

## North Carolina Healthy Hog Seminar

### **Diseases of the Reproductive System**

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Although there are a few distinguishable diseases that impact the reproductive system, the impacts of many challenges, not necessarily thought of as a disease, impact reproductive performance of sows and gilts. Homeostasis, a perception that the sow's physiological state is normal, is essential to allow her to initiate cycles, conceive and maintain pregnancy. Each of these stages of reproductive life of females have detectable interferences due to infectious diseases and some non-infectious conditions caused by flow, housing, nutrition and other management influences. As presented in Figure 1., the sow regulates cycles based on her perception of well-being. Understanding and controlling management influences will allow the producer to recognize and minimize the impact of true reproductive diseases.

#### **Initiation of Reproductive Cycles**

The number of follicles that a female could potentially use in her lifetime is established at birth. Shortly before puberty a number of these follicles are recruited to begin growing and if conditions are correct will culminate in standing estrus, ovulation and development of her first corpora lutea. If not the follicles will simply regress and never ovulate. A similar series of events occur in a sow post farrowing. These follicular waves go through this recruitment approximately every 11 to 12 days or twice per normal 18-21 day estrus cycle. Detectable heat depends on the successful coordination of hormonal concentrations and specific receptors which creates the standing response we call heat. Serious breeches to homeostasis will result in prolonged anestrus periods. Less severe interferences increase the discrepancy between expressed and detected estrus. Without proper expression of heat, it is impossible to synchronize semen capacitation and maximum fertility of the eggs to create embryos.

Any condition or disease which creates febrile states in sows and gilts effectively disconnects the circuitry necessary to maximize fertilized embryos. Elevated core temperatures can decrease the expression of estrus by:

- 1) diverting blood flow to extremities as necessary for cooling
- 2) increasing the rate of decay or internalization of receptors
- 3) speeding up the metabolism of hormones that are produced, and
- 4) effectively dampening the amount of expression that would have been present if 1-3 did not occur.

Diseases which are known to create febrile conditions, either from the wild strains or through vaccinations, are erysipelas, swine flu and PRRS among others. The classic brain-influencing disease, eradicated in NC, is pseudorabies and some streptococci lesions may reduce the responsiveness of the brain to steroids. One response commonly noted in immersing circovirus data, and when gilt multiplication units have

severe clostridium challenges, is that those infected gilts reach puberty at a later or more mature age than expected. It remains unknown if this poor fertility is due to decreased neural activity or simply a reduction in growth rate due to damage to villi of the intestinal tract.

Additionally, ongoing work at NC State suggests that both follicular growth in response to exogenous gonadotropins and the detectable expression of estrus in response to known amounts of estrogens are reduced during hot months of the year. Similarly, sows and gilts have a decreased response to exogenous production drugs (PG-600<sup>®</sup>) in the presence of disease or temperature challenges. Even a short-term inflammatory response to lameness, retained pigs, and/or bacterial contaminants which occurs between recruitment of the follicular wave and expression of estrus will no doubt impact optimum pigs per inventoried sow by increasing the number of unmated females.

### **Influences on Conception**

In addition to reducing the standing response febrile events may reduce the viability of embryos and if present at insemination decrease the lifespan of deposited semen. The diseases most often associated with decreased conception are bacterial in nature and include brucella, staph aureus and E. coli. Proteolytic bacteria deposited with the semen and/or late inseminations may also cause elevated inflammatory responses from uterine tissues and reduce conception rates.

Additionally cystitis and other severe bladder infections have been associated with elevated regular returns. Whether the mechanism here is retrograde infection into the uterus, or that the female had decreased water relative to needs which somehow damaged the embryo has not been determined. Since the early embryo lives in a yolk sac it is possible that osmotic concentrations are elevated in response to water shortages. It is evident that the quality of ultrasonic detection of pregnancy is improved after females have access to ample amounts of good quality water.

Closely associated with water intake, nutrient status mid-cycle (11 days prior to ovulation) is related to the initiation of cycles, number of embryos ovulated and subsequent fertility. Perhaps the best indicator of normal wean-to-estrus intervals (WEI) is the maximum feed intake or the amount of feed consumed per sow during the middle of her lactation period. This is placed in the conception discussion because sows which have a predictable WEI are apt easier to mate, predictable in terms of semen availability and are most often the animals with the largest number born alive. On the converse, sows with any of the issues covered here are more apt to have more litters with less than 7 born alive due to the lower number conceiving.

### **Maintenance of an Established Pregnancy**

Multiple retrospective studies have shown that there are “normal” pregnancy losses in swine units. PigChamp states that a normal ratio of 3 regular returns occur for each 1 irregular return to estrus. Normal returns to estrus happen due to failures to conceive

and irregular cycles are due to failure to maintain pregnancies. The maternal recognition of pregnancy occurs at 11-12 days post mating associated with elongation and space claiming activity performed by normally developing embryos. It is generally thought that at least 4 health embryos are necessary to send this signal to the sow. If this activity occurs the female will not cycle in the normal 18-21 days. Return to estrus after embryo loss is dependent on the age and mineralization of lost embryos, the amount of inflammatory response mounted by the sow, and the sow's ability to re-establish homeostasis after the event. The producer's ability to detect the expressed estrus depends on the frequency and intensity of boar exposure, and the animal's ability to express the event. Since typical heat-checking activities diminish after the animal is pregnancy checked, a large number of females that loose litters are first reported as failing to farrow.

The greatest impact on failure of sows to maintain pregnancy is most likely related to embryo quality (as discussed above). These embryos are competent enough to last past the initial elongation but not able to attach and develop to term. Once again, with normal sows, it is normal for some embryos to expire during gestation so conceptually events timed to allow more and uniform conceptions will be more apt to result in larger litters at birth. Also, greater ovulation numbers allow for greater hormonal control of pregnancy, possibly including the uniform delivery of the litter.

Even considering this discussion, some diseases impact embryo survival to term (Table 1). PRRS chooses to impact early development and late gestating or early farrowed fetuses. If the challenge is severe enough, abortions may travel through the entire gestation area, perhaps impacting small litters first. Swine influenza, PRRS, Erysipelas and sometimes Parvovirus present febrile challenges, poor feed intake and etc. which if severe can cause expulsion of litters prematurely. The phantom cause of lost conceptions, Leptospira, most often weakens the conceptus which may cause losses at any stage of gestation and be presented as delayed returns through weak or "squeaker" pigs at birth.

The most commonly discussed disease impacting pregnancy maintenance is parvovirus because of the number of mummies that are presented. As discussed earlier, once mineralization occurs the fetus can not be completely reabsorbed so a fetus at some stage of development is often presented. Because development in uteri is predictable over time, the general formula to detect the length of gestation that the challenge was presented is  $\text{Crown-rump length} \div 3 + 25 = \text{age of fetus}$ . Remember there is a normal occurrence of mummies per litter which is best accounted for a percentage of the total litter rather than simply a number per litter.

The management challenges which mimic these diseases are:

- 1) poor insemination timing and quality,
- 2) temperature extremes (excess heat or perhaps severe chilling),
- 3) moldy feed issues which change hormone concentrations as monitored by the female.
- 4) untimely and/or stressful movements,

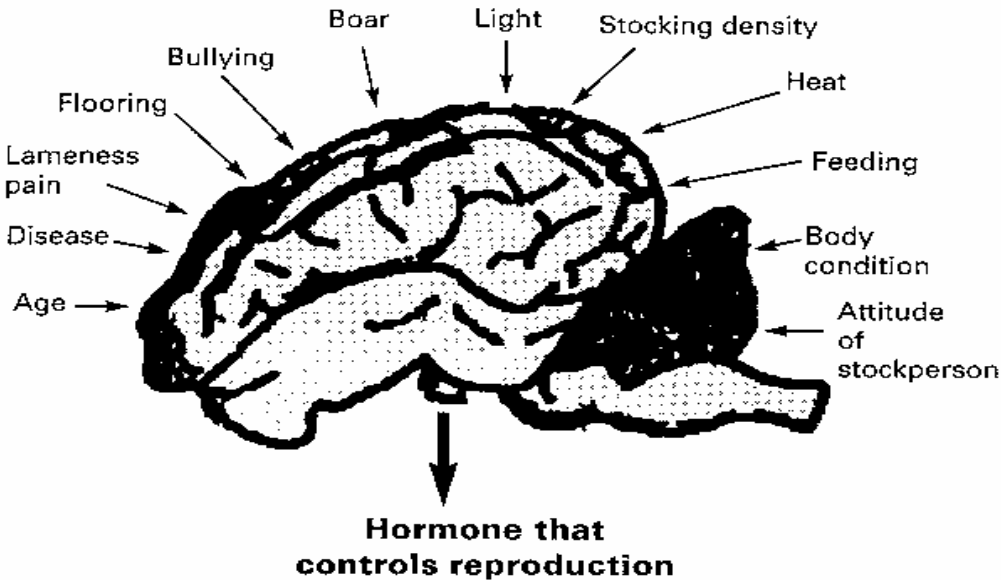
- 5) water quality and quantity, and
- 6) all the interactions of feed including amount, timing of delivery and nutrient status (body condition) of the sow as the litter develops.

When sows are unexpectedly found open or aborting, or simply fail to farrow it is often the first thought to chase a clinical disease when it may be an environmental or management issue being expressed.

## **Conclusion**

Swine production before the detection of PRRS appeared much simpler. Producers rarely chased diseases and concentrated on providing an environment including plenty of air, good feed, ample water and animal husbandry. As farms grew larger, artificial insemination increased and PRRS became the hot topic, many “diseases” became responsible for poor fertility. Yes, it is true that there are some distinguishable diseases that actually cause lesions in reproductive tissues. But, the most common impact of diseases on reproductive events is in their attenuation of pregnancies which were “at risk”. Except in serious abortion storms, “immune-like” responses which a female presents to normal stressors are often more costly to lifetime productivity than any true disease. Healthy, vaccinated gilts that never express estrus and are culled or weaned sows that have chronic low production due to farrowing house issues or poor breeding techniques are far more costly than a few abortions. Expanding awareness of day-to-day issues will allow faster and more accurate diagnosis of a disease event and mitigation of its impact on performance.

Figure 1. Hormonal regulation of reproductive cycles.



**Table 1. Most frequent presentation of notable reproductive diseases.**

Parameter	Sow sick	Pigs sick	Mummies	Stillborn	Abortion	Weak born
PRRS	Yes	Yes	Yes	Yes	Yes	Yes
PRV	Yes	Yes	Yes	Yes	Yes	Yes
Parvo	No	No	Yes	No/yes	No	No
Lepto	Yes/no	No/yes	Yes/no	Yes	Yes	Yes
SIV	Yes	Yes	No	No	Yes	No
PCV2	Yes/no	Yes/no	Yes	Yes	Yes	Yes
TGE	Yes	Yes	No	No	Yes/no	No

Courtesy of Dr. Brad Thacker, Intervet, Inc.