Grass silage in diets for organic growing-finishing pigs

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Abstract

In this study, organically raised pigs received an increasing proportion of grass silage up to 10 and 20% dry matter in the daily ration in the grower and finisher period, respectively, to determine the effects of grass silage on feed intake and growth performance. The pigs receiving a mixture of grass silage and compound feed ingested 0.3 kg DM/d (13% of their daily ration) as grass silage and realised a similar daily net energy intake as pigs fed compound feed only. However, the silage fed pigs realised a lower daily gain (37 g/d) and a lower calculated net energy utilisation (1.6 MJ/kg) for gain and a lower dressing percentage (1.1%) of the carcass. The optimal feeding system and the nutritive value of grass silage for growing pigs requires further investigation to improve the silage intake and clarify and minimise the loss in animal performance.

Introduction

In organic pigs farms in the EU, roughage must be added to the daily ration (Commission Regulation 889/2008). Inclusion of early harvested grass silage in the diet of growing finishing pigs may reduce the need for import of protein rich feed ingredients and contribute to the closure of regional nutrient cycles. However, information on the nutritive value of grass silage, the potential inclusion level in the diet and consequences for growth performance is scarce. Growing pigs with free access to both compound feed and silage, showed a high preference for compound feed and have a low silage intake (Van der Peet et al., 2006). Studies in sows suggest that silage intake is improved when cut at an early stage of maturity and ensiled with a relatively low dry matter (DM) content (Van der Peet-Schwering et al., 2010). Thus the present study was conducted to determine the effect of early harvested grass silage in a completely mixed ration, on performance and nutrient utilisation of growing pigs.

Material and methods

Animals, housing and design

This study has been conducted at the Research Farm for organic pig production in Raalte, the Netherlands from July 2011 to January 2012. The experiment comprised two dietary treatments:

1) control, pigs fed compound feed only

2) silage, pigs fed a mixture of compound feed and grass silage.

Each treatment comprised 8 pens with 16 pigs each, females and castrates mixed, in total 256 pigs (Pietrain x (Dutch Landrace x GY)) from 26 to 119 kg body weight. At a mean age of 11 weeks and a mean body weight of 26 kg, the pigs were blocked on the basis of offspring litter, gender, age and body weight and allocated to the two treatments. The pigs were housed in two naturally ventilated rooms with 8 pens each. Pen dimensions were 4.4 x 4.7 m of which 4.4 x 1.6 m was concrete slatted floor. Straw was used as bedding material in the closed area. In addition, each pen was connected to an outdoor area of 4.7 x 3.2 m, half of which had concrete slatted floors.

Diets and feeding

The aim of this experiment was to include grass silage in the daily ration of growing finishing pigs without substantial loss in performance. A completely mixed ration was used to avoid selection of compound feed. The proportion of grass silage was gradually increased in order to minimise selection and feed refusals. The pigs of each treatment received a similar amount of calculated net energy (NE) on the basis of a generous feeding scheme to allow (near) maximum feed intake. The compound feed and the mixture of compound feed and grass silage were supplied in a dry feeder with three eating places per pen. Water was freely available from nipple drinkers. Pigs of the control group received a grower diet (9.7 MJ NE, 8.8 g apparent ileal digestible (AID) lysine/kg) during the first 4 or 5 weeks, depending on the initial BW of the pigs per block, and a finisher diet (9.3 MJ NE, 7.0 g AID lysine/kg). The pigs in the grass silage group received a

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similar daily amount of calculated net energy from a mixture of these compound feeds and grass silage. The proportion of grass silage gradually increased from 0 to 10% on DM basis in the grower phase and from 12 to 20% DM in the finisher phase.

Grass silage was harvested from 4.6 ha of organic pasture, first cut on May 11, 2011 at an estimated yield of 3 tonnes of DM per ha and ensiled on the same day in large (350 kg) plastic covered bales. Six weeks later samples were taken from a representative number of bales and proximate composition was determined. The grass silage contained 32% DM, 192 g crude protein (CP) and 205 g crude fibre per kg. Based on digestibility studies with grass silage in sow diets (Van der Peet-Schwering et al., 2010) we estimated the NE value at 7.9 MJ/kg DM. Prior to feeding, the grass silage was cut in a mixer feeder wagon, weighed, mixed with concentrate and supplied to the pigs in a dry feeder in each pen. The daily feed allowance was supplied in 3-4 servings because of the large volume of the grass silage mixture. Each morning only a small amount of grass silage was left over in the trough.

Management and observations

Feed allowance and feed refusals were registered on a daily basis. The pigs were weighed at start of the experiment, at change-over from grower to finisher diets, four and eight weeks later and prior to slaughter. The animals were routinely controlled for any health disturbances and required medical treatments and death of animals was registered. The pigs were slaughtered at a minimum target carcass weight of 86 kg, as required to obtain a premium price for organic pigs. Pigs in each pen were slaughtered in two or three batches. Data of live weight and body gain of individual pigs were used to determine the optimal slaughter date. At slaughter, carcass weight was registered, dressing percentage was calculated from body weight prior to slaughter and carcass weight, and muscle and backfat thickness and lean meat percentage were determined using the HGP-method.

Statistical analysis

Feed intake, growth performance and carcass data were analysed with ANOVA for a randomised block design with pen as experimental unit, using Genstat statistical software. $P<0.05$ was regarded as significant.

Results

In the control treatment one pig died during the experiment and one pig was removed because of tail biting. Two pigs in the control group and one pig in the silage group were qualified as outliers with extremely poor growth and removed from the dataset. A summary of results for pig performance and carcass characteristics is presented in Table 1. The maximum inclusion of 10 and 20% grass silage was realised in week 4 of the grower period and week 3 of the finisher period, respectively (data not shown). Due to the gradual increase in the proportion of silage, and due to leftovers of grass silage, the mean ingested proportion of grass silage was 6 and 15% from the grower and finisher ration, respectively. Overall, the silage intake was 0.3 kg dry matter/day, being 13% of DM and 10% of NE of the daily ration.

The pigs were fed according to a feeding scheme. The reduction in compound feed intake was similar to the calculated energy intake from grass silage, corrected for leftovers. Despite a similar energy intake of 23 MJ NE per day, the daily gain was substantially lower (37 g/d, $P=0.002$) and the energy usage per kg of body gain substantially higher (1.6 MJ NE/kg body gain, $P=0.02$) in silage fed pigs. The carcass weight and dressing percentage of the silage fed pigs was significantly lower whereas the lean meat percentage, corrected for carcass weight, was similar for the two treatment groups. Daily gain corrected for dressing percentage was 50 g/d lower ($P<0.001$) in silage fed pigs. Several reasons may have contributed to this reduction in feed utilisation. The actual intake of feed, especially silage may have been lower than calculated because of feed spillage. Indeed some grass silage was observed in de bedding material of the pen. Furthermore, the digestibility and net energy content of the grass silage may have been lower than 7.9 MJ/kg dry matter as calculated on the basis of proximate composition and previous digestibility studies in sows. Digestibility of fibrous ingredients may be higher in sows than in growing pigs (Shi and Noblet,1993). A digestibility study in growing pigs should further clarify this aspect. It seems unlikely that the amino acid supply was limiting in the grass silage diet since the muscle thickness and lean meat content were not reduced in silage fed pigs. Finally, pigs receiving the grass silage may have used more energy for maintenance processes, In our facilities with three eating places per pen of 16 pigs, observations of farm staff indicate that inclusion of grass silage increased time required for eating and competition at the feeder. In addition, the increased visceral mass due to ingestion of fibrous feed, as indicate by the lower dressing percentage, may have increased the energy expenditure of the metabolic organs (Jørgensen et al., 1996). A

further reduction of the particle size of the grass silage may improve digestion and reduce spillage of the feed material. Further studies are required and planned to elaborate these aspects.

Table 1: Effect of supply of grass silage in a completely mixed ration on growth performance and carcass characteristics in organically raised growing finishing pigs.

	Control	Grass silage	SEM[1]	P-value
Number of pigs	124	127		
Number of pens	8	8		
Initial body weight (kg)	26.1	26.1	0.02	0.69
Final body weight (kg)	119.4	118.7	0.57	0.38
Variation in final body weight (kg)	5.8	4.6	0.38	0.06
Days to slaughter	104.1	107.8	-	-
Feed intake				
Compound feed (kg/d)	2.44	2.24	0.026	<0.001
Grass silage (kg DM/d)	-	0.29	-	-
Proportion of silage (DM-basis)	-	12.8%	-	-
Compound feed (MJ NE/d)	22.9	20.9	0.26	0.001
Grass silage (MJ NE/d)	-	2.3	-	-
Complete ration (MJ NE/d)	22.9	23.2	0.27	0.34
Daily gain (g/d)	897	860	5.3	0.002
Corrected daily gain (g/d)[2]	890	841	4.9	<0.001
Feed conversion (MJ NE/kg)	25.5	27.1	0.40	0.02
Corrected feed conversion (MJ NE/kg)[2]	25.7	27.6	0.38	0.007
Carcass characteristics				
Carcass weight (kg)	93.1	91.2	0.40	0.01
Dressing percentage	78.0	76.9	0.28	0.03
Lean meat (%)[3,4]	56.7	57.2	0.27	0.26
Muscle thickness (mm)[3,4]	61.0	61.1	0.93	0.96
Back fat thickness (mm)[3,4]	16.5	15.9	0.24	0.12

[1] SEM, pooled standard error of the mean
[2] Corrected for differences in dressing percentage, i.e. based on carcass gain
[3] Determined with the Hennessy Grading Probe (HGP) between the 3rd and 4th rib
[4] Analysed using carcass weight as covariate in the statistical model

Discussion

Grass silage in the ration of growing pigs may increase the use of locally produced feed materials. We used a completely mixed ration to avoid selection of compound feed. The realised silage intake in the grower period may be too low in relation to costs of labour and equipment for feeding grass silage. In late finisher pigs a higher proportion of grass silage can be included in the ration since leftovers were small and the realised portion of ingested grass silage was close to 20%. Further increase in the proportion of grass silage may be possible provided that the feeding system allows adequate time and space for feed consumption. Our feeding system with dry feeders limited the silage intake; the optimal feeding system requires further attention. In addition, daily gain, energy utilisation for gain and dressing percentage were lower in silage fed pigs. Thus, the nutritive value of grass silage for growing pigs requires further investigation to clarify and minimise the loss in animal performance. A reduction of the particle size by chopping the grass may improve digestion and reduce spillage of the feed material.

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