pork industry handbook

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Troubleshooting Swine Reproductive Failure

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Some reproductive failure occurs in all swine breeding operations, but for practical purposes reproductive failure is regarded significant only when production levels fall below the expected norm. These norms vary from operation to operation and are based on such things as percentage of animals cycling, conception and farrowing rates, average litter size, and number of pigs produced per sow per year (Table 1). The detection of moderate rates of subfertility depends upon the observation ability of the caretaker, regular recording of reproductive events, and analysis of reproductive records.

There is a tendency to equate reproductive failure with infectious disease, but in fact most problems are not infectious. This tendency probably springs from the need to assign the problem to a tangible factor such as an infectious agent and to public awareness of infectious diseases. Most reproductive problems have causes that may involve management practices, nutrition, environmental effects, toxicoses, genetics, and disease conditions. Solving reproductive problems requires a thorough knowledge of the breeding herd management and the collection and analysis of pertinent objective data (Table 2). This may be followed by submission of appropriate samples to a diagnostic laboratory. Many problems defy an exact laboratory diagnosis because the causative agent may no longer be present or the problem may have been related to management or environmental factors.

It is often practical to categorize the reproductive problem into one or more areas so that specific investigations or tests can be applied. Table 3 shows the more common reproductive signs or complaints concerning swine reproduction. Bars indicate the relative importance of the female or the male to each of these reproductive problems. Each category will be discussed in this fact sheet with reference to some known causes and diagnostic procedures.

Anestrus

Gilts

Common complaints with gilts are delayed puberty, silent estrus, and anestrus after a few heats. These problems are often related to confinement housing and are influenced by breed and age of the gilts, the season, whether a boar is present, and to some extent the duration of daylight or artificial lighting.

Landrace and Large White breeds tend to cycle better in enclosed facilities and at an earlier age than most other breeds in enclosed facilities. It is best to purchase breeding stock that has been shown to reproduce well under management conditions similar to those intended for the animals purchased. About 80-85% of gilts should be showing regular cycles by 7-8 months of age, but this percentage may be much lower in the summer and fall months. This percentage will not increase significantly for gilts kept beyond 9 months of age. Thus, it is not genetically or economically sound to keep noncyclic gilts beyond 9 months of age.

Gilts that are kept in an enclosed facility, isolated, or tethered are slower in reaching puberty than are gilts kept outside. With gilts in enclosed facilities, smaller numbers per pen (8-12) are better than larger numbers. It is best to provide at least 12 hours of daylight or artificial light per day and a minimum of 15 sq. ft. floorspace per animal. Movement of gilts to new pens or to outside housing and increased exposure to adult boars will often stimulate heat in a number of anestrous gilts.

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Table 1. Expected norms for reproductive performance.

Gilts cycling by 7 months	75-80%
Weaned sows cycling by 1 week—1st litter	70-75%
—older	80-85%
First service farrowing rate—gilts	80-85%
—weaned sows	85-90%
Litter size—total	10-12
—born live	9-10
Boar, rested for 1 week:	
ejaculate volume	150-300 ml
sperm concentration	200-300 x 10^6/ml
Boar fertility—sows that farrow from matings to that boar	80-90%
Sows diagnosed pregnant that subsequently farrow	90-95%

Table 2. Records useful in identifying reproductive problems.

Number of times each boar is used weekly.

Conception and (or) farrowing rates for each group of sows.

Percentage of gilts bred by 8 months of age.

Percentage of sows rebred by 1 week after weaning.

Percentage of sows diagnosed pregnant that subsequently farrow.

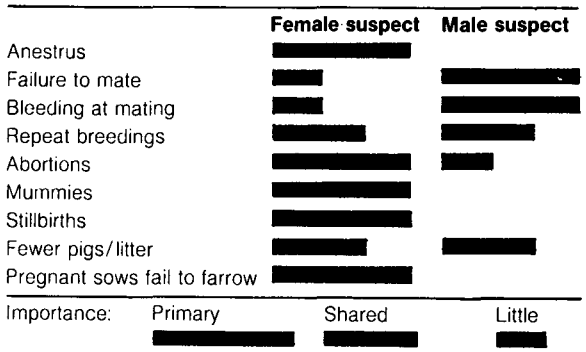
Average litter size, born live, mummies, and stillborns for each group of sows.

Culling rate after weaning:

- % 1st litter
- % 2nd litter
- % Older

Estimates of feed intake during gestation and lactation.

Table 3. Signs of reproductive failure.



Gilts should be examined closely for underdevelopment of the external genitalia. These are often heavily muscled, lean animals which have delayed puberty and, because this is a heritable condition, treatment should not be attempted.

Since undetected heats often mistakenly suggest anestrus, heat detection methods should be evaluated. Estrous detection should be conducted at least once daily with the aid of a mature boar. Each female must have sufficient time for behavioral interaction with the boar either by moving the boar from female to female or by moving females past the boar's pen. With the latter method, a quick immobilization response is usually seen in sows or gilts in estrus. The caretaker may assist in estrous detection by applying back pressure to the females as they interact with the boar. The use of electronic devices which have vaginal probes for detecting estrus have been reported to be beneficial but this benefit is primarily the result of additional attention to estrous detection.

Weaned sows

The most common cause of anestrus in weaned sows is insufficient energy intake during lactation. This is particularly important in sows weaning their first litters. The frequency of feeding, the design of the feeder (large enough for sows) and waterers, and the energy level of the feed should be evaluated. There may be a need to add fat or other high energy products to the lactation diet during the summer or when feed intake is low. Improper feeding which leads to excessive weight loss during lactation or insufficient weight gain during pregnancy is the primary consideration when anestrus occurs following weaning.

The length of lactation also influences return to heat. Sows with short lactations, particularly if less than 24 days, require more time to cycle after weaning. There is evidence to suggest that weaning the heaviest pigs in the litter at least 48 hours early will improve cycling performance, especially in first-litter sows.

The stress of grouping sows and withholding feed after weaning will lengthen the average interval to estrus. Most sows should get 6-8 lb. of their gestation ration for at least the first week after weaning. Housing the sows in crates or small groups may increase the percentage of sows that cycle early. Exposure to a mature boar either in adjacent pens or by daily movement of the boar among the sows will also stimulate early cyclicity in postweaning sows. Mixing 3 or 4 sows with the boar for the first 48 hours after weaning reduces fighting between sows and provides boar stimulus to initiate cycles.

The summer and fall months are periods of reduced cycling in sows, but the effect of this is minimal if the practices just mentioned are utilized and good heat detection methods are followed. A light period of at least 12 hours for both lactating and weaned sows also appears to be beneficial.

The diagnosis of anestrous problems should be based upon heat check and breeding records. Eighty percent of the gilts should be cycling regularly by 8 months of age, or an average 4% of the gilts of that age should be in heat each day. Between 85 to 90% of the sows should have cycled within the first 10 days following weaning. Estrous detection methods and frequencies should be checked closely to assure proper procedures are followed. Other diagnostic procedures might include slaughter examinations or obtaining serum progesterone levels to determine if estrus has been missed.

Failure to Mate

Male refusal

Boars or sows may refuse to mate even though the female is showing signs of estrus. Usually this is a boar-oriented problem. Insufficient sexual behavior by the boar may be caused by immaturity, lack of proper sexual experience, genetics, overuse, overconditioning, or pain associated with breeding.

Normally young boars begin aggressive mating behavior by 5-6 months of age. Boars that are not sex-

ually active by 7.5 months are problem boars. Rarely is this problem related to a deficiency of male hormone, and hormone therapy gives poor results. More often, the problem can be traced to a lack of breeding experience or to the boar's ancestory. Providing young boars with sexual experience through observation and interaction with compatible males and females is the preferred therapy. Boars that are unresponsive to this experience should be culled.

Experienced boars may have periods of reduced libido. Overuse, overconditioning, and old age are possible causes for reduced libido, but pain associated with breeding is the most common cause of abated libido. Pain from feet, leg, or back lesions caused by injury or disease is accentuated by mounting and may inhibit sexual desire in the male. Lesions of the penis or prepuce may also cause sufficient pain to inhibit sexual activity.

Some boars may mount sows but are unable or unwilling to enter the female. This may be due to pain from skeletal disease or to abated libido occurring as the boar passes his prime age of sexual drive. Other boars may develop the habit of diverting the penis into their preputial diverticulum. This condition can be corrected by surgery, but large diverticula are heritable and predispose the boar to this problem.

Virgin boars that fail to mate should be examined for abnormalities of the penis, including fibrous tags (persistent frenulum) or incomplete erection. Both are heritable conditions, and affected boars should not be used for breeding stock production. Boars with fibrous tags can often be salvaged for commercial use with surgical correction.

The diagnosis of these boar problems is based on good observations, radiographs to detect bone disease, and, occasionally, examination of a boar under anesthesia for penis or preputial problems.

Female refusal

Sows or gilts in estrus may occasionally refuse a boar, particularly a young boar. For this reason mature boars make better teasers. Sows or gilts that object to entry of the boar frequently have cervical or urethral damage from prior breeding or farrowing.

Bleeding at Matings

Hemospermia (blood in the semen) results in reduced conception rates. Boars should be examined for trauma of the spiral part of the penis. This occurs commonly from homosexual activity and with pen mating, when boars have difficulty entering sows. Sexual rest for two weeks and eliminating the cause are necessary for return to normal function. Bite wounds to the penis are usually inflicted by an intruding sow or boar during breeding. One or more boars in the pen may be injured. Affected boars should be given antibiotics for 10 days and sexual rest for 3 weeks. At this time the boar should be test mated and examined under anesthesia if bleeding still occurs.

After breeding, virgin gilts and some sows may bleed from cervical or urethral injury. Most recover by the next estrous period.

The diagnosis of a bleeding problem is made by observation at mating, vaginal examination of the female and, occasionally, examination of the boar under anesthesia.

Repeat Breedings

When repeat breeding is a herd problem, it is helpful to determine the percentage of repeat breeding sows, the percentage of sows with return intervals of 24 days or more, and the service records of individual boars.

Repeat breedings, regular intervals

When more than 15% of the bred sows return to estrus within 18-23 days both male and female infertility must be investigated. Primary considerations are boar infertility and poor timing of matings that result in lower conception rates. Very low conception rates often indicate male infertility. Diagnostic efforts should include semen quality examination, observation of boar behavior and mating ability, and a review of boar management and use.

Boars used excessively (more than 7 matings/week) on a continual basis may have reduced fertility. Therefore, boars should be rotated every 24 hours during heavy pen mating usage (2 boars for every 4-6 sows weaned/week). When hand-mating or AI is employed, heat detection and breeding times are important. Best fertility occurs when females are bred 10-12 hours before ovulation. However, the interval from the start of heat to ovulation is variable. It is estimated to be about 36 hours in gilts and 48 hours in sows, but the detection of first signs of heat may be difficult or delayed. For this reason, two services per heat period are recommended. Table 4 gives a suggested breeding schedule based upon the frequency of heat detection checks.

Table 4. Breeding schedule for hand-mating (hours after detecting heat).

	Frequency of heat detection	
Type of female	**once daily**	**twice daily**
Gilt	0 & 24	12 & 24
Sow	12 & 36	24 & 36

Double mating increases conception rates by 10 to 30% because it increases the chance of breeding near ovulation. Nearly all the sows and at least 70% of the gilts in a breeding program should have double services.

Boars exposed to high environmental temperatures (greater than 85°F) may suffer reduced fertility for several weeks. Providing shade and water sprinklers for the boar during hot weather reduces heat stress and semen damage. Likewise, acute systemic diseases that cause a high fever in the boar can cause semen damage. Boars exposed to cold stress for several days during the winter can be rendered infertile or subfertile for several months.

Evaluation of semen samples will detect the infertile and some subfertile boars. Other subfertile boars can only be detected by evaluating the breeding record (conception rate and litter size) of individual boars.

When an individual sow or gilt returns to estrus repeatedly at regular intervals, lesions of the oviducts or uterus should be suspected. The reproductive tract can be examined at slaughter or by surgery.

Another cause of reduced fertility in the female is uterine infection. Bacteria may be introduced into the uterus at farrowing and at breeding. Most of the affected sows return to normal fertility by the next estrus. A few animals may have a noticeable vaginal discharge at

approximately 16-17 days after breeding. The boar with preputial infection may be responsible for spreading infection among females.

Parvovirus is the most prevalent viral agent involved with infertility. It rarely causes repeat breeding alone but often results in mummification of fetuses, and in sows that fail to farrow after appearing pregnant. It occurs much more frequently in gilts than in sows.

Eperythrozoonosis (Epy) has been suggested but not proven to be a cause of infertility in the sow and gilt. This is most often diagnosed as a problem in the fall. It is theorized that the decrease in fertility during late summer is analogous to a seasonal anestrus in other species rather than the effect of eperythrozoonosis.

Repeat breeding with delayed return to estrus

Normally, the incidence of delayed (24 days or more) return to estrus following breeding is rarely higher than 3-4%. This percentage may increase by 3 to 4 times for females mated in July, August, September, and October.

Delayed return to estrus suggests a loss of early pregnancy. Uterine infections caused by viral or bacterial agents may be the cause. Pseudorabies and parvovirus are viral agents likely to be connected with this problem. Bacterial agents associated with lower conception rates and delayed return to heat include a wide variety of organisms. *Staphylococcus* species (spp.), alpha- and beta-hemolytic *Streptococcus* spp., *Escherichia coli*, *Pasteurella multocida*, *Antinobacillus* spp. and *Corynebacterium suis* are commonly present in the vagina and occasionally are introduced into the uterus. The involvement of *Mycoplasma* spp. and *Ureaplasma* spp. in swine infertility is questionable.

Bacterial infections may be prevalent in the uterus or vagina due to contamination from the farrowing barn, post farrowing infusions with irritating solutions, bladder infections, or breeding. Sanitation in the farrowing and breeding facilities is extremely important when attempting to curtail this problem. Removal of manure from behind sows in individual stalls, on a daily basis, may be helpful.

Diagnostic efforts in repeat breeding problems should be directed to:

1. Boar fertility and use.
2. Bacterial culturing of vaginal discharge.
3. Serological (blood) tests for pseudorabies and parvovirus. Interpretation of the test results is difficult unless results of a prebreeding test are also available.
4. Diagnostic procedures for early pregnancy, including blood tests for progesterone or estrone sulfate, and ultrasonic pregnancy detection tests.
5. Examination of reproductive tracts collected at slaughter. Bacterial culturing of these tracts may not be satisfactory because of contamination of the organs with scalding water and urine during slaughter procedures.

Abortions

An abortion rate of 1-2% is regarded "normal" in the swine breeding herd. This increases slightly during the warm fall months.

When many abortions occur, specimens should be submitted to a diagnostic laboratory. An exact diagnosis is achieved only 20-30% of the time. Abortions are caused by infectious, toxic, genetic, metabolic, and other factors.

Infectious agents such as pseudorabies virus, *Streptococcus* spp., *E. coli*, *Erysipelothrix rhusiopathia*, *Salmonella* spp., *Pasteurella spp., and Hemophilus parahemolyticus* cause systemic disease, fever, and abortion in 2-14 days. They frequently cause abortion storms.

Leptospirosis and brucellosis usually cause abortions without prior evidence of systemic disease. Toxoplasmosis and mycotic infection cause sporadic abortions of similar nature.

Toxic agents also cause abortions. Carbon monoxide poisoning produced by poorly adjusted or unvented heaters in the farrowing house causes late-term abortions without much evidence of systemic disease in the sow. These aborted pigs have cherry red tissues. Less common is the abortion associated with T-2 (trichothecene) toxin in moldy feed. Aflatoxin, ergotoxins, vomitoxin, and zearalenone are agents produced by moldy feed, but they do not generally cause abortion. Likewise, nitrates or nitrites in feed or water have not been shown to cause abortion or fetal loss in swine.

Cold stress can also cause abortion in late-term sows. Usually this is caused by inadequate energy intake and acute heat loss when bedding is scant or absent. These abortions may occur in confinement during the winter when sows are on limited feed and lie on cold concrete floors.

Diagnostic procedures for determining causes of abortion include submission of aborted fetuses and placentae to a diagnostic laboratory for culture and histologic examination; submission of blood samples to be tested for pseudorabies, brucellosis, and leptospirosis; testing feeds for mycotoxins, and monitoring the environment for carbon monoxide or cold stress.

Mummified Fetuses

Mummified fetuses occur in normal farrowings at a rate of 4-5%. These represent fetuses that died in the uterus at 35 to 90 days' gestation without causing sufficient uterine reaction to result in abortion. Noninfectious causes of mummies include placental insufficiency and lethal developmental abnormalities.

Parvovirus is the most common infectious agent known to cause mummification; however, other viruses may cause mummies in the litter. Together these viruses are responsible for the condition commonly called SMEDI syndrome because they cause stillbirth, mummies, embryonic death, and infertility. Parvovirus has been diagnosed most commonly and hence has received a great deal of attention.

Infection of the litter with parvovirus must occur in the first 70 days of gestation to cause fetal death. Fetuses usually vary in age and size at death because the virus spreads slowly from one fetus to another in the uterus. It occurs in both sows and gilts but most sows have immunity prior to breeding, while 25% or more of the gilts are susceptible prior to breeding. Gilts raised in isolation may not have prebreeding exposure to parvovirus, and they are much more likely to become infected during pregnancy. Gilts can be tested for immunity (seroconversion) to parvovirus prior to the breeding period, and immune animals can be used for breeding. Exposing the gilts and animals being introduced to the breeding herd to the pens of finishing hogs and also older sows will generally improve seroconversion rates. Additionally, the gilts should develop immunity to the

other SMEDI agents in the herd. Vaccination of gilts with parvovirus before service has reduced the incidence of this problem.

Parvovirus can be readily identified in mummified fetuses by laboratory examination. This is the most reliable method of diagnosis. Elevated serologic titers are not significant as a cause of fetal loss unless blood samples have also been taken before breeding and a rise in parvovirus antibodies can be demonstrated in the second sample.

Stillbirths

A stillbirth rate of 6-8% is common in swine farrowing units. This represents death of the fetus just before or during farrowing. These rates increase rather dramatically as the sow ages, particularly after 6 litters.

There are several factors that contribute to increased stillbirths. Infections such as leptospirosis or pseudorabies and carbon monoxide toxicity may increase stillbirths, but abortion will be present in other sows.

Overweight sows and gilts or those subjected to heat stress have higher stillbirth rates. Likewise, sows or gilts that are uneasy in the farrowing facilities or disturbed during farrowing are likely to have slower farrowings with more stillbirths. Low blood glucose, hemoglobin, or calcium may reduce the responsiveness of the uterine muscles and cause delayed or prolonged labor resulting in stillbirths.

Sows with large litters and prolonged parturition and sows with small litters, but large pigs, have a higher incidence of stillborn. Gilts with small pelvic size also have higher stillborn rates. Stillbirths can be significantly reduced if farrowings are supervised and sows with prolonged labor are treated with oxytocin. Supervision of farrowings has been facilitated by synchronized farrowings with prostaglandin and oxytocin.

Diagnosis of the cause of stillbirth involves testing for infectious agents, carbon monoxide toxicity, altered blood chemistry, observing the farrowing process to determine if stillbirths are related to prolonged labor, and determining the age and parity of problem sows.

Small Litters

Small litters are considered significant when more than 15% of sows farrow less than 7 pigs. Major factors affecting litter size are breed and heterosis of the dam, number of previous litters (parity of the sow), the duration of prior lactation, and the adequacy of the male services.

It is obvious that breed and heterosis of the dam will influence the number of pigs farrowed. Selecting gilts from prolific dams and using boars from prolific breed lines will generally increase litter size.

Sows in their 3rd, 4th, or 5th parity generally have larger litter sizes, but litter size weaned is generally reduced after 6 litters. To maintain maximum litter size and replacement efficiency, a herd should be approximately 35-40% 1st and 2nd litter sows.

Breeding sows at 21 days or less after farrowing will significantly reduce litter size. Litter size will generally increase as the interval from the previous farrowing is increased up to about 35 days.

Inadequate boar coverage will also decrease average litter size. Subfertile or overused boars cause small litters. Improper timing at mating, breeding too early or too late, will cause individual sows to recycle or have small litters. Poor conception rates in pen or pasture breeding will accentuate the boar usage leading to overusage, small litters, and increased recycling. With handmating, the boar/sow ratio recommended for weekly weaning programs is 1 boar per 10 to 15 sows in the herd. This results in approximately 2 matings per week for each boar. Pasture and pen mating ratios should be about 1 boar to each 3 sows weaned per week.

Diagnostic procedures for determining the cause of reduced litter size in the herd include assessing boar fertility and use, genetic factors, breeding practices, and average parity of the sow herd. A secondary approach is determining the possible presence in the herd of infectious agents that interfere with reproduction.

Pregnant Sows That Fail to Farrow

Occasionally, sows or gilts that were presumed or diagnosed pregnant fail to farrow. Viral infections that cause death of the entire litter during early gestation can result in sows that look pregnant but never farrow. Parvovirus introduced at 30-60 days of gestation is a likely cause.

Misdiagnosis of pregnancy occurs with variable frequency depending upon the method used and the skill of the diagnostician. Generally, sows that are wrongly called pregnant can be found by good heat detection, but anestrus during the late summer and fall months may mask the misdiagnosis.

Pseudopregnancy in the sow occurs when cycling sows or gilts are exposed to estrogenic agents such as zearalenone (sometimes produced in moldy feed). Concentrations of 4-10 ppm zearalenone will cause anestrus. These sows fail to return to estrus, react questionably to pregnancy testing devices that detect fluid in the uterus, and have some mammary development. Pseudopregnancy may also occur more frequently in sows bred in early fall.

Procedures for diagnosis of failure to farrow are directed to assessments of pregnancy detection procedures, the possibility of moldy feed, and infectious agents. Examination of reproductive tracts at slaughter may reveal uteri full of mummified fetuses. These should be tested for parvovirus. Sows with empty tracts, which have large pale, mature corpora lutea but no old corpora lutea or new large follicles, and a thickened congested uterine lining suggest pseudopregnancy. If available, feed from previous periods should be tested for zearalenone.

Summary

The first step in investigating swine reproductive failure is recognition of the problem. Many times several causes exist simultaneously. The attention directed toward these problems often improves the reproductive management and productivity even when a diagnosis has not been confirmed.