Recent advances in canola meal utilisation **in swine nutrition**

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Canola meal (CM) can be used as a cost-effective protein substitute for other protein sources such as soya bean meal (SBM) in pig diets. Depending on its relative nutritive value and cost, it is economical to replace soya bean meal partially or fully with CM. The literature contains enough evidence that CM has been used for more than forty years in swine diets.

Starter pig diets

It appears that the majority of the studies on CM use in starter pig diets were mainly focused on growth performance. In the past, it was suggested that complete or partial replacement of soya bean meal with CM had negative effects on pig performance. It was also documented that increasing inclusion of CM linearly reduced average daily gain (ADG) and average daily feed intake (ADFI) in weaned pigs.

In a preference trial, weaned pigs were offered a choice between a SBM based control diet and CM at 5-20% inclusion level. Results indicated that pigs preferred to eat the SBM based control diet more than any of the diets containing CM. There was also a significant reduction in the amount of feed consumed when the CM inclusion level was increased from 5 to 20%.

The possible reason for the low intake of a diet containing CM by starter pigs may be the influence of glucosinolate (GSL) break-down products on thyroid function and the reduced palatability due to the presence of GSL and their break-down products.

Recent findings, however, are contrary to the results of past research. For instance,



Canola meal offers an alternative in swine diets as it is a cost-effective protein source. (Photograph: www.animalsciencepublications.org)

a recent study reported that either solvent-extracted canola meal (SECM) or expeller-pressed canola meal (EPCM) at 150g/kg inclusion level combined with crude glycerol can partially replace SBM and wheat in weaned pig diets.

Growth performance

In a study by Landero, 0, 50, 100, 150 and 200g SECM/kg, in replacement for SBM, was fed to weaned pigs. It was found that from 0 to 28 days on trial, increasing inclusion of SECM up to 20% did not affect body weight gain, feed intake and feed efficiency, although increasing inclusion of CM reduced linearly the apparent total tract digestibility (ATTD) of energy, dry matter (DM), crude protein (CP) and quadratically the dietary energy (DE) content of the diets.

Landero *et al.* conducted another experiment to determine the effect of feeding increasing levels of EPCM up to 200g/kg diet to weaned pigs. They found no significant differences in growth performance although there were linear reductions in ATTD of DM, energy and CP.

In a more recent study, Sanjayan *et al.* demonstrated that SECM from *B. napus* black and *B. juncea* yellow can be included in the weaned pig diets at up to 25% without adverse effect on the growth performance (*Table 1*). In another study, Mejicanos evaluated high levels of inclusion of parent and dehulled *B. napus* and *B. juncea* CM replacing SBM at 15% level and found increased growth performance when using Fine 2 dehulled CM.

There were two possible explanations proposed for the improved performance of weaned pigs at high CM inclusion. Firstly, diets in the past were formulated mainly

Table 1: Effect of dietary canola meal inclusion and canola meal type on nursery pig performance[a].

Item	Control	*B. juncea* yellow		*B. napus* black	
	0%	20%	25%	20%	25%
ADG, g/d	400	385	390	395	391
ADFI, g/d	617	607	620	622	618
G:F	0,63	0,64	0,63	0,64	0,63

[a]Piglets were fed canola meal containing diets in two phases for 28 days.

based on CP and DE and not on standard ileal digestible amino acids (SID AA) or NE.

Zijlstra and Payne suggested that formulating diets with byproducts as alternative feedstuffs would minimise the risk associated with reductions in growth performance if the NE and SID AA systems were used. The second reason is that recent cultivars of CM have comparatively low amounts of GSL compared to old cultivars.

Grower, finisher pig diets

Previous studies reported that CM can be used to replace only up to 50% of the supplemental protein from SBM in grower pigs. However, replacement of 75% or complete replacement of SBM by CM significantly reduced the growth performance. Sauer *et al.* indicated that lower DE and lysine contents in CM compared to SBM and the effect of GSL on feed intake and metabolic process might be the possible reasons for the low performance in grower pigs.

Thacker suggested that good performance could be achieved in grower pigs if CM supplies only one half of the supplementary protein in the diet. In a review on CM, Schöne *et al.* suggested that growing pigs can tolerate a maximum level of 2µmol/g of GSL in the diet. But the total GSL content of Canadian CM is around 7,2µmol/g, which implies a maximum level of 33% CM in a growing pig diet.

Studies to determine the digestibility of nutrients of CM have been conducted. For instance, Bell *et al.* (1998) reported that *B. napus* black and *B. juncea* yellow had similar digestible protein and energy in finisher pigs. An experiment using toasted and non-toasted black and yellow seeded *B. napus* and yellow *B. juncea* in grower pigs suggested that DE and NE content of *B. napus* yellow seeded is higher than that of conventional *B. napus* black and *B. juncea*.



The Canadian National Research Council indicates NE value for SECM from black *B. napus* to be NE for yellow seeded *B. napus* averaged 2 102kcal/kg, while values for yellow *B. juncea* averaged 2 340kcal/kg. The SID AA of SECM and EPCM in grower pigs has been reported by several studies. In the mentioned studies, EPCM had greater digestible AA compared to SECM.

Carcass characteristics

Previous studies also indicated that CM can be included in pig diets without affecting growth performance and carcass characteristics of the finisher pigs. A performance study was conducted in grower pigs with a decreasing amount of expeller extracted CM (22,5%, 15%, 7,5% and 0%) to validate the performance and carcass characteristics.

Increasing the inclusion level of expeller extracted CM did not affect carcass characteristics, such as back fat thickness, loin depth, jowl fat and fatty acid profile; ADG, however, was reduced by 3g/day per 1% inclusion of EPCM. Zanotto *et al.* fed 20%, 40%, 60% and 80% of CM in replacement of soya bean meal to growing finishing pigs and found a quadratic treatment effect on the weight gain.

These authors found that a substitution level of 40% soya bean meal yields a high weight gain and a heavier carcass, although it had greater back fat depth. Busboom *et al.* found that canola feeding not only increased the proportion of unsaturated fatty acid in adipose tissue and muscle tissue, but it also did not affect the carcass characteristics.



Studies have shown that average sow performance and piglet weight were not affected by different levels of canola meal in the rations given during the research.

Sow diets

Spratt and Leeson evaluated the effects of inclusion of raw, ground, full fat canola on sow milk composition and piglet growth using *B. napus* (cultivar Tower) at levels from 5 to 25% commencing on 109 days of gestation and continuing until 21 days postpartum. They found that sow performance was not affected using 5 and 10% canola seed level, but at 15% a decrease in daily weight gain was observed, resulting in the loss of weight

on sows from 7-21 days postpartum; milk was not affected.

More recently, King *et al.* evaluated the effect of diets containing up to 20% of SECM on sow performance. Results indicated that average sow performance and piglet weight were not affected by the different levels of CM in the diets.

In another study, Clowes *et al.* evaluated phase-feeding protein to gestating sows over three parities. The study used CM at a rate of up to 8,1% and did not find an effect on maternal growth, piglet birth weight, litter growth in lactation, wean-to-breeding interval or subsequent litter size.

Quiniou *et al.* studied the effects of feeding 10% of low-glucosinolate rapeseed meal (*B. napus*) during gestation and lactation, over three reproductive cycles, on the performance of hyper-prolific sows and their litters and found no differences when compared to diets containing no rapeseed meal. In their study, sows farrowed 43,6 and 43,8 piglets over three reproductive cycles, respectively.

Determination of SID AA of new cultivars of canola is very important in order to formulate the diet efficiently, thereby helping to achieve predictable growth performance in pigs.

Piglet weight at birth or weaning survival and litter weight gain were not affected by dietary inclusion of CM. Plasma thyroxin levels of sows and piglets indicated that thyroid function was not altered by inclusion of canola of less than 2µol/g of GSL. The use of diets containing 10% of CM on gestation and lactation of hyper-prolific sows over three parities did not affect sow longevity and reproductive and litter performance.

Conclusion

CM offers an alternative in swine diet as it is a cost-effective protein source. This literature review provides information about the nutritive value of CM and recent techniques (i.e. development of new canola cultivars, dehulling of CM, and supplementation of feed enzymes and fermentation) that have been used to improve the nutritive value of CM and overcome the limitations encountered by the swine industry and its use as feedstuff.

Determination of SID AA of new cultivars of canola is very important in order to formulate the diet efficiently, thereby helping to achieve predictable growth performance in pigs. Furthermore, enzyme supplementation to cereal based diets has yielded inconsistent results.

References available from the authors.

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