Technical Notes
Comparing the captec bolus to chromic oxide dosed twice daily using sheep in confinement

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Abstract

Thirty-six wethers were used in 3 trials to compare estimates of fecal output using chromic oxide either in a continuous-release bolus or dosed twice daily. Wethers were confined in metabolism crates and fed alfalfa. Chromium content was determined in rectal grab samples. Only in trial 2 were differences (P = 0.06) detected between the ability of the 2 methods to precisely estimate fecal output. Variation of estimated fecal output was greater using the bolus than estimates using the twice daily dosing method. Both methods tended to over-estimate actual fecal output under pen fed conditions.

Key Words: fecal output, continuous-release bolus

Forage intake is one of the most important factors influencing the nutritional status of grazing animals. Measurements of forage intake in grazing studies are, at best, marginal estimates. In addition, the methods commonly used to estimate forage intake may alter grazing behavior of the study animal. Therefore, more suitable methods of estimating forage intake are needed. The ideal method would be accurate, precise, and have minimal effect on animal grazing behavior.

The most common method of estimating forage intake of grazing ruminants is to divide an estimate of total fecal output by a measure of forage indigestibility. Daily dosing with chromic oxide (Cr_2O_3) is the most common method of estimating fecal output (Le Du and Penning 1982). This method, however requires dosing the animal at least once a day and marker excretion may vary diurnally (Raleigh et al. 1980). Boluses that release a continuous amount of marker into the rumen (Parker et al. 1989, Estell et al. 1990, and Hatfield et al. 1990a) should theoretically reduce variation in marker excretion, stabilize recovery rates, and decrease the amount of animal handling required with daily marker dosing.

The objective of this study was to compare estimates of fecal output using the continuous-release Cr_2O_3 bolus with fecal output estimates obtained from a twice daily dose of Cr_2O_3. Both precision and accuracy of fecal output estimates were investigated.

Materials and Methods

Thirty-six Polypay wethers (avg wt = 51 kg) were used in 3 separate trials (6 days/trial) to compare accuracy and precision of fecal output estimates of the continuous-release bolus[2] (138 mg chromium/day) with a twice daily dose of Cr_2O_3 powder in gelatin capsules (1,370 mg chromium/dose). Twelve different wethers (6/method) fitted with fecal collection bags and confined in metabolism crates were used in each period. Trials consisted of a 10-day adaptation and 6 days of fecal collections. Wethers receiving the bolus were dosed orally with a continuous-release Cr_2O_3 bolus on day 3 of adaptation and allowed at least 7 days for marker release rate to achieve equilibrium (Parker et al. 1989). Wethers receiving the twice daily dose of Cr_2O_3 were dosed orally on day 3 of adaptation and continued receiving the 2 g dose of Cr_2O_3 at 0730 and 1630 through the end of the collection period.

During each adaptation and collection period, wethers were allowed to consume alfalfa pellets ad libitum. Dry matter (DM) chemical composition of the alfalfa pellets was 13.6% crude protein, 54.3% neutral detergent fiber, 40.3% acid detergent fiber, and 9.2% acid detergent lignin.

Fecal collection bags were emptied twice daily at 0730 and 1630. Feces were weighed, and a 5% aliquot was retained from each sample and refrigerated for later determination of DM. Rectal grab samples of feces were taken at the same time that fecal collection bags were emptied. Weight of rectal grab samples was included in the calculation of fecal DM output, which was calculated by animal within period. Rectal samples were composited across time and day within a trial for each animal.

Rectal grab samples composited by animal within trial were prepared for chromium analysis using a modified version of the method described by Williams et al. (1962). A 0.5-g fecal sample was ashed in a silica basin for 90 min at 600° C. Samples were digested in 3 ml of phosphoric acid-manganese sulfate solution and 4.5% (wt/vol) potassium bromate solution until effervescence ceased or a light purple color appeared. Samples were brought to volume in a 100-ml volumetric with deionized water and mixed thoroughly. Chromium concentration was determined by atomic absorption spectrophotometry using an air/acetylene flame.

Statistical Analysis

Accuracy of marker-estimated fecal output (g, DM) derived from each method was compared within a trial to total fecal collection values using a paired *t*-test (McClave and Dietrich 1982, Freund and Littell 1981). The P-value for each comparison provides an indication of the accuracy of marker-estimated fecal output (i.e., the difference between the estimate and total fecal collection). Small P-values indicate inaccuracy, but not necessarily lack of precision. Precision of estimated fecal output was evaluated in a complete random design using estimated fecal output as a percentage of actual fecal output. A low P-value indicates the 2 methods vary in the bias associated with their estimates of fecal output (i.e., low precision).

Results

Fecal output estimates using the bolus were not different ($P>0.19$) from total fecal collection in trials 1 and 3 (Table 1). The marker estimate of fecal output using the twice daily dose was not different (P = 0.14) from total fecal collection in trial 2. The bolus in trial 2 and twice daily dosing in trials 1 and 3 did not ($P<0.04$) provide accurate estimates of fecal output.

Only in trial 2 were differences (P = 0.06) detected between the 2 methods in ability to estimate fecal output (Table 2). However, the precision of marker-estimated fecal output using the bolus appear to be lower than marker estimates using the twice daily dosing method (Table 2). The average standard error for the bolus method

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[1]"Captec" chrome manufactured by Captec Pty. Ltd., Australia, distributed internationally by Nufarm Limited, Manu Street Otahuna, P.O. Box 22-407, Auckland 6, New Zealand. Use of this product by the U.S. Sheep Experiment Station does not constitute a guarantee or warranty by the USDA or an endorsement by the Department of Agriculture.

Table 1. Marker estimates of fecal output compared with total fecal collections.

Trial	Method[1]	Fecal output g dry matter/day: Total collection	Marker estimate	Mean difference	SE[2]	P[3]
1	B	785	918	133	88.4	.19
1	D	917	1042	125	56.3	.04
2	B	653	931	278	87.9	.03
2	D	843	903	60	33.5	.14
3	B	787	776	11	6.2	.85
3	D	1001	1113	112	33.2	.02

[1]B = continuous-release chromic oxide bolus.
D = twice daily dosing with 2 chromic oxide/dose.
[2]Standard error associated with mean difference between total fecal collection and marker-estimated fecal output, n = 6.
[3]P-value for hypothesis that mean difference is not different from 0.

Table 2. Comparison of marker estimates of fecal output when expressed as a percentage of total fecal collections.

Trial	Method[1]	Estimate (% of total collection)	SE[2]	P[3]
1	B	121.1	12.9	.50
1	D	113.7	5.4	
2	B	142.9	12.7	.06
2	D	108.0	4.4	
3	B	100.4	7.9	.28
3	D	111.9	4.2	

[1]B = continuous-release chromic oxide bolus.
D = twice daily dosing with 2 g chromic oxide/dose.
[2]Standard error associated with mean difference among animals on the same treatment, n = 6.
[3]P-value for hypothesis of no difference between methods.

was 2.4 × greater than the standard error associated with the twice daily dosing method.

Discussion

Neither method provided a consistently accurate estimate of total fecal output when used in confinement feeding trials, although the bolus performed extremely well in trial 3. The twice daily dosing method provided a more precise estimate of total fecal output (Table 2). Previous research (Hatfield et al. 1990b) conducted at this laboratory, however, indicated that estimates of fecal output using the bolus in grazing trials were accurate under some conditions and precise under all conditions tested. We conclude that the intra-ruminal continuous-release Cr_2O_3 bolus may have application in grazing research, but total fecal collections are needed on a subsample of animals to validate marker estimates of fecal output.

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