# USING 240 HOUR uNDF IN THE FIELD

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## INTRODUCTION

The term uNDF (undigested NDF) is a relatively recent addition to the lexicon of ruminant nutrition (Mertens, 2013). It represents the undigested NDF residue after a given length of ruminal digestion time. Determination of uNDF is an old analysis, as it is how NDF digestibility is determined, by weighing what remains as a means of determining what disappears. What is new regarding uNDF is our use of it in determining the fast and slow fiber pools, calculation of rates of digestion, and how gut fill maxima and minima may be estimated. Cotanch et al. (2014) provide a thorough explanation of uNDF application in modeling and ration formulation.

Determination of uNDF requires specific methodology of individual sample digestions using the modified Tilley-Terry system as modified by Raffrenato and Van Amburgh (2010), with filter pore size of 1.5 µm in order to capture all of the small undigested fiber particles. Larger pore size filter systems result in an under-estimation of uNDF. Near infrared calibrations to the Tilley-Terry system are appropriate for analysis of uNDF across time points. Also, NDF residues must be ash-corrected and reported on an organic matter (om) basis.

Previous research conducted at Miner Institute (Cotanch et al., 2014) of high and low forage and high and low NDFd of corn silage-based rations, differing in dietary uNDF240om, resulted in a range of uNDF240om intakes, as % of BW, of 0.30 to 0.39. The high forage/low NDFd ration and low forage/high NDFd ration resulted in intakes of uNDF240om of 0.39% and 0.30% of BW. It was believed that these values could serve as initial reference points to mark gut fill limits of maximum and minimum fill. A possible rumen fill maximum of 0.40% BW and possible minimum of 0.30% was proposed to ensure adequate rumen fill of peNDF (Mertens, 1997). Summary of a second trial conducted at Miner Institute where diets ranged from 50-39% forage with substitution of hay crop silage with NFFS and straw, but similar dietary level of uNDF240om, showed similar uNDF240om intakes of 0.33-0.36% of BW. Of the total dietary treatments between the two studies, 7 of 8 diets resulted in ratio of rumen fill: intake of uNDF240om of 1.57-1.61. This led to the belief that uNDF and possibly uNDF240om could be used to better estimate DMI and gut fill max and mins.

A number of questions arose relative to the field application of this concept that warranted further investigation.

1. How does intake of uNDF240om vary across stage of lactation, or does it?
2. Is uNDF240om the best predictor of DMI and rumen fill or is some other time point, such as u30 more appropriate?

3. Sensitivity of the cows to uNDF?

HOW DOES INTAKE OF uNDF240om VARY ACROSS STAGE OF LACTATION?

To look at how intake of uNDF240om varies across DIM and stage of lactation, TMR samples and intakes were taken of the far dry, close-up dry (CUD), fresh, high and low lactating groups at Miner Institute. Analyses of NDFom, uNDF30om and uNDF240om were conducted using the Tilley-Terry system. Individual cow intakes were calculated from the pen average (Figure 1). Across pens, intake of uNDF240om ranged from 1.9 kg in CUD up to 2.6kg in the high group. Intake of NDFom and uNDF30om showed greater range across stage of lactation. Intake of NDF ranged from 7.2 to 9.6 kg/d from CUD to high and uNDF30om intakes ranged from 3.9 to 6.3 kg. Gut fill and DMI estimations appear more sensitive to NDF and uNDF30om compared to uNDF240om. Transitions of intakes across groups appear to be smooth and adequate, as production and herd health were good at this point in time.

The same data are expressed relative to the CUD group in Figure 2. This approach may be helpful in monitoring dietary transitions between groups. It also becomes clearer that uNDF30om may be more sensitive than NDFom or uNDF240om when monitoring intakes across stages of lactation.

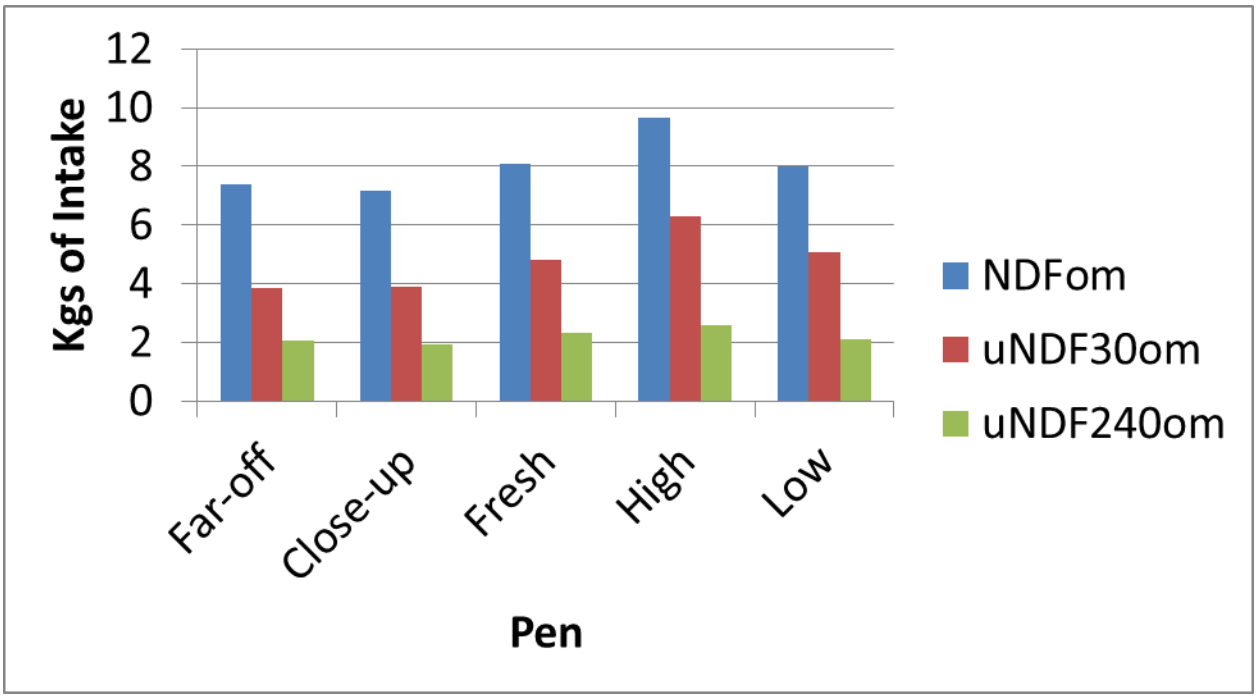

Figure 1. Intake of NDFom, uNDF30om, and uNDF240om across stage of lactation, (kg).

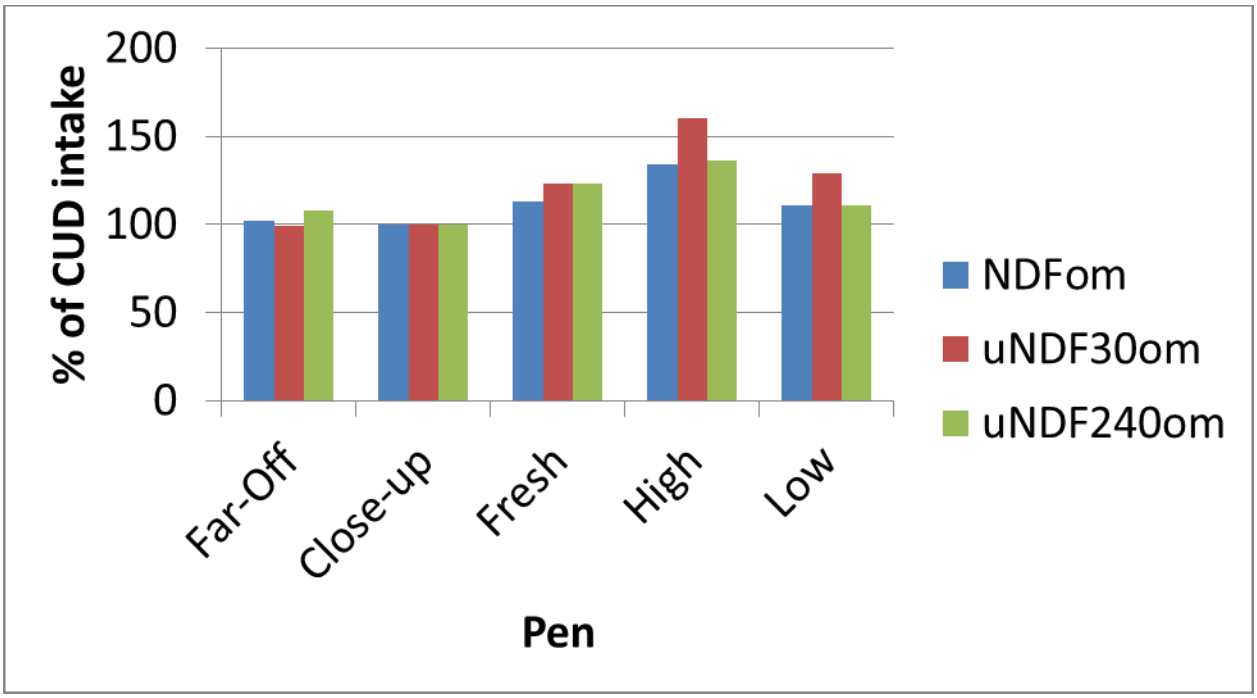


Figure 2. Intake of NDFom, uNDF30om, and uNDF240om relative to the CUD group across stage of lactation.

## SENSITIVITY OF COWS TO uNDF

Samples and intakes for the data discussed above were collected in October of 2014, when intakes and milk production were high. A second round of samples were collected in February 2015 after a diet change where intakes and milk production were drastically reduced; 6.8 and 2.3 kg of milk in the high and low groups, respectively, and 2.3 kg of DMI in each group. Table 1 lists the uNDF240om for the high, low and far-dry groups with calculated estimates of per-cow intake of uNDF240om. Average cow body weight of 820 kg was used to calculate % of BW values. Of note is that dietary uNDF240om is nearly 4%-units greater in February 2015 when milk and DMI drastically dropped in both lactating pens. The far-dry cows experienced nearly a 1.8 kg drop in DMI as well. Intake of uNDF240om varied by stage of lactation. The high cows ate about 2.6 kg uNDF240om in October 2014 when consuming nearly 30.5 kg of DMI and averaging over 54.5 kg of milk. As a percentage of BW, this group was consuming about 0.32% of BW as uNDF240om. When forage quality dropped in February 2015, it appears gut fill of the high cows was limiting as uNDF240om intake was about 0.41% of BW, similar to the previously mentioned benchmark. However, for later lactation cows and dry cows, the benchmark values do not hold, as DMI decreases occurred when uNDF240om intake was only 0.32% of BW for both the late lactation and far dry cows.

Table 1. uNDF240om of diets and estimated intake kg (lb) and as percentage of BW based on pen intakes.

| | Date | DMI, kg est. | uNDF240om, % of TMR | uNDF240om, kg DMI, est. | uNDF240om, % of BW est. |
|---|---|---|---|---|---|
| Pen 2 High | Oct 2014 | 30.5 | 8.5 | 2.6 | 0.32 |
| | Feb 2015 | 28.2 | 12.0 | 3.4 | 0.41 |
| Pen 5 Low | Oct 2014 | 24.1 | 8.7 | 2.1 | 0.26 |
| | Feb 2015 | 21.8 | 12.1 | 2.6 | 0.32 |
| Far Dry | Oct 2014 | 15.0 | 14.5 | 2.2 | 0.27 |
| | Feb 2015 | 13.2 | 19.2 | 2.5 | 0.31 |

## SUMMARY

From this quick summary of uNDF analyses of the Miner herd rations it appears that uNDF240om does play a role in limiting intake as well as providing sufficient gut fill. However, benchmarks of uNDF240om intake as kg or as % of BW seem to differ across stage of lactation and will likely vary from herd to herd. Tracking intake of uNDF240om across diet changes may benefit cows in order to provide sufficient gut fill while avoiding situations of unexpected gut fill limits.

## REFERENCES


Cotanch, K. W., R. J. Grant, M. E. Van Amburgh, A. Zontini, M. Fustini, A. Palmonari and A. Formigoni. 2014. Applications of uNDF in ration modeling and formulation. Pages 114-131 in Proc. 2014 Cornell Nutr. Conf. for Feed Manufacturers. October 21-23. Syracuse, NY.

Mertens, D.R. 1997. Creating a system for meeting the fiber requirements of dairy cows. J. Dairy Sci. 80:1463-1481.

Mertens, D. R. 2013. Indigestible versus undigested NDF – The distinction. Unpublished white paper prepared for Fiber Group meeting at 2013 meeting in Syracuse, NY.

Raffrenato, E., and M.E. Van Amburgh. 2010. Development of a mathematical model to predict sizes and rates of digestion of a fast and slow degrading pool and the indigestible NDF fraction. Pages 52-65 in Proc. Cornell Nutr. Conf. for Feed Manufacturers. October 19-21. Syracuse, NY.