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Performing pig consultancy in a Norwegian farm

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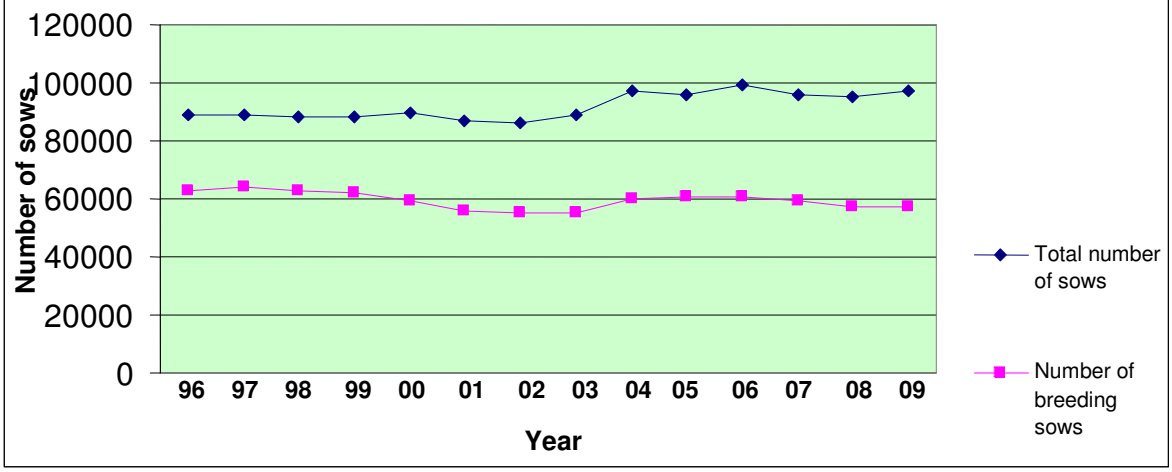
1. Introduction

1.1. Short history

It is believed that there has been domestic swine in Norway as early as 1500 – 1400 B.C.[i], migrating from Europe through Sweden. From the beginning, the pig industry had little importance in Norway, and most pig producers kept pigs only for own use. From the end of the 1800s this changed and pig meat became an important slaughter product. Its importance continued to increase through the 1900s and is still increasing today[ii]. The number of pigs in Norway in 2004 was 100 000 breeding swine and 1.40 million swine for slaughter.[iii] For 2010 these numbers were 102 000 and 1.49 respectively[iv]. 297 000 tonnes of pig meat was produced in 2007, which is an increase by 4000 tonnes from 2006.[v]

Fig. 1. Number of sows in Norway per 1st of January 1996 – 2009[VI]



1.2. Importance of pig meat in the Norwegian kitchen

Meat in general has an important role in the Norwegian kitchen, and the meat consumption has had a steady increase since the 1950s. The consumption of meat in 2009 was 77 kg per capita.[vi] From the list of the most popular meat types, pig is on top. Norwegians eat about 25 kg pig meat per capita per year. The most likely explanation for this is the consumers' awareness and wishes to eat healthy food. The last 40 years, the carcass weight of the pig has not changed, but the fat has decreased with 17 kg and the meat has increased with the same amount.[vii]

1.3. Rate of self – supply with pig meat

The supply and demand for pig meat in Norway varies not only from season to season, but also from one year to another. An organisation called Nortura has been responsible for the market regulation since 1936[viii], which means that they have to ensure the distribution of meat throughout the country and regulate the balance between demand and supply of meat. Nortura owns most of the slaughterhouses in Norway and can therefore increase the meat production if demand is higher than the supply, and insert measures to decrease production if supply is higher than the demand. In addition to this, export and import are used to balance the demand and supply in the Norwegian market.

Table 1: The variations in import of different types of pig meat in 2004 to 2006[ix]

Year	2006	2005	2004
Pig meat, total	933	2 676	899
Ham, salted, smoked or dried meat with or without bones.	507	1 317	535
Fat: salted/smoked/dried	10	20	124
Conserved products, including bacon crisps	416	1 339	240

* The numbers are given in tons

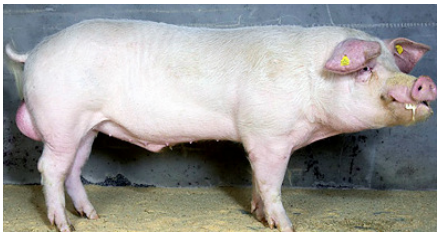
Norway is also forced to import certain amounts of meat from abroad due to the WTO agreement and the EEA agreement. This quota is responsible for the import of pig meat the last years, as Norway is, and has been, self – supplied with pig meat the last years. In 2010 there is an excessive production of pig meat in Norway, and it will therefore be exported within the WTO quota of 3790 tons.[x] The import of red meat is much higher than the pig meat, but some pig meat is imported every year.

1.4. Pig breeding

1.4.1. Main breeds[xi]

The Norwegian pig breeding is based on a pure breed from four different breeds, including Norwegian Landrace, Yorkshire, Duroc and Hampshire, and how they should be crossed to obtain the best results. Landrace and Duroc is bred and raised in Norway, but the Yorkshire is imported from Sweden.

1.4.1.1. Norwegian Landrace



Picture 1. Norwegian landrace boar

This is the oldest pig breed in Norway. It has been bred systemically since the 1960s. It is known for its high daily weight gain, its low feed conversion rate, its high proportion of lean meat and its large litter sizes and mothering ability. Norwegian Landrace is the most numerous of the breeds in Norway and counts to about 4000 sows. It is characterised by its white colour, long body, hanging ears, and straight nose. Norwegian Landrace is said to be a combined breed, as it is used for both its prolificacy and its meat producing abilities and is involved in both the maternal and paternal side in the crossing.

1.4.1.2. Yorkshire

Picture 2. Yorkshire boar

Yorkshire is the oldest known pig breed, as it dates back to the 1700s in England. The Norwegian pig breeding companies have decided to concentrate on only two pure breeds (Landrace and Duroc) because breeding programs are expensive. Yorkshire is therefore imported from “Quality genetics” in Sweden. Landrace is more effective than the Yorkshire, but by crossing the two, more and stronger piglets are obtained. The Yorkshire is known for its good maternal advantages, including large litter size, good lactation, low neonatal losses and long reproductive life. They look quite similar to the Landrace in their colour size, but they are shorter, heavier in front, have erect ears and concave nose.

1.4.1.3. Duroc

Picture 3. Duroc boar

The Duroc breeding in Norway started towards the end of the 1980s. Genes from the Danish, Swedish and Canadian Duroc population makes the basis for the Norwegian Duroc. As the gene pool of Duroc in Norway needed time to expand, the real breeding results have not started to show until the recent years. Duroc is a breed with very good meat quality. It has more intramuscular fat than the other breeds compared to Landrace and Yorkshire, and is used to make the meat tastier. It is the slaughterhouses that owns the Duroc population in Norway, but the breeding companies are responsible for the breeding itself. The Duroc is characterised by its red colour and short body. It is also heavier built than the white breeds. It does not have very good reproductive abilities, but this does not matter, as the breed is used for the paternal characteristics only.

1.4.1.4. Hampshire

Picture 4. Hampshire sow

This is the newest pig breed in Norway, which the breeding companies have been working on since 2005. The Hampshire is special because of its tasty meat and high intramuscular fat ratio. It has especially good productive abilities due to the large litter size, good feed conversion rate and high daily weight gain. It is still not very common in Norway, but from the spring 2007, Hampshire semen was made available to all pig farms in Norway.

1.4.1.5. Hybrids

The hybrid breeding in Norway is based on the fact that a Landrace (L) sow is crossed with a Yorkshire (Y) boar to produce a LY sow. About 65% of all sows in Norway are LY sows. The LY sow produces more piglets and

has more weaned piglets per litter than the pure bred Landrace and Yorkshire. The piglets produced by the LY sow are also stronger than the pure breeds.

1.4.1.5.1. Noroc

Noroc: The LY sow is crossed with a LD (Landrace x Duroc) boar to make the end hybrid called Noroc. Noroc is therefore 50% Landrace, 25% Yorkshire and 25% Duroc.

Picture 5. Noroc hybrid

1.4.1.5.2. Privathybrid

Privathybrid: Two breeds are used – the Landrace and the Yorkshire. But instead of crossing the LY sow with the LD boar (noroc), the LY sow is crossed back with a pure Landrace boar.

1.4.2. Breeding organisation

There are a few main contributors in the breeding of pigs in Norway. The national breeding organisation is Norsvin. Norsvin decides which goals to achieve and which breeds to breed. Norsvin's breeding goals for Landrace and Duroc is the following: "Norsvin aims to fulfil the interests of the whole industry. All aspects of the production, from before the piglet is born to the quality of the end product after slaughter, should be considered to balance the breeding goal. Norsvin is unique in that it combines the producers'-, the breeding industries' and the consumers' interests in the breeding goal of so large pure breed populations." [xii] The system is based on three types of pig farms: the breeding (gene) farm, the reproduction farm and the production farm.

- The breeding (gene) farm

  Norsvin breeds three breeds: Landrace (about 2300 sows and 50 elite boars), Duroc (about 650 sows and 50 elite boars) and Yorkshire (about 100 sows in farms where the semen is imported from Quality Genetics in Sweden). There are 52 of these farms spread all around the country, 42

keeps Landrace and 10 keeps Duroc. These are the only farms that produce semen boars for further selection.

- The reproduction farm

  There are almost 110 reproduction farms in Norway today. An agreement has been made between Norsvin, the slaughterhouses and the reproduction farmers. These farms buy Landrace sows from the breeding farms and inseminate these with Yorkshire semen from Norsvin to produce LY hybrids. These are sold to the production farms. Every breeding farm has fixed reproduction farms to which they deliver pigs. The most important role of the reproduction farms is to produce the LY hybrids.

- The production farm

  This type of farm makes up the largest part of the pig producers in Norway. They are divided into three: weaned pig producers, slaughter pig producers or combined. The weaned pig producers inseminate heir LY sows, keep the offspring until they are 9 – 10 weeks old and sell them to slaughter pig producers. The slaughter pig producer have no sows, but buy 25 kg pigs from the weaned pig producer to feed the to 100 kg, hen sell them to the slaughterhouse.

Another contributor to the pig breeding in Norway is Nortura. Nortura is an organisation comprising most slaughterhouses in Norway, and is owned by the farmers. Nortura answers to the market demand for meat, not only in quantity, but also in quality. As mentioned above, they own the Duroc population in Norway, but Norsvin is responsible for the breeding itself.

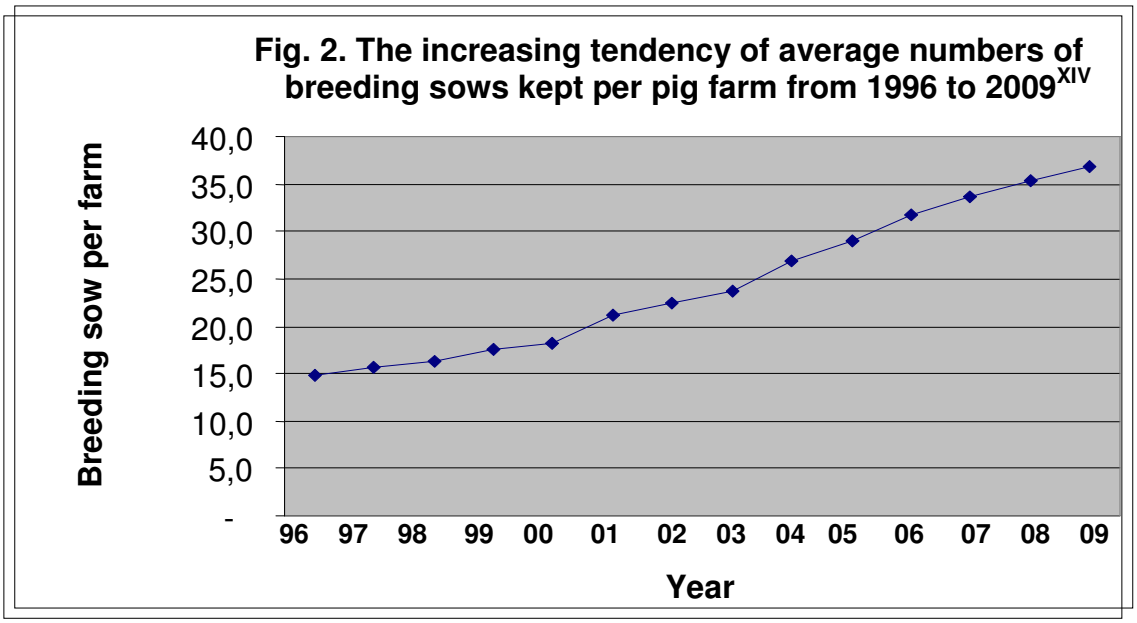
Private contributors also exist, such as ScanPig. ScanPig's main goal is to maintain the profit in swine production. To obtain this, they have started to introduce Hampshire into the breeding programs, as the third pig breed with a breeding program in Norway.

1.5. Pig health in Norway

The health status for pigs in Norway is generally good and not changing. Brachyspira hyodysenteriae has recently been eradicated on a national basis[xiii] by sanitation and tiamulin medication of sick animals. The most frequently reported diseases in pig farms last year was polyarthritis in pigs less than 1 month old, gastrointestinal diseases in nursing piglets and the periparturient disease complex in sows. No cases of list A or B diseases including ASF, CSF, Anthrax, FMD, infectious cystitis, TGE, Foot rot, Leptospirosis and PRRS were reported in the last year. Most farms vaccinate against Parvovirus infection and Diamond skin disease.

1.6. Overall structure of pig farms

As mentioned above, the larger pig farms did not start to develop until the end of the 1800s. On a national basis, the agriculture in Norway the last 15 years has developed towards fewer but larger and more effective farms.



In the last 25 years, the number of farms that uses their land themselves has decreased with 56% and employment in agriculture has decreased to half. During the same period, the meat production has increased with 55% and the average area of land per farm unit has increased with 140%!

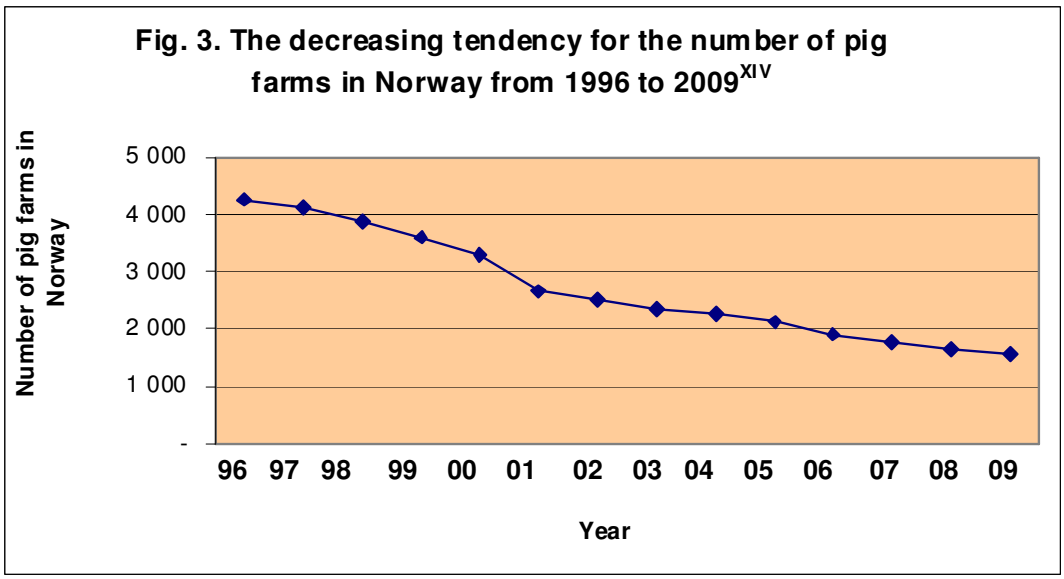


Fig. 3. The decreasing tendency for the number of pig farms in Norway from 1996 to 2009[XIV]

1.7. The role of foreign breeding organisations

As mentioned above, the Yorkshire semen is imported from Quality Genetics in Sweden. This company is responsible for the breeding programs of Yorkshire. The Duroc genes used to be imported form Denmark and Canada, but the gene pool in Norway today is big enough to keep the breeding on a national level only.

1.8. Summary

The foregoing data indicate the overall importance of pig breeding in the Norwegian animal agriculture. Upgrading the genetic merit of the present pig population by appropriate breeding programmes, keeping up the high health standards and constant improvement where it is requested together with giving multilateral scientific and practical assistance to the farmers' community for optimising the housing, feeding and animal welfare conditions is imperative in the present agricultural strategy of Norway.

1.9. Goal of the thesis

As a veterinarian undergraduate who wish to have swine practice and become pig consultant in my country I wanted to practice the theoretical knowledge I acquired with studying the general principles of animal hygiene and implement the information I get acquainted with when studying the herd-heath programmes for the swine industry within the frame "Animal Hygiene". Therefore, I studied and described the work of an average pig breeding farm that operates in Vestfold, Norway.

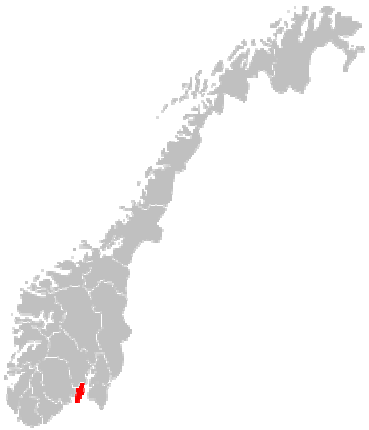
The goal of my efforts was to improve and deepen my practical skill in pig consultancy on the one hand and disclose data and information which might be useful for the interested readers, on the other. The study was decisively based on the lectures, lecture notes and Power point presentations in "Animal Hygiene" and "Pig Herd-Health Programmes" delivered and complied by Professor Pál Rafai, department of Animal Hygiene, Herd-Health and Veterinary Applied Ethology, Faculty of Veterinary Science, Budapest, Hungary, to whom I owe special thanks for all the good advices and for always being available when help was needed.

2. Method

By using the information I acquired in the above mentioned studies and especially relying on the check lists we learned, I have visited repeatedly a pig breeding farm and on this basis I described and critically evaluated the farm. In this work I have received a lot of help from the owners, Mr and Mrs Ånestad, to whom I owe special thanks. They were kind not only to disclose the main production data, but they were always ready to discuss different activities of the farm.

3. Results

3.1. Description of the pig farm

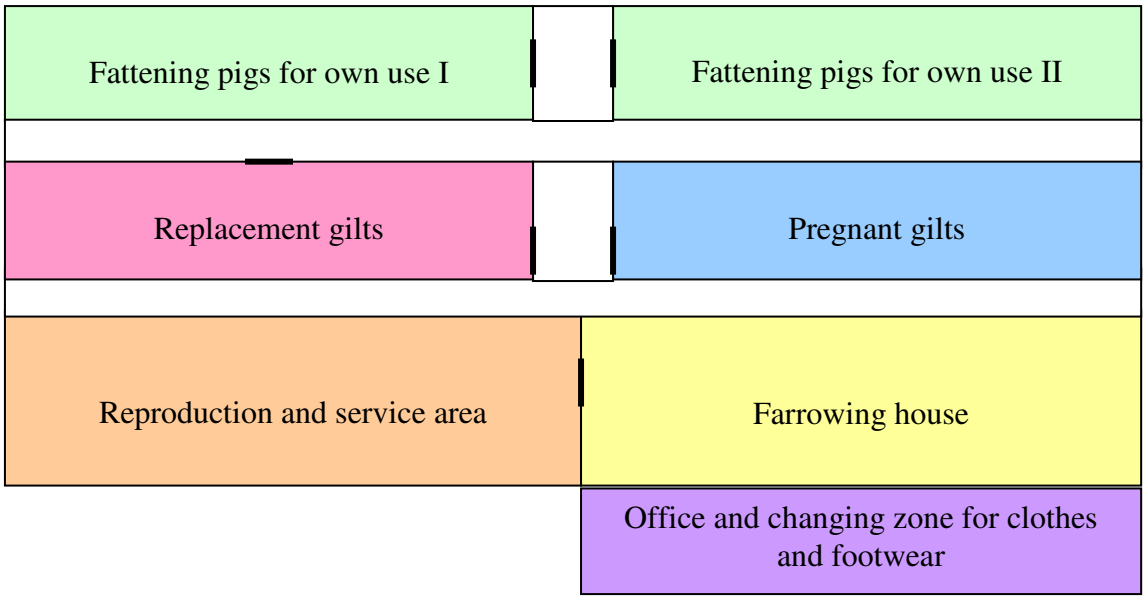


The farm in question is owned by Mr and Mrs Aanestad, and is located in Re in Vestfold, Norway. The farm, with its 280 da[1] is not particularly big, but

[1] da = decar = $1000m^2$

Mr and Mrs Aanestad, who have both been fulltime farmers since 1985, rent 180 da land and has recently bought another farm which is 220 da to expand their production. In total they are managing 660 da. The farm is a breeding farm, which makes it a bit different from the typical meat producing farms in the region. Both sows and boars are produced for further breeding. In addition to the pig production, the farm produces grains such as wheat and barley, timothy grass and peas.

Diagram 1: An outline of the pig house



3.2. The life on the farm

At this farm, the goal is to wean the piglets when they are 35 days old and 10 kg. The sow is then moved to the empty sow area, and the piglets are left in the farrowing area for some more days. The weaned piglets can take one of four directions: Sent away to become semen boars, sold to fattening farms, fattened and sent to the slaughterhouse or selected for further breeding in this farm or another farm

3.2.1. The semen boars

The semen boars are chosen on basis of the genetic merit of the ancestors by a semen boar plant located in Hamar, Hedmark before they are born. The plant orders a boar in a specific litter according to what kind of genetics it has. The farmer will mark the boar with a green ear tag (picture 1), and keeps it until it is 62 days old (25 kg) and send it to Hamar for selection. In Hamar it will go through several tests and only the very best ones will go all the way and become semen donor boars (elite boars). The farm is paid according to how far the boar reaches in the tests. The number of boars sold to Hamar from this farm in 2009 was 88, of which only 8 became elite boars.

Picture 6. A semen boar candidate with green ear tag

3.2.2. The pigs sold to fattening farms

These are simply the pigs that are sold to farmers who only have meat production. The farmers who buy pigs from Mr and Mrs Aaanestad order how many they want, and they only buy from this particular farm. The piglets are sold at around 10 weeks of age and about 28 kg. The number of pigs sold to fattening farms in 2009 was 766.

3.2.3. The pigs fattened and sold to the slaughterhouse

These include the sows which are not accepted as breeding gilts after the two selection processes (see below). The piglets not selected and not sold to other farms as fattening pigs, are also included here. The number of pigs sent to the slaughterhouse comes from this group. In 2009 this number was 930, of which 152 were gilts excluded after the first or second breeding selection.

3.2.4. The pigs selected for further breeding

These are the sows in the litter, which go through two selection processes before they are accepted as breeding gilts. These are mostly kept by the farm itself, to be able to improve the breeding merit of the coming boars and sows. The selection in general is based on conformation, locomotor characteristics, occurrence of congenital defects in the litter, number and positions (even distribution) of teats and litter size (too many pigs/litter is not wanted!). The first test is carried out when the would-be breeding gilts has reached the normal slaughter weight (110kg live weight). For this selection, an index based on the breeding value is used. The breeding value is calculated from the results of a test based on weight, age and back fat thickness at 100 days of age. If the overall index is high, two or three sows are kept from this group. If the overall index is lower, one sow is kept and if the index is bad, none of the sows are kept for the second selection. The second selection is a continuous process until insemination, where further 20 – 30 % gilts are excluded due different problems (mostly locomotor disorders or absence of heat) The ones that are not accepted in one of the selections go to group 3: fattened and sold to the slaughterhouse. The sows that are accepted are retained in the breeding program until there is reason for culling.

Picture 7. Gilts ready for selection

The females accepted for breeding are inseminated at an average of 230 days of age and are about 345 days old when they have their first litter. The piglets are kept suckling for 5 weeks, before they are weaned at 35 days of age and about 10 kgs of weight. The reason for this late weaning, according to the farmer, is to have stronger piglets with better post weaning survival rate.

Picture 8. Two pregnant postweaning sows

At weaning, primiparous sows will be subjected for another “selection”. This selection is based on testing the above breeding values in addition to the production results, which include number of live piglets born per litter, the piglets’ weight at 3 weeks of age, the number of weaned piglets per litter, the mothering abilities, behaviour and returning to oestrus. It is then decided if the sow is to be inseminated again or culled. Emphasis is also put on the degree of relation between the pigs, in order to have a certain control and exclude inbreeding. A combination of these are used and called the ***selection value***. The selection value is based 25% on the relation to other pigs and 75% on the breeding value. The picture shows two sows three days post weaning, waiting for insemination. The right sow was evaluated to have a BCS (body condition score) of 2, while the left sow is slightly over conditioned with BCS 4.

3.3. Own investigation

When entering the pig house, the first you are asked to do is to take off your shoes and step onto a plate where you can put on the farm’s own trousers and jackets. You then have to slide over to the next area and step into the boots. The next door that meets you leads into the office, and from there you can walk into the farrowing house.

3.3.1. The office

The office contains a computer with all the plans and records of performance for this particular farm. Due to the fact that this farm is a reproduction farm, it keeps good records of their reproduction parameters. They are members of a national computer system for pig farms, called ***ingris*****,** where they can plot in their own numbers and compare to the national average in some cases.

Table 2: The relevant reproduction parameter records of the farm in question for the last 5 years.

Performance data	**Target**[2]	**2005**	**2006**	**2007**	**2008**	**2009**
Expected weaned piglets		1784	1959	1920	2006	1986
Weaned piglets/sow/year		22.9	21.8	22.1	21.2	22.8
Farrowing sows/year		80	91	89	95	89
Number of weaned litters		160	192	189	180	192
Piglets born alive/litter		13.0	12.3	12.6	12.8	12.9
Piglets born dead/litter		1.5	1.6	1.6	2.1	2.1
Piglets weaned/litter		10.8	10	10.4	10.2	10.6
Age at weaning (days)	35	37	36	37	37	38
Weight at weaning	10				10.4	9.9
Dead until weaning (%)		17.4	18.9	17.9	20.3	17.6
Average weight at 3wk (kg)		6.9	7.1	7.1	7.1	7.0
Empty days per litter[3]		19	16	18	21	15
Weaning to service (days)	5	5	7	6	6	7
Regular returns (21±3 days)		11.2%	8.6%	8.1%	10%	4.6%
Irregular returns (24 days)		4.5%	3%	3%	2.5%	2.4%
Farrowing rate		80.3%	88.3%	89.7%	82.2%	90.3%
Weaned piglets/sow/year		22.9	21.8	22.1	21.2	22.8
Litters/sow/year	2.44	2.13	2.17	2.43	2.10	2.15
Age at first parturition (d)		344	337	340	343	346
MMA (number of animals)			0	1	2	0
Joint diseases (number)			14	14	30	15
Diarrhoea (number) [4]			43	9	26	19

These numbers are obtained from the farm and sent to the national computer system each year. The farmers then receive average numbers in return, to be

[2] Set by the farm, based on the national average
[3] This number includes the days from weaning to the next insemination (5 – 7 days), in addition to the days from insemination to return to oestrus (regular or irregular), or slaughter. It is an average for the whole farm.
[4] Underreported in piglets younger than 3 weeks, as they have no individual number yet and are easy to forget

able to see where they can improve (table 6). The computer system also contains numbers for individual sows so that the farmer can check how each and every sow is doing at all times. The above parameters and numbers will be discussed in more detail in the discussion part of this thesis.

3.3.2. The farrowing house

The farrowing house is not too big. It consists of 46 pens, which measures 5m^2 each. The law demands that the size of these should be at least 4.5m^2. There is a moveable crate for fixation in each of the pens, but these are only in use if the problem with crushing is extensive for individual sows. The farrowing house is quite old, which is evident from the walls and the crates, but it is kept very well and is functional even today. The creep area is equipped with a house for the piglets with an infrared lamp as heating source. The atmosphere is relaxed, the temperature is optimal and the ventilation is good when considering the air quality, especially regarding the dust. The sows are fed with dry feed which is automatically dropped into individual troughs. Water is let down on top of the feed. The sow gets increased amounts of feed for flushing just before insemination. Just after the insemination, the feeding is restricted to 2.5 – 3 feed units per sow[5]. After farrowing, the amount of feed offered to the sow is increased gradually and reaches ad libitum within 1 – 1.5 weeks. The amount of feed she eats at 3 weeks of lactation is noted for each and every sow, and the appetite throughout the period is ranged from 1 (decreased) to 3 (very good).

[5] 1 feed unit is based on the net energy in 1 kg barley with 85% dry matter

Picture 9. A postpartum sow and her piglets in a typical pen in the farrowing house

The bedding consists of wood shavings and straw.

When the piglets are born, their tails are not docked, as this is forbidden in Norway, but the corner teeth are rasped to avoid extensive injury to the mother's teats. Mrs. Aanestad will also plaster the front of the piglets' forelimbs to prevent skin injuries and arthritis when the piglets are fighting for the teats and sliding their carpus over the hard concrete floor. This is practiced by some other farmers in the area too, claiming that the problem with arthritis is decreased. When the piglets grow, the plaster will wear off and disappear. No sneezing or nasal discharge could be observed in the farrowing house. The major reason for losses in the farrowing house is crushing.

3.3.3. The reproductive and service area

The next room we walk into is the reproductive and service area, where the newly weaned sows are kept and inseminated. The room houses 45 – 50 sows, in 10 pens. The sows are kept together in groups of four or five, in pens with wood shaving bedding and a central dunging area. This is the oldest part of the whole building, but the temperature and ventilation can still be considered to be good. The sows are kept here for some weeks after insemination.

The sows are bred by artificial insemination, with semen ordered from the boar plant in Hamar. Only one boar is therefore kept in this farm, and he is used as a teasing boar by walking in the corridors of the reproductive and service area from time to time. He was bought into the farm 9 years ago and has

been used since. He is in good condition and has no history of external parasites.

The sows are inseminated as soon as they reach standing heat, which is detected by careful observation of external changes (swollen vulva) and behaviour in the days before positive response to the back pressure test. The farmers wish to inseminate 8 – 9 sows at the same time, to be able to obtain some degree of synchronicity. Hormone therapy is strictly forbidden in this type of farms. The sows are inseminated twice, with 12 hours interval in gilts and 24 hours interval in older sows. The average weaning to service interval in 2009 was 7 days, 2 days longer than the goal of the farm. The sows which are inseminated are marked with the date of insemination (Picture 10).

Picture 10. Sows in the service area marked with the insemination date on their back. The sow to the left was inseminated February 8th and the sow to the right was inseminated February 4th

Doppler ultrasound was the method used to detect pregnancy previously, but the farmers did not like this method. Today, they just assume that the sows are pregnant, and observe carefully for return to oestrus (swollen vulva, behaviour, erect ears). As long as the farrowing rate is above 90%, they see no need to carry out any other pregnancy tests. If it falls, however, they will do measures to stop the tendency. If the sow returns to oestrus within 21 days, she either lost her embryos before the maternal organism could recognise the pregnancy, or she never conceived at all. The regular returns in 2009 were 2.4%. If the sow returns to oestrus after this period, abortion probably occurred. The irregular returns in 2009 were 2.2%. The non - pregnant sows will

be inseminated again and if the second time also fails, culling is considered. The pregnant sows will be marked with a D and kept in this room until they are moved to the pregnant sow area. The farrowing rate in 2009 was 90.3%

Picture 11. Pregnant sows in the service area

No obvious illness or uterine discharge could be noted in any of the sows in this area, but by taking a look around the room, it was evident that the body condition of the sows showed great variance.

Table 3: The results of an evaluation of a random sample of the sows in the service and reproductive sow area.

Sow number	Weaning date	BCS	Decubitus
54471	Feb 8th 2010	2.5	None
52904	Feb 8th 2010	2.5	None
54584	Feb 1st 2010	3	None
54802	Feb 1st 2010	1.5	None
52847	Feb 8th 2010	2	None
52922	Feb 8th 2010	2	None
52842	Feb 1st 2010	1.5	None
52844	Feb 8th 2010	2	None
51243	Feb 8th 2010	2	None
48164	Feb 8th 2010	2	Deep shoulder ulcer

The problems with lameness are not very prominent in this farm. Some of the sows with decubitus showed mild lameness as well, but it was not very evident. Some of the sows were lying on the dunging channels, making their

teats and body dirty, but all in all the teats were healthy and seemed to be functional. The gilts chosen for further breeding in this farm has gone through thorough selection, so non-functional teats are in all likelihood acquired after the selection processes.

There are no problems with parasites in this farm, but sows are vaccinated against Parvovirus at 135 days after insemination for the 2nd, 4th and 6th litter. She is also vaccinated against Diamond skin disease 95 days after insemination from the second litter onwards, and Coli diarrhoea at 75 and 95 days after insemination for the 1st litter, then as Diamond skin disease from the 2nd litter onwards.

In January and February 2010, 26 sows were culled. Out of these, 20 were culled due to decreased breeding quality, one due to regular return, one due to abortions, one due to leg problems, one because she was aggressive, one due to absence of heat and one due to diminished mothering abilities.

Table 4: Information about five random sows which were culled due to decreased breeding quality.

Number	Parity	Live piglets/litter	Weaned piglets/litter	Appetite	BCS after weaning
51201	3	13, 16 and 14	8, 12 and 12	Normal	3
51507	3	11, 14 and 14	12, 9 and 11	Normal	3
52746	2	12 and 10	11 and 9	Very good	1.5
49585	4	13, 18, 14, 9	12, 11, 12, 9	Decreasing	2
53985	1	13	10	Very good	2

When talking about decreased breeding quality in this farm, it does not mean that the breeding quality is no longer acceptable. It means that new and better replacement gilts are available (according to the selection value). The average sow in this farm will have 1.7 litters before she is culled. This number is extremely low and probably not economically feasible from a production point of view, but the reason for this short reproductive life is that a short

generation interval is the key to an effective selection process and genetic progress. Very many sows are culled after their first parity, while other can be kept until their 5th parity if she is in good shape and her breeding values are maintained.

Table 5: The proportion of gilts and sows and their distribution according to stage of reproduction in the farm in question compared to that of a good farm.[xiv]

Stage of reproduction	**Gilts (%)**		**Sows (%)**	
	Good farm	This farm	Good farm	This farm
Unserved	23	20.4	6	7.5
Served, not yet farrowed	60	63.3	72	62.4
Farrowed, not yet weaned	17	16.3	21	22.6
Weaned, awaiting for culling	≤ 0.2	0	1	7.5
All	28	48	72	52

3.3.4. The replacement gilt area

Picture 12. Replacement gilts waiting for selection and insemination

The replacement gilt area houses the gilts meant for further breeding both in this farm and in other farms. These are the ones which passed the whole selection process. The selection process starts when the gilt is 65 – 130 kg, when weighing and back fat thickness is measured. The results are adjusted to 100 kg live weight, and the age at 100 kg live weight is calculated. The mean age at this particular farm is 147.8 days. With 100% optimal conditions, the Landrace should be able to obtain 100kg live weight at the age of 125 days. It is the responsibility of the breeding farm to choose the sows with the highest breeding value and best exterior for use as mothers in the future. The animals get complete breeding values after the replacement gilt examination is carried out (see earlier).

Those gilts with the best values are kept on the farm or sold to other breeding farms. Those with lower value are slaughtered. After this examination, the testing of ancestors and ancestral records are taken into consideration. Exterior examination of the primiparous sow is important to ensure a longer reproductive life of the sow, in addition to the exterior of the slaughter pig. The exterior examination is carried out as near to the parturition as possible. The value the sow get by this examination is added to that of 20 other examinations, including the evaluation of front legs, hind legs, back, locomotion and teats.

The replacement gilt room is newer than the rest of the farm so far. The gilts are kept in 15m^2 pens with wood shaving bedding, in groups of 4 to 7. They are clean and healthy. The ventilation and the temperature are good and the atmosphere is calm. Gilts are vaccinated against Parvovirus and Diamond skin disease at 165 and 195 days of age, before insemination takes place. The gilts in this room are either inseminated and moved to the pregnant gilt area, or sold to other farmers as replacement gilts.

3.3.5. The dry (pregnant) sow area

This is where the inseminated premiparous sows are kept until one week before expected farrowing. This area is as new as the replacement gilt area, with the same bedding and feeding system. The feed level in this area is restricted to avoid too fat sows before farrowing. They are fed 2 kg dry food each, which is mixed with water when hitting the trough. Water is supplied ad libitum, and there are more than enough feeding troughs to avoid fighting between the sows.

Picture 13. Pregnant sows waiting to be placed in the farrowing house

The pens are 15m^2, and the sows are kept together in groups of three or four. The environmental temperature and ventilation

is optimal and the atmosphere is calm. The sows have plenty of wood shaving bedding and are clean. The body condition scores of these sows do not vary to the same extent as in the service area, probably because these have never lactated before, but are fresh from the raising period.

Table 6: Information about the three sows in the first pen.

Sow number	Insemination date	Expected farrowing	BCS	Decubitus
55550	Nov 15th 2009	March 12th 2010	3	None
55566	Nov 15th 2009	March 12th 2010	3	None
55509	Nov 17th 2009	March 14th 2010	3	None

Table 7: Information about the three sows in the next pen.

Sow number	Insemination date	Expected furrowing	BCS	Decubitus
55225	Oct 24th 2009	Feb 20th 2010	3	None
55044	Oct 23rd 2009	Feb 19th 2010	3.5	None
55105	Oct 27th 2009	Feb 23rd 2010	3	None

3.3.6. The fattening house

The fattening house accommodates the growing and finishing pigs. The pigs not chosen for further breeding is put here, some after weaning at 35 days of age and 10 kg, and some after the selection processes. The pigs that are meant for further sale to other farmers are also put here until they are ready for sale at around 10 weeks of age and about 28 kg. The number of pigs sold to fattening farms in 2009 was 766. The pigs that are not sold, but finished here are kept until they are about 110 kg. The number of pigs brought here for fattening and finishing in 2009 was 778, excluding the sows coming from the selection processes.

The rooms in this building are 10 years old and the newest part of the farm. The fattening house consists of three rooms, with 6 pens in each room. The pens are 14m^2 and each pen houses 10 – 12 pigs. This gives the pigs plenty of

space in the beginning, but as the pigs are growing, the space per pig is decreasing. The last phase of the fattening process will be moved to the new farm as soon as it is available which will make more space for the fattening pigs. Only pigs of the same age group are kept in one pen at the same time. One clear advantage can be seen with this method, and that is the pigs do not have to go through re-grouping again and again. This exposes them for less stress, which is evident from the look of the pigs. Tail-chewing and fighting is not a problem in these pens. Another advantage is the possibility for all – in – all – out for every pen as soon as it is empty. All – in – all – out is not possible for the whole room because separate age groups are present in different pens.

The pens are kept clean with wood shaving bedding and a dunging area where water nipples of different heights are placed above. The ventilation and temperature is good and there are no excessive disturbances in the room. The fattening pigs are fed ad libitum with dry food from the central channel. Pigs of the same age are kept in the same pen, and in one pen the pigs are strikingly even in weight. No sneezing, nasal discharge or other obvious signs of disease can be noted. The vaccination programs are carried out on the breeding sows after insemination, nothing is done with the fattening and finishing pigs. One or sudden deaths sometimes happens, but the dead pig is then removed from the pen and sent to destruction.

Picture 14. Young fattening pigs with plenty of space in the pen

Picture 15. Photo taken through the window into the next fattening room, with larger pigs and thus more crowded

4. Discussion and suggestions

To be able to discuss the performance data of the farm in question, it is helpful to compare it to the average performance data on a national level. Only the years from 2005 to 2008 are discussed, as these are the newest available numbers on a national basis.

Table 8: The average performance data on a national basis from 2005 to 2008.

Performance data[xv]	**2005**	**2006**	**2007**	**2008**
Weaned piglets/sow/year	22.7	22.7	22.4	22.6
Piglets born alive/litter	12.4	12.4	12.5	12.5
Piglets born dead/litter	1.1	1.1	1.2	1.2
Piglets weaned/litter	10.6	10.6	10.7	10.7
Age at weaning (days)	34.2	33.6	34.1	33.9
Dead until weaning (%)	14.5	14.4	14.9	24.7
Empty days per litter	20.7	20.3	21.0	20.1
Weaning to service (days)	6.5	6.4	7.8	7
Regular returns (21±3 days)	13.1%	12.3%	13.4%	13.2%
Irregular returns (24 days)	8.1%	8.3%	8.4%	8.3%
Farrowing rate	78.6%	78.7%	78.2%	78.5%
Litters/sow/year	2.15	2.15	2.14	2.16
Age at first parturition (d)	354	353	357	355

Table 9: The performance data of the farm in question from 2005 to 2008.

Performance data	2005	2006	2007	2008
Weaned piglets/sow/year	22.9	21.8	22.1	21.2
Piglets born alive/litter	13.0	12.3	12.6	12.8
Piglets born dead/litter	1.5	1.6	1.6	2.1
Piglets weaned/litter	10.8	10	10.4	10.2
Age at weaning (days)	37	36	37	37
Dead until weaning (%)	17.4	18.9	17.9	20.3
Empty days per litter	19	16	18	21
Weaning to service (days)	5	7	6	6
Regular returns (21±3 days)	11.2%	8.6%	8.1%	10%
Irregular returns (24 days)	4.5%	3%	3%	2.5%
Furrowing rate	80.3%	88.3%	89.7%	82.2%
Litters/sow/year	2.13	2.17	2.43	2.10
Age at first parturition (d)	344	337	340	343

4.1. Weaned piglets per sow per year

When comparing the numbers, we find that the farm in question have less piglets weaned per sow per year than the national average. The most likely reason for this is that this farm breeds for genetic improvement, not for the production itself. The average sow in this farm will have 1.7 litters before she is slaughtered, which is not advisable from an economical point of view. However, since genetic improvement is the goal, shorter generation intervals are desired, and better offspring will therefore be used. To increase the production and decrease the cost, they should have kept the sows for a longer period of time, as the largest litters will be obtained from the 3rd, 4th and 5th parturition normally.

4.2. Piglets born alive and dead per litter

The farm in question has more piglets born per litter, dead or alive, than the national average. One reason for this might be the selection pressure, which forces these numbers up. When the litter size increases, it is only natural that some embryos will be weaker and may not survive the parturition. This problem could be

solved by breeding for more even litters than for the number itself, but this is a long process and must be prioritised to be reached.

4.3. Piglets weaned per litter and dead until weaning

The number of weaned piglets per litter is slightly lower than the national average, and the number of dead until weaning is extremely high. The farmers are aware of this and have therefore collected an approximate for the reasons of death:

- Crushing (especially the first 1 – 3 days): 40%
- Weak piglets (2 – 5 days): 20%
- Injuries (2 – 5 days): 15%
- Diarrhoea (0 – 3 days and 3 – 5 weeks): 10%
- Chronic joint diseases (becomes weak and euthanized): 15%

The crushing percentage is very high, which may be surprising when looking at the creep areas and the low average age of the sows. However, a number of factors may have importance when it comes to crushing. According to an article written by the Norwegian association for veterinarians[xvi], the size and shape as well as the creep feed area, influences how successful a farrowing pen is when it comes to preventing pre-weaning losses. Norwegian laws demand that the size of the farrowing pen is minimum 4.5m^2, but this size is probably too small for Norwegian sows. An area of 6 – 6.5 m^2 is a better solution. The farm in question has farrowing pens of 5m^2, which is big enough for the standards, but could be bigger to avoid extensive crushing. Too small farrowing pens will inhibit the sows' nest building behaviour, which will make them even more restless during and after parturition so that the survival percentage decreases. Studies also show that the extent of crushing is less if sows are fixed in the farrowing pen. The rules says that it is forbidden to fix swine unless it is done in connection with feeding, treatment or insemination, especially restless animals during oestrus and especially restless sows from the time of parturition until 7 days after parturition. Tying down is not accepted as a method of fixation.[xvii] The farm in question could try to fixate more of the sows to avoid crushing, but this is not appreciated by the laws and regulations. One should also be careful not to fix large sows in too narrow fixation crates, as this will prevent them from lifting their teats properly and thereby preventing the piglets from drinking enough

milk, which will again lead to weaker piglets and higher pre-weaning losses. The creep area is of vital importance when it comes to crushing. If the piglets fail to learn to sleep in the creep area, the rate of crushing will increase. It is therefore important to teach the piglets that this corner is warm, and to keep the corner dry and free from wind. Mrs. Aanestad puts the piglets into the corner after they have suckled for a while, but admits that she could be more consistent by trying several times.

The temperature should also be discussed in connection with crushing, as the optimal temperature for the piglet and the sow is very different. The lower critical temperature for the neonatal piglet is 32 - 34°C, while the optimal temperature for the sow is 15 - 19°C[xviii]. If the core temperature of piglets decreases with a couple of degrees, their ability to survive is severely reduced. They are not suckling as they should and their core temperature decreases even more as a result of the decreased energy intake. They are too weak to find the creep area and will therefore lie as close to the mother as possible, predisposing them for crushing. The temperature in the farrowing room is not optimal for the piglets, but for the mother. The temperature in the creep area is optimal for the piglets, which is evident from how the piglets seem to lie in the corner. They are lying side by side, but not on top of each other.

Good hygiene is also important to decrease the pre-weaning mortality. The all-in-all-out concept should be used in the farrowing house. Since the farm in question is weaning more sows at the same time, the all-in-all-out is carried out. A study based on hygiene programs[xix] showed that the occurrence of diarrhoea in neonates decreased from 28% to 5% after one year with the program. The pen should be dry with enough bedding at all times, but the farm in question seems to have no problems here.

One should also consider the health status of the sow if she crushes many of her piglets. If many piglets are crushed, the sow is likely to be ill. MMA is the most common background if the sow is crushing her piglets because she is ill. In this particular farm, if we believe the numbers, MMA is not very common. Other diseases could

also be in the background, but most of the sows seem healthy and has a normal body temperature of 38.5 – 39.5°C

The stockman himself has a major role when it comes to pre-weaning mortality. First of all he/she has to act calm around the sows to be able to maintain their calmness. In farms with good management, the pre-weaning mortality was registered to be 11.1%, while in those with bad management, 15.2% was the registered result.[xx] When observing the farm in question, the sows seem very calm around their stockman. All in all, no stress could be spotted. Another vital job of the stockman is to be present and observe during parturition periods. Long lasting parturition may decrease the vitality of the piglets, which will again lead to crushing or even starvation. Weak piglets often end up behind the sow because they are unable to move to the front. After a short period of time they will reach a lower core temperature due to the wet floor. If one dries these piglets, ensures open airways and puts them to the teats, their chance of survival will increase to a great extent. Effective observation during, and shortly after parturition will therefore reduce neonatal losses.[xxi] Supervision of the sows during the parturition period is not optimal in this farm. The sows are supervised closely two times daily, but this is probably not enough. It is known that the neighbour farmers often sleep in their barn during the parturition period to be able to achieve better results when it comes to crushing.

4.4. Age at weaning

The age at weaning is significantly higher in this farm than in the average Norwegian farm, but one must also look at the goal of the particular farm and compare it to the actual performance data. The goal for this farm is to have a weaning age of 35 days, but this goal has not been reached during the last 5 years. The reason why the weaning age is so high is that they want to wean more sows at the same time to synchronise better. The problem is that the parturition date is different, making some sows wait until day 38 and later. The suggestion for improvement will be simply be to wean some of the sows earlier, to be able to decrease the average weaning age. According to the law, a piglet should not be weaned before 28 days of age[xxii], but the farmers have the opportunity to wean some of the sows before day 35. An-

other suggestion could be to synchronise the parturition better, but as long as the use of drugs is strictly forbidden, it is difficult to synchronise more than they already do.

4.5. Weaning to service interval

The farm in question has better numbers than the national average, but the goal interval from weaning to next service is 5 days, while the actual number of days today is 7. By decreasing this number, even only by two days, the effectiveness can be increased. They managed to reach this number in 2005, so why not now? One reason could be the late weaning age, which will again affect the sow's cycle. Since suckling is a natural negative feedback mechanism on the cycling, she may be delayed in return to oestrus because of this. The farmers should decrease the weaning age and see if this helps on the cycling.

4.6. Empty days per litter, regular and irregular returns, and farrowing rate

These are four points where the farm in question scores high and have very good numbers. It is interesting to consider the farrowing rate compared to the national average, when knowing that they have no other method than observation for pregnancy detection. This shows that these farmers are dedicated to their work and that they know how to "read" their sows.

5. Conclusion

When looking at the results of the farm, it can be concluded that this farm has its struggles, but also aspects which it is very good at. By improving some of the main aspects, such as the pre-weaning mortality and the weaning age, they can obtain better results and improve their profit. Their dedication to their work is exceptional and they are motivated to put time and money into improving some basic points. This is evident also from the fact that they have bought another barn to be able to collect all the sows there and be able to synchronize them better. The new barn has larger farrowing pens, so it will be interesting to see if this has an effect on the pre-weaning mortality.

6. Summary

By careful observation and explanation of the pig farm itself, in addition to studying the performance data of the farm in question, several important points regarding the efficiency and profitability of the pig production could be identified. The farmers themselves were aware of some of the problems, but were grateful to be told about less obvious problems. A lot could be learned from the process, both for the farmers and me. It could be concluded that the results of the farm are good in average but there is always room for improvement. The farmers will look into the problems and try to improve where it is possible, and it will be interesting to look at their numbers again in a year or two.

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8. Bibliography

[i] Wikipedia: Gris. URL: http://no.wikipedia.org/wiki/Svin (accessed June 22nd 2010)
[ii] Museumsnett: Grisens historie. URL: http://www.museumsnett.no/gamlehvammuseum/html-files/undersider/gris.html (accessed June 22nd 2010)

[iii] Odd Vangen, Store Norske Leksikon: gris – raser. URL: http://www.snl.no/svin/raser (accessed June 22nd 2010)
[iv] Statistisk sentralbyrå (Statistics Norway): Auke i talet på svin, written April 8th 2010. URL: http://www.ssb.no/emner/10/04/10/jordhus/ (accessed June 22nd)
[v] Pig progress.net: Norway increases pig production, written March 31st 2008. URL: http://www.pigprogress.net/news/norway-increases-pig-production-id1455.html (accessed June 23rd)
[vi]Helsedirektoratet – god helse og omsorg for alle: Vi spiser 77 kilo kjøtt hver i året, written April 10th 2010. URL: http://www.helsedirektoratet.no/ernaering/kostholdetundersokelser/utvikling_i_norsk_kosthold_2009/vi_spiser_77_kilo_kj_tt_hver_i__ret_697844 (accessed June 23rd 2010)
[vii] Mat oppskrift: Forbrukerne vil ha magert svinekjøtt. URL: http://www.matoppskrift.no/sider/artikkel502.asp (accessed June 23rd 2010)
[viii] Nortura: Markedsregulering. URL: http://www.nortura.no/markedsregulering/ (accessed June 23rd 2010)
[ix] Endre Myhr, Kjøtt og fjørfebransjens landsforbund: Import. URL: http://www.kjottbransjen.no/?did=9110530 (accessed June 22nd 2010)
[x] Endre Myhr, market and prognosis manager in Kjøtt og fjørfebransjens landsforbund (reply on an e-mail June 22nd 2010)
[xi] Norsk Landbrukssamvirke: Dyrevelferd i norsk husdyrhold: Svin, Fire raser. URL: http://www.dyrevelferd.info/view_article.asp?id=24 (accessed June 22nd 2010)
[xii] Ina Ranberg, Norsvin: Avlsmålene for landsvin og duroc, October 2nd 2009. URL: http://www.norsvin.no/index.php/avl/norsvins-avlsmaal (accessed July 1st 2010)
[xiii] Animalia: Annet om helse på gris, March 29th 2007. URL: http://www.animalia.no/Tjenester/Helsetjenesten-for-svin/Helse/ (accessed July 1st 2010)
[xiv] Prof. Dr. Pál Rafai, Animal Hygiene lecture material (accessed July 2nd 2010)
[xv] Terje Iversen, manager: Stabile resultater i InGris, July 2nd 2009. URL: http://medlem.nortura.no/aktuelt-ingris/stabile-resultater-i-ingris-article25121-11774.html (accessed July 21st 2010)
[xvi] Ingeborg Anni Haukvik, Tore Framstad and Mona Gjestvang, Norsk veterinærtidskrift 2002, 114, 2: How to reduce losses until weaning. Pp 167 - 171
[xvii] Legislations and regulations for Norwegian pig keeping: FOR 2003-02-18 nr 175: Forskrift om hold av svin, chapter II, paragraph 11
[xviii] Baxter SH. Neonatal mortality: the influence of the structural environment in manipulating pig production. Barnett JL, Hennessay DP, eds. Manipulating pig production II. Proceedings of the Biennial Conference of the Australasian Pig Science Association, Albury, NSW. Werribee 1989: 102-9
[xix] Svendsen J, Billie N, Nielsen NC, Larsen JL, Riising HJ. Preweaning mortality in pigs. 4. Diseases of the gastrointestinal tract in pigs. Nord Vet Med 1075; 27:85-101
[xx] Seabrook MF. The human factor – the benefits of humane and skilled stockmanship. Farm animals: it pays to be humane. Reading: centre of agricultural strategy, 1991: 70 – 82.
[xxi] Holyoake PK, Dial GD, Trigg T. Reducing pig mortality through supervision during the perinatal period. J Anim Sci 1995; 73:3543-51.
[xxii] Legislations and regulations for Norwegian pig keeping: FOR 2003-02-18 nr 175: Forskrift om hold av svin, chapter II, paragraph 9