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USSEC, partners establish Asian aquaculture feed formulation database

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Tool useful for feed formulation, ingredient purchasing, quality control, research

The development of cost-effective compound aquaculture feeds has been a key factor in the rapid development of the aquaculture sector in many parts of the world. Asia represents the most important market for aquaculture feeds, with an annual production of about 30 million metric tons (MT). Some experts predict the Asian aquaculture feed industry will double over the next two decades due to the continued transitioning of aquaculture operations toward use of compounded feeds in more intensive production and the continued growth of the sector in general.

The Asian aquaculture feed sector is characterized by its great diversity. More than 300 fish and crustacean species are produced in a wide variety of culture ponds, tanks and net pens, and under varied environmental conditions. Numerous adjustments need to be made to the nutritional compositions, ingredient compositions and physical characteristics of feeds according to species, life stage and animal weight.

Aquaculture feeds are becoming complex mixtures of an ever-increasing number of ingredients of plant, animal and microbial origin. Feed manufacturers require robust but highly flexible tools to assist them in the formulation of cost-effective feeds. Furthermore, socioeconomic factors, local preferences

Given the huge volumes of aquafeed required to support Asian aquaculture, effective feed formulation is key to continued industry growth.

and competition result in significant market segmentation.

Limited nutrition information

Large amounts of information on the nutrient requirements for different aquatic species have been compiled in recent years in a number of reference documents. However, this information generally targets a limited number of species and only one life stage.

For example, nutrient requirements reported in the 2011 National Research Council's Nutrient Requirements of Fish and Shrimp were derived mainly from studies using juvenile fish, which are typically fed semi-purified diets or diets with high nutrient digestibility. These estimated requirements do not account for changes in body weight and life stage, the effects of a diet's nutritional composition and/or the digestibility of its nutrients, nor do they "factor in" safety margins to account for the reality of nutrient losses during manufacturing, storage and feeding.

Consequently, the information available in the reference literature is not always easily translatable into practical nutritional specifications or guidelines that aquaculture feed manufacturers can upload into least-cost feed formulation programs.

Formulation database

For 30 years, the U.S. Soybean Export Council (USSEC) has worked with the global aquaculture sector to promote the use of soy products from the United States in aquaculture feeds. As aquaculture has expanded, it became clear to USSEC that there are not enough trained formulators for aquafeeds. Furthermore, the information available in reference literature for aquaculture species is incomplete and lags far behind that for terrestrial livestock species.

To help aquaculture formulators with some of the tools and training needed to produce high-quality aquaculture feeds, the organization spearheaded the Asian Aquaculture Feed Formulation Database (AAFFD) project this year. The project targets the development of dynamic databases that will be accessible free of charge to aquaculture feed formulators. The information and associated tools will enable the formulation of cost-effective and nutritive feeds for a wide variety of Asian aquaculture species under a broad range of conditions.

The project was established with initial funding from the Nebraska Soybean Board. Complementary funding was later obtained from the United States Agency for International Development (USAID).

Integrated information

USSEC and USAID entrusted the AAFFD development to Veridis Aquatic Technologies Inc., a Canadian corporation focused on implementing cutting-edge benchmarking to improve the productivity, sustainability and profitability of commercial aquaculture operations. Veridis in turn sought the expertise of the University of Guelph's Fish Nutrition Research Laboratory, a research group that has developed world-class nutritional models and feed formulation tools for different culture species over the past three decades.

Working in close cooperation, the various partners decided the AAFFD would be comprised of two distinct, yet integrated and coordinated sub-databases: a Feed Ingredient Composition Database (FICD) and an Aquaculture Species Nutritional Database (ASND).

This large project required the contribution of numerous research associates and graduate students with expertise in the nutritive values of feed ingredients, aquafeed formulation and nutritional modeling. The two AAFFD databases were populated with data collected from scientific and technical literature, a survey of feed industry stakeholders and estimates generated using cutting-edge mathematical models developed at the University of Guelph.

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The FICD data include information on the chemical and nutritional compositions of over 300 ingredients commonly used in Asian aquaculture feeds. The ASND database includes nutritional specifications for 24 aquatic species representing approximately 90 percent of the commercial aquaculture production in Asia. These two sub-databases together provide feed formulators with the information necessary to develop locally specialized feeds specific to a number of species using combinations of ingredients that best fit local conditions and preferences.

A cloud-based interface accessible anytime from anywhere around the world was developed to access the databases. The user-friendly interface at http://tinyurl.com/AAFFD permits the export of data from the databases in a format compatible with the needs of nutritionists, feed formulators and common least-cost feed formulation programs.

Perspectives

The AAFFD clearly does not replace nutritionists, feed formulators and consultants in their respective roles, as any database must be linked with additional knowledge and experience to create reasonable, effective and profitable formulations. But by compiling detailed information on the compositions of commercially available feed ingredients, the AAFFD can be a reference tool for individuals involved in feed formulation, ingredient purchasing, quality control and research. It can be used as a starting point by less-experienced feed manufacturers or as a reference for comparisons to nutritional guidelines currently used by established feed manufacturers.

While the focus of this project is on the Asian aquaculture feed market, the information and tools are also valuable for other markets. USSEC plans to expand the number of species and ingredients covered by the AAFFD to a more global context.

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