

Regaining Competitiveness: Alternative Feedstuffs for Swine

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■ Introduction

Research to reduce feed costs or, better yet, enhance the competitiveness of the pork industry, can be approached from a variety of angles. For example, feed quality evaluation to better match nutrient supply to nutrient requirements may provide solutions in the mid-term. Long-term, crop breeding may increase grain supply or quality. Short-term, however, the most effective solution is to expand the use of alternative feedstuffs in swine diets.

Although feed grain prices have dropped since their records levels of last year, large opportunities exist to develop more cost-effective feeding programs using alternative feedstuffs. To regain competitiveness, the western Canadian pork industry must implement aggressive strategies to use other feedstuff combinations than have been used for the last decade. A key to managing the risk of using alternative feedstuffs to maintain growth performance is feed formulation using modern evaluation systems: net energy (NE) and standardized ileal digestible (SID) amino acids. A strategy to include multiple alternative feedstuffs will likely be most effective.

This paper summarizes recent research findings to use alternative feedstuffs in swine diets.

■ Alternative Feedstuffs in Nursery Diets

The two main feedstuffs of a nursery diets are the cereal grain, regularly wheat, and the protein (amino acid) source, regularly soybean meal. Wheat can be replaced successfully in nursery diets with cereals such as triticale

(**Table 1**). Soybean meal can be successfully replaced with ground legume seeds such as zero-tannin faba bean (Omogbenigun et al., 2006). Protein feedstuffs tend to be more expensive feedstuffs, and hence opportunities exist to include specialty protein sources such as faba bean and field pea protein concentrates into nursery diets (Gunawardena et al., 2008b).

Table 1. Growth performance of weaned pigs fed either wheat or triticale¹

Variable	Wheat	Spring triticale	Winter triticale	SEM	Wheat vs.	Wheat vs.
					spring triticale	winter triticale
ADFI, g/d	814	786	785	21.8	0.187	0.102
ADG, g/d	541	537	545	13.1	0.920	0.924
G:F	0.67	0.69	0.70	0.01	0.001	0.001

¹Adapted from Beltranena et al. (2008).

From a dietary component perspective, energy is most expensive. Crude glycerol, a by-product from the bio-diesel industry may provide opportunities as a replacement of 4 to 8% cereal grain (**Table 2**), provided approval by regulatory bodies. Legume starch tends to be digested less well by young pigs. Starch concentrates, a co-product of fractionated legume seeds, can however be extruded and thereby become an attractive feedstuff for young pigs (Wierenga et al., 2008). In all reported studies, diets within each growth performance study were formulated to equal NE and SID amino acid content.

Table 2. Growth performance of weaned pigs fed diets containing 0, 4, or 8% crude glycerol¹

Variable	Crude glycerol (%)			Pooled SEM	P value	
	0	4	8		Linear	Quadratic
ADG, g/d	516	541	556	0.01	0.066	0.772
ADFI, g/d	719	784	754	0.02	0.162	0.037
G:F	729	715	760	0.02	0.193	0.166

¹Adapted from Zijlstra et al. (2008b).

Apart from using modern feed evaluation and formulation systems, the risk of including high-fibre feedstuffs in nursery diets can also be managed partially by including fibre-degrading enzymes into the diet. Apart from reducing nutrient digestibility, fibre may also reduce voluntary feed intake of pigs

(Nyachoti et al., 2004). Ameliorating these effects should provide a direct stimulus for energy intake and thus growth.

■ Alternative Feedstuffs in Grower-Finisher Pigs Diets

Alternative feedstuffs continue to be increasingly available for inclusion into swine diets. A description of digestible nutrient profile and subsequent validation of growth performance are required to ensure that growth performance can be maintained and that feed costs are competitive.

Nutrient Profile

The first critical step to introducing new feedstuffs into diets for grower-finisher pigs is the characterization of their digestible nutrient profile, preferably including a NE and SID amino acid content. Crops for production in Western Canada such as zero-tannin faba bean continue to be developed and require assessment of nutrient profile (Zijlstra et al., 2008a). Crops that independently are difficult to process into feed, such as flax seed, can be combined with other crops such as field pea and co-extruded prior to mixing into swine diets. Co-extrusion may also enhance digestible nutrient profile (Htoo et al., 2008) especially for nursery and grower pigs with a reduced appetite.

New feedstuffs have become available via the development of the biofuel sector. Distiller's dried grains plus solubles (DDGS) has become a commodity feedstuff in just a few years. Numerous trials have been conducted describing corn DDGS, but wheat-based DDGS is also being used in the swine industry. Wheat DDGS is higher in fibre and lower in fat than corn DDGS (Widyaratne et al., 2007) and the digestible nutrient profile of wheat DDGS is therefore lower than corn DDGS (Widyaratne and Zijlstra, 2008). Expeller-press canola meal has a more attractive digestible nutrient profile than regular solvent-extracted canola meal (Seneviratne et al., 2009). Variability of digestible nutrient profile is a main concern with co-products from the biofuel industry (Zijlstra and Beltranena, 2008).

The local flour industry offers possibilities to obtain co-products such as millrun. These feedstuffs are high in fibre; fibre-degrading enzymes offer potential to uplift digestible nutrient profile (Nortey et al., 2007, 2008). Enzyme effects might however not be as consistent for high-fibre feedstuffs that have undergone fermentation and drying processes (Widyaratne et al., 2008).

Up-front fractionation of legume seeds allows for partial separation of protein and starch fractions. For example, field pea and faba bean can be air classified fast and economically thereby achieving a nutrient digestibility as high as soy protein concentrate and corn starch, respectively (Gunawardena

et al., 2008a). As such, an additional market for legume seed has been provided, and an alternative, cost-competitive local feedstuff has been created.

Validation

To convince the industry to adopt a new feedstuff, feed formulation, or feed processing techniques, validation is required to establish if performance and carcass quality can be maintained or achieve specific targets. Trials at commercial facilities containing 20 or more pigs per pen provide the best evidence if inclusion of alternative feedstuffs provide economic advantages.

For validation studies, feeds have traditionally been rarely formulated using NE and SID amino acid content. The effects of including an individual alternative feedstuff have been tested, generally resulting in limited differences in growth performance, or a curvilinear pattern at inclusions above 10 to 20%. Some specific examples include field pea or faba bean can replace soybean meal entirely in diets for grower-finisher pigs (Gunawardena et al., 2007). Also, inclusion of expeller-press canola meal quadratically reduced gain and feed intake (Table 3).

Table 3. Growth performance of grower-finisher pigs fed diets containing 0, 7.5, or 15% expeller-pressed canola meal¹

Variable	Expeller-pressed canola meal, %				SEM	P value	
	0	7.5	15	22.5/18		Linear	Quadratic
ADG, kg/d	0.976	0.959	0.920	0.912	0.01	0.01	0.01
ADFI, kg/d	2.571	2.509	2.380	2.343	0.02	0.01	0.01
G:F	0.366	0.369	0.373	0.378	0.01	0.14	0.03

¹Adapted from Seneviratne et al. (2009).

The inclusion of individual alternative feedstuffs, however, is not the most interesting approach to reduce feed cost; the inclusion of multiple feedstuffs is.

Using such an approach, the content of cereal grain in the diets was reduced from 82 to 43% in, for example, the third phase, whereas co-product inclusion increased concurrently. Even though growth performance was reduced using increasing levels of co-product (Table 4), the economic performance of pigs fed high levels of co-products in the diet was superior. These combined data indicate that simply looking into maintaining growth performance may not results in the most competitive swine production system.

Table 4. Growth and economic performance of grower-finisher pigs fed diets containing low, medium, and high levels of co-products¹

Variable	Co-product level			SEM	P value
	Low	Medium	High		
ADG, kg/d	1.00 ^a	0.93 ^b	0.92 ^b	0.01	0.01
ADFI, kg/d	2.87 ^a	2.71 ^b	2.66 ^b	0.04	0.01
G:F	0.35	0.34	0.35	0.03	0.52
Feed cost, \$/kg gain	0.842 ^a	0.788 ^b	0.747 ^c	0.01	0.01
Income over feed, \$/pig	39.5 ^a	39.9 ^a	42.4 ^b	0.97	0.01

¹Adapted from Zijlstra et al. (2009).

■ Conclusions

The pork industry in western Canada remains under severe competitive pressure, in part due to high feed costs. The current situation dictates that the risk of using increasing amounts of alternative feedstuffs, if available, should be taken. These risks, however, should be managed properly. Even though western Canadian nutritionists have generally worked with more complex feeds than colleagues in the US, the use of even more complex feeds globally attest that further reductions in feed costs can be achieved.

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