Evaluation of Ankom F58 Filter Bags Compared to Beakers for Analysis of Neutral Detergent Fiber

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Summary with Implications

Feed ingredient, feed refusals, duodenal and fecal samples were analyzed to compare two methods of determining neutral detergent fiber. All samples were weighed into Ankom F58 fiber bags and analyzed using an Ankom 2000 automated fiber analyzer. Results were then compared to the Van Soest beaker method. The fiber values determined from both methods were within 3.5% of one another, with the beaker method being consistently greater compared to the Ankom method, except for fecal samples. Variability in fiber estimates for ingredients, feed refusals, and feces translated to substantial inconsistency in estimated neutral detergent fiber digestibilities among treatments. It is important to utilize a technique that results in correct neutral detergent fiber values because these values are used to further calculate digestibility of diets.

Introduction

Forages are a crucial ingredient in formulating cattle feed rations. Additionally, forage is the most consumed nutrition source in a beef animal's lifetime, constituting over 80% of the total feedstuffs. Having accurate neutral detergent fiber (NDF) and acid detergent fiber (ADF) is vital in the formulation of rations. Both NDF and ADF values are used to estimate the total amount of digestible nutrients of feedstuffs. Accurate estimates of fiber content are important so rations can be efficiently formulated for animal performance while also costing less for the producer. The Ankom Fiber Analyzer was developed to facilitate ease and minimize human error during the process of determining the NDF and ADF values of the samples. The Ankom machine can be more efficient than the Van Soest beaker method. With the beaker method, a person is limited with both time and equipment when analyzing NDF values, whereas in the Ankom machine, one can place up to 24 individual bags onto the trays and let the machine complete the reflux to determine fiber. Additionally, the process is automated which may lead to less human error and improved precision in comparison to the beaker method. However, the use of the Ankom F57 bags with the Ankom machine created concerns due to washout of small particles, especially with biological samples such as fecal and duodenal samples that are used to estimate diet digestibility. Ankom has a newer bag (Ankom F58) which uses a special polymer that promotes a finer porosity. This increases flow throughout the bag reducing clumping of the sample and washout of small particles. Therefore, the objective of this experiment was to compare the NDF values derived from the Van Soest beaker method and the Ankom machine using Ankom F58 bags.

Procedure

Neutral detergent digestibility was measured by collecting fecal, duodenal, feed refusal, and ingredient samples from a digestion trial with 6 periods and 6 steers (*2021 Nebraska Beef Cattle Report*, pp. 46–49). A total of 36 fecal, duodenal, and feed refusal samples were used in duplicate to acquire an average NDF value. Ingredient samples from each period including steam-flaked corn, dry-rolled corn, high-moisture corn, corn silage, and Sweet Bran, were also run in duplicate to acquire an average NDF value. Ankom F58 sample bags were used rather than F57 sample bags due to the finer porosity (25 microns vs. 6–9 microns for F57 and F58, respectively). The finer porosity is due to a different polymer used in the F58 bags that is said to increase the flow throughout each bag while reducing clumping of the sample.

Sample Preparation

After collection, samples were freeze-dried or dried in a 60°C oven, ground through a 1-mm screen using a Wiley Mill and composited by animal within period. All samples were 1-mm when analyzed for NDF, except high starch samples (corn and orts) which were ground through a 1-mm screen and then ground through the cyclotec (0.5 mm).

Ankom procedure

All samples were weighed into Ankom F58 bags in duplicate. The bags each contained 0.5 gram of sample and then sealed twice with a 6" impulse bag sealer. A total of 24 bags were placed on bag suspenders into the Ankom 2000 automated fiber analyzer. Sodium sulfide and alpha amylase were added according to the Ankom machine NDF instructions:1.0 mg of sodium sulfide and 1 mL of alpha amylase distributed over the top of the bags and 4 mL of alpha amylase added to the amylase dispenser with distilled water up to the fill line. The neutral detergent solution was then opened to allow it to flow into the drum. The machine was turned on and set to the "NDF" preset cycle. After the cycle successfully ran, the samples were rinsed in distilled water to get any residue off the outside surface. Then the samples were placed on a drying rack to dry for 24 hr at 100°C. Samples were then weighed to compare the original weight of the sample to the weight after the NDF procedure to determine the NDF content.

Beaker procedure

Samples were also analyzed in duplicate using the Van Soest beaker method. Beakers were used to hold 0.5 g of each sample, 0.5 g of sodium sulfate, and 100 mL of neutral detergent solution. Alpha amylase was added to the beaker in 0.5 mL increments (1 mL total) after reflux began and ten minutes prior to filtering. The samples

Table 1. Comparison of a beaker method with the Ankom method for analyzing specific samples for neutral detergent fiber (NDF)

Sample	Beaker NDF[1]	Ankom NDF[2]	Average difference[3]	Correlation[4] (r)
Fecal	42.64%	46.12%	-3.55%	0.38
Duodenal	18.75%	15.18%	2.94%	0.94
Feed refusals	15.63%	13.53%	2.04%	0.87
Ingredient	21.01%	18.68%	2.33%	0.99

[1]Beaker NDF-Value based on Van Soest beaker method.

[2]Ankom NDF-Value based on the Ankom automated NDF method using F58 filter bags.

[3]Avg. Difference-Average NDF value difference between Van Soest method and Ankom machine method.

[4] Correlation Coefficient (r)-Linear correlation

Table 2. Comparison of a beaker method with Ankom F-58 filter bags for analyzing diets with steamed flaked corn (SFC) or high moisture corn with dry rolled corn (HMC/DRC) at 0, 20, and 40% Sweet Bran to find the neutral detergent fiber digestibility (NDFD)[1]

	Treatment					
	SFC			HMC/DRC		
	0	20	40	0	20	40
NDFD Beaker[2], %	24.5	49.2	49.9	25.1	49.6	59.8
NDFD Ankom[3], %	16.6	32.6	41.4	23.6	41.4	48.0

[1]NDFD- Neutral Detergent Fiber Digestibility.

[2]Beaker- NDF value based on Van Soest beaker method.

[3]Ankom- NDF value based on Ankom automated NDF method using F58 filter bags.

were refluxed on a hot plate for one hour. After reflux, samples were filtered using a Whatman 541 filter (22 micron pore size) to isolate NDF material. The filters were folded and dried at 100°C for 24 hr and then NDF content was determined.

Results

The automated Ankom method produced similar NDF results compared to the Van Soest beaker method for 3 of the 4 sample types. As shown in Table 1, there was less than a ±3.5% difference between the two methods. The NDF values for the ingredient, feed refusal, and duodenal samples were slightly greater for the beaker method compared to the Ankom machine, but the correlation between the estimates was high (r = 0.87, 0.94, and 0.99 for diet refusals, duodenal samples, and ingredient samples, respectively). The differences in the absolute values between methods may be a function of washout of particles when using the Ankom filter bags (even though the pore size is smaller), or incomplete solubility of non-NDF material in the beakers. Regardless, there appears to be strong agreement between methods for ingredients, diet refusals, and duodenal samples. However, the NDF values for the fecal samples were greater for the Ankom machine. Additionally, NDF values for the fecal samples between the Ankom and beaker method were not well correlated (r = 0.38). It is unclear why the NDF values for the fecal samples were greater for the Ankom machine and why there was little agreement of the fecal samples between the two methods. Perhaps there was greater fecal NDF loss with the beaker method when using a filter paper with a larger pore size. However, this reason is puzzling since the duodenal, feed refusal, and ingredient samples were all highly correlated between the two methods, and the beaker method produced higher values for those sample types. Further research is needed to determine why the two methods produce different NDF results for fecal samples.

The resulting NDF values between the two methods were used to calculate total tract NDF digestibility of each diet (using fecal, ingredient, and feed refusals NDFs), as shown in Table 2. In general, the calculated digestibility of NDF was greater when using the beaker method as opposed to the Ankom machine. While the two methods agreed in the order of NDF digestibility (e.g. the ranking of treatments with the lowest NDF digestibility to greatest NDF digestibility), the relative difference among treatments was inconsistent, ranging from 1.5 percentage units difference to 16.6 percentage units different in NDF digestibility between both methods. These discrepancies are due to inconsistencies in both estimated NDF intake and NDF excretion. While there was strong correlation between the two methods for ingredients and feed refusals, small differences in NDF content can have a large impact on estimated NDF intake. Furthermore, the disagreement in NDF content of the feces results in inconsistent estimates of NDF excretion. Both factors impact the estimates of NDF digestibility.

Conclusion

Most samples that producers or their nutritionists send to a lab for analysis are ingredient or diet samples. These data suggest there is strong agreement in the resulting NDF estimates when using Ankom F58 filter bags and the traditional NDF beaker method developed by Van Soest. However, there is little agreement between the methods for fecal NDF, which is problematic for researchers wanting to estimate diet NDF digestibility of finishing diets. Having accurate digestibility estimates are important because it allows consultants to develop rations that more accurately target a desired rate of gain, improving producers' efficiency and economic return.

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