Nutrient cycling in winter grazing cattle on pasture; three years following bale grazing.

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Introduction and background:
Perennial pastures are typically low in fertility which results in reduced productivity. On the other hand manure from livestock overwintering in confinement is nutrient rich and expensive to apply to fields. Bale grazing forage to cattle directly on fields/pastures during the winter time offers the opportunity to add much needed fertility to perennial pastures and reduces manure disposal costs related to over-wintering cattle in confinement. Bale grazing allows livestock to return a large proportion of the nutrients they consume directly to the landscape where they are fed. It reduces feeding time and costs normally associated with feeding livestock in confinement during the winter months as well as saves on the manure removal costs to the operation. Manure and feed leftovers contain valuable nutrients that become available over time to annual or perennial crops which improves forage productivity and quality.

This project started before bale grazing was applied in 2007 with funding from the Covering New Ground (CNG) program and the Pembina Valley Conservation District (PVCD). In 2008, funding was provided by the Livestock Stewardship Initiative (LSI) program and the PVCD. In 2009 and 2010, funding was provided by the Agricultural Sustainability Initiative (ASI) and the PVCD. This project was designed to measure and to monitor the soil nutrient levels of ten differently and independently managed bale grazing sites.

Methodology:

The ten established perennial pasture sites involved in this project were initially soil sampled to a depth of 48 inches in the fall of 2007 to determine the nutrient level of each pasture before bale grazing. Each cooperator bale grazed their herd in the fall 2007 to early winter 2008. In the summer of 2008, October 2008 and October of 2009 each site was soil sampled to 48 inches depth to compare to the earlier soil sample results. In 2007 and 2008, six core samples were taken at each site to form a composite sample for each sampling depth. In 2009 and 2010, ten sub-samples were collected at each site, within the bale grazed zone, to form a composite sample. Bale grazed sites varied in size from 3 to 14 acres. Each site belonged to a different owner and was managed independently from the others.

Forage samples were hand clipped in the bale grazed green zones and compared to samples collected in-between or away from the bale grazed zones to compare feed quality.

Forage quality in Bale Grazing systems

Nutrients from forage fed to cattle on pasture are returned to the pasture in the form of urine, feces and feed litter. Plant growth responds very rapidly to improved soil fertility resulting in increased forage quantity and quality. Field analysis results from forage samples collected on 7 of the 10 sites monitored in this project are summarized in the graphs below. Consistent phosphorus and potassium increased in most cases compared to the check areas. Total Digestible Nutrients (TDN) and phosphorus increased slightly compared to the check areas.

Soil nutrient trends

Phosphate-P average level in the topsoil of 10 bale grazed sites in the Pembina GD area from 2007 to 2010.

<table>
<thead>
<tr>
<th>Sampled date</th>
<th>Check</th>
<th>Clearwater</th>
<th>West Cartwright</th>
<th>Crystal city</th>
<th>Cartwright</th>
<th>Clearwater site</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007-10</td>
<td>0.32</td>
<td>0.35</td>
<td>0.27</td>
<td>0.30</td>
<td>0.05</td>
<td>0.23</td>
</tr>
<tr>
<td>2008-10</td>
<td>0.24</td>
<td>0.35</td>
<td>0.30</td>
<td>0.27</td>
<td>0.05</td>
<td>0.23</td>
</tr>
<tr>
<td>2009-10</td>
<td>0.23</td>
<td>0.30</td>
<td>0.27</td>
<td>0.24</td>
<td>0.05</td>
<td>0.23</td>
</tr>
<tr>
<td>2010-10</td>
<td>0.23</td>
<td>0.30</td>
<td>0.27</td>
<td>0.24</td>
<td>0.05</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Phosphate-P (0 to 6 inches) has an average of 6 species per site. Quackgrass was initially (dandelions at one site). After three year of bale grazing, established perennial grasses have taken over and dominate those areas.

Plant species trends

Forage summary and observations

Bale grazing was considered as very beneficial by all cooperators involved in this project. They all continue the practice at a comparable level or on a larger scale. Forage yield was measured on some sites in 2010. Forage yield was consistently higher on the bale grazed areas compared to the check. Relative dry matter (DM) yield ranged from 150% of check to over 500% of the check area. Sites with the highest bale densities had more uniform plant growth across the pasture area. Three years after bale grazing was applied, pastures growth, protein level and potassium content remains elevated in plants sampled in the bale grazed, greener zones, compared to the check. TDN and phosphorus remained almost unchanged in the greener zones compared to the check. Feed litter and manure accumulated most where a bale grazed and tended to delay forage re-growth the first year after bale grazing was done. Sometimes heavy fertilizer cover prevented plant re-growth completely but only on a very small area. In 2010, those heavy residue areas are not visible anymore being completely covered by plant growth. Litter to no new weed growth appeared on the bale grazed areas after the first year of bale grazing. Weeds already present tended to benefit from the added nutrients and grew larger initially (dandelions at one site). After three year of bale grazing, established perennial grasses have taken over and dominate those areas.

The plant population in the green zones is changing after bale grazing was applied; only a couple of grass species (brome grass and quack grass) tend to dominate the area bale grazed as compared to a broader variety of plant species in the check areas. Similar findings in the 2009 and 2010 surveys.