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Characteristics of Swedish gilts at service and producers' opinions about gilt production

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Svenska gyltors egenskaper vid betäckning och producenters åsikter om gyltuppfödning

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Preface

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Contents

1 Abstract

In Sweden, selection for leanness in pigs has been going on for almost a century. This sometimes results in gilts and sows being too lean and consequently in a risk for reduced reproduction and health status. The Swedish recommendation includes that gilts should be mated after seven months of age, after one documented oestrus, at 120-140kg live weight and with a backfat thickness of 16-20mm. Five gilt producing herds were visited and records of age, heart girth (for weight estimation), body condition (visual estimation), backfat thickness and exterior were made. The same records were also taken in four gilt buying herds on newly purchased gilts. Interviews were made with all farmers regarding the relationship to customers or producers, gilt rearing, gilt characteristics at first service and what a good gilt look like. The statistical analysis showed that gilts are inseminated at an average age of 245 days, at 156kg live weight and with an average backfat thickness of 13.3mm. The exterior status was good among all gilts. The interviews confirmed that gilt producers and the gilt buyers agree on what a good gilt should look like. One difference regarding traits of a good gilt was that the gilt producers sometimes focused more on direct production traits like litter size, while their gilt buyers found traits like body condition, exterior and age more important. Both producers and buyers stressed that age and size are most important when inseminating gilts. As long as the gilts had at least 12mm backfat both parts seemed to be satisfied. Based on the literature, the records and the interviews, a change of the current recommendation on backfat thickness is suggested. The proposed recommendation includes that gilts should be mated between seven and nine months of age, on the second or third oestrus, at around 140kg live weight and with a backfat thickness of 13-18mm. Some producers asked for a production follow-up, and the thesis includes a draft of a follow-up form that gilt producers can send to their customers.

2 Sammanfattning

I nästan hundra år har det i Sverige selekterats för magert griskött. Ibland resulterar detta i att gyltor och suggor blir för magra och följaktligen i minskad reproduktion och hälsostatus. Enligt den svenska rekommendationen skall gyltor betäckas första gången när de är minst sju månader gamla, tidigast på andra brunsten, när de väger 120-140 kg och har 16-20 mm sidspäck. I fem gyltproducerande besättningar gjordes registreringar av ålder, bröstomfång (för skattning av vikt), hull (visuell bedömning), späcktjocklek och exteriör. Samma registreringar gjordes även på nyligen inköpta gyltor i fyra gyltköpande besättningar. Vid bestättningsbesöken gjordes intervjuer med lantbrukarna. Dessa behandlade relationen mellan kunder och producenter, gyltuppfödning, önskvärda egenskaper vid betäckning och hur en bra gylta skall se ut. De statistiska analyserna visade att den genomsnittliga gyltan betäcks vid en ålder av 245 dagar, 156 kg levande vikt och vid 13,3 mm sidspäck. Exteriörbedömningen visade att gyltornas exteriör var god överlag. Intervjusvaren bekräftade att gyltproducenter och deras kunder var överens om hur en bra gylta bör se ut. En skillnad mellan producenter och köpare var att producenterna ibland fokuserade mer på direkta produktionsegenskaper som t.ex. kullstorlek, medan egenskaper som hull, exteriör och ålder ansågs viktigare bland köparna. Både producenter och köpare framhävde att rätt ålder och storlek är de viktigaste egenskaperna vid betäckning av gyltor. Utifrån mätresultaten och intervjusvaren kunde det konstateras att så länge en späcktjocklek på 12 mm uppnås är båda parter nöjda med gyltornas hull. Tillsammans med studerad litteratur gav registreringarna och intervjusvaren grunden för en förändring av rekommendationen kring gyltans betäckning. Förslaget är att gyltor skall betäckas mellan sju och åtta månaders ålder, på den andra eller tredje brunsten, vid ca 140 kg levande vikt och med en späcktjocklek på 13-18mm. Gyltproducenterna efterfrågade en mer utbredd produktionsuppföljning från kundernas sida och uppsatsen inkluderar en återrapporteringsblankett producenterna kan skicka med gyltorna vid leverans.

3 Introduction and objectives

In Sweden, half of all sows are culled every year, due to reproductive disorders, low production, udder problems, inferior body condition and lameness mainly (Engblom, 2008). As much as 17% of the sows had only had one litter before being culled. That is an uneconomic way of production and one way of reducing culling rate would be to improve the gilt rearing.

To be able to produce profitable sows with high longevity, good management of gilts during rearing is important. Knowing when to breed the gilts is important since it affects the profitability (Rozeboom et al., 1996). The feed costs for non-productive periods and lifetime productivity of the sow are both dependent on the time of breeding (Rozeboom et al., 1996). Gilts should be mated at 120-140kg, with a backfat thickness of 16-20mm and between 220 and 240 days of age (Hidås et al., 2009). Since many breeding organisations in Europe today have leanness included in the breeding goals (Rydhmer, 2005; Faba, 2009; ACMC, 2010; DanBred, 2010; Norsvin, 2010; Quality Genetics, 2010) gilts today might have less than the recommended backfat thickness. Selection efforts and better nutrition has resulted in higher lean percentage and growth rate until slaughter but also in decreased backfat thickness at puberty (Eliasson, 1991). The backfat issue has been discussed lately and the breeding organisations together with Lantmännen have recently elaborated a new recommendation for time of first service including recommended backfat thickness of 15-18mm (Tengvall Nilsson et al., 2010).

Many Swedish gilt producers decide when to mate the gilts depending only on age and on visual estimates of the gilts' body condition. Ultrasonic devices are not commonly found in multiplier herds (Laustsen, 2010). Backfat thickness is related to the sows' total amount of body fat (Mullan & Williams, 1990; Charette et al., 1996) and backfat measurement can therefore be a valuable tool for evaluating body fat. There are studies showing positive correlations between subjective scoring of body condition and backfat measurements (Maes et al., 2004). For sows in parity one the correlation at 80 days of gestation was 0.32, which is lower than for sows in higher parities. By measuring backfat thickness, more accurate values of body condition can be achieved than by visual measurements. As a complement to visual body condition measurements it would be interesting to investigate the backfat thickness at service of Swedish hybrid gilts. Since backfat thickness and weight of gilts at service and at delivery often are unknown, it would also be valuable to investigate if gilt producers and gilt buyers have the same opinion about the produced gilts. Maybe the producers and the customers have different ideas about what a good gilt should look like.

The objectives of this study was to investigate characteristics of Swedish hybrid gilts (with regard to age, oestrous number, body condition, backfat thickness, weight and body exterior) at service and at delivery and if the recommendation for time of first service is followed. Which factors decide time of first service and what determines if the customers get satisfied or not?

4 Hypothesis

The hypothesis of this study is that 1) gilt producers and gilt buyers have the same opinion regarding what good gilts should look like and 2) Swedish hybrid gilts have less backfat at service than recommended.

5 Literature study

5.1 Piglet and gilt production in Sweden

5.1.1 Pig breeding

The Swedish pig breeding is managed by two organizations; Nordic Genetics, which is owned by Quality Genetics and Finnpig (Quality Genetics, 2010), and Avelspoolen which is owned by Swedish non-cooperative abattoirs and by Norsvin (Avelspoolen, 2010). Nordic Genetics is the larger company and sell about 600 000 AI-doses and trade 25 000 gilts per year (Quality Genetics, 2010). Avelspoolen sell around 220 000 AI-doses and trade around 11 000 gilts per year (Avelspoolen, 2010).

The pig breeding in Sweden has a hierarchical structure and is formed like a pyramid (Figure 1). In the nucleus herds there are only purebred sows with the best genes and breeding values. The nucleus herds are closed; no live animals can enter and only artificial insemination is used. In the nucleus herds the selection for genetic progress takes place. The nucleus and multiplier herds produce F1 gilts by crossing two female breeds (Yorkshire × Landrace). These dams are mated with a terminal sire, producing piglets in the piglet producing herds. One third of the piglets are later sent to fattening herds. Two thirds of the piglets are raised on the farms until slaughter (integrated production). This results in a gene flow downwards from the nucleus herds. It takes a couple of years before the genetic progress achieved in the nucleus herds reaches the commercial herds.

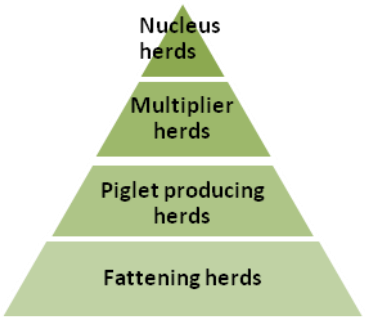


Figure 1. The Swedish pig breeding system.

5.1.2 Pig breeds and breeding goals

Almost all sows used for piglet production in the Swedish commercial herds are today crosses between Norwegian Landrace and Swedish Yorkshire. Nordic Genetics use Hampshire as a terminal sire (Quality Genetics, 2010) while Avelspoolen use a cross between Norwegian Landrace and Norwegian Duroc, called SPII (Avelspoolen, 2010). The breeding goals for the four breeds are presented in Table 1.

Table 1. Breeding goal traits (Avelspoolen, 2010; Rydhmer et al., 2010)

Sweden		**Norway**	
Yorkshire	**Hampshire**	**Landrace**	**Duroc**
Days at 100kg	Days at 100kg	Feed consumption	Feed consumption
Backfat thickness at 100kg	Backfat thickness at 100kg	Weight at 3 weeks	Weight at 3 weeks
Exterior	Exterior	Growth (piglet)	Growth (piglet)
Feed consumption	Feed consumption	Growth (finisher)	Growth (finisher)
Osteochondrosis; elbow, knee	Osteochondrosis	Carcass yield	Carcass yield
Carcass yield		Meat percentage	Meat percentage
Number of functional teats		Drip loss	Drip loss
Age at first farrowing		Intramuscular fat	Intramuscular fat
Number born alive (parities 1-3)		Number born alive	Number born alive (parity 1)
Litter weight (parities 1-2)		Number still born	Longevity including:
Weaning to service interval		Age at first service	-four leg traits
		Weaning to service interval	-back shape
		Mortality before 3 weeks	-movements
		Litter weight	-scrotum hernia
		Number of teats	-umbilical hernia
		Number of inverted teats	-cryptorchidism
		Longevity including:	-osteochondrosis
		-four leg traits	
		-back shape	
		-movements	
		-scrotum hernia	
		-umbilical hernia	
		-cryptorchidism	
		-osteochondrosis	
		-shoulder lesions	

5.1.3 Selection and management of gilts

Sows need to be replaced by gilts. These can either be born and raised by the piglet producers or bought from hybrid producing herds. There are several ways of gilt management around first service. Nyhlin et al. (2008) suggest the following: gilts are moved to the insemination unit at around five months of age when first boar contact and oestrus monitoring should start (Figure 2). Some days before the third expected oestrus, careful oestrous detection is very important. Insemination is performed on the third oestrus. When all gilts in a batch are inseminated they are moved to the pregnancy unit. Oestrous detection should be performed three weeks after insemination to identify possible returns to oestrus. Four weeks after insemination, pregnancy tests are performed. When gilts are close to farrowing, they are moved to the farrowing unit.

The replacement gilts need to fulfil some requirements to suit as high producing mothers with high longevity. Quality Genetics' (2010) requirements include:

- ≥14 functional teats
- Normal developed for its age
- Good exterior

Malmström (2005) propose some recommendations for gilt selection:

- No inverted teats

- Even and good looking teat pairs whereof at least three are placed in front of the umbilicus
- No malformations (in the birth litter)
- Good hoofs and leg posture
- Good health (do not select gilts that frequently have been medically treated)

Malmström (2005) suggests that selection should be performed at least three to four stages before service; the first one at the time of ear tagging (around three weeks of age), the second one at around 25kg live weight, the third one around six months of age (in connection to the vaccinations) and the fourth one at the age of service (Figure 2). Hidås (2010) compared herds where replacement gilts were purchased with herds where replacement gilts were raised on the farm. She found that herds with purchased replacement gilts had lower proportion of gilt litters, lower yearly culling herds held higher quality than gilts bred on-farm.

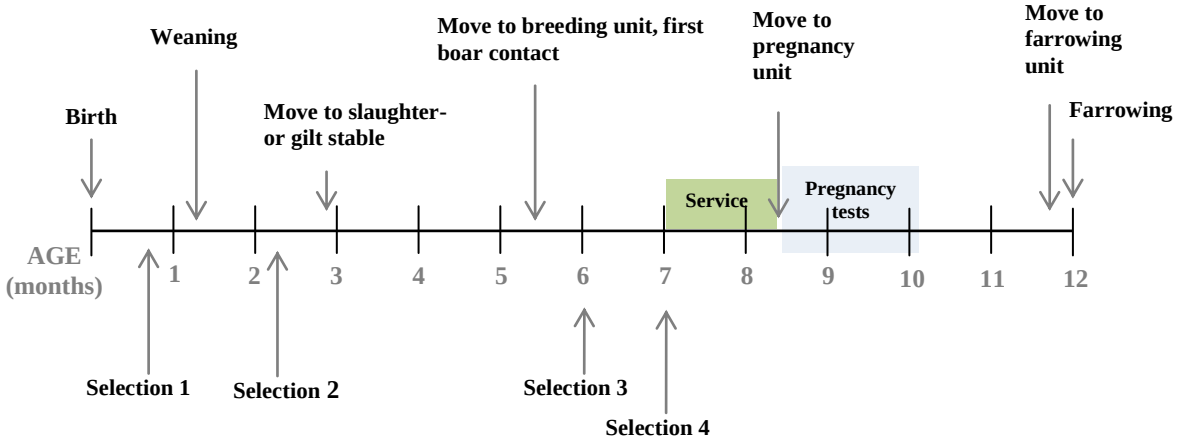


Figure 2. Suggestions for gilt rearing (modified from Nyhlin et al., 2008) and suggestions for time of gilt selections (Malmström, 2005).

Hidås (2010) investigated which traits Swedish piglet producers found important when selecting gilts for replacement, and as Figure 3 shows, number of teats is deemed as most important followed by growth rate.

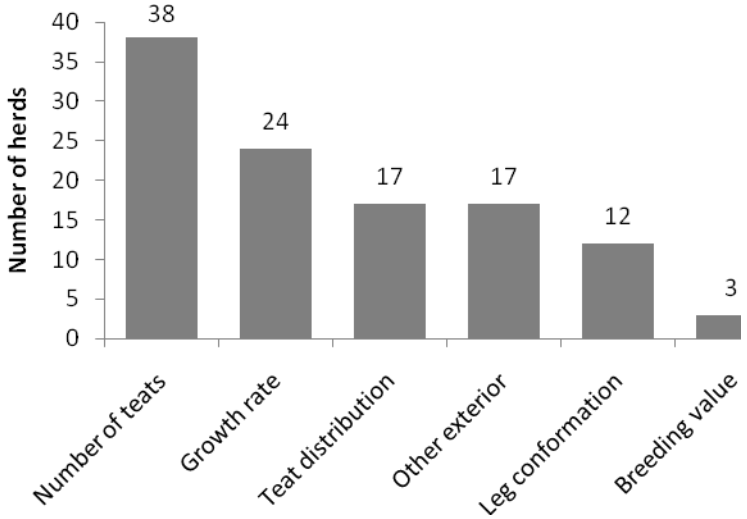


Figure 3. Traits that farmers evaluated when selecting gilts for replacement (N=42) (Modified from Hidås, 2010).

Gilts can be sold as selected gilt (around 30kg), not inseminated (5.5-6 months), ready for service (7 months) or pregnant (Quality Genetics, 2010). Gilt buyers can make complaints if the gilts do not fulfil some specified requirements. A reduction of the price can occur if a selected gilt or not inseminated gilt has exterior defects. A farmer can put in a claim for gilts ready for service if she shows defects that were present before delivery, if she does not show oestrus before 10 months of age or if she does not become pregnant after two inseminations on two consecutive estruses. A pregnant gilt can be reclaimed if she shows defects that were present before delivery, if she is not pregnant, if she does not farrow within 7 days before or after expected farrowing date or if a group of at least two gilts give birth to less than eight live born piglets on average (Quality Genetics, 2010).

5.2 Gilt puberty

A gilt enters puberty when she gets her first oestrus with ovulation, followed by regular oestrous cycles and this often occurs at six to seven months of age (Tummaruk et al., 2007). There are several factors affecting the time of puberty including breed, weight, birth month, litter size in which the gilt was born, nutrition, growth rate, diseases, environment and exposure to boar (Le Cozler et al., 1999a; Tummaruk et al., 2000; Holm et al., 2004; Tummaruk et al., 2007). Every day of rearing a gilt is a cost for the farmer. Early puberty can reduce that cost since the gilt becomes productive earlier (Kirkwood & Aherne, 1985; Rozeboom et al., 1996). Studies have found negative correlations between backfat thickness at 90kg and age at puberty and between growth rate (between 25 and 95kg) and age at puberty meaning that faster growing and fatter gilts reaches puberty earlier (Eliasson et al., 1991; Bidanel et al., 1996; Tummaruk et al., 2001). Gilts coming into puberty between 181 and 200 days of age gave birth to more piglets during parity one to three than younger or older gilts (Tummaruk et al., 2007). Sterning et al. (1998) found that Yorkshire gilts that came into puberty late lost more weight during lactation but had larger litter weight gain. One study found that sows that came into puberty early in life were likely to have good longevity compared to sows that came into puberty later (Serenius & Stalder, 2007).

Studies suggest that criteria for minimum age, weight and backfat thickness must be fulfilled before puberty can begin (Kirkwood & Aherne, 1985; Eliasson et al., 1991). Other studies claim that age is more important for puberty onset than body weight and backfat thickness (Newton & Mahan, 1993).

5.3 Sow longevity

From year 2002 and three years forward the annual removal rate of Swedish sows was 49.5% (Engblom, 2008). The main reason for culling was reproductive disorders (26.9%), but old age, udder problems, low productivity and lameness (18.7%, 18.1%, 9.5% and 8.6% respectively) were all important reasons for culling. The removal rate differs between herds and can be influenced by management, health status and housing system. Engblom (2008) also found that 17% of the sows only had one litter before being culled. A high removal rate of low parity sows leads to a lower average parity number in the herd. This in turn leads to lower level of production and consequently also a less profitable business since sows do not get profitable until after their third litter (Lucia et al., 2000).

5.4 Recommendation for time of first service

The recommendation for time of first service varies between countries. Swedish gilts are recommended to be mated on their second or third oestrus, at 220-240 days of age, between 120 and 140kg live weight and with a backfat thickness of 16-20mm (Hidås et al., 2009). Hidås (2010) later recommended a backfat thickness of 18-20mm. Another Swedish recommendation, recently announced, is 7-8 months, second or third oestrus, around 140kg live weight and 15-18mm backfat (Tengvall Nilsson et al., 2010). The Danish Pig Research Centre has a recommendation of 12-18mm backfat and 130-140 kg at first service (Danish Pig Production, 2007). Other studies

suggest mating at 130-150kg body weight, 18-22mm backfat (Challinor et al., 1996) and 220-250 days of age (Bečková et al., 2005) to maximize sow efficiency. There are studies suggesting even higher minimum weight (135-150kg) (Foxcroft et al., 2004; Williams et al., 2005; Government of Alberta, 2010). Tarrés et al. (2006) suggest backfat thickness over 16mm at 5.5 months of age and 15-19mm at first farrowing; less than 15mm or more than 19mm significantly increased the risk of culling. Serenius & Stalder (2007) claimed that the best time of first service for Finnish crossbred gilts is close to 200-210 days of age. Different studies claim different traits as the most important factor for time of first service and it is hard to conclude from the literature whether oestrous number, weight, age or body condition is the most important factor to maximize profitability.

5.4.1 Oestrous number

Studies have found favourable associations between insemination at later oestrous numbers and production results. Young & King (1981) found that the frequency of pregnancy increased with oestrous number (69.6% on the first oestrus and 77.4% on the third) and that gilts inseminated on the third oestrus weaned more piglets than gilts inseminated on the first oestrus. Insemination on the second or third oestrus can also result in decreased farrowing problems compared to insemination on first oestrus (Rozeboom et al., 1996). The sows' longevity does not seem to be affected by the oestrous number at first insemination (Rozeboom et al., 1996; Le Cozler et al., 1999b).

5.4.2 Age

The recommendation for age at first service varies in different studies, but most studies agree that age at first service influence the productivity of gilts. In parity four and five, number of piglets born alive decreased if the gilts were older than eight months at first service and the total number of produced piglets per sow decreased with increased age at first farrowing (Tummaruk et al., 2001). Serenius & Stalder (2007) found a significant negative correlation between age at first farrowing (260-700 days) and sow longevity; the older the gilt the higher the risk of being culled. Engblom et al. (2008) also found that gilts that farrowed at 420 days of age ran higher risk of culling compared to gilts that farrowed at 360 days of age. Other studies propose older gilts at service. Le Cozler at al. (1998) showed that the number of liveborn piglets in parity one and number of weaned piglets per litter increased with age at first farrowing. This is suggested to be due to higher backfat thickness and body weight along with less variation in ovulation rate and embryonic mortality. Rozeboom et al. (1996) found that gilts older at first farrowing weaned heavier piglets but did not find any relationship between age at first service and sow longevity. Holm et al. (2005) saw that selection for decreased age at first service (within 120-500 days) resulted in increased returns to heat, less piglets born alive in first litter but also to shorter weaning to service interval. In parity one the number of piglets born alive increased with gilt age at first service (from five to eleven months) (Tummaruk et al., 2001; Holm et al., 2005).

Age at first service influences the production economy; the older the gilt is at first service the higher raising cost for the producer. Schukken et al. (1994) investigated the optimal age at first service for 15000 Dutch gilts. They calculated profitability by including number of pigs born alive and the sow's number of days in the herd and concluded that 200-220 days at first service was the optimal economical age.

5.4.3 Weight

Several studies argue that gilts need a weight of 135-150kg when first mated (Foxcroft et al., 2004; Williams et al., 2005; Government of Alberta, 2010); gilts weighing less than 135 kg had fewer piglets over three parities. They deem that the gilts will not be able to achieve proper body mass at first farrowing (>175-180kg) if they are weighing less than 135kg at first mating and therefore they will not have enough body reserves to maintain body condition through further parities. If they have lower weight they will not have enough body fat and culling due to injuries

can increase (Foxcroft et al., 2004). According to Williams et al. (2005) weight is the absolutely most important factor determining time of first service and gilts in the right weight span should be mated regardless of age and backfat thickness. Bečková et al. (2005) state that leaner gilts have lower weight at first service.

5.4.4 Backfat thickness

Backfat thickness has been found to have a positive correlation to longevity among replacement gilts (Kunavongkrit at al., 2002). Lean animals have low fat resources to mobilize when needed during the gestation period and this leads to decreased reproductive performance (Kersey DeNise et al., 1983; Gaughan et al., 1995). Body reserves are also important for the sow to be able to produce enough milk and minimize the unproductive days between weaning and next service (Whittemore, 2006). Studies found that gilts with 14-18mm backfat around 100kg live weight gave birth to more live born piglets and had shorter weaning to service interval than leaner or fatter gilts (Gaughan et al., 1995; Tummaruk et al., 2001). Maes et al. (2004) showed that decreased backfat thickness resulted in higher level of stillborn piglets. Both Bečková et al. (2005) and Tummaruk et al. (2001) concluded that gilts with thick backfat (at 20 weeks of age and 100kg live weight) weaned more piglets than leaner gilts. High backfat thickness positively affects litter weight at 21 days (Bečková et al., 2005) and thick backfat can also result in lower returns to heat in later parities (Tummaruk et al., 2001). Good body condition of the gilt at farrowing increases the chance to produce heavy and viable piglets (Sandberg, 2006). Gilts in low body condition are also more likely to develop problems with shoulder lesions (Zurbrigg, 2006).

Studies have found that gilts with backfat thickness between 16 and 19mm at six months of age have the highest survival probability and that backfat less than 16mm or over 19mm resulted in increased risk of culling because of low productivity (Tarrés et al., 2006; Fernàndez de Sevilla et al., 2008). Tarrés et al. (2006) found that backfat thickness over 19mm at first farrowing in gilts increased culling due to lameness. An unfavourable correlation was also found between backfat thickness and weaning to service interval after first litter.

As shown above, many studies show the importance of enough backfat at first service. Nevertheless, too fat gilts results in lower feed intake during lactation, increases sow weight loss, reduces reproductive performance and can increase the risk of culling (Maes et al., 2004; Young & Aherne, 2005; Tarrés et al., 2006). There are also studies saying that the fat content of young animals is not an important measure of the animals' energy supply when they get older and that selection for low backfat thickness would not affect the breeding performance of the animals negatively (Holm et al., 2004). Williams et al. (2005) suggest that there is hardly any relationship between backfat thickness and weight at first service or in the following three parities and that measuring backfat will not give a significant measure of body condition when evaluating sow longevity. They also stress that backfat do not need to be counted for when deciding time of first service, as backfat is of minimal impact on gilt productivity. Some studies found no correlation between backfat thickness and longevity in sows (Rozeboom et al., 1996; Yazdi et al., 2000).

Tengvall Nilsson et al. (2010) from Nordic Genetics state that the Swedish hybrid sows often seem to be in good body condition but have very thin backfat layer at performance test.

5.4.5 Exterior

The exterior of a gilt highly affects her longevity. Sow leg status is genetically related to sow longevity and good leg status can reduce involuntary culling (López-Serrano et al., 2000; Serenius & Stalder, 2007). Leg weakness was the second most common reason for involuntary culling after reproductive failure in first parity sows in the US (Stalder et al., 2005). Engblom (2008) found lameness to be less important in culling of Swedish crossbred sows, ranging between 6% and 13% in the first seven parities with an average of 8.6%.

According to Tarrés et al. (2006) backfat thickness and leg weakness are genetically correlated. They found that less than 15mm backfat at first farrowing increases the risk of culling due to lameness. López-Serrano et al. (2000) found unfavourable genetic correlations between backfat thickness and leg weakness and also favourable correlations between leg conformation and longevity and that longevity can be improved by selection for good leg condition.

5.5 Measurements of body weight, backfat thickness, body condition and exterior traits

5.5.1 Body weight

O´Connell et al. (2007) made monofactorial regression models to predict sow weight from information on parity number, day of gestation, backfat thickness, and morphometric measurements. Heart girth (measured as the circumference behind the front legs and in front of the first mammary glands) gave the best prediction with a coefficient of determination (R^2) of 0.81 (equation: 0.35 x heart girth – 254, P<0.001). O´Connell et al. (2007) also made multiple regressions to improve the accuracy of the weight prediction. They found the best two factor model to be -133 + 3.77 x parity number + 0.32 x day of gestation + 1.17 x P2 backfat + 0.23 x hearth girth (R^2 0.89 and P<0.001) and they suggested this model to be a useful tool in a farm situation with absence of a weighing scale. The model works better for sows in later gestation than for sows in early gestation. Thingnes et al. (2009) estimated hybrid gilt weight out of heart girth measurements using the equation 2.99 x heart girth (cm) – 198 (R^2=0.86 and p<0.0001).

5.5.2 Backfat thickness

An accurate spot for measuring backfat thickness with ultrasonic in pigs is at the P2 position (X in Figure 4) (Renco Corporation, 2006). This spot is located at the level of the last rib, around 6.5cm from the dorsal midline and is a common position used when measuring backfat (Simmins et al., 1994; Challinor et al., 1996; Charette et al., 1996; Shrestha et al., 2003; Maes et al., 2004; Tummaruk et al., 2007; O'Connell et al., 2007). Backfat is sometimes also measured at the P3 position; at the level of the last rib, 8cm from the backbone (Y in Figure 4, Laws et al., 2009).

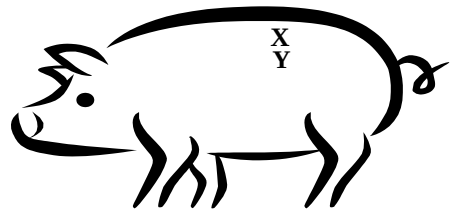


Figure 4. The P2 and P3 positions for measuring backfat thickness.

5.5.3 Body condition

Young et al. (2001) and Young & Aherne (2005) claimed that visual scoring of sow body condition always is a very subjective and non-scientific way of measuring body fat. Using that kind of measurement is not sufficient to obtain a reliable view of the sows' condition (Maes et al., 2004; Young & Aherne, 2005). Backfat thickness and body condition score are poorly associated and studies show that sows scoring three (good condition) at visual scoring had backfat values ranging between 7.5 and 23mm (Young et al., 2001). Maes et al. (2004) showed a correlation of 0.32 (varying between 0.28 and 0.62) between subjective body condition scoring and backfat for gilts at 80 days of gestation. Kunavongkrit at al. (2002) state that there is a positive correlation between backfat thickness and body condition and that backfat measures could be used to eliminate the bias of the investigator. Variation in muscularity can also mislead the estimation of body condition and a well muscled sow can look fatter than she really is (Figure 5, Hilgers & Hűhn, 2009). Charette et al. (1996) concluded that body condition can be

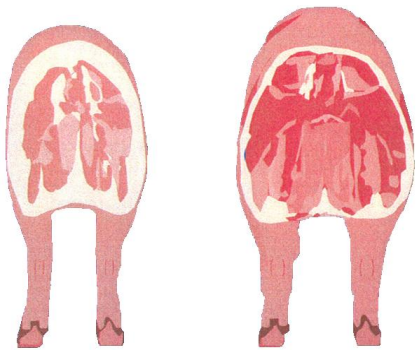


Figure 5. A gilt looking fat can be leaner than a gilt looking thin (Hilgers & Hűhn, 2009).

estimated either by direct measurement of backfat and live weight or by measurements of body morphology (height, width etc).

5.5.4 Exterior

There are several ways of evaluating gilts' exterior, but most studies focus on at leg conformation only. However, López-Serrano et al. (2000) used five exterior traits; leg status, length, muscularity, height and overall type and scored them individually on a nine degree scale. Van Steenbergen (1989) did an evaluation of linearly scored exterior traits using 21 different exterior traits including nine different leg status scores, three back status scores, two ham scores, two hoof scores, two movement scores, nipples and constitution score. Tarrés et al. (2006) evaluated sow exterior out of two traits; teat quality and feet plus leg morphology. The teat trait included number of teats, number of inverted teats and the number of small teats. The feet and leg morphology trait included three leg scores and size of inner claws. A new system of evaluating pig exterior in nucleus herds has been elaborated by Nordic Genetics and Norsvin to create a more uniform hybrid (Tengvall Nilsson, 2010a). The exterior evaluation is performed by a technician in connection to the ultrasonic measurement of backfat thickness. The exterior evaluation on boars at Månseryd (Quality Genetics' boar testing station) is however not changed. The Månseryd system consists of six leg traits, movements, back and hoof size using a nine degree scale (1 best and 9 worse). That system has been modified and the new system aims to measure the animals' load-bearing capacity (see Appendix I). The new system has however not been put into practice yet (Tengvall Nilsson, 2010b).

5.6 Interviews

There are two types of interviews; qualitative and quantitative. Simplified, when investigating questions that can be answered by using numbers (or other measurable scales like 'less' or 'more') quantitative interviews are a good tool (Trost, 2005). In a quantitative interview the interviewer has a number of questions he/she wants to have answered (Rönnqvist, 2004). A qualitative method aims to understand a behaviour and to emphasize things that are less known (Trost, 2005) and to better understand the investigated subject, while the quantitative interview wants to study different connections (Rönnqvist, 2004). A qualitative interview is less formalized and gives the interviewed more space. The interviewer is also given more possibility to change the questions as the comprehension about the subject increases (Rönnqvist, 2004). This means that one does not necessarily get results that can be processed through calculations and statistics. Scientificity and statistical significance are harder to achieve using qualitative methods than with quantitative methods. Discussion and reflection of the results is one method to achieve scientificity. Another difficulty in qualitative interviews is to stay objective. Sometimes it can though be useful to be subjective to create a more comfortable situation between the interviewer and the interviewed (Trost, 2005).

6 Own study

6.1 Materials and methods

The expression 'first service' or only 'service' will be used many times in this text. Both expressions are used but whether it actually is the first service is not always known. The collected data of insemination date does not tell whether it was the first insemination or if the gilts had been inseminated before but did not get pregnant. For many of the gilts it was easy to conclude that it was the actual first insemination by looking at the gilts' age and littermates' age. Also, when writing about service the word 'insemination' will mainly be used, but in some farms boars were used for mating. Thus, insemination refers to insemination or natural service. The expression 'body condition' will also be used frequently. It refers to the animals' way of looking thin or fat.

Good body condition means a gilt/sow that has enough body fat for that stage of their life/lactation cycle.

All farmers got a copy of the manuscript and were given the opportunity to make objections. However, none of the farmers raised any objections of the manuscript to be published.

6.1.1 Herds

Five gilt producing herds and five piglet producing herds that bought gilts from the gilt producing herds were chosen for the project. All herds bought animals or AI from Quality Genetics. Five farm pairs (A-E) were then created and these pairs are described in Appendix II. The five gilt producing herds were chosen by the number of produced gilts and their geographic location; as large herds as possible in the middle and southern parts of Sweden. The herds were both multipliers and nucleus herds but only information on hybrid gilts was included in the study. The gilt buying herds were also chosen by geographic location and production size; herds in the same area as the producers and herds that bought the largest number of gilts from the producers were chosen. All herds were visited once except one gilt buying herd that was visited twice. The first herd was visited on April 16 and the last herd on May 28. One gilt buying herd could not be visited due to unexpected circumstances and was excluded from the project. The number of gilt buying herds ended up on four.

The visited herds varied in production size, between 112 and 780 sows in production and thus also the number of employed herdsmen (Table 2). Some herds had pig production as only production while others had other production types beside the pig business. There were herds that produced feed for own use and herds that bought all feed. Some had very good production results while other herds had less good results. When visiting the farms information of birth date, date of service and arrival date for purchased gilts were collected.

Table 2. Herd information. Hyphens mean that the question was not asked and question mark means that the farmer did not know the answer

Farm couple	**A**		**B**		**C**	**D**		**E**	
Producer (P) or buyer (B)	P	B	P	B	P	P	B	P	B
Production size (sows in production)	160	600	180	780	250	120	220	110	270
Selling ambition (gilts per year)	1200	-	1200	-	1200	700-800	-	1000	-
Other businesses	No	Yes	Yes	Yes	Yes	No	No	Yes	No
Herd staff	3	7	3.5	4	7	2	1.5	4	2
AI or boar	Mainly boar	-	AI/ boar	-	AI	AI	-	AI	-
Number of customers/ producers	15-20	1	~5	2	3-4	7-8	1	?	3
Production results (average no. piglets)	-	11.25 weaned/ litter	-	22-23 weaned/ sow/year	-	-	25.8 weaned/ sow/year	-	10 weaned/ litter

6.1.2 Recordings

In total 224 gilts were included in the study; 144 gilts in gilt producing herds and 80 gilts in gilt buying herds. The 80 gilts in the buying herds were not the same as in the producing herds as there was no time for waiting until the measured gilts had been delivered. Since one herd was excluded from the project the goal of measuring 100 gilts from gilt buying herds was not obtained. The gilts' birth dates and insemination dates were collected on the farms. For those gilts

that had not been inseminated, dates for insemination were collected afterwards. As seen in Figure 6 there were six gilts older than 380 days at the day of the measurement. These gilts were regarded as too old and were, together with 25 gilts with unknown date for service, excluded from the statistical analyses of traits at service (N=193). The recordings (except for exterior) were performed in the feeding stalls (if available) where the gilts were not able to escape. Recordings of backfat, heart girth, body condition and exterior were done before or after the interview, depending on when the farmer was available for the interview.

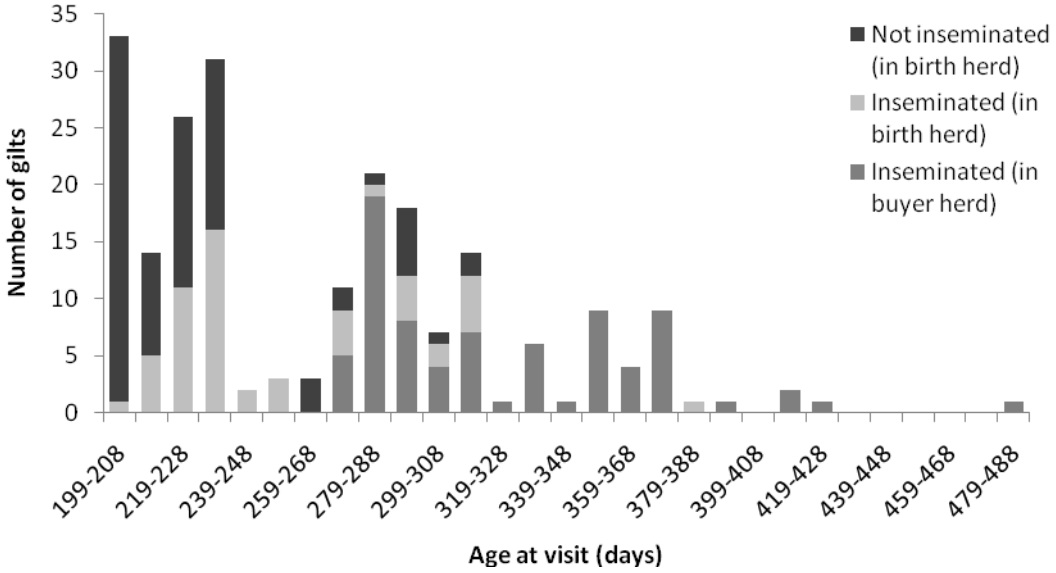


Figure 6. The distribution of gilts of different age at the time of visit (N=219, five values missing due to unknown age).

6.1.2.1 Weight

The visited herds did not have a weighing scale suitable for gilts. Instead weight was estimated with help of heart girth, measured behind front legs and in front of the first mammary glands with a measuring tape. Heart girth was measured on gilts in feeding stalls and on loose gilts where feeding stalls were not available. Two equations were used to estimate weight:

Weight (kg) = -133 + 3.77 x parity number + 0.32 x day of gestation + 1.17 x P2 backfat + 0.23 x hearth girth (mm) [1]

(R^2=0.89 and p<0.001 according to O'Connell et al., 2007)

Weight (kg) = 2.99 x heart girth (cm) - 198 [2]

(R^2=0.86 and p<0.0001 according to Thingnes et al., 2009)

Gilts that were not inseminated and gilts with unknown insemination date were excluded when using model [1].

6.1.2.2 Backfat

Backfat was measured with a Lean-Meater Series 12, which is a microprocessor controlled ultrasonic instrument (Renco Corporation, 2006). Backfat was measured at the P3 position, 8-9cm from the dorsal midline on both sides and the average of these two recordswas used in the analysis. In order to practice recording, measurements were made on a number of gilts and sows at the experimental herd of the Swedish University of Agricultural Sciences at Lövsta. These animals were also measured with the ultrasonic instrument Krautkramer USM 22 which is used at Lövsta. All the other recordings that should be performed in the visited herds (exterior, body condition and heart girth) were also practiced on the animals at Lövsta.

After the visits, a number of gilts with records received from the Lean-Meater were compared to records received from the Krautkramer USM 22 that is used on SLU's experimental herd at Lövsta. Two different measuring sites were also compared. Seven sows and seven gilts were measured with both ultrasonic instruments (Table 5).

The Krautkramer was handled by an experienced staff member. She applied the probe around 7-8cm from the dorsal midline and then adjusted the frequency until three high peaks could be seen on the screen and registered the value at third peak. There are two different recordings measured with the Lean-Meater. The Lean-Meater 1 registrations are measured on the exact same site as the Krautkramer measurements. The Lean-Meater 2 registrations are measured like the on farm in this study; the highest registered backfat thickness with three layers of backfat seen on the screen. Figure 7 shows how to read the Lean-Meater screen.

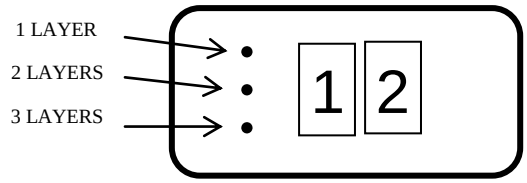


Figure 7. The Lean-Meater screen showing 12mm backfat and three layers of backfat (modified from Renco Corporation, 2006).

6.1.2.3 Body condition

After recording the backfat thickness, body condition evaluation was performed. For visual recordings of body condition a Norwegian body condition evaluation scale was used (Helsetjenesten for svin, 2010) (Appendix III, Figure 1). The evaluation included five traits; appearance, ribs, backbone, hipbone and ischium. Each trait was evaluated individually and half points were used to get more accurate results. The scores for the five different traits were added together and an average for each animal was calculated. After the recording, the average was rounded up or down to the scale with 0.5 intervals (from 0.5 to 5.0).

6.1.2.4 Exterior

Exterior assessment was made once on each animal according to Quality Genetics' new system for exterior evaluation (Serenius, 2010) (Appendix I). The assessment includes seven traits; back, front legs, rear legs, sickle hocked rear legs, hoofs, movements and teat quality. Four of the traits (back, sickle hocked rear legs, hoofs and movements) were evaluated on a four-degree scale where four was optimal and one was the largest deviation from optimum. The front- and rear legs traits (hock, fetlock, knock-kneed/sabre-legged) were evaluated on a seven-degree scale where four was optimal and one was too stiff and seven too flexible. The measurements of rear legs and hoofs were done in individual feeding stalls in six herds. Three herds had no individual feeding stalls and measurements were made in the pen (concrete floor or deep straw bedding). Hoof measurement was not performed in one herd since the gilts were held on deep straw bedding without opportunity to look at the gilts on solid floor. The recording of backs, front legs, sickle hocked rear legs and movements were made on loose gilts. Teat quality was not included in this project.

6.1.3 Gilt inspection

Seven of the nine farmers had the possibility to do a gilt inspection during the visit. The instructions were to imagine that the observed gilts were about to be mated and that they should comment anything that they thought was worth commenting such as size, body condition, exterior etc. All comments were noted by the interviewer. The gilt inspections were performed when the farmers were available, sometimes before the recording and sometimes after. The information from the gilt inspections was later compared to the measurements of the gilts.

6.1.4 Interviews

Qualitative interviews were chosen for this study. The interviews were performed on the farms, before or after the recording of information on the gilts, depending on the farmer's time schedule. No tape recorder was used during the interviews. Two different questionnaires were used; one for the producers and another for the buyers (Appendix IV). The questionnaires were divided in

different topics; background information about farms and farmers, relation to Quality Genetics, relation to buyers or producers, selection of gilts, timing of first service, backfat thickness and general opinions about animal quality. The questionnaires were not followed strictly. The interviewed got the chance to talk as much as he or she wanted without the interviewer breaking in with questions. Some questions were thus answered without being asked. During the gilt inspection, farmers often answered questions that were not asked.

6.1.5 Statistical analyses

The statistical analyses were performed in the SAS 9.2 program (SAS Inst. Inc., Cary, NC, USA). The statistical procedures used were proc means, proc freq, proc corr and proc glm. For analysing variation in backfat thickness, heart girth and weight at service and at delivery, analysis of variation (proc glm) was used and the statistical model used was:

$$y = \mu + herd + regression\ of\ day\ difference + e \quad [3]$$

Analyses were made for producers and buyers separately. Day difference is the number of days between the measurement and service (both positive and negative values). Two regression coefficients (b-values) were estimated; one for gilts studied before delivery and another value for gilts studied after delivery. These regression coefficients were used for correcting backfat, heart girth and weight to "values at service".

Average values of backfat thickness, heart girth and weight at first service and at delivery for each group were estimated. An investigation of the collected dates of service was performed. The gilts were separated into three groups; one group including gilts where the date of service most likely was the date of first insemination, one group where the date most likely was the date of the second or later insemination and one group where including gilts where the service number was unknown. The exterior results were analysed with proc means and proc freq.

7 Results

7.1 Records

In the gilt producing herds the time difference between the visit and service (day difference) varied between 80 days before service (-80) and 25 days after service (+25) with an average of -8 (Figure 8). In the gilt buying herds the day difference varied between 45 days and 76 days after service with an average of 59.

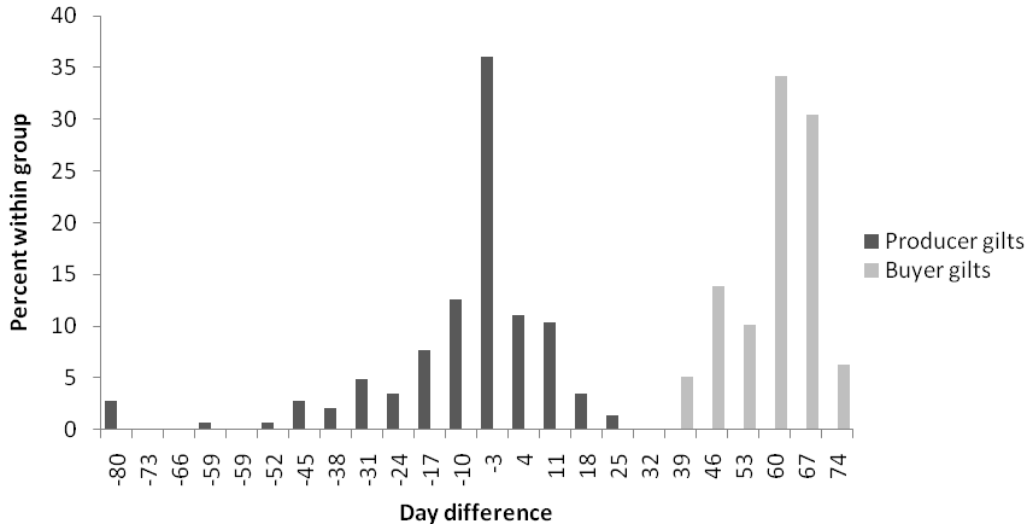


Figure 8. The distribution of gilts with different day difference according to visiting day (before and after service) (N=199; 25 values missing due to unknown service day).

There are no records of oestrous number at service, since none of the farmers registered first oestrus.

7.1.1 Weight

Two methods of estimating weight were compared to each other and to real weights recorded at 16 Yorkshire gilts at Lövsta (Table 3).

Table 3. Comparison of real and estimated weights (kg) for 16 Yorkshire gilts. Weight 1 is estimated according to O´Connell et al. (2007) and Weight 2 according to Thingnes et al. (2009)

Gilt	Real weight	Weight 1	Weight 2
1	182	211	194
2	195	223	206
3	152	193	170
4	158	186	167
5	165	195	173
6	172	202	185
7	135	165	149
8	185	216	188
9	184	217	188
10	213	249	227
11	161	182	173
12	136	158	149
13	127	154	146
14	141	184	176
15	147	167	167
16	148	178	164
Average	163	192	176

Both described methods of estimating weight were applied for gilts in the nine herds and the results are shown in Table 4. Average weight estimated from the model by Thingnes et al. (2009) was 176kg (std 28) and from the model by O'Connell et al. (2007) average was 182kg (std 35). The model by Thingnes et al. (2009) was used in further statistical analyses. The correlations between "Real weight" and "Weight 1" was 0.97, between "Real weight" and "Weight 2" 0.95 and between "Weight 1" and "Weight 2" 0.96.

Table 4. Average heart girths (cm) and estimated weights (kg) for each herd calculated from the measured values of heart girth at the time of visit. Weight 1 is estimated according to Thingnes et al. (2009) (N=224) and weight 2 according to O´Connell et al. (2007) (N=212)

Couple	Producer /Buyer	Heart Girth	Weight 1	Weight 2
A	P	121	164	167
	B	133	200	210
B	P	118	156	156
	B	131	193	212
C	P	123	169	165
D	P	114	154	147
	B	127	182	201
E	P	116	150	147
	B	138	216	232
Average		125	176	182

7.1.2 Backfat

Table 5 shows the recorded backfat thicknesses received from measurements by the Krautkramer and the Lean-Meater. The Lean-Meater 1 registrations are measured on the exact same site as the Krautkramer measurements. The Lean-Meater 2 registrations are measured like the on farm in this study; the highest registered backfat thickness with three layers of backfat seen on the screen. The highest thickness value was mostly found around 8-9cm from the dorsal midline.

Table 5. Comparison of backfat thickness (mm) measured with the Krautkramer and the Lean-Meater

Animal	Krautkramer	Lean-Meater 1	Lean-Meater 2
1	9	14	16
2	15	15	15
3	11	11	12
4	9.5	10	10
5	12.5	12	13
6	10	10	14
7	13.5	13	15
8	15	15	16
9	11	12	13
10	13	14	15
11	9	9	11
12	11	12	14
13	12	12	13
14	14	14	15
Average	11.8	12.4	13.7

The correlations between "Krautkramer" and "Lean-Meater 1" was 0.76, between "Krautkramer" and "Lean-Meater 2" 0.58 and between "Lean-Meater 1" and "Lea-Meater 2" 0.85.

Average backfat thickness was thus in this study measured at the P3 position rather than at the P2 position. It was measured on both sides of the gilts and the average of these two records was used as the backfat thickness in all further statistical analyses. The thickness often differed between both sides (Table 6).

Table 6. Differences in backfat thickness at the P3 position between left and right side (N=224)

Difference (mm)	Frequency	Percent
-3	1	0.5
-2	6	2.7
-1	58	25.9
0	102	45.5
1	45	20.1
2	12	5.4

The measured backfat thickness differed much between herds (Table 7). Gilts in the producer herds ranged between 11.7 and 14.5mm on average and in the buyer herds between 13.8 and 19.0mm on average. The corresponding coefficients of variance (CV) for backfat were 15% and 23% respectively. Average age also differed much and age affected backfat thickness (r = 0.30, Table 12). As Table 7 shows, similarities can be found within and between the different farm couples. Couple A had much thinner backfat on average than couple E.

Table 7. Mean values for age (days), body condition score, backfat thickness (mm) and estimated weight (kg) (according to Thingnes et al., 2009) for each herd at the time of visit (N=224)

Couple	N	Age		BCS[1)]		BF[2)]		Weight	
		Mean	Std	Mean	Std	Mean	Std	Mean	Std
A	30	299	21	3.0	0.4	11.7	1.5	164	17
	27	350	29	3.4	0.4	13.8	2.5	200	16
B	30	221	11	3.3	0.5	13.0	1.5	156	10
	20	313	42	3.2	0.4	15.4	2.9	193	18
C	22	226	16	3.6	0.3	13.5	2.0	169	16
D	31	233	13	3.2	0.4	13.3	2.0	154	15
	13	292	18	3.5	0.4	16.0	2.5	182	12
E	31	212	17	3.5	0.3	14.5	2.4	150	16
	20	323	54	3.8	0.5	19.0	4.4	216	35

[1)] Body condition score
[2)] Backfat thickness (mm)

The average body condition score for each herd can be seen in Table 7, ranging from 3.0 to 3.8 and CV was 12%. The relationship between backfat thickness and body condition score is presented in Figure 7.

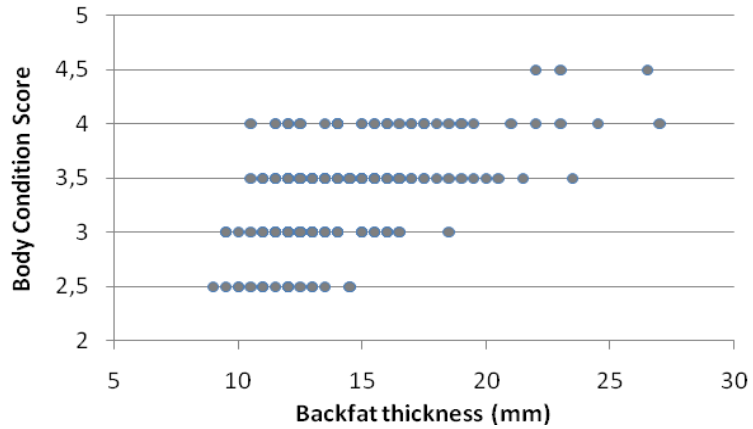


Figure 7. The relationship between backfat thickness and body condition score (N=224).

7.1.3 Exterior

Results from the exterior evaluation are shown in Figure 8. Score 4 is regarded as best for all traits and the larger deviation from 4 the worse (Appendix I).

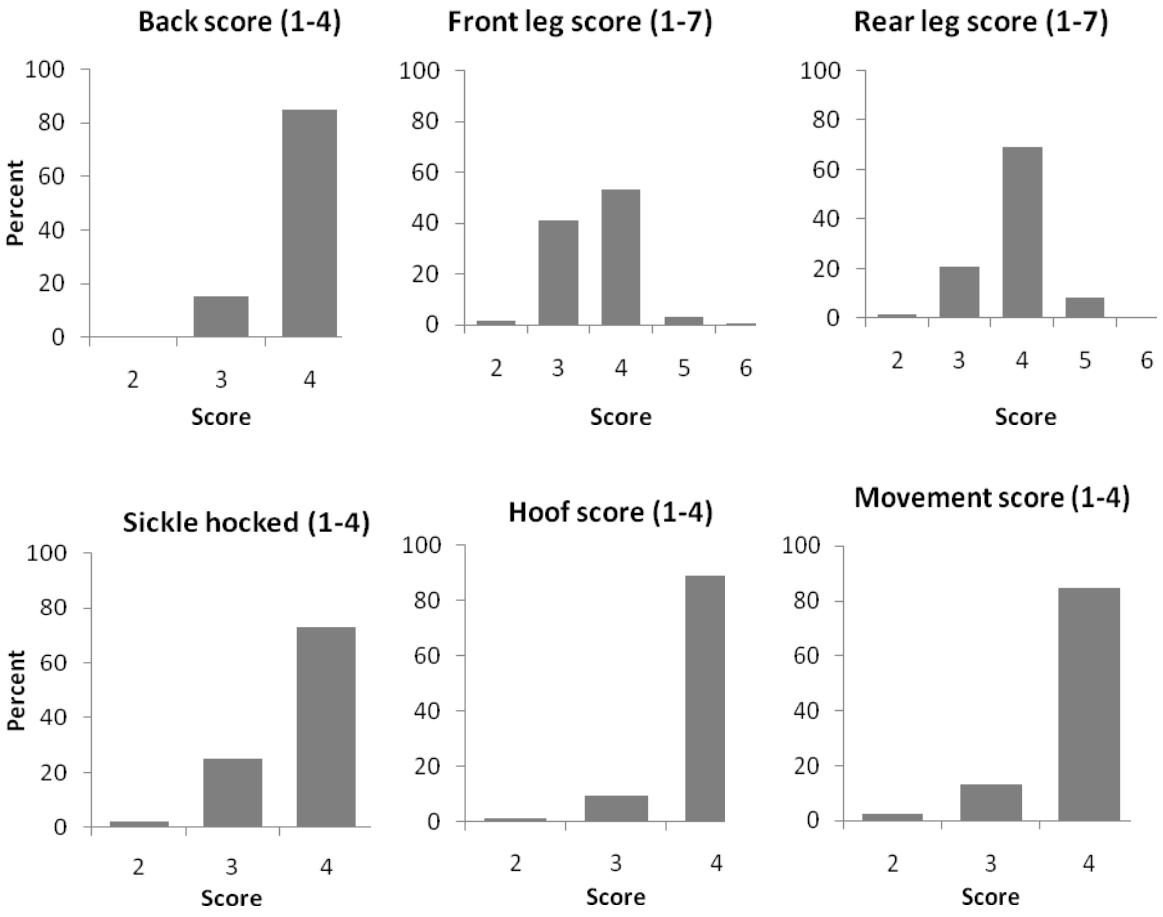


Figure 8. Results for the exterior evaluation including six traits. N=222 for all figures except for Hoof Score, where N=209.

Figure 9 shows that front leg exterior seems to be the most problematic trait in the nine herds, as it had lowest proportion of gilts with score 4 for both producer- and buyer gilts. The "perfect" gilt, from an exterior point of view, should have score 4 in all traits. In total 21% of all gilts were perfect (17% of the producer gilts and 27% of the buyer gilts). Table 8 shows the percentage of gilts that scored 4 in different exterior traits within herd.

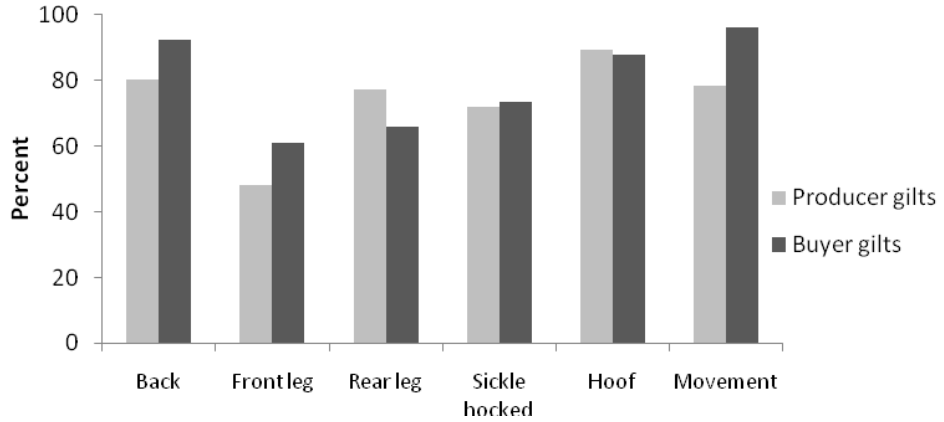


Figure 9. The percentage of gilts that scored 4 in different exterior traits.

Table 8. The percentage of gilts that scored 4 in different exterior traits within herd. Hoof score registrations were not performed in one herd

Couple	Back	Front leg	Hind leg	Sickle hocked	Hoof	Movement
A	76	79	55	79	93	100
	89	78	44	78	96	100
B	90	80	57	60	93	40
	100	55	90	60	90	90
C	64	18	68	68	100	95
D	84	35	87	81	97	71
	100	38	85	85	-	100
E	84	23	84	71	68	90
	84	58	58	74	74	95

7.1.4 Estimates

Recorded backfat thickness, heart girth and weight at service were corrected to day at service, using model [3] and the regression coefficients from Table 10, and the results are shown in Table 9. The missing values (N≠218) are a result of 13 unknown service dates for one herd and 12 gilts culled before service. Model [3] (with the same regression coefficients) was also used to estimate the same traits at the time of delivery and the results can be seen in Table 9. The regression coefficients used in model [3] are presented in Table 10.

Table 9. Estimated variables for the average gilt at service and at delivery

SERVICE	N	Mean	Std	Min	Median	Max
Age (days)	190[1)]	245	32	203	235	330
Backfat (mm)	193	13.3	2.7	7.4	12.8	24.0
Heart girth (cm)	193	119	6	104	119	135
Weight (kg)	193	156	18	112	157	204
DELIVERY						
Age (days)	77[2)]	316	41	261	305	408
Backfat (mm)	79	15.3	3.5	8.9	14.9	26.5
Heart girth (cm)	79	131	7	117	130	149
Weight (kg)	79	193	21	152	190	247

[1)] Three values missing due to unknown biological age
[2)] Two values missing due to unknown biological age

Table 10. Regression coefficients (b-values) for backfat, heart girth and weight on days from visit to service and delivery, and the statistical significance (p) and coefficients of determination (R^2)

Before delivery (N=119)	**b**	**p (day diff)**	**p (herd)**	**R^2**
Backfat (mm)	0.01	0.2258	0.0005	0.17
Heart girth (cm)	1.21	0.0259	0.0013	0.21
Weight (kg)	0.33	0.0259	0.0013	0.21
After delivery (N=74)				
Backfat (mm)	0.04	0.5403	0.0018	0.24
Heart girth (cm)	2.46	0.0771	<0.0001	0.27
Weight (kg)	0.74	0.0771	<0.0001	0.27

The average age at service was estimated to 245 days, the average backfat thickness to 13.3mm, heart girth to 119cm and the weight to 156kg. Age, backfat and weight at time of service differed much between herds and the results for each herd couple can be seen in Table 11.

Table 11. Average estimated age, backfat thickness, heart girth and weight at service and their standard deviation for each herd couple (N=193)

Couple	**Age (days)**		**BF[1)]**		**HG[2)]**		**Weight (kg)**	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
A	290	23	11.6	2.2	120	6	162	18
B	229	23	12.8	2.2	116	5	150	16
C[3)]	231	14	13.6	2.1	124	4	172	12
D	233	19	13.4	2.1	116	5	149	16
E	239	28	15.0	3.1	119	6	159	19

[1)] Backfat (mm)
[2)] Heart girth (cm)
[3)] Only producer herd

The phenotypic correlations between age at service, body condition, fatness and size are shown Table 12. Herd and day difference are included in the model.

Table 12. Phenotypic correlations between different traits at visit and their significance level (p)

	N	**Correlation**	**p**
Age-Backfat	186	0.30	<0.0001
Age-BCS[1)]	186	0.14	0.0532
Age-HG[2)]	186	0.45	<0.0001
Backfat-BCS	189	0.43	<0.0001
Backfat-HG	189	0.57	<0.0001
BCS-HG	189	0.47	<0.0001

[1)] Body condition score
[2)] Heart girth

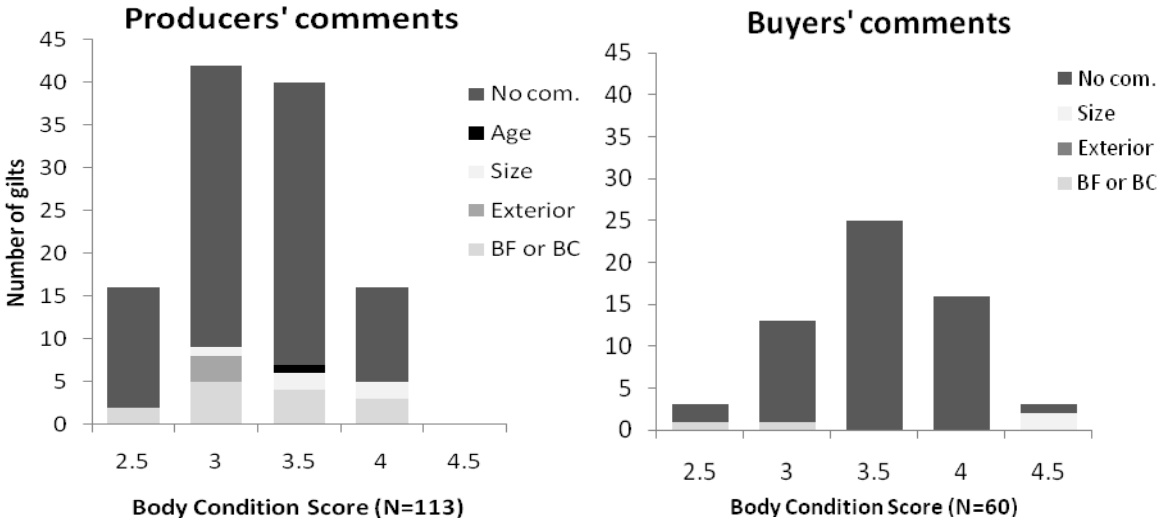
The gilts were sorted in three groups according to the most likely service number. Estimations for age, backfat thickness, heart girth and weight for these groups are shown in Table 13. These estimates at first service were 7 days, 0.2mm and 2kg lower than the estimates for all gilts (Table 9).

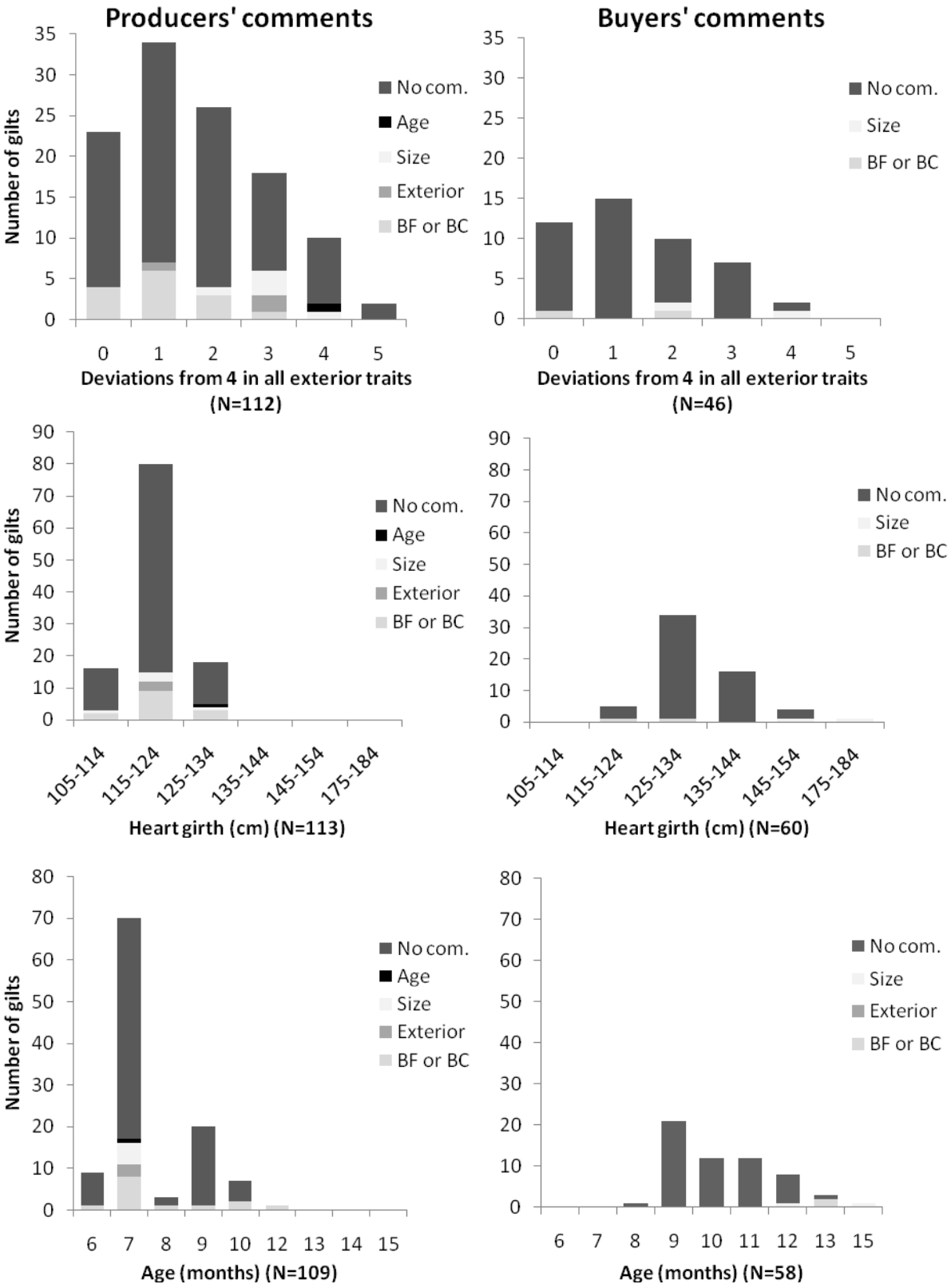
Table 13. Estimated variables for the average gilt at service where the date of service corresponds to 1st service, to 2nd or later service or unknown service respectively

1st service	N	Mean	Std
Age	116	238	31
Backfat (mm)	136	13.1	2.5
Heart girth (cm)	136	118	6
Weight (kg)	136	154	19
≥2nd service			
Age	27	280	30
Backfat (mm)	33	14.5	3.2
Heart girth (cm)	33	120	6
Weight (kg)	33	162	18
Unknown service			
Age	18	248	23
Backfat (mm)	20	13.1	1.6
Heart girth (cm)	20	120	36
Weight (kg)	20	161	11

7.2 Gilt inspection

A gilt inspection was performed in seven of the nine herds (four producers and three buyers). The farmers had a walk around in their stable and commented the gilts' looks, and the interviewer noted all comments. The farmers mentioned if the gilts were too thin or too fat (backfat or body condition, BF or BC), if they were too large or too small (size), if they had some bad exterior characters (exterior) or if they were too old or too young (age). This information is presented in Figure 10 in relation to the records. Sometimes the farmers pointed out gilts that they found good looking, but they are in the figure presented together with No comments (No com.). Gilts without comments are presented as "No com". Backfat or body condition was the most commented trait. Age and exterior was not commented much; age by one farmer and exterior by another farmer.




Producers' comments
Number of gilts
No com.
Age
Size
Exterior
BF or BC
Deviations from 4 in all exterior traits (N=112)
Buyers' comments
No com.
Size
BF or BC
Deviations from 4 in all exterior traits (N=46)
Number of gilts
No com.
Age
Size
Exterior
BF or BC
105-114
115-124
125-134
135-144
145-154
175-184
Heart girth (cm) (N=113)
No com.
Size
BF or BC
Heart girth (cm) (N=60)
Number of gilts
No com.
Age
Size
Exterior
BF or BC
Age (months) (N=109)
No com.
Size
Exterior
BF or BC
Age (months) (N=58)

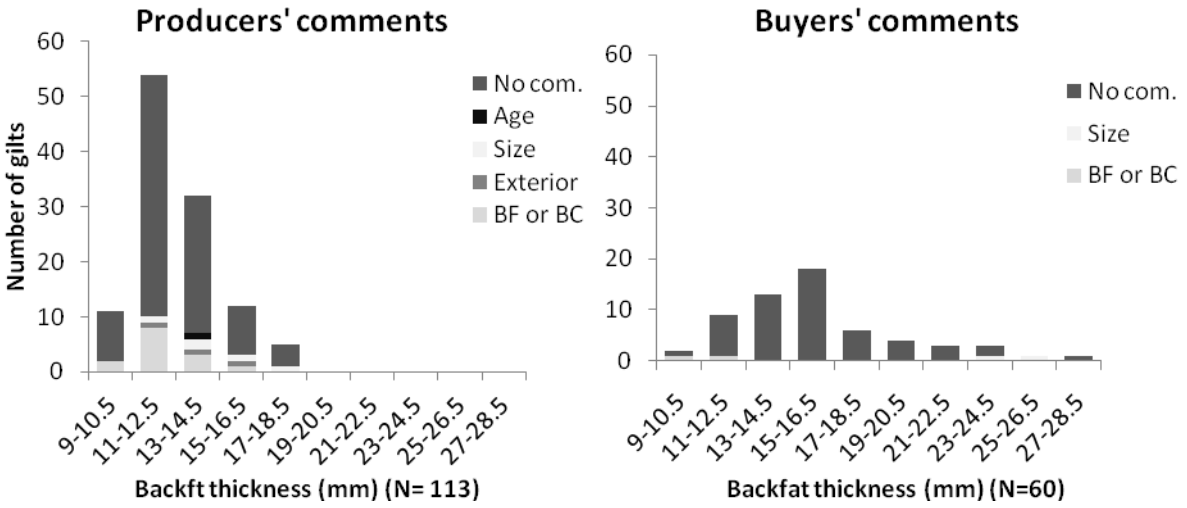


Figure 10. The producers' and buyers' comments about their gilts in relation to body condition score, heart girth, exterior, age and backfat thickness at the time of visit. No com. = no comments, BF = Backfat and BC = Body Condition.

7.3 Interviews

The following results are based on the farmers' answers at the interviews. Some of the information found under headings 7.3.1 - 7.3.3 is summarized in Table 14.

7.3.1 Gilt producers about...

7.3.1.1 ...selection of gilts

Four producers make the first selection when the piglets are three weeks old. At that time they all sort out gilts with less than 14 teats and gilts that have an uneven teat distribution or teats between the teat pairs. Three of the producers also take away runt pigs and sick animals at that time. Two of the farmers make a second selection when moving the gilts to the insemination unit at 5.5-6.5 months of age. Small gilts are sorted away as well as sick gilts, gilts with hernia and gilts with bad legs, hoofs or back. The last producer makes the first selection at 23 weeks of age when the gilts are moved to the insemination unit. Thin gilts, gilts with bad legs and back and gilts with less than 14 teats are sorted out. All farmers also stated that the sorting procedure is going on during the whole rearing period, where gilts with bad legs and gilts that are sick, injured or too thin are sorted away.

7.3.1.2 ...time of first service

The recommendation

The producers had fairly good knowledge about the Swedish recommendation for time of first service. Their knowledge about the age recommendation varied; four producers answered 240-280 days, ≥7 months, ≥7.5 months and 7-10 months respectively. The farmer answering 7-10 months wanted the gilts to be no older than 8 months at first service. The last farmer did not mention age. Regarding the weight recommendation, two farmers answered 120-140kg and two other farmers at least 130kg. The last farmer did not mention weight but said that the gilts should be well developed. The awareness about the backfat recommendation varied but only one farmer had a clear answer; 16-18mm. That farmer stressed that 16-18mm is unrealistic and impossible to achieve and also unnecessary. Another farmer was not certain about the backfat thickness recommendation but thought 14-15mm. The other three producers did not know the existence of the backfat recommendation, but one of them answered that gilts should be in good body condition. All farmers thought that following the stated recommendation result in good animals.

When are gilts inseminated?

The age at first service differed between herds. One farmer makes sure that the gilts are older than eight months. Three other producers answered that the gilts are between seven and eight months and the last producer starts breeding at 29 weeks of age (6.8 months). Four of the farmers stressed accurate age as the most important factor when deciding time of first service while the last farmer considered body size as most important.

One question concerned gilt live weight at insemination and none of the producers weighed the gilts at any time. Four of the farmers believed that their gilts' average weight at insemination was around 120-140kg. Another farmer pointed out the importance of gilts being large enough because gilts that are too small at service can have problems reaching full body size as adults. However, all farmers claimed that weight is not the most important factor when deciding time of first service.

When discussing body condition, all farmers agreed that too thin gilts results in increased risk of lack of the fat reserves that the gilts need to manage the first litter well. One of the farmers also pointed out that gilts should not be too fat either; too fat gilts was deemed to result in farrowing problems during the first litter and also later in life.

Another question regarded oestrous number at first service. Three farmers believed they inseminate gilts on the second (two farmers) or third (one farmer) oestrus at the earliest. Nevertheless, none of these farmers registered date for first oestrus and did not really know on which oestrus number gilts are inseminated. The other two producers answered that they inseminate at the earliest on the second respective the third oestrus. One producer said that oestrous number has no importance while the three others had not really thought about oestrus number as a factor taking into account when deciding time of insemination.

None of the producers measured backfat thickness. They all select the gilts looking largest in a batch (not necessarily fattest). Three of the producers emphasised backfat thickness at first service as very important. They agreed that good fat reserves is necessary to be able to produce many piglets and to maintain good production for many years (longevity). The other two farmers stressed that backfat thickness is important at first farrowing but not at time of first service. One farmer had a deviating answer, pointing out that gilts should be lean rather than fat at first service and then fattening should start after insemination. All producers reckoned that estimation of backfat thickness only by looking and palpating the gilts is difficult but that large deviations probably can be estimated. One producer stressed that many gilts look round and fat but that the body mass is mainly muscles and that those muscles mislead the estimation. On the question whether the farmers think that they would benefit by measuring backfat thickness when deciding time of first service their answers differed. The two nucleus herds measure backfat on purebred gilts and find that helpful. Nevertheless, those two farmers and another one believed that measuring backfat on the hybrid gilts would take too much time. One farmer had never experienced the problem with lack of backfat and thought that backfat measurements would not be profitable. The last farmer believed that known backfat thickness could be helpful when selecting gilts for delivery, but not for deciding time of first service.

7.3.1.3 ...Quality Genetics

All producers were satisfied with the purebred gilts or semen bought from Quality Genetics. Adjectives mentioned were “good producing”, “good quality”, “nice temperament” and “nice and lean”. One farmer had experienced problems with osteochondrosis and hoof lesions as well as with many returns to oestrus and disturbed milk production two weeks after farrowing. Three of the farmers claimed that the animal quality has increased in latest years, such as more piglets born alive and better longevity. Two of those farmers also stressed that the animals have become less good looking.

The arrangement between the farmers and Quality Genetics seemed to work well. Mostly the farmers get the right amount of animals or doses on the right time. They all agreed that Quality Genetics handle the contact with the buyers good and that problems are rare.

7.3.2 Gilt buyers about...

7.3.2.1 ...selection of gilts

One question concerned how the gilt buyers would act with the opportunity to influence the selection of gilts on their respective gilt producing farm. The answers differed slightly but they all mentioned the importance of the teats. On buyer stressed the importance of number of teats, large body size, enough weight and good legs. Gilts with few blind teats, gilts looking round and fat and proportional did another farmer deem as valuable. The third buyer mentioned good body condition and good legs. The last buyer stated that gilts having at least 14 teats, good temperament and looking robust (not too thin or small) important.

7.3.2.2 ...time of first service

The recommendation

The gilt buyers' knowledge about the recommendation varied. One farmer answered 7-8 months but claimed they should be at least 8 months and large, because otherwise, longevity would be low. Another farmer answered good body condition. The recommendation was unknown for the last two farmers, but one of them had a guess on 15mm backfat at delivery. As long as the gilts have 20mm backfat at first farrowing the backfat thickness at service was deemed as unimportant.

When should gilts be inseminated?

One question regarded when gilts should be inseminated. One farmer stressed that following the directive and make sure the gilts are large enough at breeding results in good gilts. Another farmer wanted the gilts to be at least eight months old and in good body condition. Not too small or too old gilts at service were the third farmer's opinion. The last buyer had no preferences when choosing time of first service, but gilts being large enough and around one year old at farrowing were deemed as important. Nevertheless, he pointed out that he does not mind the gilts farrowing before one year of age as long as they are looking good.

Three gilt buyers stressed the importance of gilts having enough backfat, because they need fat reserves when they start lactating to be able to manage over many parities. One of them also claimed that gilts with thick backfat release more eggs at service. The last farmer had never thought about backfat per se as an essential trait, but found body condition very important.

7.3.3 Arrangement between gilt producers and gilt buyers

The relationship between gilt producers and gilt buyers seemed to work well; all farm couples emphasised the good arrangement. There was one gilt buyer who had complained about too thin gilts at some occasions but besides that, both the buyer and the producer agree that the arrangement works well. Like all the other farms, this farm couple follow Quality Genetics' rules regarding reclamations. The producer stressed the importance of maintaining a good relationship to his customers and has given this buyer two gilts as compensation for delivering too thin gilts. If the buyer has complaints of more serious extent (like the thin gilts) he calls Quality Genetics, which in turn informs the producer. Less serious complaints are solved directly between the farmers over the phone. Once the buyer made the complaints about too thin gilts, the producer claimed he is more thorough to deliver the fattest gilts. After the discussion about the thin gilts, the buyer also finds the gilts being in much better body condition and also believes that the producer was not aware of the gilts being thin.

In the second herd couple, both parts found the arrangement working very well. The buyer has, at a few times, reclaimed gilts which were not pregnant. The gilt producer cares for feedback from his customers. When delivering the gilts he adds a follow-up paper form which is filled in by the

buyer and returned to the producer. Consequently, the producer gets good knowledge about his own production results and trends.

Another gilt buyer has at a few occasions, been delivering very old gilts, gilts not being pregnant and gilts with bad legs. If his complaints are justifiable, the gilts are discounted. Like previous producer, this producer applies a feedback system where a follow-up paper form is received. The answering frequency is around 80% and this buyer is one of the farmers always returning the paper-form.

The fourth buyer always receives the right number of gilts on time; most likely due to the large number of bought gilts, the buyer assumed. According to the producer, the gilt buyer has reclaimed gilts giving birth to too few piglets in the first litter (less than eight live born piglets on average in a group of at least two animals, Quality Genetics, 2010). Still, this happens very rare and was nothing the buyer mentioned. The producer seeks more feedback from his customers and from the whole Swedish pig industry. He pointed out the importance of following up the sold gilts' production result. To be able to compare the received results to other producers, a national database is needed. Without anything to compare to, knowing how good or bad you are is difficult, he deemed.

The last producer believed the gilts are in agreement with the buyer’s requests. The buyer has especially requested gilts with large body size and the producer tries to always deliver large gilts. Complaints from the buyer are rare, but incidences with a gilt farrowing three weeks too early (she got pregnant on the first insemination but the producer thought she did not) has occurred. The gilt buying herd was never visited and whether they agree in the producer’s apprehension is unclear. The producer would appreciate more feedback from gilt buying herds, but also pointed out that to receive feedback they have to invite to this.

7.3.4 Experienced animal quality

The experienced animal quality differed between farmers. One farmer was not completely satisfied with the bought gilts. He stated they are very good mothers and produce well but the gilts have been in poor body condition; some only having 6-7mm backfat at delivery. He found that the gilts have generally become leaner during later years. Since problems with too thin backfat have occurred, the buyer has bought an ultrasonic instrument (a Lean-Meater, the same as the one used in this project) and started measuring backfat on the delivered gilts. There has been a conversation about the lean gilts and, as mentioned above, the producer has not been aware of the gilts being that lean. The problem with lean gilts has however decreased since the producer now sends the fattest gilts to this gilt buying herd. When the producer received the results from the backfat measurements in this study, he started giving supplement feed to gilts he found thin. The buyer was also displeased about the gilts teats; too many gilts with less than 14 teats have been delivered. He believed the problem is due to the producer letting through too many gilts with inverted teats, believing they will pop out but seldom does, and "less than 14 teats is a catastrophe"' when the gilts are producing as many piglets as they do today he deemed. There has been a problem with shoulder lesions, but the buyer states that is not caused by his producer, rather by bad breeding work.

Another gilt buyer has earlier received very small gilts ("as like they have been mated too early"), but it has become better lately. It is not until the third litter they start producing well; the first two litters look quite bad she claimed. Gilts having small extra teats between the teat rows is another experienced problem. One question regarded change of animal quality over time, and the farmer claimed that the animals’ leg conformation status has become much better.

One buyer was very happy about the delivered gilts. He found them really good looking and even in quality. He started buying gilts from one of the visited producers two years ago because he was unsatisfied with gilts delivered from another producer, and is very happy he did this change.

The last buyer said that the gilts produce very well and have good temperament. Still, the gilts have had problems with their legs and have ended up sitting after weaning, not being able to rise. Hoof quality can also be improved. On the question regarding change of animal quality, the farmer answered that the gilts might produce larger litters nowadays, but he also said that that change is small.

Since the introduction of the Norwegian Landrace, three producers claimed the animals have become poorer in quality. Two of them thought that the Norwegian Landrace gives gilts with weaker legs. The common opinion that they produce more piglets is not true according to one producer. He has been documenting his production results for many years and the number of weaned piglets has not increased in his herd. Another producer claimed that the animals have become longer and leaner. All four gilt buyers said that they do not know or have an opinion of whether the changes in quality (both positive and negative) are a result of change of breed.

7.3.5 A good gilt

The gilt buyers had different approaches to the qualities of a good gilt at delivery. Age was important for two of the gilt buyers who wanted the gilts to be at least one year old at farrowing. One buyer did not mention age as an important factor while the last buyer found it important that the gilts are not too old at delivery That farmer did not mind the gilts being younger than one year at farrowing as long as they look nice. One buyer wanted gilts that are large enough, round and fat and another buyer wanted gilts that are even in body size. Another buyer stressed the importance of having at least 15mm backfat and good exterior at delivery. The last farmer wanted gilts with enough body fat (around 16mm when looking at the records) and good body size (not too small).

One question concerned what kind of gilts the gilt producers believe their gilt buying herds want and the answers differed between the producers and the buyers. Two producers emphasised good producing gilts with many nice teats. One of them also believed that customers want gilts that are not too young, have sufficient of backfat and gilts with good legs. The second also answered that he would like to have gilts that last for many parities. He referred to "lifetime production" several times during the interview and believes that is the most important trait of good producing gilts. Another farmer thought that gilt buyers want gilts that are at least one year at farrowing, have at least 14 teats and good udders, have good temperament and good legs as well as are large in body size and quite fat. The fourth producer thought that his customers prioritise gilts that produce many piglets, but also gilts with good legs. The last farmer had no thoughts regarding what kind of gilts his customers want.

7.3.5.1 How to produce a good gilt

One question concerned how to best produce a good gilt. Two producers did not have any special recommendations while one producer thought that giving a low protein feed ad lib results in good looking gilts that are in good body condition. He mentioned the importance of being very precise with vaccinations (for parvo, mycoplasma and erysipelas) and also with the oestrous monitoring so that insemination is done at the right time. Another producer’s tips for producing the best gilts was to give them the best feed, keep them on deep straw bedding as much as possible and give them lot of attention. The last producer stressed the importance of vaccinations being given at the right time and pointed out that even body condition should be aimed for. Giving good feed and good management were also deemed as important.

The gilt buying farmers had different approaches to the production of a good gilt. One farmer focused on breeding organisations, suggesting that these should adopt a more long-term perspective. Rather than counting the number of piglets born alive, the number of weaned piglets should be considered since the income is based on the latter. Moreover, the breeding organisations should select fatter gilts, rather than leaner ones as has been the norm. Fourteen teats are not enough, he also stressed, since one or two teats will become non-functional during their lifetime. "Hurry slowly" is an expression he used. By that he meant that to produce sows with a good

exterior, and, in particular, with strong legs, it is counter-productive to feed the gilts too intensively. In sum, the farmer was of the opinion that the breeding focus of these organisations is not always in harmony with the needs of Swedish commercial herds.

In the answer to the same question of how to produce a good gilt, a second buyer drew attention to the condition of the gilt and the number of piglets born. He stated that it was desirable to have animals that are large when they farrow and even in size, and also have good body condition, good backfat thickness, and strong legs. It was seen as unsatisfactory to have gilts giving birth to 16 piglets, because the gilts are often unable to care for that many. If the gilts have 16 piglets, only 14 will be weaned. A smaller number of piglets (he mentioned 12) is easier to rear and has a stronger chance of survival. To some extent this farmer is in agreement with the one described above in terms of breeding practices. A third farmer emphasised that the gilts should be held on deep straw litter and fed so that they do not grow too fast. For her, both feeding and management were important. The last buyer had no particular opinions about gilt rearing.

Table 14. Information and opinions about farmers' routines and gilt rearing collected during the interviews. Empty lines mean that the farmer did not know the answer, did not mention it or did not answer the question. Hyphen means that the question was not asked. BC means Body Condition. A-E refers to the farm couples

Questions	**A**		**B**		**C**	**D**		**E**	
	Producer	**Buyer**	**Producer**	**Buyer**	**Producer**	**Producer**	**Buyer**	**Producer**	**Buyer**
Selection-when	3 weeks	-	23 weeks	-	3 weeks ~6 months	3 weeks 6.5 months	-	3 weeks	-
Selection-what	Teats	Teats Body size Legs	Teats Hoofs Back BC	Teats Proportional Fat	Teats BC Size Health Exterior	Teats Size Runt pigs Exterior	BC Legs	Teats Runt pigs Umbilicus Hernia	Teats Good temperament Robust
Known recommendations:									
-age	240-280 days			7-8 months	7.5 months	7-10 months		>7 months	
-weight (kg)	120-140kg		120-140kg		≥130kg			130kg	
-backfat		15mm at delivery	16-18mm		14-15mm	Good BC	Good BC		
Inseminate-when (from interviews)		Follow the directives							
-oestrus	≥3rd		≥3rd		≥2nd	≥2nd		≥2nd	
-age	≥8 months		≥29 wk	≥8 months	7-8 months	7-8 months	~1 year at farrowing	7-8 months	Not too old
-body condition			Satisfying	Good BC	Not too thin	Satisfying		Not too thin	
- body size		Large enough					Large enough		Not too small
-weight (kg)	120-140		120-130		130				
Most important	Age		Body size		Age	Age		Age	
Inseminate-when (from the records)									
-age (days)	290 (=9.5 months)		229 (=33 weeks)		231 (=7.6 months)	233 (=7.3 months)		239 (=7.9 months)	
-backfat (mm)	11.6		12.8		13.6	13.4		15.0	
-weight (kg)	162		150		172	149		159	
Is backfat important at first service?	Very	Very	No, but at farrowing	Very	Very	No, but at farrowing	Very	Very	
How to produce a good gilt	Nothing special	Better breeding (fatter gilts, >14 teats, high milk production) Hurry slowly	Good feed Vaccinations Precise with oestrous monitoring	High feed intake during lactation	Best feed Deep straw bedding Give attention	Vaccinations Good feed Good management			Loose housing Grow slowly Good management

How should the bought gilts be?	-	≥15mm backfat at farrowing Good exterior	-	≥1 year at farrowing Not too small Round and fat	-	-	Large and even in body size ~1 year at farrowing Fewer piglets born alive	-	Not too old Enough body fat Not too small
What do you think your customers want?	Good producing Many teats Old enough Sufficient backfat Good legs	-	No thoughts	-	≥1 year at farrowing ≥14 teats and good udders Large body size Good temperament Good legs Fat	Many piglets Good legs	-	Lifetime production Good longevity Good producing Nice teats	-

8 Discussion

8.1 First service

After all records had been collected from the herds, a problem in the study arose. It is unclear whether the dates for time of first service is the dates for first insemination or if it is the date for the insemination that resulted in pregnancy. The gilts might have had returns to oestrus and been inseminated more than once. Some gilts had an insemination age over 350 days. These gilts had probably been inseminated before but not got pregnant, which means that the date of insemination is the date of the insemination that resulted in pregnancy. If that is the case, the estimated average age, backfat thickness, heart girth and weight at service in Table 9 are higher than age at first service. By looking at the age of the gilts and their littermates, it could often be determined whether the date of service was the first service or the second or later service. Table 13 shows that gilts with real first insemination date had lower age (238 days compared to 245), thinner backfat (13.1mm compared to 13.3mm), less heart girth (118cm compared to 119cm) and lower weight (154kg compared to 156kg) than the average for all gilts (Table 9). The estimates for the first group in Table 9 are thought to better describe the average hybrid gilt at first service. If returns to oestrus affect the backfat thickness at service more than table 13 shows, backfat thickness at first service (13.1mm) will decrease even more. Thus, it will not get closer to the recommendation.

8.2 Methodology discussion

To be able to get satisfactory number of observed gilts, five gilt producing herds and five gilt buying herds were chosen for the study. At least 100 animal recordings per group were planned to be included, and therefore five herds per group were chosen. Unfortunately, one herd could not be visited due to unexpected circumstances and the number of buyer gilts ended up on 80. The gilts in the gilt buying herds were not from the same batch as the gilts in the gilt producing herds. The gilts were delivered around six weeks after service and the time schedule for this study did not allow the waiting. Besides, it was not found important to record the same gilts.

Nine farmers and 224 gilts is a small sample, and the obtained results do maybe not represent the whole Swedish hybrid gilt population. The results may, though, provide an indication of what gilt producers and gilt buyers think is important in gilt breeding and how old, fat and heavy gilts are at service. To obtain better results, information of age, backfat thickness and weight would have to be collected at the exact time of first service for many gilts in many herds. It would require lot of time and recourses to carry out such a large study. The farmers would have to make the recordings themselves. That would bring too much work for the farmers and the results would probably be unreliable because of farmers not measuring backfat at the same site.

8.2.1 Interviews

The results from the recordings are reflected in the answers from the interviews. Some of the records are supported by the interview answers while others are not. By having interviews as a part of the result, farmers' thoughts and actual actions could be compared.

The study aimed to investigate farmers' feelings and opinions about different topics which could not be measured with some type of scale. Therefore, qualitative interviews were chosen. According to Trost (2005) it is important that the interview takes place where the interviewed feels comfortable. Of that reason, and of the sake of convenience, the interviews were performed on the farms in connection to the measurements. No recorder was used during the interviews (only notes) because the place for the interviews was often very noisy and listening to tapes would have taken too much time. The questions were not either of the kind that made it important to record pauses, tone of voices and laughs etc. that would require a recorder (Trost, 2005).

8.2.2 Gilt inspections

The gilt inspection aimed to investigate what the farmers think a good gilt look like and compare the comments about the gilts to the records. It would have been interesting to do a larger, better planned inspection. The gilt inspection should also have been given more time at the farms and to obtain results easier to compare to the records, more instructions should have been given. The farmers should have been asked to comment all gilts and say if they found them too small or too large, too fat or too thin, too young or too old, had some exterior traits that they found not fully satisfying or anything else that they found worth commenting. It should have been clear that comments on all traits were expected, not only backfat. Since the farmers were aware of that the project aimed to investigate gilts' backfat thickness at first service, they probably commented backfat thickness more than they should have done if they thought the project aimed at something else. All farmers did not have time to do the inspection. I found the recording and the interviews much more important at that time and did not make enough effort making the farmers do the inspection properly. It was hard to make some of the farmers take their time and judge all gilts. They were often in a hurry and ran through the stable only commenting the divergent gilts. More instructions would probably have helped them in taking the gilt inspection more seriously.

8.2.3 Backfat thickness

Recording backfat, heart girth, body condition and exterior was completely new for me. It took some time to get confident doing the measurements which probably resulted in that gilts on second half of the visited farms were more accurately measured.

The Lean-Meater was new for all involved persons and there was no one nearby who was used to manage the instrument. Reading the paper instructions helped but practical instructions would have made the measurements easier. When measuring backfat, the Lean-Meater indicated how many fat layers found at that exact site, and when it indicated three layers the right position had been found. This position is according to the literature found around 6.5cm from the dorsal midline (Simmins et al., 1994; Charette et al., 1996; Tummaruk et al., 2007; O'Connell et al., 2007). However, measuring 6.5cm from the dorsal midline did almost always result in the instrument not showing a stable thickness record. It flickered around and did not find three backfat layers. When moving the probe downwards and measuring around 8-9cm from the backbone at the level of the last rib the instrument showed three backfat layers and one stable thickness record. Therefore all measurements were made 8-9cm from the dorsal midline. Tummaruk et al. (2007) also used a Lean-Meater from Renco Corporation when measuring backfat thickness and they made the measurements about 6-8cm from the dorsal midline. There are other studies that also have measured backfat thickness around 8cm from the dorsal midline (Laws et al., 2009). The instructions said that if the probe was held in a 90-degree angle from the gilts back at the right position and then removed straight out from the gilts back, still pushing the button, the screen would freeze on the accurate thickness. However, when measuring in the feeding stalls and loose in the pen the gilts could always move backwards and forwards. That made it hard to remove the probe straight out from the gilt and the screen often froze on very small numbers. That is probably due to when removing the probe it registers the last backfat thickness found and when the gilt moved while removing the probe it was hard to remove it in a 90-degree angle out from the gilt and the instrument therefore register incorrect thickness. Therefore, the registration was made by first finding three backfat layers and then finding the spot with the highest value where the number on the display did not flicker but showed the thickness steadily.

The Lean-Meater was compared to the Krautkramer to see if the instruments were comparable and to compare the measuring sites (Table 5). Since all the on farm measurements were performed 8-9cm from the backbone, comparison between the values measured 8-9cm from the backbone with values measured 7-8cm from the backbone was found interesting. Backfat measurements made on the same site as the Krautkramer (7-8cm from the backbone) of animal 2-14 resulted in values that

did not flicker (Lean-Meater 1 in Table 5). However, moving the probe about 1cm further down resulted in somewhat higher backfat thicknesses that did not flicker and those numbers (Lean-Meater 2) are measured at the same site as all the on farm measurements. If assuming that the Krautkramer or the 7-8cm site are more reliable than the Lean-Meater or the 8-9cm site, the slightly different values might indicate that all backfat measurements are somewhat higher than accurate. One source of error is that the probe can be pressed more or less hard to the animals' back and when pressing harder the backfat is probably pressed together and therefore lower backfat is recorded than accurate. As the instruments were handled by two different persons at Lövsta we might have pressed the probe differently hard. The same source of error might have influenced the measurements of the gilts at the farms. The gilts were moving a lot which might have resulted in pressing the probe harder than needed. Without pressing the probe rather hard it did however not find the three layers.

Like in the study by Tummaruk et al. (2007) measurements on both sides were made and an average was used in the analysis. Table 6 shows that different backfat values could be obtained on left and right side. Whether this was a result of the measurements not being done on exactly the same positions on each side or if the backfat differed between both sides is unclear. However, the backfat thickness can differ between left and right side. Cisneros et al. (1996) made backfat measurements on both sides of 80 pigs at the P2 position. The minimum backfat value on the right side was 10.7mm and on the left side 12.6mm.

The Lean-Meater instrument itself was very handy and could be placed in the pocket when doing other measurements. As a beginner, I though found it hard to know when the instrument showed the accurate value. Since the instrument showed backfat thicknesses that sometimes differed two millimetres if moving the probe one centimetre one or the other way still indicating three backfat layers, it was difficult to know which value that was correct.

8.2.4 Body condition

Visually estimating body condition is probably the most common way of deciding gilts' body condition. A Norwegian condition scale was used for the visual estimations. This scale was preferred instead of Lantmännen's body condition scale (Appendix III, Figure 2, Sigfridson, 2010) since it has five scores instead of four. Using five scores (plus half scores) was thought to result in more accurate estimations. When comparing the two systems, Lantmännen's four scores seems to fit well in between Norsvin's five scores; Lantmännen's score 1 corresponds to score 1.5, score 2 corresponds to 2.5 etc. According to Lantmännen's system score 3 means good body condition with around 17mm backfat which is desirable for a gilt at all times (Sigfridson, 2010). That score corresponds to score 3.5 in this study. The five traits included in the body condition system used, were evaluated individually and then added together to calculate an average for each gilt. Since the average not necessarily ended up on whole or half points, the average had to be re-evaluated to fit whole- or half point score and this was done after the inspection. It would probably have been better to decide which of the nearest whole or half point score that fits best at the inspection. Doing so had excluded the step of re-evaluating and perhaps given more accurate results.

8.2.5 Weight

Measuring heart girth was not easy. When the gilts were in feeding stalls, the only way of reaching around the gilts was to climb on the bars. If the measurements were made in a pen of loose gilts it was even harder since the gilts many times ran away. Depending on how the gilts were standing (e.g. lowered or bowed back) different values were obtained. Often when the measuring tape was put around their chest the gilts bowed their back and the value got larger than accurate. However, the measurements registered were the ones when the gilts had the most relaxed way of standing. Optimal had been to measure the gilts at feeding since they then tended to care less about the measuring tape. This was hard to implement since the measurements then

would have had to stretch over several feedings. To register heart girth as a measurement of size or weight is probably not easy enough for farmers. Some type of small pen where the gilts are unable to move around might make it easier. But if the farmer has to move the gilts to this special pen they could as well use a weighing scale and get more accurate measures of weight. If the farmers often make heart girth registrations, the gilts will probably get used to it and it might be easier. Even so, I do not see measuring heart girth as a feasible way of estimating weight.

Estimation of weight was done using two different equations; [1] and [2]. Model [1] by O´Connell et al. (2007) tended to overestimate the weight of gilts at Lövsta and it was also said in the article that it worked better for sows in later gestations. Thus, model [2] by Thingnes et al. (2009) was thought to suit the studied gilts better.

8.2.6 Exterior

The exterior scoring was new for me and without any "standard gilts" to compare with it was hard to distinguish the different scores from each other. One gilt had a more camel like back than another gilt but should she get score three or two or even score one? Another difficult trait was leg score. There were gilts that showed tendencies of being knock-kneed (score below 4) and at the same time showed tendencies of being sabre-legged (score above 4). If taking both traits into account they would equalise each other and the score would end up on 4. Gilts with both traits were scored according to the trait that was most distinct. The first visited herds might be more biased then later visited herds, as experience increased. However, the results of the different exterior traits show no tendencies of being evaluated tougher or kinder in later visited herds compared to earlier visited herds. The exterior evaluation was performed very carefully and the results can nevertheless show a tendency among the gilts.

In the exterior evaluation the recommendation was to measure back score and hoof score in a weighing scale and the other traits on loose gilts. Without access to a weighing scale the hoof score was performed in feeding stalls (where available) or on concrete floor. Six of the herds had deep straw bedding and therefore the rear leg score was performed in feeding stalls. It was found to be easier to evaluate rear legs on gilts standing on solid floor. Teat quality was not estimated in this project since it was thought to be too difficult to measure without the ability to restrain the gilts in e.g. a weighing scale. Even more practice before the real recordings would have been good.

8.3 Records

8.3.1 Age

The average age at service was estimated to 245 days (8 months). This age is according to the recommendation. The age at true first service is probably lower since some gilts most likely have returned to oestrus at least once, but the difference is not large. Interesting is that average age differed two months between herds, ranging from 229 days to 290 days. The correlation between age and backfat thickness was low (0.30). This might indicate that farmers who inseminate young gilts not necessarily inseminate gilts with thin backfat. Two producers exemplify this well. One producer bred old gilts (average age 290 days) and they had an average backfat thickness of 11.6mm. The other producer bred young gilts (229 days on average) but they have an average backfat thickness of 12.8mm.

8.3.2 Body weight

The average body weight at service was estimated to 156kg (Table 9) which is more than the recommendation for Swedish hybrid gilts (120-140kg, Hidås et al., 2009). Weight and heart girth measurements were also made on 16 Yorkshire gilts at the experimental herd at Lövsta. On average the gilts were 14kg heavier if estimating the weight from heart girth with the model by Thingnes et al. (2009) compared to the actual measured weight (measured in a weighing scale). This corresponds to a heart girth increase of 4.7cm. My guess is that the true heart girths are less

than the records and that gilts in reality are lighter then estimated. However, I do not think that the true heart girth is that much less so that the average weight at service is within the recommended weight interval.

Studies state that selection for leanness can result in larger mature body size and consequently heavier animals (Kirkwood & Aherne, 1985; Whittemore, 1996; O'Dowd et al., 1997). Since selection for lean animals has been ongoing for almost a hundred years (Kungliga lantbruksstyrelsen, 1970) the gilts might have become larger. van Wettere et al. (2006) concluded that today's gilts are heavier than gilts 20-30 years ago. I believe that the recommended weight interval is too low to suit today's Swedish gilts. However, the results regarding weight at first service received from this study are too vague to base any recommendation on. I reckon that the recommendation should be re-evaluated, but a larger study, where weight is estimated by using a weighing scale is needed before any such changes can be done. The newly announced recommendation of around 140kg live weight (Tengvall Nilsson et al., 2010) is probably more realistic than the older one (120-140kg) and I think the new recommendation is better for the today's Swedish gilts.

The phenotypic correlation between heart girth (weight) and backfat thickness was 0.57. No literature of phenotypic correlation between these traits has been found. However, one study tested Italian Landrace x Large White pigs and found the correlation to be 0.34 between weight and backfat thickness (Lo Fiego et al., 2005). Other studies found a genetic correlation between backfat thickness and live weight gain of 0.55 (Hovenier et al., 1992) and 0.28 (Bidanel et al., 1996). Williams et al. (2005) also claimed that the relationship between live weight and backfat thickness is very vague. A result of the high correlation is that farmers inseminating heavy gilts will also get gilts with high backfat thickness at first insemination, and vice versa.

8.3.3 Backfat thickness

The estimated backfat thickness at service was 13.3mm (Table 9). That is much less than the recommended 16-20mm (Hidås et al., 2009). As discussed above, the estimated backfat thickness might be higher than correct if some of the gilts have returned to oestrus. To be considered is also the very cold temperature during the winter in 2010. Some of the farmers experienced that the gilts became thinner than normal this winter, and that it took long time before their body condition stabilised on a normal level. The recordings were performed from April 16 to May 28 and the gilts might have been thinner than normal at that time.

The question of interest is still if the gilts need 16mm backfat at first service to produce well. The literature says that backfat is needed for the gilt and sow to increase the number of piglets born alive, decrease number of stillborn piglets, produce enough milk, increase piglet viability, increase litter weight, increase number of piglets weaned, decrease the weaning to service interval, reduce the returns to oestrus and increase sow longevity (Gaughan et al., 1995; Tummaruk et al., 2001; Maes et al., 2004; Bečková et al., 2005; Sandberg, 2006; Tarrés et al., 2006; Whittemore, 2006; Fernàndez de Sevilla et al., 2008). Table 15 shows that the piglet production results, found in PigWin, have been improved between year 1993 and 2009. The gilts and sows produce more piglets per year, they have less unproductive days per litter and the piglets are heavier at delivery. The percentage of oestrous returns has, however, increased as well as the percentage of gilt litters. The fact that the gilt litters have increased most likely means that the sows' longevity has decreased and that sows are culled earlier.

Table 15. Changes in production results for PigWin connected herds over the last 16 years (modified from PigWin, 2010b)

Trait	1993	1998	2003	2009
Produced piglets/sow and year	18.5	20.9	21.8	23.2
Number of litters/sow and year	2.1	2.1	2.2	2.2
Average piglet weight at delivery	26.7	30.3	29.9	31.0
Unproductive days/litter	19.6	17.7	17.0	16.7
whereof empty days	7.3	6.5	6.4	5.9
Oestrous returns (%)	9.0	7.0	8.1	8.2
Gilt litters (%)	21.2	20.8	23.9	23.3
Number born alive/litter	10.8	11.2	11.7	12.7
Number stillborn/litter	0.7	0.8	0.8	1.0
Number weaned/litter	9.2	9.7	10.0	10.5

The gilts in farm pair D can be seen as an example of lean gilts producing well. The producer inseminate gilts that have 13.4mm backfat, weigh 149kg and are 233 days old on average and deliver them when they are nearly 8 weeks pregnant and have 15.6mm backfat. The buyer is very satisfied with the gilts body condition and had a production result of 25.8 weaned piglets per sow last year (compare to PigWin average of 23.1 and the best 25% of 25.1 piglets weaned, PigWin, 2010a). Apparently, for this farmer 13.4mm backfat is enough. Maybe, the recommendation needs a change, since the gilts are not producing worse with less backfat. Maybe it is enough to have 13mm at first service. A problem when trying to reach 16-20mm backfat is that an intense feeding strategy is needed. Intense feeding often leads to high growth rate and consequently too young or too heavy gilts at service (Tengvall Nilsson et al., 2010). Lantmännen, Norsvin and Nordic Genetics have together recently compiled a checklist for gilt rearing and it includes recommendation for first service; insemination should be done at 7-8 months of age, at the earliest second to third oestrus, around 140kg live weight and 15-18mm backfat (Tengvall Nilsson et al., 2010). This means that the recommendation for backfat thickness has decreased from 16-20mm to 15-18mm. I think that 15mm is hard to achieve with today's genetic material. The Danish Pig Research Centre recommends that the gilts should have a backfat thickness of 12-18mm at first service (Danish Pig Production, 2007) and I believe that is a more feasible goal. With the results from the recordings and from the interviews I propose that 13mm backfat would be enough at first service, and that the lowest recommendation should be 13mm. However, I see a danger with setting 13mm as the minimum backfat thickness, as the risk of gilts becoming too lean will increase. A higher backfat thickness might be a smarter recommendation to decrease that risk. But since the average backfat thickness at service was 13.3mm and all farmers with gilts having backfat thicknesses over 12mm were satisfied, I find 13mm being the best recommendation. Regarding the upper backfat limit I believe 18mm is good. According to the results obtained, 18mm backfat corresponds to a body condition score between 4 and 4.5 on the Norwegian scale. The upper backfat recommendation today is 20mm and according to the results in this study, gilts with 20mm backfat would have a body condition score over 4.5. I reckon that gilts with body condition score above 4.5 at first service are too fat. According to the literature, gilts with too much fat can have reduced feed intake during lactation, increased sow weight loss during lactation, reduced reproductive performance and increased the risk of culling (Maes et al., 2004; Young & Aherne, 2005; Tarrés et al., 2006). There is also an economical aspect. Gilts with too much fat have been given too much feed and feed is expensive. Therefore, I propose that the recommendation for backfat thickness should be 13-18mm.

8.3.4 Body condition

The correlation between body condition score and backfat thickness was 0.43 ($p<0.0001$, $N=189$). This is higher than estimates in the literature; 0.32 (Maes et al., 2004) and 0.19 (Young et al.,

2001). Whether this is because the body condition evaluation in this study was performed very rigorously by looking and touching five different parts of the gilts, because different scales were used or because the body condition estimations were performed by different persons is unclear. However, I think the different variables all affected the outcome of the body condition evaluation and the correlation to backfat thickness. With the obtained results, I propose that a gilt at first service should have a body condition score between 3.5 and 4.

8.3.5 Exterior

The results show that gilt exterior status is quite good. Twenty-one percent of all gilts scored 4 in all traits. This might be because the farmers have made at least one selection of gilts and culled gilts that do not seem to suit well as mothers. In that selection, and during the whole rearing period, the farmers have taken away gilts with exterior traits that were not favourable. Figure 9 indicates that the average exterior status is better in the gilt buying herds than in the gilt producing herds. This might be a result of gilt producers performing one last sorting of gilts before the gilts are sold (after my visit). The exterior recordings are also done on different batches and variations between batches occur. Hidås (2010) found that only 12 of 42 Swedish piglet producing herds evaluated leg conformation when selecting gilts for replacement and as Figure 9 shows, the three leg traits (front leg, rear leg and sickle hocked) were also the traits with less proportions of scores 4 (Figure 3). Hidås (2010) also found that 17 farmers took other exterior traits into account when selecting gilts.

8.4 Gilt inspection

As Figure 10 shows, backfat thickness or body condition is the most commented trait by the farmers. If this is because the farmers think it is more important than the other traits is unclear. All farmers were aware of that the measurements and interviews were tools to investigate backfat thickness. The notice of this might have made them pay more attention to body condition than they would have done if the project would have had another purpose. Figure 10 shows that among the three delivered gilts with body condition score 4.5, two were commented on because of their size. Gilts with body condition score 3.5 or 4 were not commented on at all or were evaluated as good looking gilts. This might indicate that the gilt buyers would like the gilts to have body condition score 3.5 or 4 at delivery. Comments on backfat thickness or body condition are more frequent if the gilts have backfat thicknesses less than 13mm. Two of five gilts with backfat thickness over 22.5mm and two of four gilts with heart girt over 144cm (233kg) were also commented for their size. Comments about exterior in relation to exterior scores did not show any relationship because of very few comments about exterior.

8.5 Interviews

Making the interviews was not easy. I had never done anything like this before and it took some practice to get used to the situation and to better know how to ask questions. The first interviews were not as well performed as the last ones. Using qualitative interviews aimed to better understand farmers' opinions of some issues, and give them the chance to answer more freely. However, to obtain a large material for discussion more attendant questions should have been asked. Since the farmers knew the study focused on backfat thickness, the answers were probably not completely spontaneous.

8.5.1 ...selection of gilts

All producers seemed very happy about their relation to Quality Genetics. The way Quality Genetics handle the routine contact to the buyers/producers well and the contact regarding reclamations and other problems were deemed as satisfying.

One trait that seemed very important for more or less all producers and buyers was the number of teats. All farmers sort out gilts that have less than 14 teats and some of them also the ones that have a bad teat distribution. Less than 14 teats are not acceptable in the commercial herds; Quality

Genetics require 14 functional teats on replacement stock. Other traits that the farmers selected for differed between herds. Some thought body condition was important and other thought exterior traits was more important. Body condition was more frequently mentioned among the buyers than among the producers. None of the farmers make three to four selection runds on regular basis as suggested by Malmström (2005). But they all sort away gilts during the rearing period whenever needed.

8.5.2 ...time of first service and animal quality

Some questions concerned traits at insemination and the animal quality. The results from the recordings showed that what farmers believe they do, is not always in accordance with their actions.

One farmer said that he always makes sure that the gilts are older than 8 months (242 days). He also states that backfat at first service is very important to maintain good production for many parities. The gilts are mated at an average age of 290 days but still they only have an average backfat thickness of 11.6mm at first service. The gilts are quite heavy; average weight is 162kg at service. Heavy gilts with low backfat thickness might be an example of gilts becoming larger but still being very lean. The gilts have probably not been given enough energy. The feeding standard says that gilts over 90kg live weight should be fed according to their body condition (Simonsson, 2006). As the farmer thought the gilts were much fatter than they actually were, they might have been fed too restrictive. The results also indicate that the producer has good intentions and believes his gilts are in the right age and body condition. He was surprised when seeing the results from the backfat measurements. The farmer believed that the gilts were fatter than they looked like. The possibility that the gilts were too thin had never occurred to him. This producer's gilt buyer said that following the recommendation for time at first service is probably good, but as long as the gilts have at least 15mm backfat at delivery, he is satisfied. The results showed that the gilts had 13.7mm on average at delivery (average for all herds' was 15.3mm) and as mentioned earlier, there has been discussions about backfat between the farmers. By measuring backfat thickness the producer could have prevented the conflict.

The second producer mentioned the recommendation of 120-140kg and 16-18mm but also thought that the backfat recommendation is unrealistic. The results show that he mates the gilts at an average weight of 150kg and a backfat thickness of 12.8mm, which is less than average. He did not mention the age of the gilts but the results show mating at an average age of 229 days, which is the lowest age at service among the farms (compare to average for all gilts, 245 days). This age is according to the recommendation and the farmer stressed that age is not very important for deciding mating time. Body size was deemed as more important. The gilts are fed a breeding feed until 100kg live weight and then dry sow feed ad lib. A breeding feed contains the same amount of crude protein as a finishing feed and minerals and vitamins as a sow feed (Göransson, 2010). By using a breeding feed the breeding animals put on more muscles which are favourable at the ultra sonic testing performed on the purebred animals. This might, however, also be the reason for the gilts measuring only 12.8mm backfat at service. The gilt buyer wants the gilts to be at least eight months and in good body condition at first service. Very small gilts have been delivered before, as if they had been mated too early, but she found that is better now. However, the average age was 229 days (around 7.5 months) so majority of the gilts are not eight months at service. The farmer did not mention this and is probably unaware of it.

One producer had heavy gilts; 172kg live weight at service. They had an average backfat thickness of 13.6mm and an average age of 231 days. The farmer pointed out the importance of not mating the gilts after nine months of age. In a follow-up three months after the visit it showed that five of the 22 measured gilts (23%) had been culled whereof two due to no signs of oestrus. Since the farmer did not want the gilts to be too old she might have culled them instead of keep trying. Maybe the gilts in this herd had fewer chances of showing oestrus than on other farms. The

farmer might also have selected more gilts than needed to cover for gilts not showing signs of oestrus or not becoming pregnant.

Another producer claims that the gilts should be no older than eight months (243 days) at first service. The results show that the gilts are 233 days on average and that corresponds quite good to the farmers own statistics for the last years (236 days) and the average age are also below eight months. Gilts should be more lean than fat before insemination, was also deemed. The average backfat thickness was 13.4mm at service which is higher than the average (13.3mm). This farmer's gilt buyer made clear that backfat thickness is very important; both for longevity and because the gilts release more eggs with more backfat. The buyer is very happy about the delivered gilts since they live up to his requirements.

The last producer had the gilts with the thickest backfat among the gilts; 15.0mm on average. The farmer stressed that backfat is very important at the time of first service. He also said that gilts are inseminated between seven and eight months of age and the result shows that they are 239 days on average (7.9 months). This farmer's gilt buyer has never thought about backfat thickness as an important factor, even if he thinks that body condition is. This might be because he has bought gilts from this producer for the last ten years and the producer has the fattest gilts among the five producing herds. The gilts had an average backfat thickness of 18.7mm at delivery and they weighed 213kg on average (compare to the herds' average of 15.4mm and 194kg at delivery). Gilts being too lean have probably never been a problem for this buyer. The buyer does not mind the gilts being younger than one year at farrowing as long as they look nice, and he has experienced that the gilts sometimes have been too old at delivery. The results show that the gilts are 319 days on average at delivery, which is very close to herds' average (318 days). However, the collected data tell that there were two gilts older than 400 days at delivery, which must be considered as old. Without the two old gilts the average age is 305 days. Probably the farmer has taken notice of old gilts but never really thought about the average age.

With the obtained results from the recordings and from the interviews I propose that the age recommendation should remain; gilts should be mated between seven and eight months of age. No evaluation of the upper age limit has been done and therefore, I cannot suggest any changes of the upper limit.

The recommendation for time of first service also includes oestrous number; mating shall be done at the earliest on the second oestrus. None of the farmers mentioned this recommendation during the interviews and none of them registered oestrous number at service. According to the producers, they all inseminate gilts at the earliest on the second or third oestrus which is according to the recommendation. Because the average age at service was 239 days, they probably have had at least one oestrus. Most likely the gilts enter puberty after they have been moved to the insemination unit and the gilts are then mated on the following oestrus or later. Most farmers do probably start oestrus detection after the moving of gilts. Interesting though, none of them seemed to think that oestrous number is of importance, and at least three of the farmers did not count the oestrous numbers. Hidås (2010) found that among 42 Swedish piglet producing herds with own gilt recruitment, the oestrous number at first insemination was unknown for the majority and the assumptions varied between first and fifth oestrus. Since the Swedish recommendation include oestrous number I, just like Hidås (2010), would find it interesting to further investigate the insemination routines in Swedish gilt producing herds regarding oestrous number. It seems unnecessary to include oestrous number in the recommendation if no one takes it into account. This however, would require much time and resources since data cannot be found in PigWin and have to be collected on farm. Since the farmers do not seem to monitor oestrus before the gilts enter the insemination unit, I propose that the recommendation regarding oestrous number should remain, but "observed" should be added; gilts should be mated on the second or third observed oestrus. Important though is that the gilts are fulfilling the age recommendation for the oestrous

recommendation to be useful. Gilts should thus be inseminated on the second or third observed oestrus if they are between seven and eight months of age, and gilts with delayed puberty should be culled. The farmers should also be better informed why oestrous number is important at first service.

None of the interviewed farmers mentioned breeding values (handelsvärde) during the visit. That was unexpected, as the breeding value affects the economic profitability of a sow. A sow's breeding value is based on a genetic evaluation where different traits get different economic weights (Mattsson, 2009). The breeding evaluation considers relationships between individuals and also environmental effects and the animal is evaluated within its herd. The difference in economical value of a sow with a breeding value of +5 and a sow with breeding value -5 is 250 SEK, if assumed that the sows produce five litters and wean ten piglets in each litter (50 piglets x difference in breeding value / half of the alleles from the sow). To be able to be in the front of the breeding progress, breeding of animals with high breeding values is important (Länsstyrelsen Västra Götalands län, 2006). Hidås (2010) found that among 42 Swedish piglet producing herds only three evaluated breeding values when selecting gilts for replacement (Figure 3).

9 Implications

Some conflicts between gilt producers and their customers can probably be avoided by having some type of follow-up. Quality Genetics could provide a paper form where the gilt buyers can write down things they are satisfied with, complaints or suggestions for improvements etc. If the producers could print such a paper form from the homepage or download it and send it by e-mail, more producers would probably use them. If the producer in the farm couple with the backfat conflict had sent follow-up paper forms to his customers and several of them had returned the form with complaints about too thin gilts, he might have been able to avoid the conflict. By having some kind of follow-up system both producers and customers might get more satisfied. A common opinion among farmers is, nevertheless, that they have enough duties as it is today and they do not want more reports to handle. But if Quality Genetics provides the paper form and inform all the farmers (both producers and customers) that it exists and is importance, it might increase the amount of follow-ups. A suggested follow-up paper form is found in Appendix V.

The following suggestion of a new recommendation for time of first service is based upon the read literature and on the results obtained from the recordings and from the interviews. Gilts should be mated when they meet the following recommendation:

- Age between seven and eight months
- On the second or third observed oestrus (if the age recommendation is fulfilled)
- Live weight around 140kg
- Backfat thickness between 13mm and 18mm

Since almost all producers seem pleased with the arrangement and the delivered gilts, I cannot recommend that all producers should start measuring backfat thickness on regular basis. I do, however, think that measuring backfat thickness once in a while (together with an advisor) can help the farmers in evaluating body condition, as gilts sometimes look fatter than accurate. By aiming to inseminate gilts with body condition score 3.5 or 4 (using the Norwegian scale) the risk of gilts being too lean is minimised.

10 Conclusions

Gilt producers and gilt buyers agree on what a good gilt should look like. Both parts find age and size most important when inseminating gilts. Almost all farmers seem pleased with the arrangement and the quality of the animals.

The average backfat thickness at service does not meet the recommendation. Gilts are inseminated at an average backfat thickness of 13mm and the recommendation is 16-20mm. The Swedish recommendation does no longer suit today's animals and it is proposed that the recommendation should be changed. The proposed recommendation includes that gilts should be mated between seven and eight months of age, on the second or third observed oestrus, at around 140kg live weight and with a backfat thickness of 13-18mm.

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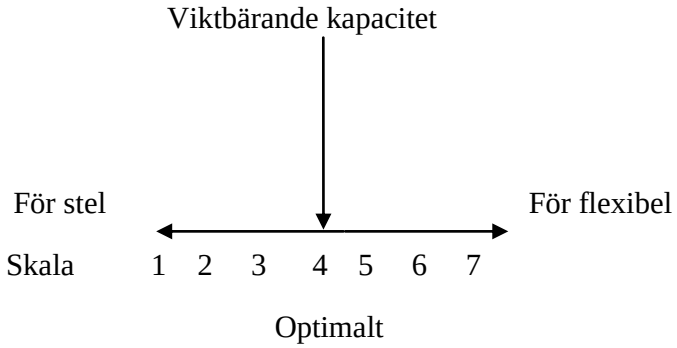
Appendix I (Serenius, 2010)

Ny exteriörbedömning vid ekolodning

Nordic Genetics och Norsvin har jobbat tillsammans att uppdatera exteriörbedömningen vid ekolodning. Den nya exteriörbedömningen kommer att ersätta den nuvarande bedömningen vid ekolodning i fält. Exteriörbedömningen på Månseryd och av semingaltar ändras inte. Målet är att en del egenskaper registreras i vågen och resten när djuren går fritt. I det nya systemet är målsättningen att mäta viktbärande kapacitet, som är korrelerad med hållbarhet (Figur 1). Djur med för rak struktur i bak- eller framben anses ha sämre hållbarhet. Förklaringen är att lederna har mindre flexibilitet från ligamenten som håller ihop benen i leden. Vi antar att mindre flexibilitet leder till slitage och benproblem. En gris med större vinklar i lederna har mer flexibilitet från ligamenten när de rör sig. Vi antar att detta minskar belastningen på lederna och gör att de håller för högre belastning.

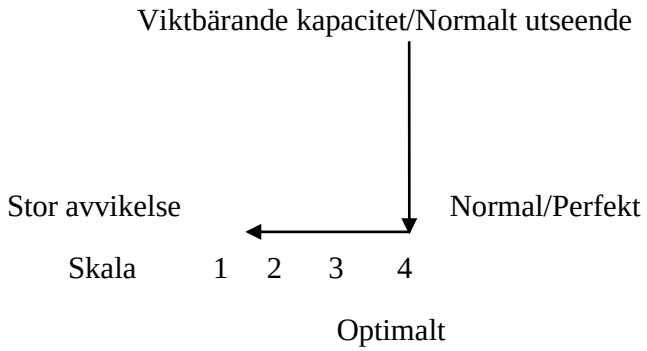
För stel struktur (fram och bak) ges 1 på skalan från 1 till 7. Grisen är vanligtvis bockbent eller/och har raka kotor. Även s.k. kobenthet och vridna kotor ges 1. För bakben ersätts bockbenthet med raka hasor. Ett perfekt djur får 4. Detta är ett djur som antas ha hög hållbarhet och inga synliga defekter.

Alltför flexible struktur (fram eller bak) ges 7. Dessa djur är vanligtvis sabelbenta, har mycket veka kotor och krokiga hasor. De kan tom gå på lättklövarna vilket inte är optimalt, speciellt inte redan vid åldern när de testas.



Figur 1: Viktbärande kapacitet och bedömning.

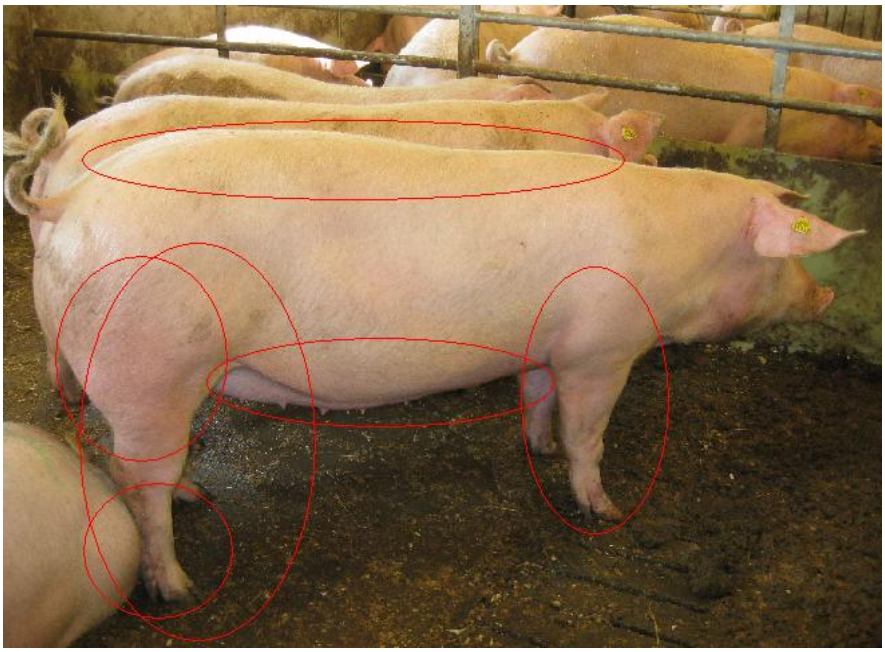
För bedömning av rygg, underställdhet och rörelser används skalan 1 till 4, (figur 2). Alla egenskaper bedöms separat. På samma sätt som innan ges 1 till djur med mycket sänkt eller knipt rygg, mycket underställd eller oacceptabla rörelser . Djur med rak rygg, som inte är underställda och rör sig ledigt ges poäng 4. 2 och 3 ges till mellanliggande djur.



Figur 2: Viktbärande kapacitet och bedömning.

Anledningen till att använda två skalor är att en del av bedömningarna kan ses som linjära t.ex. kotor som kan visa sig från för raka via normala till för veka. Vår population idag anses idag ha för raka kotor, följaktligen vill vi röra oss mot mer flexibilitet. Målsättningen är att sluta selektera när medel är över 4. Med de här argumenten har vi grupperat egenskaperna så att den önskade riktningen för selektionen är samma för alla (selektera mot 7or). För andra egenskaper anser vi inte att det kan bli ”för mycket”. T.ex. om ett djur har en normal rygglinje så kan det maximalt få 4. Detsamma gäller underställdhet och rörelser.

De röda cirklarna på gyltan nedan (figur 3) visar nyckelområdena som behöver fokusera på för att göra en korrekt bedömning av djurets strukturella funktion. Dessa sex cirklarna är: rygg, spenkvalitet, framben, bakben, underställdhet och klövkvalitet. Dessa områden, tillsammans med rörelser är de viktigaste egenskaperna att bedöma. Den nya exteriörbedömningen följer dessa områden och ses nedan.



Figur 3: Cirklar markerar de viktigaste områdena i den nya exteriörbedömningen.

1. **Ryggkvalitet**- Rygglinjen är viktig för att bedöma djur som är knipta (kyphosis). Dessa djur kan ha en mycket tydlig fördjupning I främre delen av ryggen. Vi använder skalan 1-4 där 1 är en stor fördjupning (kamelliknande), 2 och 3 mellanliggande bedömningar och 4 är normal. Egenskapen kommer att bedömas i vågen.
2. **Spenkvalitet**- bedömningen av spenkvalitet görs av både gyltor och galtar. Kvaliteten registreras som antal inverterade spenar och antal onormala spenar. Spenkvalitet kommer som idag att bedömas i vågen antingen av besättningen själva eller av avelstekniker.
3. **Frambenskvalitet**- Den nya exteriörbedömningen fokuserar på den främre cirkeln och bedömer benet som helhet med flera egenskaper i ett mått. De egenskaper som ingår är knä och kotor (framifrån och från sidan). Den som bedömer måste ta hänsyn till den vertikala linjen mellan lederna och mitten på grisens fot . Den visar hur grisen bär upp sin vikt. Vi föreslår en glidande skala med 7 steg där 1 är för rak, 4 optimal och 7 för vek . Bedömningen ska göras antingen före eller efter ekolodning.
4. **Bakbenskvalitet**- Det nya systemet kombinerar de tre cirklarna ovan till två cirklar: bakbenskvalitet och underställdhet. För bakbenskvalitet gäller samma som för frambenskvalitet. Egenskaperna benämns som has och kota. Detta inkluderar både bedömning från sidan och bakifrån. Bedömningen ska göras antingen före eller efter ekolodning.
5. **Underställdhet**- Detta tillstånd ska bedömas separat från bakbenstruktur. Det nya systemet är en 4-gradig skala, där 1 är gravt underställd, 2 och 3 är måttligt underställd och 4 är korrekt placering. Bedömningen ska göras antingen före eller efter ekolodning.
6. **Klövkvalitet**- Systemet bedömer både klövarnas jämnhet och vidden mellan dem. Skala är 1 till 4 där 1 är ojämna klövar eller små tättsittande. Mellanliggande djur bedöms 2-3 och djur med korrekta klövar får 4. Eftersom fram- och bakben bedöms i ett mått, måste den som bedömer bestämma sig för ett genomsnitt för alla fyra klövarna. Bedömningen görs i vågen.
7. **Rörelser**- Bedöms från 1 till 4 där 4 är optimala rörelser. Djur som har stela rörelser får 1 medan smidiga grisar med kattlika rörelser får 4 (optimalt). Bedömningen ska göras antingen före eller efter ekolodning.

Sammanfattning; egenskaperna föreslås registreras vid följande platser

I vågen	*Efter ekolod*
Rygglinje	Framben
Spenar	Bakben
Klövar	Underställdhet
	Rörelser

Anledningen till att bedöma efter ekolodning är att alla grisarna först ekolodas. Alla har då varit uppe och rört på sig och blivit av med stelhet som de fått från alla ligga ner/sova.

Appendix II

Farm couple descriptions

The first herd is a hybrid producing herd with 160 sows in production and with a goal of producing 1 200 gilts per year (which is not always implemented). The gilts are the main part in the business but they also sell some crops. The farm has three employees working with the pigs, including the interviewed man. The interviewed man has grown up on this farm and worked with pigs for his whole life but became responsible for the farm in 1985. The interviewed man is responsible for the farm but the care taking of the gilts is mainly handled by his son. The gilts are reared on deep straw litter in groups of 10-15. They are fed ad lib with wet feed until 50-60kg and then more restrict in individual feeding stalls. The farm use boars for mating the gilts, but also use artificial insemination (AI) when there are too many gilts for the boars to handle. The producer has around 15-20 customers which he sell gilts to on regular basis. The visited gilt buying herd has bought gilts from the producer for about two years. They buy 12 gilts every second week, which are delivered once a month. This means that 12 gilts are seven weeks in gestation and the other 12 are nine weeks when delivered. They buy gilts from no other farm. The buyer is a piglet producing herd with around 600 sows in production. The farm has seven pig care takers including the interviewed man, who has been supervisor since 2004 and also is responsible for the gilts. The pigs are the main part of the business but it also includes crop production and forestry. The newly arrived gilts are held on deep straw litter in groups of 6-8 with individual feeding stalls. This gilt buying herd weans 11.25 piglets per litter which can be compared to PigWin average of 10.5 (PigWin, 2010a).

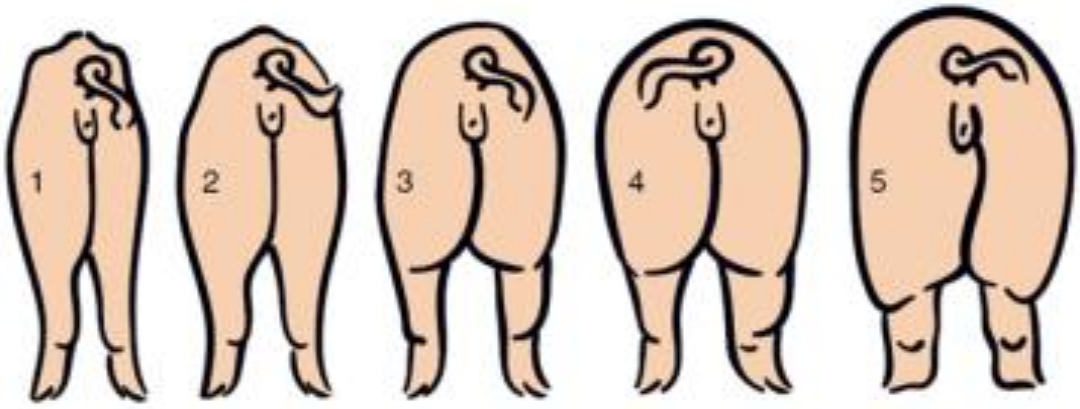
Another gilt producing herd is a nucleus herd with 180 sows in production which produce both purebred Yorkshire gilts and hybrids. They sell around 650 hybrid gilts per year mainly to the same five herds. There are 3.5 pig care takers and 5.5 employees working with building and the crop production. The interviewed man is chief of the farm but he is not the one handling the gilts on daily basis. At 23 weeks of age the first gilts are moved to the insemination stable. The care takers choose the largest ones first. The gilts are then assumed to come on heat for the first time and it is also assumed that the second heat comes three weeks later. After they have had their (assumed) second heat they are inseminated on the next heat. Around 60% of the gilts are inseminated and the rest are covered by a boar. The gilts are reared in groups of 15 from nine to 23 weeks of age on partly slatted floor. After 23 weeks of age the gilts are held in groups of 22 on partly slatted floor and fed in individual feeding stalls. The gilts are fed ad lib with a breeding feed until 100kg live weight and then they are fed a dry sow feed ad lib to make them put on some fat instead of muscles. The farm has a feedback system where the gilt buyers can brief the gilts production results and the answering frequency is below 50%. The second gilt buying herd has bought gilts from the visited herd since before year 2000. They buy around 20-22 animals every third week from two producers, but the main part of the gilts come from the visited producer. The herd includes around 780 sows in production and they wean between 23 and 24 piglets per sow and year. There are four pig care takers and the interviewed woman, who has worked on the farm for seven years, is not the one responsible for the gilts. The farm has crop production and some other business but the pigs are the main part of the enterprise. After arriving at the farm the gilts are held in one group with deep straw bedding and with space for 30 gilts. The gilts are fed 29-30MJ metabolisable energy (ME) when they arrive at the quarantine. One week before farrowing they are moved to the farrowing stable and are then given 26MJ ME to prevent MMA for later being fed 120MJ ME after farrowing.

The fifth herd is a nucleus herd with 250 sows in production, producing around 1 200 gilts (both purebred and hybrids) per year. There are seven persons working with the pigs and the interviewed woman, who has worked on the farm for one year, is in charge of the gilts. The farm has crop production and forestry beside the pig business but the pigs are the main part of the business. The gilts are fed 36MJ ME wet feed per day before insemination. When they are pregnant they are fed 30MJ ME and thin gilts are given some extra. All gilts are inseminated, the boar are only used if they run out of AI-doses. The gilts are held on deep straw bedding in groups of around 20. The farm has around 4-5 customers including the visited herd. They sell 15-20 animals to this herd once a month and have done so for about one year. Since no meeting could be arranged with the gilt buying herd no information about that herd is available.

One herd is a hybrid producing herd with 120 sows in production. They produce between 700 and 800 gilts per year. The interviewed man has been working with the pigs on this farm for his whole life but became responsible for the farm in 1982. They have around 7-8 customers buying gilts. The gilts are held in regular fattening pens and are fed 34-36MJ ME when they are moved to the insemination unit at 6.5 months. Thin animals are fed 37MJ ME per day. This farmer keeps records of every sow's production results and with every delivery of gilts he sends with a follow-up paper form that many of the customers fill in and returns. The farm applies AI in almost all cases. The gilt buying herd has bought gilts from the visited producer for more than two years. They buy 100 gilts a year, 8-10 animals per month, and buy gilts only from this herd. The herd has 220 sows in production and they have good production results; 25.8 weaned piglets per sow and year. The interviewed man has grown up on the farm and became responsible in 1994. 1.5 persons are working with the pigs which are the main income in the business. The gilts are fed directly in the deep straw bedding and they are given a lactation feed after arriving to the farm. The farmer does not know the energy fed but the gilts are given 3kg feed.

The last farm couple is a hybrid producing herd with around 110 sows in production. The farm has a goal of producing 1000 gilts per year but has not reached that yet. Four employees are working with the pigs including the interviewed man. He has lived and worked on the farm his whole life. The pigs are around one third of the farm's business, one third is crop production and the last third is other business. The gilts are held in regular finishing pens with concrete floor and a common feeding trough. AI is used on all gilts. The gilts are given wet feed but the farmer does not know the given amount of energy. The farm sells ten gilts once a month to the visited gilt buying herd and has so done for about ten years. The buying herd buys gilts from a few other farms as well. The production includes 270 sows in production and two pig care takers are employed. The interviewed man has grown up on the farm and took over the business in late 1980s. The gilts are held on deep straw bedding. They are given a home mixed dry feed, 24-25MJ ME per day. The farm weans just above ten piglets per litter.

Appendix III



Character\Score	1	1.5	2	2.5	3	3.5	4	4.5	5
Appearance when looking from behind	Very thin		Thin		Normal		Little fat		Very fat
Ribs	Visible		Are covered, but can be felt		Not visible and can hardly be felt		Cannot be felt		Are covered by a thick layer of fat
Backbone	Prominent		Visible at shoulder but covered further back		Can only be felt with pressure		Cannot be felt		The midline can be seen as a groove along the back
Hipbone	Prominent		Visible		Not visual, but can be felt		Can hardly be felt		Cannot be felt
Ischium	Distinct		Are covered, but can be felt		Are covered, can be felt with pressure		Cannot be felt and the root of tail are covered by fat		Cannot be felt and the root of tail are covered by fat

Figure 1. The body condition evaluation system used. Modified from Helsetjenesten for svin (2010).

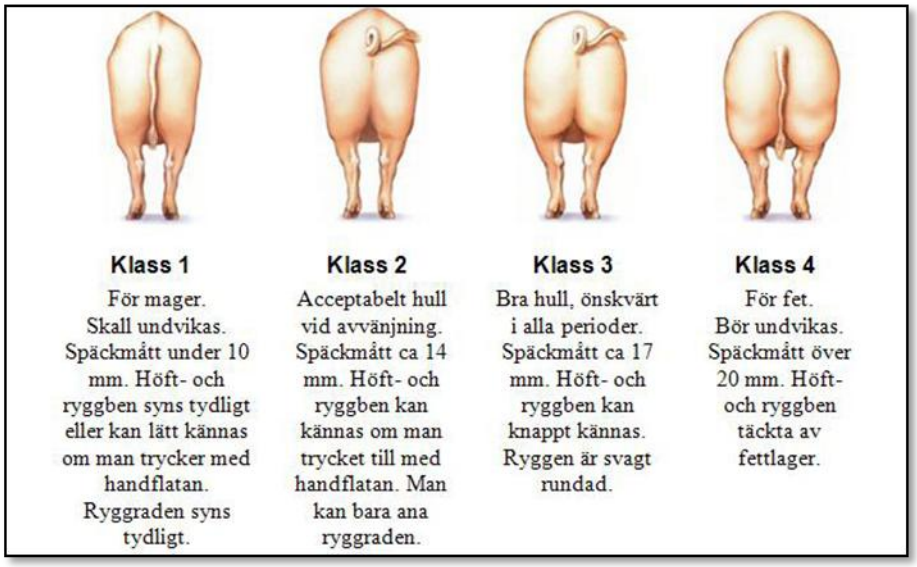


Figure 2. The body condition evaluation system used by Lantmännen (Sigfridson, 2010).

Appendix IV

Questions to gilt producers

Background questions

- For how long have you been in the pig production business? For how long have you produced hybrid gilts for sale?
- Areal of the farm?
- Number of mother animals in your herd?
- Number of produced gilts per year?
- Do you use boar or insemination?
- How many employees on the farm/pig production? Who is in charge of the oestrous monitoring and insemination of gilts?

Quality Genetics

- You buy mother animals and/or semen from Quality Genetics (QG). How does that relation works in regard to:
    - Animal quality - mother animals (production results, difficulties to farrow, leg-, cloves-, back- and movement quality, health, body condition and backfat thickness, age, size, temperament, teats, other)?
    - Animal quality - semen (production results, difficulties to farrow, leg-, cloves-, back- and movement quality, health, body condition and backfat thickness, age, size, temperament, teats, other)?
    - The relation to QG (are the right amount of animals/semen delivered and in time, reclamations of animals)?
    - The relation to your customers (are the support from QG good regarding contact to customers)?

      … what is good/bad and what can be done better?
- Has the quality of the animals changed during the last years and what has then changed?
- Do you experience the ”new” Norwegian Landrace different to the ”old” Swedish one?

Relation to customers

You sell gilts to XX.

- How many gilts and how often?
- For how long have they been your customer?
- How many other customers do you have?

How does the relations to XX works?

- Are XX satisfied with the delivered gilts?
- Do you manage to deliver the right amount and in time?
- Can XX reclaim gilts and does that happen/have happened? On which basis?
- Do you get too little/enough/too much feedback from XX?

- What type of gilt do you think that XX wants regarding age, body condition, backfat thickness, size, health status and leg health?
    - What do you think is their priority?

Selection of gilts and choice of time at first service

- When do you select gilts (all steps from birth to service)?
- Which traits do you select for?
    - Which traits are important and why (different in different steps)?
    - How do you prioritize the different traits?
- Choice of time at first service:
    - When do you inseminate in regard to:
        - Age
        - Weight
        - Body condition
        - Backfat thickness
        - Oestrous number
        - Size
        - Or do they just fit in this batch?
    - How do you prioritize the different traits when you decide the time of first service and why?

Backfat thickness

- Do you believe that backfat thickness is important? Why?
- Do you believe/reckon that a visual body condition rating (including touching and pressing the animal) reflects the backfat thickness?
- Do you know what the common recommendation for age, weight and backfat thickness is at first service?
    - Do you think that recommendation is good?
- Do you think that you would benefit by measure backfat thickness to decide time of first service?

General questions

- What are the best ways of producing a good gilt regarding:
    - Breeding
    - Feeding
    - Management (including oestrous detection, insemination, vaccinations and health controls)
    - Relations to customers
    - Other?

Questions to gilt buyers

Background questions

- For how long have you been in the pig production business? For how long have you produced hybrid gilts for sale?
- Areal of the farm?
- Number of mother animals in your herd?
- Production results?

- How many employees on the farm/pig production?

Relation to producers

You buy gilts from YY.

- For how long have you been a customer to YY?
- How many animals do you buy and how often?
- Do you buy gilts from other breeders?
- How does that relation works in regard to :
    - Animal quality (production results, difficulties to farrow, leg-, cloves-, back- and movement quality, health, body condition and backfat thickness, age, size, temperament, teats, other)?
    - The agreement (are the right amount of animals delivered and in time, have you ever made a complaint of animals? on which basis?)

  … what is good/bad and what can be done better?
- Do you give feedback to YY?
- Has the quality changed during the last years and what has then changed?
- Do you experience the ”new” Norwegian Landrace different to the ”old” Swedish one?

Sorting out of gilts and choice of time at first service

- If you had the chance to influence the selection and culling of gilts at YY:
    - Which traits do you find important and why?
    - How would you prioritize those traits and why?
- If you had the chance to influence time of first service at YY, which traits do you find important (e.g. age, weight, body condition, backfat thickness, oestrous number, size)?
    - How would you prioritize the different traits and why?

Backfat thickness

- Do you believe that backfat thickness is important? Why?
- Do you believe/reckon that a visual body condition rating (including touching and pressing the animal) reflects the backfat thickness?
- Do you know what the common recommendation for age, weight and backfat thickness is at first service?
    - Do you think that recommendation is good?

General questions

- What are the best ways of producing a good gilt regarding:
    - Breeding
    - Feeding
    - Management (including oestrous detection, insemination, vaccinations and health controls)
    - Relations to customers
    - Other?

A good gilt

- How should a good gilt look like when she arrives at your farm regarding:

- Age
- Body condition
- Backfat thickness
- Weight
- Size

… and why?

Appendix V

ÅTERRAPPORTERING

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Leveransvecka: *2010-08*

Öronnnr	Betäckningsdatum	Grisningsdatum	Totalt Födda	Levande födda	Nöjd* (Ja/Nej)
1231	2010-01-01				
1232	2010-01-02				
1233	2010-01-02				
1234	2010-01-01				
1235	2010-01-03				
1236	2010-01-01				
1237	2010-01-03				
1238	2010-01-03				
1239	2010-01-01				
1230	2010-01-01				

* Uppfyller gyltan dina krav?

Kommentarer om dessa gyltor:

Skicka eller mejla denna blankett till adressen ovan när gyltorna grisat

Tack på förhand!