Feeding value of red clover-grass, Persian clover and common vetch for pigs

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Implications

Red clover-grass, Persian clover, and common fetch that are generally grown for green manuring in organic cropping cycles, are also valuable forages for the feeding of pigs. They could substitute up to 30% of concentrates (on dry matter basis) in the feeding of growing pigs without negative impact on nitrogen (N) retention. This indicates that protein and amino acids of these legumes are well digested and utilised by the pigs. However, inclusion of roughage to pig diets shifts N utilisation so that N excretion to faeces is increased while N excretion to urine is decreased. Persian clover, in particular, is an intriguing roughage for pigs as its protein contains more amino acids that that of red clover-grass or common vetch. In addition, the digestibility of fibre is good in Persian clover, due to lower cellulose and lignin content in the fibre fraction. In practice, the voluntary feed intake of roughages remains lower, from 5% to 20% of pigs' dry matter intake depending on the production phase.

Background and objectives

Grass and legume forages are considered excellent rooting and enrichment material for pigs, but they can also contribute to the energy and amino acid supply of pigs (Carlson et al. 1999, Reverter et al. 1999). In organic cropping rotation, annual legumes such as Persian clover and vetches are grown for green manuring and fodder and pasture for ruminants (Stoddard et al. 2009). They could be suitable feedstuffs for organic pig production too, but there is a lack of information about their feeding value for pigs. Therefore, our aim was to study the nutrient composition and digestibility of red clover/grass, Persian clover or common vetch, and protein utilisation by N balance in growing pigs fed diets with 15% or 30% of these forages on dry matter (DM) basis.

Key results and discussion

Red clover-grass, Persian clover and common vetch contained crude protein (CP) 187, 196 and 196 g/kg DM, respectively. Their protein contained lysine 4.0, 5.1 and 4.8 g, threonine 3.9, 4.0, and 3.7 g, and methionine 1,5, 1.6 and 1.3 g per 100 g CP, respectively. When the basal diet was replaced with roughages, the total intake of essential amino acids did not change much (e.g. lysine intake 15.3 vs. 14.7 – 15.8 g/d, threonine 11.3 vs. 11.1-12.0 g/d, and methionine 4.3 vs. 4.2 – 4.6 g/d). Faecal digestibility of energy was the highest in Persian clover, 63.7%, followed by red clover/grass (49.1%) and common vetch (42.6%). In particular, the digestibility of crude protein and fibre in the whole digestive tract were higher in Persian clover than in red clover/grass and common vetch. The fibre of Persian clover contained less cellulose and lignin compared to red clover-grass and common vetch.

Inclusion of roughage to pig diets shifted N balance so that faecal N excretion was increased while opposite was seen in urinary N excretion (Table 1). However, the proportion of ingested N that was retained by pigs growing on average 790 g/d did not differ between the treatments. Similarly, Tywonczuk et al. (1997a) reported that supplementing a cereal-soybean meal diet for finishing pigs with up to 15% of Persian clover meal decreased the metabolizable energy value of the diet but had no adverse effects on N balance or nutrient digestibility. In order to maintain weight gain and feed conversion efficiency, the maximum recommended level was 10% (Tywonczuk et al. 1997b). According to Kaliszewicz et al. (1992), fresh or ensiled Persian clover can replace

part of soybean meal in the diet of growing-finishing pigs, but can reduce growth performance. The optimal cutting stage is between the budding stage and start of flowering, when OM digestibility is the highest.

Table 1. Nitrogen balance of pigs fed diets with red 15% or 30% of clover/grass (RCG), Persian clover (PC) or common vetch (CV) on dry matter basis.

	N intake g/d	N in faeces g/d	N in urine g/d	N retained g/d	Retained % of intake
Basal diet	48.8^{bc}	9.9^{a}	14.8^{c}	24.1^{ab}	49.6
RCG 15%	48.4^{ab}	12.5^{bc}	12.4^{ab}	23.5^{ab}	48.8
RCG 30%	47.3^{a}	14.0^{c}	11.0^{a}	22.3^{a}	47.2
PC 15%	49.6^{bc}	12.3^{bc}	12.4^{ab}	24.9^{b}	50.2
PC 30%	50.3^{c}	13.6^{c}	11.6^{ab}	25.2^{b}	50.4
CV 15%	49.2^{bc}	11.6^{ab}	13.0^{bc}	24.6^{b}	50.3
CV 30%	49.5^{bc}	13.6^{c}	12.4^{ab}	23.5^{ab}	47.9
SEM	0.46	0.43	0.42	0.46	0.84

How work was carried out?

Roughages were grown in Jokioinen, Finland and harvested with silage chopper: common vetch (*Vicia sativa* var. Ebena) on August 14th, red clover-grass (second cut, 46% red clover, 46 % grass species and 8% weeds of fresh mass) on August 16th, and Persian clover (*Trifolium resupinatum* var. Accadia) on August 28th. Clovers were in early bloom and vetch in late bloom. The roughages were stored frozen until fed to pigs. The basal diet (CP 178 g/kg DM) consisted of barley, peas, rapeseed cake and mineral-vitamin premix. It was fed as such or replaced with 15% or 30% (dry matter basis) roughages which were mixed with the basal diet in a cutter before being fed to the pigs (85 g dry matter/kg weight$^{0.75}$/d). The study was carried out in a 7 x 5 cyclic change over design. Seven pigs were fed the experimental diets in five 16-day periods (2 d for transition, 10 d for adaptation, and 4 d for total collection of faeces and urine) between 32 and 95 kg body weight. Diets, faeces and urine were analysed by standard methods (AOAC 1990), and digestibility coefficients were calculated by regression method.

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