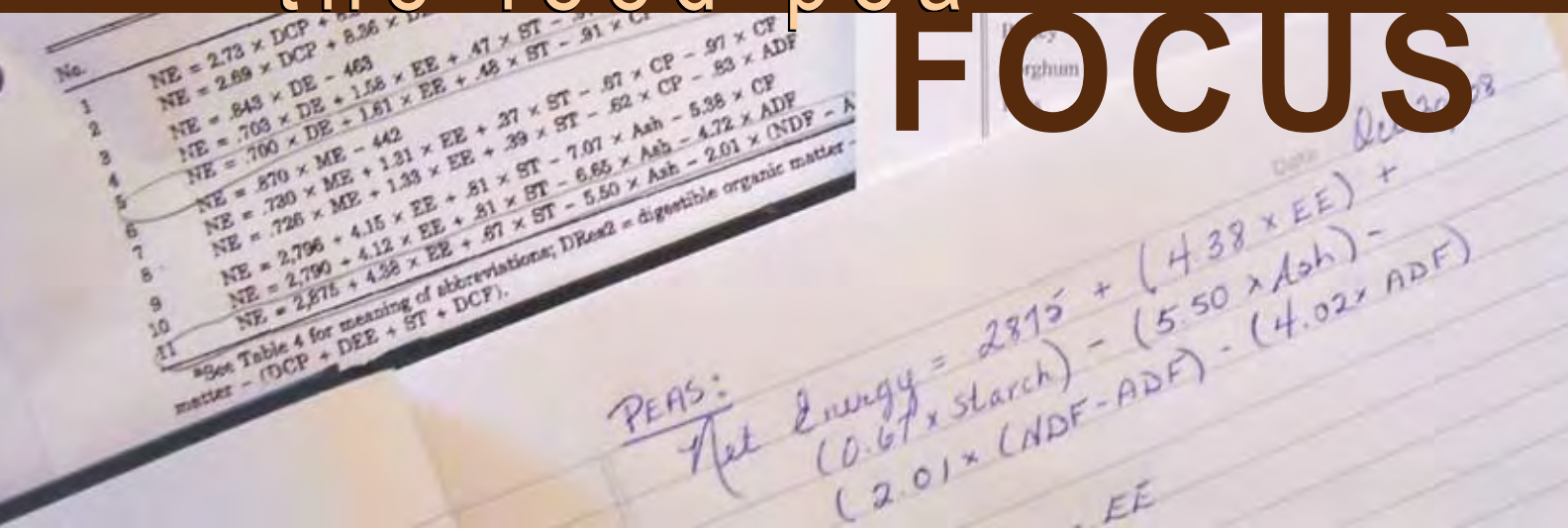
the feed pea FOCUS



2008 BUMPER YEAR FOR PEAS

Western Canada's 2008 pea production has exceeded all previous records, yielding an estimated 3.527MMT. Quality in this year's crop was exceptionally good, with only 8% below Canada #1 and #2 grades (Schmeiser, SK Ag&Food, personal comm). It is predicted that with potential yearend carryout near 20%, there will be an excellent supply of high quality peas available for the feed industry.

NET ENERGY AND PEAS

Some nutritionists question whether the benefits of the Net Energy (NE) system outweigh the time and cost of changing over their feed formulation values for swine. This question is particularly common for nutritionists who feel that the DE and ME systems have worked well and provided reliable results for decades. The current issue of the Feed Pea Focus will therefore discuss the rationale behind the NE system, examine calculated and proposed values from different energy systems and research institutions, and look at some of the benefits that should result from formulating diets using NE.

WHO WILL BENEFIT FROM USING THE NE SYSTEM?

The NE system was designed to accurately reflect the efficiency with which chemical bonds in feedstuffs are converted to energy that can be retained in the bodies of hogs and other animals. By definition, the DE and ME systems express the amount of heat energy that feed ingredients contain, not whether it is available at the cellular level. The difference between the heat energy content and the body's ability to store it can be so great that the ingredient energy hierarchy actually changes between systems (ie: NE system: corn>wheat>barley> peas>SBM vs. DE system: SBM>corn>peas>wheat> barley).

The Net Energy system will not provide equal benefits to all nutritionists. For nutritionists formulating diets containing only two ingredients (ie: corn and SBM), the optimal ratio of ingredients will have been established and the energy system used will be less important. However, many nutritionists perform formulations using feedstuffs that vary extensively in composition. These professionals require values that accurately reflect the amount of energy available for production of pork.

Whether the Pulse Growers will benefit from promoting the NE system will depend upon the relative value of energy and amino acids in feed formulation systems. The Pulse Growers have chosen to promote peas and other pulses within the NE system because it accurately displays that peas (2320 kcal/kg, as-fed) contain significantly more energy than ingredients with higher protein levels, including SBM (1940 kcal/kg, as-fed).

WHY DOES THE HIERARCHY OF INGREDIENTS DIFFER BETWEEN THE DE, ME AND NE SYSTEMS?

DE and ME values are erroneously high because they measure the large amount of energy present in the amino groups of amino acids, but living systems are able to capture only a fraction of this energy. DE is measured using bomb calorimetry, which is not representative of the metabolic pathways in living organisms, and this is where a major error occurs. In a bomb calorimeter, amino groups burn to N_2 gas and H_20 in the presence of oxygen, releasing large amounts of heat energy (2657 kcal/kg for NH_3 as NH_4OH). Only an estimated 50% of the energy in amino groups can be captured through the biological process of deamination. Nitrogenous compounds contain high levels of energy and the significance of this becomes apparent when the energy content of the amino acid alanine (4328kcal/kg) is compared to that of its deaminated equivalent, pyruvate (2953 kcal/kg; Campbell, unpublished communication). The ME system corrects energy loss from ammonia excreted in the urine; however, approximately 40% of amino acids are retained in well-formulated diets (Leterme, personal comm), and the unavailable energy in these retained amino groups is still credited to the ME value of the feedstuffs. The error is even worse for high-protein ingredient ME values calculated from DE using a standard conversion factor (ie: ME = DE*0.96).

In contrast to swine, Dr. Jean Noblet indicated that the ability to predict performance for poultry did not differ between the AMEn and NE systems (2005, personal communication). The AMEn system deducts a correction factor for nitrogen that stays in the body - a situation markedly different from that for hogs. The correction for retained nitrogen-based energy sources can be seen in the formula for AMEn: AMEn = Intake Energy - ((Fecal and Urinary Energy) + 36.53*(Intake Nitrogen - (Fecal and Urinary Nitrogen))[1]. Poultry AMEn and swine NE values agree well in terms of their ingredient energy hierarchy (Table 2).

A second major issue with the DE and ME systems is that they do not take into consideration the varying efficiencies with which the carbon skeletons of fats, CHO, protein and short-chain fatty acids (SCFA) are converted to ATP. Triglyceride fatty acids and glucose enter the Krebs' cycle as acetyl CoA and pyruvate, respectively, taking advantage of all energy-yielding steps within this metabolic pathway. Amino acids and short-chain fatty acids enter the Krebs' cycle at a variety of points that capture less total energy.

Table 2. Swine DE, ME, NE and young poultry AMEn values for various feed ingredients (kcal/kg, as-fed basis)[2].

	DE	ME	NE	AMEn[2]
Corn	3390	3310	2650	3130
Wheat	3310	3210	2510	2980
Barley	3070	2970	2280	2610
Peas	3320	3160	2320	2430(2690)*
SBM 48%	3520	3210	1940	2230

* 2430 (2690) kcal/kg in mash (pelleted) diets for young birds; 2490 (2750) for adult birds, respectively

[1] http://ir.library.oregonstate.edu/dspace/bitstream/1957/5092/1/SR no. 751_ocr.pdf

[2] Sauvant, D., Perez, J-M., Tran, G., ed. 2003. Tables de composition et de valeur nutritive des materieres premieres destinees aux animaux d'elevage. INRA. Paris, France.

ARE EXISTING NE VALUES ACCURATE FOR WESTERN CANADIAN INGREDIENTS?

Various institutions in Europe (INRA, CVB) and the United States (NRC) have put forward NE values for feedstuffs. These are shown beside values calculated from western Canadian data for DE, CP, EE and starch (Table 3). Differences exist between the various sources of NE values, but are small enough that the energy hierarchy of ingredients is maintained throughout.

Table 3. Comparison of NE values suggested by INRA[2], CVB[3] and NRC[4], and calculated[5] using western Canadian ingredient data (kcal/kg, as-fed basis).

	INRA	CVB	NRC	Calculated
Corn	2650	2540	2395	2590
Wheat	2510	2380	1925	2535
Barley	2280	2260	2340	2210
Peas	2320	2300	2195	2360
SBM 48%	1940	1940	2020	2110

ARE THERE OTHER BENEFITS TO USING THE NE SYSTEM?

DE and ME systems assign significant energy values to high protein ingredients, and therefore tend to have least-cost solutions containing amino acid levels in excess of requirements. In order to prevent this scenario, some nutritionists have described limiting maximum protein inclusion levels in some rations. The NE system should minimize this issue, as there is reduced financial incentive to use protein as an energy source. When less protein is consumed and broken down for energy, ammonia excretion will also be reduced, resulting in enhanced air quality in hog barns and improved environmental sustainability for the surrounding farmlands.

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[3] CVB. Veevoedertabel. CVB, Lelystad, The Netherlands.

[4] NRC. 1998. Nutrient Requirements of Swine, Tenth Revised Edition. Publ. by National Academy Press, Washington, DC.

[5] Noblet, J., Fortune, H., Shi, X.S. and Dubois, S. 1994. Prediction of net energy value of feeds for growing pigs. J. Anim. Sci. 72:344-354. Equation #5: NE=0.700*DE + 1.61*EE + 0.48*Starch - 0.91*CP - 0.87*ADF using data from Thacker, PA and Qiao,S. 2004. Pig News and Information 25: 165N-170N, and reference #4.