



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

Overall assessment report

D6.1 and D 6.2

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CORE organic II

Organic pig and poultry systems in Europe based on 100% organic feed supply

This report summarises the integrated findings of feedings strategies for organic pigs and poultry, based on 100 % organic feed, which are economic viable, support animal health and welfare and tend to reduce the environmental impact of the production (D6.1 and D6.2). The report is based on the findings about technical-biological relationships as presented in the Synthesis Report of ICOPP (Smith et al 2015). This is not further referred to in the report. Where other information is used references are given.

Introduction

Due to the request for using entirely organically produced feed for livestock by 2018 there is a need to evaluate the practical possibilities in doing that from an environmental, farm economy and animal welfare point of view. Therefore, the overall aim of this report is to consider the consequences when organic pigs and poultry in Europa are to be fed entirely with organic feedstuffs of local origin. The task includes the following aspects;

1. how to cover the nutritional needs with organically produced feed stuffs at all stages of their life
2. what organic feed stuffs are available
3. how can more local feedstuffs be made available

The first aspect is mainly related to difficulties in covering the amino acid requirement of the animals and in particular for the young animals as piglets, a young broiler, and young hens, whereas the other aspects are mainly related to the mass of appropriate feeds available.

Pig systems

Typical systems

Differences exist in how organic pigs are kept in different countries. An overview of European pig production systems is given in Fruh (2011). The main differences within organic pig production are related to whether sows or growing pigs are kept at free range. While in UK and Denmark sows are typically kept in free range whereas growing pigs are kept in indoors facilities with access to a protected outdoor run, in other countries often both farrowing sows and growing pigs are kept indoor with access to an outdoor run while gestating sows are kept outdoors and in Sweden it is mandatory to have growing on pasture in summer. Generally high producing breeds are used.

Only limited data on herd level input-output exists. For the present purpose these differences were found to be of less importance since the differences in diets among free range and indoor systems would basically be if part of the roughage were fresh (grazed) or given as silage. While the energy demand of the pigs might differ depending on the housing conditions the requirement for protein and in particular amino-acid's does not differ much dependent on rearing conditions. Thus for pig production we designed one basic system based on existing (grey) data from Denmark, Germany and The Netherlands.

Feed rations

In Table 1 is given an example of feed use for the different categories of animals in organic pig production system, both in terms of dry matter and in terms of protein.

Table 1. Typical feed use for different groups of pigs in an organic pig production system, kg dry matter and kg protein (after Jacobsen et al. 2015).

Feed item	Per sow in one year		Piglets from 1 year sow (13.8-30 kg)		Slaughter pigs from 1 year sow (30-110 kg)		Total from 1 year sow and pigs produced		Pct of total feed use	
	DM	Prot.	DM	Prot.	DM	Prot.	DM	Prot.	DM	Prot.
Skim milk powder /fish meal /potato proteins	-	-	77	45			77	45	1.2	3.6
Pea/faba beans	150	41	138	39	1572	420	1860	500	28	40
Oil seed cake	128	51	90	32	586	205	804	288	12	23
Cereal	1238	125	291	29	1915	189	3444	343	52	27
Total concentrates	1516	217	596	145	4073	814	6185	1176	93	93
Grass clover	230	45	33	5	215	34	478	84	7	7
Total	1747	262	628	150	4288	849	6663	1261	100	100

Adaptation possibilities

The group of feedstuffs named skim milk powder/fish meal/potato protein were included in order to make sure that piglets could be feed the recommended levels of amino acids in particular lysine and methionine, and which are difficult to obtain with the typical organic protein sources like peas/faba beans/lupines. This is the component that often includes conventional feed at present. While it amounts to more than 10% in the piglet's diet, it appears that this group only amount to 1-1.5 pct of total dry matter needed in the entire production.

In this project it was demonstrated that heat treated grass pea seeds and dehulled sainfoin seeds and in particular mussel meal, when included in limited amounts, were appropriate ingredient in the diets for piglets. Organic mussel production is recognized in some areas and it is assumed that the less valuable (smallest) of the mussels harvested can serve as feed in these areas. Grass pea seeds and sainfoin are often low yielding crops but can be grown under harsh conditions with poor soil fertility and does not compete with higher yielding crops. Thus since these feed stuffs can be used with good production results they represent an opportunity to feed piglets. However, if one aims to ensure maximum growth of piglets probably some sort of protein concentrates needs to be added. This can be derived from a range of protein sources that can be grown organically and or based on organic milk sources. Overall it seems that from an animal health and welfare as well as an economical and environmental point of view (due to the very limited amounts requested in a pig production system) no major concerns are related to supplying the piglets with 100 pct. organic feed also from European sources.

The bulk of the protein supply can be derived from the classical protein sources, like pulses, in organic agriculture. The main problem here is the lack of these crops at a European level as documented in WP 1. In a recent finalized European project 'Legume Futures' (Legume Futures, 1014), it was found that inclusion of more legumes in the conventional arable farming (except for the Nordic countries) would be both an economical advantage at farm level and an environmental advantage at

the EU level. Here it was taken into account that inclusion of legumes in the crop rotation substitute imported soybean products to EU, but on the other hand also reduced cereal export. There is no reason to believe that such benefits should not also be reached in organic farming. At present pulses at EU level are grown on an area corresponding to 12% of the area with cereal (Fruh et al., 2014) and thus from a crop rotational point of view there are space for a doublings of the production of pulses. However, as also shown in WP 1 there is also a lack of dry matter (cereals) for organic pig and poultry production, and thus this solution has also drawbacks.

New sources for energy and protein might be roughage based. In the project it was shown that clover grass and in particular luzerne harvested at a young stage of development (fresh or as silage) has an appropriate amino acid composition and that this protein can be utilized to a high degree by pigs and poultry. Furthermore, the protein yield and dry matter yield is typically considerably higher per ha than that of cereals or pulses. Eg yield per ha of protein, lysine and methionine is typically almost double that of soybeans. However, the utilization of the energy in the clover grass or lucerne is not very good except for in sows in gestation stage.

In a scenario work (Jacobsen et al., 2014) we compared a typical Danish pigs systems where sows were kept outdoors and slaughter pigs in stables with access to outdoor run with a system where slaughter pigs were kept outdoor all year round. In the first system feeding were basically based on concentrated feed, whereas in the alternate system the feeding was to the widest extent possible based on roughage without compromising growth rate. This was achieved by an increase in the area with clover grass at the expense of cereals and peas at the example farm keeping the overall land use unchanged. The net result was that the need for bought- in protein to the example farm was reduced from 68% to 51% of total needs, while no difference in need for imported energy. No major differences in environmental impact were observed. Thus such a system allows for much more home-grown protein sources.

It has to be mentioned that in the before mentioned case the feed requirement for the slaughter pigs was increased due to the outdoor rearing. Also yield of clover grass per ha was reduced to the outdoor rearing. If translated into a system where pigs were still in stables mainly fed concentrate and only sows were relying more on roughage, the share of total protein coming from roughage can be increased from 7% (as in table 1) to 14% without changing the overall feed demand. And such a change will overall reduce land use related to organic pig production due to the higher yield per ha of forages than cereals and the fact that the legume forages support a higher yield in the following cereal crops compared to a more cereal dense crop rotation.

Poultry systems

Within poultry production one need to distinguish between layer and broiler production and within the layers between the young layers and the adult layers. Within layer typically high producing breeds are used. Within broiler systems the production has to take place with genotypes not growing more than 30 g per day.

Feed rations and adaptation possibilities

The young layers are perceived to be most difficult to feed a 100% organic diet due to its high demand for methionine. Here mussel meal and fish meal are important supplements, but as also shown in the project insect meal can be used if once allowed by the EU safety regulation and likewise protein from organically produced Spirulina algae is a relevant. However, it is also important to be aware that early cut lucerne silage has relative higher content of methionine than e.g. soybeans and that this can be used to balance amino acid composition, without compromising egg production and at the same time support animal welfare if combined with high energy density feeds. Protein from organically produced Spirulina algae can fully replace protein from traditional organic sources in broiler diets.

For adult layers the main challenge is to have access to the typical protein sources in organic livestock production like described for the pig production in general.

In broilers often the genetic merit exceeds the maximum allowed growth rate if fed a diet that support maximum growth. Here the problem may be less how to compose a nutritional optimal diet from a growth perspective, but to ensure that the animal health and welfare is not compromised when feeding a 'suboptimal' diet. In this project it was demonstrated that lucerne silage could contribute with 10-15% of the protein supply when combined with a high energy density diet. Steenfelt et al. (2014) showed that gait score was significantly improved when feeding a diet restricted in amino acids, but at the same time overall feed use was increased and as a results of the lower growth rate, tenderness of breast meat was reduced. This effect however could be avoided if a restricted feeding was followed by a more intense feeding in the very last period (Eskildsen, 2014; Therkildsen, 2013) and with good health results.

In more slow growing broilers it was found in this project that protein in the diet could be significantly reduced compared to recommendations without compromising growth rate, and also in doing so, the chickens, if allowed access to a good range, could cover parts of their requirement for amino acids by the foraging.

It is interesting that also for poultry leguminous forage represent an alternative source for protein supply and in particular the supply of methionine. At the same time this supports animal health and in addition growing leguminous forage in a crop rotation designed for poultry production will support the overall crop production at the farm.

Conclusion

As indicated in the previous, for the individual farm there are many options to base the feeding on feed of 100 pct organic origin and produced in Europe without compromising health and welfare as well as production. The main problem is the lack of organic feed stuffs in Europe relatively to the demand, both in terms of energy and protein, in concentrated feed stuffs which are essential in the present feeding of monogastrics. Furthermore, looking at the individual amino acids, there is in particular a lack of methionine with a self-sufficiency of 40% against a self-sufficiency of total protein of 56% and a self-sufficiently of overall concentrated feed stuffs of 68% in the ICOPP countries.

On this background a crucial finding in ICOPP was that it is possible to a much larger extent than presently done to cover the protein requirements of monogastrics by early cut leguminous silage like lucerne which under most growing conditions yield much more protein and methionine per ha than other protein crops, including soybeans. Due to the N fixating properties of legumes and the positive effect on soil fertility and weed control to include a perennial crop in a cereal based crop rotation, it will in most cases be both economical and environmentally beneficial to include a crop like lucerne in organic feed production for monogastrics. The challenge might instead be exactly how to handle the silage in the feeding systems at the farm, and there is a need explore this in more detail.

Despite the benefits of including Lucerne and clover grass in the feed production and feeding, a drawback is that the utilization of the fibre fraction by the monogastrics is low and in particular in the growing pigs. Thus, one does not achieve the full potential of the energy production by these crops. Presently there are several initiatives to investigate how the protein rich parts of green biomass like grass and clover grass can be separated used as protein feed for monogastrics, while the fibrous part can be used as feed for ruminants or used for other purposes. In view of the very good amino acid composition of the clover grass or luzerne, such a technology seems to present an interesting way to increase the overall feed supply for organic livestock.

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