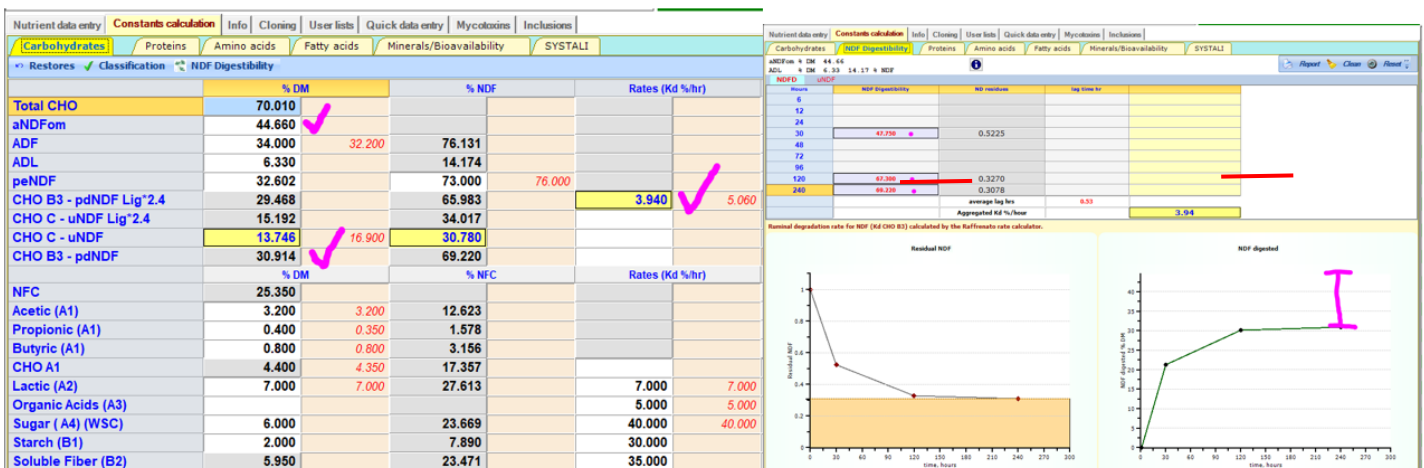## NDS Tools to help with 2019 Forages
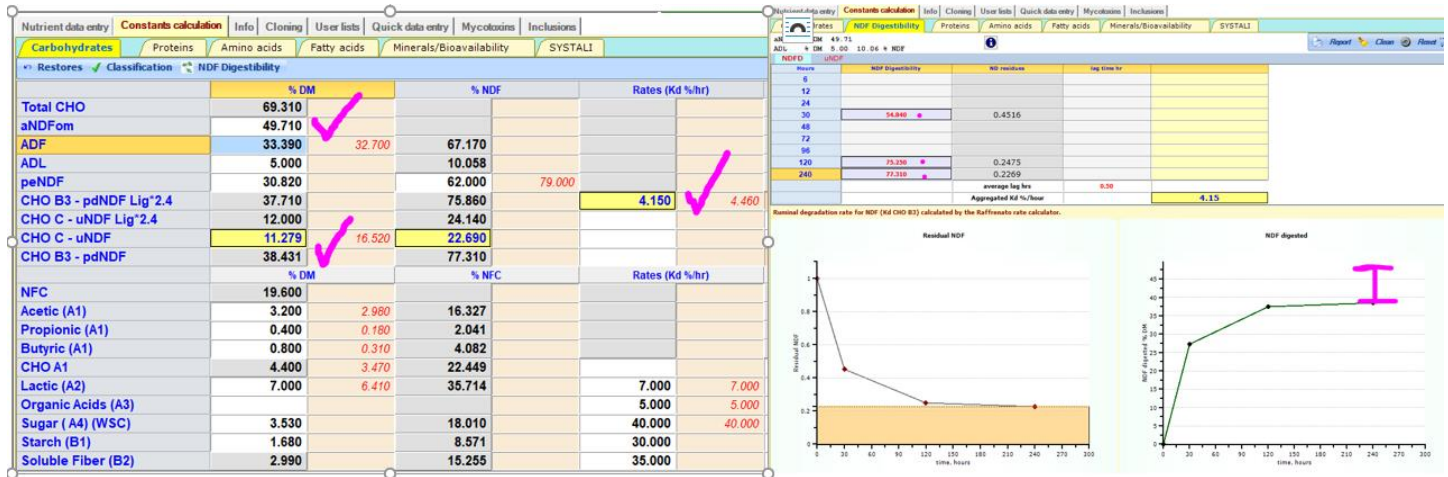
By RUM&N and NDS-NA staff

The most recent summary data for forage production of grass and alfalfa silages show the effect that the 2019 spring growing season had on this year's crop so far. When comparing the values to 2018 for both the NE and Central US, the digestibility rate is slightly lower (compared to 2018) but the most outstanding difference is that the average uNDF pool is higher in the 2019 forages. The main consequence is a reduction of the potentially digestible NDF (pdNDF) and an overall reduction of the digestible organic matter. This and the limited amounts of forages in the early 2019 growing season have given nutritionists the challenge of meeting the requirements of high producing dairy cows using more by product feeds and unconventional feeds, not traditionally fed in some areas. However, certain regions of the US are familiar with using regional byproducts, such as almond hulls (West), citrus (Southeast), and beet pulp (Northwest), and these and other feeds can fit well into rations and supplement forages, especially when forage production has been a challenge. Several tools in NDS can help nutritionists to understand what feeds (and their potential) to use in helping to maintain good rumen health and good milk production. The rumen is designed to ferment pdNDF and this is found in abundance in good forages and many byproducts. The various fiber fractions and definitions (e.g. NDF, aNDFom, fNDF, peNDF, uNDF, peuNDF,…) and respective rates and time points can be confusing, but the rumen has requirements which can be met not only with good forages, but also supplementing some of these forages with non-forage NDF sources.

Number 1. FORAGES

The primary goal is to know what your forages are and what the NDFd time points mean for the specific forage digestibility. Below, an NDS example, using haylage, is shown when looking in the forage analysis area for carbohydrates.

The haylage shown has an aNDFom of 44.66% and, with the three-time point NDFd, the calculated rate is 3.94%/h and the uNDF pool (i.e. fraction C) is now shown as 13.746%, resulting in a calculated pdNDF of 30.914%. Right above the uNDF and pdNDF values, the old "Ligninx2.4" system would result in a uNDF of 15.192% and a pdNDF of 29.468%. The three-time point NDFd would therefore result in more pdNDF, compared to the "Ligninx2.4" system. The figures on the right show visually how the fast, slow and then uNDF pools are proposed to be used in the rumen in CNCPS according to the Raffrenato calculator. Both the residual graph and the NDF digested graph are shown as powerful visual tools to understand and interpret the fiber in this sample.

This second sample shown above is now at 49.71% aNDFom with a rate of 4.15%/h and the uNDF pool is 11.279% resulting in a pdNDF pool of 38.431%. This sample is higher in aNDFom, and fiber is more available to the rumen and, even if the Relative Feed Value (RFV -standard calculations from labs) is 10 points lower than the previous forage, it will have the potential to make more milk. With less uNDF, as a % of total NDF, there is more fuel per amount of DM to be digested in the rumen, obviously depending on the total forage NDF. In recent discussions with some graduate students, it came out that the ratio uNDF/NDF could be potentially used to rate forages. Using the uNDF/NDF the value of two forages can be compared by looking at the undigestible portion as a percentage of the total NDF. At Miner Institute they are looking at the pdNDF portion of the NDF for crops grown and now coming up with yields of pdNDF per acre as forages are harvested. As an example of the confusion, if we consider alfalfa, our industry has coached growers and dairymen that lower NDF is better. However, in alfalfa the ratio of uNDF/NDF is constant. Thus, often low alfalfa NDF results in low total NDF rations which can become almost problematic. Then the lower NDF alfalfa is constant in its (high) uNDF content giving low NDF and still high uNDF or low fiber diets with higher fill factors.
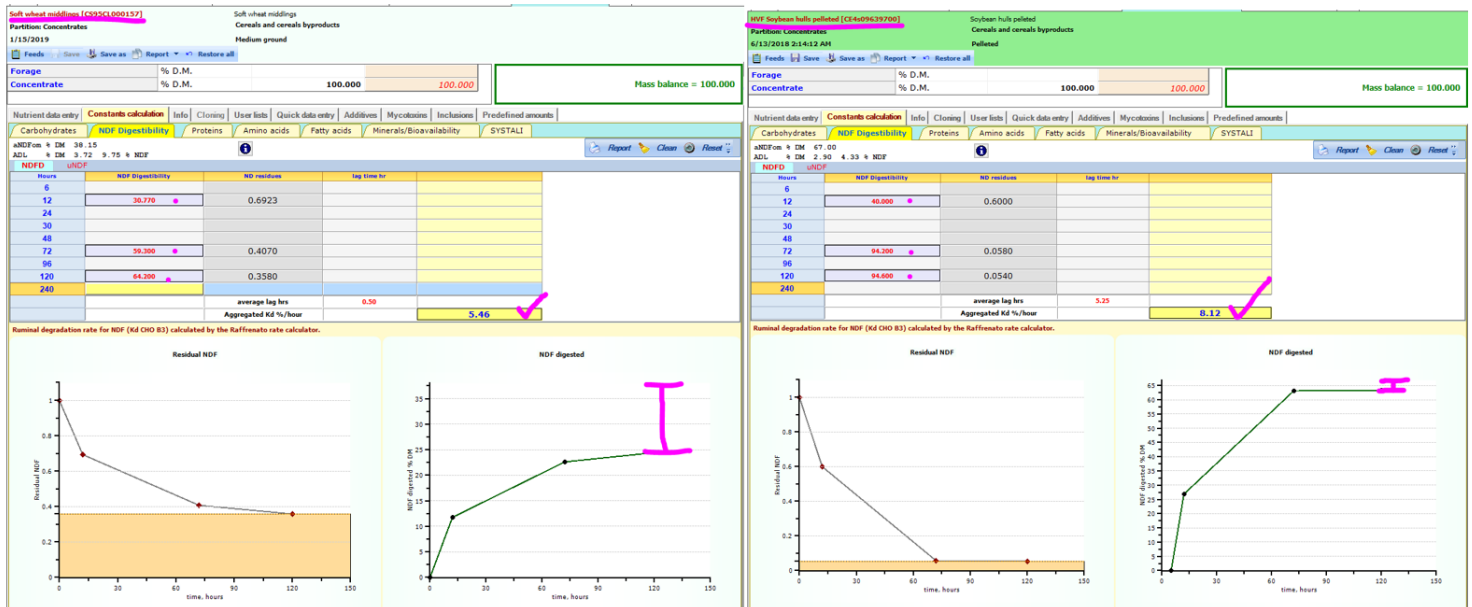
Back to our examples of the two slightly different haylages, another tool that can be used to better understand their effect is the Rumen Fill Tab (see figure below). The "Initial recipe" uses the example 2 haylage (lower uNDF/NDF), whereas the "Current recipe" uses the example 1 haylage (maintaining the same amount in the recipe). Based on the uNDF intake, uNDF in the rumen, peuNDF intake and uNDF30 intake, NDS shows how these can affect DMI. In the example below, the changes in forage quality may result in a DMI decrease from 0.17 to 0.91 lbs. The lower NDF digestibility can translate in in a potential loss of milk production between 0.31 to 1.64 lbs. While there is no a perfect answer, NDS shows the negative (in this case) potential result (within these four values) that the user can use at his/her discretion. The results come from the uNDF in the total ration increase and a corresponding slight decrease in pdNDF. The Milk Production loss shown in this case is only the calculation from the decrease in digestibility however, the potential decrease in DMI from the uNDF increase must also be considered. NDS will list the potential loss of the DMI as a calculation of the possible loss going to the higher

uNDF forage. Therefore, If we consider the loss of DMI (0.91 lbs) and let NDS re-evaluate the data, the total milk loss is over 2.5 pounds when accounting for both the reduced DMI and digestibility.

Intake	Check DMI	Forages/Concentrates	Rumen fill	Other items						

	Initial recipe			Current recipe			DMI lbs/day		Milk Production lbs	
	lbs/day	%DM	%BW	lbs/day	%DM	%BW	Δ	Expected	Δ	Expected
DMI	58.453			58.453						
uNDF Intake	5.705	9.76	0.36	5.853	10.01	0.37	-0.36	58.09	-0.65	86.66
uNDF Rumen	7.826		0.49	8.000		0.50	-0.31	58.14	-0.56	86.75
uNDF Ratio Rumen/Intake	1.37			1.37						
peuNDF Intake	3.570	6.11		3.754	6.42		-0.91	57.54	-1.64	85.67
uNDF30 Intake	4.428	7.57	0.28	4.481	7.67	0.28	-0.17	58.28	-0.31	87.00

Number 2. NON-FORAGES or BYPRODUCTS

When the forage production for a given year or an area of country are producing less than adequate forages either from quality or quantity, non-forage or byproducts NDF sources can be used to meet the fiber requirement of the rumen. Although the rumen does not have a forage requirement, it is very evident that good forages can meet all the fiber requirements and sustain high milk production, even when forages make up more than 70% of the ration. High producing cows do seem to operate more consistently if forage NDF levels are at least hitting minimal levels as low as even 15%. This is much lower than previous published requirements of 20-21%. The addition of byproducts does bring in NDF into the rations and these products have different NDF digestion patterns and hence have different time points used for the calculations to get a rate and pool size.
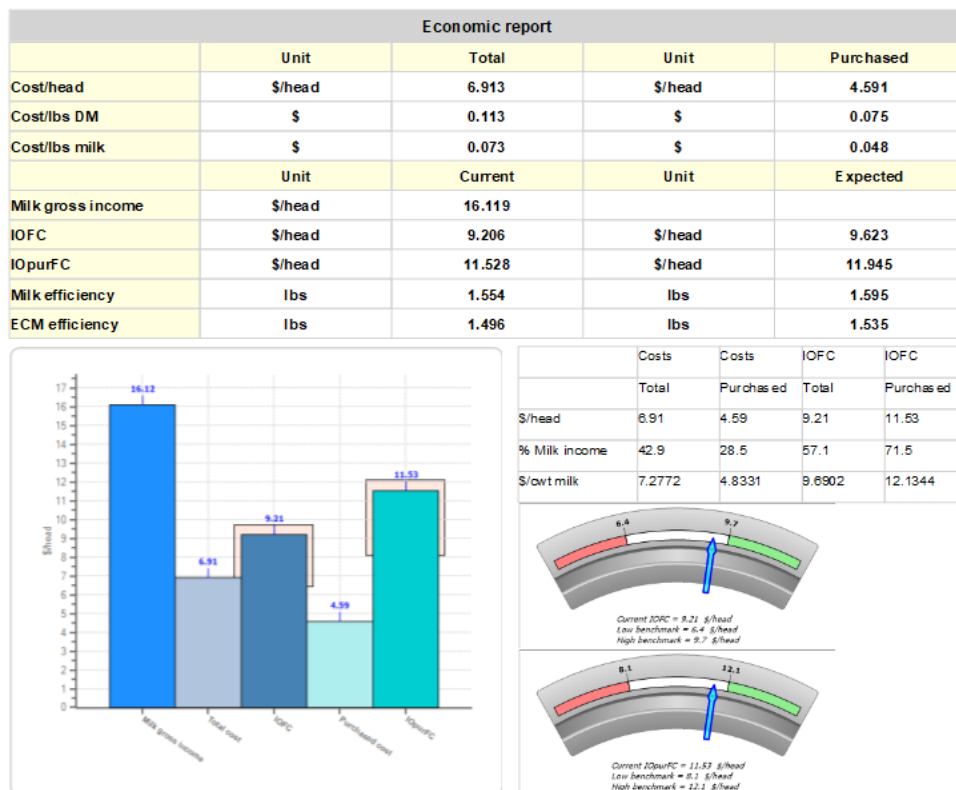

In the picture above we can see that the digestion of NDF, that are used to calculate both rate and pool, are 12, 72, and 120-hour NDFd. The two products shown in the example, which are wheat midds (on the left) and soybean hulls (on the right), have a very different digestion rates and the uNDF pool size is drastically different.

Below the inputs and calculations for each product are some very useful graphs that can help us interpreting the pools and rates. On each of the NDF DIGESTED graphs the uNDF240 pool size has been highlighted to help understand each product. Similarly, to forages, the uNDF240 pool (fraction C) is vastly different than the obsolete calculation used for years (i.e. ligninX2.4). By using these values, the uNDF240 of these rations is the most recent and the RUMEN FILL tab displayed earlier can be monitored, managed and manipulated to try to achieve and understand intakes.

3. ECONOMICS

This topic might have been listed first since as one of my mentors has told me before, "most nutritionist will be fired for what we don't understand." That was directed to most consultants not knowing the economics of the milk production, milk pricing, and the income over feed cost (IOFC) or over income over purchased feed costs (IOpurFC).

a. Make sure that you are using the Milk Pricing system that allows you to auto load the most current Federal Milk Marketing pricing and if the PPD (Producer Price Differential value representing the other milk uses in the area by region), bonus, and total deductions are known those can be manually inputted into each farm. (Additional pdf and videos go over this topic as well) You can also enter a fluid milk price.

b. Also, from the Recipe page and looking under the FEED DETAILS tab and FEED INFO, you can assign feeds as home grown or purchased. This will allow showing both IOFC and IOpurFC for the ration on the ECON information.

c. Using the Comparison functions, you can see if the changes are positive relative to the income of the farm. The opportunity that even lower milk production can return more income to a farm is always worth investigations. Also watch the total feed cost per head and then look at the IOFC. Below is the graph from the Production Efficiency tab to show returns for that recipe.

Economic report				
	Unit	Total	Unit	Purchased
Cost/head	$/head	6.913	$/head	4.591
Cost/lbs DM	$	0.113	$	0.075
Cost/lbs milk	$	0.073	$	0.048
	Unit	Current	Unit	Expected
Milk gross income	$/head	16.119		
IOFC	$/head	9.206	$/head	9.623
IOpurFC	$/head	11.528	$/head	11.945
Milk efficiency	lbs	1.554	lbs	1.595
ECM efficiency	lbs	1.496	lbs	1.535

	Costs Total	Costs Purchased	IOFC Total	IOFC Purchased
$/head	6.91	4.59	9.21	11.53
% Milk income	42.9	28.5	57.1	71.5
$/cwt milk	7.2772	4.8331	9.6902	12.1344

Current IOFC = 9.21 $/head
Low benchmark = 6.4 $/head
High benchmark = 9.7 $/head

Current IOpurFC = 11.53 $/head
Low benchmark = 8.1 $/head
High benchmark = 12.1 $/head

In conclusion, the use of these tools in NDS can assist in working with the forage basis present in the farm and attempt to introduce byproducts into the diet to help meet the needs for the high producing herd while looking at $ invested into the ration and returns to the producer for those formulated rations.

Send us your comments on this topic! Dave Weber is at rumendvm@gmail.com; RUM&N Staff is at info@rumen.it

Note that the features and utilities developed by the NDS team described above are not components of the underlying CNCPS model, and do not change the CNCPS outputs or results. _Questions about the use of these features should be directed to the NDS support team, and not to the CNCPS group at Cornell._