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Incidence of Bovine Enterovirus, Coronavirus, and Group A Rotavirus, and Concentration of Total Coliforms in Midwestern Pasture Streams (Three-year Progress Report)

Abstract

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

Keywords

RFR A9082, Animal Science, Veterinary Diagnostic and Production Animal Medicine

Disciplines

Agricultural Science | Agriculture | Veterinary Medicine

Incidence of Bovine Enterovirus, Coronavirus, and Group A Rotavirus, and Concentration of Total Coliforms in Midwestern Pasture Streams (Three-year Progress Report)

RFR-A9082

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Introduction

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

Grazing of cattle in streamside areas has been associated with increases in the concentrations of total coliforms (TC) in pasture streams in some studies. However, in other studies, there has been evidence of significant contributions of TC to pasture streams from other animal species, such as wildlife. Furthermore, although the presence of TC 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 diarrhea in humans.

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

selected enteric viral pathogens in pasture streams.

Materials and Methods

Bi-weekly water samples were taken from May through November 2007 and March through November 2008 and 2009 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, and BRV viruses, and TC concentration per 100mL of sample.

The FREQ procedure of SAS was used to test the incidence of viruses found for the associations of the cattle being in the pasture on the day, two, three, four, five, six and seven days prior to sampling, along with monthly variation in BEV, BCV, and BRV incidences in upstream and downstream samples. Proc REG was used to test relationships of TC concentration by stocking densities of farms. Proc GLM was used to test the means of the TC concentrations for upstream and downstream samples. A P-value of 0.05 was determined statistically significant with tendencies expressed by a P-value of 0.10.

Results and Discussion

The mean incidence of samples (n=1,274; Table 1), for BEV (49 incidences), BCV (14 incidences), and BRV (6 incidences) in water samples collected both upstream and downstream were 3.91, 1.12, and 0.49%, respectively. There was no difference for incidence of BEV, BCV, or BRV between upstream and downstream samples across all farms. Incidence of BEV in upstream samples

tended to be related to cattle presence on the day, two and four days prior to sampling, but downstream samples only tended to be related to cattle presence on the day of sampling. Incidences of BCV and BRV were not related to the presence of cattle in the pasture at anytime during the three-year period.

Seasonal incidences of BEV and BCV in upstream and downstream samples were greater in the summer and fall, respectively, than spring, but BRV incidence did not differ in upstream and downstream samples between seasons.

Concentrations of TC were regressed against cattle stocking densities for the sampling periods between samples or the entire year. However, no relationship existed between TC and the stocking density measures evaluated.

The mean concentrations of TC (n=1,066) for upstream and downstream samples were 1,269 and 1,417 CFU/100 ml, respectively. Differences were observed by farms, but large variations occurred between upstream and downstream samples.

Results imply that although grazing cattle may contribute to the loading of pasture streams

with fecal coliforms and enteric viruses, substantial numbers of bacteria and viruses may be present in the stream water entering a pasture. The relationships between the incidences of enteric viruses and cattle presence 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 for BEV, BCV, and BRV in water samples collected at upstream and downstream locations from 13 pastures on 12 farms during the 2007, 2008, and 2009 grazing seasons.

Pasture	Incidences of Viruses					
	Bovine Enterovirus		Bovine Coronavirus		Group A bovine rotavirus	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
1	1	1	0	2	0	2
2	4	3	0	0	0	1
3	0	1	0	0	0	0
4	0	1	0	2	0	1
5	2	3	1	0	1	0
6	0	1	0	2	0	1
7	1	5	2	1	0	0
8	2	3	1	1	0	0
9	1	2	0	0	0	0
10	4	4	1	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	21	28	6	8	1	5
Percent incidence	3.34	4.47	0.96	1.28	0.16	0.80