

## **EFFICIENCY AND PRODUCTIVITY IN PIG NUTRITION**

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The efficient use of feed ingredients in diets for pigs is an important determinant of the productivity in modern pig production systems. Thus, there is a need to accurately estimate the feeding value of various feed ingredients. Several factors have to be considered for the adequate nutritional evaluation of feedstuffs. These include information (i) on the content of energy yielding nutrients (e.g. starch, sugars, lipids, protein), (ii) the digestibility and post absorptive utilization of nutrients, in particular indispensable amino acids, (iii) the physico-chemical characteristics (e.g. solubility, viscosity) of feedstuffs, but also (iv) potential effects of feed ingredients on pigs' voluntary feed intake and (v) effects of specific feed ingredients on animal product quality (e.g. fatty acid composition) need to be identified. Moreover, so called anti-nutritional factors (ANF's) have been recognized as important factors that may negatively affect efficiency and productivity in pig nutrition. Some of the most important ANF's present in feedstuffs which are frequently used in pig nutrition will be addressed in greater detail in the following.

The EU-wide ban on the use of protein from animal sources in 2001 contributed to an increased demand for plant protein sources in the feeding of livestock. However, most protein-rich feedstuffs of plant origin contain various kinds of ANF's that interfere with the utilization of nutrients, thus limiting their use particularly in the nutrition of non-ruminant animals such as pigs and poultry. As a result, depressions in growth performance and animal health due to a variety of mechanisms including reducing protein digestibility, binding to various nutrients or damaging the intestinal wall, thereby lowering digestive efficiency, were observed. Major ANF's that interfere with nutrient digestion and absorption in non-ruminants include protease inhibitors, lectins, tannins, alkaloids, pyrimidine glycosides,  $\alpha$ -galactosides, glucosinolates, and sinapins. The type and content of these ANFs may vary considerably among different feedstuffs, moreover, many feedstuffs contain several ANFs, and the amount of ANFs may vary both between and within varieties, due to differences in plant's growing conditions and genetics. Protease inhibitors and lectins are most significant for legume seeds (soybeans, peas, faba beans, lupins), tannins are present in

rapeseed, faba beans and peas, whereas glucosinolates and sinapins dominate in rapeseed. Finally, alkaloids and  $\alpha$ -galactosides are important in lupins, and pyrimidine glycosides can generally be found in faba beans. However, due to significant progress in plant breeding, grain legume and oilseed cultivars with negligible low contents of ANF's are commercially available. Moreover, the application of refined processing technologies designed to reduce the content of ANF's in feedstuffs has proven to be an efficient tool. In particular, the use of hydrothermal treatment procedures during feed processing substantially reduces the activity of several heat-labile ANFs such as lectins and protease inhibitors but contents of tannins and glucosinolates are diminished as well.

**Keywords:** Pigs, nutrients, anti-nutritional factors, efficiency.

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