Grazing Management Effects on the Sward and Physical Characteristics Relative to Streams in Cool-Season Grass Pastures

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Summary and Implications

Different grazing management practices in pastures may affect the sward and physical characteristics of riparian areas which affect sediment, phosphorus, and fecal pathogen loading of the pasture streams. To measure these effects, six 30-acre cool-season grass pastures, bisected by a stream, were split into two blocks with three treatments per block. Pastures were grazed by continuous stocking with unrestricted stream access (CSU), continuous stocking with access to the stream restricted to a 16-foot wide stabilized stream crossing (CSR), or rotational stocking (RS). For data and sample collections, pastures were divided into 4 zones: on the streambank (streambanks zone), 0 to 110 feet from the streambanks (110 zone), 110 and 220 feet from the streambank (220 zone), and greater than 220 feet from the streambank (upland zone). Forage heights were measured and forage samples were collected and analyzed for dry matter and mass from areas where cattle did or did not congregate in each zone monthly from May to October. The percentages of bare and fecal-covered ground were also measured monthly at each sampling site. Sward heights were lower in cattle congregation areas than open areas through all months ($P < 0.05$). In the later months of the grazing season, sward heights and forage mass were less in the streambanks and 110 zones of the CSU pastures than CSR pastures. Pastures with CSU also had higher ($P < 0.10$) percentages of fecal-covered ground cover in the 110 zone than the other treatments through August. There were few significant differences between treatments for forage sward height, forage mass or bare or fecal-covered ground in the 220 and upland zones in any month.

Introduction

Water quality of pasture streams is important as the streams provide water for drinking, fish habitat, and recreational purposes. Poorly managed grazing may allow cattle to congregate around a stream where they may create higher concentrations of bare and fecal-covered ground in an area of the pasture that is sensitive to erosion. The use of different grazing systems can reduce the amount of time that cattle congregate near streams and reduce the negative impacts caused by cattle grazing within these areas. The objective of this project was to study the effects of different grazing management practices on the sward and physical characteristics of cool-season grass pastures.

Materials and Methods

Six 30-acre pastures containing smooth bromegrass and reed canarygrass and bisected by a stream near Rhodes, Iowa were split into two blocks of three treatments. Treatments included: continuous stocking with unrestricted stream access (CSU), continuous stocking with access to the stream restricted to a 16-foot wide stabilized stream crossing (CSR), or rotational stocking (RS). The RS pastures were divided into 5 paddocks. Cattle in non-riparian paddocks were rotated when the cattle had grazed half of the available forage or for a maximum of 14 days. Riparian paddocks were grazed to a minimum sward height of 4 inches or for a maximum of 4 days. Riparian buffers on either side of the crossings in pastures with the CSR treatment were not grazed. Each pasture was stocked with 15 fall-calving Angus cows from mid-May to mid-October. All pastures had been grazed by these treatments for the preceding three years.

Forage sward height and mass and the percentages of bare and fecal-covered ground were measured in open and congregation areas on the streambanks (streambanks zone) or from 0 to 110 feet (110 zone), 110 to 220 feet (220 zone) or greater than 220 feet (upland zone) of each pasture monthly from May to October. Congregation areas were determined as the areas under the drip-line of a trees, areas around the alternative waters (unavailable to cattle for all but one week of each month), areas around the mineral feeders, and areas of water access points along the stream. Sampling locations were at up to 6 randomly selected sites in the congregation and open areas in the streambanks, 110, and 220 zones of each pasture. Forage sward height and the percentages of bare and fecal-covered soil were measured at 48 and 24 randomly selected sites in open and congregation areas, respectively, in the upland zone of each pasture. Forage mass was measured at 24 randomly selected sites in open and congregation areas in the upland zone of each pasture. Forage sward heights were measured using a falling plate meter (4.8 kg/m^2) and the percentages of bare and fecal-covered ground were measured using the line-transect method over 50 feet. Forage samples were collected by hand-clipping all forage within a 0.25-m^2 square to a height of one inch from the ground.

To measure the differences between congregation and open areas, data were analyzed by the GLM procedure of SAS by month using treatment, zones and congregation as independent variables. To analyze the effects of grazing

treatments, data in each zone were calculated as weighted averages based on the percentages of congregation and open areas of each zone in each pasture. Data were analyzed using the GLM procedures of SAS by month and zone with block and treatment being the independent variables.

Results and Discussion

Effects of Cattle Congregation

As expected, mean forage sward heights, forage masses, and the proportions of ground that were bare were lower ($P < 0.05$) in the congregation areas than open areas in all months except for June (Table 1). As there were few and inconsistent interactions between congregation and treatments or zones for forage sward height, forage mass or the proportion of bare ground, congregation areas were defined similarly regardless of treatment or zone.

In spite of the congregation of the cattle, fecal cover in the congregation areas was only greater ($P < 0.05$) than open areas in July.

Sward Height and Forage Mass

Forage sward heights on the streambanks were greater ($P < 0.05$) in CSR than CSU pastures in September and October (Fig. 1). Forage sward heights in the 110 zone were greater ($P < 0.05$) in CSR than CSU pastures in August as well as September and October (Fig. 2). Forage sward heights of RS pastures were also greater ($P < 0.05$) than CSU in August and September in the 110 zone. Because of excessive rain and flooding during June, the riparian paddocks of the RS pastures were excluded from the rotation of cattle through the paddocks because of the concern that excessive erosion could have taken place during these extremely wet conditions. As a result, cattle were not allowed to graze the riparian zone until late July, allowing for greater height and mass of forage in the riparian zone at least until that time. There were no differences in forage sward heights between treatments in the 220 (Fig. 3) and upland (Fig. 4) zones from May through September. However, in October, forage sward heights in the 220 zone were lower ($P < 0.10$) in CSR than RS pastures. In the uplands, the sward heights of pastures with the RS and CSU were greater ($P < 0.10$) than CSR pastures and the sward heights of pastures with RS were greater ($P < 0.10$) than CSU pastures.

Forage mass in pastures with CSR treatments were greater ($P<0.10$) than CSU pastures during September and October in the streambanks (Fig. 5) and during September and October in the 110 zones (Fig. 6). Forage mass in the streambanks zone of pastures with the RS treatment were greater ($P < 0.10$) than CSU pastures in July, but less ($P < 0.05$) than CSR pastures in October. In the 220 zone (Fig. 7), forage mass in pastures with CSR were greater ($P < 0.05$) than CSU pastures and pastures with RS were greater ($P < 0.05$) than CSU pastures in June. Pastures with CSU had greater ($P < 0.10$) forage mass than CSR pastures in the uplands (Fig. 8) in July and September. The greater sward heights and forage masses in the upland zones in the later months of the grazing season were likely caused by the cattle in CSR treatments having 7.5% less ground to graze, as they were not allowed to graze in the riparian buffers on both sides of the stabilized stream crossings.

Fecal and Bare Ground Cover

Fecal-covered ground on the streambanks only differed ($P < 0.05$) in October when pastures with either the RS or CSU treatments had greater fecal cover than CSR pastures (Fig. 9). In the 110 zone, CSR and RS pastures had less fecal cover ($P < 0.10$) than CSU pastures in the months of May through August (Fig. 10). In September, CSR pastures continued to have lower ($P < 0.10$) fecal cover than CSU pastures, while RS pastures did not differ from CSU pastures. There were no significant differences in fecal cover between treatments in either the 220 or upland zones.

The proportions of bare ground on the streambanks of pastures with the CSU treatments were greater ($P < 0.10$) than CSR pastures in May, July, and October and RS pastures in May and October (Fig. 11). Bare ground proportions in the 110 zone of pastures with the CSU treatments were greater ($P < 0.10$) than RS pastures in May and September, and CSR pastures in May, September, and October (Fig. 12). Similar to fecal cover, there were no differences in bare ground between treatments in either the 220 or upland zones (Data not shown).

Conclusion

The results of this study show that allowing grazing cattle unrestricted access to pasture streams reduced forage sward heights and forage mass within 110 feet of the stream. Moreover, restricting stream access to stabilized crossings with riparian buffers reduced the proportions of fecal-covered and bare ground within 110 feet of the stream. Similarly, rotational stocking with flash grazing of the riparian paddock can reduce bare ground and increase forage sward height and mass near the stream. Rotational stocking can also reduce fecal deposition near the stream until later in the season when cattle have been able to graze the riparian paddock multiple times. These results represent the first year of a two year grazing trial.

Acknowledgments

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Table 1. Mean sward heights, bare ground, fecal cover and forage mass in open and congregation areas of pastures averaged between zones and treatments of the 2008 grazing season.

			Month			
Location	**May**	**June**	**July**	**August**	**September**	**October**
			Sward height, cm			
Open	14.1	21.9	19.5	15.8	13.1	6.9
Congregation	11.4	18.9	10.7	9.6	7.3	4.7
Significance	P < 0.05	P < 0.05	P < 0.05	P < 0.05	P < 0.05	P < 0.05
			Bare ground, %			
Open	4.9	9.9	4.1	6.7	5.4	2.8
Congregation	12.3	9.5	12.9	12.8	12.3	8.1
Significance	P < 0.05	NS	P < 0.05	P < 0.05	P < 0.05	P < 0.05
			Fecal ground cover, %			
Open	0.19	0.29	0.39	0.62	0.76	0.98
Congregation	0.17	0.53	0.75	0.65	4.1	1.5
Significance	NS	NS	P < 0.05	NS	NS	NS
			Forage mass, kg/ha			
Open	1653	2349	2322	2668	2842	1418
Congregation	1071	2895	1464	1697	1494	999
Significance	P < 0.05	NS	P < 0.05	P < 0.05	P < 0.05	P < 0.05

Figure 1. Forage sward height in the streambank zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) during the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, (P < 0.10).

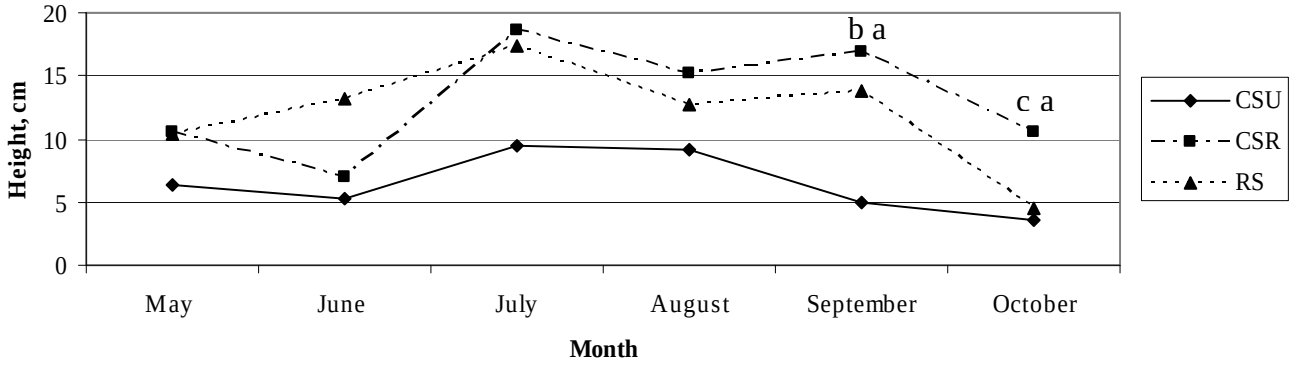

Figure 2. Forage sward height in the 110 zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) during the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, (P < 0.10).

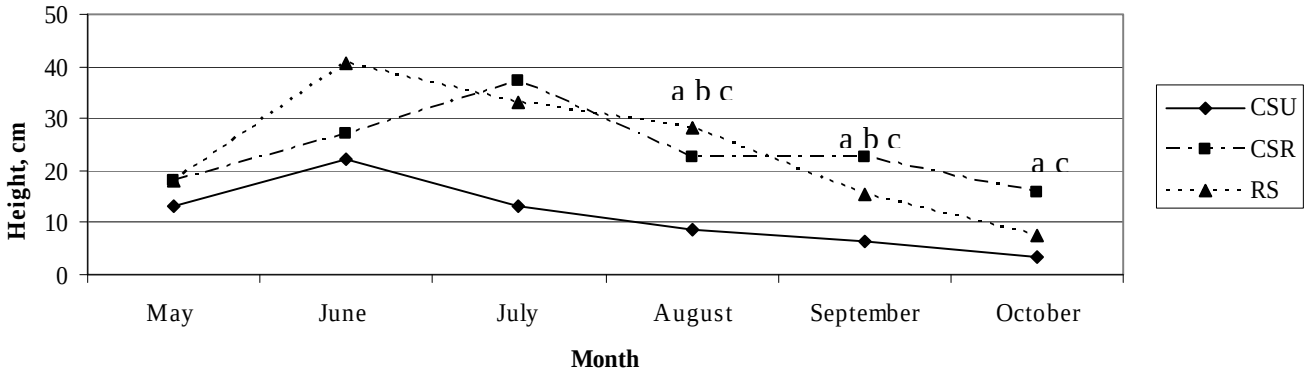

Figure 3. Forage sward height in the 220 zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) during the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, (P < 0.10).

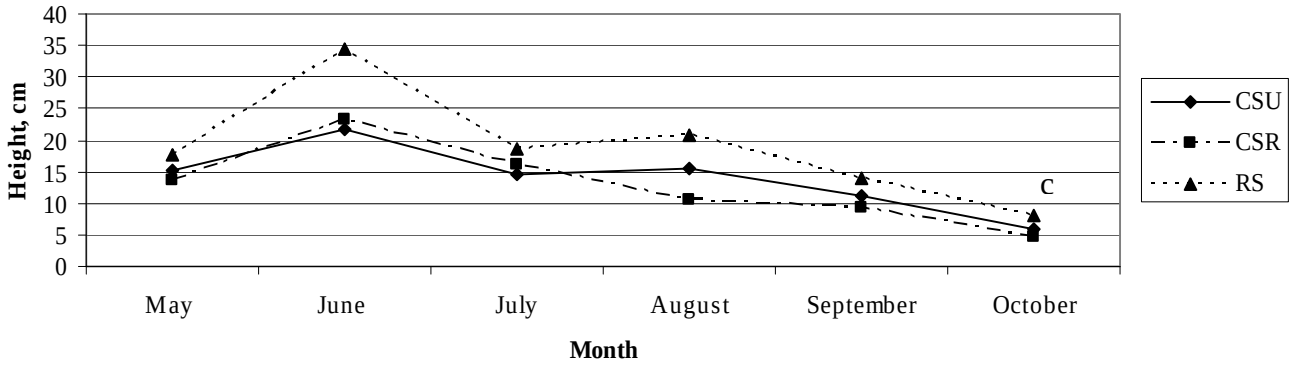

Figure 4. Forage sward height in the upland zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) during the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, (P < 0.10).

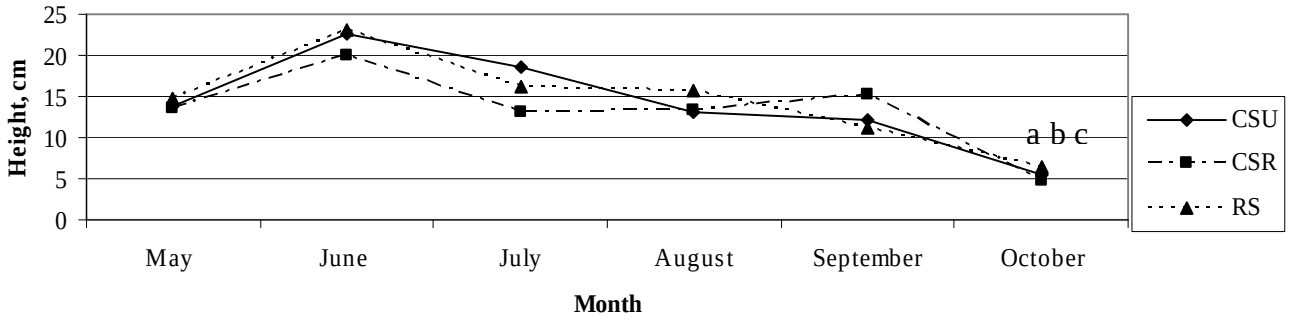

Figure 5. Forage mass in the streambanks zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) during the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, (P < 0.10).

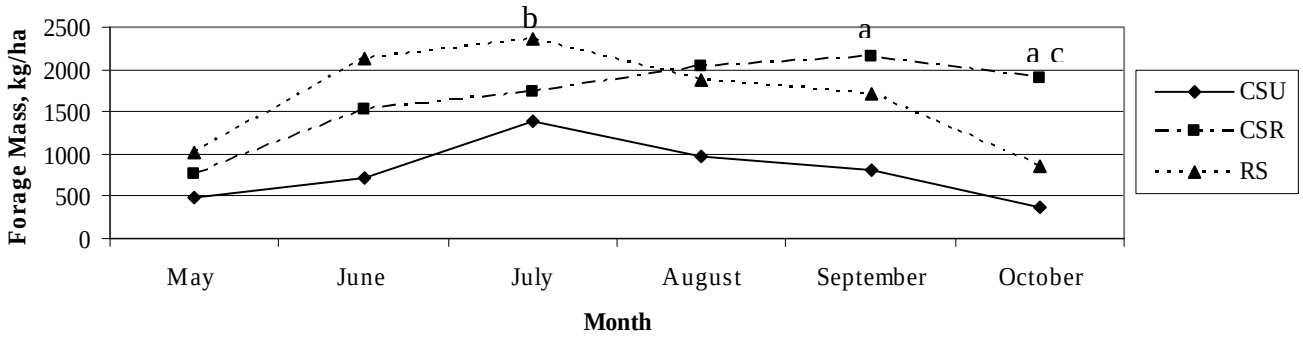

Figure 6. Forage mass in the 110 zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) during the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, (P < 0.10).

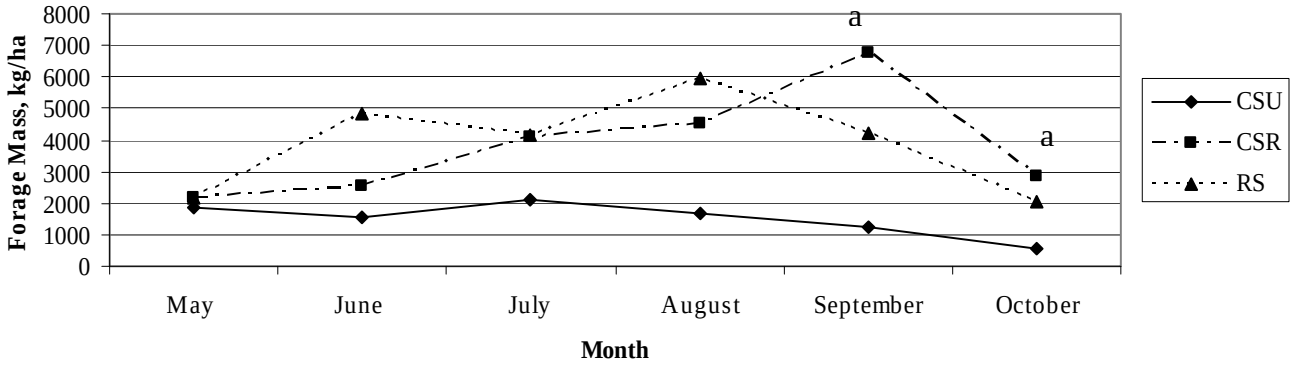

Figure 7. Forage mass in the 220 zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) over the three stocking treatments during the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, (P < 0.10).

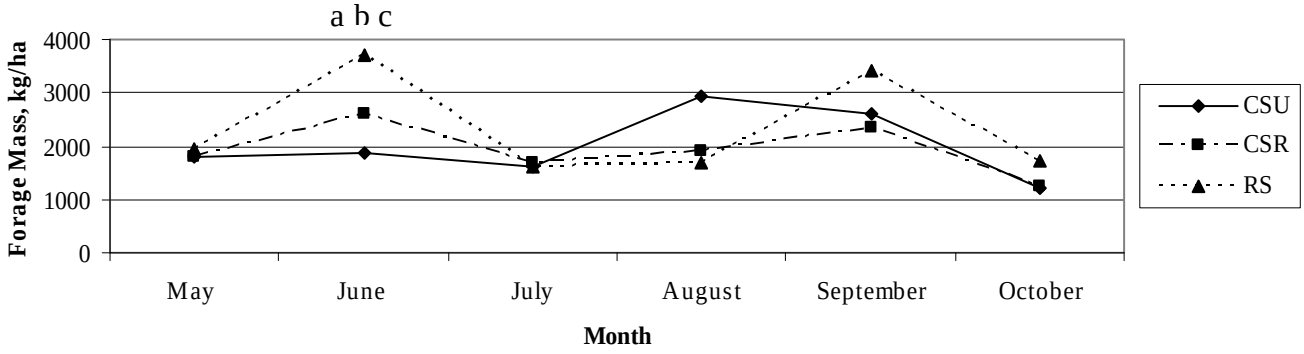

Figure 8. Forage mass in the upland zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) during the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c= CSR differs from RS, (P < 0.10).

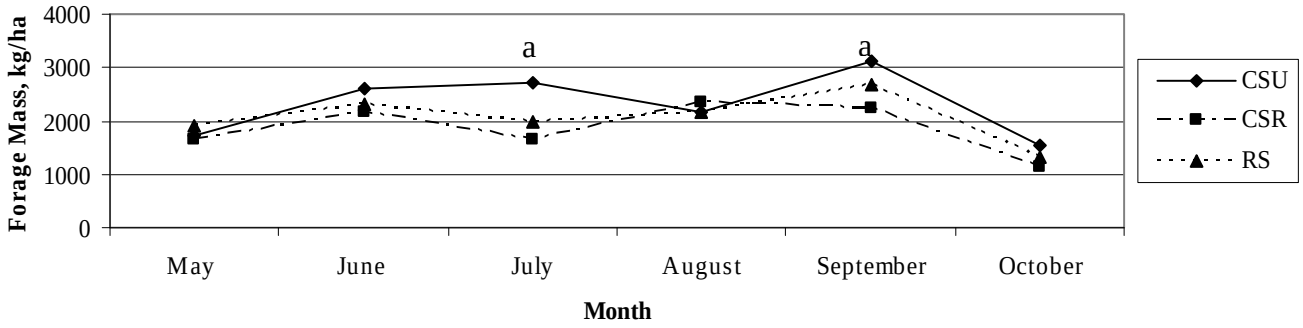

Figure 9. Fecal ground cover in the streambanks zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) in the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, (P < 0.10).

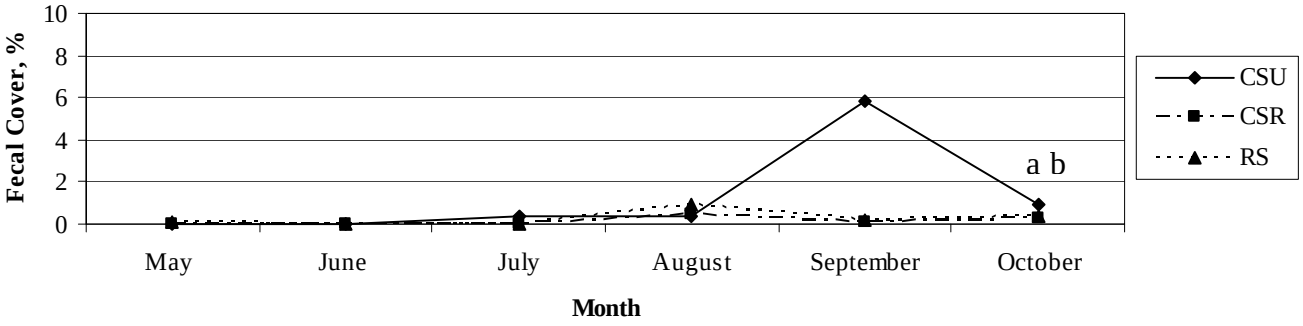

Figure 10. Fecal ground cover in the 110 zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) in the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, (P < 0.10).

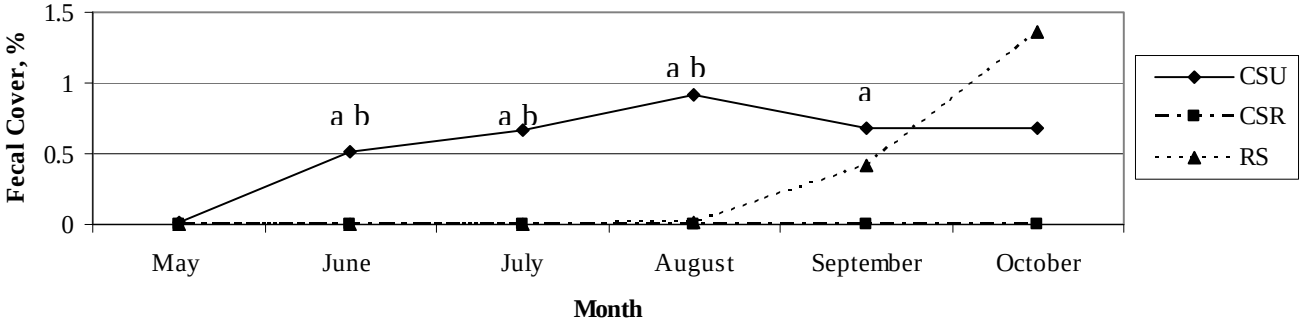

Figure 11. Bare ground in the streambanks zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) in the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, (P < 0.10).

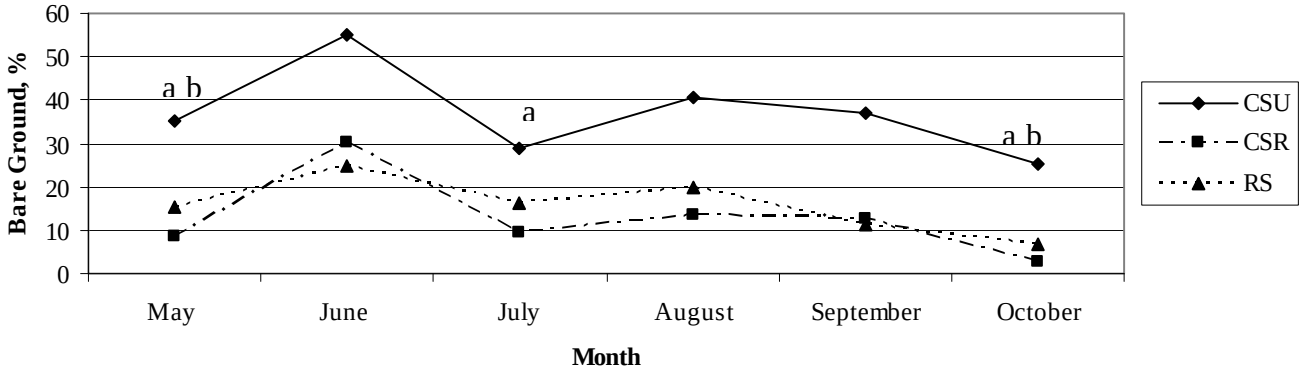

Figure 12. Bare ground in the 110 zone of pastures grazed continuous stocking with unrestricted stream access (CSU), continuous stocking with restricted stream access (CSR), or rotational stocking (RS) in the 2008 grazing season. a = CSU differs from CSR, b = CSU differs from RS, c = CSR differs from RS, ($P < 0.10$).