TECHNICAL NOTES

Total Urine Collection from Free-grazing Heifers

M.A. STILLWELL, R. SENFT, AND L.R. RITTENHOUSE

Abstract

A urine collection device for female bovines is described. This device allows simultaneous collections of urine and feces, is reusable, and is designed for use on free grazing animals. Tests of the device were successful and showed no major problems under field conditions.

Studies of nitrogen and energy dynamics of free-grazing animals are essential to the understanding of the function of grazed ecosystems. In most cases, however, intake and fecal excretion are the only parameters examined, even though urine represents an important pathway of excretion of metabolic N and energy (Church 1976). Established procedures exist for determining intake and fecal excretion for free-roaming animals (Van Dyne 1980), but measurement of urinary output remains a difficult task.

Gorski et al. (1957) suggested a system of total collection of both urine and feces for female bovines, but difficulties in harness adjustment and the need for frequent removal of the excreta made it impractical for range conditions. Lesperance and Bohman (1961) used an inflatable catheter and truck inner tube mounted on the back of the animal to collect urine. The disadvantage of this system was difficulty in draining the bag. Further, maintenance of sterile conditions to prevent urea hydrolysis and reuse of bags was impractical. Our objective was to design a urine collection device for simultaneous collection of urine and feces, that was reusable and easily sterilized, and could be used on free-grazing heifers.

Materials and Methods

Fecal Collection Bag

The fecal collection bag and harness was similar to that designed by Garrigus and Rusk (1939). The design was modified only by the addition of two buckles to the girth strap, two D-rings to the breast collar (Kartchner and Rittenhouse 1979), and a vertical 3-cm slit in the fecal bag opposite the heifer's vulva.

Urine Collection Bag

The urine collection device was composed of 2 parts: (1) a carrier, and (2) a series of 6 closed urine drainage bags connected to a urinary catheter. The carrier was made from heavy nylon-reinforced vinyl sown to form 6 pockets (Fig. 1). A small slit was made in the corner of each pocket to allow access to a drainage tube. A strap was added under the front pockets to fasten the carrier to the girth strap of the fecal harness. Grommets in the front and rear corners allowed attachment of D-rings on the breast collar and sides of the fecal bags.

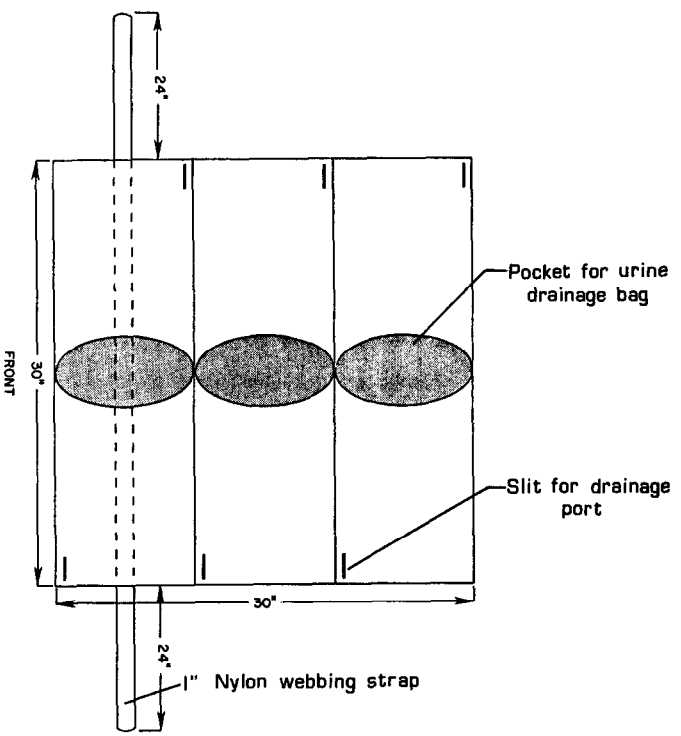
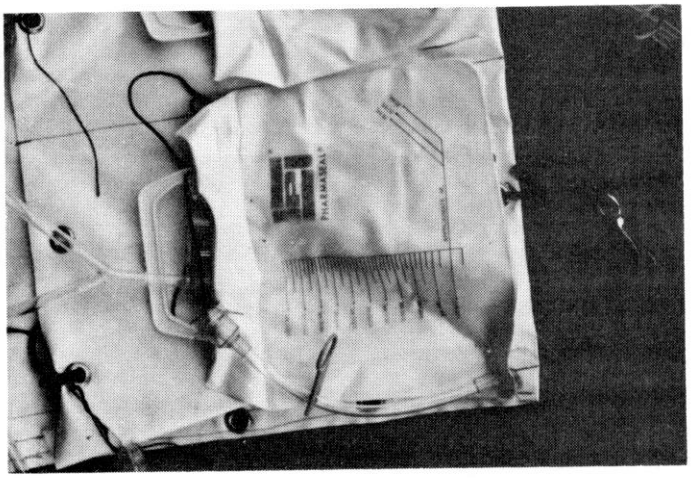


Fig. 1. *The carrier for the urine collection apparatus was made from a single 30 × 60" piece of nylon-reinforced vinyl tarpulin material folded and sewn to form 6 pockets. A urine drainage bag was stuffed into each pocket. The slit in the lower left corner of each pocket allowed easy access to the drainge port of the urine drainage bags. The nylon webbing straps were attached to the girth strap of a modified fecal collection bag harness.*

Urine flowed through a #24 Foley catheter into a series of six 2-liter Pharmaseal closed urine drainage bags with one-way valves (Fig. 2). A 1/4-in. Nalgene Y split the urine stream from the catheter into 2 flows entering the first pair of bags (Fig. 2). A pair of Y's just above each of the front bags shunted backflow from the front bags to the middle pair. Backflow from the middle pair of bags was directed to the rear bags via a second set of Y's. A

Authors are graduate students and professor with the Range Science Department, Colorado State University, Fort Collins, Colo.
This research was supported by NSF Grant No. DEB 7906009 and Colorado State University Sci. Ser. No. 2783.
Manuscript received September 24, 1982.



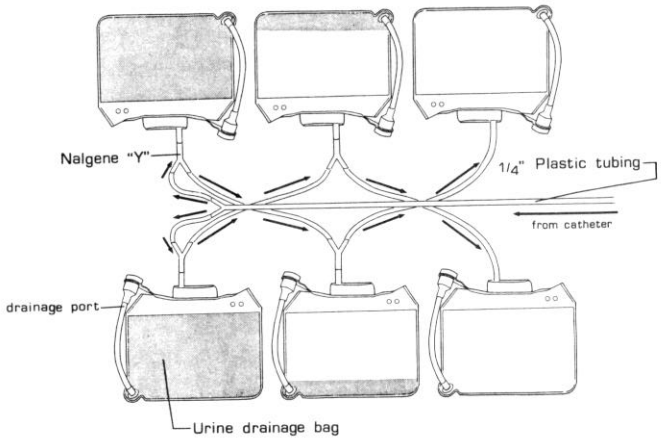


Fig. 2. *Interior plumbing of the apparatus consisted of six 2-liter urine drainage bags connected to a urinary catheter via 1/4" plastic tubing. Diection of urine flow is indicated by the arrows. The tubing was arranged so that the anterior bags filled first at approximately equal rates. Overflow from the forward bags was directed to the middle bags; and overflow from the middle bags went to the rear bags. Drainage ports and tubing are protected from brush and barbed wire by a 30 × 30" vinyl cover which snaps on the carrier.*

drainage bag was stuffed into each pocket of the carrier and drainage tube allowed to extend through the slit. A metal clamp was used to close the drainage tube, which was secured to the top of the pocket. A removable vinyl cover was attached to the carrier to prevent damage to the catheter line or the drainage tubes.

The urine was collected from the bags by lowering the drainage tubes and removing the clamp. Urine was stabilized by adding 10 ml of 10 ppm phenylmercuricacetate solution to each bag after

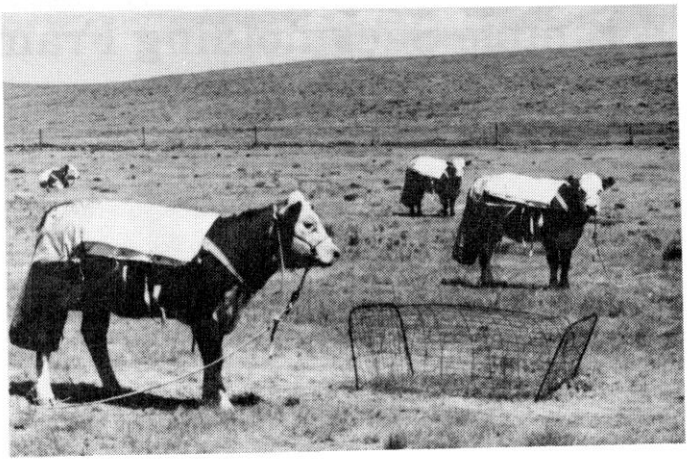


Fig. 3. *Free-grazing heifer fitted with both urine and fecal collection bags.*

drainage. The bags were reused after cleaning with deionized water and sterilization with ethylene oxide at 55°C (Veterinary Medicine Teaching Hopsital, CSU).

The urine collection apparatus was tested during the summer of 1981 on 4 yearling heifers grazing a 125-ha shortgrass prairie pasture northeast of Fort Collins, Colo. (Fig. 3). The heifers carried the bags for one 7-day period each month from May to October. No major problems occurred with the functioning of the apparatus or with the heifers themselves. The fit of carrier was easily adjusted, and collection of total urine and feces from the 4 animals was accomplished in as little as 20 minutes.

Literature Cited

Church, D.C. 1976. Digestive physiology and nutrition of ruminants. Vol. I. Digestive physiology. 2nd ed. Metropolitan Printing Co., Portland, Ore.

Garrigus, W.P., and H.P. Rusk. 1939. Some effects of the species and stage of maturity of plants on the forage consumption of grazing steers of various weights. III. Agr. Exp. Sta. Bull. 454.

Gorski, J., T.H. Blosser, F.K. Nardock, A.S. Hodgson, B.K. Soni, and R.. Erb. 1957. A urine and feces collecting apparatus for heifers and cows. J. Anim. Sci. 16:100-106.

Kartchner, R.J., and L.R. Rittenhouse. 1979. A feces-urine separation for making total fecal collection from the female bovine. J. Range Range. 32:404-405.

Lesperance, A.L., and V.R. Bohman. 1961. Apparatus for collecting excreta from grazing cattle. J. Dairy Sci. 44:503-505.

Van Dyne, G.M., N.R. Brockington, Z. Szocs, J. Duck, and C.A. Ribic. 1980. Large herbivore subsystem. p. 269-537. *In:* Grasslands, systems analysis and man (A.I. Breymeyer and G.M. Van Dyne, eds). Cambridge Univ. Press, New York.