The Future of Amino Acid Nutrition.

By Les Berghorn, General Manager

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Improved Digestibilty Canola Meal

AminoMax Pro is a blend of canola meal and soybean meal, processed to improve rumen undegraded protein (RUP). The blend provides an amino acid profile that is superior to high RUP soybean meals, so less is needed to meet amino acid requirements for milk production. Research results clearly show that the processing technology improves digestibility as well as RUP, particularly for the canola meal component. Total tract nitrogen (N) digestibility for solvent extracted canola meal is typically between 80 and 84%. Soybean meal, on the other hand, has an N digestibility higher at 88- 91%. In a recent study conducted at Miner institute, the total tract N digestibility of AminoMax Pro was 88%, almost exactly the same as a leading rumen protected soybean meal product (89% N digestibility). The process increased the canola digestibility up to that of soybean meal, and maintained the digestibility of the soybean meal. Trials conducted at Cornell University further confirmed that the N digestibility value of canola meal is improved with processing. There were no changes in the RUP digestibility of soybean meal after processing. Because the digestibility of soybean meal is so high already, there is little opportunity to improve digestibility further. Interestingly, the RUP digestibility for canola meal was elevated by over 10 percentage unit after applying the proprietary AminoMax process. How can this happen? The protein meals are forced through an expander cone under high pressure. This causes two things to happen: the pressure alters the cellular structure so that contents are released from the more fibrous canola meal, while at the same time reducing particle size and increasing surface area. Both the pressure and the smaller particle size allow greater digestibility.

Table 1. How expanders improve digestibility

	Cone pressure kg/cm^2,			
N Digestibility, %	0	11.7	24.4	35.2
Low fiber diet	77.5	81.1	83.8	82.8
High fiber diet	69.2	74.5	77.1	78.3

A wealth of research in monogastric nutrition demonstrates the importance of each of these factors, and here are some examples. Kansas State Researchers (Traylor et al., Asian-Aust J. Anim. Sci 12:59-70) evaluated 4 levels of pressure on various types of diets: 0, 11.7, 24.4 and 32.5 kg/cm^2, (equivalent to 0, 166, 347 and 462 lb/in^2). N digestibility increased as pressure increased with a typical low fiber meal diet. But the expander pressure exerted its greatest effect in a more fibrous diet that contained 50% wheat mids (Table 1).

Furthermore In spite of the fact that corn and soybean meal diets are quite digestible to pigs, particle size is important. A study conducted with growing-finishing pigs Callan et al. (Anim. Feed Sci Technol. 134: 223-234) indicated that, as particles became smaller, diet digestibility improved.

The same applied in ruminants, where fiber levels are much more varied than with swine. The expander treatment used to produce AminoMax Pro uses both pressure and smaller particle size to provide the substantial improvement in total tract N digestibility with canola meal, adding extra value to this already exciting ingredient.

What is wrong with protein solubility and the nylon bag test?

Protein from feed ingredients serves two roles. First, part of the protein from each ingredient is degraded in the rumen to serve as fodder for the microbes (Rumen Degraded Protein, or RDP). Second, some protein escapes, or bypasses the rumen, and provides additional protein to the animal in the small intestine, adding to the supply provided by the rumen microbes (Rumen Undegraded Protein, or RUP).

In the past, protein solubility has been used as a method to estimate RDP, and to predict when an ingredient supports microbial growth, and when it supports the animal. As a step up from that, the nylon bag test showed when material left the bag, and equated those results to protein that became available to rumen microbes. In essence, soluble protein and protein that became soluble was assumed to be RDP.

Recent research shows soluble proteins are not always degraded in the rumen, and some of the soluble protein actually provides RUP to the cow in the small intestine. Using either the soluble protein measurements or the nylon bag measurements can severely underestimate the RUP value of ingredients. Furthermore, the rate at which soluble proteins are degraded in the rumen varies widely from ingredient to ingredient.

Thus meaning that only equating the insoluble portion of the protein that bypasses the rumen to RUP will provide an underestimation of the true RUP value of the feed ingredient. This is illustrated in Table 2. Less than half of the soluble protein in canola meal and linseed meal is broken down in the rumen.

Table 3. Determined rates of degradation for the soluble protein fractions of proteins*

Ingredient	Rate of soluble protein degradation, %/hr	Effective degradability of the soluble fraction	Effective escape of the soluble fraction
Wheat Distillers' grains	62	85	15
Soybean meal	46	73	27
Field peas	39	71	29
Lupin beans	34	56	44
Canola meal	19	44	56
Linseed meal (expeller)	18	42	58

*Hedqvist and Uden, Anim Feed Sci Technol.126:1-21.

As the table shows, very little of the soluble protein in some ingredients, such as wheat distillers' grains escapes rumen degradation. On the other hand, over half of the soluble protein in canola meal and linseed meal contribute to the RUP value. This means that they can make a substantial contribution to the available amino acid pool entering the duodenum.

Want to know more?

Call (855) 785-3625 email General Manager Les Berghorn at lesb@aminomax.com Or visit AminoMax.com

We don't need to analyze for lignin!

One of the toughest analyses to conduct in the laboratory is lignin. There are several methods available, and none give consistent results across different types of plant materials. Brinkman and co-workers (J. Chem. Ecol 28: 2483-2501) found that acid detergent lignin was the most unreliable of the 3 methods tested, and the least amenable to near infrared (NIR) calibration.

Most forage laboratories have offered their clients lignin results based on acid detergent lignin. Worse, many digestion models used lignin values, either determined or generated by NIR, to predict fiber digestibility.

Fortunately, Cornell University and Miner Institute have provided us with a better method: uNDF. This method computes the amount of neutral detergent fiber (NDF) that remains undigested after 120 hours for concentrates, or 240 hours for forages. This has resulted values that are quite different than those obtained using Lignin * 2.4 to estimate the indigestible fraction of NDF. While there has been little change for soybean meal, an ingredient with relatively little lignin, the NDF digestibility of canola meal more than doubled. Beet pulp and wheat mids, ingredients low in lignin, were less digestible than previously believed based on the lignin equation. This new method will certainly help to make formulas more accurate, and best of all, no lignin analyses are required!

Approximately 23% of the NDF in canola meal is in the form of lignin. Older models estimated the indigestible component of NDF by multiplying lignin *2.4. This calculation suggests that over half of the fiber would never be digested.

ME and NE-L were then calculated using the very poor fiber digestibility value. As a result, many nutritionists resisted using canola meal because the energy value was too low!

A joint research project conducted at Miner Institute and Cornell University clearly demonstrated that there is no relationship between lignin and fiber digestion for concentrate ingredients. Forage testing labs now routinely determine NDF digestibility. In fact, the NDF digestibility of canola is much better than previously calculated, contributing to higher calculated energy values.

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