factsheet
Pork Information Gateway

Troubleshooting Swine Reproduction Failure

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Originally published as PIH-96.

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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 may 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 observational ability of the caretaker, regular recording of reproductive events and analysis of reproductive records.

analysis of reproductive records. There is a tendency to equate reproductive failure with infectious disease, but 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 from public awareness of infectious reproductive diseases. Most reproductive problems have causes that 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 prior management or environmental factors.

Gilts cycling by 7 months	75% to 85%
Weaned sows cycling by 1 week-1st litter	70% to 75%
–older	80% to 85%
First service farrowing rate-gilts	80% to 85%
–weaned sows	85% to 90%
Litter size total	10 to 13
–born alive	9 to 12
Boar rested for one week:	
–ejaculation volume	150 to 300ml
–sperm concentration	200 to 300 x 106ml
Boar fertility—sows that farrow from matings to that boar	80% to 90%
Sows diagnosed pregnant that subsequently farrow	95%

Table 1. Expected norms for reproductive performance.

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 often are related to modern 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. It is best to purchase breeding stock from herds that have been shown to reproduce well under management conditions similar to those intended for the animals purchased. About 80-85% of the 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.

Number of times each boar 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 alive, mummies, and stillborns. for each group of sows.
Culling rate after weening:
% 1st litter
% 2nd litter
% Older
Estimates of feed intake during gestation and lactation.

Table 2. Data useful in identifying reproductive problems.

	Female suspect	Male suspect
Anestrus		
Failure to Mate		
Bleeding at mating		
Repeat breeding		
Abortions		
Mummies		
Stillbirths		
Fewer pigs per little		
Pregnant sows that fail to farrow		
Importance:	Primary	Shared	Little

Table 3. Signs of reproductive failure.

Gilts that are kept in an enclosed facility, isolated or tethered are older when reaching puberty than are gilts kept outside. When gilts are housed in enclosed facilities, smaller numbers per pen (8-12) are better than larger numbers. It is best to provide 8-10 hours of daylight or artificial light per day and 20ft^2 floor space per animal. Longer day lengths will decrease the proportion of gilts cycling. Moving gilts to new pens or to outside housing and exposure to adult boars often will stimulate heat in a number of the noncycling gilts.

Since undetected heats often are mistaken for anestrus, heat detection methods should be evaluated. Tests for estrus 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, immobilization is usually seen in sows or gilts in estrus. The caretaker may assist in detecting estrus by applying back pressure to the females as they interact with the boar. Continuous exposure of the gilt to boar stimuli decreases the efficiency of this method because the interaction between the animals becomes less intense over time. Electronic devices which have vaginal probes have been used successfully for detecting estrus but require additional labor.

Gilts should be examined closely for underdeveloped external genitalia. These often are heavily muscled, lean animals which have delayed puberty and, because this is a heritable condition, replacement gilts should not be selected from these animals.

Weaned Sows. A common cause of anestrus in weaned sows is insufficient energy or protein intake during lactation. This is particularly important in sows weaning their first litters. The frequency of feeding, the design of the feeders (large enough for sows) and waterers, and the nutrients in the feed should be evaluated. There may be a need to add energy or increase the protein in the lactation diet when feed intake is low. Improper feeding which leads to excessive weight loss during lactation or insufficient weight gain during pregnancy are the primary considerations when anestrus occurs following weaning. Conversely, excessive feed intake during gestation (overweight sows) will lead to decreased feed intake during lactation resulting in severe weight loss and sometimes anestrus after weaning.

The length of lactation also influences return of heat. Sows with short lactations, particularly if less than 21 days, may 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. Thin sows should be fed 6-8lb of the gestation diet for at least the first week after weaning. Housing 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, also will stimulate early cycling in postweaned sows. Mixing 3-4 sows with the boar for the first 48 hours after weaning reduces fighting among sows and provides boar stimulus to initiate cycles.

The summer and fall months are periods of reduced cycling in sows. The effect of this is minimal if the previously mentioned practices are utilized and good heat detection methods are followed.

The diagnosis of anestrous problems should be based upon heat detection and breeding records. Eighty percent of the gilts should be cycling regularly by 8 months of age, or an average of 4% of the gilts of that age should be in heat each day. Between 85-90% 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, over-conditioning or pain associated with breeding. Normally young boars begin aggressive mating behavior by 5-6 months of age. Those that are not sexually active by 7.5 months are problem boars. Rarely is this problem related to a deficiency of male hormone; consequently, hormone therapy gives poor results. More often, the problem can be traced to a lack of breeding experience or to the boar's ancestry. 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, heat stress, over-conditioning 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 also may cause sufficient pain to inhibit sexual activity. Some boars may mount sows but be 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), incomplete erection or short penis syndrome. Usually these boars can expose only the spiral tip of the penis while attempting to mate. These are heritable conditions, and affected boars should not be used for breeding stock production. Boars with fibrous tags often can 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 are better teasers. Gilts that aggressively refuse the male should be culled as undesirable genetic stock. Shy gilts that simply avoid the boar when in estrus may breed normally with additional boar experience. However, it is more desirable to select replacement gilts that readily express estrous behavior at an early age. Sows or gilts that object to entry of the boar may have cervical, vaginal or urethral damage from prior breeding or farrowing.

Bleeding at Mating

Hemospermia (blood in the semen) has been clinically associated with reduced conception rates. Bleeding boars should be examined for trauma of the shaft and 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 elimination of the cause are necessary for return to normal function. Bite wounds to the penis usually are 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. After 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, vaginal 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.

Type of Female	Frequency of heat detection	
	Once daily	Twice daily
Gilt	0 & 24	12 & 24
Sow	12 & 36	24 & 36

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

Repeat breedings, regular intervals. When more than 15% of the bred sows return to estrus within 18 to 23 days, both male and female infertility must be investigated. Primary considerations are boar infertility and poor timing of matings that result 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 per 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 to 6 sows weaned per week). When hand-mating or artificial insemination (AI) is employed, heat detection arid 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. That interval is estimated tobe 30-36 hours in gilts and 38-44 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.

Double-mating increases conception rates by 10-30% because it increases the chance of breeding near ovulation. Nearly all the sows and at least 70% of the gilts should have double services if adequate heat detection methods are used. Boars exposed to high environmental temperatures (greater than 90°F) for several days 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. Conversely, 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 be detected overly by evaluating the breeding record (farrowing rate and litter size) of individual boars. When an individual sow or gilt returns to estrus repeatedly at regular intervals after breeding, 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 or at breeding. Most of the affected sows return to normal fertility by the next estrus unless a chronic urinary tract infection exists. The sow with a urinary tract infection may have bloody urine. A few animals may have a noticeable vaginal discharge at approximately 16-17 days after breeding as they abort the pregnancy. The boar with preputial infection often is 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. It occurs much more frequently in gilts than sows.

Eperthrozoonosis (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 eperthrozoonosis.

Repeat breeding with a 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 and when bred females are moved and mixed during early pregnancy (up to 4 weeks postbreeding).

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 that may cause this problem. Bacterial agents associated with lower conception rates and delayed return toheat include a wide variety of organisms. *Staphylococcus* species (spp.), alpha- and beta-hemolytic *Streptococcus spp., Escherichia coli, Pasteurella multocida, Actinobacillus spp.* and *Eubacterium suis* are commonly present in the vagina and occasionally are introduced into the uterus. Achronic leptospirosis infection may cause repeat breeding in sows, but abortions are usually seen in other sows in the herd. 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, 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 also are available.
4. Diagnostic procedures for early pregnancy detection, including blood tests for progesterone or estrone sulfate, and ultrasonic 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 as normal in the swine breeding herd. The number increases slightly during the 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 *Actinobacillus* pleuropneumonia cause systemic disease, fever, and abortion in 2-14 days. They frequently cause abortion storms. PRRS normally follows a similar pattern. Sick sows are observed first, followed by abortions and later by stillborn, weak pigs and mummies. Nursing and weaned pigs often will have pneumonia. A viral agent is the most likely cause. In Europe a similar syndrome known as Porcine Epidemic Abortion and Respiratory Syndrome (PEARS) has been associated with a new viral isolate named the Lelystad virus. Researchers in the United States have isolated a viral agent (BIAH-001 responsible for causing PRRS which seems to differ antigenically from the Lelystad isolate.

Leptospirosis and brucellosis usually cause abortions without prior evidence of systemic disease. Leptospira bratislava is a recently investigated serotype which appears to be widespread in swine herds and has been isolated from aborted fetuses. Its incidence in abortion storms and swine reproductive failure syndrome is very low. Toxoplasmosis and mycotic infection cause sporadic abortions of a 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 systematic disease in the sow. These aborted pigs have cherry red tissues. Zearalenone is a mycotoxin produced in moldy feeds which has been associated with causing abortions. Aflatoxin, ergot and vomitoxin 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 also can 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 during the winter when

sows are on limited feed and lie on cold concrete floors. Diagnostic procedures for detemiining 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 pseudorables, 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 35-90 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 such as EMC, Enteroviruses and the Swine Reproductive Respiratory Syndrome, may cause mummies in the litter. Parvovirus has been diagnosed most commonly with mummies 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. Fetusesusually 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. 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 boars and older sows or their manure generally improve seroconversion rates. Additionally, the gilts should develop immunity to other viral agents in the herd. Gilt herds which have been maintained in isolation for disease control may rely on prebreeding vaccination for parvovirus protection.

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 evidence that parvo caused fetal loss unless blood samples also have 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 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 if these agents are present.

Overweight sows and gilts or those subjected to heat stress have higher stillbirth rates. Likewise, sows or giltst hat are uneasy in the farrowing facilities or are 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 fewer than 7 pigs. Major factors affecting litter size are breed and heterosis of the dam, number of previous litters (parity of the sow), duration of prior lactation, and adequacy of male services. It is obvious that breed and heterosis of the dam will

influence the number of pigs farrowed. Selecting gilts from prolific dam and sire breed lines will generally increase litter size.

Litter size generally increases with each parity beyond the second litter, but litter size weaned is generally reduced after 6 litters. To maintain maximum litter size and replacement efficiency, a herd should be approximately 25-30% first and second litter sows.

Breeding sows at less than 21 days after farrowing will generally reduce litter size. Litter size tends to increase as the interval from previous farrowing is increased, up to about 35 days. However, total pigs per sow per year are significantly higher with the shorter lactation period. The appropriate weaning age for a given production unit will depend upon nursery management and the reproductive response of the weaned sows.

Inadequate boar coverage also will decrease average litter size. Subfertile or overused boars can cause smal llitters. 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 hand-mating, the boar/sow ratio recommended is 1 boar per 2 sows weaned weekly. This results in approximately 4 matings per week for each boar. Pasture and pen mating ratios should be about 1 boar to each 2 to 3 sows weaned per week with the boars working in groups of 2 in a pen of 8-12 sows and another 2 boars rotated in their place at 24 hour intervals. This maximizes boar usage through less competition but minimizes overuse of individual boars.

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 to 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 incorrectly called pregnant (false positive) can be identified by good heat detection methods but an estrus during the late summer and fall months may mask the misdiagnosis. Pseudopregnancy in the sow occurs when noncycling sows or gilts are exposed to estrogenic agents such as zearalenone (sometimes produced in moldy feed). Concentrations of 4-10ppm zearalenone will cause an estrus. 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 also may 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 with a thorough review of production records. Many times several problems exist simultaneously, but the attention directed toward these problems often improves the reproductive management and productivity even when a diagnosis has not been confirmed.

Information developed for the Pork Information Gateway, a project of the U.S. Pork Center of Excellence supported fully by USDA/Agricultural Research Service, USDA/Cooperative State Research, Education, and Extension Service, Pork Checkoff, NPPC, state pork associations from Iowa, Kentucky, Missouri, Mississippi, Tennessee, Pennsylvania, and Utah, and the Extension Services from several cooperating Land-Grant Institutions including Iowa State University, North Carolina State University, University of Minnesota, University of Illinois, University of Missouri, University of Nebraska, Purdue University, The Ohio State University, South Dakota State University, Kansas State University, Michigan State University, University of Wisconsin, Texas A & M University, Virginia Tech University, University of Tennessee, North Dakota State University, University of Georgia, University of Arkansas, and Colorado State University.