Reproductive Management of Early Weaned Sows

Technical Report No. 15

Introduction

At the present time, the age at which pigs are weaned appears to be decreasing within the U.S. swine industry. According to data from the PigTales® records bureau, weaning age has decreased among their producers from 22 to 16 days between 1990 and 1995. This is equivalent to a rate of 1 day per year. If this trend is representative of changes within the commercial sector of the industry, then projected weaning ages on swine farms by the year 2000 would be between 12 and 14 days (Figure 1). Whether or not this actually occurs remains to be seen. Nevertheless, there appear to be some distinct production advantages associated with decreasing lactation lengths and the age at which pigs are weaned. These include reduced feed costs and loss of body condition for sows during lactation; increased reproductive potential in terms of litters per sow per year; and improved herd health via implementation of segregated early weaning programs. It is interesting to note that improved health and the opportunity for increased female productivity are the two reasons most commonly given by producers for their decision to implement early weaning programs.

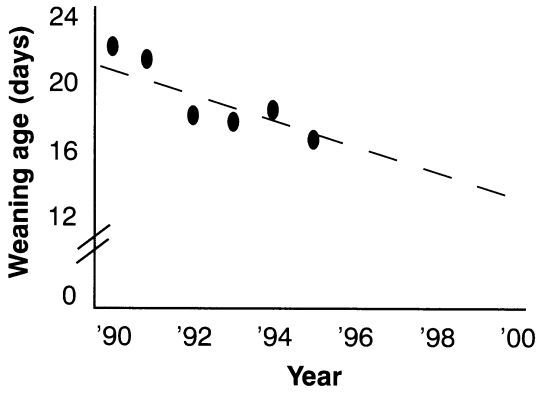

Figure 1. Recent trends in weaning age within U.S. swine industry. (Maher, 1996, Pig Topics, vol. 14, no. 10)

While early weaning offers many advantages, it also involves some challenges for producers. These involve the care and nutrition of the weaned pigs and the subsequent reproductive performance of sows. Although early weaned pigs have greater nutritional and environmental needs than those weaned at older ages, these apparently can be met in a practical and cost effective manner. Evidence for this is provided by scientific studies which have demonstrated that after about 10 days, a sow's milk actually limits the growth potential of her pigs and by the excellent weight gains by nursery pigs and low death losses achieved on some operations which are currently weaning at 12 days.

In contrast, extended rebreeding intervals, low farrowing rates, small litters and the occurrence of erratic estrous behavior frequently are associated with early weaning programs. The exact weaning age at which these reproductive problems begin probably differs from herd to herd. In fact, several recent retrospective studies have reported only small reductions in reproductive performance when the average weaning age was reduced to 12 days However, these reports tend to be an exception rather than a common occurrence on farms weaning at very young ages, in fact, it is generally accepted that there is an inverse relationship between lactation length and incidence of fertility problems in sows as weaning age decreases the likelihood of reproductive abnormalities increases. This may be why the most common reason given by producers for not implementing early weaning programs is fear of the reproductive consequences which normally accompany this practice. Thus, it may be safe to say that the unpredictable and often poor reproductive performance of sows is a major obstacle on farms currently or contemplating using early weaning.

Even if producers are not considering reducing the weaning age within their herd, most have been faced with situations in which sows had to be weaned within the first week of lactation due to poor milk production or some other reason. Thus, at some point, every operation has been forced to make management decisions regarding early weaned sows. The purpose of this monograph is to review the reproductive endocrinology and physiology of the postpartum sow and discuss several reproductive management strategies that have been implemented in conjunction with early weaning programs. An understanding of what normally occurs "inside the sow" after farrowing is important for making decisions about weaning ages and attempting to solve reproductive problems associated with short lactation lengths. It is hopeful that the information presented will be useful for producers, veterinarians and swine consultants in making informed production decisions involving early weaned sows.

Recovery of the Sow's Reproductive System after Farrowing

Successful reproduction in sows requires the coordination of at least four organs: the hypothalamus, pituitary gland, ovary and uterus (Figures 2 and 3). In general, the hypothalamus receives sensory input from internal and external sources and translates this information into an endocrine signal in the form of gonadotropin-releasing hormone (GnRH). The pituitary gland is stimulated by GnRH to secrete follicle-stimulating hormone (FSH) and luteinizing hormone (LH). These two hormones are referred to collectively as gonadotropins and are responsible for stimulating follicular growth, steroid hormone production and ovulation on the ovaries. Once ovulation occurs, fertilization, implantation and embryonic development are regulated by both physical and endocrine changes within the uterus.

It has been well documented that each of these four organs require a period of time after farrowing in which they recover, or regain the ability to function in a normal fashion (Figure 4). Recent work suggests that the pituitary gland is not able to respond to increasing levels of ovarian steroids with a normal secretory pattern of LH until 10 to 14 days post-farrowing. Apparently, sufficient amounts of LH are present in the pituitary before this time, but are not released during the first 2 weeks of lactation even when normai levels of ovarian steroids are present. Whether or not this is due to a lack of appropriate stimulation from the hypothalamus or from an inability of the pituitary gland to respond to normal endocrine signals is not clear.

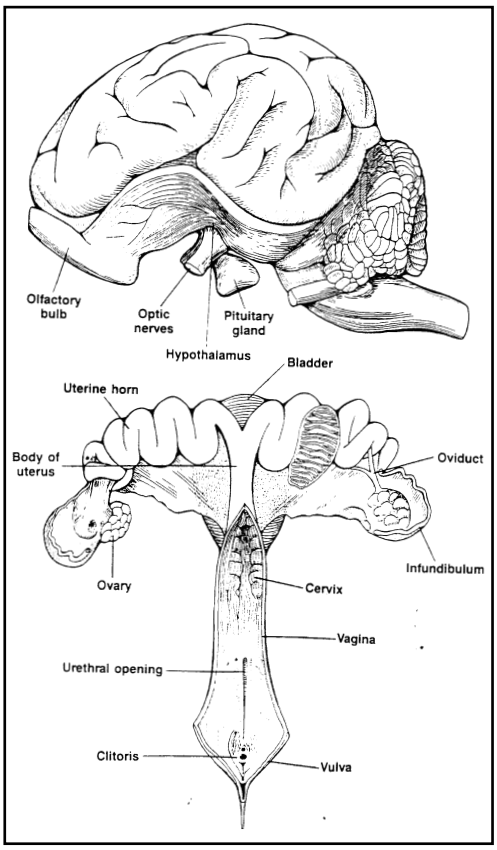

Figure 2. Female reproductive anatomy.

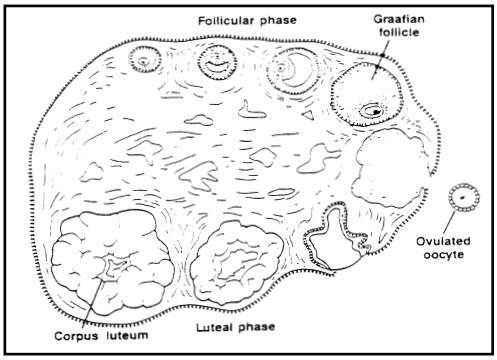

Figure 3. Normal ovarian changes in sows.

Immediately after farrowing, the uterus must shrink in size (referred to as involution) and replenish most of the cells contained within its inner lining - the endometrium. This process requires between 12 and 16 days. in contrast to the brain and uterus, the ovary appears to be capable of normal activity within several hours, or at the latest, 1 day after farrowing. Evidence for this is provided by the observation that ovulation of fertile eggs can be induced shortly after farrowing via the exogenous administration of gonadotropins. Thus, it appears that the sow's reproductive system requires at least 10 and, perhaps, as long as 16 days after farrowing before it is capable of resuming its full operational status. It is possible that both genetic and environmental factors influence this process. However, at the present time, the nature of these and their relationship to postpartum recovery in sows remain to be determined.

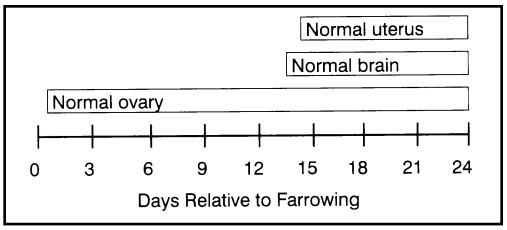

Figure 4. Relative rates of recovery of the brain, uterus and ovary following farrowing in sows. Day 0 represents the day of farrowing.

Causes of Reproductive Problems in Early Weaned Sows

During lactation, the sow's reproductive system normally is in a period of quiescence. This is due to the fact that the suckling activity of the nursing pigs has an inhibitory effect on the secretion of gonadotropins. Thus, in addition to supplying baby pigs with milk, lactation also provides an opportunity for repair and recovery of the sow's reproductive organs. The problems associated with early weaning in sows are the result of the sows' reproductive system trying to resume normal activity before it is capable of doing so. In other words, one of the organs may be able to act in a normal fashion, while others cannot. A good example of this is the high incidence of cystic follicles that is often observed in early weaned sows. When the nursing litter is weaned, the suckling-induced inhibition on the secretion of LH and FSH is removed. In response to this, LH and FSH increase and stimulate follicles to grow. Growing follicles produce estrogen which normally causes a surge of LH and ovulation in females weaned between 18 and 21 days after farrowing. However, in the early weaned sow, as mentioned previously, if the pituitary has not had sufficient time to recover. then no surge of LH occurs. Follicles do not ovulate, but continue to grow to very large sizes – a condition referred to as cystic follicles (Figure 5).

Sows with cystic follicles will exhibit classic estrous behaviors and stand to be bred. However, they seldom conceive because ovulation never occurred. Cystic follicles result because ovarian follicles respond to LH and FSH produced by the pituitary gland, but the brain cannot elicit an LH surge in response to steroid hormones produced by the ovarian follicles.

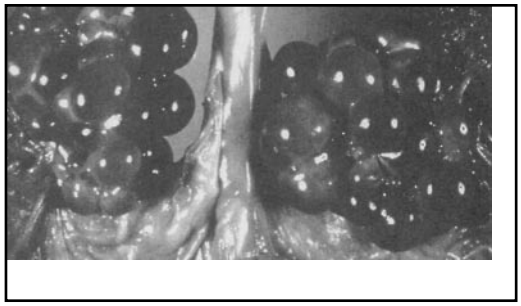

Figure 5. Photomicrograph of cystic follicles from an early weaned sow. Note the numerous large blister like structures on both ovaries. These are cysticfollicles.

Based on the information presented in Figure 4 about the timing of the recovery of the brain, uterus and ovary, it is evident why a variety of reproductive problems have been reported with early weaned sows. Failure to exhibit any signs of estrus is related to an insufficient release of gonadotropins and a lack of follicular development, whereas small litters and low farrowing rates most likely are the result of incomplete uterine repair prior to fertilization and implantation. Consequently, the biological limit in terms of how quickly the female reproductive system can resume normal function after farrowing is probably somewhere between 10 and 14 days.

Management Strategies for Early Weaned Sows

Based on the previous discussion of the reproductive changes that occur in sows after farrowing, it appears that there are two physiologically appropriate avenues through which the reproductive problems in early weaned sows can be prevented — either facilitate the rate of recovery of the sow's reproductive system or devise a strategy where pigs can be weaned at early ages, but the sow is prevented from resuming reproductive activity until after her recovery is complete. It is important to note that good nutritional management during lactation, regardless of its length, is still critical for the resumption of reproductive activity. Thus, without proper diets and feeding programs, it is unlikely that any of the strategies discussed subsequently will benefit early weaned sows.

Administration of Gonadotropins at Weaning

Use of exogenous gonadotropins just prior to or at weaning has been shown to be an effective management treatment for the induction of a synchronized, fertile estrus in sows weaned after 21 days of lactation. The rationale behind this strategy is to use exogenous gonadotropins to augment the normal endogenous secretion of LH and FSH. Field studies conducted in Minnesota indicate that administration of P.G. 600®, a commercial product with LH and FSH-like activity, reduced the weaning-to-estrus interval in first parity sows by 4 days (8.7 versus 12.7 days) without influencing farrowing rate (76.7% versus 76.9%) or total number of pigs born (10.3 versus 10.4 pigs) compared to non-injected controls. The weaning age for these animals was 10.6 days. From a physiological perspective, it is important to examine these results in conjunction with what is known about the recovery of the sow's reproductive system. In this particular situation, weaning occurred at 10.6 days. If this is added to the weaning-to-estrus interval for each treatment, then the sows receiving P.G. 600® were bred at 19.3 days after farrowing (10.6 + 8.7), while a similar value for control females was 23.3 days (10.6 + 12.7). Based on these calculations, both groups of females were bred at a time when recovery should have been complete.

P.G. 600® probably is capable of inducing estrus in early weaned sows because of its biological mode of action. However, before gonadotropin therapy is used on a routine basis within a herd, it is important to have an accurate estimate of how quickly sows will respond and, with this, calculate a farrowing-to-breeding interval. If the period between farrowing and breeding is greater than 14 days, then one would assume that reproductive performance would not be compromised. In contrast, if the farrowing-to-estrus interval is less than this, then the possibility exists that sows would normally be bred before their reproductive systems were fully recovered and fertility may be compromised.

Delayed Matings

The practice of delaying matings until the second post-weaning estrus has been shown to improve both farrowing rates and litter size in sows that normally experience a decreased number of pigs born alive in their second parity. The effectiveness of this strategy has been attributed to the additional time it provides for uterine and endocrine recovery following weaning. When this practice has been applied to early weaned sows, a significant improvement in both farrowing rate and number of pigs born alive were observed. For example, in one study, females that were weaned at 11 days post farrowing and bred on their second estrus after weaning had higher farrowing rates (87.7%) and larger litters (11.6 pigs) compared to sows weaned at the same time, but bred at their first estrus (70.4% and 10.4 pigs). However, the delayed mating regimen also increased the weaning-to-breeding interval by about 19 days (28.5 versus 9.4). Consequently, delaying matings or "skip breeding" also appears to be a viable management strategy for early weaned sows. However, the reproductive advantage of this practice needs to be evaluated in conjunction with the additional cost of maintaining non-productive sows for an extended period of time. Obviously, based on differences in daily production costs, skip breeding may be advantageous for some operations, but not for others.

Induction of Ovulation Before Weaning

Induction of ovulation during lactation also provides a way to circumvent the reproductive problems associated with early weaning. The rationale behind this practice is as follows. If follicles could be induced to ovulate shortly after farrowing, then resumption of sexual activity would be blocked by progesterone from the resulting corpora lutea. Sows, then, could be weaned at any time after farrowing, yet would not be expected to return to estrus for 18 to 21 days after ovulation. Numerous studies have shown that ovulation can be induced in a high percentage of sows using a combination of P.G. 600® followed by administration of human Chorionic Gonadotropin (hCG) 72 hours later. This induction strategy is very effective when applied to sows after day 14 of lactation, but of limited usefulness during the first two weeks after farrowing.

In contrast, recent studies indicate that a single injection of Chorulon® (hCG) within 12 hours after farrowing induced ovulation in a high percentage of multiparous (75%) and primiparous (90%) sows. Based on progesterone profiles, a normal luteal phase resulted and these females when weaned at less than 14 days exhibited similar farrowing-to-estrus intervals as sows allowed to lactate for 18 days. Subsequent farrowing rates and numbers of pigs born alive were also similar between the two groups, Chorulon® induces ovulation when administered shortly after farrowing because there are normally large, ovulatory-sized follicles present on the ovaries at this time. Within 24 to 36 hours after farrowing, these follicles normally start to regress and are replaced by smaller ones. A single dose of hCG administered after the first 24 hours post-farrowing does not reliably induce ovulation because the normal population of follicles on the ovary at this time are too small to respond. It is important to recognize that, at the present time, use of Chorulon® or any hCG in swine is considered an "extra-label" use of this product. The prospect of using hCG as a management strategy for early weaned sows is still under investigation.

Summary

There is no question that early weaning programs offer some real production advantages for swine producers. However, they also involve certain risks. The primary risk appears to be the possibility that the fertility of sows upon rebreeding may be reduced. The normal recovery period of the sow's reproductive system after farrowing probably is around 14 days. This may vary some among herds, but it is a fact that, within any herd the likelihood of experiencing reproductive problems increases the further weaning age is reduced below 14 days. Nevertheless, there are several strategies that have been used effectively to minimize the reproductive problems associated with early weaning, These include use of exogenous gonadotropins and delaying matings until the second estrus after weaning. At the present time, use of P.G. 600® at the time of weaning, is effective provided that the time period between farrowing and breeding is greater than 14 days. Thus, in order to use this strategy effectively, producers must know when most sows exhibit estrus after administration of P.G. 600®. Delayed matings or skip breeding also appears to be effective from a reproductive standpoint. However, it does involve accumulation of additional non-productive sow days. Finally, at the present time, strategies using single injections of hCG are still in development.

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