Benefits of a Cross-Species Software Platform for Livestock Nutrient Requirement Systems

Global Food Production Challenge:

Global population is projected to exceed 9 billion people by 2050 (*1*) with substantial increases in demand for meat and milk. Because food production resources are already limited (*2, 3*), livestock feed efficiency must improve to help meet future food demand. Efficient livestock production occurs when nutrient supply to the animal is precisely matched with requirements which is accomplished only with the aid of ration balancing tools such as the NRC Nutrient Requirement programs.

Figure 1. Linking Ration Balancing, Feed Efficiency and Food Security

The Problem:

Current NRC nutrient requirement programs have diverse user interfaces which are costly to develop and maintain; are cumbersome to use in research and extension efforts; and do not provide utilities crucial in training animal nutrition professionals with skills relevant to today's industry thus reducing the impact of the programs.

The Solution:

A well designed, common, cross-species software platform for nutrient requirement models will improve educational efforts, increase adoption by producers and extension personnel, and reduce cost and time associated with updates and maintenance. Savings in maintenance can be invested in added functionality needed to train skilled animal nutrition professionals across species thus improving adoption of the programs.

Specific benefits:

A common, cross-species software platform will reduce development and maintenance costs for the NRC series.
- Most of the interface and report code and the database structure could be identical across species. Only the model code and the contents of the database are unique to a species. Updates to a common piece of code would not have to be duplicated across species and would reduce costs. This is the approach used for industry developed ration balancing software.

A cross-species software platform will enhance animal nutrition education in universities and help to better improve the readiness of tomorrow's animal scientists, industry professionals, and animal producers
- Attempting to teach undergraduate nutrition using NRC software is hampered by the diversity of software. There isn't enough class time to teach 4 or 5 different programs. Almost all of the commercial software utilizes model code that diverges from the NRC thus clouding the concepts being taught or is not configured for multiple species. A common NRC software platform configured similar to commercial software but without all of the "bells and whistles" would be a huge benefit for teaching nutrition. Students could become competent and apply their knowledge for any species of interest. They could also more easily transfer to a commercial package when they enter the industry.
- Least cost formulation is used in the industry to minimize ration costs while meeting all of the nutritional needs of the animal. When not used, it is not uncommon for ruminant rations to be overpriced by 10 to 50 cents per head per day or to be grossly overformulated for one or more nutrients. Students are not currently being taught to use such an algorithm, and thus are not prepared for industry work. Savings associated with reduced maintenance costs could be invested into addition of an optimizer. This would further enhance educational progress, again allowing skill development across species and approved adoption of the programs.
- Development of ration formulation knowledge in students will translate to more informed producers who will expect more from their nutritionist and can cross check the quality of the nutritionist's work. Given that 40% of dairy operations (*4*) and 84% of beef cow/calf operations (*5*) do not source their nutritional information from a professional nutritionist or extension agent, it is critical that all students
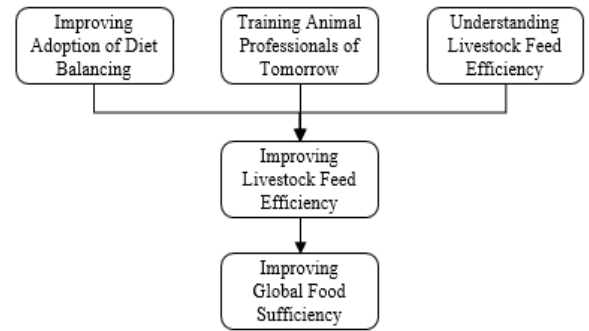
entering the industry have skills in ration formulation. This will lead to improved animal efficiency and reduced nutrient excretion.

A cross-species software platform will enhance extension of animal nutrition knowledge by expanding the utility of tools and reducing barriers to adoption

- The current NRC calculators are not adequate for daily ration work. Thus extension nutritionists are forced to adopt a commercial package to conduct outreach efforts. Since the commercial packages typically do not utilize standard NRC programs, outreach efforts often diverge from the NRC knowledge base.
- Enhancing the capability of the NRC program by inclusion of an optimizer and by simple streamlining of the interface would yield a tool that could be used on a daily basis by extension specialists across the US. This would lead to a more consistent message, better outreach programs, and improved efficiency.
- Outreach efforts are being wasted on duplication of efforts. At least 8 different platforms have been developed by University Extension groups (Arkansas, Michigan State, N.C. State, Oklahoma, Washington State, Wisconsin, UC-Davis, and Cornell). A well-constructed, cross species platform would eliminate the need for these duplicative efforts allowing focus on further development of the NRC program and more time spent on outreach.
- Deployment of new knowledge developed within USDA-funded, integrated research projects is currently problematic as there is no platform to deploy new components developed through research efforts. Thus the ability to complete the outreach portion of such a project is very limited. An open-source version or a version that could be altered upon special permission by the NRC would provide a platform for on-farm testing of new nutrition principals. For example, a new system for quantifying phosphorus availability to the animal was recently developed at Virginia Tech within an integrated project, however, there is no platform available that could be updated with the new system and used on farm to demonstrate applicability and build a database of farm experiences which would lead to enhanced adoption of the system.

A cross-species software platform would make it easier to develop small applications for mobile devices.

- Development of the mobile apps would benefit from the common platform in the same manner as the PC-based software: less development and maintenance costs and application of common software across species.

References

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