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POWER

Welfare and environmental impact of organic pig production

A collection of factsheets

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Content

Introduction

Despite a huge diversity in system layout and management strategies between and within countries, European organic pig producers face common animal welfare challenges related to piglet mortality and health problems around weaning. Further, outdoor concrete runs in systems for growing-finishing pigs challenge the organic goals of providing livestock with the possibility to carry out natural behaviour in a natural environment and are associated with a high risk of ammonia emissions. On the other hand, pasture systems facilitate natural living, but are challenged by a high risk of nutrient leaching.

In the POWER project, we addressed these challenges in close cooperation with organic pig producers throughout Europe. They participated in workshops to share views on challenges, possible innovations and best practice examples, and hosted a wide range of experimental activities and provided farm data for overall system analyses.

This handbook aims to create a common toolbox of knowledge-based strategies for organic pig producers and presents best practice examples from across Europe for inspiration. Thereby, we wish to facilitate the continuous development of an economically competitive production, which meets the principles of organic farming. We hope that we succeeded and that you, organic pig producers and advisors across Europe, will find the handbook informative, inspiring and valuable!

On behalf of the POWER project team,
Anne Grete Kongsted

The project generated scientific knowledge within four focus areas:

1. Design and management of concrete outdoor areas to provide growing pigs with stimuli-rich environment while reducing the risk of emissions.

2. Management strategies to improve pig health, survival and performance before and after weaning.

3. Animal welfare, environmental impact and productivity of combined housing and pasture systems.

4. System resilience and sustainability aspects in organic pig production.

Photos focus areas 1, 2, 3, 4: Mirjam Holiger (FiBL, CH), Katharina Heidbüchel (TI_OL, DE), Anne Grete Kongsted (AU-AGRO, DK), Jürgen Herrle (Naturland)

FiBL

AARHUS UNIVERSITY

Improved concrete outdoor runs in housing systems for growing-finishing pigs: general information and legislation

Description

Access to an open-air area is an important part of organic pig production in Europe. It provides an area devoted to satisfying the pigs' need to explore their environment and strengthen their immune system. In many parts of Europe, this requirement is fulfilled by indoor housing systems with access to a concrete outdoor run, especially for growing-finishing pigs but also for sows.

The advantages of this housing system, as compared to free range, are the prevention of nutrient leaching to the soil, higher mechanisation/automation of feeding and manure removal and improved feed conversion in growing-finishing pigs. However, depending on the design, these runs can be very barren, making them unattractive to the pigs resulting in limited use. In addition, large areas soiled with faeces and urine in the outdoor run can result in high ammonia emissions.

Following their natural behaviour, pigs use different, so-called functional areas for resting, exploring, eating, and elimination. Therefore, an outdoor run's design that accounts for and supports this behaviour is important for a well-functioning housing system in terms of animal welfare, workload and the environment.

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run
Production stage
All stages of pig production

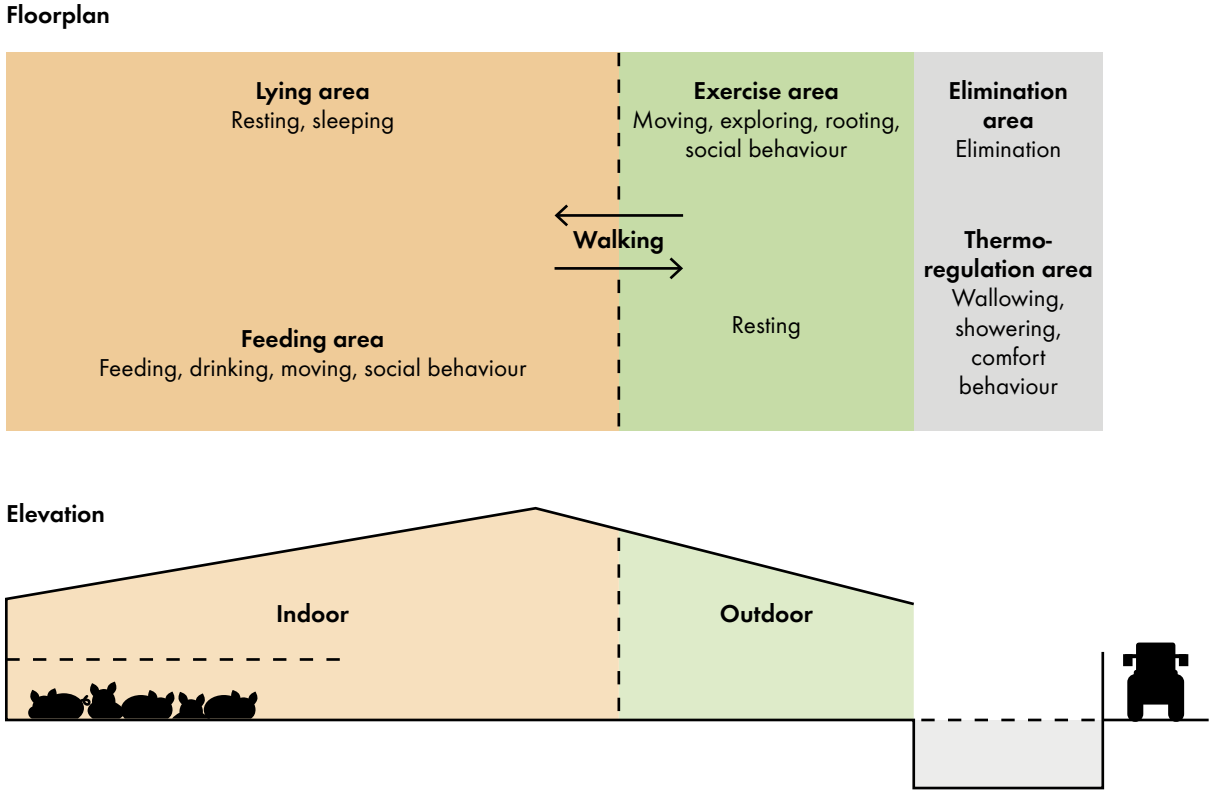
Every measure and tool introduced will be scored according to its impact on animal welfare, CO_2 + NH_3 emissions and finances.

- welfare: **no or little** impact
- welfare: **positive** impact
- welfare: **high positive** impact
- environment: **no or little** impact
- environment: **positive** impact
- environment: **high positive** impact
- **low** costs
- **medium** costs
- **high** costs

Table 1: Functional areas and corresponding behaviours in indoor and outdoor areas

	Indoor	Indoor or outdoor	Outdoor		
Functional area	Lying area	Feeding /drinking area	Exercise /rooting area	Thermoregulation /comfort area	Elimination area
Behaviour	• Resting • Sleeping • Farrowing • Suckling	• Feeding • Drinking • Moving • Affiliative and agonistic social behaviour	• Moving • Exploring • Rooting • Resting • Affiliative and agonistic social behaviour	• Thermoregulation (wallowing, showers) • Comfort behaviour	• Elimination

Illustration 1: Schematic layout of a housing system with an outdoor run for growing-finishing pigs



A well-designed outdoor run enables pigs to separate functional areas. Resting and feeding is located indoors. The roofed part of the outdoor run provides space for resting, social behaviour, exploration and rooting. The elimination area, drinkers and cooling facilities are located in the non-roofed, slatted floor area. Source: adapted from an illustration by Herman Vermeer (WUR, NL) in Wimmler et al. 2022.

Legislation

- EU organic Regulations 2018/848 and EU 2020/464 stipulate that all livestock shall have "permanent access to open-air areas that allow the animals to exercise" to "enhance the immune system and strengthen the natural defence against diseases". For pigs, it is additionally specified that "exercise areas shall permit dunging and rooting".
- Minimum surface requirements (m^2/pig) for the indoor and outdoor area depend on the age and sex of pigs, as well as on the breeding cycle. (Regulation EU 2020/464; Swiss Ordinance on organic farming SR 910.181).
- The outdoor run may be partially covered. Depending on the national regulations, a maximum of 50-75 % cover of the required outdoor surface area is allowed.
- At least half of the minimum surface of the outdoor run must be solid floor.
- The outdoor run shall provide means for the regulation of body temperature.
- National regulations and private organic standards specify these (e.g. rooting materials to be used, means for thermal regulation) or specify additional requirements (e.g. access to pasture, prohibition of a slatted floor, characteristics of pen partitions).
- Further information can be found in table 2, page 3 and in Wimmler et al. (2022).

Relevance for animal welfare

- To allow species-specific rooting behaviour, it is crucial to provide sufficient and suitable material like straw, roughage, or compost in the outdoor run. These materials can be supplied in a defined rooting area, easily accessible racks or simply on the floor. Providing possibilities for exploration and rooting allows pigs to satisfy their natural behaviour and prevents abnormal behaviour such as tail biting.

Table 2: EU organic regulations, national regulations and private standards concerning concrete outdoor runs for organic growing-finishing pigs

Outdoor access
EU: Permanent access to open-air areas, preferably pasture, whenever weather, seasonal and soil conditions allow. These areas shall be attractive for pigs and provide an outdoor climate. **NL:** Floor condition cannot be a reason to limit outdoor access. **CH:** Daily access for several hours. **Bio Suisse (CH):** Outdoor access must be permanent. **Soil Association (UK):** Permanent access to pasture or vegetated range. **KRAV Association (SE):** Possibility for grazing during the appropriate part of the year (i.e. not always required for each individual, if lifespan is shorter than a year). **Demeter International:** Free contact with natural surroundings (sun, rain, natural soil).
Space requirements for outdoor runs
EU: Minimal surface/pig: ≤50 kg = 0.6 m², ≤85 kg = 0.8 m², ≤110 kg = 1.0 m², >110 kg = 1.2 m², (equals 43 % of minimum pen area). **CH:** Minimal surface/pig: 25–60 kg = 0.45 m², 60–110 kg = 0.65 m². **Industry agreement (DK):** Minimal total outdoor surface/pen: 10 m² (≤40 kg) & 20 m² (finishing pigs). **Bio Suisse (CH):** Minimal surface/pen: 25–60 kg = 7 m², 60-110 kg = 10 m² **FederBio (IT):** The outdoor run must have the same surface as the minimum indoor area.
Roof
EU: Open-air areas may be partially covered. Maximum of covered surface (% of minimal outdoor area). **NL, SE:** 75%. **AT:** 50–90% (depending on year of construction, animal category and precipitation). **DE:** 50–90 % (varying between Federal States). **CH, DK: 50%** **Bio Suisse (CH):** Minimal open (not covered) surface: 0.23 m²/pig (25–60 kg), 0.33 m²/pig (60–10 kg).
Floor
EU: At least half of the minimal surface of both the indoor area and the outdoor run shall be solid floor. **DE:** Slatted floors are not permitted in the outdoor run. **FederBio (IT), Bio Cohérence (FR):** Slatted floor is not permitted indoors and outdoors.
Enrichment
EU: The exercise area shall permit rooting. Roughage, fresh or dried fodder, or silage shall be added to the daily ration. Possible substrates: **AT:** Loose organic material on the floor (e.g. straw, hay, leaves, sawdust, spelt husks) or roughage on the floor or in a rack. **DK:** Straw, soil, silage, green fodder and others. **FR:** Straw, earth or others. Silage may be used as rooting material, but its provision only in a trough is not sufficient. **SE:** Straw, peat, bark, sand/earth or silage. **Soil Association (UK):** Natural materials e.g. bean haulm, bracken or rushes, sawdust and wood shavings, sand and non-organic straw. You must not use peat. **Prüf Nach!/ Zurück-zum-Ursprung (AT):** At least two different types of rooting material must be provided regularly.
Thermoregulation
EU: Access to shelters and means allowing regulation of body temperature. **CH:** Access to cooling (e.g. air cooling, floor cooling, showers or wallows) for pigs ≥25 kg when temperatures exceed 25 °C. For cooling, all pigs (except lactating sows with piglets) must have a shower or wallow available **SE:** During the warm season, pigs kept outdoors should have access to a wallow. **Dyrenes Beskyttelse (DK):** Access to a mud bath (wallow) or sprinkler for pigs >20 kg when average daily temperatures exceed 15 °C. **Soil Association (UK):** Wallows and/or shade during summer.
Pen partitions
EU: No specifications. **NL:** At least 4 m unobstructed view from the rear end of the outdoor run. The lower 50 cm of the partition may be solid. **FR:** Pen partitions of the outdoor run limited to the height strictly necessary to restrain animals in the pen. A fully covered area with three solid walls cannot be considered as an outdoor run. **Industry agreement (DK):** Ensured view; the front fence should be open from a height of 60 cm. Minimum 10 m between buildings.

Austria (AT), Denmark (DK), France (FR), Germany (DE), Italy (IT), Netherlands (NL), Sweden (SE), Switzerland (CH) United Kingdom (UK)
Source: (Wimmler et al., 2022).

- The outdoor run offers the pigs different climatic stimuli around the year and allows the animals to choose between different microclimatic zones.
- Increasing summer temperatures require possibilities for cooling in the outdoor run. Therefore shade should be provided, and showers or sprinklers should be installed. An opportunity to scrub, e.g. on brushes, makes the outdoor run even more attractive.

Relevance for environmental impact

- Since pigs separate their elimination area from other activities, the design of the outdoor run can influence their elimination behaviour to a certain extent. By adding resources, such as rooting areas or roughage, to the outdoor run, elimination behaviour is directed to a designated, limited area. This reduces the total area soiled with manure and associated ammonia emissions in the outdoor run.
- Regular and frequent cleaning of the elimination area is crucial to reduce ammonia emissions.
- Outdoor runs that allow pigs to regulate their body temperature, e.g., with showers or sprinklers, improve thermal comfort. This increases efficiency through improved pen cleanliness, higher weight gain in growing-finishing pigs, and improved reproductive performance in sows.

Further information

- **Bio Suisse (2021)**: Standards for the production, processing and trade of "Bud" products. At: www.bioaktuell.ch [Link].
- **EAER (1997)**: EAER Ordinance on organic farming SR 910.181 of 22 September 1997 of the Federal de-partement of economic affairs, education and research (EAER). At: www.fedlex.admin.ch [Link].
- **EU (2018)**: Regulation (EU) 2018/848 on organic production and labelling of organic products. At: eur-lex.europa.eu [Link].
- **EU (2020)**: Commission Implementing Regulation (EU) 2020/464 of 26 March 2020 laying down certain rules for the application of Regulation (EU) 2018/848. At: eur-lex.europa.eu [Link].

Straw bedding can be provided in the roofed part of the outdoor run. The elimination area is located in the non-roofed part.

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POWER

The project "POWER – Proven welfare and resilience in organic pig production" is one of the projects initiated in the framework of Horizon 2020 project CORE Organic Co-fund (https://projects.au.dk/coreorganiccofund/) and it is funded by the Funding Bodies being partners of this project (Grant Agreement no. 727495). The opinions expressed and arguments employed in this factsheet do not necessarily reflect the official views of the CORE Organic Cofund Funding Bodies or the European Commission. They are not responsible for the use which might be made of the information provided in this factsheet.

CORE organic

Improved concrete outdoor runs in housing systems for growing-finishing pigs: rooting area

Description

Good functioning rooting areas integrated into outdoor runs allow pigs to satisfy their need for exploratory behaviour.

Different substrates can be used as rooting material, including thermally sanitised compost, soil and wood chips. Soil-like materials are preferred for rooting by pigs. Therefore, straw is not recommended in rooting areas. Generally, selected rooting materials should be reusable as fertiliser on the fields. Wood shavings, bark chips and wood chippings are only suitable to a limited extent as their use increases ammonia emissions in the rooting areas. Additionally, they could acidify the soil and post-composted, if necessary, before application on the field.

Rooting areas should be designed to be filled and cleaned mechanically to avoid excessive manual labour.

Legislation

- EU organic Regulation 2018/848 stipulates that "Exercise areas shall permit dunging and rooting by porcine animals. For the purposes of rooting, different substrates may be used."
- Swiss Ordinance on organic farming SR 910.181 as the basis of the private standard production "Bio Suisse": Dry sows that do not have access to pasture shall have access to a rooting area with minimum dimensions of 0.5 × 2 m and 30 cm depth per 10 dry sows.

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run
Production stage
All stages of pig production

Welfare Environment Cost

Relevance for animal welfare

Rooting is one of the exploratory behaviours' pigs are strongly motivated to express and includes digging, grubbing and scooping with the snout, raking with the forelegs and chewing or gnawing on items turned up by these activities. The goal of rooting behaviour is to find feed resources to satisfy the pigs' immediate needs like hunger and explore novelties and changes within their surroundings.

The provision of rooting areas makes the outdoor runs more appealing for pigs. Depending on the climate, these areas are used for rooting behaviour but also for resting. Sometimes pigs use the rooting area also for elimination behaviour, especially when the rooting material is already wet. This is important since a fouled pen area positively correlates with higher ammonia emissions. Fouled rooting areas could also result in health problems due to impaired hygiene and increased labour for cleaning.

A soil-like material such as compost is an optimal substrate for the rooting area and can be used as fertiliser afterwards.

Relevance for environmental impact

- If rooting material such as sawdust is regularly changed, the gaseous nitrogen losses, such as ammonia, are reduced, as the overall area for elimination is reduced.
- Though likely low, the production and transport of rooting material will cause some environmental impact. This can be reduced by using on-farm produced wood chips.
- Rooting material will also need to be regularly changed. This results in more farm yard manure for storage and spreading, which have additional direct environmental impacts. However, the increased carbon content in manure on the fields may also contribute to positive greenhouse gas mitigation effects through soil carbon sequestration.

Cost and labour

- The costs and labour hours for installing a rooting area depend on the materials used and the complexity of the construction.
- Rooting areas increase labour hours, compared to solid or slatted floors, due to an increased need to clean and refill or replace rooting material. To minimise these extra hours, it is important to construct the rooting area to be able to clean it mechanically.
- Costs of the rooting material vary depending on the type of material. Sawdust and compost often need to be purchased. Material like wood chips can be produced on-farm from trees.

Recommendations / requirements

- **Fresh material:** It is important to regularly add fresh material so that the area remains attractive to pigs.
- **Dry material:** A roofed rooting area prevents that the material gets wet during rain. In autumn and winter, i.e., humid weather, the rooting substrate needs to be changed more frequently since pigs will use the rooting area for elimination when the substrate is moist. It should be avoided that new rooting material is wet when distributed in the rooting area.
- **Hygienically safe material:** Rooting material has to be hygienically safe, especially regarding African swine fever. Therefore, compost should be made of green waste, like branches or grass, and have gone through a complete composting process.
- **Stones:** Small stones in the rooting material can clock the slurry system.
- **Area size:** The size of the area should be adapted to the number of pigs. An area that is too small does not allow all pigs to root.
- **Entry and exit:** Ideally, the rooting area should have several entry and exit possibilities, so that sleeping pigs do not block them.
- **Elimination areas:** Rooting areas should not be placed on areas that pigs previously preferred as elimination areas.

The provision of rooting material allows pigs to satisfy their need to explore their environment.

Further information

- **Bio Suisse (2021)**: Standards for the production, processing and trade of "Bud" products. At: www.bioaktuell.ch [Link].
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CORE organic

Improved concrete outdoor runs in housing systems for growing-finishing pigs: benefits of roughage as nutritive enrichment

Description

Organically raised pigs must have daily access to roughage, as is not only enrichment that promotes exploratory behaviour but also a valuable part of the pigs' diet.

High-quality grass- or clover-grass silage is an ideal roughage for pigs due to its attractive taste and consistency. Other types such as corn or barley whole crop silage have comparable benefits regarding health and welfare. During the vegetation period, pigs appreciate fresh green fodder. However, good quality hay is also suitable for pigs.

Fresh roughage should be provided every day to assure attractiveness. This also prevents fouling and spoilage of roughage. As pigs are inquisitive animals, periodical change to a different type of roughage may further increase its use and attractiveness. However, farmers should choose roughage with appropriate quality and quantity which is locally produced, e.g., on-farm or regionally.

Legislation

- Roughage, like fresh green fodder, hay, silage or arable crops, must be provided as part of pigs' daily diet (EU organic Regulation 2018/848 and Swiss Ordinance on organic farming SR 910.181).
- Some countries specify the types of roughage to be used or requirements for roughage provision, e.g. on the floor or in a rack, in a way that prevents soiling (Austria), permanent access either of pasture or roughage (Denmark), if it is considered as rooting material, provision only in the trough is not sufficient (France).

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run
Production stage
All stages of pig production

Welfare Environment Cost

Relevance for animal welfare

In semi-natural environments, pigs spend about 70 % of their day-time activity rooting, foraging and searching for food.

Roughage allows pigs to perform foraging and exploratory behavioural needs and satisfies feed-related behaviours like chewing and swallowing, thus reducing redirected oral activities, such as tail biting. Pigs housed on straw with additional access to roughage, for instance, increase the time spent on foraging, exploratory and feeding behaviour, which reduces aggressive behaviours among pigs as well as skin lesions originating from social interactions.

The nutritional value of roughage should also be acknowledged. Studies have shown a beneficial effect of roughage on gastric health, as it significantly reduced the occurrence of gastric fissures or ulcers.

Fresh grass provided on the floor of the outdoor run allows pigs to perform foraging behaviour, but compared to grass provided in racks, there may be more feed waste.

Relevance for environmental impact

- Depending on silage quality (dry matter content, protein content), 10-20% of concentrate feed can be substituted. This results in a reduced environmental impact caused by the animals' nutrition.
- From a holistic farm system perspective, the cultivation of grassland and crops used for roughage can also contribute to the system`s sustainability. It offers possibilities for crop rotation, nitrogen fixation through legumes (e.g. clover-grass) and carbon sequestration through permanent grassland.
- Moreover, good animal health is a prerequisite for efficient production, which is desirable in the context of environmental impacts.

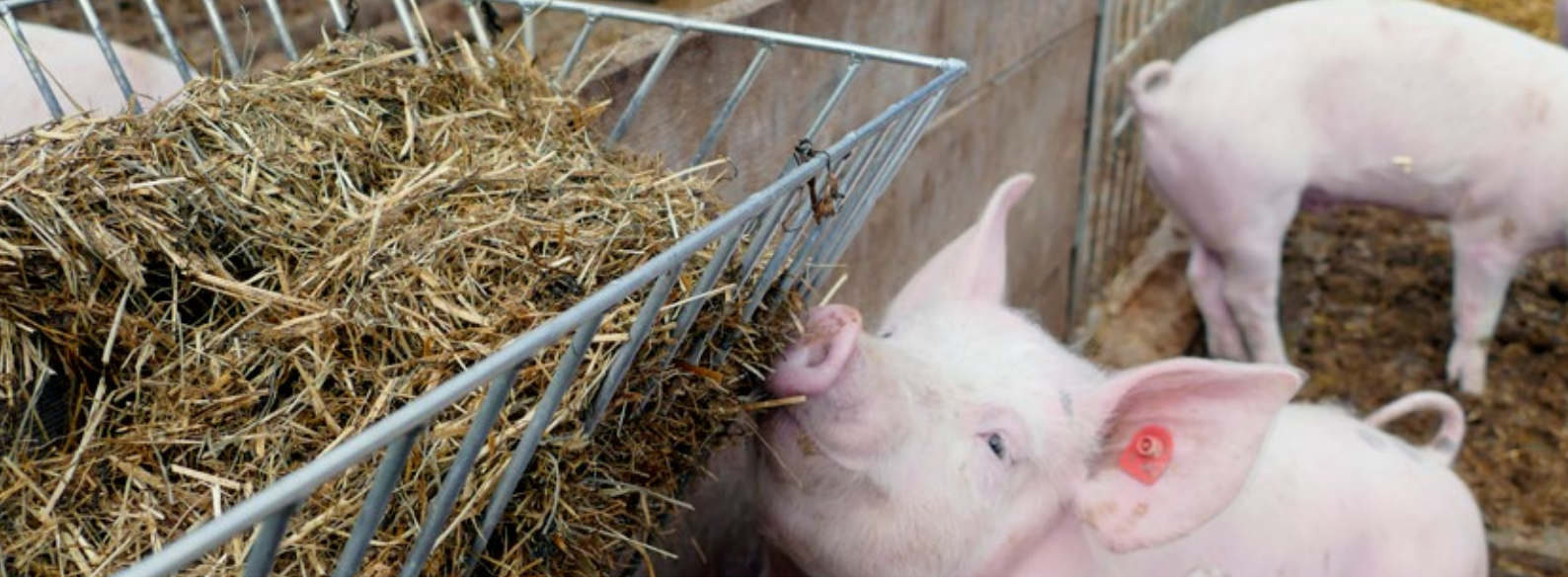
Cost and labour

- Labour demand varies depending on how roughage is provided (floor, rack), accessibility of the location for the farmer (e.g. with a tractor) and frequency of provision.
- The required amount of roughage, and thus its cost, depends on the pig`s level of consumption and wastage.
- As roughage intake by pigs is desirable, costs can be saved by minimising roughage waste (e.g. frequent provision in small quantities, racks with trough underneath).
- On-farm or regionally forage production guaranties certain independence from availability and prices and saves transport costs.

Recommendations / requirements

- **Changing frequency:** Roughage should be frequently changed and provided in adequate amounts that ensure high quantity and accessibility of roughage for all pigs during the day. This helps to prevent aggressive behaviour.
- **Amount:** The adequate amount of roughage depends on the type of roughage and provision, as well as age of the pigs. For growing-finishing pigs, 400 grams or more per pig and day are well used by the animals and can be recommended based on practical and scientific experience. However, attractiveness and freshness are crucial.
- **Cleaning:** Daily cleaning of leftovers on the floor assures good pen hygiene, which helps to prevent diseases.
- **Type of roughage:** Grass or clover-grass silage is recommended as roughage. Alternatively, fresh grass, hay, lucerne silage or pellets, as well as corn silage (whole crop) are good options. Above all, the quality of the roughage is crucial.
- **Dry matter and pH:** Good quality silage for pigs has a low dry matter content of 25-30 % and a pH around 4.
- **Straw:** In the bedded lying area straw is not considered as roughage according to organic legislation. Apart from possible hygienic issues, it competes with the needs for lying and rooting and does not meet pigs' nutritional needs.

Piglets also appreciate fresh clover-grass. Roughage should be provided in addition to straw bedding on a level, solid and clean surface.



Providing silage in a rack is also suitable for pigs.

Further information

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CORE organic

Improved concrete outdoor runs in housing systems for growing-finishing pigs roughage in a rack – how to do it?

Description

The provision of roughage is an important aspect of organic pig production. The organic legislation requires possibilities for rooting in the open-air area, which can be met by providing roughage in the outdoor run.

Provision on the floor is easy to implement and corresponds to the pigs' natural behaviour of rooting the ground. However, it is easily soiled, and therefore requires frequent cleaning. Considerable quantities are wasted. Therefore, there is a trade-off between high animal welfare, appropriate pen hygiene and acceptable workload for the farmer.

A solution can be the provision of roughage in a rack, which remains clean and is also well accepted by pigs. Racks provided daily with fresh roughage in the outdoor run increase exploratory behaviour and motivate pigs to go outdoors.

Legislation

- EU organic Regulation 2018/848 stipulates that: "Exercise areas shall permit dunging and rooting by porcine animals. For the purposes of rooting, different substrates may be used."
- Possible rooting materials include straw, hay, silage and fresh grass, leaves and soil, as well as wood chips, sawdust and other substrates specified by national authorities or private agreements.

Applicability box

Theme
Pigs
Farm Type
Indoor housing with outdoor run
Production stage
All stages of pig production

Welfare Environment Cost

Relevance for animal welfare

Outdoor runs are more attractive for pigs when roughage is provided there. Moreover, pigs visit the racks more frequently and use more of the roughage, when racks are positioned in the outdoor run, away from the indoor feeding and lying area.

Provided that accessibility is good, roughage reduces aggression and abnormal behaviour such as tail biting. However, if pigs cannot feed at the rack simultaneously, aggression can increase due to competition. Variation of roughage types may increase attractiveness for pigs. However, the freshness of roughage and daily provision are most important.

The cutting length of roughage should be adapted to the space between the bars of the rack so that the pigs can pull out the roughage. Following their natural feeding behaviour, pigs prefer eating and exploring roughage on the floor. Therefore, a trough underneath the rack enables rooting while minimising losses.

Racks provided with high quality grass-silage in the outdoor run motivate pigs to go outdoors and perform exploratory and food-related behaviour. Free-standing racks in the outdoor run provide better access in large groups.

Relevance for environmental impact

- Roughage can help to structure and enrich the outdoor run by providing an additional resource. As pigs usually eliminate away from their feed, they avoid elimination around the roughage. This can help to limit the surface soiled with faeces and urine and, consequently, lower the risk for ammonia emissions.
- Attention must be paid on excessive wastage of roughage resulting in decreased pen hygiene and considerable nutrient loss.

Cost and labour

- The costs for racks range between € 20-80 (small, mounted on a wall) and € 100-600 (large, free-standing), depending on size, quality and country.
- The racks should be easily accessible for the farmer, ideally with e.g., a tractor or mini loader. Therefore they are best positioned at the rear end of the outdoor run, but away from the area intended for elimination.
- Daily refilling of the rack is more labour intensive but advisable concerning the attractiveness for pigs.
- To avoid wastage and soiling around the rack, the spacing between the bars should be adjusted to the cutting length of roughage: not too wide to prevent roughage dropping out, but wide enough so that the pigs can pull the roughage out.

Recommendations/requirements

- **Position of the racks:** Accessibility is crucial (!) to prevent competition amongst the pigs and to minimise the workload for the farmer.
- **Type of racks depends on group size:** Single racks mounted on the wall are practical and suitable for smaller groups. Larger free-standing racks are accessible from all around and offer more space which is important, especially for large groups.
- **Rack-space per pig:** Sufficient rack-space per pig is important to increase exploration and avoid competition: A minimum of 5.5-7.0 cm/pig is recommended to reduce aggressive behaviour at the rack; this is e.g., one rack with 55-70 cm width for 10-12 pigs.
- **Installation height:** Racks should be installed low enough so that pigs can easily reach them (approx. 30 cm above ground, depending on the size of pigs).
- **Waste reduction:** A trough underneath the rack can reduce wastage and soiling of roughage while allowing pigs to root.
- **Space between bars:** Bar spacing should be adjusted to the type/cutting length of roughage: about 40 mm distance between bars for short roughage (<15 cm) and 70 mm for long roughage (>15 cm).
- **Not in elimination area:** The racks should not be positioned in the elimination area as roughage soils quickly when on the floor. Moreover, pigs are very clean animals preferring eating away from their toilet. Thus locating the rack directly in the elimination area, may motivate pigs to eliminate in other areas of the pen.
- **Rain protection:** The rack can be covered or positioned in the roofed part of the outdoor run to protect roughage from rain and moisture.

Troughs underneath the rack reduce wastage and allow the pigs to root in the material, spilled from the racks.

In the un-roofed outdoor run, racks should be covered. Short cutting length of the roughage (<15 cm) requires a small distance between the bars of the rack (e.g., 40 mm).

Further information

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POWER

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CORE organic

Improved concrete outdoor runs in housing systems for growing-finishing pigs: showers

Description

Heat stress during summer is increasingly challenging for pigs. Showers are a practical solution to provide cooling in the concrete outdoor run. For this purpose, devices for plant irrigation (tubes, nozzles) can be easily adapted. Different flow rates and droplet sizes can range from "rain-like" to "mist-like" showers. Time and frequency of shower activation can be regulated automatically with simple timers or more complex irrigation computers with possibilities for programming diverse irrigation schedules.

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run
Production stage
Sows + boars, growing-finishing pigs

Welfare Environment Cost

Legislation

- EU organic Regulation 2018/848 stipulates that: "Open air areas shall provide (…) means allowing the regulation of body temperature of porcine animals."
- Danish industry agreement requires all pigs over 20 kg to have access to a wallow or sprinkler when the average daily temperature exceeds 15 °C.
- Swiss Animal Protection Ordinance (AniPO, SR 455.1) stipulates that: "In new pig barns, during hot conditions, pigs weighing 25 kg or more and kept in groups as well as boars must be provided with cooling facilities. These can be e.g. air cooling, floor cooling, fogging systems, showers or wallows.
- The Bio Suisse standards requires a shower or wallow for all pigs except lactating sows with piglets at outside temperatures of 25 °C or higher.

Relevance for animal welfare

Pigs cannot sweat. Therefore they need other opportunities for thermoregulation, e.g. by evaporative cooling through wetting their skin with water.

In indoor housing with concrete outdoor runs, showers have been shown to reduce heat stress and increase feed intake and weight gain during the hot summer period. Showers reduce pigs' skin surface temperature and the wet floor provides a cool lying underground. Moreover, pigs in the outdoor run are more active and show less lateral lying, which indicates reduced heat stress.

Pigs show various water-related behaviours, e.g., standing and/or drinking under the shower with the head lifted, wriggling, shaking, rubbing their skin against pen fixtures or brushes.

In addition, showers increase cleanliness of pigs and the pen.

"Mist-like" showers spray small droplets over the outdoor run, helping pigs to cool down.

Relevance for environmental impact

- Water is a valuable and often scarce resource. The water consumption of showers depends on the flow rate, duration and frequency of shower activation. Optimising the flow rate and schedules for shower activation can save a lot of water. However, flow rate and droplet size should be high enough to wet the skin surface of pigs for evaporative cooling.
- Showers increase the cleanliness of the pigs and the pen and therefore potentially reduce the ammonia-emitting surface in the outdoor run.
- Added water in the manure lowers the ammonia concentration in the manure so that less ammonia is emitted to the air. This effect increases with higher quantity of water, depending on flow rate, duration and frequency of shower activation.

Cost and labour

- Companies offer sprinkling systems for cooling with more technical refinement. However, the costs and effort of installation are usually higher than simple self-made solutions.
- Material meant for garden irrigation, such as lawn sprinklers, is generally less costly and can be adapted to a wide range of housing systems with relatively low effort.
- Nozzles known for cooling systems for dairy cows ("fogging systems") are a good and cost efficient option.
- Water availability needs to be considered.
- Workload is very low, especially when the showers are regulated automatically. Work related to cleaning of pens is potentially reduced (less dirty, easier to clean).
- Additional water in the manure needs to be considered for storage and application to fields.

Under rain-like showers pigs get wet faster compared to mist-like showers. Observations also show that pigs interact more with the water from rain-like showers.

Recommendations / requirements

- **25 °C:** Showers and sprinklers should be activated when ambient temperatures exceed 25°C.
- **Bodyweight:** Showers are particularly important for pigs with a bodyweight higher than 60 kg (sows, boars and finishing pigs). Suckling and weaner piglets have different temperature requirements and rather avoid showers.
- **Lactating sows with piglets:** Showers are easy to implement in outdoor runs for pregnant sows. For lactating sows the location must be carefully considered not to affect suckling piglets.
- **Outdoor run size:** There should be enough space, so pigs can avoid the showers and can lie undisturbed in a dry area.
- **Location:** Preferably, showers are located in the open/non-roofed area of the outdoor run and away from the bedding material or feeders.
- **Slatted / solid floor:** Drainage is essential, but the use of solid floor is possible, with the advantage that it stays wet and cool for a longer period.
- **Further enrichment:** After showering or wallowing, pigs like to rub their skin, e.g., against brushes or tree trunks.

Further information

- **Bio Suisse (2021)**: Standards for the production, processing and trade of "Bud" products. At: partner.bio-suisse.ch [Link].
- **EAER (1997)**: EAER Ordinance on organic farming SR 910.181 of 22 September 1997 of the Federal departement of economic affairs, education and research (EAER). At: www.fedlex.admin.ch [Link].
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CORE organic

Improved concrete outdoor runs in housing systems for growing-finishing pigs: automatic manure scrapers

Description

Keeping fattening pigs indoors with access to concrete outdoor runs is common within organic pig production in Europe. The main environmental impact in this type of production system is related to ammonia emission from urine and faeces in the outdoor run.

Automatic scrapers in the outdoor elimination area reduce the farmer's workload while providing the possibility to increase scraping frequency. More frequent removal of manure from the elimination area, in turn, reduces ammonia emissions and thereby reduces the environmental impact.

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run
Production stage
All stages of pig production

Welfare Environment Cost

Legislation

There is no organic farming regulation in Europe regarding ammonia emissions or the cleanliness of outdoor runs for pigs.

Relevance for animal welfare

Good pen hygiene and access to a dry lying area are important to keep pigs clean and promote good animal welfare.

More frequent scraping of the toilet area in the outdoor run can improve pen hygiene, both indoors and outdoors. Frequent scraping and a good drainage of wet excretions to keep outdoor areas dry is especially important during the summer, as pigs may wallow in faeces or urine, which is detrimental to both health and ammonia emissions.

There is limited knowledge on the risk of injuries for pigs from automatic scrapers. Hence, no recommendations to decrease the risk of injuries for the construction or use of this technology can be made. Scrape-systems that move the manure across or between different groups of animals, however, increase the risk of spreading diseases.

Automatic scrapers removing manure daily or several times per day if needed, can reduce ammonia emissions.

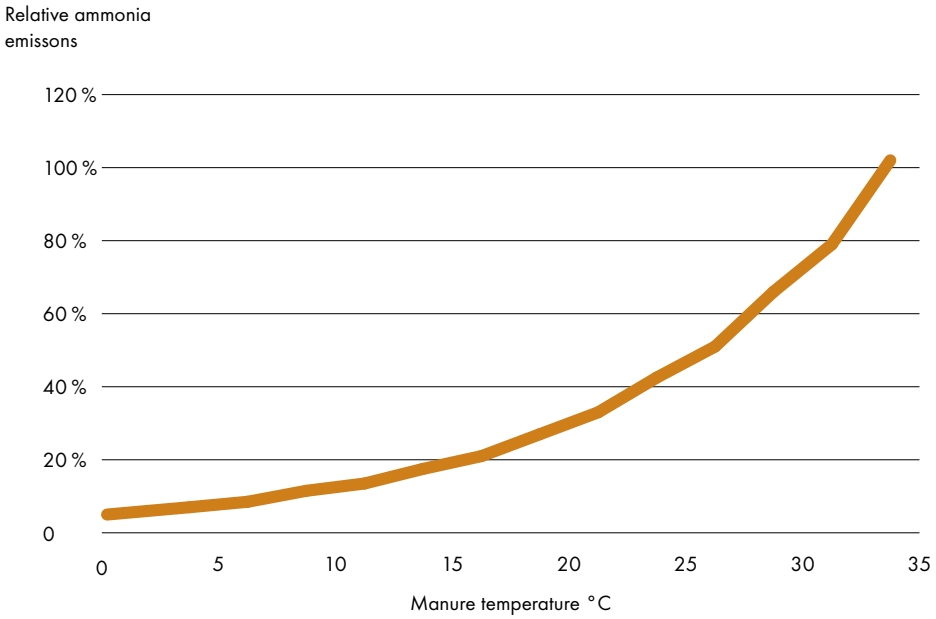

Figure 1: Graph of the relative ammonia emissions in relation to manure temperature. The higher the manure temperature, the more ammonia is emitted. At a manure temperature of 15° C, the relative ammonia emissions are at a level of 20 %, whereas at 30° C the level of relative ammonia emissions increases to around 80 %.

Relevance for environmental impact

- Ammonia emissions increase exponentially with higher temperatures (Figure 1).
- One effective way to reduce ammonia emissions from the outdoor run is to increase the cleaning frequency. Daily scraping of the toilet area during the warm period of the year considerably decreases ammonia emissions compared to no scraping for several days. A dry clean area has no to hardly detectable ammonia emissions.
- While outdoor areas are generally cleaned 1 to 3 times a week, an automatic scraper allows to remove manure daily or even several times per day, if needed.
- To further reduce emissions, the pen and outdoor run design should incentive pigs to excrete in a designated part of the run, reducing the total area where excretions occurs. Pigs naturally prefer to keep excretion areas away from lying and feeding area, and this willingness increases with age. Thus, when lying and feeding areas are provided indoors, pigs prefer to excrete in the outdoor area. Therefore, the outdoor run should be structured to allow the separation of behaviours.
- The addition of roughage or rooting areas in the outdoor run can reduce the total area used for excretion.
- Different groups of pigs can have different excretion behaviours, that cause a variation in ammonia emissions.
- Lastly, to decrease ammonia emissions good manure management principles need to be followed. This includes that removed manure is kept in a covered storage, which helps to save nitrogen for crop production.

Cost and labour

- Technologies for the automatic removal of manure on the floor are available for different livestock species. Most common are scrapers used on both solid and slatted floor. Scrapers can be either pulled in rope, chain or cable by an electrical motor or by and hydraulic rail. These usually entail high investment costs, but reduce the workload as compared to scraping with a loader.
- If automatic scrapers are retrofitted to existing outdoor runs, adjustments in the layout can be required and imply additional costs.
- On the other hand, cleaner outdoor areas can reduce soiling of the indoor areas and thereby lower the workload for cleaning or renewal of the bedding material.

Recommendations / requirements

- **Design:** The outdoor area should be designed in a way that motivates pigs to use a designated area for excretion in the outdoor run. It is also important to have good drainage of the outdoor run, especially to dry up wet concrete areas not covered by automatic scrapers.
- **Warm weather:** The frequency of manure removal should be increased during warm periods of the year to decrease ammonia emissions.
- **Manure management:** To reduce the farm's total ammonia emission it is important to have good manure management, including frequent removal of manure, covered storage of manure and incorporation in soil within a few hours after spreading on cultivated fields.
- **Safety:** Scrapers with electrical motor can be fitted with safety stops that are activated if a pig blocks the scraper. Supervision of the pigs during scraping an area is recommended, or to lock the pigs away from the area.
- **Cold weather:** Longer periods of cold weather with ice and snow can be challenging for scrapers. However, hydraulic scrapers are easily removed and areas can be scraped with a loader during these periods.
- **Robots:** Automatic robots are used in cattle production to vacuum clean alleys. This technique could reduce the risk of spreading diseases between pens, but the robots need to be adapted to pig stables.

Further information

- **Salomon E. et al. (2020)**: Ammonia emissions from outdoor fattening pigs on concrete pad – a farm case study. In: Proceedings of the IAHA video pre-conference on organic animal husbandry, pp. 44-47 [Link].

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CORE organic

Improved concrete outdoor runs in housing systems for growing-finishing pigs: temporary access to pasture

Description

In organic temporary pasture systems, pigs are housed indoors with access to an outdoor run year-round and pasture or woodland for predetermined periods during the day.

In general, the main aim of this system is diet supplementation by the provision of forage. Access is then typically granted for several hours during the day, but only during the pasture growing season to protect the sward. When the primary aim of pasture access is exercise and the prevention of boredom, access is often granted year-round on relatively small pieces of land, but only for short periods, such as one hour, twice per day.

Pastures that are used as exercise or foraging areas for pigs should always be flat. In addition, they should be located near the stable, otherwise herding the pigs back indoors gets labour intensive. To protect the sward, pasture access should never be granted when the ground is wet.

According to EU and Swiss regulations, temporary access to pasture cannot be the only access to open air areas but is always an addition to other outdoor areas, like an outdoor run.

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run and temporary access to pasture
Production stage
All stages of pig production

Welfare Environment Cost

Legislation

- Biosecurity measures are critical when keeping pigs on pastures. In several European countries, such as Germany, France and Italy, a double-fencing of outdoor pig enclosures is required to prevent nose-to-nose contact with feral pigs. Most environmental and water protection laws furthermore restrict the installation of pig pastures close to bodies of water, groundwater recharge sites or areas at risk of flooding
- Nose-ringing of pigs in temporary pasture systems is forbidden in the EU since "nose-ringing is only allowed when the animals are kept in outdoor husbandry systems" (Dir 2008/120/EC).
- In Switzerland, nose-ringing of pigs is not allowed in any production system (Swiss Animal Protection Ordinance (AniPO, SR 455.1).

A mobile piggery helps to incorporate organic pigs in crop rotation and pasture management.

In this system, a cultivated pasture can represent up to 40 % of the fattening pigs' diet.

Relevance for animal welfare

Temporary access to pasture or woodland stimulates the innate exploration and rooting behaviour of pigs, thus allowing the expression of species-specific behaviour. This significantly reduces frustration and boredom in pigs, preventing in turn harmful, misdirected exploration behaviour, such as tail and ear biting. The increased physical activity furthermore improves the pigs health and locomotor system. If the pasture is sufficiently large, foraged grass can contribute significantly to the diet and improve the health of the digestive system, while reducing feed expenses.

Relevance for environmental impact

- With suitable stocking rates, the grazing pigs will provide nutrients, e.g. nitrogen and phosphate, whilst their foraging behaviour will stimulate new growth that utilises the nutrients.
- However, it is essential that pasture deposited manure is not concentrated in one area and that large areas of pasture or forest are not left as bare soil since this could lead to excess leaching and ammonia losses.
- Overall, access to pasture or forest should reduce emissions, reducing losses during manure storage and subsequent spreading.

Cost and labour

- Depending on how much time pigs spend on the pasture, appropriate infrastructure has to be purchased. Fencing and drinkers are the minimum investments. An estimation of the cost of pasture infrastructure for Switzerland can be found in the FiBL technical leaflet on the outdoor rearing of pigs (see further information).
- If well managed, cultivated pastures can contribute up to 40 % of the diet of fattening pigs. Unless access to the pasture is automated or permanent, daily labour will be required to herd the pigs in and out of the pasture. In rotational pasture systems, the position of pasture infrastructure furthermore needs to be changed every 6 to 21 days. Lastly, labour is required for reseeding, as well as the sanitation of pasture and equipment. On the other hand, if pigs spend considerable amounts of time on the pasture, most of their defecation will happen there, reducing the required amount of labour for cleaning and changing bedding material.

Recommendations / requirements

- **Land:** Requirements for the land strongly depend on the amount of time pigs spend on the pasture per day. The more time is spent, the bigger the pasture has to be. Forage pastures, for instance, usually provide around 300 to 500 m^2 per sow and year. Exercise pastures, on the contrary, can be as small as 8 m^2 per pig and year.
- **Pasture management:** A rotational system, in which pastures are grazed 4 to 6 days and then rested at least 30 days, ideally longer, is optimal for pasture growth and maximises pasture productivity. Most farmers reseed uprooted areas of the pasture after the pigs have left. To protect the sward and prevent rooting, pigs should be herded into the pasture when hungry and back indoors when satiated. Another possibility is to designate a specific area for rooting, which is made attractive by scattering beet or maize cubes.
- **Fencing:** Outdoor lots for pigs should be double fenced and be wild boar proof to prevent the spread of highly contagious diseases, such as the African Swine Fever.
- **Health:** Humid and muddy areas on the pasture can increase the risk of endoparasites. Therefore, pastures should regularly be rotated, all pasture equipment sanitised, and faeces regularly analysed for worm infestation.

Further Information

- **EU (2008)**: Council (EU) Directive 2008/120 laying down minimum standards for the protection of pigs. At: eur-lex.europa.eu [Link].
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CORE organic

Improved health, welfare and viability in young pigs: general information and legislation

Description

Newborn piglets are highly sensitive to low ambient temperatures and delayed or insufficient intake of colostrum. These factors contribute to high levels of piglet mortality, in both, indoor and outdoor herds (13 to 40 % mortality, depending on the type of farm and management). Underlying causes are large litter sizes due to the use of conventional breeds with low birth weights, low level of human intervention, poor design of farrowing pens, lack of micro-climate control, and reduced possibilities to cross-foster. After the neonatal period, the most common health disorders for organic piglets are diarrhoea, anaemia and parasitic infections. The POWER project evaluates the efficacy of several types of action to reduce piglet mortality and health problems: improved management of sows and farrowing pen design for optimised maternal and piglet behaviour, design and management of piglet nest to improve its use, selection of sows with high potential for piglet survival, alternative solutions for iron supplementation to avoid anaemia, supplementation of probiotics to improve gut health, and a prolonged lactation to improve the robustness and growth of piglets.

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run and pasture access
Production stage
Sows + piglets, weaners

Every measure and tool introduced will be scored according to it's impact on animal welfare, CO_2 + NH_3 emissions and finances.

- welfare: **no or little** impact
- welfare: **positive** impact
- welfare: **high positive** impact
- environment: **no or little** impact
- environment: **positive** impact
- environment: **high positive** impact
- **low** costs
- **medium** costs
- **high** costs

Legislation

EU organic Regulations 2018/848 and EU 2020/464 stipulate the following:

- "Organic livestock housing conditions and husbandry practices should (…) ensure a high level of animal welfare" and that "any suffering, pain or distress should be avoided, or should be kept to a minimum at all stages of the animals' lives".
- Lactating sows must be housed in pens providing at least 7.5 m^2 per sow and access to an outdoor area of at least 2.5 m^2. A "sow must be able to move freely in her pen and her movement shall only be restricted for short periods".
- Organic piglets must be fed with maternal milk for a minimum period of 40 days.
- Tail-docking and cutting of teeth shall not be carried out routinely. Physical castration of male neonates is allowed, but only if performed before 7 days of age and with adequate anaesthesia / analgesia.
- The use of feed materials of microbial or mineral origin, and feed additives, is allowed under certain conditions defined in the regulations.

Animals raised outdoors encounter a wide variety of microorganisms and nutrients in the soil and pasture that are useful for their health and absent indoors.

- Regarding the treatment of sick piglets, the regulations stipulate that "phytotherapeutic and homoeopathic products shall be used in preference to treatments with chemically synthesised allopathic veterinary medicinal products, including antibiotics". Apart vaccinations, treatment to prevent suffering at castration, and against parasites, only one chemical allopathic veterinary treatment is authorised in the life of a growing-finishing pig.

Relevance for animal welfare

Beyond the specific points covered by the regulations, the obligation to prevent animals' suffering, pain or distress of animals implies that efforts must continue to improve the welfare of piglets in organic systems. The actions tested in POWER meet this objective by testing solutions to improve the comfort of piglets, reduce health disorders of piglets and improve piglet survival, that ultimately reduce the suffering associated with disease or agony:

- Genetic selection for piglet survival will reduce the number of dying and suffering neonates.
- The optimisation of the nest design will improve thermal comfort and avoid that piglets suffer from hypothermia.
- Increasing the farrowing area may stimulate maternal behaviour, promote colostrum intake, and thus favour the survival of neonates.
- Improving iron supply during lactation will avoid anaemia and thus contribute to the proper functioning of the immune system of the piglets and prevention of infections.
- Improving the gut microbiota and extending lactation length should result in better gut health and greater gut maturity at weaning. In turn this should prevent gut disorders, that are sources of pain and can even lead to death.

The pros and cons of all these strategies, regarding welfare, environmental and economic impacts are evaluated in the factsheets of this handbook.

Relevance for environmental impact

- The environmental impact of raising a piglet is mainly incurred by rearing and maintaining its mother. These environmental costs hardly increase with a growing number of piglets weaned per litter.
- Therefore, increasing the number of weaned piglets and high weaning weights minimises the impact per kilogram produced.
- Decreasing piglet mortality during lactation will reduce the environmental footprint of each piglet.
- Improving piglet health and viability around weaning contributes to enhanced weight gain and feed efficiency in the growing-finishing stage, and thus to a better environmental footprint of pigs.

After weaning, the most common health disorders for organic piglets are diarrhoea and parasitic infections. For weaners raised outdoors, the environmental conditions may favour contamination by common swine parasites in comparison with indoor rearing. On the other hand, the percentage of weaning diarrhoea is lower outdoors than in organic indoor farms.

The design of farrowing pens is crucial for piglet survival. Space allowance, bars on the walls and a piglet nest can reduce piglet mortality by crushing in free farrowing systems.

Further information

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CORE organic

Improved health, welfare and viability in young pigs: designing an organic farrowing pen

Description

A well-designed farrowing pen creates a safe environment for the sow, the piglets and the farmer. Dividing the pen into areas for the needs of the sow and the piglets ensures optimal use of the space, adequate temperature and easy management. Non-slippery flooring and the allowance of appropriate bedding enable the sow to exhibit her natural behaviour of nest-building around farrowing. Easy access to the piglets and the option to separate the sow ensure the farmers' safety during inspection and care of the animals.

Legislation

EU organic Regulations 2018/848 and EU 2020/464 stipulate the following:

- Minimum space allowance per sow and litter is 7.5 m² indoors with a mandatory addition of 2.5 m² outdoors.
- Floors shall be smooth, but not slippery. At least half of the indoor surface areas must be solid.
- Ample dry bedding material (straw or other suitable material) must be provided in the resting area.

The Swiss Animal Protection Ordinance (AniPO, SR 455.1) stipulates that farrowing pens have to be designed so that the sow is able to turn around. Likewise national regulations in Sweden and Norway prohibit the use of farrowing crates, where the sow is not able to turn around, in all production systems – organic as well as conventional.

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run
Production stage
Sows + piglets

Welfare Environment Cost

Relevance for animal welfare

- The design of the farrowing pen influences the sows' ability to exhibit her natural behaviour, protects piglets against cooling and being crushed by the sow, and ensures good hygiene and easy control of the health of the animals.

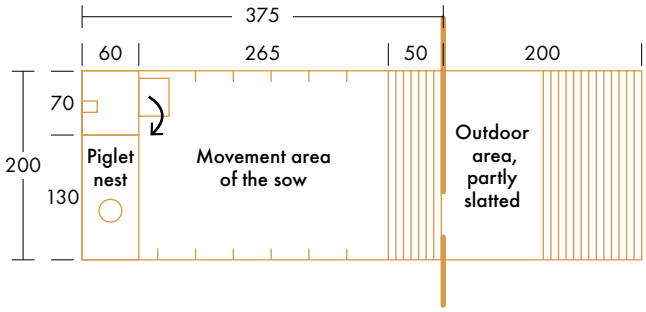
Relevance for environmental impact

- Proper insulation of the building and providing a warm microclimate only in the piglet nest, reduces the energy consumption for heating.
- Heating the whole barn can even be detrimental for the sows as they need ambient temperatures around 15 °C. Piglets on the other hand need ambient temperatures of up to 33 °C. Therefore they will use the heated piglet nest less frequently if the whole barn is heated, increasing their risk of being crushed.
- A sloping floor indoors and outdoors (1-2 %), as well as a functioning drain, ensure suitable drainage of liquids and reduce ammonia emissions.

Cost and labour

- Observation of the pigs can be simplified by ensuring that farrowing pens are easy to overlook and/or recorded with cameras.
- For the necessary treatments of piglets, the possibility to separate the sow indoors or outdoors improves work safety.
- Frequent monitoring without disturbing the sows around farrowing can save piglets, most sows farrow in the evening or night.

Figure 1: Separate areas of a farrowing pen



Layout example of a farrowing pen consists of different areas. The lying area provides space for the sow to rest, feed and move around. It should have at least 4 m², so that the sow can turn around. Before farrowing adding some extra long straw to the lying area, is recommended, so the sow can use this bedding material for nest building. The piglet nest should be heated, as piglets need a higher ambient temperature compared to the sow. The outdoor run is used for exercise, resting, dunging and rooting.

Picture10.1: Keep-off rails create a save space for piglets when the sow is lying down and therefore help to reduce piglet crushing.

Recommendations

- Farrowing pens should be divided into separate areas (see Fig. 1).
- **Indoor area:** Depending on the size of the sows, a minimum 7.5 m² indoor area (EU 2020/464) might not be enough.
- **Lying area:** The lying area of the sow should be big enough for her to turn around easily. A diameter of 2.4 m is usually suitable. Continuous fixation of the sows in crates during farrowing and the lactation period is not allowed.

Picture 10.2: Using windbreaks and plastic curtains can help to prevent drafts in the farrowing pen.

Picture 10.3: Bowl drinkers can be installed at a suitable height for both, the sow and piglets.

- **Prevent crushing:** The piglets must be able to walk around the lying sow to prevent crushing, which can either be achieved by keep-off rails on the pens′ walls (see picture 10.1) or by providing more space.
- **Materials:** Since the surface must be easy to clean and disinfect, the use of plastic is recommended.
- **Floor:** Flooring should be non-slippery, so the sow can move securely, but not too rough to avoid joint lesions in piglets. Concrete with sufficient straw, mixed with sawdust to better absorb liquids, is a good solution.
- **Bedding material:** Chopped straw or a similar bedding material should be used to make sure, that newborn piglets can walk freely.
- **Draft:** A draft inside the pen should be avoided. Swivel doors or solid walls can be used as a windbreak (see picture 10.2).
- **Feeding area:** The feeding trough of the sow should be easy to reach from the service aisle, and visible to the piglets.
- **Water source:** Water should be provided in bowl drinkers for both the sow and piglets, so the piglets learn from the sows (see picture 10.3). The mother-child waterer should be protected from frost and positioned close to the outlet so that overflowing water can drain off easily.
- **Separation of the sow:** There should be a fast and easy option to separate the sow from the piglets. Solutions are a lockable door to the outdoor run, or a swivel fence to lock the sow while eating.
- **Ambient temperature:** The pen should be divided into temperature zones: 30-33 °C in the piglet nest, > 15 °C in the pen. Depending on the season, additional heating during farrowing might be necessary.
- **Piglet nest:** The piglets nest should be easy to reach from the service aisle to simplify their observation.
- **Access to piglet nest:** When (some) curtains of the piglet nest are open on the first days after birth, the nest is more accessible for piglets.
- **Outdoor run:** The outdoor run should be big enough for proper use by the sow and mechanical cleaning. A minimum of 2.5 m^2 for outdoor runs (EU 2020/464) is too restricted; 4 m^2 (2 x 2 m), should be the minimum area of an outdoor run.

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Improved health, welfare and viability in young pigs: how to encourage piglets to use their nest

Description

The piglet nest is the warm, safe area of a free farrowing pen where piglets are protected against cold and being crushed by the sow. Therefore improving its use can help to improve the chances of survival. In an experiment, piglet nests with floor or lid heating, with and without lighting and temporary confinement of the piglets were compared to assess how frequently the piglets used the nest within their first three days of life.

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run
Production stage
Sows + piglets

Welfare Environment Cost

Legislation

- Following the EU organic Regulations 2018/848 and EU 2020/464, the suckling period should be 40 days or more. EU regulations don´t give specific rules for the design and management of the piglet nest. Only the indoor pen size is regulated and has to be at least 7.5 m^2.
- German Regulation for Productive Livestock (both organic and conventional, TierSchNutztV 2006): The floor in the lying area of suckling piglets must be solid. It must be either insulated and heated or covered with bedding. Within the first 10 days of life, the temperature in the lying area of the piglets must be 30° C or more.
- The Swiss technical directive on the welfare of pigs ("Tierschutz-Kontrollhandbuch") stipulates that the piglet nest must be heated to >30 °C in the first 3 days of life and piglets must have permanent access to the nest.

Relevance for animal welfare

- As restriction of movement is only allowed for short periods, organic sow management allows the animals to move freely and perform species-specific behaviour. Piglet losses can still occur because free farrowing can be associated with an increased risk of piglets being kicked or crushed by the sow. Due to both ethical and economic considerations, one of the aims of organic pig husbandry is to reduce piglet losses as much as possible. Early and frequent use of the piglet nest can improve piglet survival because it reduces the risk of cooling and being kicked or crushed by the sow.

A heated, bedded and insulated piglet nest provides a suitable resting area for suckling piglets.

Relevance for environmental impact

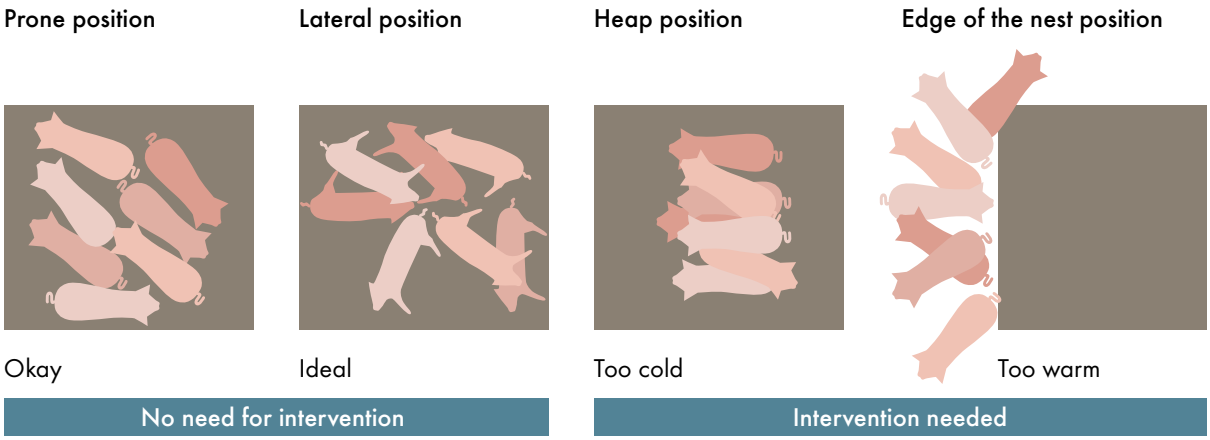
- Providing a warm microclimate only in the piglet nest instead of heating the whole barn reduces the total energy consumption for heating.
- An insulated piglet nest further decreases energy requirements.
- In our study, energy consumption was lower with underfloor heating than with lid heating. However, lower temperatures were also present; this did not show any directly discernible effects on piglet nest utilisation.
- Energy consumption for lighting in the piglet nest is very low when LEDs are used.

Cost and labour

- Over its lifetime, the cost of operating a piglet nest, i.e. the energy for heating, generally surpasses its acquisition cost. Therefore, energy efficiency of the piglet nest pays off long-term.
- The acquisition costs for electric floor- or lid-heating don't differ (€ 200 in Germany 2020).
- Locking the piglets inside their nest during the feeding times of the sow took only two minutes on average in our study.

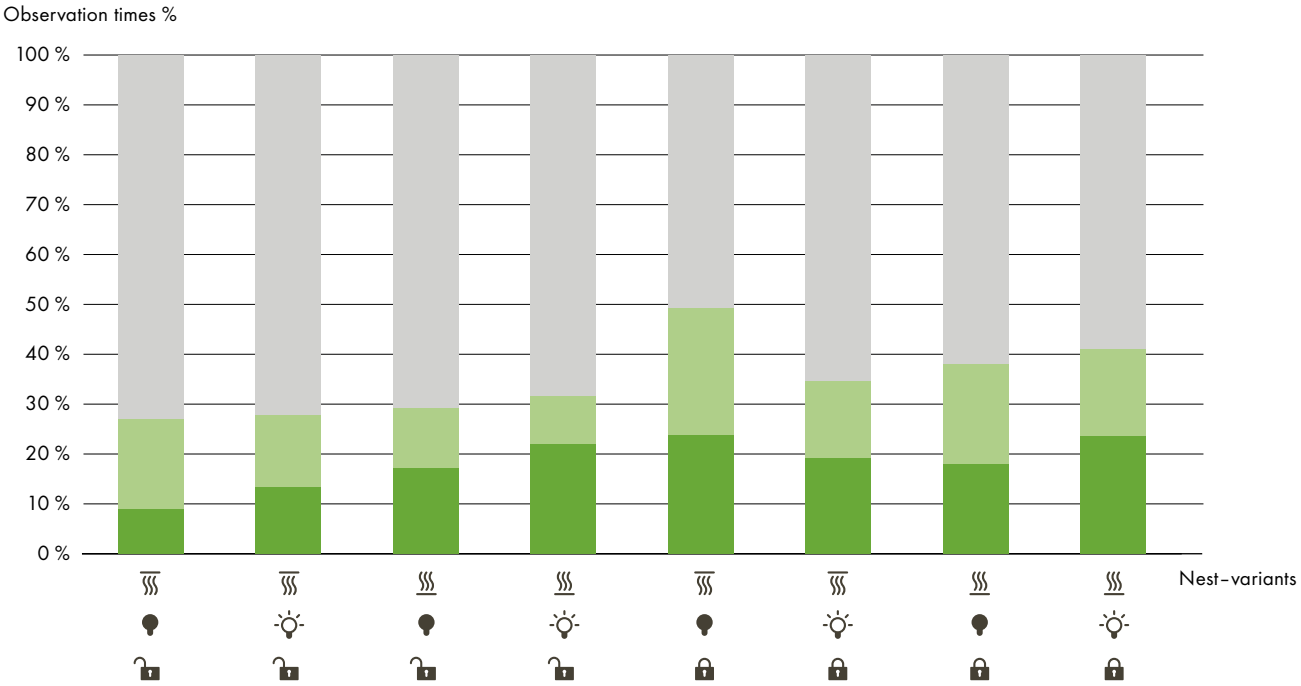
Recommendations

- **Size of the nest:** The piglet nest should be large enough to provide space for all piglets of the litter at the same time. Usually 0.8–1.0 m^2 should suffice.
- **Location of the nest:** A piglet nest close to the lying area of the sow ensures quick and easy access after birth. It is recommended to install the piglet nest adjacent to the service aisle, to allow comfortable control by the farmer.
- **Curtains:** To avoid drafts, curtains should be installed to close the nest. After farrowing, the curtain should be opened to allow easier access for the newborn piglets.
- **Temperature:** The temperature in the nest should be 30 °C or more, during the first days after birth. It is recommended to check them regularly.
- **Lying position:** The use of the piglet nest and the lying positions of the piglets allow conclusions to be drawn about the design's quality and the temperatures. However, these correlations are not yet as reliable in the first days of life, as the young animals naturally lie in a heap and with the mother sow a lot and have to get to know the nest first.



Within the first days of life, piglets tend to lie in a heap position with their mother, regardless of the ambient temperature. Therefore, it is only recommended to use the lying position of the piglets to estimate the temperature conditions when the piglets are already some days old. In principle, however, the pile position can indicate too low temperatures, which should then be increased. If the piglets are lying in a litter position at the edge of the nest or in front of it, the temperature in the nest seems to be too high and should be checked. There is no need to change the temperature in the piglet nest if the piglets are lying in a prone or side position in the nest.

Figure 1: Comparison of different piglet nest designs



In the POWER project 6 measures regarding piglet nest design and management were combined to 8 nest-variants. These were compared in terms of piglet nest use by video analysis. In nest-variants, where piglets were confined during the sow's first 4 feeding times after farrowing, the nest was empty less often, than nest-variants without confinement. Thus, piglets of the nest-variants with confinement seemed to use the nest better. The time piglets were confined was not added to the observation time. The different nest designs in terms of heating and lighting do not seem to affect nest use.

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A piglet nest made of plastic and metal can be cleaned especially well.

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CORE organic

Improved health, welfare and viability in young pigs: breeding for improved piglet survival

Description

Often the same genetic lines, where large litter size is an important selection criterion, are used in organic and conventional European farms. Large litters result in significant piglet losses in the first days of lactation.

Practical rules for the management of supernumerary piglets and their adoption by nurses exist, but are difficult to implement in many organic farms where births are not tightly grouped and where the number of sows per batch is often low. In outdoor production where human interventions around birth are challenging, crossfostering, obstetrics and neonatal care are nearly impossible.

Large litters are also associated with a high proportion of low birth weight piglets that have a high risk of dying if the number of functional teats is insufficient for the whole litter to suckle.

A frequent cause of piglet mortality is crushing, which can occur in any system. It is dependent on leg soundness and the sow's attention towards piglets. Therefore, piglet mortality could be reduced by choosing less prolific sows with high leg soundness, enhanced nursing ability including improved maternal behaviour towards piglets as well as enhanced milk production.

Legislation

EU organic Regulations 2018/848 and EU 2020/464, stipulate that:

- Any suffering of the animals […] shall be kept to a minimum.
- The choice of breeds shall also contribute to the prevention of any suffering.
- Organic farming respects high animal welfare standards and aims to meet the animals' species-specific behavioural needs.

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run and pasture access
Production stage
Sows + piglets

Welfare Environment Cost

Piglets that miss several nursing events have a higher risk of mortality.

The sow's attention towards piglets before lying down is favourable to survival.

Relevance for animal welfare

Piglet mortality is high in organic production and can reach 35 %, conflicting with the organic principles to ensure high animal welfare. Postnatal death due to crushing by the sow and piglet starvation is a source of intense suffering that should be shortened by euthanising the piglets as soon as they are detected as non-viable. However, euthanasia is not a satisfactory solution. To truly improve animal welfare, early postnatal death should be avoided. It can be achieved through a combination of solutions based on better housing and management and genetics adapted to organic farming.

Relevance for environmental impact

- The direct environmental impact of using breeds adapted to organic farming is supposed to be low even though it should be positive, since any reduction in animal losses increases the system's efficacy and hence reduces the environmental impact.

Cross-breeding improves numerous biological characteristics.

Cost and labour

- Economic losses associated with early piglet mortality may markedly impair the sustainability of pig production.
- Detecting and removing dead or dying piglets in the pen, the hut or the paddock daily is time consuming.

Recommendations

- **Breeding lines:** To optimise genetic lines for reducing piglet mortality outdoor, rustic (traditional) breeds, synthetic lines and cross-bred sows that benefit from heterosis effects (i.e., vigour due to the mix of two genetics) are recommended since they should be more robust and piglet survival should be higher.
- **Selection of breeding animals:** The two-breed rotational cross can be applied. It uses boars from pure sire lines in alternate generations to increase performance on the farm, retaining cross-bred females for maternal stock. Recourse to a multiplier at the initial stage is recommended to benefit also from the progress achieved with conventional selective breeding.
- **Piglet mortality:** Farmers should have an active role in selecting pigs for reduced piglet mortality, choosing replacement gilts from the best dams they have on the farm. To ensure piglet survival, dams without leg or lactation problems and with good behaviour, i.e., precautious when lying down and positive interactions with piglets and humans, should be preferred. Postural activity observations and scoring in the perinatal period helps identifying females at risk of stillbirth, of crushing piglets and of having starving piglets (e.g. lying on the belly to limit nursing).
- **Litter size:** A balance between the number of piglets born and sow maternal capacity should be the target. Genetic solutions can be set up if farmers collect standardised data and pedigree information and mutualise them.

Further information

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CORE organic

Improved health, welfare and viability in young pigs: oral iron supply in neonatal piglets to avoid anaemia

Description

Piglets have low iron stores at birth, but their iron requirements are high due to rapid growth. Sow milk is poor in iron, but piglets in their natural environment find sufficient iron in the soil. Therefore in most outdoor systems iron supplementation is not necessary.

For piglets reared indoors with or without an outdoor run, iron provision is required from about three days after birth to prevent any risk of anaemia.

Most commonly, an intramuscular or subcutaneous injection of iron is used. Oral supply is also possible and is administered in the form of a paste directly into the mouth of the piglets on a few consecutive days. Another option is to distribute a powder enriched in ferrous salt in a piglet trough for a couple of weeks.

Iron supplementation products need to be certified for organic agriculture. Otherwise, peat, soil or other substrates naturally rich in iron, e.g. composted river mud, used as a renewable alternative to peat, can be distributed daily during the lactation period, provided they are free from pathogens.

Iron supplementation is necessary soon after birth to prevent any risk of anaemia during the first weeks of life. The iron-rich powder or peat needs to be accessible to the piglets but not to the sow.

Applicability box

Theme
Pigs
Farm type
Indoor housing with or without outdoor run and pasture access
Production stage
Sows + piglets

Welfare Environment Cost

Legislation

- The EU organic Regulations 2018/848 and EU 2020/464 allow ferrous carbonate, ferrous sulphate and ferric oxide as nutritional additives.
- Apart from vaccinations, treatments to prevent suffering at castration and against parasites, only one chemical allopathic veterinary treatment is authorised in the life of a growing-finishing pig. If certifying bodies consider the injection of iron as an allopathic treatment, as is the case e.g. in France oral solutions must be preferred.

Relevance for animal welfare

Anaemia leads to a decreased production of red blood cells, impaired immune function and growth, and is, therefore, a major issue for the piglets' health and welfare. When supplying iron by injection, stressful handling of each piglet is unavoidable. Furthermore, dosing is not easy. Most frequently, a single dose of 200 mg is used. Iron is then stored in the liver, but storage may become insufficient 3-4 weeks after the injection. Still, the dosage should not be increased, as high amounts of iron in one dose may favour oxidative stress and play a role in inflammatory processes like arthritis.
The advantage of oral iron supply for several weeks is, that the gut regulates iron absorption precisely per the piglet's needs. Furthermore, the supply of small quantities of a highly appetising feed or peat acts as environmental enrichment for piglets and helps them learn how to eat solid food.

Relevance for environmental impact

- The environmental cost for producing and packing iron supplements has not been studied, but the impacts per piglet will be low due to the small dose per piglet. Furthermore, the iron that the piglet`s gut has absorbed is not excreted into the environment through urine or faeces.

Cost and labour

- Iron treatment is inexpensive.
- Oral supplementation of iron is more time consuming than injection, since it is repeated daily over one or several weeks.

The innate curiosity of piglets leads them to learn quickly to consume small amounts of the iron supplemented product. The addition of this palatable product in the pen also facilitates the learning of solid food consumption.

Recommendations / requirements

- **How much to provide:** In free-range systems, no iron supplementation is needed unless soils are abnormally poor in iron. Indoors, piglets should be supplied by intramuscular injections (200 mg of iron), orally by a paste (two doses of 100 mg of iron are recommended), by voluntary intake of a commercial ferrous powder distributed on top of peat (following the supplier's dosage recommendations), or by voluntary intake of a natural substrate containing iron like soil or peat and distributed daily in a trough (start with 15 g, and increase progressively until 25 g / piglet per day).
- **How to stimulate voluntary intake:** Peat, soil or powder containing iron should be fresh and hence supplied daily in a trough distinct from the one used for feed. The trough with iron supplement must be located close to the heating lamp and inaccessible to the sow.
- **How to prevent risk of iron deficient piglets:** Individual piglets that are pale or litters with low spontaneous oral intake of iron supplement should be supplied with iron, either by gavage with an oral paste or by injection.
- **What to do in case of diarrhoeic episodes on the farm:** In case of diarrhoea, the iron intake by the gut may be decreased. Additionally, the iron present in the digestive tract can be used by the present microorganisms, especially by gut pathogens, for their own growth. Therefore, the injection route should be preferred to oral supplementation.

Further information

- **EU (2018)**: Regulation (EU) 2018/848 on organic production and labelling of organic products. At: eur-lex.europa.eu [Link].
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POWER

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CORE organic

Improved health, welfare and viability in young pigs: using microorganisms to improve piglet health

Description

Weaning is a critical event in the pig's life cycle, frequently associated with severe enteric infections and it is the ptimary cause for economic loss to pig farmers. Weaning generates a combination of stressful factors such as changes in nutrition, environmental hygiene or temperature, the stress of transport, mixing with unfamiliar animals, etc. These adverse conditions weaken the barrier function of the gut microbiota and favour enteric disorders. A well-structured and diverse gut microbial ecosystem can provide the host with many beneficial functions, as it provides resistance to pathogens, modulates the activation of the gut immune system and enhances robustness to adapt to different environmental changes.

Prebiotics or probiotics can be used to facilitate the adaptation of gut microbiota to weaning and prevent the use of antibiotics. Prebiotics are food components that favour the growth of good microbes in the gut, while probiotics are micro-organisms that are directly given to the animals. Selected microbial strains can be purchased commercially, but natural products can also be used, like whey or hand-made fermented products.

In organic outdoor farms, the occurrence of weaning diarrhoea is lower than in organic indoor farms. We hypothesise that the later age of weaning and the contact with the natural environment can explain the lower diarrhoea incidence in outdoor piglets. Especially, oral contacts with the microbes from the soil and grazing the vegetation could act as natural pre– and probiotics and positively influence piglet microbiota. Inspired by this observation, the use of fermented forest litter diluted in drinking water to improve the gut health of weaning pigs is a strategy presently tested by researchers.

Applicability box

Theme
Pigs
Farm type
Indoor housing with outdoor run
Production stage
Weaners

Welfare Environment Cost

Legislation

- According to EU organic Regulation 2008/889, appropriate preparations of micro-organisms may be used to improve the overall condition of the soil or the availability of nutrients in the soil or in the crops.
- In Annex VI of EU organic Regulation 2008/889 states that enzymes and micro-organisms can be used as feed additives.
- Private organic standards should be consulted before the use of handmade products like fermented forest litter.

On the pasture weaners are exposed to microbes of high diversity, which can improve their gut health.

In indoor farms, the access to an outdoor run does not allow access to living plants and soil, leading to the development of a very different gut microbiota in comparison to piglets raised outdoors.

Relevance for animal welfare

Probiotic supplementation could help confer good intestinal health by stimulating the growth of a healthy microbiota preventing intestinal colonisation of enteric pathogens. *Lactobacillus* is the most commonly used probiotic agent. It produces lactic acid in the gut and reduces gut pH, limiting the growth of opportunistic entero-pathogen bacteria. It also has a positive action on intestinal microflora, immune status, and intestinal morphology.

Relevance for environmental impact

Efficient production is desirable in the context of environmental impacts. By improving the digestibility of nutrients and therefore increased feed efficiency, probiotics can increase growth performances. In addition, the use of *Lactobacillus* or probiotic in general can reduce the necessity of antibiotics. This in turn will reduce antibiotic residues as well as antimicrobial resistant microorganisms in the environment.

Cost and labour

- In general, the technique to use *Lactobacillus* is simple and easy to learn.
- The costs are related to the source of *Lactobacillus*. Manufacturers make selected microbial strains, but natural *Lactobacillus* are inexpensive and often byproducts of food production.
- The costs for fermented forest litter depends on the local price for organic bran and organic sugar. It can be estimated that 100 kg of the product only costs 15–20 Euros (10–15 Euros for 50 kg organic bran plus 5 Euros for organic sugar).

Recommendations

There are several recipes to grow microorganisms, many of them are used by humans to prepare food (e.g. bread, wine, sauerkraut) or feed (silage). Microorganisms are all around us, and it is easy to select and grow natural lactic bacteria. The forest litter offers the best selection of bacteria, fungal hyphae, actinomycetes algae and protozoa.

How to prepare fermented forest litter:

- **1) Collection:** Best seasons are spring and autumn. Only collect humid, rotten leafs without soil contamination.
- **2) Solid mixture:** Mix 1 part of forest litter and 2 parts of organic bran; add 0.08–0.1 part of organic sugar and water to reach a humidity of 40–50 %. Mix until the mixture is homogeneous and moist, but not too wet (it must not lose water). Press firmly in a water- and airtight container, close the container firmly and let the "silage" ferment under anaerobic conditions for at least a month.
- **3) Liquid mixture:** Mix 1 part of solid mixture, 10 parts of water and 0.1 part of organic sugar in a water tank and let it ferment with a aquarium aerator for 2–4 days. Subsequently, the solution can be diluted from 20 to 70 % in water before usage.

The two subsequent fermentations sanitise the product and enriches it with anaerobic microbial strains like *Lactobacillus* and yeasts.

Warning: this preparation is used in several countries for agricultural and zootechnical purposes, but we do not yet have definitive scientific data on its use.

The liquid fermented product of forest litter and bran contains easily 10^9-15^9 lactic bacteria / ml, that may help to improve gut health of weaners.

Further information

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CORE organic

Improved health, welfare and viability in young pigs: extended lactation to improve pig health and growth

Description

Extending the lactation is one strategy to reduce the risk of post-weaning diarrhoea.

In Denmark, a few large-scale pig producers successfully extended lactation to ten weeks in pasture systems. Ten vs. seven weeks of lactation was compared in an experimental design with 20 sows in individual paddocks and piglets weaned on pasture. Piglet weight at 10 and 14 weeks of age was comparable between treatments (see Table 1). No piglet diarrhoea was observed after weaning. Piglets weaned after ten weeks consumed on average 845 g per pig and day from seven to ten weeks of age but with a substantial variation between litters (388 g to 1,266 g).

Legislation

- EU organic Regulations 2018/848 and EU 2020/464 stipulate that pigs shall be fed with maternal milk for a minimum period of 40 days.
- In Switzerland piglets should not be weaned from natural milk before day 42 for label production (Bio Suisse regulation).
- In many European countries, including Denmark and France, industry agreements recommend a minimum average weaning age of 49 days.

Applicability box

Theme
Pigs
Farm type
Pasture s
Production stage
Sows + piglets

Welfare Environment Cost

Table 1: Comparison of weaning piglets at 7 or 10 weeks of age

Parameter	Weaning age			
	7 w[1]		10 w[1]	
	Mean[1]	SD[1]	Mean[1]	SD[1]
Piglet weight at 7 w[1], kg	19.7	4.5	19.4	4.2
Piglet weight at 10 w[1], kg	34.5	5.8	35.9	7.0
Piglet weight at 14 w[1], kg	65.8	9.1	66.7	9.0
Daily feed intake 7–10 w[1], g/pig	1,224[2]	–	845[2]	247
Daily feed intake 10–14 w[1], g/pig	2,400[2]	–	2,300[3]	–

Piglet performance and daily piglet feed intake when weaned at seven and ten weeks of age, respectively. All piglets were moved to outdoor paddocks after weaning.

[1]w = weeks; Mean = mean value; SD = standard deviation

[2]In weaner paddocks (n = 4)

[3]In sow paddocks (n = 10), exclusive intake of sow feed

Ten-week-old piglets that weigh on average 35 kg take up a lot of space at the udder. Although the sows were still lactating, no udder or teat lesions were observed after ten weeks of lactation in the POWER project.

Relevance for animal welfare

Under semi-natural conditions, the weaning process is gradual and is not completed before 13 to 17 weeks postpartum. An increased weaning age thus corresponds well to the central aim in organic livestock farming of allowing animals to express their natural behaviour. Further, it is expected to decrease the risk of weaning diarrhoea thanks to a more gradual shift from maternal milk to a plant-based diet, favouring the adaptation of the digestive abilities.

Hut- and nest size is an important aspect to take into account as in the POWER project each sow weaned on average 415 kg of piglets after ten weeks of lactation.

Relevance for environmental impact

- At weaning heavy and healthy pigs improve the overall feed efficiency in the fattening stage, which is important for reducing the carbon footprint of organic pork.
- However, the risk of nutrient losses in pasture systems will increase if the paddock area is not enlarged to take into account the higher N and P deposited per sow and piglets per lactation.

Cost and labour

- With extended lactations, fewer litters per sow are produced per year unless it is possible to induce lactational oestrus and successfully breed the majority of sows.

Recommendations

- **Length of extended lactation:** Weaning at 7 or at 10 weeks of age both seem to be equally suitable strategies to obtain good piglet health and very high piglet growth rates until 14 weeks of age if high piglet feed intake in addition to the sow's milk can be achieved before weaning and if piglets stay in an outdoor environment after weaning.

Average daily sow-feed intake in the POWER project was 14 kg/sow from 7 to 10 weeks of lactation. A part of the sow feed was consumed by the piglets. After 10 weeks of lactation, all sows were in good body condition (body condition score 3 out of 5) with an average back fat depth of 12.4 mm.

- **Piglet feeding before weaning:** Piglets should have access to feed starting at 2 weeks of age. The piglet feed dispensers should be located close to the hut and should be of sufficient size to allow several pigs to eat simultaneously. Shelter should be provided at the dispensers to protect the piglets from rain and wind while eating.
- **Piglet feeding after weaning:** Mix pre- and post-weaning feed mixtures the first few days after weaning to avoid an abrupt change in feed.
- **Lactational oestrus:** If breeding/insemination is not possible before weaning, lactating sows should be kept in single paddocks and without boar contact to reduce risk of lactational oestrus.
- **On the pasture:** Paddock size should be increased, huts and feeders should be regularly moved and sow-feed protein content should be reduced at the end of lactation when the milk production is declining to reduce risk of nutrient losses

Further Information

- **Bio Suisse (2021)**: Standards for the production, processing and trade of BUD products. At: www.bioaktuell.ch [Link].
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CORE organic

Best practice examples in combined housing and pasture systems

Description

All organic pigs in Europe are produced according to EU organic Regulations 2018/848 and EU 2020/464 and to the general principles of organic farming defined by IFOAM (https://www.ifoam.bio).

These stipulate that pigs must always have access to concrete outdoor runs, but not pasture. However, national legislations and private organic labels can have very different minimum requirements, especially concerning housing and management (for more information see factsheet 02. "Outdoor runs general information and legislation").

This part of the POWER project has aimed to identify and evaluate best practice examples and selected stakeholder-driven innovations in combined housing and pasture systems of organic pigs through-out Europe. In these systems, animals are housed both indoor and outdoor (pasture or woodland) during the production cycle. Various measures focussing on animal health and welfare, productivity, feed efficiency and manure and pasture management were collected at each farm to account for their diversity. These include a description of the system and hygiene levels, behavioural and clinical assessments of the animals, assessments of the farms' productivity, work load and labour force, and finally, a paddock assessment.

On-farm case studies were carried out during 2019 and 2020. Based on a common protocol, farm data were collected from one to two best practice farms in Austria, Denmark, Germany, Italy, Sweden and Switzerland, between one and two innovative farms in Denmark, Italy and Switzerland. Based on the collected data, the fact sheets discuss potential welfare issues, environmental impacts and labour or organisational details of the farms.

Applicability box

Theme
Pigs
Production stage
All stages of pig production

Farm type

- Indoor housing with outdoor run
- Indoor housing with outdoor run and access to pasture
- Outdoor housing

What makes a farm "best practice" or "innovative"?

- **Best practice:** In the project, best practice farms were defined as farms with a stable level of high productivity and animal welfare. This means that the farmers had to have worked with their system for several years, were not planning changes during the project period and were satisfied with their system. Moreover, the farm type and herd size had to represent commercial organic pig herds in that specific country.
- **Innovation:** Innovative farms were defined as having developed new systems and strategies that are different from the common best practice systems in the respective countries as well as having a high level of animal welfare.

Assessment of animal welfare

The housing system and management affects the welfare of animals. Different issues arise when looking at indoor or outdoor housing. Therefore, combined housing, a mixture of the two systems, includes issues from both systems.

Besides, when animals change between indoor and outdoor housing, e.g., with seasonal production or different production stages in different locations, they experience a change in their surroundings, regarding climatic conditions, different surfaces, and physical limitations which can also give rise to welfare issues.

Data on animal welfare from the farms presented in the following fact sheets are related to issues found in a previous study on animal welfare in various organic pig production systems (Leeb et al., 2019). This identified relevant clinical parameters to evaluate animal welfare in best practice and innovative farms of the present study.

- **Sows:** vulva lesions/deformations, lameness
- **Weaners:** diarrhoea, tail and ear lesions, short tails, runts and respiratory problems
- **Finishers:** diarrhoea, eye inflammation, tail and ear lesions, short tails and respiratory problems

The listed welfare issues are however, not uniquely found in combined housing systems but relate to pig production systems and management in general.

Assessment environmental impact – The life cycle analysis

Description

The project POWER showcases a variety of farms that stand out for their good management practice or innovative housing systems. Apart from improving welfare, organic pig production systems also strive to reduce their environmental impact. We calculate the emissions and environmental impacts of the selected best-practice and innovative farms in the following factsheet, using a so-called "farm-gate life cycle impact analysis". The results help to understand better ways in which organic pig farms can reduce their environmental impact.

Methods

- As part of the project, farm data from selected best practices and innovative organic farms was collected. Data included information on pig productivity, feed, housing and manure.
- A farm-gate life cycle impact analysis was then undertaken, accounting for all the inputs (e.g. externally sourced and home-grown feeds, energy usage and any purchased animals) and outputs (weaned or slaughtered pigs, depending on production stage). For each farm, environmental impacts in terms of greenhouse gas (GHG) emissions, terrestrial and marine eutrophication, as well as energy and water usage were calculated. All environmentally harmful gasses were converted to CO_2 equivalents (CO_2 eq) to make GHG emissions comparable. For more information on life cycle analysis , see the FiBL factsheet "Life cycle assessments of organic foods", shop.fibl.org, publication number 1020.
- Each farm's environmental impacts and GHG emissions were then allocated to the various farm outputs to obtain values per kilogram of weaned piglet, per kilogram of slaughtered pig, or per kilogram of culled sow. These results can be found in chapters 3.1 to 4.4 (pp. 63–118).

Pasture provides space and environmental stimuli that promote positive behaviours like rooting.

Overall results of the life cycle analysis

The life cycle analysis showed that the two most significant contributors to GHGs are emissions from manure storage and feed usage, both for breeding and the growing-finishing stage. The following patterns influenced emissions across farms:

- Farms that use faster-growing breeds require less feed per kilogram of weaned and finished pig. This reduces emissions from feed production and manure.
- Farms that keep their pigs outside tend to have lower GHG emissions since losses during manure storage are avoided.
- Warmer regions have increased emissions from manure storage, as manure releases more GHGs at higher temperatures.

Emissions of the breeding stage

At the breeding stage, the majority of emissions are caused by feeding and maintaining the sows. These emissions are accounted to the main output of the system, namely kg of weaned piglets. Systems that wean a low number of piglets per sow and year thus tend to produce higher emissions than systems with high per-forming breeds, even if the feeding of the sows is more intensive. Given the diversity of breeding systems, the carbon footprint per kg of weaned piglets showed a large range from 3.5 up to 10 kg CO_2 eq.

Figure 1: Greenhouse gas emissions of pig breeding systems

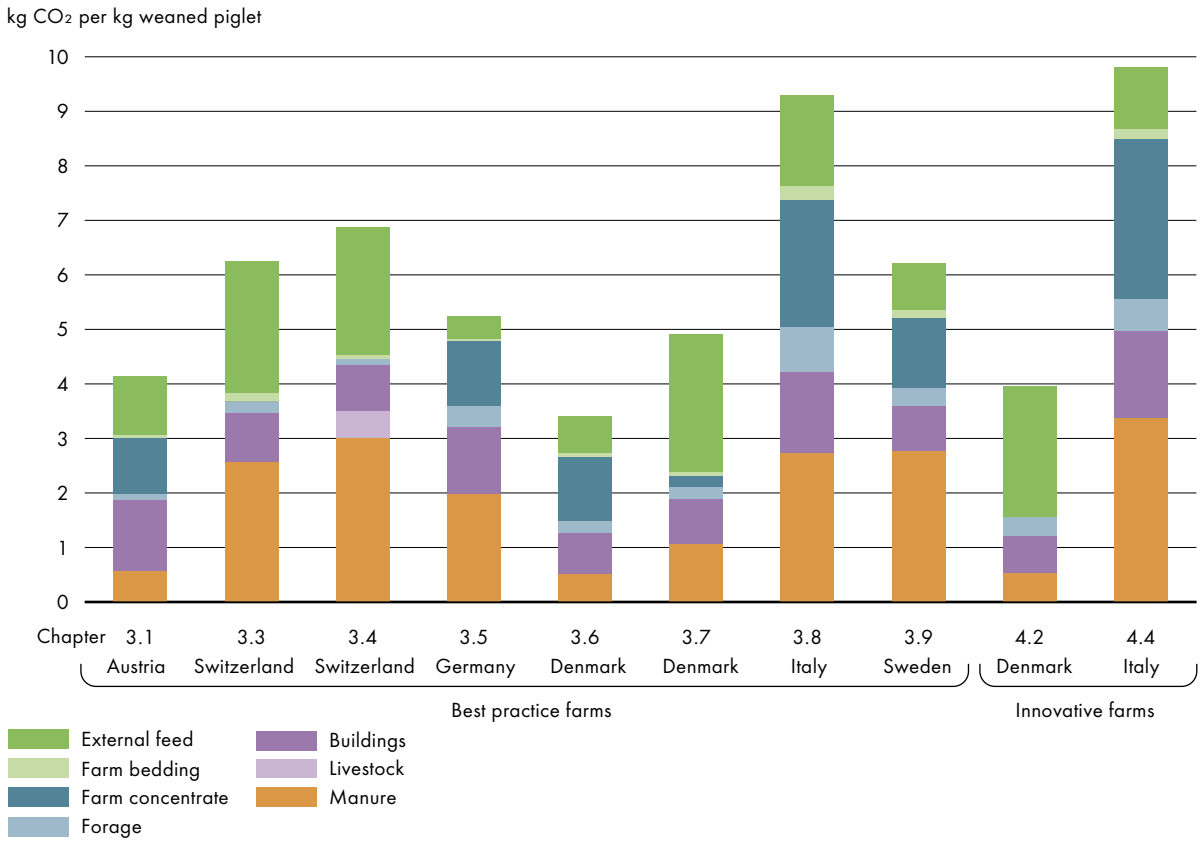
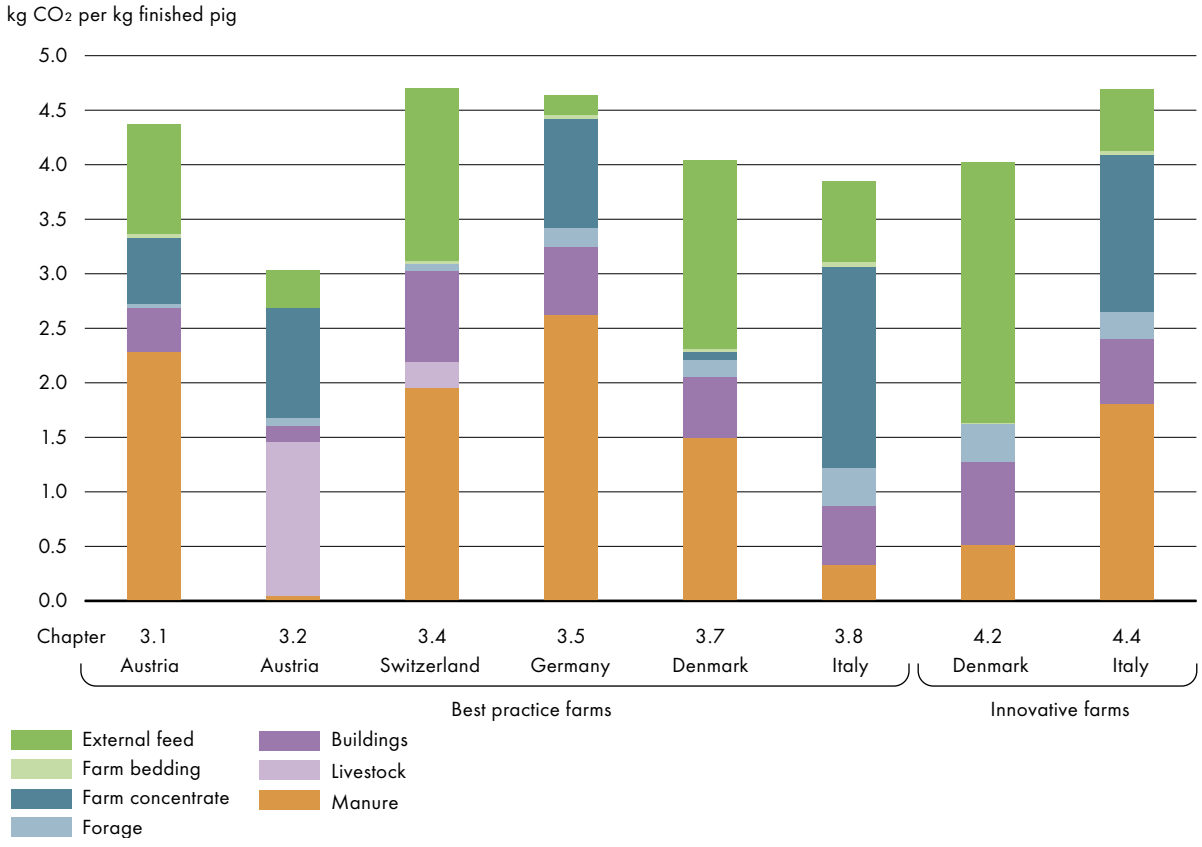


Figure 2: Greenhouse gas emissions of pig growing-finishing systems



Emissions of the growing-finishing stage

At the growing-finishing stage, the differences between systems were smaller, with the carbon footprint per kg of finished pig varying from 2.95 up to 4.75 kg CO_2 eq (figure 2). For farms that purchase weaned pigs, the emissions from the breeding stage are included as a single value ("breeding phase"). However, for farms that breed their own piglets, the emissions from the breeding stage are spread across the original categories (food usage, manure storage, etc.).

Environmental impacts apart from GHGs

Impacts from other environmental categories, including eutrophication (increase in the concentration of phosphorus, nitrogen, and other plant nutrients in an aquatic ecosystem such as a lake), energy and water usage, were distributed similarly across farms as the GHG emissions.

Recommendations

To decrease GHG emissions and other environmentally damaging impacts of pig production, farms should:

- Increase the time pigs can spend on a pasture or use an outdoor production system since manure storage emissions often represent the largest single source of GHGs.
- Avoid over-stocking and maintain a good vegetation cover year-round on pastures. For instance, this can be achieved by using rotational pasture systems or feeding pigs before they access the pastures.
- Try to avoid high carbon footprint feeds, such as imported soya, by replacing them with home-grown legumes. Home-grown feeds furthermore maintain nutrient circularity and avoid excess nutrient imports to the farm through purchased feeds.
- Optimise feeding and improve welfare (e.g. prevent heat stress) to obtain higher growth rates.
- Improve production system efficiency by reducing piglet mortality, using breeds suitable for the system, avoiding feed losses and excess nutrients that will be excreted and may be lost as pollutants.

Further Information

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CORE organic

Combined pasture and housing systems in Austria: benefits of keeping sows and piglets on large pastures and growing-finishing pigs indoors

Description

On this farrow-to-finish farm, sows are kept on 4 ha pasture all year round. The area is part of the crop rotation, although the sows remain on the same paddock for three years continuously. Pregnant sows are kept in groups. Lactating sows and their piglets are on individual paddocks. Weaners and growing-finishing pigs are either indoors with access to an outdoor run or in an outdoor climate barn with access to an unroofed outdoor area. The pigs of a conventional breed are slaughtered with a live weight of about 120 kg. Partly, they are sold directly on-farm, another part to a local butcher and a small part to the central Austrian organic producer organisation.

Pasture management

About 8 ha of arable land adjacent to the farm are fenced with a stationary game fence. This area is part of the crop rotation and also serves as pasture for the sows.

It is divided with an electric fence in two parts of almost the same size. The sows stay on one half for 3 years until they are moved to the other half. Sows are kept outdoors all year round with access to huts. All lactating sows have access to their own hut, whereas pregnant sows or sows for service share huts. Solely during farrowing and lactation, each sow has her own paddock, where the piglets can move freely under the electric fencing on the whole area. Additional to artificial insemination, a boar is running with a group of sows for natural service. Water is provided in small troughs, with a maximum of two sows per drinker.

Farm portrait

Location
Upper-Austria, Austria
Topography
Flatland and hills, close to village
Farmland
32 ha arable land, 2 ha forest
Size of pig herd
18 sows, 40 weaners, 70 growing-finishing pigs
Farming system

- Sows and piglets are housed outdoors on pasture with huts.
- Weaners and growing-finishing pigs are housed indoors with access to an outdoor run.

The paddocks are cultivated with a clover/alfalfa/grass mix and mowed 4 to 5 times per year. Concentrate feed is provided daily on the floor. During winter, silage is provided. In summer, the sows dig wallows, which the farmer fills with water as needed.

Animal welfare

- As sows and piglets are kept on natural soil with very low stocking density and huts with straw, they can graze, root, wallow and build nests. Furthermore, the separation of sows shortly before farrowing corresponds with their natural behaviour to farrow away from the others. Still, litters can mix soon, as piglets can go under the bottom wire of the fence.
- The risk of competition for resources is minimized by large paddocks with one hut for each lactating sow, a maximum of two sows per drinker and easy access to food through floor feeding.
- When rooting in natural soil, piglets ingest sufficient amounts of iron, so that no iron supplementation is needed.
- Since the piglets of different litters already had contact with each other on the pasture, weaning stress is minimised, as no grouping with unfamiliar pigs occurs.
- The weaners and growing-finishing pigs are kept on straw in pens with higher space allowance than required by organic legislation. This enables the animals to explore, play and hide; in other words, to perform species-specific behaviour, which was also reflected in the low occurrence of tail and ear-lesions.
- On pastures, sows can regulate their body temperature using natural wallows. To prevent heat stress of indoor housed pigs, showers are installed in most of the pens.
- Frequent work on the pasture close to the sows, like fencing, feeding, maintaining wallows and huts, and examining sows individually on a daily basis not only maintains good animal health but may also enhances good human-animal-relation. As piglets are used to human presence since birth, they react with curiosity to visitors, also after weaning when kept indoors.

Table 1: Animal welfare assessment

Age group	Welfare parameter	Assessment during project period[1]
Sows[2]	Skin lesions (scratches)	On 2 out of 5 occasions in only one sow
Sows[2]	Vulva lesions and deformations	Not detected
Sows[2]	Lameness and shoulder lesions	Not detected
Weaners[3]	Post-weaning diarrhoea	Mild, at 1 out of 5 occasions in one group
Weaners[3]	Runts, respiratory problems, eye inflammation	Not detected
Weaners[3]	Short tails	On 5 out of 5 occasions <33 % of the animals in 1–3 groups
Weaners[3]	Skin lesions (scratches)	On 4 out of 5 occasions <33 % of the animals in 1–2 groups
Finishers[4]	Tail lesions	On 1 out of 5 occasions <33 % of the animals in 1 group
Finishers[4]	Skin lesions (scratches)	On 4 out of 5 occasions <33 % of the animals in 1–2 groups
All animals	Sunburns	Not detected

[1]Five assessment days at different seasons, [2]Always 10 sows assessed individually, [3]Assessed on group-level, average 3 pens
[4]Assessed on group-level, average 7 pens

Part of the growing-finishing pigs are housed in an outdoor climate barn with access to a non-roofed outdoor run.

Environmental impact and productivity

- The paddocks are part of the crop rotation and are covered by vegetation (growing or regrowing) when not used by sows. The vegetation cover during the period with sows varies from 70 % to 90 %.
- Weaners and growing-finishing pigs are housed in barns with a deep litter system, cleaned every two months. They are kept either in an outdoor climate barn with solid floor or in a solid building with outdoor runs and a partly slatted floor.
- The farm achieved a low carbon footprint (greenhouse gasses = GHGs) of 4.1 kg CO_2 equivalents per kg weaned piglet and a medium carbon footprint for the finished pigs at 4.37 kg CO_2 equivalents per kg finished pig. This results from median productivity, low mortality, and reduced slurry emissions due to sows being kept on the pasture. The farm also has a high level of feed sufficiency, supporting nutrient circularity.

Table 2: Environmental impact and productivity

Productivity	**Sow**
Average no. of litters / sow / year	1.8
Average no. of piglets born/ litter	9–10
Average no. of piglets weaned/ litter	8–9
Average no. of litters / sow until culling	4–5
Feed usage / sow / year [kg]	1000
Environmental Impact	**Weaners**
GHGs[1] / kg piglet weaned	4.14
Terrestrial eutrophication [molc N][2]	0.361
Marine eutrophication [kg N][2]	0.094
Water footprint [m_3][2]	0.043
Productivity	**Finishers**
Average daily weight gain [g / day]	628
Feed conversion rate [kg / kg gain]	3.2
Environmental Impact	**Finishers**
GHGs[1] / kg finished pig	4.37
Terrestrial eutrophication [molc N][3]	0.230
Marine eutrophication [kg N][3]	0.070
Water footprint [m_3][3]	0.022

[1]Green house gases [CO_2 equivalent] per [kg] piglet weaned

[2]per [kg live weight] piglet weaned

[3]per [kg live weight] finished pig (full life cycle)

An electric fence separates lactating sows from the boar and sows in oestrus. Piglets can use the whole area, as they pass under the electric fence.

Labour and cost

- The family farm does not employ any workers.
- The feed is home-grown except the minerals and the protein component.
- The daily work routine for sows consists of checking on each pig, controlling the fences, manual provision of feed and straw. For weaners and growing-finishing pigs the daily routine consists of checking on each group, manual provision of concentrates, roughage and straw.

Take away lessons

- Due to the large pasture area per sow and the management, this farm achieves a good vegetation cover all year round.
- The combination of a professional pasture system for sows and piglets until weaning with a growing-finishing period indoors provides the basis for good animal health and welfare and at the same time reduces the negative impact on the soil.

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CORE organic

Combined pasture and housing systems in Austria: indoor reared pigs are finished on the pasture

Description

This farm is a growing-finishing farm where the animals are outdoors on pasture all year round. A group of about 150 pigs is kept on approximately 3.5 ha of cultivated pasture, which is included in the crop rotation. The animals, a conventional breed from a local organic piglet producer, enter the system with about 30 kg and are slaughtered after 120 to 140 days with about 105 kg live weight. The pigs spend their first days on this farm in an indoor area with an outdoor run. Then they are moved to the pasture in small groups, to get used to the new area and the electric fence. About two weeks before slaughter, the finishers are moved to the indoor area again. All pigs are sold to an Austrian organic label production for free-range pigs.

Pasture management

The pasture is double-fenced with electric wires. The areas are part of the crop rotation system and are used for the pigs every 7 years. A clover/alfalfa/grass mix is cultivated on the paddock.

When a new group of pigs enters the system, the total area is divided into smaller parts and is gradually enlarged to prolong the access to fresh pasture. As the area is arable land without bushes or trees, shade is provided by huts and truck trailers (see picture right).

For each group, at least 6 ad libitum feed dispensers, each with 6 to 8 feeding places, are available. Water is provided by mobile water tanks (see picture right), each with two troughs, for about 15 animals at a time. The feed dispensers, huts, truck trailers, and mobile water tanks are moved once a week to distribute the manure evenly in the whole area.

Farm portrait

Location
Lower-Austria, Austria
Topography
Flatland
Farmland
107 ha: 95.5 ha crop land including
3.5 ha of cultivated pasture,
7 ha forest , 4.5 ha permanent grassland
Size of pig herd
200 growing-finishing pigs
Farming system

- Pigs bought from indoor production
- Growing-finishing on the pasture

Animal welfare

- Having access to natural soil, straw in the huts, large paddocks and a low stocking density, the animals can graze, root, wallow, explore and rest comfortably. During the summer time, pigs spend most of the day resting in the huts, the shadow under the truck trailers or in the wallows. Sunburns usually only occur when animals are new to the outdoor system or weather changes from cold to warm. In winter, pigs spend most of the day resting in the huts, nestled in straw.
- Due to the stable groups, several feeding stations, several wallows during the summer and the large paddocks, competition for resources can be avoided. If animals are injured or sick, they are moved to the barn to take care of them.
- A considerable proportion of the pigs already had short tails when they arrived on the farm. After moving to this farm, problems of tail or ear biting do not occur anymore.
- The farmer and his wife check on the animals daily. Due to this contact, the animals react with curiosity to unknown humans. As the animals are used to entering the truck trailers, transportation stress is reduced.

Environmental impact and productivity

- The paddocks are part of the crop rotation: they are either covered by vegetation (growing or re-growing phase) or used by pigs. A clover/alfalfa/grass mix is cultivated when the animals enter the system. As soon as all animals are sold, grain is cultivated for two to three years, followed by beans and a clover/alfalfa/grass mix. The vegetation cover ranged from 0 % to 80 %. Regular moving of paddock resources (huts, trailers etc.) guarantees a balanced distribution of manure over the paddock.
- The five pens of the indoor area are not cleaned regularly but only when needed. Soiling of up to 50 % of the indoor area was detected solely at one observation. As the animals spend very little time indoors, the amount of manure is limited.
- The farm has a medium level of carbon footprint (greenhouse gasses = GHGs) of 3.52 kg CO_2 equivalents per kg live weight of finished pig. The main contributors to the footprint were the purchase of weaned piglets and feed. Although the farm is largely self-sufficient for feed, the purchased feed is protein-rich and has a higher impact factor. As the pigs are mainly outdoors, emissions from manure are minimal.

Table 1: Animal welfare assessment

Welfare parameter	Assessment during project period[1]
Short tails[2]	33 % of all animals
Tail lesions	On 1 out of 5 occasions <3 % of the animals
Skin lesions (scratches)	Not detected
Ear lesions	Always found in <3 % of the animals
Sunburns	On 2 out of 5 occasions <3 % of the animals
Respiratory problems	Not detected
Ocular discharge	On 3 out of 5 occasions <33 % of the animals
Eye inflammation	At 1 out of 5 occasions

[1]Five assessment days during different seasons. All growing-finishing pigs on pasture and in the barn were assessed at group-level. [2]In purchased weaners upon their arrival at the farm.

On the pasture, pigs have access to huts in which a bale of straw is provided. This allows, among other things, to keep the animals outdoors all year round.

Labour and cost

- The farm is a family farm with no employees.
- Feed is home-grown except for the minerals and the protein component (soy bean).
- As the pigs are on pasture all year around, the daily work includes examining the health and well-being of the pigs, controlling the fences, and providing water and feed.
- The indoor housing system with the outdoor run is relatively new and functional. It enables, for example, easy mechanical cleaning with a tractor.
- As pigs are outdoors most of the time, there is little cleaning work.
- The indoor area allows effective management of pigs:
- For habituation, grouping and health check when pigs arrive at the farm.
- For good meat quality, handling and sorting of pigs in the weeks before slaughter.

Table 2: Environmental impact and productivity

Productivity	**Finishers**
Average weight of bought weaners [kg]	30
Average duration of finishing period [days]	130
Average daily weight gain [kg / day]	0.58
Feed usage / finisher / day [kg / day]	3
Feed conversion rate [kg / kg gain]	5.2
Average carcass yield [%]	80
Average carcass weight [kg]	84
Average value per finisher [€ / kg CW[1]]	4.25
Average no. of finishers sold per year	900
Environmental impact	**Finishers**
GHGs[2]	3.03
Terrestrial eutrophication [molc N][3]	0.177
Marine eutrophication [kg N][3]	0.083
Water footprint [m_3][3]	0.034

[1]Carcass weight
[2]Green house gases [CO_2 equivalent] per [kg] finished piglet
[3]per [kg live weight] finished pig (full life cycle)

Finishers are moved to indoor pens with access to an outdoor run 2 weeks before slaughter to make sorting them by weight and loading them into a transporter easier.

Take away lessons

- By including pigs as part of the crop rotation, this farm does not need additional fertilizer.
- The strategic use of indoor housing for short periods, e.g. when pigs arrive, depart or are sick, facilitates management tasks well on this farm.
- Growing-finishing pigs kept in a low-density outdoor system display healthy social behaviour, even though they were reared indoors and arrive with signs of tail-biting.

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CORE organic

Combined pasture and housing systems in Switzerland: large scale production inclusive of animal welfare

Description

In Switzerland, conventional and organic breeding sows are generally kept in indoor systems with concrete outdoor runs. However, one of the largest producers of organic fattening pigs demonstrates standard pig housing systems and pasture access is possible, even at large production scales.

At this farm pregnant sows have year-round access to pasture and wallows whenever the soil is dry enough to prevent soil damage. In the future, the farm plans to add trees to the end of the pasture to offer additional shade during the summer. Lactating sows and weaners do not have access to pasture. The farm prefers to keep sows and piglets inside during the lactation period to avoid exposure to low temperatures or bad weather conditions. Installing a pasture for the weaners would require more fencing as the animals are much smaller than sows, which would complicate the management of the new grouping.

Pasture management

The total pasture area dedicated to pregnant sows is 1 ha. This area is divided into several long strips, such that the pasture in use can be rotated.

During the day, two out of the four groups of pregnant sows are allowed on the pasture, without mixing the groups. The next day the other two groups get access to the pasture. When the ground is sufficiently dry and hard to withstand the sows' treading, pasture access is granted from 7 am to 6 pm year-round.

Furthermore, the farmer sows a special mix of grasses meant for horse racecourses, which presents a high resistance to treading, maintaining a high level of grass cover on the pasture. Areas where the sward is breaking and sows are starting to root

Farm portrait

Location
Canton Thurgau, Switzerland
Topography
Flat
Farmland
55 ha
Size of pig herd
200-220 sows, 600 weaners
Farming system

- Pregnant sows are housed indoors and have controlled access to pasture and wallow.
- Lactating sows, suckling piglets and weaners are housed indoors with concrete outdoor run.

Combined systems grant access to pasture in addition to the concrete outdoor run.

are quickly fenced off and newly sown, except for the transition areas from stable to pasture, which is more heavily used, and the grass cover is therefore not intact.

To satisfy the sows desire to wallow and prevent digging on the pasture, the farmer installed a designated wallowing area in-between the pasture and the outdoor run. There he added concrete slats at a depth of 70 cm, to prevent the holes from deepening and fortified the entrance to the pasture with concrete.

The pasture area is double-fenced to prevent contact with wild boars.

Animal welfare

Pasture access and the possibility to wallow significantly contributes to high welfare of the pregnant sows. Sows can exercise and forage, enriching the sows' diet.

The farmer pointed out that the wallow is especially beneficial to sows freshly separated from their piglets. It allows them to cool and soothe their udders and better cope with being separated from their piglets, mixed with other sows. This enables the sows to return more quickly to oestrus.

Health checks of the sows show that skin lesions are common in this system, which is likely due to the relatively large size of sow groups (30-36 animals) and the frequent mixing of sows from different groups. Other kinds of injuries like broken legs, oedema or vulva lesions are only present on very few occasions or not at all. To prevent the transmission of parasites through the pasture, the farmer deworms his sows regularly after pathogen detection. In addition, he vaccinates against piglet diarrhoea with vaccines produced from specific pathogen variants found on-farm.

Table 1: Animal welfare assessment

Age group	Welfare parameter	Assessment during project period
Sows	Soiling	24 % of sows soiled with mud
Sows	Thin sows	3 out of 215 sows
Sows	Skin lesions (scratches)	43 % of sows
Sows	Shoulder lesions; vulva lesions, deformation, swelling	1–3 % of sows
Sows	Lameness	5 % of sows
Weaners	Soiling	In 2 out of 25 pens <33 % of all the animals
Weaners	Diarrhoea	In 5 out of 25 pens mild signs
Weaners	Runts	In 14 out of 25 pens detected
Weaners	Skin lesions (scratches)	In 6 out of 25 pens <33 % of all the animals
Weaners	Ocular discharge	Not detected
Weaners	Eye inflammation	In 5 out of 25 pens detected
Weaners	Ear lesions	In 3 out of 25 pens <3 % of all the animlas
Weaners	Short tails	In 7 out of 25 pens <33 % of all the animals
All animals	Ectoparasites	Not detected
All animals	Sunburns	Detected on one sow only

Sows use the wallowing area in between pasture and outdoor run to thermoregulate and express explorative behaviour.

Table 2: Environmental impact and productivity

Productivity	**Sow**
Average no. of litters / sow / year	2.1
Average no. of piglets weaned/ litter	11.1
Average no. of litters / sow until culling	5.2
Environmental Impact	**Sow**
GHGs[1] / kg piglet weaned	6.24
Terrestrial eutrophication [molc N][2]	0.55
Marine eutrophication [kg N][2]	0.101
Water footprint [m_3][2]	0.098
Environmental Impact	**Finishers**
GHGs[1] / kg finished pig	3.29
Terrestrial eutrophication [molc N][3]	0.266
Marine eutrophication [kg N][3]	0.051
Water footprint [m_3][3]	0.055

[1]Green house gases [CO_2 equivalent] per [kg] piglet weaned

[2]per [kg live weight] piglet weaned

[3]per [kg live weight] finished pig (full life cycle)

Environmental impact and productivity

The farm has a medium to high level of carbon footprint (greenhouse gasses = GHGs) in the breeding system of 6.24 kg CO_2 equivalents per kg of weaned piglet, but the footprint per kg of finished pig is low to average at 3.29 kg CO_2 equivalents.

Emissions from manure handling and storage are a significant source, with the remainder largely from embedded emissions within the purchased feeds. However, the farm is productive with 23 weaned piglets per sow per annum, and a finisher live weight gain of 1.08 kg per day.

Labour and cost

- The farmer spends on average 5 to 10 minutes daily with pasture management, including opening and closing pasture gates.
- All the sows at the farm are inseminated or brought into the farrowing pens on the same day of the week. This simplifies the management of several groups of sows and reduces planning difficulties.

Take away lessons

- Providing pasture access in large scale pig breeding farms, with indoor housing and an outdoor run, can improve animal welfare.
- A high percentage of grass cover can be maintained by sowing grass mixtures resistant to treading, quickly fencing off digging holes and providing separate wallows.
- Wallowing helps sows cope with the stress and physical unease from piglet separation and allows them to return to oestrus more quickly.

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CORE organic

Combined pasture and housing systems in Switzerland: evening outings for increased welfare

Description

In Switzerland it is not common for organic sows to have access to pasture. Instead, they are housed indoors year-round, with concrete outdoor runs containing rooting areas. This organic farm is a best practice example of increasing animal welfare and providing occupation by allowing sows short-term access to pasture. The farm has about 60 breeding sows, divided into three groups: young sows, pregnant sows and lactating sows. When weather conditions are favourable, pregnant and young sows get access to the pasture in the evenings. Lactating sows are kept indoors to prevent mixing of the litters and confrontations between the sows.

Pasture management

The farm manages to maintain a high level of grass cover by following three main strategies:

1. Sows are only allowed onto the pasture when the ground is sufficiently dry, and weather conditions are favourable.
2. Pasture access is limited to the evening hours, which reduces the intensity of pasture use per day.
3. Providing a designated rooting area in the outdoor run sows can satisfy their urge to dig before going onto the pasture.

The pasture is a permanent grassland with a natural mix of grasses.

Farm portrait

Location
Canton Bern, Switzerland
Topography
Hilly
Farmland
1 ha pasture area for sows
Size of pig herd
60 sows
Farming system

- Young and pregnant sows housed indoors and have controlled access to pasture.
- Lactating sows, suckling piglets, weaners and growing-finishing pigs housed indoors with concrete outdoor run.

Animal welfare

At the farm, animal welfare appears to be good. Only a few sows show skin lesions, which is likely due to the small number of animals per group and the relatively stable group structure. Both factors prevent dominance fights.

Although short, pasture access contributes to physical exercise, adds roughage to the sow's diet, and allows foraging behaviour and mental stimulation to the sows. Restricting the pasture access to evening hours virtually eliminates the risk of sunburns for the animals.

A challenge the farmer faced during the implementation of pasture access in his hilly area was that sows sometimes scratched their low-hanging udders on the ramp leading to the pasture. The farmer constructed a concrete ramp to fix this issue.

Environmental impact and productivity

The paddocks are well maintained permanent pastures. The vegetation cover was about 90 %.

The lactating sows with piglets and the weaners and growing-finishing pigs are housed indoors with a concrete outdoor run. Pens are cleaned every day.

The farm has a medium to high level of carbon footprint (greenhouse gasses = GHGs) in the breeding system of 6.88 kg CO_2 equivalents per kg of weaned piglet, and in the finishing system per kg of finished pig of 4.70 kg CO_2 equivalents.

Due to the extensive housed time, emissions from manure handling and storage are a significant source, with the remainder largely from embedded

Table 1: Animal welfare assessment

Age group	Welfare parameter	Assessment during project period
Weaners	Runts	Detected in 4 out of 6 pens
Finishers	Skin lesions (scratches)	Detected in 1 out of 4 pens
Finishers	Eye inflammation	Detected in 1 out of 4 pens
Weaners and finishers	Diarrhoea	In 3 pens normal, in 7 pens mild signs
Weaners and finishers	Ocular discharge, ear lesions	Not detected
Sows	Thin sows	In 1 out of 145 sows
Sows	Skin lesions (scratches)	In 43 % of all sows
Sows	Shoulder lesions; vulva lesions, deformation	In 3–4 % of all sows
Sows	Swellings	In 8 % of all sows
All animals	Soiling	In 2 out 0f 10 pens <33 %; 8 % of all sows
All animals	Ectoparasites	Not detected
All animals	Sunburn	Not detected in weaners or finishers, but in one sow
All animals	Lameness	Not detected in weaners or finishers, but in 6 % of the sows
All animals	Short tails	Not detected in weaners or finishers, but in one sow

Table 2: Environmental impact and productivity

Productivity	**Sow**
Average no. of litters / sow / year	2.0
Average no. of piglets weaned/ litter	10.4
Average no. of litters / sow until culling	4.2
Environmental Impact	**Sow**
GHGs[1] / kg piglet weaned	6.88
Terrestrial eutrophication [molc N][2]	0.46
Marine eutrophication [kg N][2]	0.106
Water footprint [m_3][2]	0.103
Environmental Impact	**Finishers**
GHGs[1] / kg finished pig	4.70
Terrestrial eutrophication [molc N][3]	0.303
Marine eutrophication [kg N][3]	0.068
Water footprint [m_3][3]	0.073

[1]Green house gases [CO_2 equivalent] per [kg] piglet weaned
[2]per [kg live weight] piglet weaned
[3]per [kg live weight] finished pig (full life cycle)

emissions within the purchased feeds and building infrastructure. However, the farm is relatively productive with 20 weaned piglets per sow per annum, and a finisher live weight gain of 0.83 kg per day.

Labour and cost

- The farmer spends on average 5 to 10 minutes daily with pasture management, including opening and closing gates and driving pigs in and out of the pasture. The process does not take long since the farmer always uses the same pasture, and so the sows are used to the routine.
- Infrastructure: The farmer constructed a concrete ramp to facilitate pasture access for sows and invested in appropriate double-fencing.

Take away lessons

- Pasture access does not need to last long or require significant investments to contribute to animal welfare.
- Short periods of pasture outings during the day can benefit the pigs' health, behaviour and diet while keeping labour and investment demands to a minimum.

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CORE organic

Combined pasture and housing systems in Germany: year-round outdoor housing for pregnant sows

Description

In Germany, most organic pigs are kept in barns with concrete outdoor runs. This farm is a best practice example of the combination of indoor and outdoor housing throughout the breeding cycle.

Empty sows, pregnant sows and the boar are kept in one large group on pasture from spring to fall. Equipment on the pasture includes straw-bedded huts, sun protection and wallows. In addition to the fresh grass-clover pasture, the pigs receive some concentrate feed daily. During winter pasture is not possible due to frequent water logging; instead, the sows are kept on concrete run with huts.

Before farrowing, sows are placed in individual farrowing pens. Here they stay for approximately two weeks and are then moved to a group housing system. Piglets are weaned after seven weeks. Weaners and growing-finishing pigs are kept in groups of ten to sixty animals. All animals housed indoors receive clover grass silage every day.

Pasture management

The farm has a six-year crop rotation, with the sows grazing clover grass in its second year. The annual change of the pasture avoids hygiene problems, such as parasite infestation and infectious diseases. In addition, the nutrient input can be controlled in this way.

The grazing season usually lasts from April to November. Since the vegetation decreases over time, access to a fresh pasture area is repeatedly granted. The differences in the vegetation cover are pronounced: at certain times, some areas show only about 10 %, while others show close to 100 % cover. To avoid treading damage and soil compaction at the feeding site, the farm uses concentrates in large pellets and distributes these over the whole pasture area.

Farm portrait

Location
Schleswig-Holstein, Germany
Topography
Flat, 13 m above sea level
Farmland
600 ha: 460 ha of arable land and grassland
Size of pig herd
50 sows and their offspring, as well as up to 120 growing-finishing pigs
Farming system

- Pregnant sows are housed on the pasture in summer, on a concrete pad with huts in winter.
- Weaners and growing-finishing pigs are housed indoors with concrete outdoor run.

Weaners and growing-finishing pigs have access to an outdoor run.

Animal welfare

Overall, clinical assessment reveals mostly healthy animals with only minor problems.

However, some of the weaners and growing-finishing pigs showed short tails due to necrosis during the suckling period, probably caused by mycotoxins. In addition, it's possible that sows on the pasture were lame, due to stones on the dry, hard ground. Sunburn was observed in individual animals. However, sun protection in the form of sails and wallows in the pasture reduces this risk. Skin lesions occur in all animal groups when new groups have been previously formed. However, the farm's aim is to keep groups as constant as possible, so serious injuries do not occur.

No stereotypical or aggressive behaviour can be observed in sows on pasture. Manipulation of other pigs or equipment in the pens was also not the dominant behaviour observed in the weaners and growing-finishers, but can occur very sporadically.

Table 1: Productivity

Productivity	**Sow**	
Average no. of litters / sow / year	2.1	
Average no. of piglets born / litter	15.2	
Average no. of piglets weaned / litter	10.8	
Average no. of litters / sow until culling	5.9	
Feed usage / sow / year [kg]	1,300[1]	
Productivity	**Weaners**	**Finishers**
Average daily weight gain [g / day]	345	800
Feed conversion rate [kg / kg gain]	2.5	2.8
Environmental impact	**Weaners**	**Finishers**
GHGs[2]	5.23	4.64
Terrestrial eutrophication [molc N][3]	0.22	0.154
Marine eutrophication [kg N][3]	0.099	0.067
Water footprint [m_3][3]	0.04	0.021

[1]concentrate + 760 kg grass-clover-silage + pasture

[2]Green house gases [CO_2-Equivalent] per [kg] weaned / finished Piglet

[3]per [kg live weight] weaned / finished Pig (full life cycle)

Table 1: Animal welfare assessment

Age group	**Welfare parameter**	**Assessment during project period**
Weaners	Short tails	No lesions detected, but short tails in some pens <33 % of all animals
Weaners	Runts	Only very few
Weaners	Lameness	Not detected
Finishers	Skin lesions (scratches)	In 1 pen >33%, because of new group composition
Finishers	Short tails	No lesions detected, but short tails in some pens <33 % of all animals
Finishers	Lameness	Not detected
Sows	Skin lesions (scratches)	Not detected
Sows	Shoulder lesions	Not detected
Sows	Swellings, lameness	No swellings detected, but <20 % of all sows showed lameness
Sows	Soiling	In winter: not detected; in summer: 85 % of all sows with <30% of the body muddy
Sows	Vulva lesions, deformations	Very few lesions detected; 10 % of the sows showed vulva deformations

Environmental impact and productivity

- For pigs housed indoor, the indoor areas are cleaned as needed, and the runs are mucked out twice a week. There is no slatted floor. During the project period the majority of the pens had under 10 % of their areas soiled. Regarding the outdoor runs, very clean ones (<10 % soiled), medium-soiled ones (10–50 % soiled) and very soiled ones (>50 % soiled) were documented. This depended on both, the timing of mucking out and the weather conditions.
- The farm has a medium level of carbon footprint (greenhouse gasses = GHGs) in the breeding system at 5.23 kg CO_2 equivalents per kg of weaned piglet, and a higher level of footprint for the limited number of finished pigs produced, at 4.64 kg CO_2equivalents per kg finished pig. Due to the extensive housed time, emissions from manure handling and storage are a significant source, with the remainder largely from feeds and building infrastructure. Due to the high level of feed self-sufficiency and closing of nutrient cycles the farm has lower than average eutrophication and water use values. The farm is also productive with 23 weaned piglets per sow per annum, and a finisher live weight gain of 0.82 kg per day.

Labour and cost

- Three permanent employees and one trainee are employed to take care of the pigs. Their work includes the assessment of data for scientific experiments, as well.
- No work task is fully automatised. Washing of stables and equipment as well as feeding and new bedding are done by hand. The removal of manure and the moving of huts is done using machines.
- From the farmer's point of view, it would be desirable to combine the fattening capacities, which are spread over three locations, in one complex to optimise the work processes.
- It should also be mentioned that grazing is becoming more costly due to the risk of African swine fever and the associated need for double fencing but is considered so valuable that it should be maintained in any case.

Take away lessons

- The combined indoor and outdoor housing system of pigs is very suitable on heavy soils, as year-round grazing is often not possible.
- Integrating seasonal grazing into the crop rotation has proven successful, as it avoids hygiene problems.
- Distributing concentrates in the form of large pellets over the pasture area protects the vegetation and avoids soil compaction at the feeding site.

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POWER

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CORE organic

Combined pasture and housing systems in Denmark: year-round outdoor housing for sows and piglets

Description

On this Danish farm, organic sows are on pasture all year round. Only during insemination, the sows are brought indoors for about 6 days. On pasture, lactating sows have individual paddocks and pregnant sows stay in groups of 8-20 sows. Huts are bedded with straw. Besides fresh grass, the sows get concentrate all year round and additional roughage during winter.

Piglets are born outdoors and stay there during the lactation period. After weaning, at 7 weeks of age, most piglets move indoors, but every 12 weeks, 700 weaners stay for another 5 weeks outdoors, where they have access to large tents with bedding and ad libitum feed. Thereafter, also those weaners move indoors. They are housed in groups of 220 pigs on a straw bedded area with an outdoor run and partly slatted floors indoors and outdoors. They furthermore have access to roughage and ad libitum feed. At around 30 kg the pigs are sold to another farmer, who raises the finishers indoors with an outdoor run.

Pasture management

The grazing season is long in Denmark and therefore the sows are outdoors all year long. The farm has a two-year rotational pasture management; one year with pigs on clover/grass mixture and cultivated crops the year after. Sows in Denmark are allowed to have nose rings and therefore they cannot severely damage the vegetation. On average 90 % of the land is covered during summer and autumn and 40-50 % during winter.

There is crop rotation, and pigs in different production stages rotate from one pasture area to another. Piglets weaned on pasture for periods of 5 weeks take over pastures, previously used by pregnant sows turning the pasture upside down.

Farm portrait

Location
Jutland, Denmark
Topography
Flat
Farmland
255 ha: 240 ha arable land
Size of pig herd
540 sows, 16,000 weaners
Farming system

- Pregnant and lactating sows are housed on the pasture.
- During service, empty sows are housed indoors
- Some weaners are housed first outdoors and then are moved indoors with concrete outdoor run. The other groups of weaners are housed indoors.

Indoor pens for weaners have a partly slatted floor, which reduces the workload for cleaning.

This leaves only an average of 20-30 % of the area in those paddocks with full vegetation cover, preparing the land for next year's crops.

Animal welfare

Clinical assessments on the farm show problems with ear lesions for weaners housed indoors (see table 1). No thorough assessment was conducted for weaners held on pasture, as this was not possible for the large groups of pigs on large pasture areas. However, ear lesions don't seem to be a problem here. The same can be said for short tails due to tail biting as well as diarrhoea.

There were no major welfare issues for pregnant sows. Only a few skin lesions are seen when sows are mixed in groups after the lactation period, where they have been on single paddocks. Only very few sows had sunburns on ears, body or udder. Soiling of pigs from mud, which is not a welfare issue, was very widespread, especially during summer. This makes a clinical assessment difficult. Nevertheless, vulva lesions or deformations as well as lameness, were not a problem on the farm.

Sows on pasture did not perform negative behavioural manipulation of other sows, huts or feed troughs. For the weaners, this was also not the dominant behaviour

Environmental impact and productivity

- For weaners housed indoors, the indoor area is cleaned once a week. During the project period both, solid and slatted floors, were in 6 out of 12 pens 10-50 % soiled, never more than 50 %. The outdoor area is only cleaned after each batch, i.e. every 5 weeks, resulting in hygiene scores wherein most of the pens 10 to 50 % of the area was soiled on the solid floor more than 50 %.
- The farm has a low level of carbon footprint (greenhouse gasses = GHGs) in the breeding system of 3.41 kg CO_2 equivalents per kg of weaned piglet. As the pigs spend most of their time at pasture, emissions from manure handling and storage are minimised, with most of the emissions related to the home-grown feeds. Due to the high level of feed self-sufficiency and closing of nutrient cycles the farm has lower than average eutrophication and water use values. The farm is also productive with 25 weaned piglets per sow per annum, and a high weaner live weight gain of 0.44 kg per day.

Table 1: Welfare Assessment

Age group	Welfare parameter	Assessment during project period
Weaners, indoors	Ear lesions	In 8 out of 12 pens: < 3 %; in 1 pen: > 3 %
Weaners, outdoors	Ear lesions	Not detected
Weaners	Runts	A few in 2 out of 12 pens
All	Short tails / tail biting	Not detected
All	Diarrhoea	Not detected
Pregnant sows	Skin lesions (scratches)	43 out of 394 sows
Sows	Sunburns on ears, body, udder	Only very few
Sows	Soiling, in summer	115 out of 224 sows: < 30 % of body muddy
Sows	Vulva lesions or deformations	Not detected
Sows	Lameness	Not detected

To provide shade, some of the pastures are partly covered with trees.

Labour and cost

- The farm has nine full-time employees. Six of them are involved in management and planning; all take care of the sows, and three take care of the weaners.
- Installation of fences on pasture, modification of huts according to season and washing stables and equipment are done by hand. The indoor, provision of feed, new bedding and manure removal is done by machines, and removal of huts and pigs on pasture. Only feeding of weaners housed indoors is fully automated.
- It is crucial for the farmer to organize the different tasks well and to allow employees to contribute throughout the decision-making process, and to be able to test new ideas. They would like to have even more employees to have more time for the small details of the various work tasks.

Table 2: Productivity

Productivity	**Sow**
Average no. of litters / sow / year	1.9
Average no. of piglets born/ Litter	17
Average no. of piglets weaned / Litter	13
Average no. of litters / sow until culling	3.5
Feed usage / sow / year [kg]	1,700[1]
Productivity	**Weaners**
Average daily weight gain [g / day]	441
Feed conversion rate [kg / kg gain]	2.17
Environmental impact	**Weaners**
GHGs[2]	3.41
Terrestrial eutrophication [molc N][3]	0.32
Marine eutrophication [kg N][3]	0.083
Water footprint [m_3][3]	0.04

[1]concentrate + 700 kg roughage + pasture

[2]Green house gases [CO_2-Equivalent] per [kg] weaned piglet

[3]per [kg live weight] weaned pig

Take away lessons

- Having sows on pasture all year requires working routines that ensure optimal conditions for the sows regardless of the different weather conditions throughout the year.
- Calm sows are a necessity to be able to handle them on free range areas.
- This farm has many committed and experienced employees and structured working routines that ensure a high level of animal welfare and good pasture management.

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CORE organic

Combined pasture and housing systems in Denmark: special outdoor feed troughs for pregnant sows

Description

Sows are on pasture all year round. Only during insemination the sows are brought indoors for about 7 days in groups of 20 sows. On pasture lactating sows have individual paddocks and pregnant sows stay in groups of 6-18 sows. Huts are bedded with straw. Besides fresh grass, the sows get additional roughage during winter together with concentrate. The farmer invented special feed troughs for the pregnant sows on pasture.

Piglets are weaned at 7 weeks of age. All weaners are housed indoors, with access to an outdoor run, in groups of 190-220 pigs. They have a straw bedded area indoor and partly slatted floors indoors as well as outdoors. They have ad libitum access to concentrate indoors as well as access to roughage indoors and outdoors.

At around 35 kg bodyweight, the pigs are sold to another farmer, who raises the growing-finishers indoors with an outdoor run.

Pasture management

The farm cooperates with another farmer, who cultivates the pasture areas in-between groups of pigs. A pasture area is used for approximately half a year and then for one year of cultivation.

Before sows are moved to a new area, it is cut and used as roughage. Both pregnant and lactating sows are moved continuously to new pasture areas for 3 months. Used pasture areas are then reseeded. Organic sows in Denmark are allowed to have nose rings; therefore, they cannot cause severe damage to the vegetation. During the summer and autumn of the project period, the vegetation covered 70-90 % of the pasture areas with pregnant sows and during winter on average 40-50 %.

Farm portrait

Location
Jutland, Denmark
Topography
Flat
Farmland
95 ha pasture and arable crops
Size of pig herd
222 sows, 5,300 weaners
Farming system

- Pregnant and lactating sows are housed on the pasture.
- During service, empty sows are housed indoors
- Weaners are housed indoors with an outdoor run.

To reduce ear lesions in weaners kept indoors in groups of 190–220 animals, the farmer provides easily accessible minerals.

Animal welfare

Clinical assessments of pregnant sows show no major welfare problems, only some skin lesions can be observed. Scratches are assumed to arise during mixing in the service area after being on an single paddock during lactation. During the project period only 4 out of 333 sows had vulva lesions; one had deformations as well (see table 1). Lameness was not a problem. Soiling with mud was widespread during summer, but this is not considered to be a welfare issue. Sunburns on ears can be sporadically seen during summer but were not a major issue for sows on pasture.

For weaners, ear lesions were the most prominent welfare issue (see table 1). The farmer started providing extra and easily accessible minerals (magnesium oxide and monocalcium oxide) to mitigate this problem, which seems to help. Runts can be seen in a few pens, but diarrhoea and tail lesions were not a problem.

Sows on pasture didn't perform negative behavioural manipulation of other sows, huts or feed troughs. For the weaners, this was also not the dominant behaviour observed.

Environmental impact and productivity

- The indoor area, where weaners are kept, is cleaned weekly, whereas the outdoor run is cleaned daily. During the project period, the outdoor slatted floor area was scored as the dirtiest, but never more than 50 % of the area was soiled. The remaining areas had good hygiene. The service area had slightly poorer hygiene although cleaned daily.
- The farm has a medium level of carbon footprint (greenhouse gasses = GHGs) in the breeding system of 4.91 kg CO_2 equivalents per kg of weaned piglet. Emissions from manure storage are higher as the weaners are housed with an outdoor run. The extensive use of external feeds also creates issues of higher eutrophication impacts due to the imported nutrients. However, the farm achieves high productivity of 27 weaned piglets per sows per annum, and a weaner live weight gain of 0.532 kg per day.

Table 1: Welfare assessment

Age group	Welfare parameter	Assessment during project period
Weaners	Ear lesions	In 5 out of 9 pens: < 3 %; in 1 pen: > 3 %
Weaners	Manipulation of other pigs, feeders etc.	Not a dominant behaviour
Weaners + Sows	Short tails / tail biting, diarrhoea	Not detected
Weaners	Runts	A few in 3 out of 9 pens
Sows	Skin lesions (scratches)	22 out of 333 sows
Sows	Sunburns on ears	10 out of 333 sows
Sows	Soiling, in summer	Half of the sows: < 30 % of body muddy
Sows	Vulva lesions or deformations	4 out of 333 lesions, 1 lesion + deformation
Sows	Lameness	Not detected
Sows	Manipulation of other sows, huts, etc.	Not detected

The farmer invented special feed troughs for pregnant sows on pasture. These troughs attempt to reduce feed waste as sows have to open the lids to access the feed, preventing birds or rodents from getting to the feed.

Labour and cost

- This housing system for sows is labour intensive, since most work tasks, such as feeding sows on pasture, providing roughage or renewing of bedding, are done by hand. In some pens removing manure can be done by machine, which saves on the workforce.
- The farm has three full-time employees. Only one of them is involved in management, one is mainly dealing with the sows and the third employee works both with the sows and weaners.
- It is crucial for the farmer that there is a good collaboration between the staff, so everybody likes to work. He would like to have more tasks automated, e.g. providing bedding and washing stables.

Take away lessons

- This farmer is very aware of the environmental impact of his farm. Focusing on the pasture management, he tries to mitigate the impact, having a somewhat different rotational system than the average Danish pig producer.
- Innovative ideas can lead to inventions like the farmer's feed troughs that helps to reduce feed waste on the pasture, which is good for both, the environment and revenue.

Table 2: Productivity

Productivity	**Sow**
Average no. of litters / sow / year	2.0
Average no. of piglets born/ Litter	17
Average no. of piglets weaned / Litter	13
Average no. of litters / sow until culling	2.7
Feed usage / sow / year [kg]	1,329[1]
Productivity	**Weaners**
Average daily weight gain [g / day]	532
Feed conversion rate [kg / kg gain]	2.7
Environmental impact	**Weaners**
GHGs[2]	4.91
Terrestrial eutrophication [molc N][3]	0.62
Marine eutrophication [kg N][3]	0.106
Water footprint [m_3][3]	0.097

[1]concentrate + pasture

[2]Green house gases [CO_2-Equivalent] per [kg] weaned piglet

[3]per [kg live weight] weaned pig

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CORE organic

Combined pasture and housing systems in Italy: year-round access to pasture for growing-finishing pigs

Description

This Italian farm uses an extensive outdoor system to breed and fatten the local heritage breed *Cinta Senese*. The farmer aims to keep his animals outdoors, with access to soil all year round, using agroecological approaches to maximise pasture usage.

Pregnant sows are kept together with a boar year-round in a large metal fenced olive grove. Lactating sows are moved indoors to protect piglets from predation, with access to an outdoor run for about 60 days. Weaners then move into large paddocks with pasture, trees and bushes. The 80 growing-finishing pigs rotationally graze the 8 ha of pasture, cultivated with different crops to prolong as much as possible the use of fresh forage. Growing-finishing pigs are only fed in the evening with a complete mixture, having up to 40 % forage in their diet. The intensive use of pasture increases the percentage of linolenic acid (*C18:3n-3*) in the growing-finishing pigs' meat and back fat. Pigs are slaughtered at the age of one year with a live weight of 100 to 130 kg. The whole production is sold directly on the farm.

Pasture management

The farmer aims to offer growing-finishing pigs a long grazing period with constant access to crops at an optimal level of ripeness. The grazing season begins in March and ends in November, depending on the climatic situation. Each year, a different pasture is sown of pure or mixed alfalfa, clover, barley, sorghum, and peas. Pigs have access to pasture every day, from morning to evening, and the pasture is rotated every 15 days. During the summer, pigs spend the hottest hours of the day resting under trees or wallowing in mud while grazing in the mornings and evenings. Water is always available in troughs.

Farm portrait

Location
Tuscany, Italy
Topography
Flatland and hills
Farmland
1,100 ha forest and pasture +
400 ha arable crops
Size of pig herd
10 sows, 80 weaners,
80 growing-finishing pigs
Farming system

- Pregnant sows and weaners are housed outdoors on the pasture
- Lactating sows are housed indoors with an outdoor run
- Growing-finishing pigs are housed indoors with outdoor run and access to pasture during the day.

During the nine-month grazing period, growing-finishing pigs have access to various fodder, like alfalfa, clover, barley, sorghum or peas.

During winter, growing-finishing pigs stay in a large forested area.

Animal welfare

- Given the availability of large outdoor areas, pigs are free to express their full behavioural repertoire, such as exploration, grazing, rooting, resting or hiding.
- Furthermore, the low density of pigs prevents aggression and social competition, which usually causes skin lesions.
- Using a local breed with slow growth, strong limbs, and dark skin is advantageous for preventing health problems, e.g. lameness, sunburn, in this outdoor system.
- Pigs are examined twice a year for parasites and dewormed only if necessary.
- After birth, piglets have immediate access to soil, making iron supplementation unnecessary.
- Due to the high number of manual tasks (opening and closing of fences, feeding with buckets and leading pigs to new pastures), the farmer has a close relationship with his animals. This is demonstrated during clinical visits, in which pigs display curiosity rather than fear.

Environmental impact and productivity

- The indoor areas have solid floor and are cleaned weekly. The outdoor areas are cleaned after each batch. The pastures are constantly in rotation, covered by vegetation (growing or regrowing), or used by pigs.
- Sometimes, after a new sowing, the farmer uses native microorganisms to increase soil life and improve the use of nutrients.
- The pasture-based diet and restricted feeding decrease the average daily growth of growing-finishing pigs. These pigs are allowed to grow slowly to develop the proper muscle maturity, suitable for processing into typical seasoned products sold in farmer-to-consumer direct marketing.
- The farm has a high level of carbon footprint (greenhouse gasses = GHGs), in the breeding system 9.29 kg CO_2 equivalents per kg average for weaned piglet, but a low carbon footprint of 3.84 kg CO_2 equivalents per kg of finished pigs. The high emissions from the breeding system are mainly due to the lower productivity of the local breed, as well as manure emissions due to the housed period during lactation. The farm makes extensive use of home-grown crops, but also uses some externally sourced feed. The long finishing period creates additional environmental burdens due to daily maintenance feed needs and manure

Table 1: Animal welfare assessment

Age group	Welfare parameter	Assessment during project period
Weaners	Ear lesions	Not detected
Weaners	Runts	Not detected
Pregnant sows	Skin lesions (scratches)	Not detected
Sows	Sunburns on ears, body, udder	Not detected
Sows	Soiling	Not detected
Sows	Vulva lesions, deformations	1 sow with vulva lesion in 28 sows visited
Sows	Lameness	Not detected
All animals	Short tails (tail biting)	Not detected
All animals	Diarrhoea	Not detected

production (mainly on pasture), typical of more extensive, specialty local breed production, maintained for reasons beyond the scope of LCA assessments.

Labour and cost

Overall, this farming system requires a lot of labour and good planning. The most labour intensive tasks are:

- Fencing new paddocks during the grazing season
- Cleaning out the indoor areas, since the buildings are very old and not easily adaptable. However, since pigs stay mainly on the pasture the amount of manure accruing in the indoor areas is limited.

Take away lessons

The use of cultivated, rotational pastures, the large outdoor areas for animals, the high level of animal welfare and the attention dedicated to the whole production chain, where the pigs are allowed to grow slowly can result in high quality of fresh and processed meat.

Table 2: Productivity

Productivity	**Sow**	
Average no. of litters / sow / year	1.6	
Average no. of piglets born / litter	5	
Average no. of piglets weaned / litter	4	
Average no. of Litters / Sow until Culling	9	
Feed usage / sow / year [kg]	1,000[1]	
Productivity	**Weaners**	**Finishers**
Average daily weight gain [g / day]	300	350
Feed conversion rate [kg / kg gain]	3.3	5.7
Environmental impact	**Weaners**	**Finishers**
GHGs[2]	9.29	3.84
Terrestrial eutrophication [molc N][3]	0.67	0.31
Marine eutrophication [kg N][3]	0.24	0.144
Water footprint [m_3][3]	0.04	0.019

[1]concentrate + pasture

[2]Green house gases [CO2-Equivalent] per [kg] weaned/finished Piglet
[3]per [kg live weight] weaned/finished Pig (full lifecycle)

Further Information

ICROFS (2021): Innovative pasture systems from Denmark and Italy. Video. International Center for Research in Organic Food Systems ICROFS, Tjele. Available in English: www.youtube.com [Link].

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CORE organic

Combined pasture and housing systems in Sweden: multi-suckling pens with access to pasture in the summer

Description

On this farm, pigs are housed indoors with access to a concrete outdoor run. During summer, pigs also have access to the pasture, except sows in service and during the first days after farrowing. Before farrowing, sows are kept on straw bedding, where they also farrow. Immediately after farrowing the sow and her piglets are moved to an individual indoor pen for 10 days. Thereafter, they are transferred to a group-suckling pen with outdoor access, where 7 sows with piglets are kept together. Piglets are weaned when they are 7 weeks old. After weaning, the sows are moved to the service area and the weaners stay in the group-suckling pen, with feed troughs for the weaners. Both pens for sows and weaners have mainly straw bedding and a concrete outdoor run. The weaners also have a partly slatted floor, both indoors and outdoors. All pigs are fed indoors 2–3 times per day and have ad libitum access to roughage on the outdoor run when they do not have access to pasture. The weaners are sold to another farmer when they are 12 weeks old.

Pasture management

The grazing season in southern Sweden lasts from May to September. The farm has a two-year rotational pasture management, one year with grass pasture and one with barley. There are two fields outside the barn, and the pastures are altered annualy to go either to the left or right. All pastures are connected to the stable so the pigs can move freely between barn and pasture. The paddocks are approximately 1,500 m^2. They are long and narrow and widen further away from the stable. During the first part of the grazing season, the paddocks are limited to 50 % of their size. There are two harvests of grass in the unused area before the paddock is extended. When the groups are moved, new groups

Farm portrait

Location
Southern Sweden
Topography
Flat
Farmland
216 ha: 200 ha pasture and arable land
Size of pig herd
168 sows and 3,600 weaners
Farming system

- Pregnant sows, lactating sows, their offspring and weaners are housed indoors with concrete outdoor run and have access to the pasture in summer.

In the group-suckling pen, red lights are installed in the creep area to attract the piglets.

can take over the pasture from the previous groups. In the middle of June, the grass cover in paddocks was 50-70 % for the group-suckling pens and 70 % for sow pens.

Animal welfare

Overall, this farm has high animal welfare with clean animals and minor injuries (see table 1). Only very occasional aggressive behaviours between the animals and no stereotypic behaviours were observed. In pregnant sows, no major welfare issues were found, and only some skin lesions scratches could be detected throughout all stages of gestation. Soiled pigs occur but vary over time and are not a welfare issue. Occasionally sows show lameness, vulva lesions or deformations. During pasture season sunburn on udders is not common, and only a few sows had sunburns on the ears or body.

Weaners showed mild signs of diarrhoea in half of the assessed pens during the project period. Occasional ear lesions and short tails were observed, but there were no open tail lesions. When runts are observed, they are sorted out to nursery sows before the pigs are moved to the multi-suckling pen. At weaning the pigs are sorted by size again. Eye inflammation, ectoparasites or scratches were detected in weaners. During pasture season sunburn on the ears and body can be found in weaners.

Environmental impact and productivity

Concrete outdoor runs of weaners and pregnant sows are cleaned weekly. Indoor bedding of weaners is removed between batches and one time during their five-week-long stay. For pregnant sows,

Table 1: Welfare Assessment

Age group	Welfare parameter	Assessment during project period
Weaners	Scratches, eye inflammation, ectoparasites	Occasionally
Weaners	Short tails / tail biting	Occasionally, no open tail lesions
Weaners	Diarrhoea	Mild signs in half of the pens
Weaners	Runts	Only in 1 pen
Sows	Skin lesions (scratches)	19 %
Sows	Soiling, in summer	1. Visit: 38 %; 2. + 3. visit: 3-6 %
Sows	Vulva lesions or deformations	Only a few
Sows	Lameness	Only a few
All	Sunburns on ears and body	Only a few
All	Stereotypical behaviour	Not detected

Table 2: Productivity

Productivity	**Sow**
Average no. of Litters / sow / year	2.1
Average no. of piglets born / litter	16.0
Average no. of piglets weaned / litter	11.5
Average no. of litters / sow until culling	4.9
Feed usage / sow / year [kg]	1,367[1]
Productivity	**Weaners**
Average daily weight gain [g / day]	570
Feed conversion rate [kg / kg gain]	1.9
Environmental impact	**Weaners**
GHGs[2]	6.20
Terrestrial eutrophication [molc N][3]	0.26
Marine eutrophication [kg N][3]	0.107
Water footprint [m_3][3]	0.044

[1]concentrate + pasture
[2]Green house gases [CO_2-Equivalent] per [kg] weaned piglet
[3]per [kg live weight] weaned piglet

the indoor bedding area is replaced every second week. Indoor soiled areas and slatted floors are generally clean and dry, with soiled parts on 10-50 % of the total area. During the project period, 50 % or more of the outdoor run was soiled. This indicates that the pigs prefer to use the outdoor run as an elimination area. In the weaning pens, manure often builds up in corners and edges of the slatted floor where there is less movement of the pigs.

The farm has a high level of carbon footprint (greenhouse gasses = GHGs) on the breeding system of 6.20 kg CO_2 equivalents per kg of weaned piglet. Emissions mainly occur from the manure storage due to an extended housing period in Sweden. The extensive use of home-grown feeds reduces eutrophication impacts and water use for feed production. The farm also has a high level of productivity with 24 piglets per sow per annum and a weaner live weight gain of 0.57 kg per day.

Labour and cost

- The farm has four employees, most of their time is spent within the pig enterprise, either with practical work, planning or accounting.
- They try to do as much work as possible with a compact loader to avoid heavy work.
- Feed management is automatic, except in the first 2 weeks after weaning when weaners are fed manually with special dry feed. However, the farmer and his employees want to find a way to reduce the manual work for feeding the weaners.

Take away lessons

- This farmer is engaged in production and employee management and proactively develops new ways to improve animal welfare and the work environment.
- To lower the incidence of Postpartum Dysgalactia Syndrome (PPDS) sows farrow in deep straw pens. This makes it possible to lower the temperature in single pens and reduces the number of PPDS.
- With good management and enough space it is possible to grant weaners and sows with suckling piglets access to the pasture in summer.

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CORE organic

Innovative farming in Switzerland: the "pig caravan"

Description

The farm "Silberdistel" in Switzerland invented a self-contained mobile pigsty, to fatten pigs on permanent grassland, while protecting the soil and maintaining the grass cover. The so-called "pig caravan" comprises a sheltered lying area, a drinking and feeding station and even a water bath for the hot season. The floor outside of the shelter is slatted, letting faeces and urine fall onto the pasture, limiting the need for cleaning. The platform weighs 4.5 tons, is moved by tractor and provides sufficient space for up to 10 growing-finishing pigs. Furthermore, the platform has doors to both the left and right side, allowing the farmer to alternate between two pastures, facilitating pasture management. The pig caravan is used for the farm's growing-finishing pigs, housed full-time on the pasture during the vegetation period, lasting form April to October. In the winter months, growing-finishing pigs are moved indoors to protect the sward. During the growing season, all breeding sows and piglets have access to pasture which is divided into different paddocks so that soil fertility is maintained.

Farm Portrait

Location
Canton Solothurn, Switzerland
Topography
Flat to steep hills
Farmland
44 ha: 0.5 ha pasture for growing-finishing pigs
Size of pig herd
3 sows and 7-10 growing-finishing pigs
Farming system

- Growing-finishing pigs are housed on the pasture from April to October, in winter they are housed indoors.
- Sows and their piglets are housed indoors with concrete outdoor run and access to pasture during growing season.

Pasture management

The farm aims to maximise pasture productivity and efficiency, using holistic grazing management. Their grazing rotation includes cows, goats, pigs and chickens. When the caravan is placed at a certain spot, the farmer fences off two areas of around 10 x 10 m on both sides of the caravan. Pigs are given access to one of the two grazing areas for 3 to 7 days. When the farmer notices that the pigs start to uproot the grass, the grazing area is switched to the other side, using the trailer's doors. In this manner the two grazing areas are alternated for 10 to 14 days. Then, the farmer moves the pig caravan to the next spot, sows grasses or herbs into the uprooted

The "pig caravan" can easily be moved with a tractor, thanks to its two wheels and coupling device.

patches of the sward and lets the area rest for 30 to 60 days. With this system, the farm manages to maintain a grass cover of 80 %.

Animal welfare

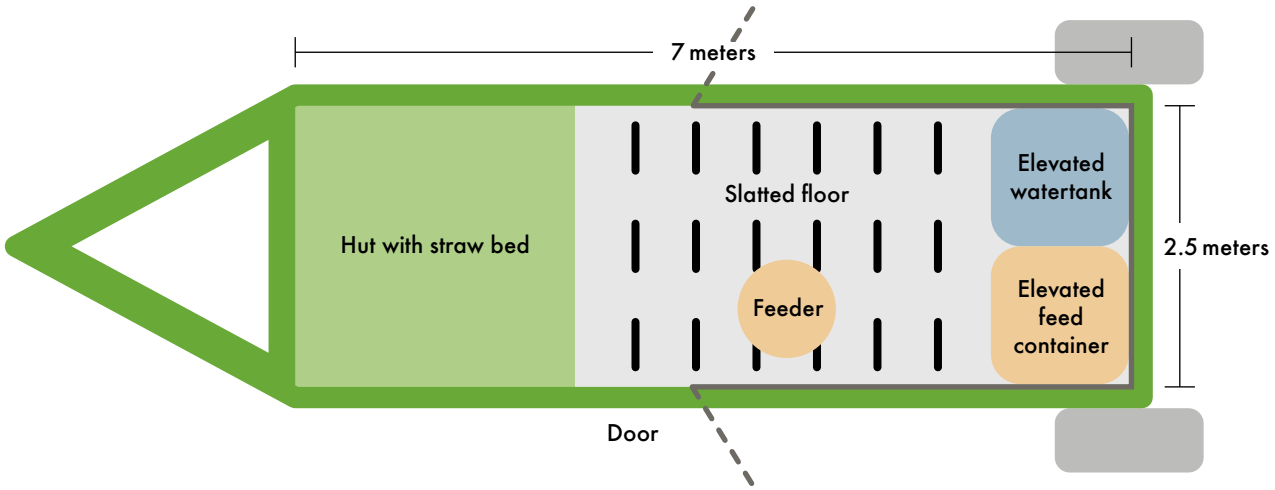
The systems is very beneficial to animal welfare. Grazing satisfies the pigs' need to perform exploratory behaviour by foraging. The regular changes of pasture area provide recurrent novelty of the environment and are beneficial for the curious animals. In addition, changes in pasture area and the intact sward also maintain hygienic conditions. The result is healthy and clean animals without any kinds of lesions. Pigs in the system seldomly need medication, in particular antibiotics.

Environmental impact and productivity

Compared to fattening growing-finishing pigs indoors with concrete floors, the pig caravan provides several environmental advantages. During the summer, all faeces are deposited on the pasture, which reduces ammonium emissions. The contact area of the caravan is limited to the steel beams and the wheels, leaving the vegetation and soil structure under the trailer largely intact. Besides grass from the pasture, pigs are fed waste products from flour and dairy production, increasing resource efficiency.

Table 1: Animal welfare assessment

Age group	Welfare parameter	Assessment during project period
Finishers	Soiling	In 1 out of 4 pens <33 % of all animals
Finishers	Runts	Not detected
Finishers	Ectoparasites	In 1 out of 4 pens detected
Finishers	Ocular discharge, eye inflammation	Not detected
Sows	Soiling	1 out of 8 sows soiled with mud
Sows	Thin sows	Not detected
Sows	Vulva lesions, deformations	Not detected
All animals	Skin lesions (scratches)	Not detected
All animals	Ear, shoulder, tail lesions, swellings or short tails	Not detected
All animals	Lameness	Not detected



Floorplan of the "Pig caravan". The plattform is big enough to accommodate 10 growing-finishing pigs. The substructure consists of a rigid iron beam frame. It supports the concrete slatted floor on the rear-end and woodenfloor on the front-end that is covered and therefore protected from rain. The Caravan can be moved by lifting it with tractor linkage drawbar on the front-end and then it rolls on his two wheels on the rear-end.

Table 2: Productivity

Productivity	
Average no. of pigs fattened / ha / year	50
Average weight at slaughter [kg]	120
Average age at slaughter [months]	8–10

Labour and cost

- It took the farmer 3 weeks of labour to construct one pig caravan.
- Expenses for one pig caravan: 6,000 CHF.
- Moving of the pig caravan takes on average 15 minutes. Additional time is needed for fencing.
- The farmer spends on average 5 minutes daily with inspection and feeding of the pigs.

Take away lessons

- A well designed caravan including shelter, feeding and drinking station, together with frequent pasture rotation, allows fattening of healthy pigs on pasture without destroying the grass sward.

Further informations

- **FiBL (2019):** Sau Karavan - Bodenschonende Schweinehaltung auf Dauergrünland (Core Organic POWER). Video. Research Institute of Organic Agriculture FiBL, Frick. Available at: www.youtube.com [Link].
- **Webpage of the farm**: www.silberdistel-kost.ch [Link]

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Innovative farming in Switzerland: breeding Berkshire Pigs outdoors year-round

Description

While it is common to fatten pigs outdoors during the vegetation period, only a few farmers manage to relocate all parts of pig breeding and fattening, including farrowing, year-round to the outdoors. The Swiss company "KURO" is one of the few in Switzerland which does this. Crucial to their system are a group of Berkshire breeding sows and boars, as well as prefabricated, mobile outdoor huts imported from the UK. The farmer does not own the land he uses but rents it from neighbouring farmers on a yearly basis. The farmer also created his own feed mixture, which excludes soy, with local millers. All meat is marketed directly to consumers and restaurants via a mail-order service, a pick-up point and shop.

Pig breed and breeding system

The Berkshire pig is a robust, English heritage breed. The farmer breeds his sows one to two times per year, depending on consumer demand. For breeding, 3 to 5 sows are grouped with one boar into a farrowing group. For each sow, one insulated farrowing hut with piglet shelter is available. Huts are bedded with a thick layer of straw but not heated otherwise, albeit this would be possible. Farrowing is staggered throughout the year, including during winter. Sows farrow 4 to 9 piglets and remain in their farrowing group until piglets are weaned at 3.5 months of age.

Farm portrait

Location
Canton Zurich, Switzerland
Topography
Flat
Farmland
1 ha for breeding the sows,
2.5 ha for growing-finishing pigs
Size of pig herd
15 sows, 1–3 boars,
70–90 growing-finishing pigs
Farming system

- All pigs are housed outdoors, in mobile huts, year round.
- Growing-finishing pigs are housed in groups.
- Sows are housed in farrowing groups but have individual huts.

This farm's robust sow breed also farrows outside in winter with the protection of the huts.

Fattening of weaners

Weaners are separated according to sex into groups of 35 to 45 pigs since males do not get castrated. They are further fattened for 12 months and slaughtered at an average weight of 100 kg (females) to 110 kg (males). The farm fattens about 80 to 100 animals per year, depending on consumer demand.

Pasture management

Before moving pigs onto a new piece of land, the farmer sows rye into the pasture, later foraged by the pigs. Due to limited land access, the farmer only changes the plots he uses about once per year. This results in the complete destruction of the sward, which is undesirable from an environmental point of view. However, after the pigs leave, plots are plowed and used for cropping such that the accumulated nutrients are integrated into a system of crop rotation. Ideally, the farmer would like to change plots every three months.

Animal welfare

Animal welfare appears to be highly satisfactory in this system. The farmer has not observed fighting within the groups. Furthermore, piglet losses are very rare. Due to the breed's thick fur and black pigmentation, the pigs are not sensitive to sunburn and withstand cold temperatures. They are therefore perfectly adapted to being raised outside.

Table 1: Productivity

Productivity	
Average no. of pigs fattened/ha/year	40
Feed usage/day/growing-finisher [kg]	1 – 1.2
Average weight at slaughter [kg]	100
Average age at slaughter [months]	15.5

Table 1: Animal welfare assessment

Age group	Welfare parameter	Assessment during project period
Finishers	Soiling	In 5 out of 10 pens
Finishers	Faeces	All normal
Finishers	Runts	Not detected
Finishers	Ocular discharge, eye inflammation	Not detected
Sows	Soiling	1 out of 8 sows soiled with mud
Sows	Thin sows	Not detected
Sows	Vulva lesions, deformations	Not detected
All animals	Ectoparasites	Not detected
All animals	Skin lesions (scratches)	Not detected in finishers, but in 3 % of the sows
All animals	Ear, shoulder, tail lesions, swellings or short tails	Not detected
All animals	Lameness	Not detected
All animals	Sunburns	Not detected

To enrich the sows' and piglets' diets, the farmer sows rye into the pasture.

Environmental impact and productivity

The fattening and breeding of pigs outdoors year-round reduces ammonia emissions. However, significantly more land is used than in traditional pig fattening, where animal feed is usually outsourced. To prevent nitrogen leaching, preserving the grass sward is essential and needs to be improved in the current system.

Labour and cost

- Farrowing huts cost CHF 1,500 to CHF 2,000 (€ 1,400 to 1,800), depending on the accessories.
- The farmer requires about 2 to 4 hours per day for feeding and routine tasks. Moving all of the infrastructure to a new plot requires about 2 weeks of time.
- The direct marketing of meat requires additional time, but the profit margin is higher compared to selling to retailers.

Take away lessons

- Berkshire pigs can be successfully bred and fattened year-round outdoors.
- The system requires large pieces of land and a frequent rotation of the pasture to prevent the destruction of the sward.
- The integration into a crop rotation is necessary, such that accumulated nutrients are used.
- Good communication with the general public and other involved stakeholders is required to ease concerns and educate about the outdoor keeping of pigs during winter. The farmer uses information boards.

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CORE organic

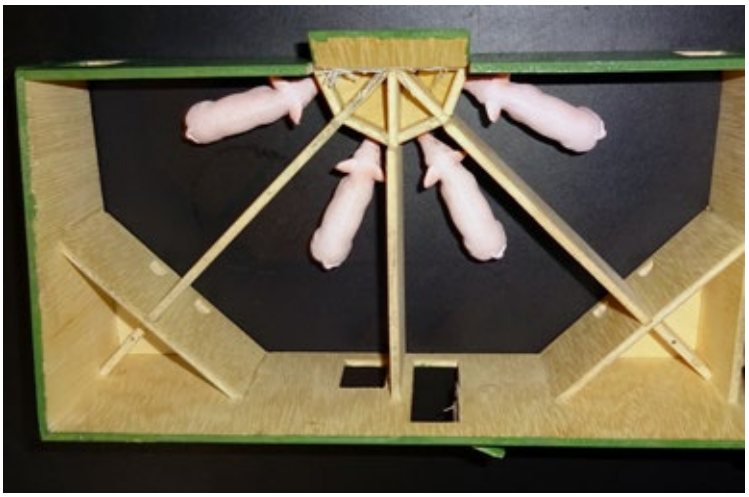
Innovative farming in Denmark: special huts for sows on the pasture

Description

Sows are outdoors all year round, except for six days during service when they are kept indoors. They are kept in groups of 12 sows in a large bedded area with individual feeding stalls and an outdoor run during this period.

Lactating sows are housed on the pasture with access to huts designed by the farmer (see picture 1, page 2). Each hut houses four sows in individual sections (see illustration, page 3), with individual paddocks. Feed and water are located within the hut. In hopes of preventing the sows from lying on their piglets, the farmer installed bars on the walls of the lying area, and there is a heated piglet nest (see picture 2, page 2). The huts can be relocated by tractor, and fencing is easily moved using a smart device on the huts, where wires are coiled.

Pregnant sows are housed in an average group of 12 sows on the pasture with access to large huts that the farmer also designed. Piglets are sold directly when weaned at seven weeks of age.



Pasture management

Sows stay on the same paddock area for approximately six months. The cultivated pasture on a paddock is first used by lactating sows for nine weeks and then by pregnant sows for 16 weeks. Subsequently, the paddock is used for cultivation during 1.5-2 years. When pregnant sows come on the paddock area, the area is extended to disperse manure deposition.

To keep a high vegetation cover, all sows noses are ringed. During the project period, on paddocks with lactating sows, the vegetation cover was 80-90 % during spring, summer and autumn, while 70 % in winter. For pregnant sows, the vegetation cover was 70-80 % in summer and autumn, 50 % in spring and 40 % during winter. This reflects the fact that pregnant sows take over paddocks from lactating sows.

Farm portrait

Location
Northern Jutland, Denmark
Topography
Flat
Farmland
30 ha: 23 ha temporary grass land
Size of pig herd
112 sows
Farming system

- Pregnant and lactating sows are housed on the pasture with huts, designed by the farmer.
- During service, empty sows are housed indoors for 6 days.

Picture 1: The hut for lactating sows grants access to the pasture for the sows, but a barrier, that the suckling piglets cannot cross prevents them to from getting on the pasture the first week after birth.

Animal welfare

No major welfare issues were found on either pregnant or lactating sows. During the project period, only 1 of 76 lactating sows had a vulva lesion and none had deformations. Hardly any lame or too thin sows can be found in this system. Also, skin lesions are rare, indicating good management of group formation. Soiling is not widespread among the sows, and in summer, only some sows have sunburns on their ears.

No negative behavioural manipulation was found among pregnant sows.

Table 1: Welfare assessment

Age group	Welfare parameter	Assessment during project period
Sows, all	Soiling, in summer	Only a few
Sows, all	Sunburns on ears	6 out of 104 sows
Sows, lactating	Vulva lesions	1 out of 76 lactating sows
Sows, lactating	Vulva deformations	Not detected
Sows, lactating	Lameness	1 out of 76 lactating sows
Sows, pregnant	Manipulation of other sows or equipment	Not detected

Environmental Impact and Productivity

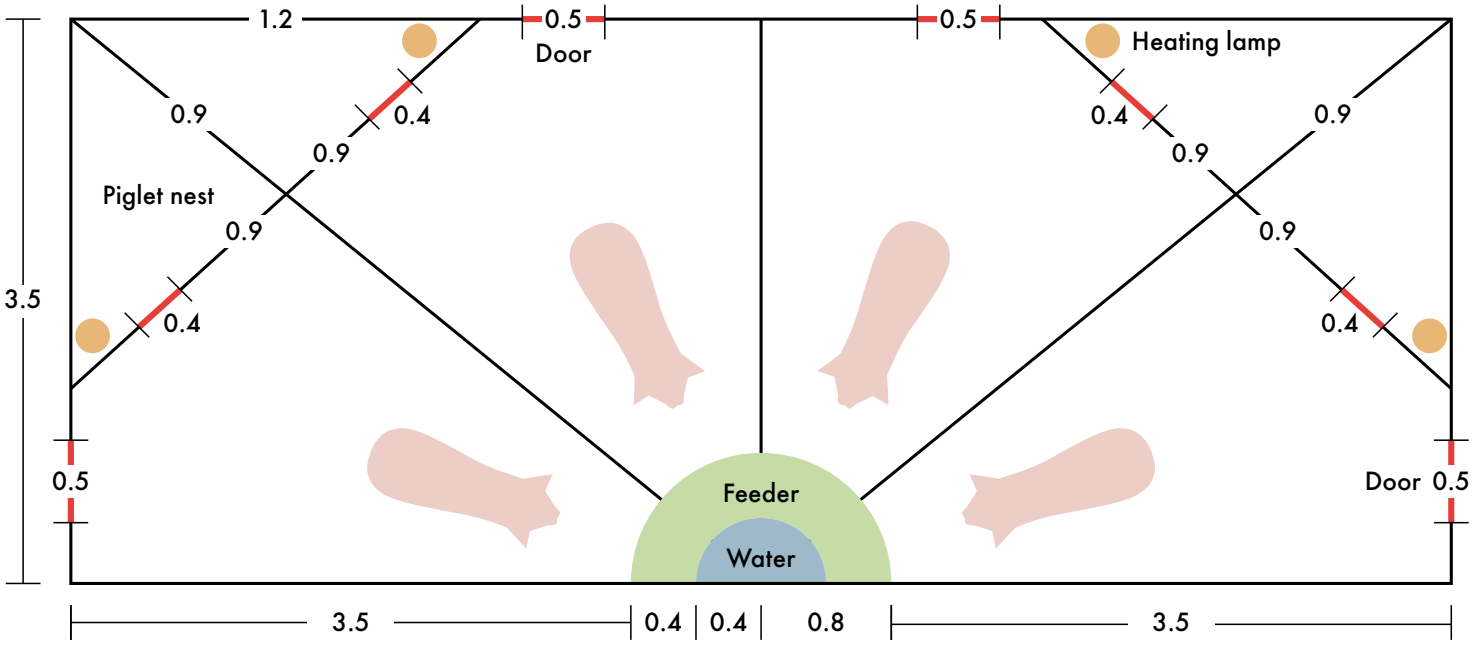
Table 2: Productivity

Productivity	Sow
Average no. of litters/sow/year	2.0
Average no. of born piglets/litter	17.1
Average no. of weaned piglets/litter	11.5
Average no. of litters/sow until culling	3
Feed usage/sow/year [kg]	1,760[1]

[1]concentrate + pasture

Picture 2: Inside the farrowing hut with the feeding area in front (picture on the right side) and the heated piglet nest in the back.

Picture 3: After sows are on a paddock for 6 months, it is then used for crop cultivation for 1.5–2 years.



Labour and cost

- The huts' were designed to replicate an indoor farrowing pen and implement this on pasture. An important feature of the design is that the farmer can stand up inside the huts to have good working conditions.
- The farmer would like to have an even more flexible grazing system and a better feeding routine for pregnant sows as this is a labor-intensive task.
- The farmer runs this farm on his own. He is spending approximately 20 % of his time on management and the remaining time taking care of the pigs.

Take away lessons

- The farmer succeeded in taking all the elements of an indoor farrowing pen and implementing them into a hut for the pasture.
- However, designing a system that will reduce piglet losses in the first days after farrowing is challenging. The idea with a piglet nest and bars on walls has not been working optimally. It takes a lot of effort for the farmer to adapt the newborn piglets to use the piglet nests.

Further Information

ICROFS (2021): Innovative pasture systems from Denmark and Italy. Video. International Center for Research in Organic Food Systems ICROFS, Tjele. Available in English: www.youtube.com [Link].

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CORE organic

Innovative farming in Denmark: mobile wagons with fenced pasture area

Description

This farmer has designed a mobile system for weaners and growing-finishing pigs. It consists of three movable wagons with a fenced pasture area. Depending on the season and pig size, the wagons are moved together with the fences 1–2 times a day using a tractor, providing new pasture areas for the pigs. The wagons have solid floors of wood with straw bedding. To allow extra ventilation during warm weather, roof vents and windows with curtains on the sides are present. A ramp provides access to the pasture area. It is possible to create small separate areas in the wagons, e.g. for sick animals.

Each wagon contains on average 150 pigs with access to a 180 m^2 pasture area. The pigs have access to the pasture day and night, all year round.

All wagons contain a feeding area including a water source, but only in wagons for growing-finishing pigs there is a weight sorting system in combination with the feeding area. Water comes from an intermediate bulk container (using approximately 15,000 litres/year). Power is supplied to each wagon using a diesel generator. A camera pointed at the pasture area connected to a tablet in the tractor helps to ensure that no pig is hurt when moving the wagon and fence.

Pasture management

There is a three-year rotational period for each pasture area. In between pigs, pasture areas are cultivated. Vegetation scores were performed at each visit. Even with new grass available once or twice a day, the vegetation cover was only 10-20 % for weaners during autumn/winter and 40-70 % during spring/summer. For finishers, there was an average of 50 % cover in all seasons. However, each pasture area is only used for one day as the wagons are moved continuously – 1 time per day in autumn/winter and 2 times a day in spring/summer. Consequently, the damage to the sward is limited.

Farm portrait

Location
Northern Jutland, Denmark
Topography
Flat
Farmland
100 ha: 76 ha arable land
Size of pig herd
1,300 weaners and growing-finishing pigs
Farming system

- Weaners: 1 mobile wagon with access to pasture.
- Growing-finishing pigs: 2 mobile wagons with access to pasture.

Inside the mobile wagons, there is an automatic feeder for growing-finishing pigs powered by a generator attached to the wagon.

With an on average 1 pig per 1.2 m^2 pasture results in a quick opening of the swat. Therefore, the pasture area is moved 1 to 2 times daily.

Animal welfare

Daily, free access to fresh grass supports high animal welfare from a behavioural point of view. No negative behavioural manipulation of other pigs or materials were detected.

No major welfare issues were found on the farm. A few runts were occasionally seen in the wagon with weaners, but diarrhoea, tail and ear lesions or short tails could not be detected. For finisher pigs, ocular discharge, short tails and lameness were the main issues, but no diarrhoea, eye inflammation, tail or ear lesions were found.

Sunburns could be found among both weaners and finishers, mainly on ears, but not that often on the body. At least one hernia in growing-finishing pigs in each wagon was detected.

Environmental impact and productivity

- Moving the wagons daily results in pigs being on the same pasture area for short periods (half-day). This has several advantages; dispersing the manure on a larger pasture area, lowering parasite pressure, reducing the risk of nutrient leaching, and allowing for faster vegetation regrowth.
- The pigs are mainly defecating outdoors, and the indoor areas stay more or less clean. New bedding is provided each day, and soiled bedding is removed. Hygiene scores on the farm show no indoor areas being more than 50 % soiled.
- Productivity data of the farm is shown in table 2.

,

Table 1: Welfare assessment

Age group	Welfare parameter	Assessment during project period
Weaners	Runts	Only a few
Weaners	Ear lesions, tail lesions, short tails, diarrhoea	Not detected
Weaners	Manipulation of other animals or equipment	Not detected
Growing-finishing pigs	Ocular discharge	6 out of 8 examined pens, only a few animals / pen
Growing-finishing pigs	Short tails	3 out of 8 examined pens, only a few animals / pen
Growing-finishing pigs	Lameness	3 out of 8 examined pens, only a few animals / pen
Growing-finishing pigs	Diarrhoea, ear lesions, tail lesions	Not detected
Growing-finishing pigs	Hernia	On average 1/150 Pigs
All	Sunburns on ears and body	Mainly on the Ears, in 1/3 of the Pigs

Table 2: Productivity

Productivity	Weaners	Growing-finishers
Average daily weight gain [g / day]	620	892
Average feed conversion rate [kg / kg gain]	-	2.9

Labour and cost

- The farm has no full-time employees besides the farmer, but he has help on some weekends and holidays.
- A critical task in this system is to move the wagons each day. This is done by tractor. The system does not have a burdensome work- load, but challenges with the generators supplying power for the weight sorting systems have been very time-consuming.
- The farmer has a range of new ideas to implement in the future, like changing the power supply to solar power cells, changing the weight sorting system to manual weighing and cultivating crops, like radish, on the pasture areas for the pigs to supplement their daily ration.

Take away lessons

- This system satisfies future expectations of consumers on animal welfare, having pigs on fresh grass while at the same time mitigating the environmental impact from organic pig production.
- The price for housing one pig in this mobile system is more or less equal to housing a pig indoors with an outdoor run.
- Building a mobile system of this size is a very challenging task, and it has been an instructive experience. To build these mobile wagons, the farmer formed a cooperation with a company that puts his ideas into practice. The developmental and improvement process is still ongoing.

Further Information

ICROFS (2021): Innovative pasture systems from Denmark and Italy. Video. International Center for Research in Organic Food Systems ICROFS, Tjele. Available in English: www.youtube.com [Link].

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CORE organic

Innovative farming in Italy: pasture rotation in the forest

Description

On this farm, the local heritage pig breed *Cinta Senese* is bred and reared outdoors in a hilly forested area. Pigs have unlimited access to paddocks that consist of large, forested parts and pasture areas. In the forest, pigs find protection from the wind and extreme temperatures in the summer and winter.

Pregnant sows stay with the boar in a large paddock. Lactating sows have smaller paddocks individually or in pairs. Their paddocks have huts as well as bushes and trees. To protect weaners from predators and keep the group calm, they are reared with a few pregnant sows. Growing-finishing pigs are reared in large paddocks, which are rotated every 2 to 3 months.

Pigs are slaughtered at the age of one year with a live weight of 100 to 130 kg. The whole production is sold directly on the farm.

Pasture management

To protect the forest ecosystem, it is important to preserve the integrity of leaf litter and tree roots. Therefore the number of pigs in each paddock has to be limited. Small groups of 15–20 growing-finishing pigs stay on paddocks of two or more hectares. The forest feeds pigs mainly in autumn, with e.g. acorns, while pigs feed on fresh pastures in the clearings, mainly in spring and autumn. After 2–3 months, the pigs are moved to another paddock, and the used paddock rests for at least one year to recover from foraging damage. Weaners have smaller paddocks of about one hectare, which are mainly covered by pasture. The pigs are fed in the morning to satisfy nutritional needs and preserve the vegetation cover. Single feed components are bought externally and are mixed on-farm.

Each paddock is equipped with tanks to provide water using nipple drinkers. The fencing is made of strong electric wires.

Farm portrait

Location
Tuscany, Italy
Topography
Hilly area
Farmland
420 ha: 60 ha permanent pasture,
350 ha forest, 10 ha other production
Size of pig herd
12 sows,
100 weaners and growing-finishing pigs
Farming system

- All animals are housed year-round outdoors on paddocks that all include forest as well as pasture.

Sows of the local heritage breed Cinta Senese have a strong maternal instinct. Therefore weaners are reared together with some pregnant sows that protect them from predators.

Animal welfare

- On this farm, pigs are kept in their natural habitat, in a forest area where they are free to express their full behavioural repertoire originating from their wild ancestors.
- The use of large paddocks with low stocking densities makes it possible to avoid lesions on skin, tails or ears due to social competition.
- During the observation period, the only health problem was oedema disease in weaning piglets, reduced by vaccination.
- Thanks to its compensatory climatic activity, the forest allows pigs to avoid thermoregulatory problems that occur in extreme heat or cold.
- Sows have a long reproductive career. *Cinta Senese* sows have a strong maternal instinct that allows defending suckling piglets and weaners from predators.
- The farmer has a close relationship with his animals. Every day he inspects them, opens and closes feeding areas, feeds them with buckets and leads pigs to new paddocks. The level of trust of pigs in humans is very high so that during the clinical visits, the problem is the excess of curiosity, not fear.

Environmental impact and productivity

- Due to the large size of the farm, a paddock rotation system is possible, which is key to environmental sustainability of this farm.
- The farm is totally dependent on the input of purchased feed. The pig's high feed conversion rate increases production cost, but the price of fresh and processed meat compensates these expenses.
- Pigs must grow slowly to develop the right muscle ripeness suitable to process into typical high prize Tuscany seasoned products. This makes the use of a local breed in a low input system necessary, where feed is rationed and pasture yield can be poor.

Table 1: Animal welfare assessment

Age group	Welfare parameter	Assessment during project period
Weaners, outdoors	Ear lesionss	Not detected
Weaners	Runts	Not detected
Pregnant sows	Skin lesions (scratches)	Not detected
Sows	Sunbruns on ears, body, udder	Not detected
Sows	Thin sows	4 sows in 30 visited
Sows	Vulva lesions, deformations	Not detected
Sows	Lameness	Not detected
All animals	Short tails (tail biting)	Not detected
All animals	Diarrhoea	Not detected
All animals	Ocular discharge	In 1 out of 4 paddocks <33 % of all animals

Table 2: Productivity

Productivity	**Sow**	
Average No. of Litters / Sow / Year	2	
Average No. of born Piglets / Litter	6	
Average No. of weaned Piglets / Litter	5	
Average No. of Litters / Sow until Culling	12	
Feed usage / Sow / Year [kg]	1,000[1]	
Productivity	**Weaners**	**Finishers**
Average daily weight gain [g / day]	250	300
Feed conversion rate [kg / kg gain]	4.0	6.5

[1]concentrate

Labour and cost

- The farm has several employees, one solely appointed for the pigs.
- The level of work is related to the animal category, production stage and season.
- The most important and time-consuming work is inspecting and fencing paddocks, including many kilometres of electric wires in the forest.
- In this type of farm, work is endless, and planning is crucial since the situation is constantly changing in this natural system.

Take away lesson

- The "ancient" approach of pig fattening in large forest areas in rotation, which ensure a high level of animal welfare, can produce high-quality processed meat.

Further Information

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CORE organic

Resilience of organic pig producers

Description

Organic pig farmers, whether large or small, are exposed to the risk of external shocks. External shocks can be economic, environmental, institutional or social changes that challenge the farms' production. The capacity to cope with such types of shocks is called "resilience". The POWER project assessed the resilience of selected best practices and innovative farms in order to understand how they cope with shocks. Here, we describe the resilience strategies of these farms.

Methods

- Eighteen innovative and best practice farms were interviewed about their strategies to cope with six shocks that could threaten their farm: increased input costs, decreased pork prices, disease outbreaks, climate change, legislation change or labour shortages.
- The narratives of the farmers were analysed using a so-called "farming system resilience framework". This framework suggests that farmers can cope with shock in three different ways called "resilience capacities", these are:
  1) Robust, which means being able to continue production without any change.
  2) Adaptable, which means being able to change some of the production practices.
  3) Transformable, which means being able to change the farm's production activities.
- When a farm has to stop all of its farming activities, it is considered **non-resilient**.

Applicability box

Theme
Resilience of pig producers
Production stage
Sows + piglets, weaners, growing-finishing pigs
Farm type
Combined system (indoor housing with outdoor run or access to pasture) and free-range system

Resilience strategies of pig producers

For all interviewed pig producers, the attitude, personal vision, beliefs and social capital played an important role in insuring resilience to shocks. Apart from these, producers had differing strategies to cope with shocks, depending on their resilience capacity (robustness, adaptability or transformabilty). Examples of these three resilience strategies are described in the following table for the six different shocks.

Table 1: Six external shocks and organic pig farmers' strategies to cope

Shock	Robustness	Adaptability	Transformability
Increased input costs	• Sufficient margin on price	• Increasing home-grown feed	• Switch to other livestock
Decreased pork prices	• Sufficient margin on price • Diverse sale channels	• Direct marketing allows adjusting prices	• Switch to other livestock
Disease outbreaks	• Insurance • Indoor production system • Good double fencing	• Flexible infrastructure allow-ing to move indoor • Home mixing of feed	• Convert to cash crop
Climate change	• Cooling infrastructure • Build up savings	• Create microclimate • Decrease pig production	• Switch to other livestock
Legislation change	• Reduce number of pigs if legislation requires more space per pig	• Build partnerships with other farmers if outdoor system is abolished	
Labour shortages	• Relying on family labour or volunteer network • Mechanisation	• Social media campaigns • Young professional program	

Producers differed not only with regards to their resilience strategies but also with regards to their inherent characteristics. The characteristics of a farm can limit its ability to respond to shocks, and therefore determine the producer's resilience strategy. Each farm type and resilience strategy furthermore proved to be non-resilient towards certain types of shock. The characteristics, strategies and points of non-resilience are summarised in the figure below.

Further Information

- **Meuwissen M.P.M. et al. (2019)**. A framework to assess the resilience of farming systems. Agricultural Systems 176, 102656. (Link)

Table 2: Robust, adaptable and transformable farms

Robust: safety oriented	Adaptable: limited by an outdoor system	Transformable: flexible through diversification
• Mostly specialised, large-scale pig breeders and fatteners. • Have invested into good permanent infrastructure and tend to rely on capital reserves to handle shocks. • Non-resilience is the result of a lock-in from the high initial investment, as producers cannot transform until they have paid-off the investment.	• Farms are mostly specialised on pig production. • Produce in outdoor systems and reply on external feed. • Non-resilience is due to legistation changes that could ban full outdoor systems and to disease outbreak, such as african swine fever.	• Very diverse farms with, among others, pigs that are mostly fed on home-grown feed. • Farms mostly use a combination of indoor and outdoor system. • Non-resilience is related to high dependence on skilled labour. The diversity requires broad skills and the ability to pay decent wages.

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Closing Chapter

The Core Organic Cofund project POWER results contribute to an increase in animal welfare and health of organic pigs while reducing the environmental footprint of the farming systems.

Outdoor run structure
The findings provide information on possible outdoor run structuring that promote animal welfare and hygiene, their environmental effects and monetary impacts. This enables organic pig producers to find suitable measures targeting their farming system to enhance animal welfare and health.

Piglet health and survival
With the evaluation of several types of action to reduce piglet mortality and health problems, POWER provides practical recommendations on management and pen design to the organic piglet producers.

Best practice and innovative farms
The innovative and best practice farms researched were portrayed and presented to disseminate their systems and practices to colleagues throughout Europe for inspiration.

Project network and cooperation
The POWER project was built on a close and inspiring cooperation between researchers and organic pig producers in eight European countries. A major thank you to all organic pig producers hosting experimental studies, providing farm data, participating in interviews, workshops and meetings etc. across Europe.

Benefits of this publication format
Using fact sheets as dissemination material, researchers can put their results into an easily readable format that allows a better understanding of results in a larger context and introduces further advisory aspects to the topic. The fact sheets can be supplemented or updated as desired. Other topics can also be integrated into the collection of fact sheets later on.

We welcome feedback, suggestions for improvement and additions to the existing and new fact sheets.

The POWER Team

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