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# ZONVARKEN: A NEW CONCEPT OF PIG FARMING

CASE STUDY

COMPASSION  in world farming **Food Business**

## BACKGROUND

The Netherlands is one of the largest pork producers in the European Union and a major exporter of pork and pork products. Pig farming in the Netherlands is characterized by large, intensively managed operations. According to the Central Office for Statistics in the Netherlands, in 2022 there were **11.3 million pigs (including 1 million breeding animals) housed** in the Netherlands and almost **17 million pigs were slaughtered** for meat. The majority of these animals are **kept in intensive indoor systems** while less than 1% of the pigs in the Netherlands are kept in organic systems.

Pigs reared in intensive systems are housed in barren, overcrowded pens, on bare floors without bedding, which restricts freedom of movement and their ability to engage in highly motivated behaviours such as foraging and rooting for food. Tail docking, tooth clipping, and surgical castration, all painful procedures, are commonly practised. In the Netherlands, breeding sows can be kept in sow stalls for the first four days of gestation and in farrowing crates from one week before farrowing up until the piglets are weaned (up to 5 weeks in total for every litter). Farrowing crates are a severe form of confinement where sows cannot even turn around or engage in important intrinsically motivated behaviours such as nest building prior to farrowing. Sows in the Netherlands produced an average 2.35 litters in 2021<sup>1</sup>.

There has been increasing public concern about the welfare of pigs in intensive farming systems in the Netherlands, with many consumers becoming more interested in where their food comes from and how it is produced<sup>2</sup>. As a result, there has been a growing demand for meat coming from pigs that have been raised in more humane and sustainable systems.

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<sup>1</sup> [https://projectblue.blob.core.windows.net/media/Default/Pork/Pork%20MI%20files/CostPigProduction2021\\_221117\\_WEB.pdf](https://projectblue.blob.core.windows.net/media/Default/Pork/Pork%20MI%20files/CostPigProduction2021_221117_WEB.pdf)

<sup>2</sup> <https://www.wur.nl/nl/nieuws/Consument-betaalt-graag-meer-voor-informatie-over-herkomst-varkenshaasje.htm>

Consumers are also increasingly concerned by the environmental impact of meat<sup>3</sup>. In addition farmers struggle with long working hours and unreliable and unstable incomes which often lead to farmer protests and difficulty in negotiating any changes in sector, leading to more sustainable production (as recently happened in 2022/23 because of government's goals to reduce nitrogen emissions). Concerns over animal welfare, environmental impact of meat production, and farmer income are often seen as conflicting.



**'Zonvarken' is a new concept of pig farming in the Netherlands.**

Founded in 2018 by four entrepreneurs with backgrounds in farming, genetics, and feed production: Rob Nieuwenhuis (farmer), Otto Offenbergh (pig genetics), Jeroen Koks (food business product manager), and August Offenbergh (animal feed sector), the Zonvarken concept aims to address these key issues in pig farming. Zonvarken products are available at Jumbo, country-wide, the 2nd largest supermarket chain in the Netherlands.

<sup>3</sup> <https://www.cbs.nl/nl-nl/longread/rapportages/2021/klimaatverandering-en-energietransitie-opvattingen-en-gedrag-van-nederlanders-in-2020/6-vleesconsumptie>

*“My personal drive to develop Zonvarken is to give other farmers the opportunity to join us. More Zonvarkens also means more farmers who can be again proud and happy to be pig farmers.”*

Jeroen Koks  
Co-founder Coöperatie Zonvarken



The Zonvarken concept is a modern cooperative structure based on a small-scale business model. A full-time farmer runs two barns of 25 sows each, while a part-time farmer runs just one barn. Under this model, Zonvarken estimates that a full-time farmer can sell 1,200 meat pigs per year (50 sows, each producing 2 litters of 12 pigs per year). To join the cooperative, a farmer must invest in the right barn design (estimated cost €1,100,000 for 50 sows, €600,000 for 25 sows). A significant part of this cost covers the green roof and the manure system, both important features for reducing the environmental impact of the system. A farmer who switches from intensive farming can get a very favourable loan (~1% interest) from Groenfonds, a social enterprise and green investment institution, and the Zonvarken cooperative gives a 5-year guarantee for sales and price.

A Zonvarken farmer does not own the pigs in their barns, which are instead owned by the cooperative. However, as members of the cooperative, the farmers are co-owners of all pigs in the cooperative.

The Zonvarken model works as an All-In-All-Out (AIAO) production system – animals remain in their same groups without mixing throughout the production period, and the group moves through the phases of production at the same time. Pigs are reared until 25 weeks of age (~5.5 months of age, average 93 kg) before they are sent for slaughter.

Three Zonvarken farms are currently in operation (two full-time with 50 sows each, one part-time with 25 sows) and the intention is to scale the cooperative to 13 farms of 50 sows. This will ensure that farrowing is spread evenly throughout the year, guaranteeing a stable supply of pigs.

The Zonvarken concept aims to have a farming system which benefits pigs, the farmer, and the environment. The starting point was building a pig farm that tackles the main problems of the pig industry in the Netherlands, including poor animal welfare, high carbon and nitrogen emissions, low income for the farmers, and air pollution experienced by those living in the surrounding areas.

## PIG WELFARE

Zonvarken has been officially awarded 3 stars, the highest rating possible, by the Dutch "Beter Leven" animal welfare certification scheme. In this model, the farmer has enough time available to look after the pigs due to the small-scale AIAO design.

### Meat Pigs

Zonvarken pigs are reared in a Specific Stress Free (SSF) family pen. In each pen, two or three sows are housed together with their piglets in straw bedded pens. Piglets are not tail docked and tooth clipping or grinding is not performed. The sows are removed when the piglets are weaned at 8 weeks of age. This long period with the sow ensures the piglets have access to high quality milk and are able to adapt better to solid food, resulting in less weight loss than conventional systems.



The piglets remain in the same pen and same group from birth right up until slaughter, including on the transport truck, removing the risk of aggression and stress which occurs when piglets are mixed. The walls of the pens in the Zonvarken stall are made of wood, which means fewer loud noises and a much quieter environment. As the piglets grow, the indoor pen size is increased to provide sufficient space (max. 36m<sup>2</sup>, 1.3m<sup>2</sup> per pig). In addition, the pigs have permanent access to an outdoor paved yard (28m<sup>2</sup>) and are periodically given access to a 'piglet playground', an unpaved lawn area, so that they can really root in soil. Feed is mixed in the straw several times a day to stimulate foraging and rooting behaviour.



Thanks to an enriched environment with plenty of space and stable groups, Zonvarken reports no problem of tail biting. The pigs are slaughtered around 5.5 months of age by electrical stunning at Compaxo in Zevenaar. The new slaughter line (2022) has been designed with input from NGO "Eyes on animals".

## Sows

The sows in the Zonvarken model also have a better life than those in intensive systems. When not with their piglets, sows are group housed with access to an outdoor grass covered orchard area (~1 Ha) with trees and a wallowing area. Here they have plenty of space and can root in the soil and cool off in the hot weather. Sows may only be separated for short periods for insemination but are immediately returned to the group, and remain group housed until just before farrowing. Selection for calmer sows and provision of an enriched environment has ensured that group housing throughout the whole gestation period is possible.





Zonvarken sows farrow in spacious zero confinement pens (2-3 sows per pen) with plenty of straw bedding on solid floors and access to the outdoor yard. In this system, the sow does not suffer from the severe restriction of movement of conventional farrowing crates and can perform the highly motivated nest building behaviour in the period before farrowing.

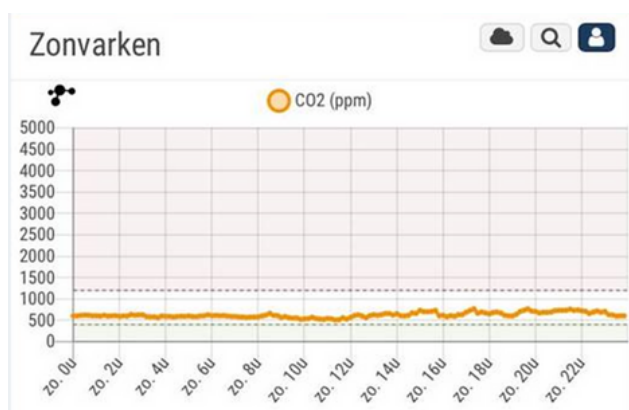
The production pressure on the sow is lower than in conventional systems. Zonvarken sows produce only two litters per year (compared to the national average of 2.35 in 2021<sup>4</sup>) and Zonvarken do not breed for hyperprolific sows – their aim is an average litter size of 12 (maximum 14) piglets/sow which is lower than the European average of 15 piglets born alive per litter in 2021<sup>5</sup>). Rather than breeding for high productivity, Zonvarken breed for sows which demonstrate good maternal behaviour based on the Hampshire, Dutch Landpig and Spanish Duroc breeds.

Zonvarken reports that they do not observe major problems with crushing of the piglets in their free farrowing system. In fact, current (2023) pre-weaning piglet mortality at 11-13% is under the national average of 13-14% and the aim is to reach 6-7% in the future, when the new breed of pig is fully developed (in 2 generations). Some lessons learned to ensure the system runs smoothly include keeping sows to a maximum of three in the farrowing pens and making sure that sows are synchronised in their farrowing cycles to ensure that all piglets have equal access to colostrum.

<sup>4</sup> [https://projectblue.blob.core.windows.net/media/Default/Pork/Pork%20MI%20files/CostPigProduction2021\\_221117\\_WEB.pdf](https://projectblue.blob.core.windows.net/media/Default/Pork/Pork%20MI%20files/CostPigProduction2021_221117_WEB.pdf)

## Healthy Environment

Poor air quality is a risk factor for tail biting and respiratory disorders in pigs. Zonvarken barns are clean and naturally well-ventilated with fresh air, and manure is separated and frequently removed reducing ammonia build up in the barn. In addition, ionizing lamps are used to reduce particulate matter and odour to a minimum.



The barns have green roofs consisting of sedum – a plant which captures a lot of particulate matter. Low measurements of environmental parameters in the barns, such as humidity, ammonia, and CO<sub>2</sub>, confirm that the environment is healthy.

In conventional pig barns, ammonia concentrations of 5-18ppm are 'normal' (RIVM, Dutch National Institute for Public Health and the Environment), but it is known that people can experience breathing problems at concentrations above 6ppm. In Zonvarken barns, sometimes the concentration of ammonia is so low that it is not detectable (1ppm). The CO<sub>2</sub> value of outdoor air is 400ppm and in office spaces it may be between 800 and 1200ppm. Zonvarken measures 600-700 ppm CO<sub>2</sub> in the barns.





## FARMER WELLBEING

Due to the small-scale design and the AIAO principle, a Zonvarken farmer can complete the business within a 40-hour working week. For this he/she receives approximately €40,000 gross income annually. On top of this, the farmer receives payments from the cooperative for usage of the barn. In this way, the Zonvarken farmer is guaranteed a fair income for their work and can enjoy a good work-life balance. In addition, the good air quality in Zonvarken barns ensures a healthy working environment.

Pig farmers who want to switch from intensive pig farming and join the Zonvarken concept can do so if the cooperative can guarantee sales. This means that current members of the cooperative do not risk losing their income if the concept grows faster than the market. Zonvarken actively creates the market for their products through engaging directly with retailers and the meat processing industry. Making the switch requires the building of new barns with the right set-up.



## REDUCING ENVIRONMENTAL IMPACT

The Zonvarken concept goes beyond animal and farmer wellbeing and aims to reduce the environmental impact of pig production. They do this in several ways.

### Feed



Feed and feed production activities are the main contributor to the environmental impact of pig production, estimated to be responsible for between 31-76% of overall greenhouse gas emissions<sup>5</sup>. Zonvarken uses feed made from return flows and residual flows (waste products and by-products) from the human food industry. Their supplier, "Voerwaarts" specialises in making animal feed from residual food waste.

They obtain a large part of the raw materials from FeedValid, a leading party in the collection of food return flows such as stale bread and broken crackers. Thus, no agricultural land is used to grow feed specifically for the Zonvarken pigs, resulting in feed that has an approximately 60% lower CO<sub>2</sub> footprint than conventional pig feed. Additionally, as the feed is made from waste, there is no direct or indirect food competition with people.

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<sup>5</sup> Andretta, Ines, et al. "Environmental impacts of pig and poultry production: insights from a systematic review." *Frontiers in Veterinary Science* 8 (2021): 750733.

The feed that Zonvarken pigs receive:

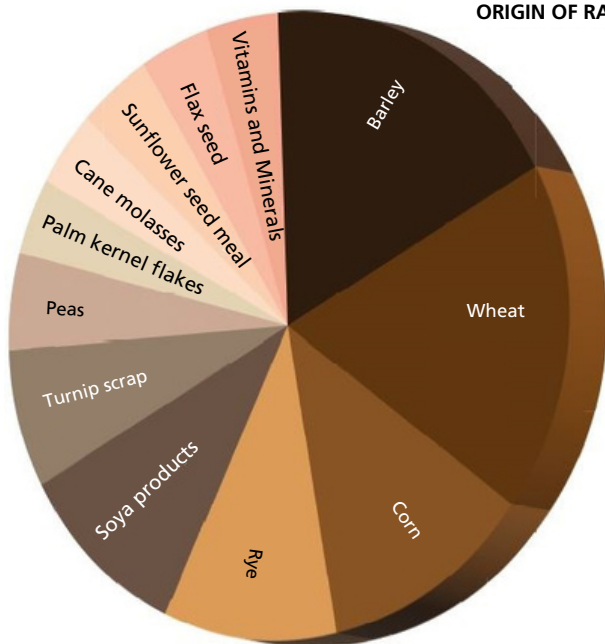
- ✔ does not compete with human food
- ✔ is made from residual and return flows of human food
- ✔ does not contain grains or other ingredients specifically grown for animal feed
- ✔ does not contain GMO products
- ✔ does not contain soy meal

Additionally, Voerwaarts do not use gas in the production of feed. In contrast with most feed producers in the Netherlands, pellets are 'cold' pressed, and part of the feed even comes as flour (unpressed) to the Zonvarken farm. This results in further CO<sub>2</sub> savings compared to conventional feed.

COMMONLY USED PIG FEED



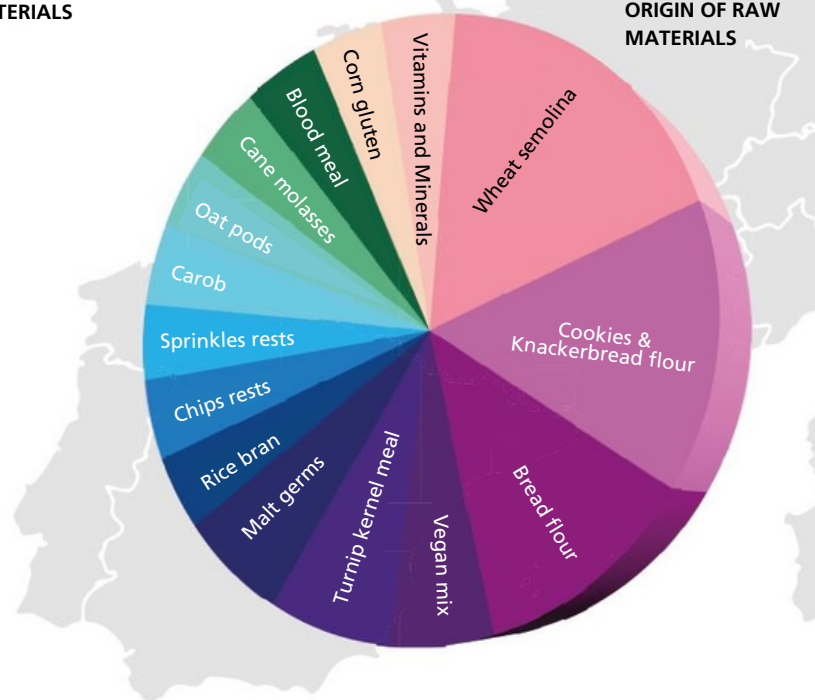
ORIGIN OF RAW MATERIALS



CIRCULAR PIG FEED



ORIGIN OF RAW MATERIALS



## CO<sub>2</sub> FOOTPRINT COMMONLY USED VS. CIRCULAR

Standard piglet feed	CO <sub>2</sub> Eq/ton	Circular spectrum	Circular piglet feed	CO <sub>2</sub> Eq/ton	Circular spectrum
Corn	570	6	Cracker bread rest stream	130*	3
Barley	447	6	Wheat semolina	306	4
Wheat semolina	306	4	Bread flour return stream	120	2
Turnip scrap	802	4	Palm kernel flakes	618	4
Wheat	450	6	Sunflower seed meal	424	4
Sunflower seed meal	424	4	Corn gluten	1412	4
Beet pulp	423	4	Beet pulp	423	4
Soya scrap	4487	6	Malt germs	295*	4
Palm kernel flakes	617	4	Cane molasses	222	4
Cane molasses	222	4	Oat pods	271	4
Flax seed	1446	6	Sprinkles	54	3
Soybean hulls	2136	6	Chips rest stream	42	3
Synthetic amino acids			Vitamins and Minerals		
Vitamins and Minerals					
639 CO <sub>2</sub> Eq/ton			354 CO <sub>2</sub> Eq/ton		

Indication of the differences in CO<sub>2</sub> footprint between conventional sow feed and circular sow feed.

CO<sub>2</sub> equivalents are averages, valid at location of origin. Transport and production operations are not yet included in this calculation.

\*= estimated values. For other raw materials these are calculated values.

## Manure Management

Manure from animal production is a major source of ammonia ( $\text{NH}_3$ ) emissions. Air with a high ammonia content is undesirable for pigs, the farmer, and the environment. However, if urine and faeces are immediately separated and removed, this reduces the release of  $\text{NH}_3$  emissions in the barn. Zonvarken use the innovative Separate Floor system (patent-pending) which separates the solid faeces and urine directly.



The solid manure is removed several times a day by means of a moving floor system (devised by Tangelder Techniek). This process has reduced ammonia emissions by about 70%.

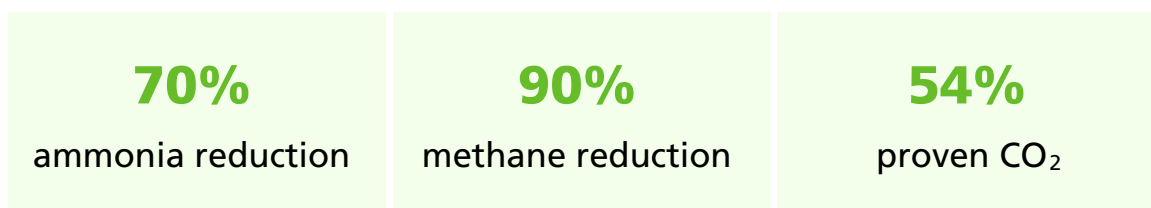
Reducing ammonia emissions literally means that the valuable nutrient nitrogen remains on the farm and ultimately serves as nutrient for plants via the manure on the field. This manure management process also results in a big reduction in methane (up to 90% reduction). Additionally, by incorporating straw in the solid manure, it can be converted into bokashi, a high-quality fertilizer made of fermented organic material which can be used to improve soil health.

## Additionally

- ✓ Trees are being planted at Zonvarken farms (orchard where the sows can go outside)
- ✓ Zonvarken barns have green roofs composed of sedum, a plant that absorbs CO<sub>2</sub> and particulate matter
- ✓ Zonvarken barns include natural light and ventilation, and all farrowings are centralized to two times a year, all factors that can help reduce energy consumption
- ✓ Only therapeutic antibiotic use on Zonvarken farms.  
Low stress and lack of mixing in the AIAO system reduces the need for therapeutic use
- ✓ All measures to improve the air quality in the barn reduce the risk of air pollution experienced in the neighbourhood

Zonvarken aims to fully compensate for their CO<sub>2</sub> emissions and they already have a proven reduction of 54% CO<sub>2</sub> emissions. They expect this to rise to 70% reduction once their separated urine is allowed to be used as a substitute for chemical fertilizer.

### KEY NUMBERS – ENVIRONMENT FRIENDLY



*“Zonvarken is a revolutionary pig farm. It shows that maximum animal welfare, minimum emission of CO<sub>2</sub> and ammonia, minimum disturbance for the neighbourhood and a healthy income for the farmer can go hand in hand.”*

## ANIMAL WELFARE ZONVARKEN



3\*\*\*  
“Beter Leven”



Healthy environment



Natural light & ventilation



Only therapeutic antibiotic use

## MEAT PIGS



Delayed weaning at 8 weeks



No tail docking, no tooth clipping or grinding



Enriched straw bedded pens



No mixing with unfamiliar pigs



Indoor space allowance for fattening pigs: 1.3m<sup>2</sup> per pig



Additional permanent access to outdoor yard



Periodic access to outdoor lawn area for rooting and play



Selection for good maternal behaviour



Breeding for max. 14 piglets per litter & selection for more robust litters



Pre-weaning mortality rate: 11-13%, goal 7%



Transport to slaughter – max. four hours



No use of high concentration CO<sub>2</sub> for slaughter



## SOWS



No caged systems



Group housing throughout gestation



Free farrowing in zero confinement pens



Access to nest building material prior to parturition



Indoor and outdoor access in farrowing pen



Enriched outdoor access during gestation – orchards, wallow

## KEY NUMBERS

**40-hour**  
work week  
for farmer

**50 sows**  
per farmer for  
full-time or  
**25 sows**  
for part time

Max  
**14 piglets**  
per litter

**2 litters**  
per year  
per sow

Farmer gross  
income:  
**€40.000**  
per year +  
payment for  
barn use

Currently  
**3 farms**  
operational  
(125 sows)



## KEY MESSAGES

Zonvarken takes a holistic approach to address many of the key issues in pig farming from animal welfare to farmer wellbeing and environmental impact.

Well-designed housing which takes the animals' needs into account can be profitable and provide a good quality of life for the pigs and the farmer.

Zero confinement free-farrowing systems do not necessarily result in higher mortality in piglets if systems are spacious, well designed, and well managed.

Selection for smaller more robust litters and good maternal behaviour is a key aspect for the success of free-farrowing systems.

Providing an enriched, low stress environment for growing pigs reduces key welfare problems like tail biting, common in conventional systems.

Antibiotic use can be minimised by rearing animals in low stress environments.

Innovative approaches to feed and manure management can vastly reduce the environmental impact and at the same time allow for the provision of meaningful enrichment, such as straw, for the animals.

Good manure management can also be used to increase soil health.

The model is based on small scale farms but can be replicated elsewhere.

A concept that addresses animal welfare and environmental issues meets consumers' expectations of sustainable systems, which raises a lot of interest from leading retailers, supply chain partners, as well as other farmers who want to transition to this system.



## ZONVARKEN: A NEW CONCEPT OF PIG FARMING

### TO FIND OUT MORE

Further resources on pig and sow welfare can be found on Compassion's Food Business website here: <https://www.compassioninfoodbusiness.com/resources/pigs/>

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