Influence of Electronic Diversion from Riparian Areas on Livestock Grazing Behavior, Nutritional Physiology, Stress Physiology, and Performance

Teena M. Tibbs, T. DelCurto, M. McInnis, A.R. Tiedemann, and T.M. Quigley

SUMMARY

A challenge facing public land managers and beef cattle producers in the western United States is distribution of livestock relative to sensitive riparian areas. Tools used in the past, such as corridor fencing, are not as readily accepted due to concern over wildlife, recreation, and aesthetic values. As a result, beef cattle producers and range managers need tools which may replace traditional fencing to control livestock movement and distribution.

One potential tool involves the use of radio transmitters and receivers to control livestock movement and distribution (Quigley et al., 1990). The concept of the transmitters and receivers is similar to a shock collar used for training dogs. The cattle wear a radio receiver eartag that is the size of a small transistor radio and weighs 3.5 oz. A battery operated transmitter is placed in an area of desired livestock exclusion and is manually set to send out a signal that creates an exclusion zone to the animals wearing the eartag receivers. When an animal wearing an eartag receiver approaches the signal boundary from the transmitter (exclusion zone), the animal receives an audio signal and, if they do not return to the grazing zone, a maximum of four electrical signals. If the animal leaves the exclusion zone before receiving four electronic signals, the signals will stop, but, if they ignore the signals and remain in the exclusion zone, they will receive the audio and four electronic signals. The signal from the transmitter and subsequent stimulus received by the eartag will then train the animals to avoid exclusion areas (Figure 1).

Objectives

The objectives of the following study were to determine the effects of electronic diversion from riparian areas on beef cattle health, nutrition, and performance.

EXPERIMENTAL DESIGN

Thirty-six yearling heifers (avg. wt = 656 lb) and eight rumen fistulated steers (avg. wt = 554 lb) were stratified by weight and, within stratum, randomly allotted to 6 pastures (3 blocks, 2 treatments) with 6 heifers per pasture and 2 steers in 4 of the 6 pastures. The treatments consisted of three control pastures where animals had free access to the entire pasture, and three pastures where animals were diverted from the riparian areas by wearing electronic eartags that emitted audio and electrical stimulus when they entered the exclusion zone (Figure 2).

Body weight and condition of the heifers was measured on day 0, 28, and 56 after being off water and feed for 16 hours. Blood samples were obtained at the same times, with an additional sample taken on day 14 of the study period to look at the physiological stress occurring, if any, to the animals. Rumen fistulated steers were used to obtain fecal output measurements and rumen evacuation samples that determined diet quality and animal performance.

RESULTS

The heifers with free access to the entire pasture performed better than the heifers diverted from the riparian area. Average daily gain (ADG) was 18.8 percent greater in control heifers verses the treatment heifers diverted from riparian areas with both groups still maintaining a positive ADG. In contrast, body condition was not influenced by treatments (Table 1).

The blood samples taken at trial initiation (day 0), day 14, day 28, and day 56 (early trial termination) suggests that no physiological stress occurred with heifers that received electronic stimuli. Blood samples were assayed to measure plasma cortisol, a primary indicator of stress in the circulatory system, and T3/T4 levels. The measurements indicated no influence by treatments, thus suggesting that heifers were not significantly stressed by electronic eartags. In addition, serum urea nitrogen N levels tended to be higher in control heifers verses treated heifers. The differences in serum urea may be explained, in part, by the heifers with access to the riparian area selecting a higher quality of diet (Table 1).

Crude protein (CP) content of diets were higher in the steers with free access to the riparian area verses the steers diverted from the riparian area. In contrast, no differences were observed in the fibrous constituents of treatment and control diets. Thus confirming that animals diverted from the riparian area selected a lower quality of diet due to their altered distribution (Table 1).

DISCUSSION

The ability to control livestock movements and distribution relative to riparian areas with electronic diversion would provide livestock producers and public land managers an alternative tool to use in addressing the issues they are facing today. The potential benefits in the ability to electronically divert livestock from sensitive areas are: 1) modifying livestock distribution, 2) providing a tool to use in multiple-use rangeland resource management, and 3) providing an economical alternative to corridor fencing of riparian areas. When diet quality was analyzed it appeared the animals diverted from the riparian area consumed a lower quality of diet. The lower quality of diet consumed suggested the grazing behavior had been altered and, as a result, influenced animal performance.

This study indicated that no significant signs of physiological stress were put on the animals from electronic stimuli being received by their ears when they entered the exclusion zone. There was, however, physical damage that occurred to the ears from the eartag being too heavy (3.5 oz). This damage to the ears necessitated early termination of the study (day 56, rather than the planned day 84). The patent is pending on this electronic diversion system, but when the patent is granted a company can purchase the rights to the system and

improve upon the technological problems. Problems, such as making the eartag smaller and controlling the exclusion zone boundary, need to be addressed before the potential use of this tool can be realized.

LITERATURE CITED

Quigley, T.M., H.R. Sanderson, A.R. Tiedemann, and M.L. McInnis. 1990. Livestock Control with Electrical and Audio Stimulations. Rangelands 12:152-155.

Table 1. Influence of Electronic Diversion From Riparian Areas on Livestock Grazing Behavior, Nutritional Physiology, Stress Physiology and Performance

Item	Treatment[a]	Control[b]	SE	P-Value
Wt. Gain, lb/day	1.46	1.76	0.09	0.02
BC Change	1.05	0.86	0.11	0.23
Intake, lb/day	14.12	15.12	0.58	0.19
Distance Traveled, mi/day	3.23	3.51	0.31	0.53
Grazing Time, hr/day	7.26	7.68	0.40	0.60
Diet Composition (% of OM)				
CP, %	13.40	16.90	0.74	0.03
ADIN, (% of total N)	24.70	22.30	1.97	0.43
NDF, %	66.60	68.20	0.89	0.28
ADF, %	41.80	41.30	0.66	0.60
Physiological Performance				
T3, ng/mL	1.62	1.62	5.37	0.96
T4, ng/mL	55.00	53.00	0.12	0.33
CORT, ng/mL	57.50	51.30	0.69	0.59
SUN, mg/dL	12.05	13.18	0.40	0.19

[a] Treatment = animals diverted from riparian areas by electronic stimulation.

[b] Control = animals with free access to entire pasture including the riparian areas.

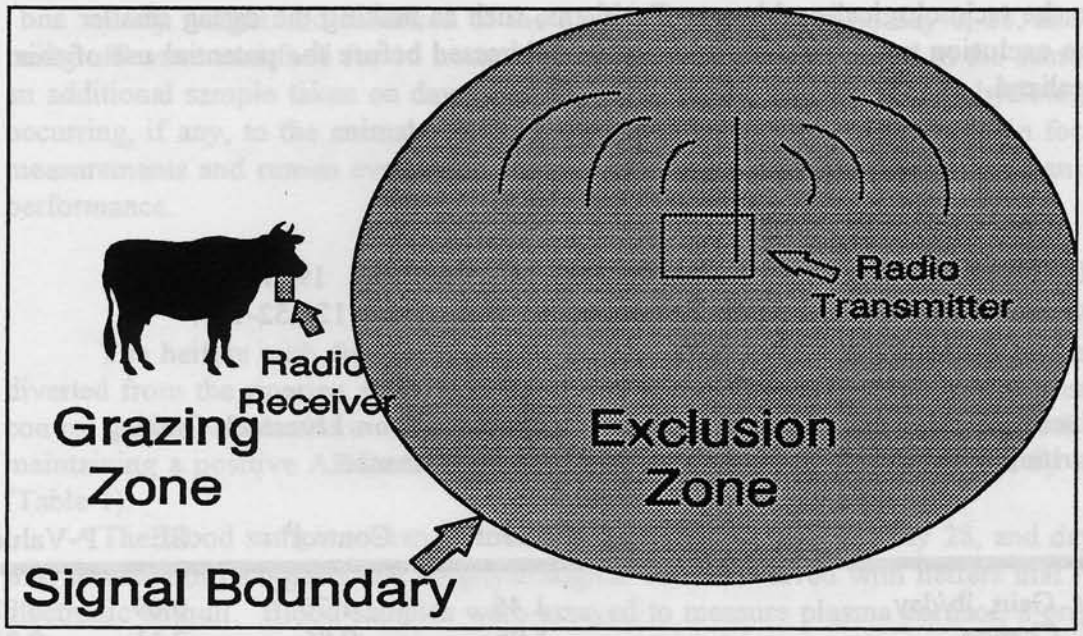

Figure 1. Animal with eartag approaches boundary of signal from transmitter that describes the exclusion zone and receives an audio warning tone. If the animal ignores audio warning it receives electrical stimulus and it turns into the grazing zone and the stimulus stops. If the animal ignores the electrical stimulus the eartag will lock up after four stimuli.

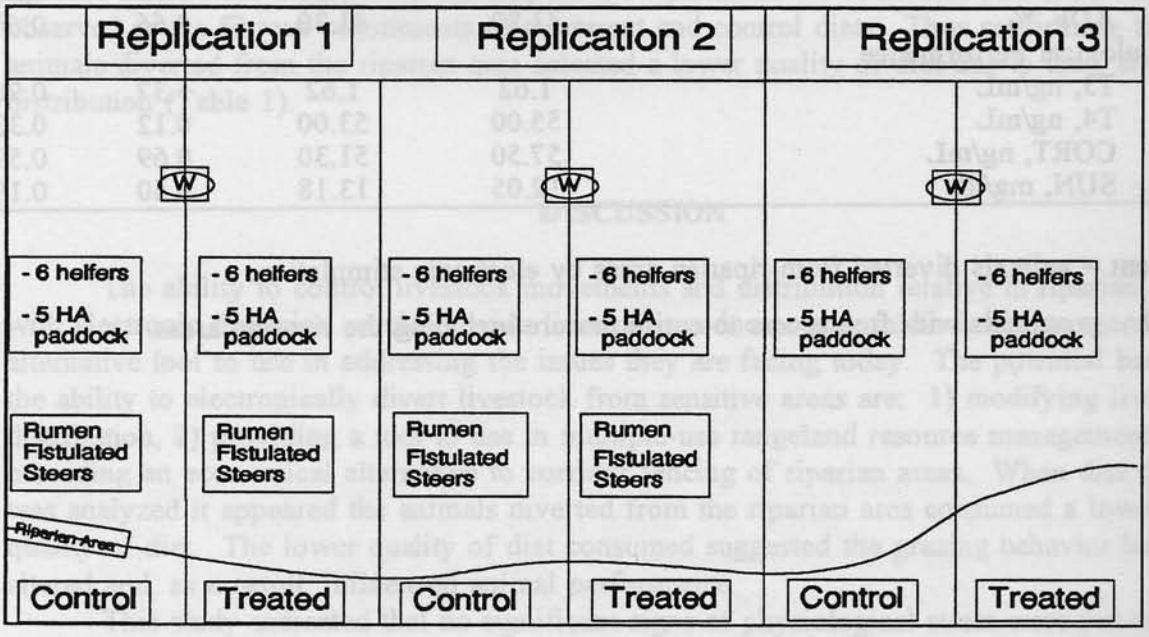

Figure 2. Experimental Design and Physical Layout of the Study Plan. Animals were rotated among pastures within replication every 14 days. Water tanks (W) will be available away from riparian areas for all treatment groups. Diet quality and intake estimates will be determined in replications one and two using the rumen/esophageal steers.