Feedlot Runoff Monitoring Results from Three Years of Snowmelt Events

Ron Wiederholt

Introduction

The North Dakota Discovery Farms program was initiated in 2007 in cooperation with the North Dakota Department of Health and North Dakota United States 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 gaging stations installed strategically at the farmstead.

Gaging station 1 (G1) is installed to capture the runoff that is funneled to a natural exit point directly at the edge of the feedlot. Gaging stations 2 (G2) and 3 (G3) are installed ¼ and ½ mile, respectively, down-landscape from the feedlot. G2 and G3 were installed to determine the impacts of feedlot runoff flowing through a heavily grassed and wooded drainage area as well as the effect of cropland runoff that enters the drainage area directly above G2. G1 measures the runoff from about 30 acres while G2 and G3 measure the possible runoff from nearly 600 acres. There is no runoff containment or diversions installed at the feedlot. There are tree or building windbreaks on the north and northwest sides of the feedlot.

The spring snowmelt events for 2009, 2010 and 2011 were above normal. This caused some challenges with equipment and management of sampling and runoff measurement. However, good data was collected that can help us better understand the impacts of snowmelt on feedlot runoff management.

Results

The monitoring data showed that feedlot runoff has a temporal pattern. The majority of the runoff that would be of concern happens with snowmelt runoff. Over the three years, no runoff events happened during the summer or fall that could be measured at G3. However, with the extreme snowmelt events during the spring of 2009, 2010 and 2011, runoff was measured during the months of March, April and May at all three gaging stations with the exception of March 2011 when there was an equipment failure at G2 and no flow was recorded.

The data in Table 1 is the combined monthly average data from the three years of runoff during March, April and May and shows a significant load of nitrogen (N) in the runoff water at the edge of the feedlot (G1). However, there is a 54 percent decrease in N load by the time the runoff water is measured ½-mile down-landscape at G3. In contrast, the flow that is being measured increased 80 percent from G1 to G3. Therefore, there is a significant amount of snowmelt runoff water entering the drainage area from the cropland adjacent to the feedlot. It is difficult to explain the lower N loading at G2 vs. G3 but the result could be partially explained by the lack of data collected during March 2011 at G2 due to an equipment failure.

Table 1. Total Nitrogen Load and Runoff Flow at the Edge of a Feedlot (G1) and two sites 1/4 (G2) and 1/2 (G3) mile down-landscape from the feedlot during the snowmelt period of 2009, 2010 and 2011.

	G1	G2	G3
Total Nitrogen Load (lbs)	11793	3509	5441
Total Flow (cu ft/sec)	14	47	71

Table 2 shows that the rate of N loading in the runoff water decreases from 850 lbs/cu ft/sec at G1 to 77 lbs/cu ft/sec at G3 which is a 91 percent decrease. This is another way to look at the combination of load and flow and shows that most of the decrease in N load from G1 to G3 is due to an increase in runoff entering the system leading to a dilution effect.

Table 2. Rate of Nitrogen Loading at the Edge of a Feedlot (G1) and two sites 1/4 (G2) and 1/2 (G3) mile down-landscape from the feedlot during the snowmelt period of 2009, 2010 and 2011.

	G1	G2	G3
Total Nitrogen (lbs)/cu ft/sec	851	75	77

Discussion

The confirmation of the temporal pattern of the runoff has some significant implications for management of feedlot runoff. At the study site, there has been no work done to divert snowmelt water from entering the feedlot. Snow accumulation in the tree windbreaks around the feedlot has been significant the past three winters. Like many feedlot situations, the snowmelt is allowed to flow into and through the feedlot.

After reviewing the data, the feedlot owner has decided to move forward with installing diversions to help manage snowmelt runoff. Monitoring will continue at the site to determine the impact of diverting the snowmelt from entering the feedlot.

Monitoring station at Underwood Discovery Farm.