2020

Evaluation of Ankom F58 Filter Bags Compared to Dacron Bags and Beakers for Analysis of Acid Detergent Fiber

Braden C. Troyer
University of Nebraska - Lincoln

Hannah C. Wilson
University of Nebraska-Lincoln, hhamilton6@unl.edu

James C. MacDonald
West Texas A&M University & University of Nebraska - Lincoln, jmacdonald2@unl.edu

Evaluation of Ankom F58 Filter Bags Compared to Dacron Bags and Beakers for Analysis of Acid Detergent Fiber

Braden C. Troyer
Hannah C. Wilson
Terry J. Klopfenstein
James C. MacDonald
Andrea K. Watson

Summary with Implications

Feed and fecal samples were analyzed to compare three methods of determining acid detergent fiber. Each sample was weighed into both Dacron and Ankom F58 fiber bags and then analyzed using an Ankom fiber analyzer. Results were then compared to the Van Soest beaker method. Ankom F58 bags helped reduce washout of small particles associated with Dacron bags, but fecal samples needed to be incubated in detergent for an extended amount of time to isolate acid detergent fiber material. Utilizing a technique that produces correct acid detergent fiber values is important for producers because these values are used as a proxy for calculating total digestible nutrients of feedstuffs.

Introduction

Forage sources account for over 80% of the feed amounts allocated to a beef animal over their production lifetime. This includes the forage a cow consumes while gestating and lactating, as well as all of the forage consumed during the backgrounding and finishing phases of an animal's life. The importance of understanding the amount of fiber in these forages is important due to its effect on intake, digestibility, and energy availability. Additionally, the acid detergent fiber (ADF) procedure is used by commercial labs to predict total digestible nutrients of feedstuffs. The Ankom Fiber Analyzer was developed to minimize the amount of human error associated with determining fiber in feed samples. This instrument, which was designed to replace the Van Soest method of using beakers, monitors temperature, time, and the number of washes used during each cycle, which increases accuracy and precision across runs. Feed samples are weighed into bags and then placed in the machine to be analyzed. Traditionally Dacron bags were used, which have a pore size of 50 micrometers. Recently, a new Ankom F58 bag was developed, which has a pore size of 25 micrometers. With some samples there can be washout of small particles through the larger pores, conversely, if pores are too small there may be limited removal of soluble material by the detergent solution. The objective of this study was to determine if samples weighed into either Dacron bags or Ankom F58 bags, then analyzed for ADF in the Ankom machine produced similar values as using the Van Soest method of beakers.

Procedure

Four feed samples were collected and ground through a 1-mm screen using a Wiley Mill in order to analyze a variety of forages ranging from low quality to higher quality. Fecal samples were also collected and ground using a 0.5 mm screen in a Tecator cyclotec sample mill following freeze drying. Eight fecal samples were analyzed to help validate any issues found when analyzing samples with very fine grind sizes. All samples were weighed into Dacron bags and Ankom F58 bags in triplicate. Dacron bags had 1.25 grams of sample and Ankom F58 bags had 0.5 grams of sample. No sodium sulfite was used in the bags. Bags were analyzed for ADF using an automated Ankom machine with samples being exposed to 60 minutes of detergent, followed by a cycle of five minute washes. Bags were removed from the machine and dried at 100°C for 24 h to determine ADF content. Additionally, samples were analyzed for ADF in duplicate using the Van Soest beaker method, which utilizes 0.5 g of sample and 0.5 g of sodium sulfite refluxed in ADF solution for 60 minutes and then filtered using a Whatman 541 filter to isolate ADF material. The filters were dried at 100°C for 24 h and then ADF content is determined. Fecal samples were also weighed into Ankom F58 bags in triplicate and analyzed for ADF in the Ankom machine. However, bags were exposed to 75 minutes of detergent followed by a cycle of five minute washes to increase exposure to detergent and help isolate ADF material. Time of incubation was increased after the 60 minute incubation resulted in values that were higher than the beaker values when fecal samples were analyzed. Bags were removed from the machine and dried at 100°C for 24 h to determine ADF content.

Results

Both types of bags produced similar ADF results when compared to beakers for feed samples (Table 1). Feed analyzed ranged from 29 to 50% ADF and differences between methods were less than 2 percentage units for all feeds. Fecal sample ADF values were different between bag types (Table 2). On average, Dacron bags resulted in 12.1 percentage units lower ADF values compared to beakers. This suggests that there was washout of particles from the bag due to the large pore size of these bags coupled with the smaller grind size of the fecal samples. Conversely, Ankom F58 bags resulted in 6.7 percentage units greater ADF values compared to beaker values, suggesting the fecal material was not exposed to detergent for enough time to completely remove ADF soluble material. This may be due to the smaller pore size of these bags. To solve this problem the second set of Ankom F58 bags were incubated for 75 minutes instead of 60 minutes. This extended incubation in detergent resulted in ADF values that were only 2.3 percentage units greater than beaker values. Regression analysis of ADF value relative to incubation time resulted in an equation [y = (-0.26) x + 65.25] to predict the decrease in ADF as incubation time increased. This could

Table 1. Comparing Ankom F58 bags to Dacron bags when analyzing feed samples for acid detergent fiber (ADF) using 60 minute incubation in an Ankom fiber analyzer

Sample	Beaker[1]	Dacron Bag	Ankom F58 Bags
Brome 1	49.34%	48.88%	50.18%
Brome 2	40.50%	42.19%	41.06%
Alfalfa	29.80%	31.13%	29.25%
Oats	31.37%	32.51%	30.36%
Avg. Difference[2]		-0.93	0.04

[1]Beaker—ADF value based on Van Soest beaker method

[2]Avg. Difference—average ADF value difference between Van Soest beaker method and Ankom machine using individual bag type and incubation length

Table 2. Comparing Ankom F58 bags to Dacron bags when analyzing fecal samples for acid detergent fiber (ADF) using the Ankom fiber analyzer

			Ankom F58 Bags	
Sample	Beaker[1]	Dacron Bag	60 min[2]	75 min[3]
Fecal 1	37.22%	26.63%	45.50%	41.00%
Fecal 2	44.43%	33.59%	49.03%	44.50%
Fecal 3	45.26%	30.12%	53.16%	49.10%
Fecal 4	43.01%	32.25%	48.69%	45.00%
Fecal 5	41.90%	34.25%	48.69%	47.10%
Fecal 6	46.34%	28.53%	54.78%	49.30%
Fecal 7	41.33%	22.54%	46.92%	43.40%
Fecal 8	48.45%	42.91%	50.75%	47.0%
Avg. Difference[4]		12.14%	-6.67%	-2.30%

[1]Beaker—ADF value based on Van Soest beaker method

[2]60 min—60 minute incubation in the Ankom machine

[3]75 min—75 minute incubation in the Ankom machine

[4]Avg. Difference—average ADF value difference between Van Soest beaker method and Ankom machine using individual bag type and incubation length

be extrapolated to predict incubation time needed to replicate beaker ADF values.

Conclusion

Acid detergent fiber values of feed and fecal samples in Ankom F58 bags analyzed by the Ankom machine are similar to values determined using the beaker method if incubation of the bags is extended to 75 minutes, which allows the detergent to completely permeate the bag. When compared to the beakers the Ankom machine resulted in values that were within 3.0 percentage units when the longer incubation was used. Although Ankom values were close to beaker values when using the 75 minute incubation, further research on the exact amount of incubation time needed for samples in the Ankom may improve these values. Overall, the small pore size of these bags helps mitigate issues with washout when compared to Dacron bags for fecal samples or feed samples with very fine particles.

Braden C. Troyer, graduate student, Department of Animal Science, Lincoln, NE

Hannah C. Wilson, research technician, Department of Animal Science, Lincoln, NE

James C. MacDonald, professor, Terry J. Klopfenstein, professor, Andrea K. Watson, research assistant professor, Department of Animal Science, Lincoln, NE