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Bale grazing on forage fields leaves short term impacts

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In the first season after winter bale grazing, forage yield at the grazing site was reduced by 68% compared to control plots, but no difference in the second season. Residual nitrate-N and Olsen P in the soil were also higher at the centre of the bale-grazed plots. Differences were attributed to high concentrations of waste feed (21%) and feces near the bale-grazing locations.

Feeding over-wintering cattle in the field on forage or annual crop land brings benefits of reduced feedlot manure spreading, and could possibly result in increased forage or annual crop productivity the following year.

This study looked at the impact of winter bale grazing on a perennial grass-legume forage field on subsequent forage productivity and soil nutrient cycling in the Red River Valley of southern Manitoba.

The research was conducted at the University of Manitoba's Glenlea Research Station on a perennial forage field with dominant plant species of timothy grass, Kentucky blue grass, smooth bromegrass and bird's-foot trefoil. The field had not been fertilized or had manure applications for at least the previous 10 years, and had been harvested for forage each year.

Four grazed paddocks and four ungrazed control paddocks were compared. In the bale-grazed paddocks, large round hay bales were placed 40 feet (12 m) apart and access to the bales was controlled by electric fence. Ten cows grazed in each paddock from January 4, 2011 to March 2, 2011.

Forage samples were taken in the summer of 2011 and the summer of 2012 to look at the impacts one and two years after winter bale grazing. The paddocks were also sampled in the fall of 2011 and 2012 to look at difference in soil nutrients after bale grazing. Percentage area covered by waste feed and feces was estimated and mapped.

Negative impacts declined after the first year

In the first year after bale grazing, forage dry matter yield harvested in the season after the winter bale grazing was highly variable in all the plots. Yield was substantially lower in the centre of the bale-grazed plots compared to distances 8 feet (2.4 m), or further, out from the centre. However, in the second year, there were no significant differences in the bale-grazed treatments, partly because the forage yield recovered at the centre of bale-grazed areas of the paddock.

Forage crude protein, total digestible nutrients, phosphorus (P), and potassium (K) concentrations increased in the first growing season following winter bale grazing compared to the control, particularly at the centre of each bale-grazed plot. Again, these differences were not noticed in the second forage harvest.

Plant species composition had a small but significant increase in weed biomass and lower legume biomass in the bale-grazed plots. As distance increased from the center of the sampling grid, this difference disappeared.

In the first fall after bale grazing, residual soil nitrate-N ranged from 1.25 to 213 lbs. N/acre (1.4 to 240 kg N/ha) for the bale-grazed treatment and from 1 to 62 lbs. N/acre (1.1 to 69.5 kg N/ha) for the conventional treatment. This difference declined in the second year to 0.18 to 94 lbs. N/ac (0.2 to 106 kg N/ha) for the bale-grazed treatment and 1.3 to 16 lbs N/ac (1.5 to 18.3 kg N/ha) for the conventional treatment.

Variability in soil Olsen P was also large in both the bale-grazed and control paddocks, but the variability was even larger in the second year after bale grazing. This difference was attributed to a decrease in P soil tests in the control treatment in the second year. There were also greater soil P concentrations at the centre of the sampling grid in the bale-grazed treatments compared to the control treatments.

Potassium concentrations were higher in the bale-grazed treatments in the first year compared to the control, but only slightly higher in the second year.

Waste hay after bale grazing was primarily located at the bale centre and amounted to 15.6 dry matter tons/ac (35 t DM/ha) and decreased to 1.4 DM tons/ac (3 t DM/ha) at 16 feet (4.8 m) from the centre. This mass decreased away from the centre with negligible amounts 18 feet (5.4 m) and 22 feet (6.7 m) away.

Feces distribution was less concentrated at the centre of the plots, where there was 14.3 DM tons/ac (32 t DM/ha) but also some amount measured in all cells with the lowest observed at 1.4 tons/ac (3 t dm/ha).

After the second growing season, waste feed and feces still remained with depths up to 2.5 inches (0.06 m) remaining 20 months after bale grazing.

Overall, the soil nitrate-N and Olsen P near the centre of the paddocks where bales were grazed did improve forage quality, but that did not compensate for the reduced forage growth at these locations. While this effect diminished over time, if bale grazing occurred at the same site each winter, there would be an accumulation of N and P that could increase nitrate leaching and P loss in surface water. Also, spreading of waste feed and feces might be required to promote rapid decomposition in order to maintain forage productivity and reduce environmental impact.

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Gwen Donohoe, Don Flaten, Faith Omonijo, and Kim Ominski. Short-term impacts of winter bale grazing beef cows on forage production and soil nutrient status in the eastern Canadian Prairies. *Canadian Journal of Soil Science*. **101**(4): 717-733. https://doi.org/10.1139/cjss-2021-0028

Photo by Gwen Donohoe

