

Are You Using the Right Software to Balance the Ration?

Know which ration software can guarantee a precision ration(?)

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Since 1998 I've been working as an **independent** advisor in dairy management of soil, agronomy and nutrition. A part of my business mission statement includes *training* the farmer (or his feed mixer-herdsman) to formulate, **monitor** and *adjust* his ration(s). Prior to (1998) working *independently* (not as a sales representative for a supply company), I worked as a corporate trainer-troubleshooter in dairy feed management -and that included using (and teaching others to use) the Michigan State Spartan software program. I found the Spartan program to be an excellent spreadsheet-calculator, *more than adequate* to formulate rations to meet the *numerical values* for nutrients.

However, after several years' experience, I discovered that *most of the* feeding advisors I was training tended to *substitute* computer-side evaluation for the *more involved* efforts of *cowside scrutiny*. This led me toward developing a more rapid (yet *science based*) method for *formulation* (calculating dry matter and nutrient supplementation needs –*specific* instructions can be found on my website, listed above). After these years of experience, I've come to conclude that the limiting factor for successful feed programming does **not** lie in need of more sophisticated spreadsheets or **predictive** computer models.

Most often, while troubleshooting health and production failures, I find the greatest *errors* made are found out at the feedbunk and in the barn. Furthermore, I still *regularly* come across formulations produced by modern *sophisticated software* programs that are obviously *wrong* for the herd –**as judged by cow response** (acidosis / laminitis syndrome is a **big** part of why lameness is a **big** problem in our industry. In spite of improved facilities, far too many cows suffer laminitis while being fed “expertly” formulated “precision” rations). **While 'tis human to err, the cows are never wrong.** (For *practical* guidelines to evaluate cows, I'd direct readers to my website, address above.) There is **no** consensus over which computer model **predicts** most accurately.

Furthermore, *consensus* does not lead to discovery in science (read history!) - it more often leads to *fear* of questioning the status quo. Sophistication, in my *considered* opinion, may actually get in the way of **practical** feed management out on the farm. Therefore, I prefer to teach the farmer / herdsman how to make ration formulation **less** sophisticated – the *fundamental* calculations can quickly be put into the targeted *ranges* for nutrients by merely using a pen, paper, and calculator. I realize that this may seem “radical” or “reckless” to some, but *good* formulating only requires some basic mathematical skills by my view / methods. (The operative key word is *independent* in my consulting, which by definition must allow for thinking *outside of the herd*.☺) While I do wonder at (and appreciate!) the technology available to *measure and record* data (instantly, in real time) on farms, I am dismayed by the **lack of critical thinking** and **circular logic** employed to promote increased sophistication / complexity, the use of **predictive** computer models to formulate “precise” rations for ruminants.

Digestion is a *very dynamic* process in ruminants. Therefore, it is a moving target in time. It is a *scientific oxymoron* to claim “*precision ruminant*” nutrition. I think “precision” has much more to do with **marketing** and **environmental politics** than wisdom (the practical application of knowledge). It is currently in vogue to use sophisticated models to promote the use of rumen protected (“by-pass”) amino acids. Dairymen are encouraged to *trust* and invest in this technology as they are presented with mathematical **predictions** of response. Some are advocating that rations be *further* fractioned *mathematically* into components of fat (fatty acids) and sugars (the various types) in order to better **predict** outcomes in the barn. While this may be exciting for researchers and marketers, at the end of the day, the proper use of technology still appears to give us the most reliable data when it is used to **monitor / measure the actual / true** outcome (not to *predict* what it may be). Even those promoting the *predictive* models recognize that it is

necessary to make *adjustments* to rations **based upon cow response**.

Again, this seems to me to be a bit of **circular logic** and unnecessary busywork. While writing more about these things on my website I quote Glen Holub, Ph.D. of Texas A & M University as he comments about the CPM dairy software, “Many nutritionists may not have the **time** to accurately determine the correct data to input into the model.” **Does anyone stop to think?** Naw, we’re too busy entering data into predictive models.☺ Considering how unpractical these sophisticated programs can be for on-farm training, I’ve been greatly encourage to see a presentation given by **Dr. Michael S. Allen of Michigan State University** during the 2011 Tri-State Dairy Nutrition Conference that was featured in the **8/8 and 8/29/11 issues of Feedstuffs magazine**. Dr. Allen appears to be bringing a little **logic** and balance (pun intended!) back into *formulating* rations for dairy cows. While I’d encourage my fellow advisors (and dairymen) to read and consider the information presented in the entire article(s), I’ll merely quote Dr. Allen here for the purpose of brevity and to peak your interest.

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8-8-11 Feedstuffs, Status of formulation models assessed: Part 1 (emphasis added)

. . . *Complex* mechanistic models are not useful for routine diet formulation . . . energy intake and partitioning are the “holy grail” of diet formulation *and are greatly affected by diet, but these effects are completely ignored by diet formulation programs* . . . DM digestibility *ranged* from 51% to 72% for 29 cows in tie-stalls offered the same diet . . . The large range in NDF digestibility was *likely because of differences in ruminal pH* . . . The effects of diet on energy intake and partitioning are the *most* important *but often overlooked* . . . the relationships are *qualitative, not quantitative*, and are not in a form that can be included within the *traditional modeling* framework . . . The response in energy intake and partitioning to ruminal fermentability of starch **cannot be predicted by models** . . . Production response to the diet cannot be predicted . . . Models cannot accurately predict the effect of diet on feed intake and milk yield because of the numerous interactions involved. However, these effects can be used in diet formulation **by evaluation of cow response** . . . The rumen is so complex and so much remains to be understood about its biology

that it seems overwhelming to attempt to model it . . . Development of rumen models **for research and teaching purposes** will continue to advance our knowledge. However, mechanistic rumen models **add needless complexity** to diet formulation and likely do not increase accuracy . . . Both digestion rate and passage rate can vary widely . . . Data for rates of digestion and passage of feed fractions **are largely inaccurate** or nonexistent . . . They are not useful to **predict** digestibility . . . Most rumen models used for diet formulation do not include selective retention [of feedstuff particles]; *in contrast to reality* . . . Inaccurate passage rates . . . are major source of **error** for rumen models, **rendering them useless for diet formulation** . . . The rate of digestion of potentially digestible NDF is **highly** affected by **ruminal pH**, which is not accurately *predicted* by current models . . . Passage rates of nitrogenous fractions are largely unknown . . . [predicting] passage of true protein from feeds *is an exercise in futility* . . . Determining protein synthesis by ruminal microbes and the flow of microbial protein from the rumen is even more challenging . . . **and cannot be predicted accurately by models** . . . Although one of the primary reasons for the development of rumen models was to *predict* absorbed protein, increased accuracy of **prediction** is highly doubtful.

8-29-11 Feedstuffs, Status of formulation models assessed: Part 2 (emphasis added)

Nutrition models are used to **predict** . . . the goal of this article is to . . . **provide a reality check** . . . Ockham’s razor is a principle . . . we should tend toward **simpler** theories unless simplicity can be traded for increased explanatory power . . . **everything should be made as simple as possible**, but not simpler . . . Rumen models give the **false** impression of increased accuracy of nutrient supply to the animal because of their complexity . . . using complicated models for routine diet formulation is **illogical** because the added complexity does not increase accuracy . . . We will be better served with a **simplified** approach to diet formulation that concentrates on what we can **measure rather than using what is predicted poorly** . . . **Production response has little to do with the program used for diet formation** but is highly dependent upon the **experience and knowledge** of the nutritionist, the **management team on the farm** and their interaction . . . Although **more frequent [TMR] sampling** will increase costs, **eliminating unnecessary characterization** required by complex

models will offset the cost. Variation in rations delivered to the feed bunk should be assessed periodically by TMR audits, which can reveal *problems related to mixing and delivery* of rations . . . An **alternative** [this KOWboys?] approach to diet formulation allows more time and money to be focused *on the factors that have greater importance* . . . Because rumen models cannot accurately *predict* . . . the optimal forage NDF concentration for a given group of cows and source of forage *can only be determined by careful evaluation of cow responses* . . . Although **predicting** absorbed protein has been the *primary* emphasis of some rumen models, *their improvement in accuracy is doubtful* . . . amino acid profile can be determined by substituting ingredients and **evaluating responses** . . . Because rumen models cannot *predict* . . . **fat** sources must be carefully considered by **evaluating cow response** . . . While diet formulation can be simplified, **evaluating cow response** requires more attention by nutritionists and coordination with the *management teams on farms* . . . this is an **important** *determinant of the success of the nutrition program* . . . [Dairy nutritionists] increased emphasis on minutiae required by *overly complex models* dilutes their effectiveness in other important areas.”

The information presented in this article can help nutritionists decide how to balance their efforts. Energy intake and partitioning are affected by diet and should be the primary consideration when formulating diets; unfortunately, they often get less attention than they deserve. Reducing variation of rations delivered to the cow and **evaluating cow response** are integral to *successful* diet formulation and *require* greater involvement of nutritionists in the nutritional management **on the farm**.

“*All models are wrong, but some are useful*” (Box, 1979). Some of the information presented in this article will likely raise a few eyebrows or incur even stronger reactions by some, especially in regard to the **questionable accuracy of the increasingly complex models** that were originally developed as **research** models *but found their way into the field*.

Most models can be used successfully to formulate diets *as long as you know what the model can and can't do and what to trust and not to trust*. Understanding the model used is imperative, but *complex models are very difficult*

to understand, even among academics who have the **time** and resources to study them.

The **simplest** model that adequately describes the system *should* be used; if a more complex model does *not* increase accuracy, it *should not* be used for routine diet formation.

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Therefore, to answer my (title) questions, dairymen seeking *accurately* formulated rations need *not* presume complexity is necessary. In fact, this author will posit that **good formulations can be created without the aid of anyone's computer software**, and I've found it *advantageous* to teach the fundamentals of formulation *avoiding* the sophistication (basic mathematic calculations and proper nutrient *ranges* can be accomplished without computers! I have a 10 step guide on my website that I like to use to do classes.). **If one desires to utilize technology, tools that can measure cow response in real time are proving to provide a much more reliable basis for ration adjusting / “fine tuning”** (an *ultimate* example: robot milking systems and their associated technologies). Beside technology, feed mixing / testing / bunk management and **reading biological feedback from cows still reigns supreme** as the best guidepost to judge the accuracy / balance of rations.

Dairyman that find themselves being *pressured* into “needing” new technologies to accurately **predict** ration responses have good reason to be skeptical. Nutritionist-salespeople *using unnecessary complexity as a sales tool* deserve a little “push-back” from dairy producers that are under extreme financial pressure to find a return on investment from any and all feed additives - beyond the basic nutrients. The salesman that presents **predictive models** as his only evidence of efficacy either lacks understanding / practical experience or does *not* have the farmers best interest in mind -that is my **independent** view. As the 2010-11 president of the WI Assoc of Pro Ag Consultants, I'm an advocate for applied **expertise combined with golden rule ethics**. Our question for dairymen is “**who is looking out for you?**” On behalf of my WAPAC and KOW associates, **we are**. I tip my KOWboy hat to Dr. Mike Allen, it appears that **he is too!** Make no mistake, it takes *courage* and *conviction* for an academic to dare speak up with a *politically incorrect* position. Dr. Allen *deserves* our respect and gratitude –he is not *for sale*.