Technical Note 4

ICOPP

Improved Contribution of Local Feed to Support 100% Organic Feed Supply to Pigs and Poultry

Fulfilling 100% organic pig diets: Feeding roughage and foraging from the range

Introduction

The derogation from the EU Organic Regulatory Board to allow organic pig and poultry producers to include up to 5% non-organic feed within their rations was due to finish at the end of December 2014. This has now been extended to 31 December 2017 when it will become compulsory under EU Regulation (EC) no 889/2008 to provide all organic livestock with feed derived from 100% organic origins. The Regulation also requires pigs on organic farms to have access to materials they can manipulate to satisfy their behavioural need to forage and to displace abnormal aggressive behaviours such as tail biting. This guide discusses the role roughage can play in addressing the nutritional and foraging needs of pigs in organic systems. See ICOPP Technical Note 3 for information on alternative concentrates.

Benefits of roughage and foraging

Forage can make a valuable contribution to nutrition at all stages of pig development, offering a source of minerals and vitamins, enhancing feed intake, supporting gut health and reducing nutrient losses.

Accounting for 50%-60% of total production costs, prices of supplementary feed often fluctuate creating financial control issues for producers. Forage-based systems should benefit organic farmers economically by reducing overall feed costs.

Over-reliance on the input of high amounts of supplementary feed (containing cereals and oilseeds) can also result in high nutrient losses for outdoor organic pig systems, with only 30% of feed input retained in pigs until slaughter, potentially resulting in environmental pollution as surplus nutrients are excreted.

Herbage can meet 50% of the maintenance energy requirement of dry sows. Studies indicate that forage intake increases if pigs are restricted in energy and protein from supplemental feed. Levels of forage intake in outdoor areas have been found to range between 201 – 550g/pig/day depending on restriction level, pig weight and season.

However, fresh forages are low in dry matter which means that the pig must consume more material to get the same nutrient value as they would from a similar weight of supplemented feed (with a higher dry matter content). For this reason, the use of pastures and forages to contribute to the diet of younger piglets and lactating sows is limited – they need a higher concentration of nutrition at these stages of development.

Another drawback to using forages, especially pastures, is that they may not be available during the entire year. This means that the feeding program may have to be modified from one season to the next. Pigs should be rotated off pastures periodically to prevent heavy bacterial and parasite contamination.

Potential forage crops for pigs

Organic farming systems depend on the continuous fixation of atmospheric nitrogen (N_2) to maintain or increase soil nitrogen (N) reserves. The use of perennial legumes (e.g. white/red clover, lucerne) creates a valuable fertility building phase in a rotation. These crops have a high crude protein content offering a productive source of forage feed for the livestock.

Lucerne (alfalfa)

Lucerne is a versatile forage crop as it can provide valuable nutrients for pigs both as pasture and as silage. Lucerne contains between 15.4 and 24% crude protein and 1.15% and 0.27% lysine and methionine respectively (DM basis). The yield potential of lucerne is high, ranging from 10–14 t/ha annually and persisting for three years.

Recent trials (Jakobsen, 2014) conducted on growing piglets that were grazed on lucerne supplemented with a low protein concentrate feed (10.7% crude protein and 0.44% lysine per kg DM respectively) showed that, while not able to fully compensate for the low protein content of the concentrate feed, foraging lucerne contributed considerably to the supply of energy and nutrients.

In the trials, lucerne accounted for 20% of total DM intake (2,600g fresh weight ~ 470g DM), 14% of total energy intake, 41% of total crude protein intake and 48% of the total lysine intake. Piglets grazing lucerne used 169g less supplementary crude protein feed and were able to maintain an average daily weight gain of 741g with a feed conversion ratio of 2.95. The results indicate that organic pigs who graze on lucerne receive an important contribution to their protein supply.

Grazing pigs should regularly get access to new land by means of strip-grazing as constant access to good forage is necessary to maintain productivity and minimise crop damage to rooting. If the lucerne is well-established (>2 years old) and of high nutritional value the pigs clearly prefer to graze instead of rooting. This leaves the surface of the soil relatively undisturbed.

Lucerne can be grown on a range of free draining soil types (chalk, clay loams to limestone) but waterlogging will kill the plant. Sowing should take place in warm soils in late spring. As the crop's establishment is light in the first year it is recommended to subsequently sow a companion grass (e.g. timothy or meadow fescue). This will provide a thicker sward for weed control which can be problematic in organic farming systems.

Lucerne silage also has potential to provide an excellent herbage component in pig rations.

Grass/white clover

Grass/clover swards are the cornerstone of the fertility-building phase of organic farming systems. Grass/clover contains 20-24% crude protein and has a lysine and methionine content of 0.99 and 0.30% respectively (on a DM basis). Grass/clover can provide sows with between 40-65% of energy requirements and 50-60% of maintenance requirements.

Mowat et al. (2001) reported a low intake from direct foraging of clover grass for pigs (50 - 60 kg) fed ad lib. with concentrate so restricting supplementary feed may be required to encourage foraging.

Red clover

Red clover is an easy to establish perennial legume that will grow on soils too acidic or too wet for lucerne. The crop is useful for pasture or silage, with a protein content ranging between 18 and 24%.

Compared to lucerne, red clover does not yield as much forage in early spring and it is not as drought resistant. Proper management of red clover (not overgrazing or allowing it to over-mature) will provide good forage through most of the grazing season. Several studies have shown that pigs on red clover forage gain weight as rapidly as those on lucerne.

Brassicas

Brassicas (rape, kale, swedes and stubble turnips) are often used in organic rotations as a cover crop after arable silage and can be used as a feed component for pigs over winter.

Rape is a high-yielding, fast-growing annual forage providing an excellent forage for swine. When overgrazing is avoided, rape provides abundant, palatable forage for a long growing season. Rape can lead to photosensitization (sunburning) when grazed wet and pigs with white skin are most susceptible.

Herbs

Chicory leaves have a relatively high content of lysine of 1.21% and methionine of 0.4% (DM basis). Chicory has the potential to be grown throughout Europe as it grows well in poor soil and under drought conditions.

Dandelion content in a sward can contribute to the nutrient supply of foraging pigs. Crude protein content can range from 13.8% to 22.8% (DM basis) with a lysine and methionine content of 1.40 and 0.46% respectively. Other herbs of note that are both palatable and nutritional to pigs include chickweed, fat hen, plantain and birdsfoot trefoil.

Seed companies can provide organic herbal ley seed mixtures with a variety of herbs that provide a range of nutritional benefits to foraging pigs.

Forage in feed rations

The incorporation of any forage into a ration decreases the concentration of metabolisable energy because of the low concentration of metabolisable energy in forages. This reduction in the feed's energy density results in an increased intake.

Grass silage

Gestating sows can consume 1.5-1.6 kg silage per day with a dry matter (DM) content of 26%.

Recent feed trials conducted on growing pigs indicated that they can ingest 0.3 kg silage (DM)/day, being 13% of total DM intake and 10% of net energy (NE) of the daily ration. Grower and finisher pigs can ingest 6% and 15% (respectively) silage in their ration. However, the silage fed pigs realised a lower live weight gain (37 g/day). In the trials they also realised a lower calculated net energy utilisation for gain (1.6 MJ/kg body gain) and a lower dressing percentage (1.1%) of the carcass. The average number of days to slaughter for pigs fed the control diet was 104 days compared with 108 days for those that had silage included in their ration. It is unlikely that the amino acid supply was limited in the grass silage diet since the muscle thickness and lean meat content were not reduced in silage fed pigs.

For growing pigs, it is recommended to progressively increase the level of grass silage through phased feeding, to 10% on a DM basis and, for finishing pigs, from 12% to 20% on a DM basis. Supplying silage in a ration increases nitrogen and phosphorous content in manure by 13% and 7% respectively.

Arable silage

Arable silage, usually peas and a cereal, is a good way to increase the protein intake of pigs through forage feeding. It can be included readily in an organic rotation (especially with oats) due to the nitrogen fixation ability of peas and robust nature of oats.

Harvesting oats and other cereals at the milk to soft dough stage is recommended when making silage. Yields are lower, but nutrient concentration in dry matter is higher. Wilting the mass before chopping is recommended to increase the dry matter content by up to 35% to improve fermentation, avoiding juice out-flow and nutrient loss.

The length of chopping is an important factor for the success of ensiling. A theoretical chop length of 10 - 20mm is considered optimal. Finely chopped silage is ingested by pigs in greater quantity.

Peas and Beans

As rich sources of metabolisable energy and protein, peas and beans could represent a valuable nutrient source in a balanced ration with other components such as cereal grains, minerals and lucerne silage. Peas and/or beans can be added to lucerne silage to substitute soya beans.

A recent trial showed pigs fed a ration of 55% lucerne silage, 30% barley and 1% minerals mixed with 14% of either soyabeans or beans or peas had live weight gains of 662g/day, 592g/day and 665g/day (respectively) during the growing phase.

Statistical analysis of this preliminary data suggests that there is no significant difference in weight gain between pigs fed forage-based rations with soya or peas for 14 weeks from 8-10 weeks of age. However, pigs fed forage-based rations with beans did not perform as well.

Benefits of rations including beans or peas include lower feed costs, and reduced environmental impacts compared with soya beans. Organic cultivation of peas and beans is widely practiced across Europe making them a highly available source of protein.

Conserving silage recommendations

In order to maximise the quality of silage it is recommended to:

- Harvest at an early stage when the crop contains comparatively high protein and low fibre levels.
- Mow at a height of at least 10cm to prevent soil contamination, further increase protein concentration and reduce fibre content of the crop.
- Wilt the crop to at least 40 % of dry matter.
- Ensure an adequate compaction, chop the crop very short and press with a special press for corn silage.

Using these practices, lucerne silage can have at least 22.5% crude protein, 1.1% lysine and 3% methionine (DM basis).

Rooting

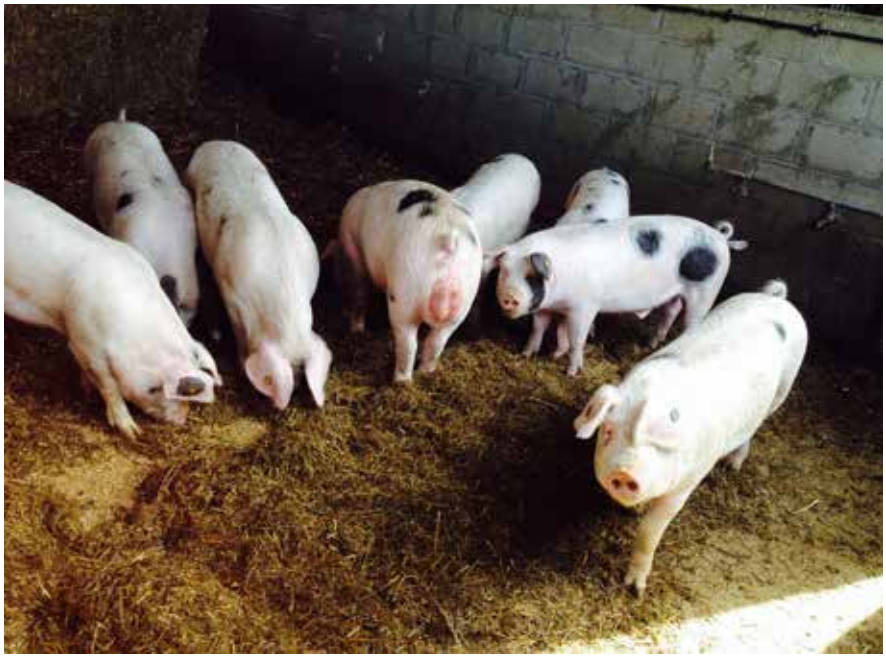
Pigs have evolved as opportunistic omnivores that forage above as well as below ground and when kept in semi-natural environments, they eat a wide range of feed items including vegetation, roots and invertebrates. Studies reported in Jakobsen (2014) have recorded 300 earthworms in the stomach of a single pig, and an intake of 414 to 1224 worms per day by village pigs weighing 20-40kg. On-farm habitats including woodlands, agroforestry, headlands, field margins and game bird cover strips support a wide diversity of floral

Table 1. Nutritional value of invertebrates to rooting pigs

Constituent	Earthworms	Arthropods	Molluscs	Insect larvae
Dry matter %	26.02	38.58	14.01	25.23
Crude Protein % DM	51.66	39.13	62.59	48.09
Lysine %	3.36	2.24	3.70	2.96
Methionine %	0.94	0.60	0.92	0.86

and faunal resources that may provide valuable nutritional opportunities for pigs. Estimated earthworm biomass in lucerne paddocks is 189g/m² and in grass paddocks (fresh weight) is 107g/m² within a depth of 20 and 25 cm. However, further research quantifying the availability of invertebrates and an animal's intake is required before integrating invertebrate resources into strategies for range feeding of pigs.

The provision of herbage-based diets facilitates foraging behaviours that can engage pigs in natural activity for 70% of their time. It can also displace abnormal aggressive behaviours such as tail biting.



Conclusions

Ranging material should form an important component of organic pig diets exploiting their natural omnivorous instinct to forage for both plant and animal food sources. Forages in the form of pasture, or as part of a complete feed, can be successfully incorporated into organic pig production. Pasture may include lucerne, white clover, red clover, herbs and brassicas. Forages may be based on lucerne silage or arable silage and peas and beans can be added to provide additional protein.

It is recommended that producers adopt feeding strategies which:

- Maximise pig intake of herbage whether on the range or as a component part of feed indoors;
- Provide a system that allows adequate time and space for feed consumption, reducing competition for feed;
- Restrict supplementary feed to a level that encourages pigs to range; and
- Reduce the particle size of herbage by chopping the silage as this may improve digestion and reduce spillage of the feed material.

Pigs can be allowed free access to grass silage in addition to a basal restricted ration of concentrate feed. This would require a feeding system suited to restricted scale feeding of the pigs, e.g. a long trough or computerised feeding of individual pigs. For a relatively low cost the nutritional value of pasture and forage can be assessed at most analytical laboratories.

Pigs grazing and receiving silage will inevitably use more energy than for maintenance processes as they will move around more; therefore live weight gain targets should be adjusted to cater for increased energy use.

Pigs have evolved as opportunistic omnivores that forage above as well as below ground and when kept in semi-natural environments, they eat a wide range of feed items including vegetation, roots and invertebrates. The provision of herbage-based diets facilitates foraging behaviours that can engage pigs in natural activity for 70% of their time. It can also displace abnormal aggressive behaviours such as tail biting.

References

Bikker P. and Binnendijk G.P. (2014) Grass silage in diets for organic growing- finishing pigs. In: Rahmann G & Aksoy U (Eds.) (2014) Proceedings of the 4th ISOFAR Scientific Conference. 'Building Organic Bridges', at the Organic World Congress 2014, 13-15 Oct., Istanbul, Turkey

Horsted, K. (2006). Increased foraging in organic layers. PhD, Danish Institute of Agricultural Sciences, Research Centre Foulum

Jacobsen, M. (2014). Organic growing pigs in pasture systems: effect of feeding strategy and cropping system on foraging activity, nutrient intake from the range area and pig performance. MSc Thesis, Agricultural Systems and Sustainability, Institute of Agroecology, Research Centre Foulum, Aarhus University

Kephart, K. B., Hollis, G. R. and Murray Danielson, D., (2010). Forages for swine. Extension, PIH-126, USA

The Food Animal Initiative and Organic Research Centre (2014) Pig Nutrition: Investigating forage feeding with alternative sources of protein

Western seeds (2014) Available online at www.westernseeds.com

Also see: ICOPP Technical Note 3: Fulfilling 100% organic pig diets: Concentrates

Find our publications on Organic Eprints. Search orgprints.org for "ICOPP"

Author: Kenny Crawley, Organic Research Centre, UK

Editors: Jo Smith, Catherine Gerrard, Phil Sumption, Organic Research Centre, UK.

ICOPP is the acronym of the project 'Improved Contribution of local feed to support 100% Organic feed supply to Pigs and Poultry' which ran from 2011 to 2014. It was funded through the European CORE Organic II ERA-net programme to support organic research, and led by Aarhus University in Denmark with 15 partners across 10 EU countries.

www.organicresearchcentre.com/icopp/