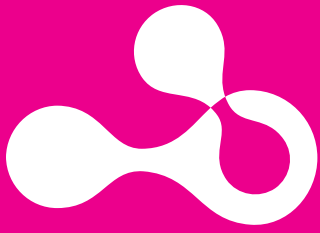


2020-21



Corporate Social
Responsibility Magazine

Responsible

The vigorous pig



Topigs Norsvin

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Vigorous pigs



Being one of the leading pig genetics companies in the world, Topigs Norsvin has a responsibility. We feel that society is currently continuously worried about the environment, food safety, and animal welfare, and we feel a responsibility to act on this.

Hans Olijslagers
CTO Topigs Norsvin

Environmental issues are increasing in importance. In many regions, animal husbandry is under pressure as it has a negative impact on the environment while more efficient production contributes to minimizing losses and lowering environmental impact. The role of animal genetics is highly underestimated in this. For example, every year we improve efficiency in our lines (e.g. protein digestibility) by 2 to 3%.

Food safety and animal health is a growing societal concern. The African swine fever crisis in Asia and Europe is showing the impact of diseases on the world's protein markets and meat availability. Disease resistance is another theme where Topigs Norsvin accepts its responsibility, for example by decreasing pig mortality by improving natural resistance against PPRS and other diseases. We see this as a more responsible way rather than going into a narrow road of gene editing for a certain disease, not knowing the exact side effects, and whether society will accept these new reproduction and genetic manipulation technologies.

In animal welfare, Topigs Norsvin has been demonstrating its responsibility for decades. Balanced breeding is a motto of Topigs Norsvin. About 20 years ago, we started selecting for mothering ability in sows and survivability of piglets. And since then, 'Every extra piglet born should be weaned at the sow', has been part of our breeding goals. Genomics and sensor technology give us opportunity to start selecting against the bad behavior of animals and boar taint levels have decreased dramatically in Topigs Norsvin pigs last 5 years.

Topigs Norsvin has taken on the responsibility to breed vigorous pigs that can meet the challenges our industry is facing. Our breeding goals are designed to keep the wellbeing of the pig, the farmer, and the environment in mind. That is how we contribute to the sustainable and responsible production of pork. Both now and in the future.

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Topigs Norsvin, a unique team of scientists, specialists, farmers, customers and partners. Spread across the world, and united in our vision to create **Progress in Pigs. Every Day.** We are proud to be a part of this company.



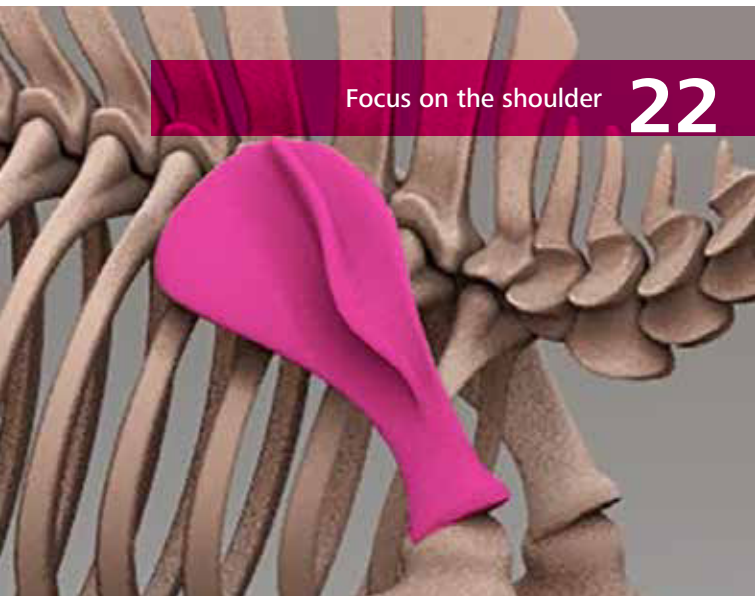
Sustainable and problem free production

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Better health and welfare

20



Focus on the shoulder

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We comply with Code-EFABAR

As a breeding company we are at the beginning of the food supply chain. This means that just like all other chain partners we are responsible for supplying safe, healthy and responsible food in a sustainable manner. We take this responsibility seriously and this is why we comply with Code-EFABAR.

Code-EFABAR, the commitment to responsible breeding, is a voluntary Code of Good Practice for and by the animal breeding sector. By adhering to this code, we at Topigs Norsvin demonstrate our commitment to sustainability. For more information, please visit www.responsiblebreeding.eu



Partner in Breed4Food

Topigs Norsvin is one of the partners of the Breed4Food research consortium, a world-leading center for research and innovation in livestock genetics. Breeding of animals requires high investments in R&D and long-term commitment to meet changing consumer demands in order to increase the efficiency within the food chain, reduce the ecological footprint, minimize the use of antibiotics and contribute to food safety, better health and welfare of livestock. By combining forces, four Dutch breeding companies create more possibilities for developing new tools with respect to this. Read more about Breed4Food at www.breed4food.com



Sustainable and **problem-free** production

The perfect team: a sow with her traits of longevity, high milk production and mothering abilities, and a piglet with its robustness, health and social behavior. Together they are the basis of a sustainable and problem-free undisturbed production, from birth to the end of the finisher stage.

The balanced breeding program of Topigs Norsvin combines all aspects of the mothering abilities, piglet vitality, health, and robustness of both sows and piglets. This enables us to live up to our credo: **«Every extra piglet born should be nursed and weaned by its own mother.»**



The contribution of the sow

Sustainable and problem-free production starts with the sow. Topigs Norsvin sows are robust and strong themselves and this enables them to produce strong and robust piglets in many self-going uniform litters.

Strong and uniform litters

We started to implement our unique and famous piglet weighing and vitality protocol 20 years ago. One of the effects of this is that sows produce uniform litters of strong and surviving piglets.

Efficient milk producer

The milk of the mother sow is the best and cheapest nutrition for young piglets. Our researchers found a relationship between milk production, fertility and longevity, and identified the genetic background of this natural mechanism. The knowledge obtained has been implemented in our breeding program. This makes the Topigs Norsvin sow an efficient feed-to-milk converter.

Many litters

A good sow can produce many litters and therefore needs a long life. Sow longevity is a complex matter. It is influenced by many traits such as leg quality, fertility and condition. As many factors play a role in longevity, it is addressed in several ways in our breeding strategy. Our female genetics are well-known for their high longevity and low mortality rate.

Calm mothers

The sow's behavior significantly contributes to the survival of her offspring. A calm mother doesn't crush her offspring, gives them time to drink colostrum, and stimulates her piglets to drink from the udder.

All this leads to a perfect start for the offspring. A good start has effects beyond the first weeks of the litters. Strong and healthy piglets will become high-quality finishers, experience improved animal welfare, are self-supporting, require less looking after, and are efficient feed-to-meat converters.

**Every extra piglet
born should be
nursed and weaned
by its own mother**

The contribution of the piglet

The piglet is the second player in the plot. Topigs Norsvin breeds piglets and finishers that are robust and surviving by nature. They can cope with climate, feed and disease challenges far better than other lines.

Vigorous from birth on

Topigs Norsvin sows farrow piglets that are more vigorous. The piglets have an earlier and higher intake of colostrum which results in a perfect start of life showing in good health, robustness and high survival rates.

These all are desirable qualities in terms of efficiency as well as sustainability.

Coping with challenges

Topigs Norsvin pigs cope better with challenges than others.

Their robustness and natural resistance allows them to better withstand challenges like disease and health issues.

Natural teammates

Topigs Norsvin breeds social pigs that are easy-going and that stimulate each other to a high feed intake. This results in less stress and a better pen performance, due to higher and more uniform growth during the whole production cycle.

**Robust and strong
pigs are sustainable
and efficient pigs**

All the above leads to uniform, efficient, problem-free and undisturbed production during finishing, resulting in a high percentage of full value pigs. Topigs Norsvin pigs are sustainable pigs that perform at a high level with low antibiotic use, high animal welfare, and low labor input.

Higher survival rates with **TN70**

Pigs in the barns and fields of the Hestbjerg Økologi farm have a lot of space and can live a happy life. Organic outdoor farming seems to be a paradise for pigs, but it is also a hard world. Especially for newborn piglets. However, the TN70 sow gives the piglets a better and stronger start. This improves survival rates.





The average pre-weaning survival rate on Danish organic farms is around 70%. But in Bertel Hestbjerg's opinion, this is not good enough for a sustainable product like organic pork. The pig farmer explains: «We, as organic producers, have an obligation to try and achieve the lowest possible mortality rate. I was unhappy with the increasing mortality rate in organic production linked to the increasing numbers of piglets born per litter and lower piglet weight.»

Bertel concluded that the local Danish genetics were not able to contribute to sufficient survival rates. He therefore started looking for a genetic solution with high survival rates and strong animals combined with high carcass quality and high production values. «I believe that the

TN70 sow gives us the best chance for succeeding in this mission.»

More pigs weaned

«This summer we weaned more pigs per sow than ever», answers Bertel when asked how the sows perform. At that moment about 50% of the sows were TN70s and the average number of piglets weaned per sow per year was 23.6. «This might seem low, but in our concept we wean at ten weeks. Recalculated to the normal weaning age in Danish organic farming of seven weeks, our average number of piglets weaned per sow is more than 26. That is very good for outdoor organic farming.»



Hestbjerg Økologi is a company with organic pig production at several locations around Holstebro in Denmark. The company owned by Bertel and his wife Marianne has 27 employees who take care of 1,500 sows. Hestbjerg Økologi produces around 25,000 finishers per year. Next to that about 5,000 weaned piglets are sold to other farmers. Hestbjerg Økologi works with the credo «If you were reborn as a pig, then you would want to end up here at Hestbjerg!» The slaughter pigs are marketed under their own brands, Poppel Gris for the Danish Coop supermarket chain and Bertel Gris for the catering and out of home channel.

Hestbjerg Økologi works with their own rules and a concept that goes beyond normal organic production. Just a few examples: Where normal organic farms wean at 7 weeks, they do it at 10 weeks. This leads to more healthy digestion which makes it possible to produce without use of antibiotics. Another example is that the finishers live in big groups with 1.9 square meter living space per animal and a «wellness center» where they can root with their snouts in a mixture of heather, wood chips and shrubs. More info at hestbjerg.dk

The improvement is mainly the effect of a higher survival rate. The national average is about 70%. At Hestbjerg Økologi the survival rate is above 80%. «We also see that TN70 litters are more uniform and heavier at birth and at weaning.» Other data about the effect of the TN70 is difficult to obtain as outdoor housing, with piglets moving around from sow to sow, makes it hard to collect data. Besides that, the sows are still in their first litters, so Bertel cannot tell much about the longevity of the TN70.

Good mothers

Although not backed up by data, Bertel and his team see clear differences between the Danish genetics and TN70. The sows are easy to work with and they are good mothers. They are nice to the caretakers as well as to their own offspring. «The mothers stay with their piglets longer after farrowing and are real milk producers. We like a sow that does the work of rearing their pigs itself. That is good for the pigs and good for our employees.»



Topigs Norsvin's robustness fits to organic production

Good news spreads fast. Also in Denmark. Although Bovbjerg Økologi is rapidly increasing the production of TN70 sows, the market is currently asking for more than the available production.

A few years ago Henrik Bovbjerg decided to start working in a niche area of pig production: The production of gilts for organic production. The young farmer is the first, and so far only, TN70 multiplier for organic sow farms in Denmark.

His choice for the TN70 sow of Topigs Norsvin was something of a surprise to many. But it turned out to be a good one. More and more customers now want to switch to the TN70. This means that the number of Norsvin Landrace sows on his farm is growing at high speed in order to meet the demand in Denmark and surrounding countries. The substantially higher survival rate of the piglets is one of the reasons for the rising demand. The easy handling and good mothering abilities appeal to the market as well.

The sows on Henrik Bovbjerg's farm have not produced many litters yet. Despite that, it is not difficult for him to

see the positive effects of the TN70 in organic systems compared to the traditional Danish genetics. «The piglets are more robust and are 250-300 grams heavier at birth, weaning weights are higher. And although the number of piglets born is lower, the number of weaned per litter is 10% higher. Next to that we see fewer health problems.»

Survival rates make the difference

The higher survival rates make a big difference. «We see this in the whole production, not only before weaning. Even the mortality rates of the sows seems to be lower.» All this combined with the easy handling of the calmer sows makes it a perfect match for organic farming. The results of the first data from the TN70 offspring show a daily gain of 1,065 grams with a feed conversion of 2.56. Henrik: "This all leads to lower production costs, more efficiency, better animal welfare, and more job satisfaction.»

Together with seven employees, Henrik Bovbjerg of Bovbjerg Økologi in Give, Denmark, runs an organic outdoor multiplier farm with 600 sows and finishers. At the moment 50% of the SPF sows are Norsvin Landrace for the production of TN70 sows. Gilts go to organic farmers in Denmark and other countries in Europe. The rest of the sows on the farm are TN70s.

More info at bovbjerg-okologi.dk



Focus on

sow longevity for **animal welfare and economics**

Sow longevity is important from the perspective of welfare and also from an economic point of view. The theme has recently gained importance in the industry, but has been part of the Topigs Norsvin breeding programme for the last fifteen years already. Director Genetics Arjan Neerhof **answers 4 questions** about sow longevity.

1 | What determines the longevity of a sow?

«There comes a point when the farmer or manager decides to cull the sow. We believe that it matters whether that is voluntary or involuntary. To increase the longevity, it is important to postpone the moment of voluntary culling until the economic optimum, but even more so to prevent involuntary culling. This is basically premature culling and can, for example, be due to injury or poor leg structure. The reasons for involuntary culling have changed throughout the years. Due to genetic selection, sow fertility has improved in the past decennia so that this is not a major reason anymore, while the transition to group housing and free farrowing crates has increased the importance of leg structure and behaviour. Furthermore, due to the increasing litter size and related milk production, as well as the required capacity to foster large litters of heavy piglets, the sow lactation feed intake has assumed high importance.»

2 | What does this mean for the breeding programme?


«First of all, it means that we need to constantly develop the programme. What is a major aspect of longevity today, might not be so tomorrow. This could be because circumstances have changed or because genetic progress has been so significant that that specific aspect is no longer, or less of, a bottleneck. At Topigs Norsvin, longevity has

been in the breeding goal since 2005. Another complication is that we cannot measure the sow longevity breeding goal trait in our genetic nucleus farms. Circumstances at the nucleus farms are incomparable to the commercial production environments, and besides that, culling decisions in the genetic nucleus herds are based on the genetic selection index to increase the genetic progress. For these reasons, the sow replacement rate is much higher compared to commercial farms.

So, to gather the data we need to determine breeding values for sow longevity, we have started to collect data and genotyping sows at commercial farms for training data in the genomic breeding value estimation. Some might call us crazy for doing that, but it is the only way to gather truly reliable and relevant data.»

3 | Which data do you use to predict the breeding values?

«An important aspect in this is, of course, the parity at culling, literally longevity. There are two breeding goal characteristics that are of importance here: the number of parities a sow reaches and whether or not she makes it to the second litter. The latter is important, not only because it takes less time to reach this point, but also because we know that there is a strong genetic correlation between reaching the second litter and a high longevity. In other words, once a sow has had her second litter, there will be a much lower change for involuntary culling



in the subsequent parities. Besides the longevity itself, there are also a number of important predictor traits. We know that the body condition at weaning, the occurrence of shoulder lesions, osteochondritis, which we measure through CT scanning, and certain fertility and exterior characteristics have a high correlation with longevity. Thanks to genomics, we know which DNA-profile ensures a good longevity and we use this information to select a new generation of boars and gilts for our breeding programme.»

4 | What has been reached within all those years of breeding for longevity?

«When I take the Netherlands, where we have a market share of about 70%, as an example, I see that circumstances for our sows have become much more demanding. The pressure on farmers to lower the cost price and to increase the number of piglets weaned while reducing costs is enormous. In fifteen years, the average number of weaned pigs per sow in the herd has risen from around 24 to well over 30 per year. On top of that, housing standards have changed and group housing has now been implemented in all farms. The efficiency has also increased considerably, whereas the amount of sow feed per piglet produced has been reduced by over 20%. In the meantime, the average replacement rate of Topigs Norsvin genetics in the Netherlands has barely increased and is still around 43%. I think that this is quite remarkable and something to be proud of.»

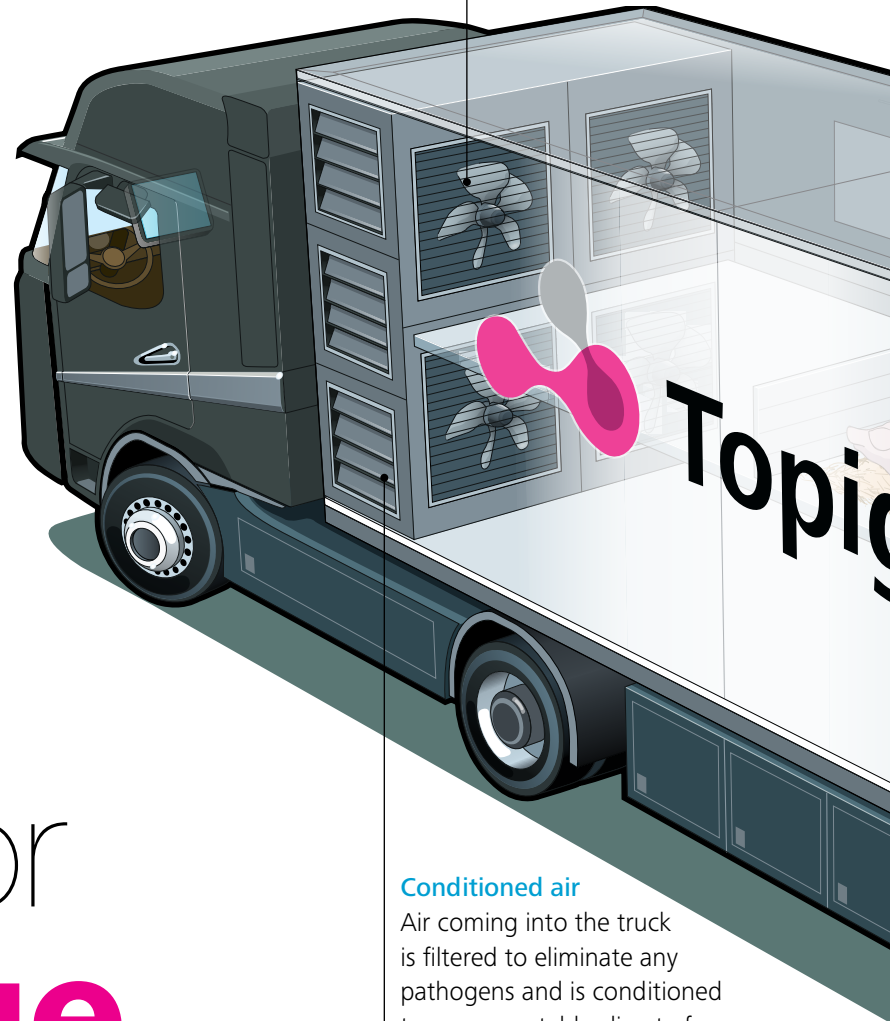
Specially trained drivers

The drivers of the truck are specially trained to handle their delicate freight with the utmost care and to take into account any concerns about welfare and safety.



Heating and cooling

To ensure a comfortable, stable climate, the inside of the truck can be heated or cooled.

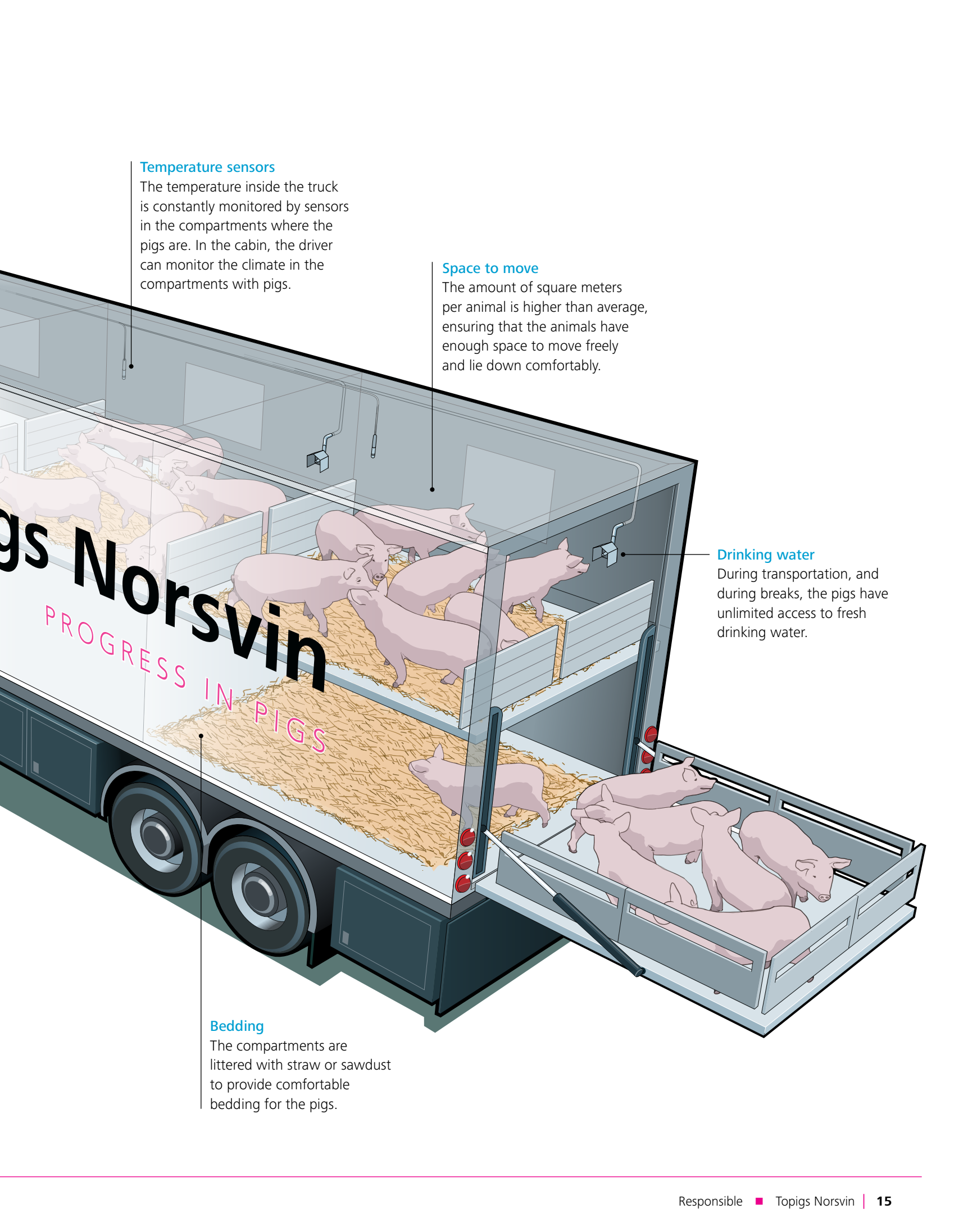


Conditioned air

Air coming into the truck is filtered to eliminate any pathogens and is conditioned to ensure a stable climate for the pigs.

High level transport for **high value animals**

The transportation of Topigs Norsvin breeding stock is a delicate and sensitive matter. It concerns high-health animals, with a high economic value. It is therefore extremely important to avoid any stress, discomfort, injury and every risk of infection. This is why only the highest standards for animal welfare and safety are good enough.



Temperature sensors

The temperature inside the truck is constantly monitored by sensors in the compartments where the pigs are. In the cabin, the driver can monitor the climate in the compartments with pigs.

Space to move

The amount of square meters per animal is higher than average, ensuring that the animals have enough space to move freely and lie down comfortably.

Drinking water

During transportation, and during breaks, the pigs have unlimited access to fresh drinking water.

Bedding

The compartments are littered with straw or sawdust to provide comfortable bedding for the pigs.

Robustness

pays off

TN Tempo - bred to be tough

Robustness is an important element of the breeding goal of all Topigs Norsvin lines. This is being made evident through the production of strong, vigorous pigs that cope better under challenging circumstances. The TN Tempo is a good example: it has already been observed on farms for many years, and was recently scientifically proven that the TN Tempo copes better with diseases like PRRS.

In 2018, a leading US integrator conducted a trial to evaluate performance differences between TN Tempo-sired progeny versus progeny sired by a leading competitor line when challenged with PRRS.

Unseen difference

The magnitude of the performance differences between lines was unlike anything that the research group had ever witnessed. TN Tempo-sired pigs outperformed pigs sired by the competitor line in nearly every trait. These results demonstrated the superior robustness of the TN Tempo.

The largest difference detected between groups was the survival rate, where the TN Tempo group had 60% fewer mortalities than the competitor. TN Tempo-sired pigs also recovered faster, resulting in faster daily gain and better feed efficiency. Together, these performance advantages led to an extra \$9.23 or €8.16 per pig placed, compared to the competitor line.

In another trial, the same integrator evaluated the performance differences between TN Tempo-sired progeny versus progeny sired by the competitor under

conventional health conditions. The TN Tempo group was the clear winner with a \$2.64 or €2.33 advantage per finisher, again, partly attributed to a significantly superior survival rate.

However, the financial advantage of the TN Tempo is not the only benefit of superior robustness. Enhanced robustness also contributes to more sustainable production. For example, lower mortality and faster recovery following disease challenge contributes to better animal welfare and reduced antibiotic usage. Robustness also leads to more efficient production, meaning that less feed and other resources are required for production.

Not only PRRS

The robustness of the TN Tempo doesn't just pay off when challenged with PRRS. In fact, the TN Tempo has demonstrated enhanced robustness to challenge other pathogens, as well as enhanced robustness to climatic challenges. The ability of the TN Tempo to maintain a hearty appetite during such challenges contributes to its robustness.

Achieving natural robustness to disease through traditional breeding

Topigs Norsvin uses the most advanced genomic technology to breed pigs for improved robustness in order to disease challenge. We have already achieved substantial genetic improvement in this area and expect to achieve even more in the future. This success is due in part to testing over 2,000 animals per year under challenging conditions and using genomic information to select more disease resistant pigs.

Topigs Norsvin is the technology leader in the industry and we follow the developments in gene editing technology very closely.

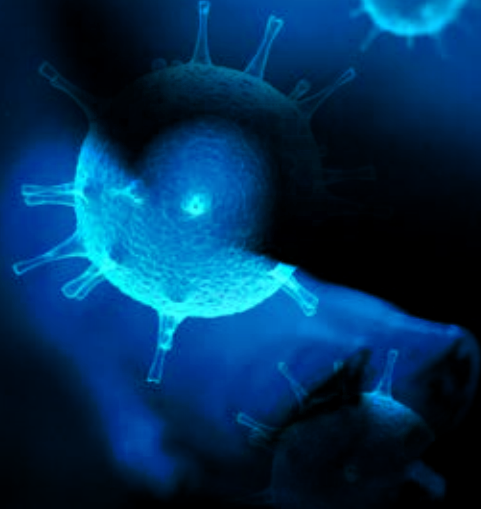
However, despite the possible advantages of gene editing, we do not currently use gene editing in our breeding program due to the immaturity of the technology, coupled with certain concerns regarding public acceptance.

Rather, Topigs Norsvin continues to pursue traditional breeding strategies to enhance their natural resistance to specific diseases, like PRRS, as well as a general robustness to the challenges of disease.



Breeding for enhanced, natural PRRS resistance

In 2018, Topigs Norsvin implemented selection for increased natural resistance to PRRS by including breeding values for partial PRRS resistance into the selection index. Breeding values are calculated based on WUR SNP genotype, a genetic marker for a major gene associated with natural resistance to PRRS. Pigs with the favorable genotype are better able to cope with the PRRS virus infection and this results in better performance following infection, and therefore, reduces the overall economic impact of the disease.



Vigorous pigs are survivors

Vigorous pigs are survivors. Topigs Norsvin's philosophy is that pigs should be able to take care of themselves. The vitality of piglets and finishers has therefore always been a point of focus. Something that is of increasing importance in the market, explains Pramod Mathur. «We notice that of all the traits in pig production, the traits related to robustness, disease resistance, and vitality are of increasing significance to our clients.»

Pramod Mathur is senior geneticist and director of research and development for Canada at Topigs Norsvin and has seen an increasing focus on vitality in the past few years. "Over the past years, remarkable improvement has been made in traits related to efficiency and productivity. These traits are now reaching their optimum.

At the same time, the trend towards lower labor continues and it is becoming increasingly difficult to manage extra piglets and fast growing feed efficient finishers due to a shortage of labor. This explains why it is becoming even more important that pigs are self-sustaining and vital.»



Definition of vitality

Mathur defines vitality as «the ability of piglets and finishers to survive and grow well under the challenging conditions in commercial environments. We consider vitality right from conception up to the finisher as it is delivered to processing plant.» To secure the vitality of Topigs Norsvin pigs in a time of increasing focus on litter size and production, Topigs Norsvin introduced a vitality protocol in 2001. «The goal of the protocol is to maintain mortality at a minimum level while continuously improving litter size to meet the requirements of the industry. To make sure that any extra piglets produced also survive without the need for extra management, we need to focus on robust, strong animals. Because of the vitality protocol, we monitor vitality at every stage of the production.»

Vitality in finishers

In addition to the existing breeding values for piglet vitality and sow longevity, Topigs Norsvin is now working on finisher survival, on the farm and during transportation. The newly established Delta Canada test station is a state-of-the-art facility used for conducting research on stress during loading and transportation and testing new concepts such as the use of metabolites and computed tomography. Mathur: "A major theme in this is the issue of dead on arrival at the slaughter plant, a problem mainly in the US where transportation distances are longer and weather circumstances can be very challenging. We are also working together with a large commercial operation in the US to investigate this. They take a DNA sample of every pig that dies on the way to the slaughter plant and we will then look at the genes and markers to gain an insight into the traits related to this issue. On top of that, we are doing research with finisher pigs in Canada where we simulate transport conditions and measure their stress levels. The goal: self-supporting, vital piglets and finishers to maximize the benefits to our clients through genetics.»

Vitality protocol

Every piglet born in the Topigs Norsvin breeding program is weighed and this accounts for up to about 750,000 piglets per year at over 100 breeding farms all over the world. «We know that birth weight is an important indicator for survival and that lighter piglets have less chance of survival. But vitality is about more than just birth weight. For more than fifteen years, we have been monitoring the survival of piglets from birth to weaning. This data is translated into the breeding value for piglet vitality. And this pays off: piglets with a high breeding value for vitality have a better chance of survival.»

Research has shown that piglets with a high breeding value for piglet vitality have higher cortisol levels in their blood just before birth, something which stimulates organ development before birth. They also have longer and better developed intestines, as well as more energy reserves at birth, for example in the form of fat reserves and higher glycogen levels in blood and liver.





Better **health** and **welfare**
through slaughter data

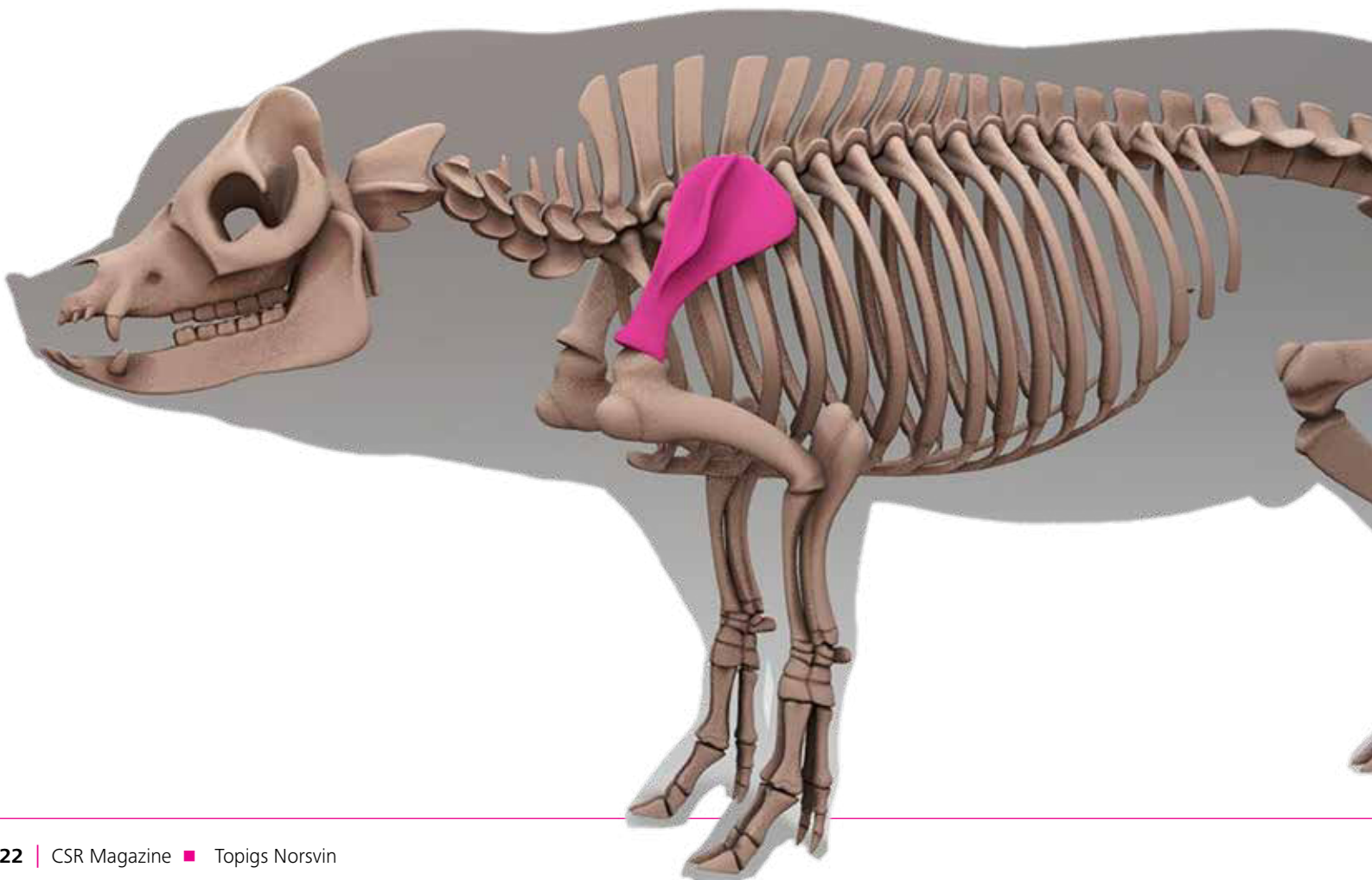


Focus

on the shoulder

Around the time of farrowing, sows spend a lot of their time lying down. This can cause wounds at the shoulder which are painful and often return in following lactations. Why do some sows develop shoulder lesions, while others don't? How can we use genetics to reduce the risk of shoulder injury, and thereby improve sow welfare and lower replacement rates? With help from a CT-scanner, Topigs Norsvin researchers look for the answers on those questions.

The main focus of this research is the scapula or shoulder blade. A bone that has a notable shape, with a protruding spine that is in almost direct contact with the ground, and covered only by skin and tissue. The CT-scanner makes it possible to closely examine this bone in live animals and connect these data to the genetic information of the animal. Researcher Øyvind Nordbø gives a quick tour of the scapula or shoulder bone and the research he is conducting.

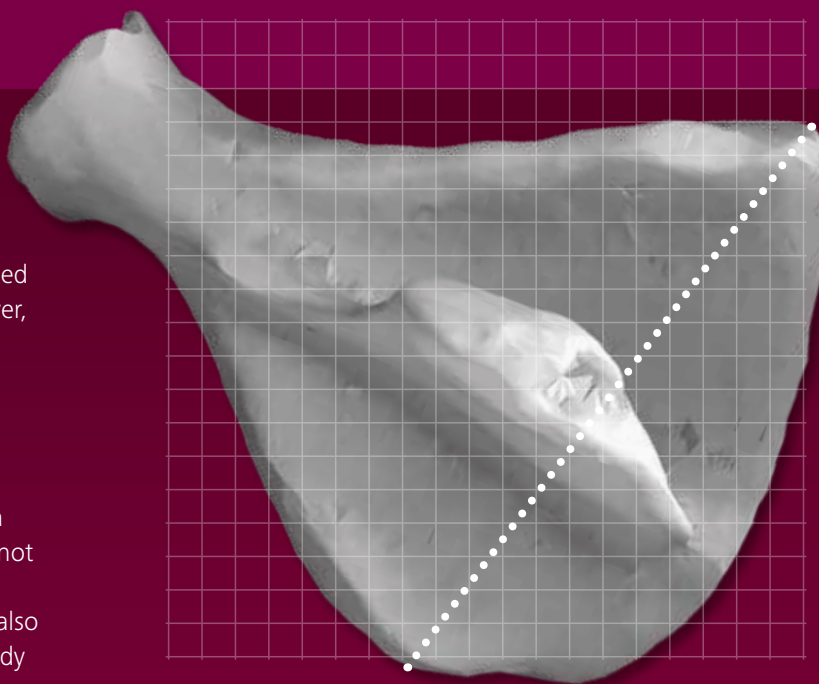


Hypothesis: **shape**

«At first we thought that the shape of the scapula was the most important factor in the risk of shoulder lesions. We assumed that perhaps the height of the spine determined whether sows are susceptible to wounds occurring. However, we decided to look further than that and also included the length, width and thickness of the bone.»

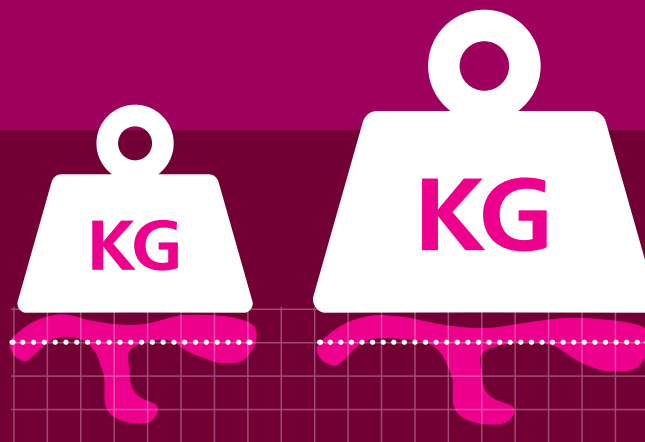
Most important: **width**

«To our surprise, it turned out that the width of the scapula was the most important aspect in determining whether or not a sow suffers from shoulder lesions. A wide scapula means a greater risk of developing severe lesions. In addition, we also found out that a wide scapula width also decreased the body condition of sows at weaning.»



More **width**, more **weight**

«Although we weren't expecting this outcome, the probable explanation for this is that a broader scapula carries more weight. Because a larger part of the sow is resting on the scapula and more weight is accumulated on the protruding spine.»



High **heritability**

«A great advantage of this new insight into the effect of scapula width is that the heritability is 0.73, which is very high. As it is possible to measure the scapula width in boars before selection, it is very valuable information. On top of that, the scapula width turns out to be strongly correlated to longevity. If we are able to include the data on the scapula width, we can increase the accuracy of the longevity index by 70%.»

The **perfect scapula**

«By using the CT images, we are now working on defining more traits of the scapula. We use a method called dimension reduction for this. This method means that we can basically

define what the perfect scapula would look like, depending on your breeding goals. The perfect scapula for carcass value will probably look different from a scapula which is connected to optimal longevity.»

Beyond the **scapula**

«One of the great things about this research is that we can apply the same method to other bones and organs. We are now preparing to use the same method for the heart which offers a lot of scope for genetic improvement.»



Reducing tail biting through **smart** resilience

Resilient pigs, which recover quickly from challenges, are less susceptible to tail biting. So how can artificial intelligence, like sensors and smart cameras, contribute to improving genetic resilience? Researcher Lisette van der Zande is working on monitoring techniques to gain an insight in the resilience of individual pigs and then translate this into breeding values.

Like every living creature, pigs are constantly exposed to challenges. Heat stress, illness, hierarchy or feed related issues are just a few examples. «In our research, we basically group together all those issues as challenges for the general wellbeing and health of the pig. The resilience of an animal is the easiness and the speed with which it recovers from those challenges,» Van der Zande explains. «Resilience is important for a number of reasons, among others because it is an important indicator of tail biting. We hypothesise that tail biting occurs less in pigs that are more resilient.»

24/7 monitoring

Van der Zande is taking part in a research project of Wageningen University which is supported by Topigs Norsvin. The project aims to develop a monitoring system that watches the pigs 24/7. Her role in the project is to focus on the development of sensors to measure the resilience of pigs. «Most data and monitoring systems focus on the group, but to be able to use data in the breeding programmes, we need individual data. The goal is to develop methods to monitor the individual pig, so that we can gather data on the resilience of individual pigs. If we have enough individual data, we can translate those insights into breeding values and use this in the breeding programme to improve the general resilience of the Topigs Norsvin pigs. That will contribute to stronger and healthier pigs, better welfare, and less tail biting.»

Behaviour after infection

Monitoring and analysing the behaviour of animals is an important part of the project. «In the first part of the research, we monitored groups of pigs using an accelerometer which detects sudden movements or accelerations. This gives a lot of information about subtle behavioural changes which are not visible with the eye. To investigate their resilience, we exposed groups of pigs to the PRRS-virus and monitored their behaviour. Which pigs became ill, and how does their behaviour change before and after infection?»

Smart cameras

Researchers are currently analysing the first data from these observations and, at the same time, preparing the next step with the use of video cameras. «We are still figuring out how to approach this, but the idea is to use a camera to capture the whole pen. An algorithm will be developed that recognises the individual pigs, and keeps tracking them. In that way you should eventually be able to monitor individual animals 24/7 without having to actually watch all the camera footage.» The advantage of cameras is that they should be able to register and distinguish different behaviours in even more detail than the accelerometer. «Accelerometers also detect the shaking of the head as movement, and although they know when an animal makes a chewing movement, it doesn't know whether it is actually feeding at that moment. The camera gives more information which makes it easier to interpret the data.»

Complex and innovative

Although the reduction of tail biting is the end goal of the research, Van der Zande emphasises that it will take some time before the results can actually be used in the breeding values. «It is quite innovative to use artificial intelligence in behaviour research, and that is rather complex. I am hoping that, once we are able to individually track and monitor an animal 24/7, we will be able to distinguish between the front and backside of the pig quite easily. In that way, we can also investigate whether the head-tail distance is an indicator of tail biting. The focus, however, remains resilience. I like to think that resilience is like a bucket which is filled by several factors: management, climate, light, disease, social hierarchy. When the bucket overflows, resilience is endangered and the chance of tail biting increases. What we are working on now is increasing the size of the bucket from a genetic point of view, which of course goes together with adequate management in order to lower the content of the bucket.»

Fascinating times make a dream come true

For more than 30 years, we have been doing research to avoid the loss of piglets due to inherited defects. And now, finally, after all those years, we can experience the benefits of some exciting new genomic tools.

For example, defects that are caused by a single gene can now be traced with high precision in the genome. These are defects that are causing death during early pregnancy, or later, resulting in mummies. Some defects are observed shortly after birth. We know that most of these variants causing genetic defects are only present at a rather low frequency. Research shows that less than 1% of the litters is affected, but that 25% of the piglets in these litters have the defect. Although these defects initially occur at extremely low frequency, they can never be avoided completely because natural changes in the genes occur in every individual.

However, we can use the new tools to monitor these defect variants and so avoid an increase in their frequency in our breeding populations. Even more, we can see that most of them only appear in one line and are not present in the other breeds. In this way, we can be sure that the crosses between our lines are not affected by these genetic defects. This gives us confidence that the finisher piglets born from our sows are not going to suffer from these diseases due to their genetic makeup.

Breeding pigs without inherited defects is a contribution to the welfare of our breeding stock. I have been dreaming of this since the beginning of my scientific career as a molecular geneticist in animal

breeding in 1985. In those early days of genomics, it took about five years to identify just one single defect. Today we can screen through the whole genome at once in no time at all!

In the future, we will be able to scroll through the book of life even better in order to identify less harmful variants and so further reduce losses in our pigs. This really makes me feel that all our efforts are now paying off for the wellbeing of our livestock.

Barbara Harlizius, Senior Researcher Genomics



