Reproductive Management: A Scientist in Production Clothing

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Many things happen when an individual with a research background becomes responsible for production. In general, he modifies his thoughts from experimental design to mass implementation. A view from the ivory towers has to be modified to an approach suitable for replication in real world situations. The following comments include a general concept and a brief discussion of items to consider in implementation of a plan to achieve the desired benefit in "normal" production settings.

Every concept has a value: the ability to implement it determines if it is worth anything.

The best example of this was revealed recently. When employees had the opportunity to mate sows three times, the "best" fertility was found when sows were first mated on Mondays. That occurred whether sows were weaned on a Monday/Thursday, Tuesday/ Friday pattern, and regardless of the age of semen used to AI the sow. Conceptually, weaned sows in our system had a wean-to-1st service (WEI) interval of approximately 5 days, and the fertility of semen is never better than when it comes out of the boar. Similarly, weaned sows should have higher conception rate and born alive than gilts and opportunity females in any herd. Logistics of transferring weaned pigs from large sow farms to off-site nurseries, transporting semen from boar studs, and emptying nurseries and finishers in a timely manor have to be reconciled with proposed targets for farrowing rates and born-alive numbers. A major consideration in our assessment of effective production strategies was that cost savings could occur if the total number of trips to the farms could be reduced. This translated into a decision to adopt once-per-week weaning across the production system.

Once this strategy was implemented, added benefits such as health improvements from the McREBEL program and from *All in-All out* strategies became available. Issues such as age of pig at weaning and lactation feed

intake were addressed because they not only affected potential reproductive performance, but also the livability and acceptability of the pigs weaned and shipped to the nurseries. Previously, when sow farms were given the chance to shift the age of pigs moved by 3-4 days, we had struggled with implementation of health programs. A much higher level of discipline is required when the truck is only going to be at your farm once per week. Challenges, such as age of semen and WEI, are now evaluated as deviations among farms rather than compliance with the program.

Estrus that is not detected is more expensive than acyclic females.

As a reproductive biologist I am challenged constantly with the difference between expressed and detected estrus. Whether we like it or not, estrous cycles, once initiated, occur in a regular pattern until something such as death or pregnancy stops them. Gilts delivered on Wednesdays for example will probably show the classic shipping response in three days. The challenge occurs in a farm that works short hours on Saturday and Sunday. It is likely that these farms will have a high incidence of "silent" heats, which are reported as acyclic gilts. Worse yet, due to the normal range of estrous cycle length, these "Phantom" heats can be repeated several times before they occur on a weekday heat check. On farms with high entry-to-1st service intervals, evaluate heat detection prior to use of strategies to synchronize estrus. It may be synchronized too tightly already! Non-productive days and gilts culled for reproductive reasons are costly in these farms simply due to gilts responding as if they read the books. When diagnosing failure to cycle, consider that the fertility of this cycle depends on events which occurred over the past 10-11 days.

Table 1. Post-Mortem results from "anestrous" gilts

On-site Observations	Diagnostics
Normal Pregnancy 35%	Normal Pregnancy 25%
Normal Cycle 32.5%	Normal Cycle 35%
Anestrus 10%	Anestrus 10%
Lost Pregnancy 22.5%	Lost Pregnancy 30%

Boar stimulation is necessary for induction and detection of estrus.

While few people with sow experience have a problem with this statement, there is a great deal of difference in the use of boars in any system. When converting to total AI, we went through the growing pains like everyone else. A quick check of WEI and % bred by 7 or 10 days after weaning, and entry-to-1st service intervals on gilts, are often used to indicate successful use of boars to

induce cycles. A comparison of total born and born alive between different mating systems (Natural-Combination-AI) best indicates the need for a boar in estrus detection and in mating quality. If the AI program is sound, optimum fertility should occur when a qualified technician uses a good boar to assist him in determining the proper time to perform inseminations. In most cases induction of heat requires more contact with the boar, while detection of the true standing response should be relatively rapid as the boar approaches. Terms such as habituation and fatigue should be discussed with managers who mismanage boar exposure. When considering timing or frequency of matings, the developer of the program must have a good handle on boar exposure.

Hormone replacement therapies do not make gilts older or more mature.

The onset of puberty in gilts and estrus after weaning in sows is an opportunistic event associated with the body's determination of homeostasis. In other words, there is an "ideal" status (adequate body stores $\pm$ nutritional supplementation $\pm$ age) for each animal that must be reached before normal reproductive events are initiated. Exogenous gonadotropins, in particular, assist in kick-starting these cycles and are extremely useful in programming production. In most cases that occurs by increasing expression of estrus to levels detectable by the employees. When these programs fail in our system, there is invariably a cause such as poor nutrition, stocking density or extreme heat, which should have been addressed prior to administration of the product(s). As stated earlier, when there are no corpora lutea present on the ovary at post-mortem examination it is tough to believe that "she was in heat". Normal programs that work during seasons when conditions are optimal must be modified during extreme conditions to be equally successful.

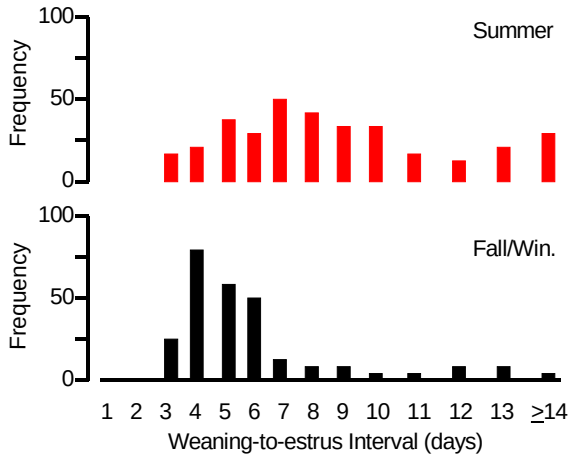
AI success is synonymous with excellent heat checking.

Most people would emphasize that mating patterns should be unique to the genotype, farm conditions, or a series of other independent items. However, variations in a large program probably occur more due to differences understanding the program and compliance issues, than to individual differences among the farms. An instrumental thought for this is "Read the Sow- Write on the Card". In other words, the individual determining whether the female is ripe for breeding is more important at first service than when other matings will occur. While documentation of the time of first service becomes a tool to diagnose reproductive failures (anything < maximum pigs), there is rarely a call for diagnosing the most productive sows. Although it often occurs in practice, no sow should receive a subsequent mating unless she indicates that she is still receptive by showing a good standing response.

Additionally, just as too little effort at heat check will be less than optimal, poor performance will also be evident when all sows have to be "worked with" to

cause them to stand. The quality of each mating is more important than a programmed number of matings-per-service. If for example, a farm is having trouble finding gilts or sows in heat during the summer, it is irrational to think they should have the same number of matings-per-service as they do in the Spring or Fall. Documentation of timing, such as wean to 1st service interval, has more of an impact on fertility than such broad categories of fertility as the percent bred by 7 days.

Figure 1. Expected Changes in WEI throughout the year



More doses of semen in an AI program do not always equal better fertility.

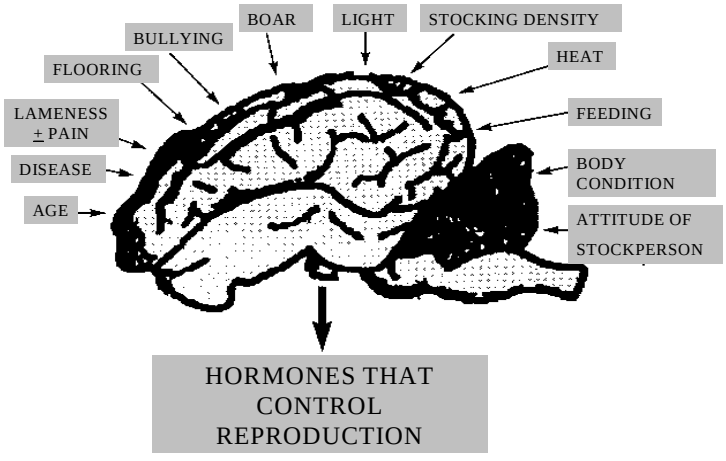
While most agree that each farm has a series of conditions that should dictate mating timing and intervals, a lot of time is spent performing matings that contribute little to the number of pigs produced by sows. More importantly, time spent performing these services can be spent on other tasks such as good heat checking. As repeated in this, and many other discussions around our operations, the most critical factor in determining the time to mate a sow is detected versus true estrus. If you have reasonable expectations for semen life, and adequate knowledge of estrus to ovulation timelines, and then apply excellent heat detection a blanket program can be written for the operation. When one includes the potential for introduction of bacteria, priming the inflammatory response and the impacts of a late service on farrowing rate and numbers born, the decision to obtain maximum pigs per insemination involves more cost considerations than just price of extra semen.

Additionally, there is more in a dose of semen than sperm cells. Naturally mated sows have a phenomenal means of fighting off bacterial contaminants inserted with, on, or through the penis. Part of this ability is simply due to the certainty that she is in estrus. But, when the maximum number of doses from an AI boar is based simply on sperm numbers, extenders take the place of secretions from the boar. While the precise compounds present have not been indicated, a minimal concentration of seminal plasma has been discussed as necessary to diminish the sow's inflammatory response to matings. Thus the concentration of proteins, including sperm, will impact the success of a mating program, and especially one that is based on the percentage of multiple matings.

Animal welfare is a reproductive issue.

In addition to the need for homeostasis before cycles are initiated, fertility of the sow being mated depends on events which occurred over the past 10-11 days. In the farrowing crate days spent with limited intake or off-feed are related to extended wean to service intervals. Additionally, poor lactation intake of feed and water appear related to embryonic loss. With repeated use of real-time ultrasonography, it appears that pseudo-pregnancy is more of an excuse than a concept. There is a minimal (generally considered to be four) number of viable embryos required at 11-12 days to provide the signal for an extended estrous cycle. Likewise, uterine space (physical and nutritional) is the limiting factor in born alive. With these statements in mind, it is fairly easy to understand why herds with excessively high percentages of sows with less than 7 born alive have higher non-productive days. Normal attrition takes care of a lot of embryos under normal conditions and physical stresses add to this loss. Remember, normal parturition is induced by fetal corticoids. Like all other steroids, the source of the stress hormone is not distinguishable to the sow.

Figure 2. Factors affecting hormones that control reproduction



The brain monitors reproductive cycles as a ratio of estrogen to progesterone more than absolute values of either hormone.

Declining progesterone with increasing estrogens provide the signal for the onset of heat. Declining progesterone with increasing estrogens (from fetal sources) initiates farrowing. If both steroids are high, such as mouldy corn fed to pregnant animals or incomplete luteinization of follicles, normal gonadotropin support is compromised and may mimic the events associated with farrowing. Steroid production from fetal, adrenal, or exogenous sources cannot be distinguished from ovarian sources. Diagnosing anestrous females includes more than a snapshot of hormone concentrations. An abortion event for example was most likely due to some causative action two to three days prior to expulsion of fetal tissues.

And finally, the value of the concept is the cost of implementation.

Without intending to be knowledgeable on all subjects, a wide variety of comments on important concepts have been opened due to once a week weaning. While there are ample scientific studies to cover each topic, implementation methods are scarce. Benchmarking and careful documentation of events, circumstances and results, remain the best measures of implementation. Just as often as we would have culled a boar in the past only to find out that his pigs had phenomenal average daily gains, we change a part of a protocol before we measure the impact. A valuable lesson from science is to spend more time and thought designing the experiment than writing the final paper. Knowing expected outcomes, following a written protocol, and understanding deviations will minimize the pursuit of trivia. Sometimes progress will be challenged, but once obtained, the benchmark moves and programs are accepted. Failures that are properly documented can be subsequently avoided.