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EC89-1908 Swine Reproductive Problems : Noninfectious Causes

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Swine Reproductive Problems:
Noninfectious Causes

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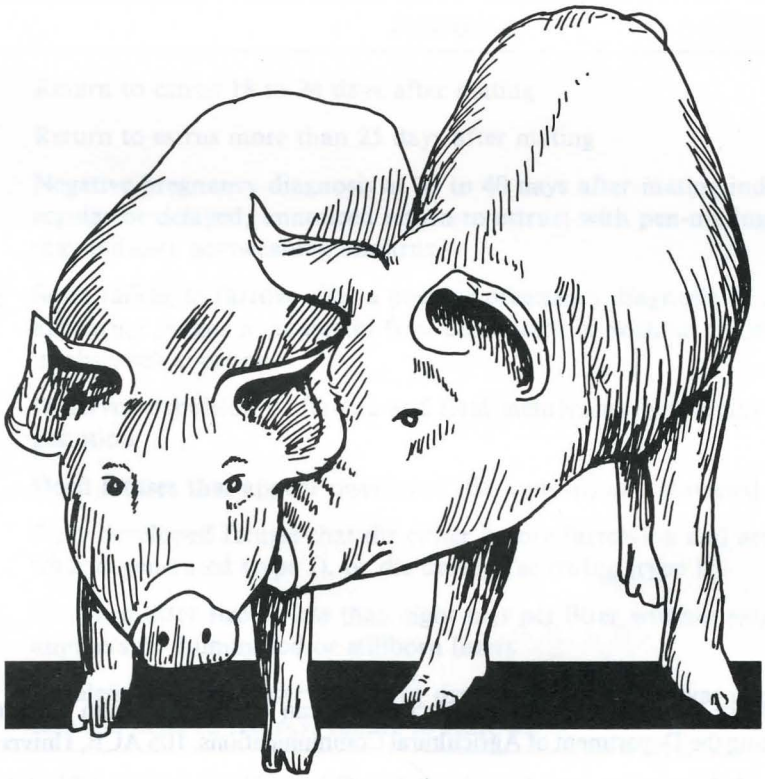

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Leo E. Lucas, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.

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The following publications are mentioned in this manuscript and can be obtained from University of Nebraska County Extension Offices or by contacting the Department of Agricultural Communications, 105 ACB, University of Nebraska, Lincoln, NE 68583-0908.

EC88-210	Swine Diet Suggestions
EC89-212	Swine Reproductive Management
G89-926	Swine Reproductive Problems: Infectious Causes

Swine Reproductive Problems:

Noninfectious Problems

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Many swine reproductive problems result from deficiencies in management, nutrition, environment and genetics, rather than from infections with a specific reproductive pathogen.

Efficient diagnosis of swine reproductive failure is possible only when reproductive records are accurately collected and analyzed. Categorizing each reproductive problem as to the time it occurred in the reproductive cycle allows diagnostic efforts to be focused on the problems most likely to occur during a particular phase of the reproductive cycle. *Table I* indicates clinical signs of swine reproductive failure and their usual rate of occurrence. Since reproductive problems may be caused by a variety of factors, it is helpful to have detailed knowledge of all management procedures.

This publication discusses noninfectious reproductive problems associated with breeding, gestation, and parturition. Infectious causes of swine reproductive problems are discussed in University of Nebraska NebGuide G89-926, *Swine Reproductive Problems—Infectious Causes.*

Problems Associated With Breeding

The problems most often encountered during the breeding phase include postweaning anestrus (delayed estrus), bleeding after service, estrous detection in recently weaned sows and gilts, delayed puberty in gilts, inadequate sexual behavior in boars, and copulation problems.

Table I. Clinical signs of swine reproductive failure[a]

Clinical Sign	*Description*	*Normal Rate*
Regular return to estrus	Return to estrus 18 to 24 days after mating	<12%[b]
Delayed return to estrus	Return to estrus more than 25 days after mating	<3%[b]
Not pregnant via ultrasonographic pregnancy test	Negative pregnancy diagnosis at 30 to 40 days after mating indicates a regular or delayed, unnoticed return to estrus; with pen-mating, it also may indicate postweaning anestrus	<10%[b]
Fail-to-farrow; not-in-pig	Sows failing to farrow after a positive pregnancy diagnosis or after appearing pregnant, indicates fetal death with or without resorption or unobserved abortion	<2%[b]
Abortions	Observed expulsion of fetuses and fetal membranes before day 110 of gestation	<2%[b]
Mummified fetuses	Dead fetuses that appear discolored (dark green) and shriveled	<1%[c]
Stillbirths	Fully developed fetuses that die either before farrowing and are somewhat degenerated (type I), or die during farrowing (type II)	<8%[c]
Small litters	Liveborn litter size of less than eight pigs per litter without excessive numbers of mummified or stillborn litters	<15%[d]
Vaginal discharges	Purulent material observed on, or draining from the vulva; may result in delayed returns, failure to farrow	<2%[b]

[a]Overall farrowing rate (no. farrowed/no. serviced) should exceed 85 percent and pigs born alive/litter ≥ 10.0.

[b]As a percentage of females served.

[c]As a percentage of total pigs born.

[d]As a percentage of litters farrowed.

(Reference: Swine Consultant, July 1988.)

Postweaning Anestrus. Delayed return to estrus (more than nine days after weaning) is associated with parity, season, lactation length, body condition, breed of female, and mycotoxins.

Parity. The number of first litter females recycling within nine days after weaning (21 to 28 day lactation) is often 30 percent less than second and third litter sows. The increase in average number of days from weaning to estrus can range from eight to 20 days in first litter sows when compared with multiparous sows. In addition, there is less variation in days to estrus and percent cycling as parity number increases.

Season. Percentage of sows returning to estrus within nine days after weaning may be reduced eight to 20 percent during the summer months of June to September when compared with the average for the remaining eight months. Also, there is a four to seven day increase in the interval from weaning to estrus.

A combination of shade and sprinklers appears to minimize heat stress experienced outside. *Shade alone may not be adequate.* Evaporative cooling in well-insulated, totally enclosed buildings, and thermostatically controlled sprinklers in curtain-sided buildings with insulation overhead, usually provide adequate relief from heat stress.

Lactation length. Research shows that as lactation length is reduced, the interval from weaning to estrus increases *(Figure 1)*. There is also more variation (range) between sows in the weaning group for number of days from weaning to estrus with earlier weaning.

Body condition. Sows in poor body condition at weaning, often fail to cycle after weaning, or take longer to return to estrus. Proper feed intake during gestation and lactation is important to maintain good body condition. First parity sows that are bred at light body weight (220 to 230 lbs) or that raise large litters (10+ piglets) often have postweaning anestrous problems due to poor body condition at weaning. Information on proper feeding of sows can be found in University of Nebraska publications, EC88-210, *Swine Diet Suggestions,* and EC89-212, *Swine Reproductive Management.*

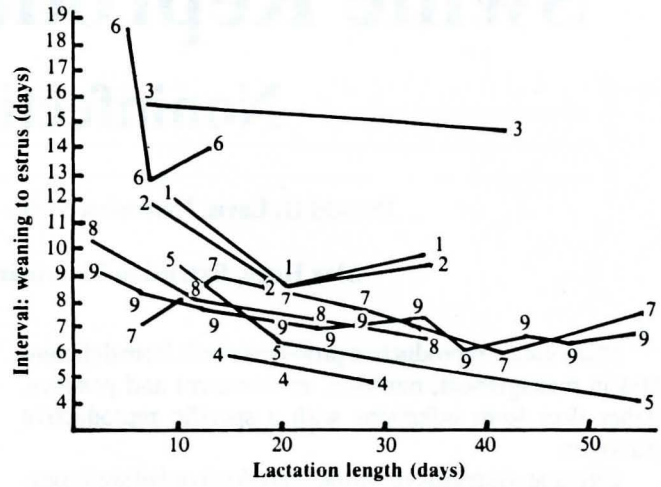

Figure 1. The effect of lactation length on the interval from weaning to to estrus. (Numbers refer to different experiments.) (Reference: Reproduction in the Pig, 1980).

Breed of sow. Studies that maintained different breeds of sows under the same environment and management show differences between breeds for the weaning to estrous interval *(Table II)* and percentage of sows exhibiting estrus *(Table III)*. The greatest variations in these traits occur after weaning the first litter. It is not possible to absolutely categorize breeds according to weaning to estrous interval because this trait is highly influenced by environment.

Mycotoxins. Zearalenone (four to 10 ppm) or other mycotoxins in the diet cause delayed returns to estrus. Sows and gilts exposed to estrogenic agents such as zearalenone or zearalenol will not cycle because they are in a state of pseudopregnancy. These animals react inaccurately to pregnancy testing devices that detect fluid in the uterus. These animals usually will not cycle until noncontaminated feed is provided. It may take several days for females to start cycling after returned to good feed. Hyperestrogenism is more common

Table II. Postweaning estrous interval (days) for first, second and third parity Large White, Landrace, Yorkshire, and Chester White Sows

	Breed				
Parity	*Large White*	*Landrace*	*Yorkshire*	*Chester White*	*Over all breeds*
1	7.8 ± .6 (83)[b]	6.6 ± .6 (70)	9.3 ± .8 43)	14.0 ± 1.0 (28)	9.4 ± .4 (224)[g]
2	6.0 ± .6 (68)	4.9 ± .6 (66)	6.0 ± .8 (42)	7.0 ± 1.0 (27)	6.0 ± .4 (203)[f]
3	6.4 ± .4 (39)	5.2 ± .7 (57)	6.8 ± .9 (37)	4.6 ± 1.2 (18)	5.8 ± .4 (171)[f]
Total	6.7 ± .4 (210)[cd]	5.6 ± .4 (193)[c]	7.4 ± .5 (122)[de]	8.6 ± 0.6 (73)[e]	
Overall					7.1 ± .2 (598)

[b]No. in parenthesses are the no. of observations.

[cde]Means in the same row that do not have a common superscript differ (P< .01).

[fg]Means in the same column with different superscripts differ (P< .01).
(Reference: J. Anim. Sci. 61:1327, 1985).

Table III. Percentage of females showing estrus as related to breed and days postweaning

	Breed							
	Large White		*Landrace*		*Yorkshire*		*Chester White*	
Days postweaning	*1*[a]	*2 and 3*[b]	*1*[a]	*2 and 3*[b]	*1*[a]	*2 and 3*[b]	*1*[a]	*2 and 3*[b]
1	0	3.1	2.3	7.3	0	2.4	2.9	4.0
4	10.2	33.1	27.9	60.2	9.4	33.3	14.7	48.0
5	38.6	70.1	52.3	84.6	26.6	73.8	32.4	74.0
6	50.0	79.5	59.3	91.1	45.3	81.0	35.3	78.0
7	63.6	84.3	63.9	94.3	45.3	84.5	35.3	78.0
8	76.1	89.0	67.4	95.9	50.0	86.9	35.3	78.0
9	78.4	91.3	69.8	95.9	50.0	88.1	38.2	82.0
10	81.8	92.1	70.9	95.9	51.6	89.3	38.2	82.0
14	85.2	92.1	73.3	95.9	53.1	90.5	52.9	82.0
21	86.3	96.2	77.9	98.4	53.1	90.5	52.9	82.0
28	93.2	97.6	80.2	100.0	67.2	92.9	82.4	86.0
30	94.3	98.4	80.2	100.0	67.2	94.0	82.4	88.0
Females not detected in estrus, %	5.7	1.6	19.8	0	32.8	6.0	17.6	12.0

[a]First parity.

[b]The second and third parities are combined because the values were similar.
(Reference: J. Anim. Sci. 61:1327, 1985).

in gilts than sows. Since mycotoxins are not always uniformly distributed in feed, the finding of one ppm or more of zearalenone is reason for concern.

Vomitoxin (deoxynivalenol) at one ppm or greater can cause poor appetite, feed refusal and, consequently, poor milk production in lactating sows. It also causes excessive loss of weight during lactation, and delayed return to estrus after weaning.

Bleeding after service. The most common reason for the appearance of blood after breeding is bite wounds on the boar's penis. The amount and duration of bleeding largely is related to the extent of the injury. These injuries are less common in individually housed boars than in group-housed boars or those used for pen mating.

Bite wounds usually require two to four weeks to heal. Severe wounds may require surgical repair or more healing time. Systemic antibiotic therapy may be helpful.

If a damaged penis has not healed after four weeks of complete sexual rest, the boar probably should be culled. Occasionally a gilt will bleed after mating, as a result of a rudimentary membrane (persistent hymen) being torn at mating or the urethra orifice being injured by the boar's penis.

Inadequate boar libido. Inadequate boar sexual behavior is caused by psychological, physiological, environmental or management factors. Factors that may influence a boar's sexual behavior are age, body condition, disease, injury, rate of usage, breed, season, housing and handling procedures (boar handler's attitude). Hormone therapy is not recommended to stimulate boar sexual behavior. Prolonged hormone therapy causes reduced fertility.

Age. Generally, inadequate sexual behavior occurs in young boars. If boars do not show sexual aggressiveness by seven and one-half to eight months of age, they should be culled. A method to evaluate boar sexual behavior is described in the University of Nebraska publication, EC89-212, *Swine Reproductive Management*.

Old boars in good body condition that have stopped working might be stimulated to mate by placing them in fenceline contact with a strange, mature, aggressive boar that champs and produces abundant saliva. This procedure also can be used for stimulating young boars.

After the problem boar has been stimulated, he immediately should be allowed to mate a sow. **Precaution: Be extremely careful when moving stimulated boars.**

Body condition. Both under and overfeeding can be a cause of low libido. Sexual behavior may be low because fat boars become lazy and thin boars may lack energy to mate.

Disease and injury. Diseases that sap the boar's energy or cause pain with mating attempts (i.e., arthrosis of shoulder joints) cause him to be unwilling to work.

A boar with bad feet is not able to give his best performance. Regular foot baths (10 percent copper sulfate solution) help prevent foot problems in boars maintained in enclosed housing.

Back injuries and bruising from falling off a sow cause pain that makes the boar reluctant to mount. The surface of the breeding pen should be firm and not slippery to prevent such injuries.

Usage. Boars used excessively (i.e., one service daily for

two to three weeks) may exhibit a decrease in sexual aggressiveness.

Season. Normally, boars are willing to mate with sows in estrous at temperatures up to 80°F; thereafter they become less willing to mate. The courting behavior of boars is clearly depressed at 104°F. Heat stress causes more of a reduction in libido in fat boars than in good body condition boars.

Breed. Standardized sexual behavior evaluation studies have not been conducted to determine whether true sexual behavior differences occur both between and within the various breeds of boars. It is possible that more differences in sexual behavior occur within a breed than between breeds.

On average, young crossbred boars are more sexually aggressive than young purebred boars; however, there is little difference between crossbred and purebred boars in their ability to impregnate sows after boars gain sexual experience.

Housing. Some boars may have decreased sexual aggressiveness and fertility levels when housed in a group because of homosexual activity. Group-housed boars should not be maintained next to estrous sows to minimize the problem.

Handling procedures. The attitude of the boar handler is important. Boars should be handled gently but firmly, as physical abuse will stimulate physical aggressiveness and diminish sexual aggressiveness.

If a young, novice boar appears to be getting frustrated after 10 minutes of attempting to mate a sow, remove the sow and let him try again the next day. Be sure the female is standing firmly and is about the same size as the boar (first litter sows are preferred). Young novice boars that do not mount but are sexually aggressive should be handled in a manner that allows them to observe older boars mate.

Copulation problems. Anatomical defects may prevent boars from copulating. Failure to extrude the penis in young boars generally is caused by a persistent frenulum (tied penis). The frenulum (adhesions arising during fetal development) usually disappears by the time the boar reaches six months of age. The defect can be corrected surgically, but the offspring should not be kept for breeding because it is suspected that this defect is heritable.

Failure to copulate sometimes may be due to abnormalities in the vulva or vagina of a gilt; allow the boar to mate another gilt before faulting the boar.

A limp or infantile penis is an abnormality suspected to be heritable. In this case the penis is smaller than normal and very limp. The boar is incapable of mating because he is unable to achieve or maintain an adequate erection.

Hesitancy or lack of willingness to breed sometimes is caused by irritation of the boar's penis as a result of thrusting against the coarse sow hair, masturbation, or foreign matter (i.e., straw or hay) being pulled into the prepuce.

Another problem that may be observed in boars is a tendency to extend the penis into the preputial diverticular pouch at mating, or as a means of masturbation. The penis remains in the sheath but the thrusting movements can be observed through the sheath. This vice may cause an ulceration of the lining of the diverticulum and affect the boar's ability to mate.

Delayed puberty. Factors to evaluate when determining the reason(s) gilts are slow to reach puberty follow.

Age of gilt at boar exposure. Gilts exposed to boars too early during development (before 125 days of age) will have a delay in reaching puberty compared to gilts at 160 to 170 days of age having contact with a mature boar.

Age of boar. Gilts should be exposed to sexually mature boars more than 10 months of age, as they produce more pheromones (sexual odor).

Season. Generally, gilts born in winter and spring are delayed in expressing first estrus as compared to gilts born in summer or fall. High environmental temperatures (more than 85°F) delay puberty, interfere with expression of behavioral estrus, reduce feed intake, and may lower ovulation rate in cycling gilts.

Method housed. Rearing gilts in enclosed housing interferes with expression of estrus in most breeds. The failure of gilts to express estrus by seven to nine months of age is primarily the result of delayed puberty, but also may be caused by an increased incidence of behavioral anestrus (ovulation unaccompanied by estrus).

Space per gilt. Gilts should be provided six square feet of floor space from 100 to 150 pounds and eight square feet from 150 to 240 pounds.

Animals per pen. Avoid housing pre-puberal gilts in small groups (three or less animals per pen) or large groups (50 or more animals per pen) in confinement, as it delays puberty. Individually penned or tethered gilts are delayed in reaching puberty compared to group-reared gilts.

Breed of gilt. Numerous environmental influences make it difficult to reach absolute conclusions about breed differ-

Table IV. Average age (days) at puberty in gilts by breed

	Study Number				
Breed	*1*	*2*	*3*	*4*	*5*
Yorkshire (Y)	199.8	221	200.7	207.1	247
Duroc (D)		224	197.0	221.1	
Spot (S)			195.1		
Landrace (L)	184.7	173	195.4		
Hampshire (H)		207		192.7	
Large White (LW)		211			
Poland China (PC)					226
Y x L	184.2		196.5		
Y x S			187.1		
Y x D			197.9		
Y x PC					222
D x S			185.2		
D x L	198.7		186.2		
L x S			188.7		
L x LW				175.3	

ences. However, among purebreds, European Landrace are generally the youngest at puberty, while American Yorkshire and Duroc tend to be oldest at puberty *(Table IV)*. Crossbred gilts generally express first estrus one to four weeks earlier than the average of the parent breeds represented in the cross.

Beneficial stress. Gilts transported, mixed, relocated and exposed to mature boars at 160 to 170 days of age attain puberty earlier than gilts not receiving these stress factors.

Feed intake. Restricting feed or energy intake by more than 30 percent of full feeding during the finishing phase may delay puberty and decrease body weight at puberty. Excessive weight gain and body fat should be prevented as these two factors contribute to unsoundness and fertility problems.

Estrous detection. Poor estrous detection in sows generally is due to excessive exposure of sows to mature boars. The key to detecting estrous efficiently and effectively is to be sure the females (sows and gilts) do not receive boar stimuli (sight, sound, smell) prior to heat checking. This is accomplished by keeping the boars segregated from the females and detecting estrous in a neutral area. Additional information on estrous detection can be found in University of Nebraska publication EC89-212, *Swine Reproductive Management.*

Problems Associated With Gestation

Problems most often encountered during gestation include repeat breeders, abortions, vaginal discharges and sows failing to farrow.

Repeat breeders. Sows returning to estrus after mating should be categorized as recycling at regular (18 to 24 days after mating) or irregular (25 + days after mating) intervals. This step is important in accurately identifying the cause(s) of repeat breeder problems.

Regular intervals. The type of mating system used (pen- vs hand-mating) is an important consideration because sows pen-mated in groups usually have a higher percentage of repeat breeders than do hand-mated groups. Factors that can contribute to sows recycling at regular intervals are presented in *Table V* (pen mating) and *Table VI* (hand-mating). For detailed solutions to these problems see University of Nebraska publication EC89-212, *Swine Reproductive Management.*

Irregular intervals. The most common noninfectious reasons for sows returning to estrus at irregular intervals after mating are embryonic death, hormonal imbalance or estrus detection problems. Embryonic death occurs when sows are: a) heat stressed (temperatures above 85°F) during the first 30

Table V. Noninfectious factors contributing to sows recycling at regular intervals after being pen-mated

Method of Weaning	*Contributing Factors*
Group-weaned Same day	Too many sows weaned for available boar power
	Too few breeding pens
	Too many sows per breeding pen
	Too many sows in estrus at one time per pen
	Inadequate number of known working boars per breeding pen
	Inadequate rotation of boars for sexual rest
	Inadequate length of sexual rest for boars
	Inadequate ratio of weaned sows per boar
	Sexual behavior problems of boars
	Extreme heat stress effects on males and females
	Thin sows, especially first litter sows
Group Split-weaned	Inadequate number of days between weaning each sub-group of sows
	Too many sows weaned per sub-group for available boar power
	Too few breeding pens
	Inadequate distribution of weaned sows among breeding pens
	Too many sows in estrus at one time per pen
	Inadequate number of known working boars per breeding pen
	Inadequate rotation of boars for sexual rest
	Inadequate length of sexual rest for boars
	Inadequate ratio of weaned sows per boar
	Sexual behavior problems of boars
	Extreme heat stress effects on males and females
	Thin sows, especially first litter sows

Table VI. Noninfectious factors contributing to sows recycling at regular intervals after being hand-mated

A ratio greater than one boar to 2.5 weaned sows is used when sows are mated two to three times per estrous period.
Females are mated only once.
Copulation is less than 1.5 minutes.
A solid estrous stance is not obtained.
Boars are over-worked due to excessive number of sows recycling from an earlier mating.
Males and females are exposed to temperatures above 85 °F (heat stressed).
Sows are too thin at weaning, especially first litter sows.
Group-penned boars have excessive homosexual activity because they are housed too close to estrous sows and working boars.
Semen quality is inadequate; i.e., less than three billion motile sperm are being inseminated, sperm motility is less than 70 percent, or sperm cell abnormalities are above 20 percent.
Blood is flowing out of the female reproductive tract during and after mating.

days of gestation; b) physically stressed (i.e., regrouping) during the intrauterine process of ova transport, blastocyst migration, spacing and implantation (three to 18 days after breeding); and c) receiving large doses (60 ppm) of the mycotoxin zearalenone after mating.

Hormonal imbalances occur when females are consuming mycotoxin-contaminated feed. Research shows that diets contaminated with four to 10 ppm zearalenone will cause anestrus. Mycotoxins cause irregular estrous cycles because during the period contaminated feed is consumed the females are in anestrus, and once the contaminated feed is removed from their diet, the females start cycling.

However, it may take several days for females to start cycling.

Sows that return to estrus 36 to 42 days after mating are most likely cycling normally, but they probably have not been checked properly for estrous activity. The major point to remember when estrous checking is to not allow females to receive boar stimuli (sight, sound, odor) for one to two hours prior to estrous detection.

Failure to Farrow. Sows that fail to farrow are either pseudopregnant (false pregnancy) or have not been accurately detected in estrus, as discussed previously.

Pseudopregnancy can occur when mature gilts consume a diet containing three ppm or more of zearalenone. The percentage of animals showing pseudopregnancy has varied from 25 percent for animals consuming a diet containing three ppm zearlenone to 87.5 percent for females consuming six to nine ppm. Necropsy of the reproductive tract at 80 days of gestation has revealed an abnormal uterus and ovaries (enlarged, flaccid, edematous uteri; very little lumen area; no follicles over two mm; and large, pinkish, solid, vascularized corpora lutea).

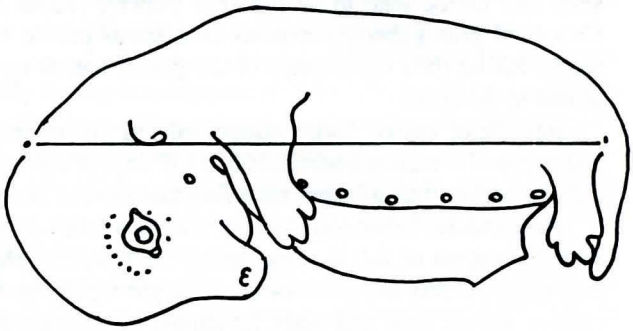

Figure 2. Diagram showing measurement of body length for pig embryos. (A straight line begins at the tail-root and ends where it cuts the profile of the head after passing below the external ear in fetuses more than 26 days of age.) (Reference: The Embryonic Pig, 1971).

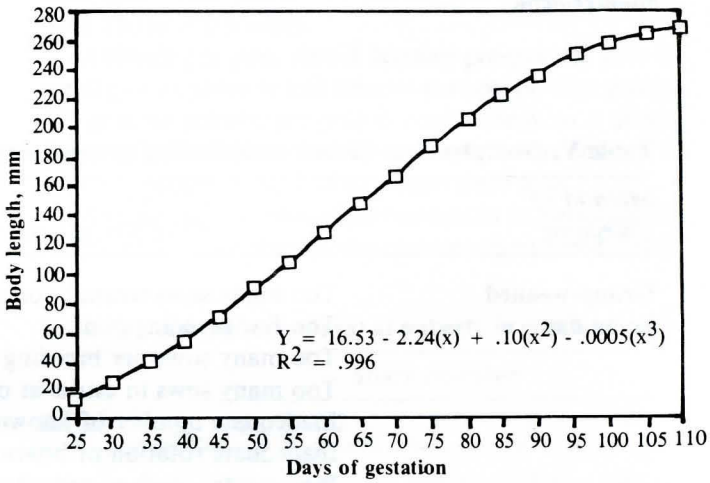

Figure 3. Relationship between fetal body length and day of gestation

Abortions. Determining the cause of an abortion problem is often complex and frustrating because the agent that produced or caused abortion is no longer present when the abortion occurs. It has been estimated that 60 to 70 percent of abortion problems are due to noninfectious causes such as environmental stress (temperature extremes), low feed intake and systemic illness.

The stage of gestation at the time of abortion can be estimated by ascertaining the body length of the fetuses as shown in *Figure 2*. Use *Figure 3* to estimate fetal age at the time of abortion.

When maternal failure is the cause of terminating pregnancy, the fetuses will be the same age. Often when fetal death occurs, fetuses within the litter will have different ages, with the youngest ones (shortest body length) having

died some time earlier than when the abortion occurred. **NOTE:** Calcification of the fetal skeleton begins at about 35 days of gestation, with immunocompetency (functioning immune system) in the fetal pig occurring around 70 days of gestation.

Vaginal discharges. Vaginal discharges may originate from the reproductive or urinary tracts. Management practices that need to be evaluated as possible sources of disease transmission are sanitation of boar pens/stall, sow pens/stall, breeding pens, and equipment used for artificial insemination and intrauterine infusion. Also evaluate hygienic techniques used by the caretaker when assisting boars with copulation or delivering piglets during difficult births at farrowing.

Prolapse. Prolapse is an eversion or turning inside out of either the vagina (birth canal), rectum or both. There are seven common causes of prolapse: 1) constipation resulting from shortage of water or lack of fiber in the diet; 2) sows too fat; 3) excessive slope on the floor at the rear of gestation or farrowing crates or tether stalls; 4) mycotoxins (zearalenone or zearalenol) in the diet; 5) relaxation of pelvic muscles in aged sows; 6) piling during cold weather and 7) genetic tendency.

The cause of prolapse problems should be investigated and eliminated. Treatment generally is accomplished by replacing the prolapse and suturing the vulva or rectum. A veterinarian should be consulted before attempting to replace a prolapse.

Problems Associated With Parturition

The problems most often encountered during parturition are stillbirths, mummified fetuses, low numbers born alive, and weak piglets.

Stillbirths. True stillborn piglets have the appearance of live littermates, but their lungs do not float in water. Stillbirths can occur prepartum (Type I) or intrapartum (Type II). Type I stillbirths usually are due to infectious agents, and Type II usually are due to noninfectious causes. Type II stillbirths usually are more frequent than Type I stillbirths.

The most common noninfectious causes of Type II stillborn piglets are: a) suffocation of piglets during birth (anoxia); b) birth of large litters (11 or more piglets); c) exposing sows to high environmental temperature (102°F) during last two weeks of gestation; d) exposing sows to high levels (150 ppm) of carbon monoxide in the farrowing facility; e) prolonged interval (30 or more minutes) between birth of piglets; f) sows farrowing their seventh or greater litter; g) possibly low hemoglobin level in sows (below nine grams per 100 ml of blood); and h) gestation feed containing ergot contaminated rye. Sows that had stillborn piglets in a previous litter are likely to produce stillborns in subsequent litters, especially if they are seventh parity or greater.

When piglets suffocate at birth a release of meconium (greenish-brown fetal feces) occurs into the amniotic cavity. The presence of meconium on the skin and in the respiratory tract of the piglet is one indication of fetal suffocation.

The majority of intrapartum deaths occur towards the end of the farrowing period.

Weak piglets (birth to seven days of age). Many factors are associated with weak piglets from birth to seven days of age. The major factors are low birth weight (less than 1.8 pounds), large litter size in older parity sows, lack of colostrum intake, defective nipple or no nipple, prolonged interval between birth of piglets, anemic sows and piglets, mastitis (inflammation of mammary gland), metritis (inflammation of the uterus), agalactia (nonsecretion or imperfect secretion of milk) due to molds and lack of water consumption, low temperature (chilled piglets), environmental gases, and energy or vitamin E/selenium deficiencies in sow diets.

Small litter size born live. Counting the number of piglets per litter will not adequately identify whether a problem truly exists when small litters are born.

To identify whether a true litter size problem exists on a whole herd or individual sow basis requires collecting and analyzing extensive reproductive records. It is important that each swine operation sets its own target for litter size, as the difference between target level and actual production level requires a close evaluation of genetic and environmental effects. Major noninfectious factors that can influence litter size are presented in *Table VII*.

Table VII. Influence of noninfectious factors on litter size born

Boar management factors

A. Excessive boar usage (seven + services/boar/week for mature boars; more than three services/boar/week for seven to eight month old boars)
B. Homosexual activity in group-housed boars
C. Environmental temperatures above 85 °F
D. Long periods (more than four weeks) of sexual rest before mating first sow

Sow management factors

A. Sows mated at improper time
B. Unsupervised mating (pen mating)
C. Sows mated less than two times per estrous period
D. Excessive weight loss during lactation, especially first litter sows
E. Excessive number of young (first litter) or old (seven or more litters) sows
F. Short lactation length (21 or less days)
G. Mating gilts at pubertal estrus
H. Not "flushing" gilts before mating
I. Heat stress (85 °F or more) of bred females during first 30 days and last two weeks of gestation
J. Improper estrous detection procedure when hand-mating
K. Breed of sow (purebred vs crossbred)
L. Breed combination in crossbred sows
M. Physical stress during first 30 days of gestation
N. Nutrition program of first litter sows during gestation and lactation

Notes