# Reformulating the indigestible fraction: How to fully maximize the feedase benefits

Feed enzymes do not improve the digestible fraction of feed; rather, they target its indigestible fraction. This is where the nutritional value of feed enzymes remains. Better knowledge of the indigestible fraction and the potential to release it should be the basis of dietary formulation with enzymes. The new generation of feed enzymes, Feedase, which enhances the overall nutrient digestibility, will revolutionize the way diets are reformulated, greatly increasing the sustainability of animal production.

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For more than 20 years, enzymes have been used to improve feed digestibility and have allowed the use of more raw materials to help animal producers reduce their feed costs. Regarding energy, not more than 75% is available to the metabolism at the end of gastro intestinal tract (GIT), while for protein 80% ileal digestibility is currently observed, meaning that 20 to 25% of the organic matter is normally not available for animal metabolism. Modern poultry and swine genotypes have largely been selected for improving their appetite and, thus, challenging their digestive abilities.

The efficiency of enzyme solutions depends not only on the ability to degrade their substrates, but also on the amount and importance of the nutrients that are prevented from digestion when associated with these substrates. Anti-nutritional effects of non-starch polysaccharides (NSP) in poultry and swine diets are well known and can be summarized as (1) encaging nutrients, decreasing nutrient accessibility to animals' endogenous enzymes; (2) increasing digesta viscosity, reducing the nutrient absorption capacity by the GIT; or (3) increasing the microbiota population and, thus, partially reducing the availability of nutrients for the animal's metabolism.

## Utilizing feed nutrients effectively

Developments of NSP degrading enzymes (NSPases) for corn-based diets, or non-viscous diets, have shown that viscosity might not be a critical issue; rather, improving the accessibility of the nutrients for the endogenous enzymes is more crucial for better utilization of feed nutrients.

Recent data have indicated that, approximately, one third of the indigestible fraction could be released by enzyme solutions. Indeed, NSP are known to reduce the feed digestibility, while NSPases have largely been used to get rid of those anti-nutritional factors, improving the nutritional value of feed; however, how can the indigestible fraction be efficiently targeted?

Based on genetic improvement of the specific fungus *Talaromyces versatilis*, it has become possible to significantly improved the production of xylanases and arabinofuranosidases, increasing the efficiency in braking down of highly ramified arabinoxylans present in summer cereals, such as in corn, sorghum, and rice. Indeed, this enrichment has drastically enhanced the efficiency of NSPases, leading to increased overall nutrient digestibility and feed efficiency. This new generation of enzyme, Feedase, is able to significantly increase the dietary nutritional value in a wide variety of feed conditions. The overall digestibility is demonstrated through improvements in the digestibility of starch, protein, amino acid, lipid, and phosphorus. Nevertheless, it is a crucial issue to understand how to optimize the benefits from such an enzyme when reformulating diets.

## Evaluating the potential for improvement

In order to estimate the potential of Feedase in animal diets, nutritionists must first know what fraction of nutrients is not digested. Evaluating the targets and the potential improvements are the aims of Rovabio® Advance Predictor. Based on a large *in vivo* database, it has become possible to develop a specific, robust, and reliable tool to help end users evaluate the indigestible fraction of their raw materials , as well as of their feeds. This allows to evaluate the improvement potential in metabolizable energy, digestible amino acids, and available phosphorus in order to optimize feed costs. The model developed proposes a precise and tailored nutritional matrix for nutritionists for the use of Rovabio® Advance in their feeds.

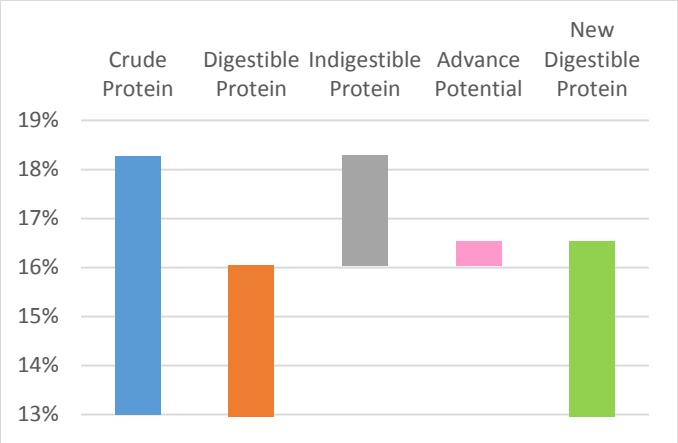


**Fig. 1 – Estimating the nutritional matrix of Rovabio® Advance in improving the digestible protein in feeds, based on the effect on the indigestible fraction of raw material.**

In order to ensure that performance is not adversely affected by reducing the nutrient density of the feeds, caused by nutritional effects not related to the role of Rovabio® Advance, some precautions for nutritionists are recommended during the formulation process. Among these provisions are some highlights to avoid: the excessive reduction of the fat content of the diet and/or the amount of oil/fat added; the imbalance in the energy to protein ratio; and the significant inclusion of raw material with low nutritional value. Such strategy might result in impairment of enzyme return on investment.

## Role of fat in animal diets

Fat has been greatly decreased in feeds nowadays, and reducing its level further through the enhanced effect of enzymes is sometimes impossible. Moreover, an excessive reduction of fat content may promote interference in its known “extra-caloric” effects, such as regulation of the transit rate of digesta in the GIT; absorption of fat-soluble vitamins; and essential fatty acid supply, especially linoleic acid and palatability (mainly in swine), as well as some technological aspects, like the quality of pellets and reduction in feed dustiness. Furthermore, the significant impact on the net energy intake must be considered—for example, when too much fat is replaced by carbohydrate (or even fiber. Practically, a reduction, through reformulation, in the total fat content of no higher than 35% is highly recommended. The energy:protein imbalance is also often associated with the misuse of the nutritional matrix when nutritionists, for various reasons, consider only the enzyme’s potential for energy uplift and do not consider its potential for amino acid uplift. Inevitably, Rovabio® Advance will release more amino acids to the animal, so the supply of these nutrients could be greater than the amount of energy required for their metabolism and deposition. This point strongly reinforces the need to fully consider the nutritional matrix of amino acids when this new generation of enzyme is used.

## Protect the intestinal mucosa

Finally, in many cases nutritionists try to take advantage of the reduction in feed nutritional density as an opportunity to include some costless raw material, which can be excessively fibrous or of inferior quality. In these cases, the risk of injury to the intestinal mucosa due to the abrasiveness of the highly structured fibers (for example, those found in the husk of rice or sunflower grains) is significantly increased, resulting in a reduction of the absorptive capacity, which opens the door for bacterial infections. Also, this could lead to the generation of intestinal inflammatory responses, which require a significant amount of body nutrients, particularly amino acids, directly affecting maintenance requirements. Moreover, depending on the quality of these raw materials, there is an increased risk of contamination by mycotoxins, oxidized fats, and allergenic compounds.

This new generation of enzyme solution allows directly targeting the indigestible fraction and, thus, improves its value, which will decrease the feed cost and improve the animal performance and the sustainability of animal protein production. With such an enzyme solution, nutritionists can take advantage of very important reductions in feed production costs, as well as the direct and indirect benefits in the performance of the animals, which are not being accounted for in the price of feed itself. In general, taking into account the current prices of the main raw materials available in the global market for the production of feed (corn, wheat, soybean meal, phosphate, etc.), the potential cost reduction by considering the full matrix of Rovabio® Advance may exceed US $15.00 per metric ton.