

MANAGING REPRODUCTION - FACT AND FOLKLORE

Doug Wey

Population Medicine, Ontario Veterinary College, University of Guelph

Guelph, Ontario N1G 2W1

E-mail: dwey@uoguelph.ca

ABSTRACT

Producers are bombarded with advice on how to improve reproductive efficiency and move closer to the elusive target of 30 pigs per sow per year. As is true anywhere else, here in North America we have some longstanding traditions and beliefs as to the most efficient way to produce pigs. Over the past several years, the Danish pork industry has been held up as the success story. I will discuss current views on selected control points in reproductive management: entry of gilts into the breeding pool, estrus detection and AI, managing the lactation period, and the weaning to estrus interval. In what ways does the management of reproduction on the most productive Danish farms differ from that in Canada and in what ways are we on the same track? Are all their strategies applicable to the North American farrowing operation?

INTRODUCTION

As producers, you are under pressure to increase reproductive efficiency, with the target of 30 pigs per sow per year dangled in front of you. You are then bombarded with advice, from the farm press, government agencies, consultants and your peers, on how to best manage your sows' lives so that you can reach this target. During my time as the head swine technician at the University of Guelph research facility, I've participated in the development of some of these strategies. But since then, I've had experiences in the 'trenches', working on several large corporate farms in Manitoba as well as on a boar stud and in a semen lab. In light of those experiences, I'd like to discuss some of the management ideas that are out there. During my presentation, I'll be referring to an article in the February 2005 issue of Better Pork, in which Henrik Jensen discusses strategies being used in Denmark to break through the '30-weaned-pig-per-year plateau' (Stoneman, 2005a). His approach was summarized in 11 points, relating to gilt management, breeding, gestation/farrowing and management of the lactating sow. As a group, I would like to discuss how some of Jensen's guidelines translate to the Canadian context.

AT WHAT AGE SHOULD GILTS BE BRED?

As in all aspects of swine husbandry, the limits have been explored with induction of puberty at earliest possible age to reduce 'non-productive' days. The use of PG600 allows us to synchronize pre-pubertal gilts quite easily and there are herds where the animals' first estrus is always reached through human intervention. In my experience, breeding on an early

induced estrus has been counter-productive as these lean young animals were still in the rapid growth phase of their lives. Getting this animal through a pregnancy and lactation without compromising her own growth poses a major feeding challenge. Poor body condition after the first lactation and the resulting lengthening of the weaning to estrus interval (WEI) are particularly challenging in first-litter animals.

In the post-PG600 era, the pendulum is swinging the other way, as we are being advised to breed gilts bigger and older. Bill Close, a UK consultant speaking at this conference in 2003, suggested not breeding gilts until 130-140 kg and 220-230 days of age, after their second or third estrus (Close, 2003). In fact, the Danish model is to not to breed gilts until they reach 160 kg and nine months (~270 days) of age (Stoneman, 2005a). Chances are, this animal will come out of lactation in far better condition than her younger, artificially induced counterpart. However, the potential benefits need to be weighed against the delay in her entry to the breeding pool.

Could there be a limit as to how long we should wait for these gilts? Based on field studies indicating that gilts mated at an older age were more likely to be culled later for infertility, a group in Uppsala, Sweden looked for a relationship between age at first mating and WEI before the second litter. Their results suggested that gilts with delayed puberty (the oldest one-third of the 452 animals in their study, mean age 226 days) tended to express delayed estrus and ovulation after their first litter, and those with weak displays of estrus at puberty had a higher risk of showing a short/weak estrus after weaning (Sterning, et al., 1998). I should point out that in this study estrus checks did not begin until after 160 days of age.

The middle ground on this topic seems to be to allow the gilts to attain puberty naturally so that their reproductive tracts and the rest of their bodies are ready to embark on their reproductive careers, while striving for reproductive efficiency by selecting for gilts that show strong heats within a reasonable time frame.

HOW LONG SHOULD SOWS STAY IN THE HERD?

Early removal of sows from the herd due to mortality, health problems, and low production is a major bottleneck in the swine industry. With sows reaching their peak production between parity 3 and 5, we obviously want first litter gilts to carry on in the herd. Mature sows are also an asset due to their acquired immunity to herd diseases. Yet 40 to 50% of sows are typically removed before three to four parities. Early culling of sows has an extra economic cost if you are buying in replacement gilts. In the Danish model, from second parity onwards sows are culled if they have less than 13 piglets, but gilts are never culled for litter size.

To attain a four litter per sow average while accounting for the normal attrition through structural and reproductive failures, we need some animals to stay in the herd up to 7 or 8 litters. If sow longevity is the goal as well as more pigs produced over her lifetime, then perhaps a later start down that road is a better way of achieving it. Our best defence against culling due to physical breakdown such as lameness or udder damage is through selection for

sound feet and legs and a good underline as well as careful monitoring of the sow during lactation (watching for mastitis, udder damage).

CAN OUR CONCEPTION RATES BE IMPROVED?

Maximizing conception rates involves meticulous attention to detail at several steps: handling of semen, estrus detection, the insemination process itself and deciding when to breed.

I will assume that you are all using AI, with most or all of your semen provided by a commercial boar stud. Given that, I will first define which responsibilities lie with the boar stud and which fall under the control of your barn staff. The boar stud manager is responsible for selecting and training boars of high genetic merit, maintaining their health and nutrition at a high standard, and adhering to a collection schedule such that they are not overused. The lab manager at the stud is responsible for ensuring that the semen is divided into doses of 2.5 to 3 billion motile sperm in ~80 ml of extender. Using conventional AI rods and insemination methods (versus 'deep' or intra-uterine insemination) there is clear drop-off in pregnancy rates at lower doses. Given that these alternative insemination methods are yet not practical under farm conditions and semen is very affordable, there is little potential for improvement of this aspect of breeding. The final contribution of the boar stud is to deliver your semen order within a reasonable time, keeping the semen at or near 17°C. From this point on, it is in your hands.

Boar sperm are extremely sensitive to temperature changes, both warm and cold. A temperature-controlled storage cabinet is essential for high AI success rates. Ideally, this cabinet should be in a location accessible to the person delivering your semen. Take care to minimize temperature fluctuations right up until the semen is put in the sow. Bring the semen doses into the breeding room in a cooler containing gel packs from the 17°C storage cabinet. Only bring the number of doses you are going to use in that session.

Given that the timing of breeding is a critical determinant in litter size and whether a sow conceives at all, heat checking is often not given the attention it deserves. Heat checking at least twice per day is essential. Even better results have been shown with three times per day, but the gain is difficult to justify under North American labour conditions. Running a boar, often vasectomized, down the aisle ahead of the breeders is a common approach. Be aware that the sow will stand for 10-15 minutes, after which she won't stand for an hour or so. Control the boar's movement with a gate, board or chain and collar arrangement. If he gets too far ahead of the breeders, the 'refractory' sows will behave like they are not in heat. In the Danish model described by Jensen, the sows are actually brought to the boar, two at a time (Stoneman, 2005a).

The actual insemination process is not difficult, but by the tenth sow there is a strong temptation to squeeze that semen bottle and move onto other tasks. Careful attention to each sow is required. Avoid 'inseminator fatigue' by taking a short break after 7-8 sows. Bringing only that number of doses in the cooler would be one way of enforcing this rule: use up the doses and head back to the lab to restock the cooler with more semen and gel packs fresh out

of the 17°C cabinet. Given the income associated with each additional pig per sow, there is nothing more important you should be doing with that time. Jensen recommends a team breeding approach, inseminating all sows in a room within 15 minutes. In my experience in 3,000 sow units, up to 40 animals need to be bred in a session. Breeding this number of animals in such a short time would not be possible.

It is well established that sows display estrus for 1 to 4 days, they ovulate about two thirds of the way through this period regardless of the duration of their estrus, and the semen needs to be in the sow 0-24 hours before ovulation. Success rates plummet if sows are bred too early or too late. Unfortunately, there are no visible indicators of ovulation and this event is not related to the onset of standing heat. Can we predict whether an individual sow will have a long estrus or a short one? A study out of the Netherlands established that the duration of estrus was related to the WEI (Kemp & Soede, 1996). Sows with short weaning-to-estrus intervals have longer heats than those coming back 5-6 days post-weaning. The sows in their study coming back by day 3 were in heat 2.5 days, ovulating 41 hours after they were first detected standing, while those coming into heat by day 6 ovulated 27 hours after the onset of heat. With a policy of breeding on the day after the sow first stands, there would be a tendency to breed the early-returning sows too early and the late-returning sows too late. One solution is delayed breeding of the early-returning sows and diligent heat-checking and prompt breeding of the late-returning sows. Another strategy is to breed the early sows three times and space the breedings of the late sows over a shorter interval (twice within 12 rather than 24 hours). Of course, the best way to ensure that sows come into heat quickly is to have them come out of lactation with good body condition. Through the effect of body condition on the WEI, sow nutrition impacts on the success of AI.

HOW MUCH, OR HOW LITTLE, SHOULD WE INTERFERE WITH FARROWING?

Attending farrowings can play a major role in reducing pre-weaning mortality, but how involved should we be in this process? A gilt and a fourth parity sow could be full sisters genetically but you aren't about to treat them the same way. As a first time mother, the gilt may require more supervision because parturition is a new experience for her and her distress could cause her to harm her piglets. At the other end of the spectrum, a seventh parity sow's uterus may have lost some of its tone leading to increased length of parturition and higher risk of stillbirths among the last of the litter. Both of these animals would benefit from attended farrowings but for different reasons.

The amount of monitoring that I have encountered in farrowing rooms in Ontario and Manitoba has been wide ranging. Some barns simply record the time and number of piglets with each farrowing sow when someone passes through the room while attending to other duties. The feed or farrowing card is used as a message board to give staff an indication of the time between piglets is 'too long'. Other barns dedicate a technician to monitoring the farrowing throughout the day. One company I dealt with went as far as to have farrowing attendants pull as many pigs as they could, regardless of birthing interval. In this instance stillbirths may have been reduced but I would be interested to know the longevity of their sows.

The amount of intervention in the form of administered hormones varies as well. Some farms use none while others synchronise all their farrowings with prostaglandins to allow for more efficient use of their farrowing room technicians. There are pros and cons to both approaches. The former will have litters born unattended, increasing the possibility of stillbirths. However the latter is not without its risks as well. Farrowing should never be induced more than two days before the due date. To avoid doing it too early, sows should never be induced without knowing the average gestation length of the herd. There is also the possibility that the contractions of an induced sow may not be as strong, necessitating further hormonal intervention with oxytocin. Once again, blanket statements and blanket treatments come with inherent risks. In all cases, a well-trained and skilled stockperson is invaluable.

HOW MUCH SHOULD WE FEED OUR LACTATING SOWS?

A general rule of thumb is to continually increase feed intake throughout lactation. A sow reaches her maximum milk production during the third week and can produce 180 kg of milk over a four week lactation. We want the sow to consume as much as possible to promote ample milk production and maintain good body condition so that both she and her piglets come out of the crate in fine shape to face their next challenge, be it in the breeding wing or the weaner room. This is not simply a case of pounding feed to every animal. Over feeding is one of the quickest and surest ways of putting a sow off feed. *“Oh you can always cut her back!”* I’ve been told. Yes you can, but by how much and for how long until you get her back to where you had her before she shut down. The idea is to feed them to appetite so our task is to maintain and increase her desire to eat. Doing so is as much an art form as it is a science even with the aid of a hungry litter draining her reserves every hour. Room temperature, infection, injury or simply being a fussy eater all affect consumption and at this level it truly is an individual interaction between that animal and the stockperson. It takes keen powers of observation to determine if there is any physical reason for poor appetite. It involves more than a little physical effort, making certain every sow gets up when you feed. Also, sows eat more if fed three times a day. If you want to spread this over a twelve hour period you are looking at an evening shift, so some flexibility in staffing may be required. Teamwork and communication are essential.

IS WHAT SHE IS EATING DURING LACTATION REALLY HELPING HER NEXT LITTER?

There is an indisputable connection between the sow’s feed intake during lactation, her milk production and the weight of her litter. But the connection between loss of body condition during lactation and subsequent reproduction is much less clear. Foxcroft and colleagues at the University of Alberta are using an experimental model in which first-litter gilts are restricted to 50% of normal intake during the last week of lactation. Although the expected effects on body condition, litter weight and WEI are observed, effects on the subsequent litter have been variable, ranging from reductions in both ovulation rate and embryo survival (Zak, et al., 1997) to no effects on reproductive performance beyond the extension of the WEI (Zak, et al., 1998, Mao, et al., 1999, Vinsky, et al., 2006).

Of more practical relevance is a study from the US based on PigCHAMP data from 30 commercial farms and more than 20,000 lactations (Koketsu, et al., 1996). Six patterns of feed intake were identified, three of which - low intake throughout lactation, low intake during the first week, and a major drop in intake lasting at least two days – were associated with decreased weights of the current litter and extended WEI. The same three feeding patterns were also associated with a higher rate of culling for post-weaning anestrus. However, there was no effect of intake pattern on litter size in the next parity. In fact, the effects of intake pattern on WEI were limited to first-litter gilts.

Despite decades of research into this question, the evidence for feeding the lactating sow to benefit the next litter is equivocal. But the sow coming out of lactation in poor condition will be slower to come into heat, which increases non-productive days. And as discussed previously, this sow will tend to have a shorter heat and is more likely to be bred late relative to ovulation. Reproductive issues in these sows, if any, can be addressed by more diligent heat checking to ensure proper timing of AI. But given the known effects on piglet growth rates, the better solution is to make sure sows, particularly first-litter gilts, come out of lactation in good body condition.

IS FOSTERING WORTH THE HASSLE?

Consistency and routine play an important role in increasing efficiency, but hopefully that gives us the time to deal with tasks that require a certain amount of thought and careful consideration, such as fostering. We want as many piglets on each sow as she can carry but close monitoring is required to identify and deal with malnourished piglets and runts, and sows that are not milking well. Disadvantaged piglets need to be moved to an udder that can support them. Thirteen similarly sized runts have a better chance of survival on one sow than they would scattered throughout the farrowing room among larger and stronger competitors.

As litter sizes increase, through improvements in genetics or management, there will be sows with more piglets than they can handle. Nurse sows and intensive cross-fostering are key components of the Danish system (Stoneman, 2005a). According to Jensen, 13 five to seven day old piglets are fostered onto first or second parity sows in good body condition after their own piglets are weaned (Stoneman, 2005a). Surplus newborns are transferred onto the 5-7 day farrowed sow. The fostering of such large litters onto gilts may be one of the more difficult concepts to apply to Canadian systems (Stoneman, 2005b). Bear in mind that a key point of the Danish management system is to grow larger gilts that are able to cope with an extended lactation without compromising rebreeding.

Moving animals around the farrowing unit is time consuming, and holding back smaller piglets for an extra week can run counter to the practise of all-in all-out. Selecting the best milking sows from the week's weaning to look after a collection of the smaller animals while weaning the rest makes sense from the piglets' perspective but puts an extra demand on that sow. Fostering, split weaning and cascading also require additional space and equipment in the form of more weaning room or extra farrowing crates. In lieu of an over-flow nursery, farrowing room accessories such as Piggy Decks provide some wiggle room. They allow us

to shift larger stronger pigs away from their mothers earlier to free up space to shuffle and accommodate their smaller crate-mates. Of course all of this becomes a moot point if disease enters the equation.

Particularly in the farrowing room, we have to balance protocol with pragmatism. If we strictly follow an all-in all-out SOP there may be times that undersized pigs are weaned that do not survive. If we hold them back then we run certain risks to our sanitation efforts. Protocols ease decision-making but a certain amount of flexibility is required, since we are working with biological entities rather than cogs in a machine.

WHEN SHOULD WE WEAN?

Like hemlines, length of lactation is something that has gone up and down over the years. With Segregated Early Weaning, an idea that arose to break the disease cycle, improve the health and survival of weaned piglets and reduce the interval between farrowings, we saw lactation lengths drop to as low as 11 or 12 days. This scheme requires that WEI, conception rate and subsequent litter size remain constant. In fact, composite figures representing 30 studies over nearly 50 years show that lactations of less than 18 days produce longer WEIs, reduced conception rates, fewer pigs in subsequent litters and reduced sow longevity (Belstra, 1999). And these figures do not tell the whole story, such as sows remaining anestrous and/or becoming cystic.

In the animals that do ovulate and conceive, why is there an effect on litter size? Are fewer eggs released or fertilized? No – ovulation and fertilization rates are fine and rarely limiting in pigs.

The issue seems to be with greater embryonic mortality by day 25-30 ... the uterus hasn't had sufficient time to prepare for a new litter of embryos to implant.

Some farms can wean early and still have respectable reproductive performance, or have WEI and conception rate issues but no problems with litter size. One explanation may be that they are handling first parity gilts differently. It is well established that first parity animals will have more difficulties with early weaning. In fact, gilts at any lactation length are more likely to have feed intake issues and to come out of lactation in poor condition. Although this may play havoc with an all-in all-out protocol, the negative effects of early weaning on reproductive efficiency can be offset to some extent by allowing the gilts to lactate a few days longer.

While there may be ways to make early weaning work, Denmark has clearly gone in the opposite direction. A lactation of at least 21 days is required by law, 28 days is more common, and cross-fostering schemes extend lactations to 30-35 days. Given the results coming out of Denmark over the last several years, it becomes increasingly difficult to support early weaning as the best way to run your farrowing room.

THE HUMAN FACTOR: HOW IMPORTANT IS STOCKMANSHIP?

In the past thirty years we have achieved remarkable efficiencies in swine husbandry, to a point where there is a danger of looking at the sow as simply a production unit. In spite of dealing with herds whose size was unheard of in the 70s, those of us who work daily with the animals are still capable of seeing each one as an individual no matter how similar the genetics throughout the farrowing room.

There have been many examples throughout this paper of situations in which attending to the needs of an individual sow or gilt or their offspring by tweaking operating procedures can increase efficiency. Studies out of Australia have shown that pleasant versus unpleasant or even neutral contact with humans can also impact on productivity. Barnett and coworkers (1984) exposed gilts to five minute periods three times per week of pleasant (gentle stroking) versus unpleasant contact with humans (slapping, brief electric shock) from 11 weeks of age. A third group had little human contact other than normal husbandry. Expression of estrus was not affected by handling, but the pregnancy rates in the unpleasant, neutral and pleasant groups were 33%, 56% and 87%, respectively.

So a positive relationship between the stockperson and the pigs is ideal, but how can we ensure that this happens? Good stockpeople are hard to find and even harder to keep. Yet again, we can look to the Danes. It is perhaps in this respect that the Canadian and Danish situations are furthest apart. Barn staff in Denmark work 37.5-hour weeks and receive at least 5 weeks vacation annually. An 1,150-sow unit had four workers in the barn, which presumably represented a portion of the total staff required to run it on a 7-day per week basis (Stoneman, 2005a). There is a support agency with a network of highly trained people available for temporary work to cover holidays and illnesses. While it is difficult to imagine how such working conditions could ever be offered under the economic constraints in place here, small steps in that direction would be well received. Retaining skilled stockpeople is one of the biggest problems facing the industry today.

CONCLUSIONS

A recurring theme of this paper seems to be that to increase reproductive efficiency and move closer to that 30 p/s/y target, we need to slow down and pay more attention to the details. The delay in getting older, larger gilts into the breeding pool may pay off in terms of litter size, good milk production and a quick return to estrus post-weaning. More time devoted to estrus detection and an awareness of the expected estrus duration of individual animals should result in better timed AI, higher conception rates and fewer not-in-pig females. Allowing a reasonable length lactation has advantages for both sow and piglets. We need to adapt our management priorities to the sow's biology rather than the other way around. Last but not least, stockmanship skills need to be valued and cultivated, and measures put in place to address problems of employee retention.

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