Evaluation of Rumen Boluses as an Electronic Identification System for Cattle in an Automated Data Collection System

A.S. Leaflet R2073

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Summary

The rumen bolus electronic animal identification system was evaluated in 120 feedlot steers during a 130 day observation period. Boluses were placed in the reticulum using a balling gun. A panel antenna was located inside (left side) of a hydrolytic restraining chute placed on load cells and connected to a Tru-Test scale indicator to display and store the electronic identification number and weight of the animal. Once displayed on the indicator the identification number and weight were stored in a file in the indicator which was later downloaded as an Excel file. Using Data/Sort in Excel the new data could easily be matched with animal Id numbers in an evolving file for the experiment. All of the boluses were retained in the animals and all remained functional. The system accurately recorded the information for 711 of 720 times the animals were weighed, or an accuracy of 98.75%.

Introduction

The National Animal Identification System (NAIS) as applied to cattle is a national program being developed to identify individual animals in the United States and to record their movement over their lifetime. The purpose of NAIS is to enable 48-hour trace back of the movements of any diseased or exposed animals and thereby ensure rapid disease containment and maximum protection of America's animals. The potential benefits of a reliable system are more extensive than disease control and include verification of source, age and process verification which have value in coordinated data-sharing systems, increasing consumer confidence in the American beef supply and increasing competitive of American beef in export markets. Radio frequency identification (RFID) will likely be used to identify cattle. These devices have an electronic number that will be unique for an individual animal and link that animal to the data base. Commercially available RFID devices developed for use in cattle include implants, ear tags and rumen boluses. These devices contain a transponder with a microchip that has the code for the identification number. The transponder can be activated by an electronic signal from a reader that decodes the data it receives and stores the number in its memory or transfers the number to another storage system. Both the reader and the transponder have antenna for sending and receiving electronic signals. The antenna can be enclosed with the electronics of hand-held readers or housed in panel readers remote from the electronics. Several types of methodologies have been developed to activate the transponders. Full duplex transponders receive electromagnetic energy from the reader and send its encoded signal back simultaneously, whereas half duplex transponders have a small capacitor that becomes charged with energy from the reader and stops sending energy while the transponder sends its encoded signal. Performance standards of an RFID system include read rate, read distance (distance from reader to transponder), failure rate and durability (life span of the transponder). Characteristics of a system that have value are tamper evident (one time use to maintain integrity of NAIS), retention of the device with the animal (minimum loss rate) and resistance to abrasion.

The rumen bolus system was evaluated in a previous study (A.S. Leaflet R1726, 2000). The transponders in the boluses used in that study were full duplex and a hand-held reader was used. The reader was not connected to a computer for electronic storage of animal ID that could be transferred to a national data base. In the time interval since the first study, the rumen bolus system has been developed to include the half duplex methodology and a panel reader has been developed that will store the numbers in an external device. This study was an evaluation of this later system.

Methods

AVID, Norco, California, developed the RFID system evaluated in this study. The transponder was in a 20 x 65 mm ceramic bolus (Figure 1) weighing approximately 70 grams. Boluses were placed in 125 855-lb steers using a balling gun (Figure 2) 131 days prior to harvest. The steers had free access to water and were fed ad libitum twice per day total mixed diets containing 80% dry rolled corn, 10% corn silage, 5% chopped bromegrass hay and 5% supplement. The reader antenna (Figure 3) was placed on the left side of a hydrolytic restraining chute positioned on load cells. The antenna could read full or half duplex transponders and could have been powered by a 12 volt battery, but was powered by a 110-volt converter. The antenna was connected to a Tru-Test Model SR 3000 indicator (Figure 4). The complete system is shown in Figures 5 and 6. When a steer entered the chute, the animal’s electronic identification number (EID) and weight were read and displayed on the weighing screen of the indicator. The indicator could have been programmed to automatically store the weight and EID number for each animal in a predetermined file, but were manually stored in the file after verifying the EID with the visual ear tag number. The EIDs were read six times when the cattle were being weighed.

After each weigh period, the indicator was taken to the office and the file downloaded to a file for the experiment maintained in a desktop computer using Link 3000 Version 1.0u (Tru-Test). The file for the experiment was set up by arranging animals within pens to obtain average weight of steers in each pen. Using Data/Sort in Excel, data in the new file could easily be matched with that in the original experimental file.

Results and Discussion

All of the boluses remained in the steers during this 130 day observation. In previous studies when similar boluses were recovered at harvest, the boluses were found in the ingesta of the reticulum. The panel antenna was located on the left side of the animals as they entered the chute. The boluses were detected by the panel antenna as the animals were walking into the chute. Infrequently a bolus was not read until the animal was in the chute and had changed position. Presumably the bolus in these animals was farther from the antenna as the animals entered the chute or alignment of the transponder with the antenna was not ideal for reading. As shown in Table 1, there were 711 correct readings and recordings out of 720 total readings, or 98.75% success. Lack of recording was not the result of failure of the transponders because there were no repeat failures of the same bolus in subsequent weigh periods. The failure to record the EID number with the weight was likely the result of the bolus not being immediately detected and our manually entering an ID number and the weight into the indicator file. We do not have an explanation for three multiple recordings. Presumably once entered into the file of the indicator, there should have been a warning of replacing the file. This evaluation was the initial experience of the operators with an automated system for recording animal ID and weight. With increased experience and confidence in the system for accurately collecting experimental data there are likely to be less lost data.

Table 1. Results of reading boluses on six different days.

Day	Number read/recorded correctly	Number not recorded	Number multiple recording
1	120		
28	117	3	
56	117	3	
84	120		1
112	119	1	1
130	118	2	1

The files in the indicator were downloaded as Excel files and stored in a desktop computer file for the experiment.

The rumen bolus EID system was not compared with other systems in this evaluation so it is not possible to rank systems. This study did not provide information on performance of the transponders over a long period of time as would be required for breeding animals. However the bolus system has value as an EID system for cattle because it can not be removed from a live animal, it is not lost from the animal and because of its location it is resistant to damage from abrasion from fences and other animals.

Acknowledgements

The boluses and panel antenna were supplied by AVID, Norco, California. The assistance of Rod Berryman, research farm superintendent; Julie Roberts, Beef Center secretary; and the animal caretakers at the ISU Beef Nutrition and Management Research Center is appreciated.

Figure 1. Bolus.

Figure 2. Balling gun.

Figure 3. Panel antenna.

Figure 4. Weighing system indicator.

Figure 5. Hydrolytic restraining chute.

Figure 6. Reading system.