Feedlot Drainage Area Soil Nutrient Levels Across the Landscape

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The North Dakota Discovery Farms program was initiated in 2007 in cooperation with the North Dakota Department of Health and North Dakota U.S. Geological Survey to better understand the water quality impacts of feedlot runoff. Surface water runoff monitoring equipment was fully installed and operational at a feedlot site near Underwood, ND, in the summer of 2008. The site that was selected is representative of medium-sized animal feeding operations in North Dakota.

There are three sets of runoff monitoring stations installed strategically at the farmstead. Gaging station 1 is installed to capture runoff that is funneled to a natural exit point directly at the edge of the feedlot. Gaging stations 2 and 3 are installed ¼- and ½-mile, respectively, down-landscape from the feedlot.

As previously reported, the nitrogen load in the runoff water during spring snowmelt from the feedlot was significant at the edge of the feedlot but was reduced by nearly 60 percent at gaging station 3 located about ½-mile south of the feedlot. During the remainder of the runoff year, no rainfall events were significant enough to trigger any sampling at gaging station three, ½-mile from the feedlot. However, there were several rainfall events during the summers of 2009, 2010 and 2011 that triggered sampling at stations 1 and 2.

Situation

The combination of decreased nutrient loading down-landscape during spring snowmelt and no runoff water reaching station 3 during the summer months raises the question of what is the nutrient loading of the soil in the drainage area? There is a dilution effect causing a decrease in nutrient load during spring snowmelt but that is not the case during the summer rainfall events.

To get a better understanding of the soil nutrient profile, some exploratory soil sampling was conducted across and down the landscape from the feedlot. Soil samples were taken to a depth of 24 inches and analyzed in 6-inch increments. Nitrate nitrogen (N) was analyzed in all sample increments but phosphorous (P) was only analyzed in the top 6-inch sample increment. The soil samples were taken at distances adjacent to the feedlot, 175 yards, 550 yards and 700 yards down-slope from the feedlot. The samples shown in this report were taken directly in the main channel throughout the drainage area.

Results

As shown in table 1, there was a significant decrease in soil N and P levels further away from the feedlot. Total soil N at the edge of the feedlot was 129 ppm whereas, 700 yards down the drainage, it dropped to 8 ppm. Soil test P was 215 ppm at the edge of the feedlot and 23 ppm 700 yards away.

Table1. Soil nitrogen and phosphorous at various soil depths and distances from the edge of a feedlot

		Nitrogen (ppm)				Phosphorous (ppm, Olsen)
Site	Distance from Edge of Feedlot	0-6"	6-12"	12-24"	Total	0-6"
1	Adjacent	79	26	24	129	215
2	175 yards	24	18	11	53	63
3	550 yards	6	3	4	13	58
4	700 yards	4	2	2	8	23

According to these preliminary results, there seems to be no major deposition of nutrients into the soil much beyond the edge of the feedlot. Groundwater contamination is not a concern at this site and the soils tests show that nitrogen accumulation in the soil profile is low as you move away from the feedlot. Future work at this site will include more intense soil sampling and forage sampling of the drainage area.