TECHNICAL NOTES

A Fecal Collection Apparatus for Deer Nutrition Studies

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Abstract

An apparatus was designed and field tested for total collection of feces from tame, free-grazing deer in range nutrition studies. Design details are presented.

Better information is needed on food consumption rates of wild ungulates in their native habitats. Most data for the North American deer (*Odocoileus* spp.) have come from studies where animals are confined to pens or stalls and fed measured quantitites of either artificial diets (e.g. Holter et al. 1977) or hand-harvested native foods (e.g. Smith 1953). The validity of inferences from these data to the range situation is limited by numerous factors, including bias due to behavioral problems associated with confinement (Mautz 1971) and negation of the selective grazing process.

All conventional techniques for determining forage dry-matter intake by the free-ranging animal require a quantitative estimate of fecal production rates. These data, along with independent estimates of diet digestibility, are then entered into the standard digestion equation to yield calculations of dry-matter intake (Smith and Reid 1955).

Fecal out-put of the grazing animal can be determined through use of suitable indigestible markers such as chromic oxide (Smith and Reid 1955) or through more laborious total collection procedures (Cook et al. 1952). Even when the marker technique is used, a limited number of independent estimates determined by total collection procedures is usually necessary for correction of bias in the indicator technique. This paper describes the design and field application of a fecal collection apparatus that we used successfully on hand-reared male mule deer (*O. hemionus*) in 2.5-ha native range enclosures. Du Plessis (1972) described use of a fecal collection bag in a study of blesbok (*Damaliscus albafrons*) in South Africa, but details on construction or evaluation were not presented. The only reference we found to use of fecal collection devices on North American deer was that of Forbes et al. (1941) where small canvas bags were attached by leather straps to white-tailed deer (*O. virginianus*) fawns in digestion studies conducted in pens.

Design

The apparatus consists of two functionally distinct parts: a bag with a zipper opening for catching fecal pellets, and a shroud-like carrier that affixes the bag to the animal and bears the weight of the bag and its contents (Fig. 1a and 1b). The bag was patterned after those commonly used on domestic sheep (Cook et al. 1952). The conventional leather-strap harness, similar to that described by Forbes et al. (1941), was useless for keeping the apparatus mounted on deer. Hence, the shroud-type mounting configuration was developed.

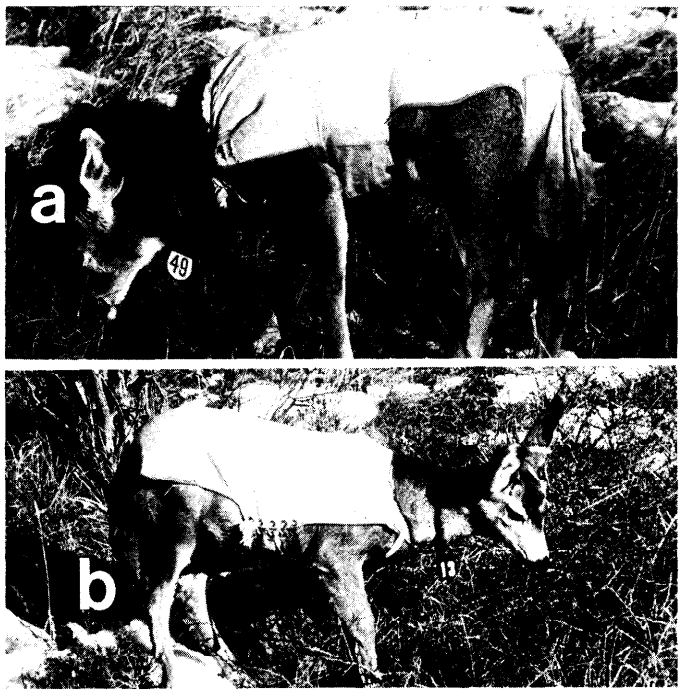

Fig. 1. *Left (a) and right (b) views of fecal collection apparatus mounted on yearling male deer. The chest band is fastened with 3-mm diameter cotton cord lacing.*

Both bag and shroud were constructed of heavy-weight (500 g/m^2) cotton duck material, with tie-straps of 3-cm cotton webbing. Dimensions shown in Figure 2 were appropriate for a male yearling weighing approximately 36 kg; proportional adjustments would be required for deer of different sizes. Darts sewed at the point of the shoulders and over the rump allow the shroud to conform to the major body contours. Fleece strips, made from either raw or tanned sheep skin having at least 1.5 cm pile, are necessary at major pressures-stress or abrasion points to prevent chafing of the animal's skin. Five pairs of 8-mm grommets served as eyelets for lacing together the chest portion of the shroud. Larger (14-mm) grommets in the leading and trailing edges of the chest band were used as tie points for the webbing straps.

Application and Evaluation

Devices were fitted to male deer approximately 5 days before field experiments were scheduled to begin, while the deer were confined to 20 × 40-m holding pens. To facilitate handling, animals wre lightly sedated with Rompun (Haver-Lockhart Laboratories, Shawnee, Kansas) at a dosage rate of 6.7 μl·kg^{-1} body weight,

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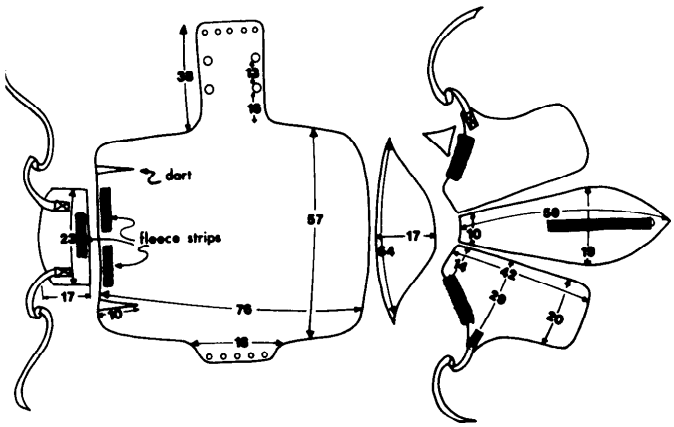

Fig. 2. *Pattern for a canvas duck fecal collection apparatus. Dimensions are expressed in centimeters and are appropriate for a 30-kg deer.*

and the apparatus was fitted into place. This degree of anesthesia did not produce recumbency and allowed careful adjustment of the apparatus to the standing animal. It also minimized the initial fright reaction to the presence of the apparatus.

Effectiveness of the apparatus was evaluated subjectively, both in the holding pens and on the 2.5-ha native range pastures where nutritional studies (Fulgham 1978) were conducted. While in the holding pens, animals were observed visually for a continuous 4-hour period to ascertain if all fecal pellets were being captured. On one occasion, three deer with collection devices in place were held overnight in a snow-covered pen cleared or fecal pellets. Both the visual observations of animals and the absence of spilled fecal pellets on the pen surface the morning following overnight confinement indicated that the apparatus would provide quantitative fecal collections under pen conditions.

In total, approximately 140 animal-days of fecal production estimates were obtained from six individual deer under range conditions, during early spring and late fall grazing periods (Fulgham 1978). Feces were collected every 12 hours and only about 11% of these attempts were unsuccessful.

All collections were performed under field conditions without active restraint of the animal. One observer maintained the animal's attention by offering a slice of apple or a piece of marshmallow candy and subsequently by petting about the head and neck. Meanwhile, a second observer quietly opened the zippered fecal bag, dumped the contents into a 3-liter aluminum pot, and reclosed the zipper. On a few occasions, an animal bolted while his bag was being emptied, spilling fecal pellets on the ground and nullifying that particular 12-hr sample.

Continuous day-time observation of animals in an associated study (Smith et al. 1979) allowed a further subjective evaluation of the collection devices under range conditions. Two sets of circumstances were found that would occasionally invalidate quantitative collection of feces. If an animal became alarmed sufficiently to bolt, fecal pellets would be thrown over the anterior lip of the bag beneath the animal's belly. This, however, was a rare occurrence and caused no major losses of samples. Daily adjustment of the rear webbing ties assured a close fit of the bag in the animal's groin area and helped minimize that problem. Installation of a canvas baffle in the throat of the fecal bag may have also helped to prevent such losses. Such a structure, might consist of a single leaf of canvas sewed to the front and sides of the bag's interior and would slope downward and rearward, but would be truncated approximately 6 cm short of the bag's rear wall. Fecal pellets would fall onto the baffle, roll downward toward the rear and fall through the opening into the main cavity of the bag. However, this modification was not tested. The other circumstance that resulted in a loss of fecal pellets was an unexpectedly large increase in fecal production late in the early-spring trial (Fulgham 1978). This overtaxed the capacity of the bag and caused pellets to spill over the anterior lip. This problem was alleviated by emptying the bags more frequently.

Use of this fecal collection apparatus in extremely cold environments should be considered with due caution. The shroud over the body trunk compresses guard hairs and interferes with pilocrection, thus it probably decreases the insulative properties of the pelage. This was not viewed as a problem under conditions of our study whre air temperatures ranged from -11 to 12° C.

Literature Cited

Cook, C.W., L.A. Stoddart, and L.E. Harris. 1952. Determining the digestibility and metabolizable energy of winter range plants by sheep. J. Anim. Sci. 11:578-590.

du Plessis, S.S. 1972. Ecology of blesbok with special reference to productivity. Wild. Monog. 30. 70 p.

Forbes, E.B., L.F. Marcy, A.L. Vorhis, and C.E. French. 1941. The digestive capacities of the white-tailed deer. J. Wildl. Manage. 5: 108-114.

Fulgham, K.O. 1978. Influence of spring sheep grazing use on the forage intake and quality of diets consumed by pen-reared mule deer under winter-range conditions. PhD Diss., Utah State Univ., Logan. 141 p.

Holter, J.B., W.E. Urban, Jr., and H.H. Hayes. 1977. Nutrition of northern white-tailed deer throughout the year. J. Anim. Sci. 45: 365-376.

Mautz, W.W. 1971. Confinement effects on dry-matter digestibility coefficients displayed by deer. J. Wildl. Manage. 35: 366-368.

Smith, A.D. 1953. Consumption of native forage species by captive mule deer during summer. J. Range Manage. 6: 30-37.

Smith, A.M., and J.T. Reid. 1955. Use of chromic oxide as an indicator of fecal output for the purpose of determining the intake of pasture herbage by grazing cows. J. Dairy Sci. 38: 515-524.

Smith, M.A., J.C. Malechek, and K.O. Fulgham. 1979. Forage selection by mule deer on winter range grazed by sheep in spring. J. Range Manage. 32: 40-45.