Nutricines – the future of animal nutrition

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The field of classical nutrition has been intensively studied by scientists and nutritionists for over 100 years. In classical nutrition, energy ingredients, protein ingredients, vitamins, minerals and traditional feed additives are combined to make a finished feed that can be given to animals, resulting in meat, milk and eggs.

The advent of continued waves of diseases that have now threatened animal agriculture on a worldwide basis has made the concept of classical nutrition obsolete.

Classical nutrition simply to produce farm protein products can no longer be considered an end in itself because it ignores the health of animals.

Total Nutrition concept

The introduction of a concept called 'Total Nutrition' is a new concept that animal nutritionists, feed manufacturers and animal husbandry experts can look at the continuum of animal production. In Total Nutrition the classical needs to raise animal protein are considered, but a host of other factors are layered upon this older concept.

This means that the environment that the animal lives in, becomes a central focus as it is subjected to both metabolic and environmental challenges.

These challenges can progressively affect the overall disease status of the animal and this disease status is essential when the concept of Total Nutrition is examined.

Total Nutrition is a consideration of both the nutritional as well as health impacts of particular nutrients on the animal's well being and eventual health and growth.

Nutrients that have these health effects have been termed 'nutricines': nutrients that may also be medicines

While waves of animal disease have affected the macro environment of animal production in recent years, perhaps one of the most striking challenges within the last 18 months has been that of the rapid price increase of base protein and energy ingredients that make up what was normally thought to be classical nutrition.

This series of economic changes began with the United States declaring a goal of producing 35 billion gallons of ethanol per

year sourced from traditional and non-traditional animal feed ingredients.

The resulting shift has brought prices of commodity ingredients to a new plateau, unrecognised before as a level of input costs for animal feeds.

Two principal economic drivers are responsible. First and foremost is the increasing price of oil. As the price of petroleum has steadily risen, the price of its main product, gasoline, has also increased. This means that ethanol has become increasingly more valuable to the point of being economically competitive.

As little as five years ago, ethanol had little overall competitive stature, even with substantial subsidies being paid by local governments. As the price of oil continues to increase, the profitability for ethanol producers will continue to rise. This allows ethanol producers to be able to afford to pay high prices, for their fermentation feedstock even with increasing maize prices. For example, at US$100 a barrel, a price thought to be non-realistic a few years ago, producers can afford to pay $7.38 per bushel for corn, or $290 per metric ton.

Transportation problems

The temporary decrease experienced currently in ethanol prices is largely due to transportation problems.

Ethanol, being produced in the middle part of the United States, has two chemical problems: its propensity to absorb water, (when distilled to pure form) and its corrosive qualities on seals and other components of the traditional gasoline pipeline industry.

While blends of gasoline and ethanol have none of these corrosive qualities, in order to transport the ethanol to the blenders, these logistical problems will have to be overcome in the next few years.

As oil prices hit new record prices, it will only be a matter of time until the effect is felt throughout the animal feed raw ingredient markets.

Feed to gain ratios

Increasing feed costs mean that points of feed conversion have become increasingly important. Just as maize prices have doubled, the relative value of a single point of feed conversion has also doubled within the last 18 months.

As nutritionists consider various strategies to improve the overall quality of the feed, feed conversion has once again taken centre stage. This must be done against a backdrop where health concerns also remain pivotal. Into such an environment, the concept of Total Nutrition can be introduced.

Impact of nutricines

Total nutrition looks not only at the traditional nutrients, but also at nutricines, compounds that can affect both the nutrient status as well as health of the animal.

To cope with the dual challenges of higher

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feed prices and increased health concerns, new feed components that can affect both health and productivity are highly sought after. An example of such a nutricine is enzymes. Enzymes have long been recognised for their ability to affect the relative productivity of animals by decreasing relative feed to gain ratios. What has been less understood is the impact of enzymes on the health of the animal.

Excess nutrients, when introduced into the small and lower intestine, can dramatically affect overall microbial populations.

These microbial populations, thereby drive the relative ability of the animal intestinal system to react to pathogens that may be in its environment.

Given that 70% of the animals' overall innate immune response is involved within its intestinal tract, excess nutrients that are not digested go on to be wasted through inefficient fermentation, but at the same time the metabolites of this fermentation systematically depresses the ability of the animal to resist disease.

In Total Nutrition, selection of enzymes must be done not only based on the ability to perhaps decrease viscosity in the small intestine (thereby, effecting traditional nutrient absorption) but also, must be selected for their impact on digestion of substrates that may effect microbial populations in the large intestine.

This selection parameter is a new concept in enzyme use, but can be elucidated through effective laboratory models. When enzymes are used for both nutritional and health reasons they live up to their classification as nutricines.

During the last 20 years of enzyme use in the feed industry, it has been repeatedly recognised that combinations of enzymes properly selected guarantee the optimum efficacy in ensuring that the least amount of undigested nutrients reach the large intestine.

These combinations of enzymes are much more effective than single enzyme components; and thus the future of these nutricines as ingredients in animal feed is focused around the customisation of particular enzymes for particular nutritional challenges.

Fat utilisation

Fat absorption was thought to be a simple matter of passive diffusion; as soon as a moderate amount of free fatty acids were exposed to the intestinal lumen they were absorbed and became available to the animal. Increasingly, it has been recognised as more fats are diverted by biodiesel the overall quality of fats available for animal feeds is also decreasing.

The decrease in fat quality means that nutricines that can affect the relative absorption as fat, can dramatically impact the nutritional status and health of the animal.

Nutritional status is affected through better overall digestibilities. Animal health is affected by allowing maximum absorption of fat in the small intestine, and precluding this nutrient from reaching a lower digestive tract. Examples of various nutricines that can have this effect include molecules such as lysophosphatidylcholine.

Lysophosphatidylcholine, which is a natural material derived from soybeans, has been shown as highly effective in decreasing overall sizes of emulsion droplets; and also to decrease relative critical micelle concentrations noted to be an essential part of fat absorption.

By decreasing both of these parameters, fat is more effectively digested; thereby allowing maximum nutrition and maximum health. The alternative use of animal feed ingredients for fuel will no doubt dramatically impact the feed industry in the next few years. Into this environment, the increasing challenge of disease indicates that we must continue to recognise that better technology for a nutritional impact encompasses both growth and health, the essential features of Total Nutrition.

Total nutrition considers both the health as well as the nutritional productivity of the animal, and incorporates the use of nutricines as an essential component of future animal feeding. ■