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Water quality considerations when winter bale grazing

With support from the Alberta Crop Industry Development Fund (ACIDF), Agriculture and Agri-Food Canada (AAFC) initiated a study to determine if bale grazing the same location twice in a three year period had any positive or negative effects on pasture productivity and quality. The project also monitored soil nutrients and water quality to assess environmental risks associated with high nutrient loading from the bales at the site. This fact sheet highlights results from the water quality monitoring.

Two old perennial pasture sites in Central Alberta were selected for study. One site was located north of Caroline in the Dry Mixedwood Subregion of the Boreal Forest Natural Region on an Orthic Gray Luvisol and the other site was located south of Vermilion in the Central Parkland Subregion of the Parkland Natural Region on a thin Black Chernozem. The Caroline soil is classified as a loam (top m: 47% sand, 15% clay) whereas the Vermilion soil is a clay loam (top m: 34% sand, 36% clay).

The hydraulic conductivity of the till measured 10^{-5} cm/s at the Caroline site and 10^{-6} at the Vermilion site. Snowmelt runoff at both sites collected in ephemeral (Caroline) or semi-permanent (Vermilion) wetlands.

Each site was bale grazed twice in three years (winter 2012/13 and winter 2014/15). Bale spacing for both treatments was 12.5 m (40 feet) with the second treatment offset from the first for better nutrient distribution. Nutrient concentrations were measured in surface runoff water and in shallow piezometers (maximum depth 7 m).

Key Findings

Nutrient concentrations in wetlands were elevated in the spring of the years immediately following winter bale grazing. Export of nutrients from the bale grazing fields to the wetlands ranged from 7-25 kg N/ha and 1-4 kg P/ha and were up to 20 times higher than the export from non-bale grazed areas. These loading rates were similar to other studies of winter grazing practices in Saskatchewan and Manitoba.

The monitoring results showed a clear difference between the two sites in the potential for nutrient movement into shallow groundwater. The data indicated that at the more coarsely textured soils of the Caroline site there was evidence of inorganic nitrogen leaching whereas there was limited evidence of downward nitrogen movement under the finer textured soils at the Vermilion site. Elevated phosphorus concentrations were also evident in the top meter of soil at the Caroline site, and contributed to higher dissolved phosphorus in the shallow groundwater.

Best Practices

Siting to reduce the risk of runoff reaching other water bodies is important when implementing winter bale grazing. Sites where runoff is captured in temporary depressions and allowed to infiltrate are ideal; however nutrient buildup in those depressions could lead to increased soil phosphorus if the sites are used frequently. At sites with coarser grained soils, shallow groundwater can be impacted by rapid leaching of nitrogen and slow downward movement of phosphorus. The risk to groundwater can be mitigated by reducing the frequency with which bale grazing occurs at the same sites. Within a pasture, bale placement should be considered for subsequent treatments in different areas of the same pasture to ensure runoff from those treatments does not influence the same runoff collection / groundwater recharge area of previously bale-grazed tracts.

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