Lactating sows integrated with energy crops

Produce pork and tree biomass on the same area

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The trees provide the sows and piglets shade and shelter *Ref : KR Hansen*

Why introduce trees?

Trees, like poplar and willow, can provide pigs, managed in pasture-based systems, with a natural and stimulus rich environment. Sows and piglets can find shade in hot seasons and shelter in wet and windy weather. Further, the pigs can rub against the trees for skin care.

The introduction of trees can reduce the nutrient leaching from soils in outdoor production because, compared to grass, fully established trees are more robust to the pigs rooting behaviour. Further, trees have a deep root system with nutrient and water uptake occurring over a long growing season. The trees can be harvested to provide biomass to be used for production of energy, or as rooting material for pigs in housing systems.

Trees in pasture based systems also have a positive effect on biodiversity and landscape aesthetics.

Where and how to plant

Two private organic pig farms in Denmark have been studied for two years. The farms are involved in large-scale organic pig production, with 200 and 300 sows, respectively. The sows are kept outdoors all year round on grassland (grass clover). On both farms, poplar and/or willow have been established in the areas used for lactating sows. On one farm, the paddocks are approximately 30 m long and include two rows of trees at one end. On the other farm, the paddocks are 40 m long and include five rows of trees at one end. Behavioural studies were carried out. In addition, data on nitrogen in soil and soil water was collected on one of the farms to evaluate the effect of trees on animal welfare and nutrient leaching.

Poplar or willow?

Willow has a more shrub-like growth compared to poplar and may grow to 7-8 m. The dense multiple stem growth may hinder supervision of the animals and restrict human movement between the trees, for example, when catching piglets. On the other hand, the shrub structure provides the pigs with a solid shelter all year round.

Poplar has a more vertical growth and may become 20-30 m tall. It gives a more "open" expression and the shelter effect may be lower compared to willow. No matter whether willow or poplar is chosen, it is recommended that the area to be established is planted with, at least, three different clones in order to reduce the risk of diseases.

The sows use the trees for "skin rubbing".
Ref : HM-L. Andersen

Willow has a more shrub-like growth compared to poplar. *Ref : AG Kongsted*

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Tree protection

To prevent damage, the trees should be established at least four years before sow access. Piglets can be given access after two years, and this reduces the need for supplementing weed control. When well-established, the trees are resistant to the sows and piglets rooting behaviour. Lactating sows may bite off smaller branches to use them as nest building material. This may increase the risk of piglet mortality through inhibiting their mobility inside the huts during the first hours after birth. Further, browsing can cause severe damage on individual trees. Cutting branches below a height of 1-1.2 m will limit the sows' access to branches and reduce bark damage.

Cutting off the branches below 1 m height reduces tree damage and lowers the risk of sows using the branches as nest material in the farrowing huts.
Ref : K.R. Hansen

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Left: The trees can be harvested on a regular basis to remove nutrients from the paddocks.
Right: The tree biomass can be used as an attractive rooting material for pigs (mixed wood chips and leaves) (*ref: K.R. Hansen*).

Paddock design

When a few rows of trees are placed in one end of a rectangular shaped lactation paddock, a large proportion of the excretory behavior is performed outside the tree zone as shown in the table below. This reduces the beneficial effect of the trees in relation to reducing nutrient leaching. If the trees were placed in the middle of the paddock with the main resources (hut and feed) placed on each side of the tree area it is possible that a larger amount of the urine and faeces will be deposited in the tree zone.

Distribution of excretory behaviour (% of behavioural observations) in five different zones in a paddock with two rows of poplar trees at one end of the paddock. Relative area is equal to the proportion of the area of each zone

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
		Feed		Hut	Trees
Relative Area, %	27	27	14	12	20
Urine, %	50	32	10	0	8
Faeces,%	31	22	14	12	21

At high temperatures, sows with access to trees spent more time in the tree area, whereas sows with no access to trees spent more time in the hut. From 2018, it will be mandatory in Danish organic outdoor pig production that pigs are provided with access to shade during the summer months, in addition to that provided by the hut. Establishment of trees in the paddocks seems an appropriate way to comply with this requirement. However, two rows of five-year-old poplar trees at one end of the paddock (as shown above) is not enough to avoid incidences of severe sunburn on ears and udders. Wallow holes are also required to provide pigs with a quick and effective means of cooling off.

Further information

Cultivation guide: https://okologi.dk/media/235799/dyrkningsvejledning_farefolde.pdf (In Danish)
Ecosystem (A Danish project, in Danish): http://agro.au.dk/forskning/projekter/pecosystem/
Homepage of an organic pig farm with poplar in the paddocks for lactating sows (in Danish): http://hestbjerg.dk/
Video clip from the farms. https://www.flickr.com/photos/agforward/15605200701/