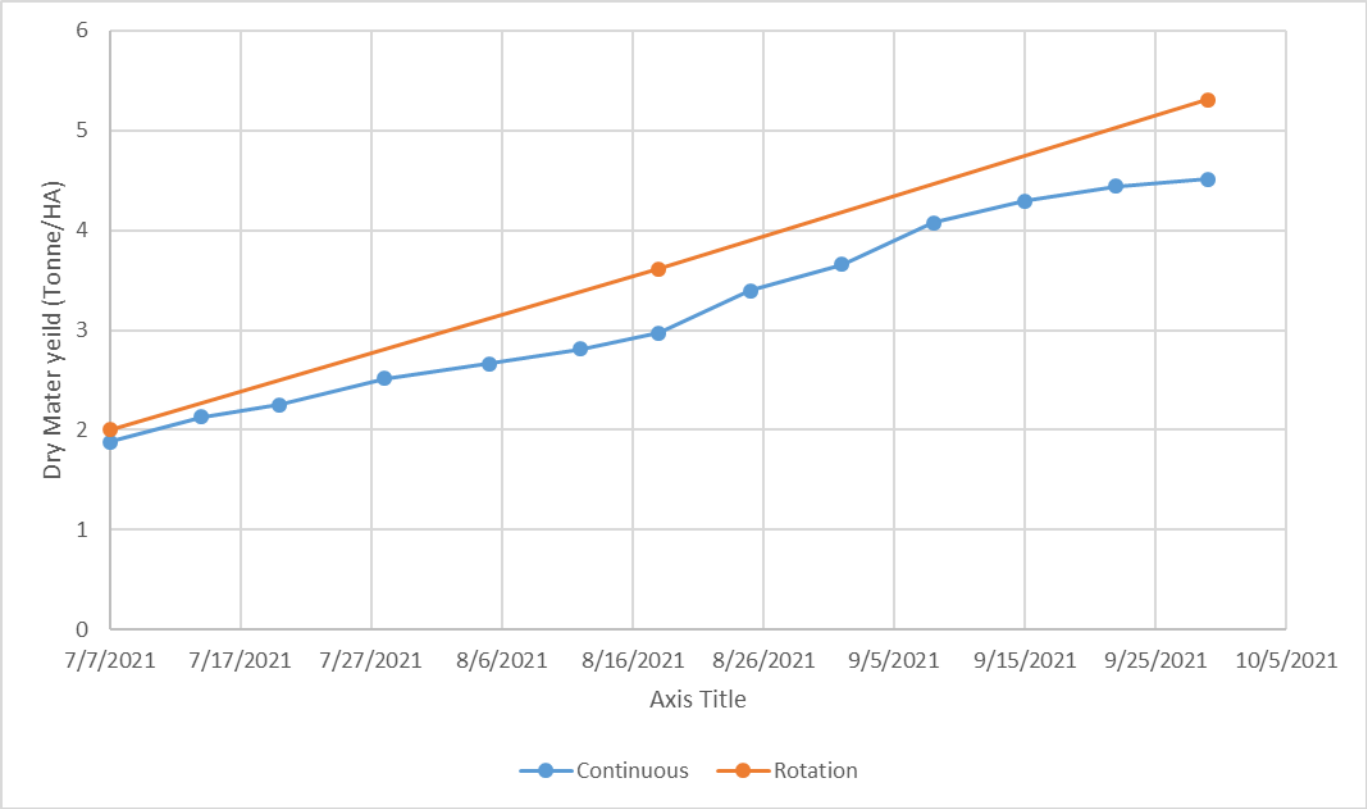

Figure 2: Forage dry matter yield on the Tantramar pasture under continuous and rotational grazing management strategies from the 2021 grazing season.

The samples were sent to A&L lab for quality analysis. To achieve a sample size large enough to test continuous grazing samples were pooled every six weeks and a representative sample was analyzed for each cage for the six-week time period. Cages that received the rotational grazing treatment resulted in a higher overall forage quality demonstrated by a higher potential yield of beef per Kg of forage produced (530.46 Kg Beef/tonne) than continually grazed cages (466.58 Kg Beef/tonne), although this elevated quality is not statistically significant ($p = 0.50$). when we combine the results of the yield and quality data we can monitor the overall performance of the two systems through the beef produced per hector and in turn dollars per hector. The beef produced was then converted to potential $/Ha using the average selling price of steers at the Atlantic stockyard steer sale closest to cattle barn up on Oct 31, 2021. This data, as displayed in figure 3, also shows that more potential dollars per hectare are available to farms under rotational grazing ($10 114.12/Ha) than Continuous grazing, this trend is also not significant ($p=0.35$).

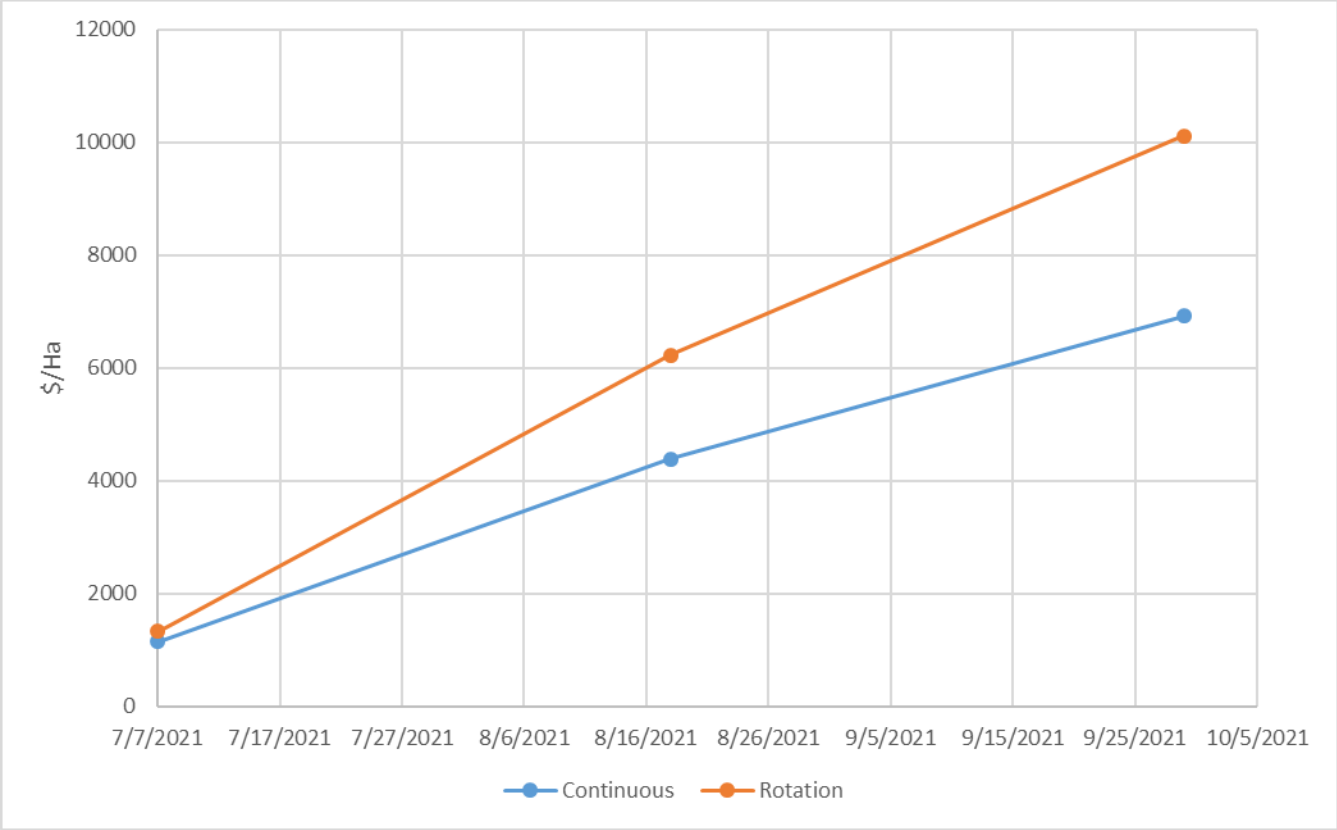

Figure 3: Potential Dollars per hectare of pasture on the Tantramar pasture under continuous and rotational grazing management strategies from the 2021 grazing season.

The 2021 season got off to a rocky start when vandals damaged fences and gates throughout the pasture. This included the cutting of cross fences, snapping of posts and removal of gates and posts. Due to this, planned cattle turnout was delayed by 2 weeks from mid-June to early July. To deter further damage to the pasture cameras were installed at the weigh house and carrel. Once repairs were completed overall 2021 was a much smoother grazing season than 2020. The new ponds supplied adequate water throughout the season and cattle were rotated weekly. One challenge encountered in this particularly rainy season was prolonged periods of rain with little sunshine exposed weakness with our solar fencer resulting in several fence breaks and cattle being out of the rotation for multiple days. To address this issue, a new solar fencer has been purchased and will be installed for the 2022 season. Finally, towards the end of the season, several grazing cages were damaged. These will have to be rebuilt or replaced in 2022.

8.3 2022 Season

In the summer of 2022 alleyway fences were installed and more resilient grazing cages were installed to replace existing broken cages in the same location. Fences were also installed around water sources and a new solar fencer was installed. Sampling began on June 15th with samples being taken every six weeks in cages 1, 3, 5 and 7 to simulate rotational grazing while cages 2, 4, 6 and 8 were sampled weekly. On June 15, 2022, when sampling began forage dry matter yield per hectare was higher in rotational grazing, with yields of 3.288 tonne/Ha under rotational grazing and 2.7 tonne/Ha under continuous grazing. However, at season end continuous grazing (8.44 tonne/Ha) yielded 0.6 more tonnes of dry matter per hectare than

continuous grazing (7.8 tonne/Ha). Although variation between sample sites was too high to yield statistically significant results (p=0.5). Results are illustrated below in Figure 4.

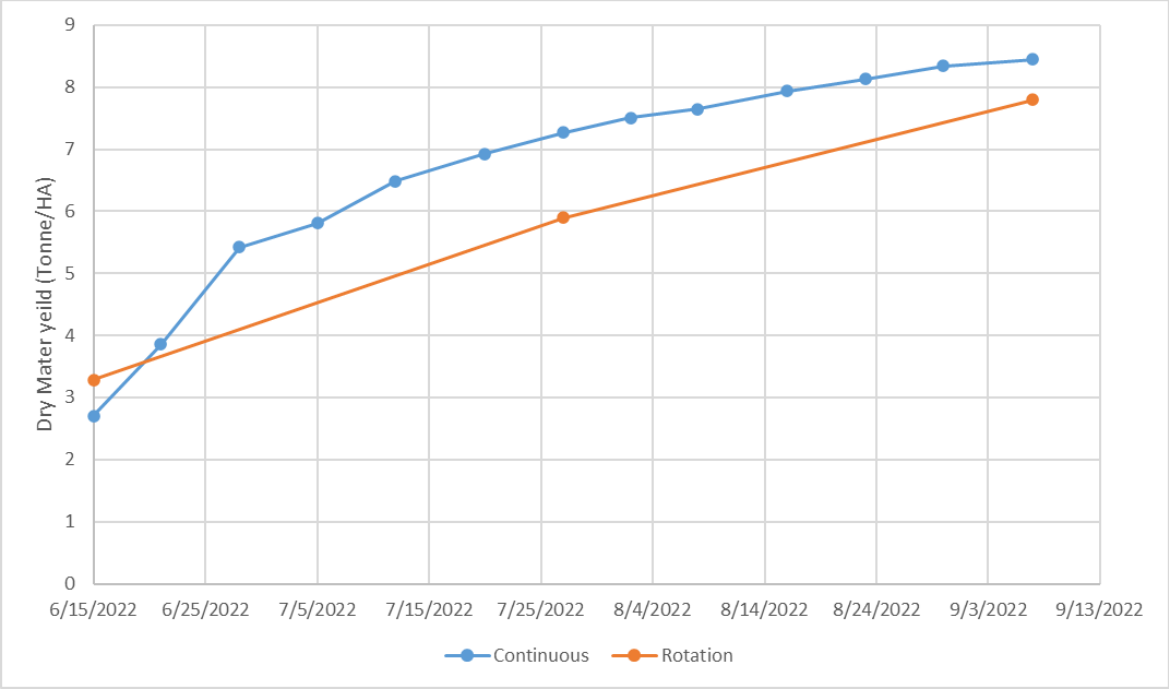

Figure 4: Forage dry matter yield on the Tantramar pasture under continuous and rotational grazing management strategies from the 2022 grazing season.

The samples were then dried and ground at AAFC Nappan and then sent to A&L lab for quality analysis. Continuous grazing samples were pooled every six weeks and a representative sample was analyzed for each cage for the six-week time period. Cages that received the rotational grazing treatment resulted in a higher overall forage quality demonstrated by a higher potential yield of beef per Kg of forage produced (310.55 Kg Beef/tonne) than continually grazed cages (296.8 Kg Beef/tonne), although this elevated quality is not statistically significant (p = 0.29). when we combine the results of the yield and quality data we can monitor the overall performance of the two systems through the beef produced per hectare. The beef produced was then converted to potential $/Ha using the average selling price of steers at the Atlantic stockyard steer sale on Oct 31st, 2021. This data, as displayed in figure 5, also shows that more potential dollars per hectare are available to farms under continuous grazing ($9632.31/Ha) than rotational grazing ($9035.90) in 2022, this trend is also not significant (p=0.28).

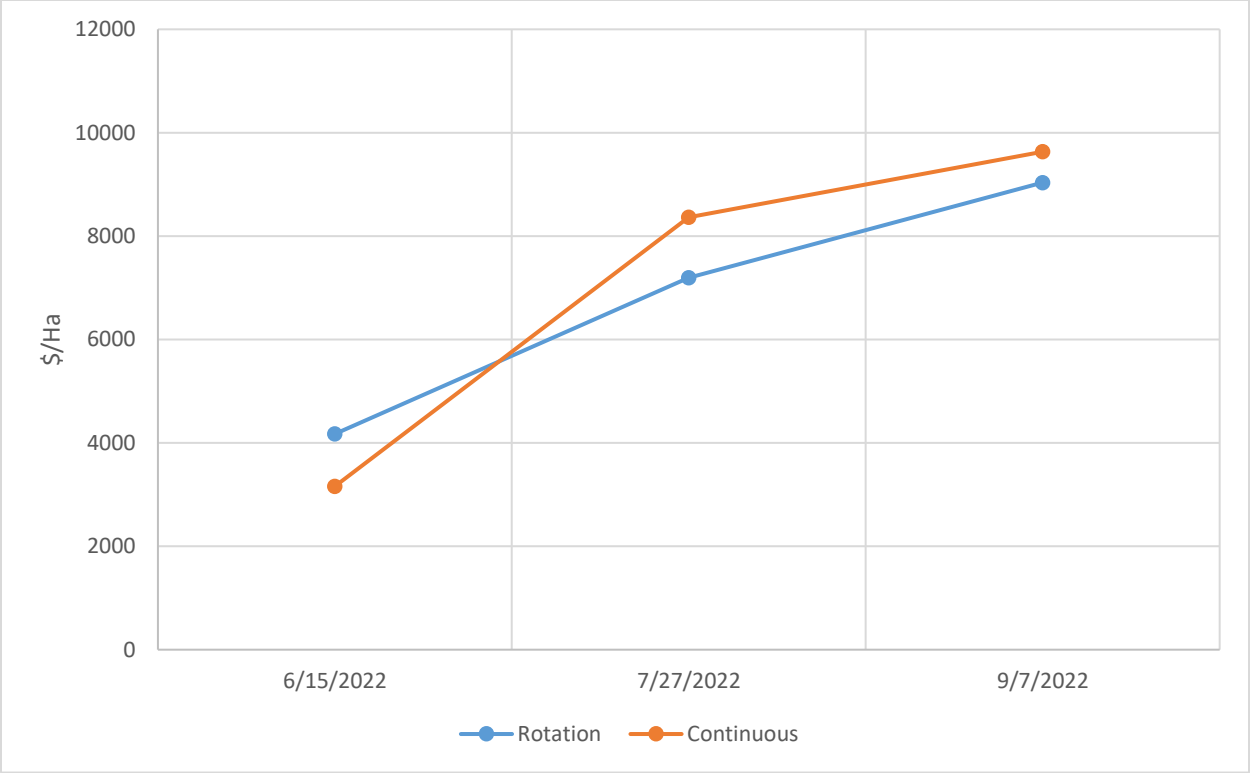

Figure 5: Potential Dollars per hectare of pasture on the Tantramar pasture under continuous and rotational grazing management strategies from the 2022 grazing season.

8.4 Combined Observations Forages

Overall yield was higher in 2022 than in 2021, with the continuous grazing treatment in 2021 (4.45 Tonne/Ha) being significantly lower than all other yield values (p=0.01). This is displayed in Figure 6.

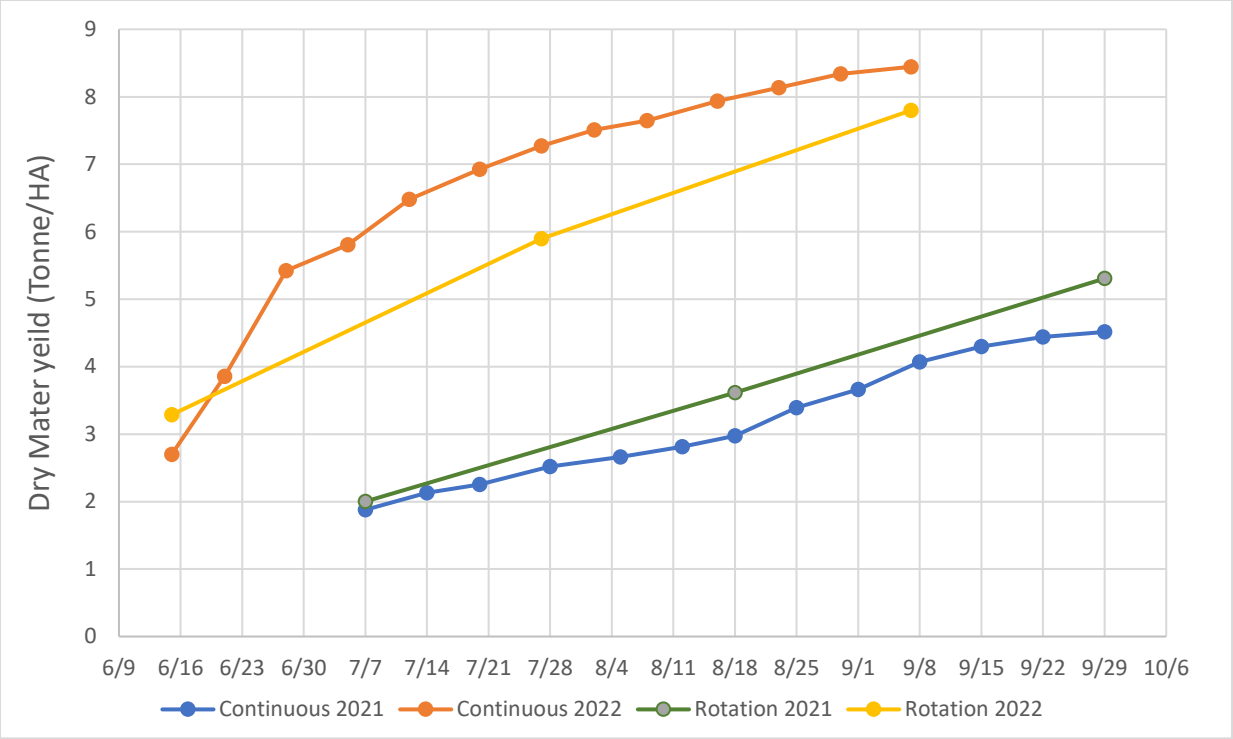

Figure 6: Forage dry matter yield on the Tantramar pasture under continuous and rotational grazing management strategies from the 2021 and 2022 grazing seasons.

The overall quality of the grasses was higher in 2021 than in 2022. As demonstrated by the beef/tonne of forage (p=<0.001) displayed in Figure 7.

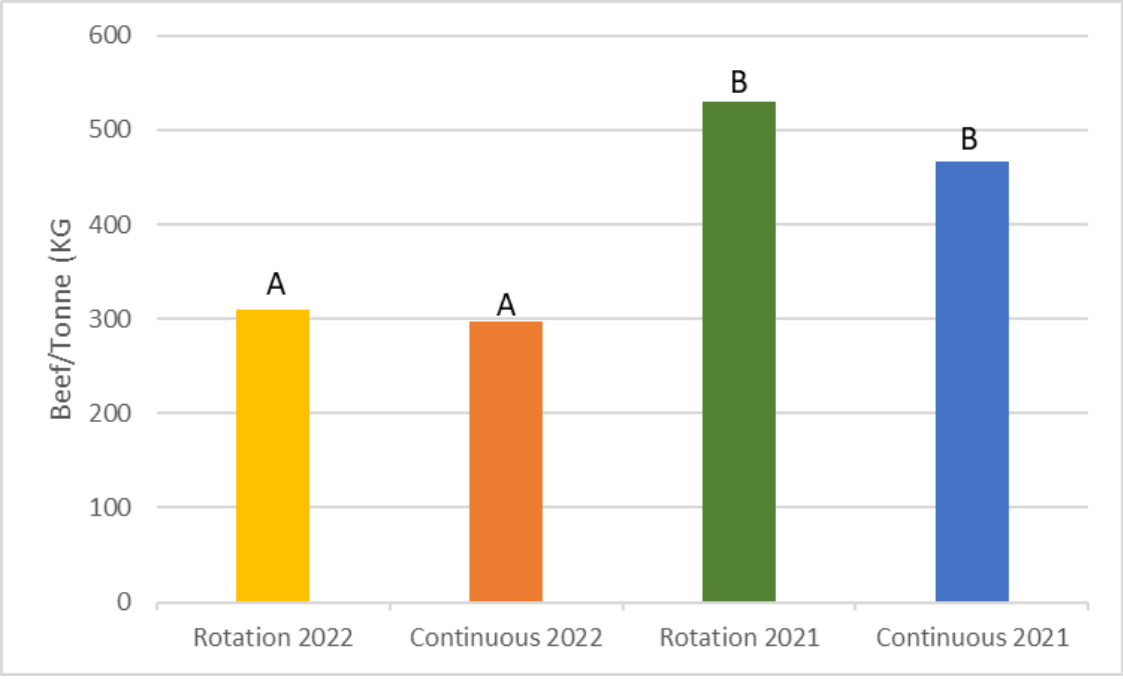

Figure 7: Potential beef production in kilograms per tonne of forage production on the Tantramar pasture under continuous and rotational grazing management strategies from the 2021 and 2022 grazing seasons.

When looking at the combination of yield and quality data in the form of potential dollars produced per hectare there is no difference in $/Ha (p=0.51) between treatments or years as displayed in Figure 8.

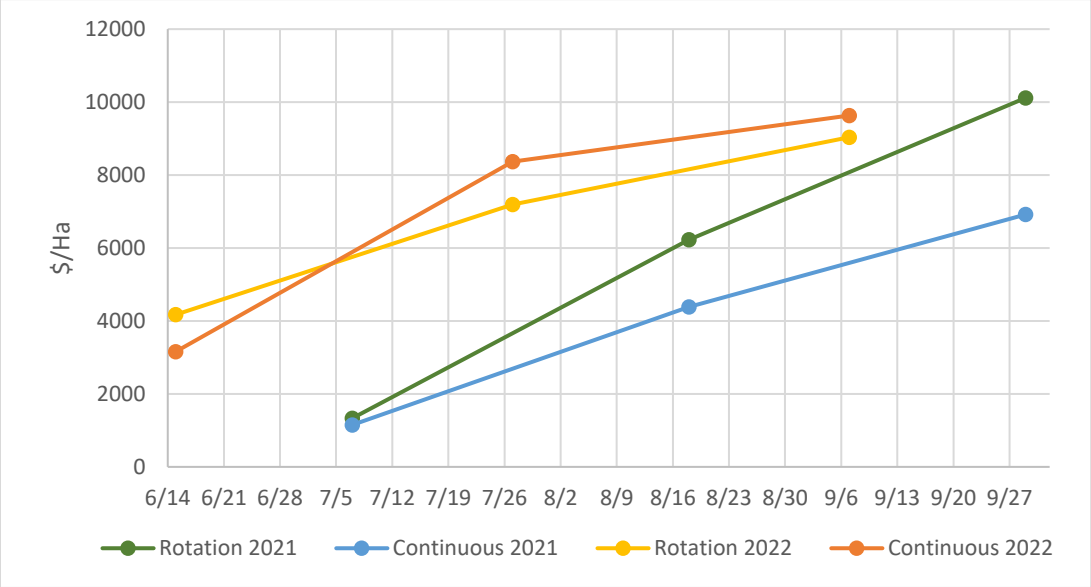

Figure 8: Potential Dollars per hectare produced by the Tantramar pasture under continuous and rotational grazing management strategies from the 2021 and 2022 grazing seasons.

Looking at the yield across the two seasons as displayed in Figure 5 and Figure 7 it cannot be determined from the results of these two seasons alone what treatment is superior. Looking at the change in yield across the season in 2022 it appears that during the spring flush, the trimmings set at one week were superior to those set at 6 weeks. However, as the season carried on the 6-week trimmings seemed to improve the yield of regrowth as the gap in yield reduced across time in 2022. It should be noted that the observation period was ended early in 2022 due to the destruction of several grazing cages by cattle. Due to the late start of the grazing season in 2021, the spring flush of forages did not play a role in the results of this season and the superior regrowth in the six-week treatment led to superior yields in the rotational grazing treatment. The combined results of the two seasons could be interpreted as evidence that a calendar approach to grazing is not the best way to manage pasture swards, as a shorter rotation seems to be beneficial in the spring with a longer rotation being advantageous as the season goes on. Therefore, pastures should be managed in response to forage production with supplemental clipping being performed in the spring to maintain the forage's vegetative state and quality. Overall this demonstration shows that pasture management has an effect on both short-term and season-long pasture yields.

8.5 Soil Results

Background sets of soil health data were collected in the fall of 2019 and 2020, sampling sites were not geo-referenced. Soil health samples in 2021 and 2022 were taken from georeferenced locations just outside of the eight grazing cages four of which are located in paddock 1 and four in paddock 3. Minimal changes have been observed with no distinguishable trends in the data. Soil results are displayed in table 2.

Table 2: Soil Health parameters collected on the Tantramar pasture between 2019 and 2022.

Year	Paddock	Active Carbon	Total Carbon	Total Nitrogen	Aggregate Stability	% Sand	% Silt	% Clay
2019	1	592	7.74	0.55	60.4	23	54	22
2020	1	1320	11.37	1.02	81.1	7.8	51	40
2021	1	1238	9.45	0.57	57.5	3.4	66	41
2022	1	723	4.18	0.44	44.4	4.9	73	22
2019	3	561.88	3.84	0.27	28.93	11	53	35
2020	3	853	5.57	0.6	67	3.8	74	22
2021	3	758	4.76	0.5	48	5.3	55	40
2022	3	1201	9.68	1.09	69.5	4.4	53	43

9. Conclusion

As a result of this project, the Tantramar pasture has been able to establish six paddocks for rotational grazing and install four new ponds as cattle water sources. The data collected as part of this project indicated that neither of the two treatments applied on the Tantramar pasture resulted in consistently improved yield, quality or revenue. This indicates that a permanent rest period set by time may not be the best way to manage your pastures. Rest and graze periods in an ideal situation should be determined by forage production, with cattle moves and clipping being performed in response to forage growth. This project did not result in any significant changes in soil health parameters and illustrates the need for a better understanding of how changes in soil health parameters should be monitored. If this project were to be repeated I would recommend a third treatment where forage within the grazing cages was clipped in response to forage growth each time forage reaches a height of 8-12 inches.