Characterizing dissolved and particulate phosphorus in snowmelt runoff from cattle winter bale-grazing sites

Barbara J. Cade-Menun[1], Brian G McConkey[1], Alan D. Iwaasa[1], H.A. (Bart) Lardner[2]

[1] *Agriculture and Agri-Food Canada, SPARC, Swift Current, SK, Canada;* [2] *Western Beef Development Centre, Humboldt, SK, Canada*

Barbara.Cade-Menun@agr.gc.ca

Bale grazing of cattle in fields during the winter has become a common practice in the Canadian Prairies, replacing winter corral feeding. The aim is to have the cattle spread feed and manure uniformly across the field, thereby increasing soil fertility while reducing manure handling, hauling and spreading. However, little is known about the environmental impact of this practice, particularly with respect to nutrients in spring runoff while soils are still frozen. To test this, we established six 350 m^2 microwatersheds. During the first year (winter 2009) of the three-year study, four microwatersheds were bale grazed (300 cow days ha^{-1}), and two were ungrazed controls. One-litre runoff samples were collected during a thaw event in March, 2009, and were filtered to through 0.7- m glass fibre filters. Particulates were analyzed for total P, C and N. Filtrate was analyzed for dissolved C, ammonium, nitrate, total N, total P and molybdate-reactive P (MRP). Additional 5-litre samples were also analyzed by ^{31}P NMR to characterize dissolved and particulate P forms, along with samples of manure mixed with hay and plant litter from the feeding site. Preliminary results indicate that concentrations dissolved C, particulate organic C, total N, dissolved ammonium, total P, dissolved total P and MRP were significantly higher in of runoff from bale-grazed sites relative to ungrazed controls. Dissolved P from bale-grazed sites was almost entirely orthophosphate, while a range of organic (orthophosphate monoesters, including phytate, and orthophosphate diesters, including DNA) and inorganic (orthophosphate, pyrophosphate) P forms were seen in runoff from the control sites. There were no significant differences in particulate P concentration. Particulates from both bale-grazed and control sites contained both inorganic and organic (orthophosphate monoesters, including phytate, and orthophosphate diesters, including DNA) P forms, as did the manure/hay and litter samples. The P forms in particulates from both feeding and control sites were significantly different from P forms in the manure/hay and litter samples. These contained more orthophosphate and less organic P than the particulates. Because this is an on-going project, it is not possible to draw conclusions about the full impact of winter bale grazing on nutrients in runoff. However, the work to date shows that it is possible to quantitatively characterize both dissolved and particulate P forms in relatively small volumes of runoff. This gives a much clearer picture of the forms in which P is transported than do simple measurements of total P and MRP.