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Incidence of Bovine Enterovirus, Coronavirus, and Group A Rotavirus, and Concentration of Fecal Coliforms in Midwestern Pasture Streams

Abstract

Grazing management practices that allow cattle to congregate near pasture streams may result in soil compaction and accumulation of manure near the streams and the loss of vegetative cover. These conditions may cause sediment, phosphorus, and pathogen loading of streams by direct deposition of feces or in precipitation runoff.

Keywords

Animal Science, Veterinary Diagnostic and Production Animal Medicine

Disciplines

Agricultural Science | Agriculture | Animal Sciences | Other Veterinary Medicine

Incidence of Bovine Enterovirus, Coronavirus, and Group A Rotavirus, and Concentration of Fecal Coliforms in Midwestern Pasture Streams

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Introduction

Grazing management practices that allow cattle to congregate near pasture streams may result in soil compaction and accumulation of manure near the streams and the loss of vegetative cover. These conditions may cause sediment, phosphorus, and pathogen loading of streams by direct deposition of feces or in precipitation runoff.

Grazing of cattle in riparian areas has been associated with increases in the concentrations of fecal coliforms (FC) in pasture streams in some studies. However, in other studies, there has been evidence of significant contributions of FC to pasture streams from other animal species. Furthermore, while the presence of FC has been used as an indicator of the possible presence of pathogenic bacteria and viruses from fecal contamination, a definitive relationship has not been established. Bovine Enterovirus (BEV), Coronavirus (BCV), and group A Rotavirus (BRV) are intestinal pathogens present in cattle feces. If these pathogens are present in water sources, they may result in scours in cattle and, possibly, diarrhea in humans.

The objective of this project was to evaluate effects of stocking rate and season on the concentrations of FC, and the incidence of

selected enteric viral pathogens in pasture streams.

Materials and Methods

Bi-weekly, from May through November 2007 and March through November 2008, water samples were taken at upstream and downstream locations on 12 streams passing through 13 pastures on 12 cooperating farms in the Rathbun Lake watershed. Water samples were analyzed by the Veterinary Diagnostic Laboratory (VDL) at the Iowa State Veterinary School for incidence of BEV, BCV, BRV, and concentration of FC.

The FREQ and LOGISTIC procedure of SAS was used to test the incidence of viruses found on the probability of the cattle being in the pasture on the day, and 3 and 7 days prior to sampling, along with the rainfall events on the day of sampling, 24, 48, and 72 hours prior to sampling by calculating an odds ratio to determine the effect of each unit change in the stocking and rainfall variable. Proc GLM was used to test the means for FC for upstream and downstream samples taken for both grazing seasons using farms as replicates. A P-value of 0.05 was determined statistically significant.

Results and Discussion

Mean incidence of samples (n=812; Table 1), for BEV (44 incidences), BCV (13 incidences), and BRV (2 incidences) in water samples collected both upstream and downstream were 5.42, 1.60, and 0.25 percent, respectively. There was no difference for incidence of BEV, BCV, or BRV between upstream and downstream samples across all farms, implying that if a pathogen was present, its source was often upstream of the

sampled pastures. Incidence of BEV in upstream and downstream samples was related to cattle presence on the day and three days prior to sampling, but the incidence of BCV and BRV was not related to the presence of cattle on the day of sampling and three days prior to sampling. Incidence of BEV, BCV, or BRV was not related to the presence of cattle in pasture seven days prior to sampling. Incidence of BEV, BCV, and BRV was regressed by stocking densities of farms and by possible seasonal effects. Using Proc LOGISTIC, incidence of BEV, BCV, and BRV in upstream and downstream samples dramatically decreased because of rainfall on the day of sampling or 24, 48, and 72 hours prior to sampling.

Means of concentrations of FC (n=680) for upstream and downstream samples were 930 and 938 CFU/100 ml, respectively. Differences in FC concentrations were observed by farms, but large variations occurred between upstream and downstream samples.

Preliminary results imply that although grazing cattle may contribute to loading pasture streams with fecal coliforms and

enteric viruses, substantial numbers of the bacteria and viruses may be present in stream water entering pastures. The relationships between the incidences of enteric viruses and cattle presence or rainfall imply that the incidences of the enteric viruses may be short-lived. Therefore, both infection of cows and calves and loading of streams with enteric viruses may be controlled by grazing management practices that alter the temporal/spatial distribution of grazing cattle.

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Table 1. Incidences of BEV, BCV, and BRV in water samples collected at upstream and downstream locations from 13 pastures on 12 farms in 2007 and 2008.

Pasture	Incidence					
	BEV ¹		BCV ²		BRV ³	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
1	1	1	0	0	0	0
2	3	3	0	0	0	0
3	0	0	0	0	0	0
4	0	2	0	0	0	0
5	2	3	2	0	1	0
6	0	0	0	1	0	0
7	1	5	3	2	0	0
8	2	3	2	0	0	0
9	1	2	0	0	0	0
10	4	4	0	1	0	0
11	1	0	0	0	0	1
12	3	1	1	1	0	0
13	1	1	0	0	0	0
Incidence	19	25	8	5	1	1
Total	407	405	407	405	407	405
samples						
Percent	4.67	6.17	1.97	1.23	0.25	0.25
incidence						

¹Bovine enterovirus.²Bovine coronavirus.³Group A bovine rotavirus.