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Evolution of CNCPS 6.5: Transition notes for NDS users

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NDS users who have maintained their copy of NDS with current updates (***STRONGLY recommended***), are running the NDS implementation of CNCPS 6.5. CNCPS 6.5 brings substantial changes to the model, with significant changes to protein fractions and amino acid content, and changes to estimation of pool size and degradation rates for CHO B3 (NDF). The current NDS version is a complete and exact implementation of the underlying biology and equation set as released by the Cornell modelling group.

There are, nevertheless, some factors related to analytical values received from ALL the major forage labs that have prevented a complete utilization of the CNCPS new biology, even though that biology is completely implemented in NDS. These issues have been unavoidable, and occurred because the new NDS biology required some changes to laboratory procedures for feed analysis. Implementing those changes has taken slightly longer than any of them expected. As a consequence, labs have not been able to report some of the new values that are required in CNCPS 6.5, nor have those values been reported on NIR results. Consequently, the values for some modeled carbohydrate pools and some rate calculations are likely to have been derived from a hybrid set of 6.1 and 6.5 input values. Therefore, many user's model results have not been precisely accurate reflections of either CNCPS 6.1 or CNCPS 6.5.

This situation has occurred because feed analysis laboratories needed to alter and validate their assays, rate calculations, and reports to reflect protocols required for obtaining the new inputs used in the 6.5 model. For example, some labs were not running the uNDF240 time point assay, nor had they done many assays of NDFd at the 120 hour time point. Another example is that the NDF input used in the CNCPS 6.5 model is now aNDFom. Commonly labs were running and reporting aNDFdm (NDF, dry matter basis) and not the new aNDFom (NDF, dry matter basis corrected for ash content, i.e. "ash free").

Also, determination of the new Kd values for CHO B3 is now done internally in CNCPS 6.5 software using Vensim software applying the Raffrenato Kd calculator. This calculation requires three NDF digestibility time points (30, 120, and 240 hours for forages; 12, 72, and 120 hours for concentrates) and thus cannot be made until the labs are able to provide them. Only when a lab had produced enough data at these new time points could they then develop and validate the new NIR calibration equations. Therefore, implementing these new rate calculations meant first developing enough data at the previously uncommon 120 and 240 hour time points for forages. This has all required a huge, and much appreciated, effort by our forage labs. NDS has already implemented the Vensim software and Raffrenato Kd calculator, and can already calculate the new rates when the NDFs at the necessary three time points are available.

Furthermore, because these new values are associated with new analytical procedures, and mostly have been derived in research labs such as the Van Amburgh lab at Cornell, there was a paucity of data available to populate the new values into the base Cornell feed library when Cornell released it. This library is fully implemented in the current versions of NDS, but even though it is the latest and official library, many of the new inputs such as uNDF240 or NDFom will need to be populated by users as they accumulate new feed analytical values from commercial labs. The new CNCPS library, already fully implemented in NDS, is a great step forward in amino acid nutrition, but is substantially lacking in providing "book values" based on these new aspects of feed fiber inputs in the library. Users should be aware that the library values for NDF, uNDF, and CHO B3 Kd contained in the library are based on the old derivations of these values (NDF =

NDFdm, uNDF = Lig*2.4, Kd CHO B3). Users will need to update their library feed values for these inputs as new values are acquired from lab analyses of feeds users submit to labs for analysis.

So what, and how much difference, does this all make? First, let me remind you that the new CNCPS 6.5 has been demonstrated to significantly improve predictions of cattle performance. Transitioning to the new model is extremely valuable to nutritionists and their clients. And while the brief transition challenges described above might be disconcerting to some users, they are in most all cases not diminishing model accuracy compared to CNCPS 6.1, they have simply delayed the full realization of the improvements resulting from employing CNCPS 6.5. This user is extremely appreciative of the enormous effort it has taken to get us where we are today, efforts made by all who I rely on to help me be a more effective modeler and nutritionist. That includes the research team at the Cornell modelling group, the various laboratories I use to provide me feed analysis, and the software developers at NDS. Huge kudos to all!

So what specific differences should users be aware of?

1. First, the rates and pools for carbohydrate fractions are affected until the transition to a complete set of CNCPS 6.5 values is complete. For instance, the NDF (CHO B3) degradation rates (Kd) are applied to the potentially digested NDF (pdNDF), which is derived by subtracting the uNDF from the total NDF. uNDF is now estimated from an NDFd assay at 240 hours for forages; in earlier model versions uNDF was estimated as lignin% x 2.4. In most cases, the $uNDF_{240}$ is a modestly larger pool than the estimated $uNDF_{ligx2.4}$. This changes the amount of fermented NDF. Furthermore, the rates (K_d) in CNCPS 6.1 were all derived based on pdNDF pools obtained using $uNDF_{ligx2.4}$. Thus, applying old 6.1 CHO B3 K_d values is not an accurate determination of fermented CHO B3 (*i.e.* NDF) when applied to pdNDF derived using $uNDFom_{240}$ instead of $uNDF_{ligx2.4}$. This will change the ME supply, and the amount of microbial yield.

2. Another issue impacting the transition to 6.5 is that some labs have still been reporting $_aNDF_{dm}$, not yet reporting $_aNDF_{om}$. $_aNDF_{om}$ is NDF, assayed with sodium sulfite, and <u>corrected for ash content</u>. Historically, CNCPS model users have been using NDF_{dm}, that is, NDF that has not been corrected for its ash content. For most forages, correcting for NDF ash content will result in a minor decrease in the size of the NDF pool depending on the forage's amount of ash contamination. Changing to NDF_{om} will result in an offsetting slight increase in the NFC pool, and specifically the soluble fiber pools. Typically the result will be a small increase in the ME supply, since the material formerly included as NDF is now apportioned to soluble fiber, which has a faster K_d and consequently yields more ME. In most cases this shift in modeled results is very minor, resulting in much less than a 1 pound change in ME allowable milk. However, for some samples, mostly ensiled forages with high soil contamination, accounting for the ash will make a substantial shift in the ME supply. Overall, using uNDFom will result in variably smaller amounts of NDF appearing in ration formulations. Users should be aware of and consider this in assessing ration NDF content relative to targeted guidelines such as minimal ration NDF content or ration NDF as a percent of bodyweight for instance.

3. Another outcome affected by the "hybrid" inputs arising from using analytical feed analyses inputs that are not completely consistent with CNCPS 6.5 includes a difference in uNDF when expressed as a percent of bodyweight. This value is useful in assessing dry matter intake potential or limitations. Similarly, MP yield can be impacted by the modeled estimates of carbohydrate fermentation due to inputs that are not totally consistent with either the 6.1 or 6.5 version of CNCPS.

As indicated previously, these temporarily "hybrid" inputs are typically not resulting in extremely large differences in modeled performance. However, in a few individual cases the differences might be substantial. Particular concern is that the hybrid inputs may lower the pdNDF (Potentially Digested NDF) pool, which will be inconsistent with the single 6.1 Kd derived from single NDFd time points for that point. The 6.1 Kd are currently still being used until the new 6.5 rate calculations based on 3 time points are able to be calculated when labs are providing the necessary three NDFd values. Therefore, it is recommended that *users might not want to input the $_uNDF_{240}$ values until the lab is also providing NDF_d for time points 30, 120, and 240*, as these will be necessary to make the rate calculations consistent with CNCPS 6.5

rates. This will also indicate that the CHO B3 (NDF) K_d can be derived from the new integrated rate calculation algorithms. These rates can also be calculated internally by NDS if the appropriate NDF_d values are input on the Feed> Constants Calculation >Carbohydrate > NDF Digestibility tab. Note that the lab specific lag time will no longer be a necessary input for rate calculations. Until the three time points used for new 6.5 rate calculations are reported, if one is importing feed analysis via the standard xml files, it would be prudent to uncheck the $_uNDF_{240}$ during the import so it is not present and will not result in the inconsistencies described above. Once the labs are able to provide the new integrated CHO B3 rates and the 120 hour NDF_d as well as the 30 and 240 hour values there will be no need to continue excluding the NDF240 on the input or import. NDS will be providing an alert in a coming NDS update which will inform the user if the $_uNDF_{240}$ is present in the sample but the complete set of three time points is not.

The labs are all expected to be able to provide a complete set of analytic values consistent with the inputs for CNCPS 6.5 in the very near future, in fact likely before you receive this newsletter. This will correct the issue for new samples analyzed after that time. It is strongly recommended however, that **feed analyses input or imported prior to the upcoming advent of labs providing these new set of results should be resampled and reanalyzed to obtain the correct analytical inputs used in 6.5 in order that the feeds used in formulation have values consistent with the new CNCPS 6.5 inputs and biology and any "hybrid" values are replaced.** Also, the Kd rates for (concentrates) byproducts, which require a different set of three time points (NDFd at 12,72, and 120 hours), are probably not going to be available via NIR analysis because there are unlikely to be enough samples run to develop the NIR calibration equations. Users and user groups would be well advised to run wet chemistry with NDFd at these three time points on concentrates that they commonly formulate with.

In summary the CNCPS model is moving forward to help nutritionists and dairy scientists to better predict and evaluate rumen nutrition with the 6.5 biology. CNCPS 6.5, and the NDS implementation, will again advance and help us to improve. However, during the transition we may have to be aware of these changes.