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Measuring the Intestinal Digestibility of Amino Acids in Bypass Plant Protein

One of the primary purposes of feeding rumen undegradable protein (RUP), or bypass protein, to ruminants is to supplement the animal with specific amino acids for which rumen microbial protein had not met the animal's requirements. Of course, the amino acids in bypass protein must be digestible in the small intestine to benefit the animal. Heating a feedstuff is one way by which the percentage of RUP is increased. Whether heating occurs naturally, as when hay is baled too wet, or is intentionally applied, as in a manufacturing process, the chemical results are similar. Amino acids react with certain sugars, and the amino acids in the resultant compounds will be degraded to a lesser degree by rumen microbes. In the manufacture of high-bypass plant protein sources like SoyPLUS®, the objective is to create just the right conditions to produce more bypass protein, while at the same time, ensuring that the digestibility of the amino acids in that protein-sugar complex has not been decreased.

Scientists at The University of New Hampshire (Boucher et al., 2009) recently conducted an extensive research trial to measure the intestinal digestibility of amino acids in the bypass protein of solvent extracted soybean meal (low ruminal bypass) and SoyPLUS (high ruminal bypass). They used three different sources of each feedstuff, all obtained from the Feed Analysis Consortium Inc., Champaign, IL. To demonstrate the detrimental effects of excessive heating on amino acid digestibility, one source of each feedstuff was cooked in a laboratory oven at 300°F for 90 minutes. One hundred fifty aliquots of each feed source were subjected to a 16 hour *in situ* ruminal incubation procedure, involving three separate incubations and four different cows. The rumen undegraded residues were composited by source, and amino acid digestibility was determined, using a bioassay, for both the intact feeds and the rumen undegraded residue.

As expected, excessive laboratory heating (cooking) decreased amino acid digestibility of both products compared to uncooked samples. This verifies that the techniques for measuring digestibility in this study are sensitive for detecting heat-damaged plant proteins. For the uncooked samples, total amino acid digestibility of the bypass protein was very high, ranging from 92% to 95% for both soybean meal and for SoyPLUS. Whether you consider just the highly heat-sensitive lysine, or all essential amino acids, digestibility of the bypass amino acids was just as good for the high-bypass SoyPLUS as for the low-bypass solvent extracted soybean meal. This clearly demonstrates that the conditions used in the manufacture of SoyPLUS have been properly established for increasing the proportion of soy protein that is rumen bypass, and that those conditions are well controlled to ensure maximum intestinal digestibility of that bypass protein.

There is a wealth of other useful information in the paper of Boucher et al. (2009). Hopefully, their techniques will lead to development of new, commercially available testing services for routine evaluation of feedstuffs.

References: Boucher, S. E., S. Calsamiglia, C. M. Parsons, H. H. Stein, M. D. Stern, P. S. Erickson, P. L. Utterback, and C. G. Schwab. 2009. J. Dairy Sci. 92:4489-4498