

1989

EC89-212 Swine Reproductive Management

Donald G. Levis

University of Nebraska-Lincoln, donlevis@hotmail.com

Dwane R. Zimmerman

Alex Hogg

Follow this and additional works at: <http://digitalcommons.unl.edu/extensionhist>

Levis, Donald G.; Zimmerman, Dwane R.; and Hogg, Alex, "EC89-212 Swine Reproductive Management" (1989). *Historical Materials from University of Nebraska-Lincoln Extension*. 4647.
<http://digitalcommons.unl.edu/extensionhist/4647>

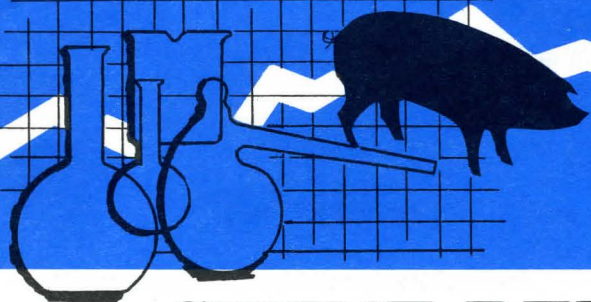
This Article is brought to you for free and open access by the Extension at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Historical Materials from University of Nebraska-Lincoln Extension by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Agri
S
85
E7

Nebraska Cooperative Extension EC 89-212

(Revised 1989)
UNIVERSITY OF NEBR.
LIBRARIES

OCT 30 1989



UNIVERSITY
of NEBRASKA

SWINE REPRODUCTIVE MANAGEMENT



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.



Cooperative Extension provides information and educational programs to all people without regard to race, color, national origin, sex or handicap.

Swine Reproductive Management

Donald G. Levis, Extension Swine Specialist
 Dwane R. Zimmerman, Professor, Swine Physiology
 Alex Hogg, Extension Veterinarian
 William T. Ahlschwede, Extension Swine Specialist
 Duane E. Reese, Extension Swine Specialist
 Michael C. Brumm, Extension Swine Specialist

CONTENTS

BOAR SELECTION AND PREBREEDING MANAGEMENT.....	1
SELECTION AND PREBREEDING MANAGEMENT OF REPLACEMENT GILTS.....	4
MANAGING THE "ACTIVE" GILT POOL.....	6
BOAR MANAGEMENT - BREEDING PHASE.....	9
SOW MANAGEMENT - FARROWING AND LACTATION.....	13
SOW MANAGEMENT - WEANING TO ESTRUS.....	14
SOW MANAGEMENT - BREEDING PHASE.....	15
SOW MANAGEMENT - GESTATION.....	17
BREEDING HERD PERFORMANCE.....	20

The following publications are mentioned in this manuscript and can be obtained from the University of Nebraska Extension Offices or by contacting Department of Agricultural Communications, 105 ACB, University of Nebraska, Lincoln, NE 68583-0918.

EC 88-210 -	Swine Diet Suggestions
EC 88-217 -	Crossbreeding Systems for Commercial Pork Producers
EC 89-264 -	Artificial Insemination of Swine
G88-880 -	Boar Selection Guidelines for Commercial Pork Producers
G74-117 -	Alfalfa in Swine Diets

The goal of most swine producers is to produce more pigs per sow per year and to maximize profits. This can be accomplished by increasing the size of individual litters born alive, increasing the number of times a sow farrows in a year, and controlling fixed and variable costs.

The size of litters is influenced by ovulation rate, conception rate (egg fertilization rate), embryonic survival, lactation length, boar fertility, boar sexual behavior and physiological age (number of estrous periods after puberty) of gilts at breeding. The number of litters for an individual sow per year is influenced by boar sex drive and fertility, sow fertility, rebreeding interval,

lactation length, and number of days open before culling. Since many of the factors mentioned are influenced by genetics, nutrition, health, environment and reproductive physiology it is important that pork producers understand how these factors influence sow productivity. This publication provides answers to many of the questions concerning management of boars, sows and gilts for optimum reproductive performance.

BOAR SELECTION AND PREBREEDING MANAGEMENT

Why Is Boar Selection Important?

The selection and purchase of boars affects the economic well-being of a pork production enterprise in three major ways. The first is function, including the boar's ability to breed sows. The second is genetics, including crossbreeding systems and individual merit. The third factor is herd health security. Failure to make good selection decisions, both in source of boars and in individual boars can have grave financial results.

What Factors Should Be Considered in Boar Selection?

Boar selection involves selecting the source of the boar as well as the individual boar. In selecting source of boars, consider health, breed, genetic improvement programs and the supplier's service record. Individually, consider soundness, sexual behavior and genetic merit. Additional information about boar selection is available in the University of Nebraska NebGuide "Boar Selection Guidelines for Commercial Pork Producers", (G88-880).

Health. Buy boars from sources which represent minimum health risk to your herd. Buy from a brucellosis free herd that is qualified pseudorabies negative. Know the health history of the herd being considered as a source of replacement stock. This will help minimize the risk of introducing new diseases into the herd.

Breed. Buy boars of the breed or breeds which fit the crossbreeding system being used. Following the crossbreeding program will maintain high levels of heterosis and good pig survival. Breed choice will affect the breeding performance of the boars you buy as well as the reproductive rates of the gilts they sire. Whether purebred or crossbred boars are used, choose the breed or breed type appropriate to the crossbreeding system. Further details about crossbreeding systems are available in the Univer-

sity of Nebraska circular, "Crossbreeding Systems for Commercial Pork Production", (EC 88-217).

Genetic Improvement Programs. Boars produced by comprehensive testing and improvement programs are recommended. The improvement program should be appropriate for the use of the boar in the crossbreeding program. Boars which sire terminal cross market hogs should come from programs designed to produce rapid efficient lean gain, including high carcass merit. Boars to sire replacement gilts for terminal crosses should come from programs which improve sow performance as well as rate and efficiency of lean gain. Breeders who test and use test results from their own herds are the preferred sources of boars. Fast growing lean boars that are sound and exhibit sexual aggressiveness are preferred.

Soundness. Unsoundness of feet and legs is the main problem encountered with young boars. Observe the breeder's herd for signs of lameness, especially among market weight hogs. Soundness problems are reduced if boars are purchased from breeders whose production facilities are similar to those the offspring of the boar will experience.

Unsoundnesses of the reproductive system should also be avoided. Although much of the reproductive tract is within the body and not visible, inspection of the external organs will give a good indication of reproductive soundness. Examine the boars for testicle development. The testicles should be the same size with the epididymis prominent at the top of the scrotum. The testes should feel firm but not hard. If the testes are adequately developed and normal in appearance, the rest of the tract will probably be normal also.

Can Crossbred Boars be used successfully?

Crossbred boar use has become common in the more intensive production units. If the breeds represented fit the crossbreeding program, they can be used successfully. Research and producer experience indicate that crossbred boars are more aggressive breeders and produce higher farrowing rates than purebred boars. They are favorably spoken of to be more durable and less likely to leave the herd early.

What Age Should Boars Be When First Used?

Don't use boars before they are 7 1/2 to 8 months old. Some boars show sexual development as early as 5 months of age. However, they are not ready for regular service. Sexual development is a gradual process. Age is a better indication of sexual maturity than is body size. As age increases, semen volume and sperm production gradually increase.

When Should Boars Be Purchased?

For best results, buy new boars 60 days before intended use (5 1/2 to 6 months of age). The 60-day period allows new boars to be isolated, retested for pseudorabies and exposed to the microorganisms on the farm. If a problem arises, there is ample time for recovery before the breeding period.

How Should Newly Purchased Replacement Boars Be Managed and Introduced To the Breeding Herd?

Isolate all new boars a minimum of 60 days and look for signs of any infectious disease. The isolation area should be as far away as possible (500 feet and preferably more than 500 feet) from all other pigs on the farm. The exact distance needed between an isolation area and other pigs on the farm cannot be absolutely given because of such factors as terrain, wind pattern, infectiousness of microorganisms, and animate vectors of infectious microorganisms (cats, dogs, rodents, humans, etc.). Human movement to and from the isolation area should be minimized by designating only one individual to take care of the pigs in the isolation area once in the morning and once in the evening. The caretaker of the isolation area should always shower and completely change clothing and footwear before contacting other pigs on the farm. Implementing the following time schedule will minimize the chances of diseases being introduced with purchased boars:

Time (days)	Management Procedure
Days after arrival	
1 - 7	Isolate; deworm; treat for lice and mange; vaccinate for erysipelas, leptospirosis (5-way) and parvovirus; provide a warm, draft-free sleeping area; provide ample supply of fresh water, watch for signs of illness throughout the isolation period. If the swine dysentery status of the herd or origin is not absolutely known to be negative, treat with an effective anti-swine dysentery drug in the feed for 30 days. After 30 days move the boar to a clean pen and treat for seven additional days. If they are entering a pseudorabies, <i>Haemophilus pleuropneumonia</i> or <i>H. parasuis</i> infected herd, vaccinate the boars for the appropriate disease 14 days or longer before leaving the isolation pen and having contact with the main herd.
8-21	Remain in isolation; treat for lice and mange (10 days after first treatment when using a spray); to provide a broader contact with the microflora present in the breeding herd, provide physical contact to cull animals that will go directly to slaughter from the boar's isolation pen.
22-35	Remain in isolation; retest for pseudorabies 21 days after arrival. THIS PSEUDORABIES RETEST IS MANDATORY IF THE OWNER/MANAGER IS SERIOUS ABOUT PREVENTING PSEUDORABIES FROM ENTERING THE HERD.
36-59	If the boar appears healthy and is free of pseudorabies, prebreeding exposure between the boar and females he is to breed should be provided by fence line contact and fecal material exchange. This procedure helps prevent viral reproductive problems. Sexual behavior should be evaluated by using estrous gilts or small sows. A semen evaluation is optional.
60 days	Begin breeding (boar is 7.5 to 8 months old).

Why Is Prebreeding Exposure to Females and Fecal Material Exchange Between Boar and Sow Herd Necessary?

Prebreeding exposure to females is a management procedure to help prevent problems due to parvovirus or one or more of eight or ten enteroviruses. Parvovirus is the culprit in the majority of viral reproductive problems. One or more of the eight or ten enteroviruses and parvovirus can be found in nearly every swine breeding herd in the midwest. Problems occur when a new strain of enterovirus is introduced with replacement stock from another herd or from gilts that have not been exposed to parvovirus after losing the passive immunity they received from antibodies in the milk during the nursing period. Often this passive immunity persists for five to six months.

Enteroviruses are controlled by exposing new boars to carrier sows 30 days before breeding is to begin. Parvovirus vaccines are available which can be used 30 days before breeding to control viral problems caused by parvovirus.

How Can Replacement Boars Be Evaluated for Sexual Behavior?

Replacement boars can be evaluated for sexual behavior by placing the boar in a pen with an estrous gilt or small sow and watching for successful mating. The boars should be evaluated at 4 different times (2 consecutive days each week) for 15 to 20 minutes each time. The following rating system is suggested for evaluating boars for sexual behavior.

Boar Behavior	Rating
Breeds gilts - check to be sure erection is maintained and penis doesn't fall out during ejaculation.	Satisfactory - if successfully mates at least 2 of 4 females.
Mounts gilt, thrusts, extends penis, no copulation.	Questionable - A boar that did not mate after the first evaluation should be provided assistance during the second and third evaluations. No assistance should be provided during the fourth evaluation. If the boar did not mate during the fourth evaluation, he should be evaluated two additional times without assistance. If he failed to mate on the last two evaluations because of hyperaggressiveness, he should be culled.
Mounts gilt, thrusts, doesn't extend penis.	Unsatisfactory - check anatomy for abnormal development and replace if a persistent frenulum (tied penis) is found.
Repeatedly noses gilt, doesn't mount, very aggressive.	Unsatisfactory - retest. Provide an area where he can see successful matings before retesting.
No interest in gilt during four evaluations.	Failure - replace.

Does Confinement Rearing Affect Boar Development and Sexual Behavior?

Definite conclusions cannot be made about whether rearing boars in confinement units is detrimental to reproductive development and performance. Social environment during rearing should be of more concern than whether the boar is confined or not. Research data indicate that

(1) individual rearing of boars has a detrimental effect on age at puberty and sexual behavior,

(2) physical contact with other pigs, male or female, during early life is very important to development of normal sexual behavior,

(3) exposure to females during rearing does not improve boar reproductive organ development,

(4) boars reared under longer photoperiods (15 to 16 hours) reach puberty at a younger age than boars reared under a shorter day length, and

(5) abnormal sexual behavior traits expressed during rearing (performing rectal ejaculations) may be related to mating behavior after puberty.

Does High Environmental Temperature Affect Boar Sexual Behavior and Semen Characteristics?

All boars are not affected the same by high temperatures. Heat stress may completely inhibit sperm production in some boars, but cause only slight reductions in semen quality in others. If a boar is sensitive to high temperatures (above 85°F) the changes in semen characteristics are:

(1) decreased volume,

(2) decreased sperm motility,

(3) decreased sperm production, and

(4) an increase in abnormal types of sperm cells.

As a result of decreased semen quality, a substantial reduction in farrowing rate will occur. Depending on the severity of heat stress, boar fertility can be depressed for two to eight weeks after heat stress ceases. Since boar fertility influences many matings, a management system must be designed to maintain maximum fertility in all boars. Boars are also less willing to mate at temperatures above 85°F, therefore, during hot weather boars should be worked during the coolest part of the day.

What Is an Effective Means for Keeping Boars Cool?

Evaporative coolers, air conditioners, concrete or mud wallows, and shade combined with sprinklers and fans can be used to cool boars. Intermittent drip cooling systems with fans have been used to cool boars in stalls. Thermal stress causes minimal perspiring in swine, so evaporative cooling of the body is limited unless water is sprinkled on the animals. It is important that the animals are permitted to dry after being wetted because evaporation of water is fundamental to evaporative cooling. A sprinkling system under a shade built over a sand or concrete floor is advisable. For breeding in confinement, an evaporative cooling system is recommended. However, if temperatures less than 85°F cannot be maintained, add a sprinkling system.

How Much Space Should Be Provided for the Boar?

Confinement. Boars should be individually housed in pens that provide 35 to 50 square feet, or stalls measuring 28 inches by 8 feet for large boars, 26 inches by 7 to 8 feet for medium size boars, and 18 to 24 inches by 6 to 8 feet for small boars. Housing boars together is not recommended.

Non-confinement. Individual boars being maintained in outside lots should have 20 square feet of total shelter and dry sleeping area. The outside dirt lot should have excellent drainage. Separate housing and feeding areas to encourage a good dunging pattern.

Housing boars together is not recommended. However, if they are going to be housed together, they need to have been reared together. When boars are penned-together, allow 20 square feet of dry sleeping area per boar, 20 to 24 inches of feed trough space per boar, and provide adequate waterer places to minimize competition for water.

Facilities need not be elaborate but should be kept clean, adequately ventilated, draft free, well bedded during cold, wet, damp seasons, and cool during hot weather.

How Should The Boar Be Fed?

A newly purchased boar will generally have a poor appetite for the first few days after arrival on the farm. Provide feed sparingly (2 lb the first day) and then gradually increase it to the level required to maintain good body condition (4 to 5 lb per day). Do not allow the boar to get too fat. Boars should be fed a diet designed for gestating sows.

Should the Semen of Recently Purchased Boars Be Evaluated?

Optional. A laboratory evaluation of semen does not provide a means of determining absolute fertility. It only provides an estimate of sperm number (concentration), motility, morphology, and volume. Boars less than 10 months of age should not be culled based on marginal semen characteristics. Sperm concentration continues to increase until the boars are 24 to 29 months old. Semen volume varies with breed, age and ejaculation frequency. Table 1 shows semen characteristics of young boars (7 to 10 months of age) when ejaculating every 72 hours.

Table 1. Semen characteristics of young boars (7 to 10 months of age) ejaculating every 72 hours.

Characteristic	Range
Volume (ml.)	190 to 240*
Sperm concentration (million/ml.)	151 to 241
Total sperm/ejac (billion)	20 to 40
Motile sperm (%)	70 to 80
Morphologically normal sperm (%)	70 to 80

*Gel-free volume.

SELECTION AND PREBREEDING MANAGEMENT OF REPLACEMENT GILTS

When and How Should Replacement Gilts Be Selected?

Replacement gilt selection will vary greatly from farm to farm depending upon the crossbreeding system used and whether gilts are home raised or purchased. Regardless of source, fast-growing lean gilts that are sound are preferred. Soundness of replacement gilts refers to functionality of skeleton, the mammary system and the reproductive system.

Skeleton. Choose gilts which can move freely on their feet and legs and can function in the production facilities.

Mammary System. Choose replacement gilts with an adequate number of apparently functional teats to wean large litters. Fourteen or more evenly spaced well developed nipples are preferred. Discard gilts with inverted or scarred (teat necrosis) teats.

Reproductive System. Choose gilts with normal appearing external genitalia. Most of the reproductive organs are internal and not visible. Normal development of external genitalia is the best indicator of a sound reproductive system. Increased prominence of the vulva and mammary system as the gilt nears puberty is a good indication of development of a normal reproductive system.

Replacement Gilts for Terminal Crosses

Home Raised Gilts. If replacement gilts for terminal crosses are produced at home, specific matings to produce gilts are required. Since these matings are not as productive as the terminal crosses, their number is usually minimized. This means that little opportunity is available for gilt selection. Adequate numbers of sound gilts is the first concern, followed by attention to size and leanness. More emphasis is placed on selection of the boar to sire the replacement gilts than the sows to produce them. Both should represent lines with excellent soundness which have been selected for litter size and mothering ability, as well as rapid lean gain.

Purchased Gilts. Purchasing replacement gilts for terminal crossbreeding has become a more popular practice. Purchasing high quality replacement gilts allows producers to profit from the more productive terminal crosses without the hassle of the specialized matings needed for gilt production. As with boar purchases, health, breed, genetic improvement program and service are factors to consider when choosing the source of gilts. With purchased gilts, screening for soundness would be the major selection criteria. If the choice is available, choose the faster growing leaner gilts from those available. With purchased gilts, the responsibility for genetic merit is carried by the gilt supplier, rather than through individual selection.

Purchase replacement gilts 45 to 60 days before the anticipated breeding time. This allows for health procedures to be conducted, for gilts to adjust to the new facilities, and for gilts to possibly cycle one time before breeding.

Replacement Gilts for Rotational Crosses

Replacement gilts for rotational crosses are generally home raised. All gilts are candidates for selection, allowing producers to be more particular about which gilts they select. A multistage selection process described below is suggested.

Birth. Earnotch potential replacement gilts at birth from the best sows based on litter size and mothering ability. They should meet the minimum teat criteria. Mark at least twice as many gilts as will be needed. Record birth dates and breed of gilt at birth so the crossbreeding system can be tracked and followed.

Reduce the litter size of litters containing replacement gilts to seven or eight by fostering barrows to other sows. This will provide a better preweaning environment for the replacement gilts and accelerate their development.

Weaning. Remove from the replacement gilt candidate pool gilts whose mothers have not milked well.

Finishing. Make final selections at 180 to 200 lb based on rate of gain, leanness and soundness of feet and legs.

What Is Early Puberty and Why Is It Important?

Gilts should reach puberty (exhibit first estrus and ovulate) at an early age, continue regular estrous cycles until bred and conceive readily at first breeding. Early puberty is necessary if replacement gilts are to be successfully bred during a limited breeding season and express their full potential for litter size. Gilts should express one or more estrous periods before the usual breeding age (7 to 9 months) since more eggs are ovulated and larger litters can result. Litter size born in gilts receiving adequate dietary energy will be increased one to two pigs per litter by breeding at second estrus rather than at first estrus. Gilts that express first estrus at a young age (less than 6 months) can be bred as long as one or more estrous periods have been expressed before breeding. This practice will materially reduce feed and other overhead costs associated with gilt maintenance without detracting from reproductive performance.

What Effect Does Genetics Have on Age at Puberty?

Most gilts reach puberty between 6 and 8 months of age (average 200 days). Crossbred gilts generally express first estrus earlier (1 to 4 weeks) than the average of the parent breeds represented in the cross. Thus, when bred at the usual breeding age, crossbred gilts will have experienced more heat periods, will ovulate more eggs, and will produce larger litters than purebreds. Inbreeding, on the other hand, tends to increase age at first estrus.

Producers should not routinely keep gilts for breeding that have not expressed first estrus by 7 1/2 months of age. Breeders should not keep replacements from dams that were late (old) in showing their first estrus or in conceiving their first litter because the heritability of age at puberty is about 25 to 35 percent.

Does Confinement Affect Age at Puberty?

Rearing gilts in total confinement interferes with expression of estrus in most breeds. The failure of gilts to express estrus by

the usual breeding age (7 to 9 months) is primarily the result of delayed puberty, but also may be caused by an increased incidence of behavioral anestrus (ovulation unaccompanied by estrus). The maintenance of older gilts (more than 9 months) in the same confinement facility where they were reared seems to increase the incidence of irregular or abnormal estrous cycles, including behavioral anestrus.

Some breeds and breed crosses (e.g., Landrace, Large White, and Landrace-Large White crosses) attain puberty about as readily in confinement as under outside drylot management; whereas, in other genetic stocks (e.g., Duroc, Yorkshire), puberty is markedly delayed in confinement.

Though factors in the confinement environment that are lacking or are inhibitory to the expression of estrus in gilts have not been identified, producers have successfully circumvented the problem by removing gilts from confinement (usually relocating them to outside lots) before breeding age and then returning them to confinement for breeding after they have begun cycling.

Does Rearing Intensity or Social Isolation Affect Age at Puberty?

Rearing Intensity. Confinement-reared gilts have less floor space and there is more competition for available space. The recommended density for finishing pigs (8 square feet/pig) appears adequate for normal pubertal development up to the time gilts are selected for replacement (4 1/2 to 6 months). Avoid developing gilts in large groups (50 or more pigs/pen) in confinement, as it delays puberty.

Social Isolation. Avoid social isolation of gilts before puberty. Individually penned or tethered gilts are delayed in reaching puberty compared to group-reared gilts.

Does Poor Air Quality in Confinement Influence Age at Puberty?

Gilts housed in confinement may be subjected to increased concentrations of manure gases, especially when ventilation is inadequate or when the ventilation system is operated at minimal levels during the winter to save on energy expenditures. Recent data reported from Purdue and Nebraska showed that gilts exposed to aerial ammonia concentrations of 20 ppm during development were delayed reaching puberty compared to control gilts maintained in an environment with low levels (less than 10 ppm) of aerial ammonia. The high level of aerial ammonia did not suppress the weight gain of the gilts. More research is needed to establish the effect of manure gases on reproductive performance, but it is believed unwise to allow aerial ammonia concentrations to exceed 10 to 15 ppm in the gilt development house.

What Are the Effects of Season and Photoperiod on Age at Puberty?

Seasonal Effects. Slaughterhouse data and controlled experiments have demonstrated that winter- and spring-born gilts are delayed in expressing first estrus as compared to gilts born in summer or fall. The cause for the delay is not known. High

environmental temperature (more than 85°F) delays puberty, interferes with expression of behavioral estrus, reduces feed intake, and lowers ovulation rate in cycling gilts. Protect replacement gilts from high environmental temperature (more than 85°F) by providing adequate shelter and enough supplemental cooling to prevent severe stress. Curtain-sided buildings with insulation overhead and equipped with thermostatically controlled sprinklers appear to be as good as totally enclosed air conditioned breeding buildings.

Photoperiod Effects. Inadequate light exposure (light intensity and duration) has been evaluated as a possible cause of delayed puberty in confinement since confinement housing often severely restricts the amount of light exposure. Controlled experiments have failed, however, to show that long days (16 or 18 hour day length) stimulate earlier puberty in gilts as compared to short days (6 or 8 hour day length). In fact, complete darkness was not found to delay pubertal development in gilts.

Can Earlier Puberty Be Stimulated By the "Transport Phenomenon" and Boar Exposure?

Transport Effect. The "transport phenomenon" is the mixing of unfamiliar gilts, their transport, and relocation to a new environment. This stimulus can trigger a synchronous first estrus in 15 to 30 percent of gilts nearing puberty. The closer the gilts are to natural puberty the greater the effect transporting will have in synchronizing estrus in gilts. Most gilts that respond show estrus 3 to 10 days after treatment. Relocation to a new environment seems to be the important component of the transport phenomenon. However, relocation to a different room and pen in confinement is less effective than relocation to an outside environment.

Boar Exposure Effect. Gilts with once daily or continuous contact (fence line or physical) with a sexually mature (more than 10 months) boar attain puberty earlier than gilts isolated from boars.

The timing or age of gilts at boar exposure has an important bearing, however, on the response obtained. Gilts exposed to boars too early during development (before 125 days of age) will be delayed reaching puberty compared to gilts provided contact with a mature boar between 135 and 160 days of age. While providing contact with mature boars before 160 days stimulates gilts to attain puberty at the earliest possible age, withholding boar exposure until after 160 days of age induces a more rapid and more synchronous estrous response (30 to 90% of gilts in estrus in 3 to 10 days).

To maximize the estrous synchrony response, relocate gilts outside so they receive once daily (15 to 30 minutes) or continuous (fence line) contact with boars. This treatment should precede the breeding period by three to four weeks to obtain heat grouping at the appropriate time and to insure that replacement gilts have experienced at least one estrous period before they are bred. Older gilts (175 to 190 days of age) will normally show a more rapid estrous response than younger gilts (160 to 175 days of age). However, well-managed, early maturing breeds or breed crosses will respond as readily at 160 days as slower maturing stocks at 190 days of age. When imposed in confinement, the combination of relocation and boar exposure seems to add nothing over boar exposure.

What Duration of Daily Boar Exposure Is Required To Produce a Stimulatory Effect?

Data from recent Nebraska experiments showed that 15 minutes of once daily exposure to mature boars was as effective as 30 minutes of daily boar exposure for stimulating early pubertal development in gilts. Gilts in both groups were placed in direct contact with a mature boar in a small heat check pen during the exposure period. A mature boar should be placed in the pen with the gilts so maximum stimulation can occur to induce puberty.

How Should Replacement Gilts Be Fed?

Proper nutrition enables replacement gilts to reach puberty at an early age and maintain a high level of productivity over several parities. In general, gilts should be selected as replacements and receive restricted quantities of feed (energy) beginning at 180 to 200 lb. Feeding a 14 percent crude protein corn/milo-soybean meal diet at the rate of 5 to 7 lb daily until breeding limits energy intake sufficiently to save on feed costs and prevent unnecessary weight gains. Gilts that gain excessive weight and body fat experience more unsoundness and fertility problems than gilts that are fed properly.

The amount of feed should be adjusted according to housing situation, condition of the gilts and age at which they are bred. A higher feed rate (7 lb per day) should be considered for gilts housed outside during the extreme cold of winter. Genetically lean gilts may also need to be fed liberally, especially if they will be mated before they reach 250 lb. Follow the recommendations of the supplier of the gilts for best results.

When feed intake is limited, sufficient quantities of proteins, amino acids, vitamins and minerals must be provided each day. Daily nutrient allowances for replacement gilts are presented in the Nebraska Swine Diet Suggestions publication (EC 88-210).

Some "downer sow" problems result when producers select replacement gilts from finishing swine and feed them restricted quantities of finishing feed. Finishing diets do not normally contain sufficient quantities of calcium and phosphorus to build a strong skeleton in preparation for pregnancy and lactation. Rather, gilts selected as replacements should receive "breeding herd" levels of minerals, including calcium and phosphorus, beginning 70 days before breeding or from selection at 180 lb to breeding. Most importantly, gilts should receive 16 g of calcium and 14.5 g of phosphorus per day during these periods. If gilts are fed 6 lb of a corn/milo-soybean meal diet per day, the percentage of calcium and phosphorus in the diet should be .6 and .55%, respectively. A properly fortified gestation diet is acceptable for replacement gilts.

MANAGING THE "ACTIVE" GILT POOL

What Is the Value of a Replacement Gilt Pool?

The replacement gilt pool should provide the needed number of cycling gilts to replace sows culled as part of the regular production schedule and meet the increased demand for replacement females brought about by seasonal influences and other factors.

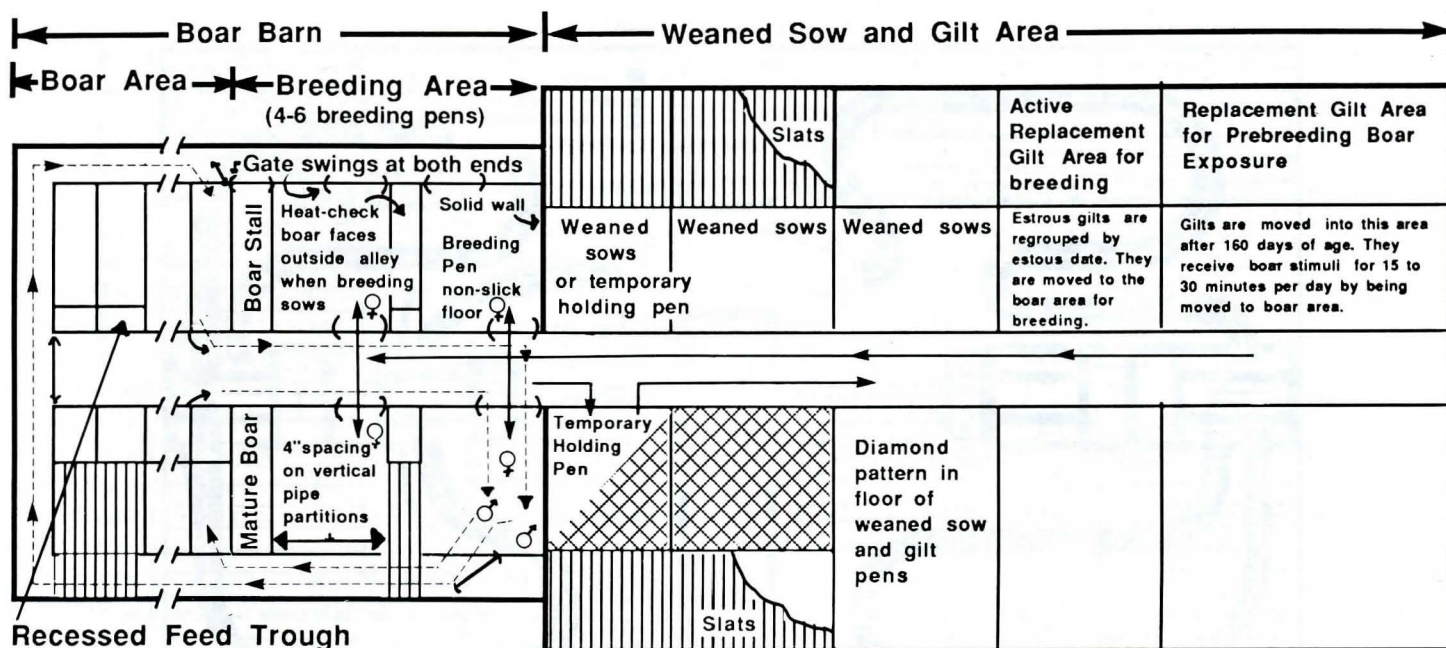


Figure 1. Facility for stimulating early puberty in gilts.

The number of additional females to mate (generally gilts) to reduce the risk of an empty farrowing crate is described on page 17. Equation 1 shows a method for calculating the number of cyclic gilts needed when recycling sows from previous matings are not available for breeding.

Equation 1. Calculating number of cyclic gilts needed for breeding (assumes no recycle sows are available).

$$\frac{A - [(B-C) \times D \times E]}{F} = \text{number of gilts to breed}$$

Example

where	A = Number of crates to fill	(10 crates)
	B = Number of sows weaned	(10 sows)
	C = Number of sows culled at weaning	(1 sow)
	D = Percent of sows cycling and bred after weaning	(90%)
	E = Expected pregnancy rate of bred sows	(76%)
	F = Expected pregnancy rate of bred gilts	(60%)

$$\text{Example: } \frac{10 - [(10-1) \times .90 \times .76]}{.60} = 6.4 \text{ (7 hd) gilts}$$

How Should Replacement Gilts Be Fed Before Breeding?

Research indicates that litter size can be improved by ending the restricted feeding program and increasing feed intake 50 to 100 percent beginning 11 to 14 days before mating. High energy feeding (flushing) during this time will maximize the number of eggs released by the ovaries.

How Should the Gilt Pool Be Managed?

Management of the gilt pool must meet the need for properly developed replacement gilts, but yet minimize the investment in feed, labor and facilities.

Prebreeding period. The first step after selection is to provide gilts the proper stimuli to induce them to begin cycling. Replace-

ment gilts selected too early (before 160 days of age) to express a good estrous synchrony response to relocation and boar exposure stimuli should be maintained away from boars. Replacement gilts should be exposed to boar stimuli at about 160 to 175 days of age to stimulate and synchronize pubertal estrus. Pubertal estrus stimulation should be programmed so the group will fit a future breeding period.

To maximize the estrous synchrony response, move gilts outside and provide once daily or continuous (fence-line) contact with mature boars. This should be done at an age determined to be effective for the genetic stock and management system being used. The treatment, whether boar exposure alone or a combination of boar exposure and relocation, should precede the breeding period by 3 to 4 weeks to obtain synchronization of estrus at the appropriate time and to insure that replacement gilts have experienced at least one estrous period before they are bred. Since once daily (15 to 30 minutes per day) boar exposure seems as effective as continuous fence-line contact with boars for stimulating early puberty, the method of providing once daily boar stimulation is preferred.

One effective way of accomplishing boar stimulation is shown in Figure 1. Gilts in the pool should be segregated from the boars, preferably in a separate room or barn adjacent to the boar stimulation area. The gilts can be moved in groups of 5 or 6 into pens next to the boars. They also can be provided direct physical contact with boars when desired. This method provides the opportunity to accurately observe and record estrous activity each day. Though this requires extra labor, it is time well spent because it reveals when and how many replacement gilts are cycling and can be bred during a future breeding period. The approach outlined in Figure 1 allows one observer to work effectively with as many as 24 gilts at a time. Gilts should be regrouped by estrous date after two weeks of initial boar exposure so that only gilts that have not yet started to cycle continue to receive boar exposure each day.

A second method of stimulating gilts in the pool with boar exposure is to move prepubertal gilts into direct fence-line

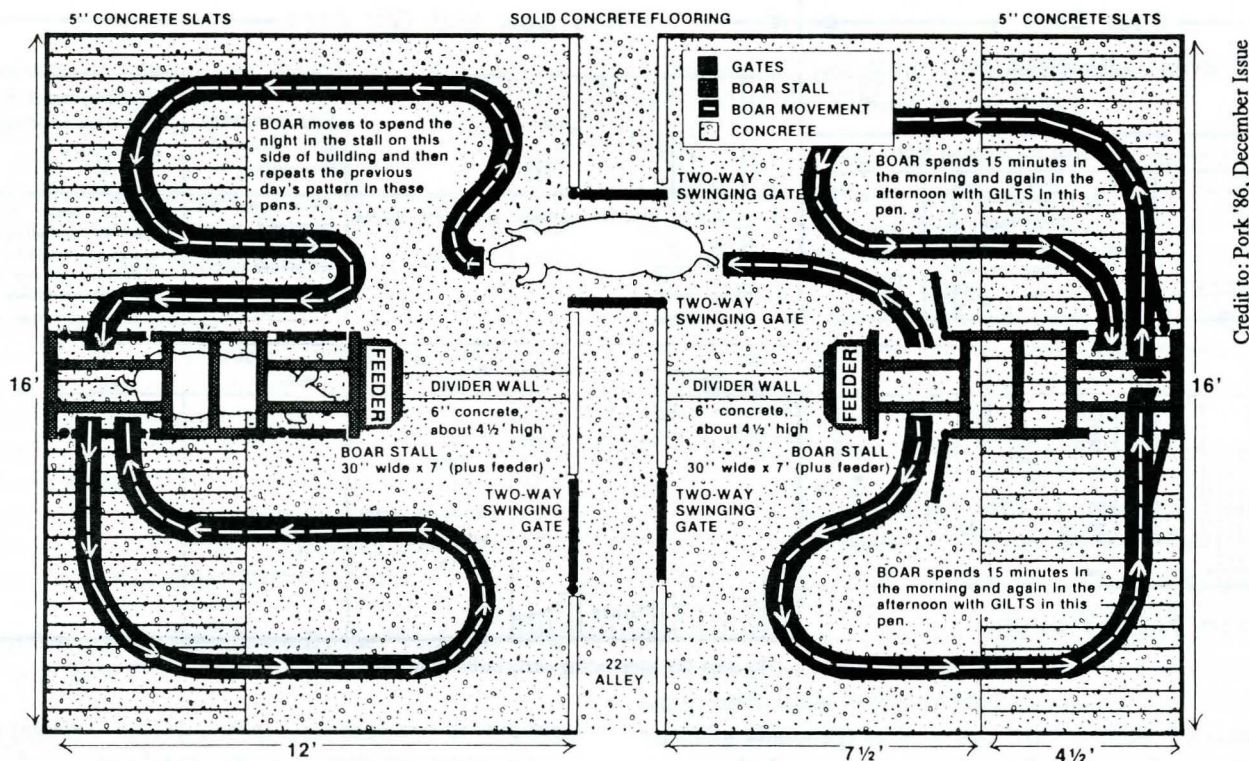


Figure 2. Suggested pen arrangement for stimulating early puberty in gilts with continuous boar exposure.

contact with boars. This might be done by setting aside pen space next to boars in the breeding barn or in a designated area provided exclusively for stimulation of prepubertal gilts (Figure 2). Although this is an effective method for stimulating gilts to start cycling, one will not be able to accurately detect estrus in the cyclic gilts unless the gilts are removed from contact with boars for a few hours before they are heat checked. Consequently, it is more difficult to establish when and how many replacement gilts are cycling and to get gilts sorted into groups for later breeding.

Another method that can be used to provide gilts in the pool with boar exposure is to take a mature boar(s) into the barn where the gilt pool is maintained. The boar(s) might be placed in a central alleyway between gilt pens and allowed fence line contact with the gilts during a portion of the day or taken into each gilt pen for 15 to 30 minutes each day. This approach should be effective provided sufficient boar stimulus is supplied, but may be more time consuming.

Gilts in the pool that are not detected in estrus within 30 days after initiation of boar exposure should be culled. They are either late maturing or cycling abnormally and are not good prospects for breeding.

Breeding period. Whether gilts are being stimulated by boars to express pubertal estrus during the development phase or they are being heat checked for breeding as part of a handmating program, good facilities are key to accomplishing accurate and efficient heat detection. Pen arrangements may vary as long as the basic principles of effective heat checking are followed (Figure 3) and animals can be moved in and out of the heat check and breeding areas with a minimum of labor. The design previously outlined in Figure 1 is one effective method for accomplishing efficient heat checking and breeding in confinement.

Whatever the method being used, the key is to make sure that contact with boars during the period of heat detection is fresh or new. Females that have been in immediate prior contact with

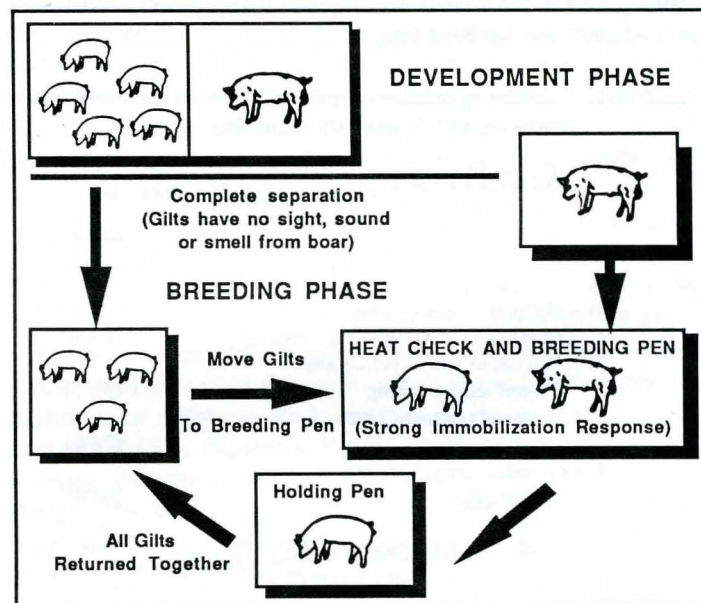


Figure 3. Basic principles for checking estrus in replacement gilts.

boars are usually slow to respond to the heat check boar and may not be detected in heat until the next day, if at all. Ideally females should not receive boar exposure for 1 to 2 hours before heat checking. When females are provided fresh boar stimulation, expect to obtain a high rate (98 to 99%) of estrous detection after only 15 minutes of contact with boars.

Are Hormones Available for Estrous Synchronization in Gilts?

At present there is no compound commercially available to synchronize estrus in gilts.

To Protect Gilts During Gestation, What Vaccines Should Be Used and When Should They Be Given?

A minimal immunization program for gilts should include erysipelas, parvovirus, and leptospirosis. If the herd is infected with pseudorabies or there is pseudorabies in nearby herds, include pseudorabies vaccination in commercial swine herds. Consult your veterinarian about the possibility of using a pseudorabies vaccine with a gene deletion so the animals can be blood tested negative at a later time if they have not been exposed to pseudorabies field virus. These vaccines might make it possible for seedstock producers to vaccinate for pseudorabies. Check current state and federal movement regulations before using gene deleted vaccines. Vaccines should be given at least two weeks before breeding and should never be administered at breeding time or during the first 30 days of gestation. Vaccination often causes a rise in body temperature for a few days and may cause embryonic death during the critical days of early gestation.

BOAR MANAGEMENT — BREEDING PERIOD

What is the Recommended Number of Services Per Boar when Hand Mating?

Table 2 shows the recommended number of services per boar when hand mating. The maximum use of boars in a breeding program depends on their sperm production and output rate. Age, breed, season, health, and frequency of ejaculation have an influence on sperm production and fertility.

Table 2. Recommended number of services per boar when hand mating.

Boar age (months)	No. services		
	Daily	Weekly	Monthly
Young (8 1/2 to 12)	1	5	20
Mature (Over 12)	2	7	28*

*Mature boars should be given 2 to 3 days sexual rest per week.

What Factors Should Be Considered When Estimating the Required Number of Boars Needed for Hand Mating?

The factors that should be considered when estimating the number of boars needed for a specific group of sows being bred are:

- 1) the number of sows in estrus each day during the breeding period,
- 2) number of services per sow,
- 3) number of services per boar,
- 4) total number of sows and gilts to breed, and
- 5) the percentage of boars not expected to perform adequately.

Also, consider the number of boars needed for seasonal influences, mating replacement gilts, and making specific matings.

Characterization of the percentage of sows in estrus on each of the first six days after weaning is helpful for estimating the number of boars needed because the weaning to estrus interval can be influenced by genetics and numerous environmental factors. An example of how to determine the total number of services required to mate a group of weaned sows is shown in Table 3. From this information the number of boars required can be calculated.

What is the Recommended Number of Weaned Sows Per Boar when Pen Mating?

It is difficult to make an absolute recommendation for boar requirements when pen mating because generally the number of sows cycling and receptive to the boar on each day of the breeding period and the number of ejaculations a boar is performing each day are not known. French researchers have reported the percentage of sows pregnant at 30 to 35 days after mating to be 92 percent for sows bred by boars that ejaculated once per day for 5 days and 58 percent for sows bred by boars that ejaculated 4 times per day for 5 days. It is not uncommon for boars to ejaculate four or more times per day when pen mating. Therefore, a conservative approach must be taken for estimating number of boars to use when pen mating especially when it is important that farrowing

Table 3. An example for distribution of estrus and breeding activity when 20 sows are weaned the same day (95 percent cycle within 6 days).

Day Bred	Identification of Female in Estrus to be Bred																			Total Number Services Per day	
	30	18	5	10	35	26	15	12	25	17	14	32	11	6	19	16	27	29	28		
SUN	S1 ^a																			1	
MON	S2	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1									11	
TUE			S2	S2	S2	S2	S2	S2	S2	S2	S2	S1	S1	S1	S1					15	
WED												S2	S2	S2	S2	S2	S1				6
THR																	S2	S1			2
FRI																		S2	S1	2	
SAT																			S2	1	

^aS1 = First service; S2 = Second service.

rate remains high. *There is no simple way to pen mate sows to be absolutely sure all sows are bred on their first estrus after weaning.* Some suggestions for determining boar requirements when pen mating are presented below.

ALL SOWS ARE WEANED THE SAME DAY. Since the number of sows in estrus accumulates over time (Figure 4), it is important to answer the following questions:

- (1) How many sows are being weaned?,
- (2) How many pens are being used for breeding?,
- (3) How many weaned sows are being placed in each breeding pen?,
- (4) Are boars going to be moved out of the sow pen for a short period while other boars are used in their place?, and

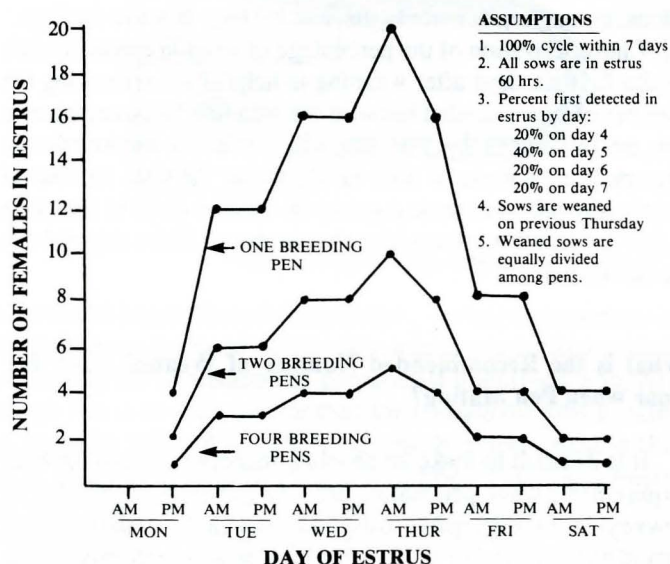


Figure 4. Number of sows in estrus on each day when pen mated in 1, 2, or 4 breeding pens (20 weaned sows)

(5) How much time are the boars given for sexual rest?

A ratio of 2.0 to 2.5 weaned sows per mature boar should be provided when pen mating. Table 4 shows a way to calculate the number of boars to use when pen mating sows that are all weaned the same day.

SOW GROUP IS SPLIT WEANED. The most reliable method for estimating the number of boars needed when pen breeding a group of sows that are split weaned is to estimate the accumulated number of sows in estrus on each day during the breeding period. The factors to be considered are:

- 1) number of days between weaning each sub-group of sows,
- 2) number of sows per sub-group,
- 3) number of breeding pens,
- 4) distribution of weaned sows among breeding pens,
- 5) rotation of boars for sexual rest,
- 6) length of sexual rest for boars,
- 7) the percentage of sows first found in estrus on each day, and
- 8) the length of time a sow is in estrus.

Table 5 shows a way to estimate number of sows in estrus on each day when a group of 20 sows are weaned in four sub-groups of 5 sows at a 2-day interval and placed in one breeding pen. This example is probably the most extreme situation that will occur because it is assumed that all sub-groups are placed into one breeding pen, 100 percent of the weaned females cycle within a 4-day period, and that each sow is in estrus 60 hours.

Why Do Boars Need Sexual Rest?

The main reason boars need sexual rest is for sperm replenishment. Sperm output of active boars decreases rapidly as shown in Figure 5. The second ejaculation contains 33-41 percent less and the third ejaculation 59-66 percent less total motile sperm than the first ejaculation after sexual rest. This decrease occurs at

Table 4. An example for calculating number of boars when pen mating sows that are all weaned the same day.

Ratio being used: 1 boar per 2 sows to breed (A = .5)					
Total number sows to breed (B)	Total number boars (C = AxB)	Number breeding pens (D)	Number boars assigned each pen ^a (E = C/D)	Number boars in each sub group of boars	
				Days of sexual rest	
				1 DAY (F = E/2)	2 DAYS (G = E/3)
10	5	1	5	2 3	2, 2, 1
10	5	2	Pen 1 = 2 Pen 2 = 3	1, 1 1, 2	NP ^b
20	10	1	10	5 5	3, 3, 4
20	10	2	Pen 1 = 5 Pen 2 = 5	2, 3 2, 3	2, 2, 1 2, 2, 1
20	10	4	Pen 1 = 2 Pen 2 = 2 Pen 3 = 3 Pen 4 = 3	1, 1 1, 1 1, 2 1, 2	NP

^a Assumes equal number of sows in each pen.

^b Not possible to use 2 days of sexual rest for all boars.

Table 5. Estimated number of sows in estrus on each day when a group of 20 sows are weaned in four sub-groups of 5 sows at a 2-day interval.^a

SUB		Number of Sows in Estrus on Each Day ^b																																										
GROUP NUMBER	MON		TUE		WED		THU		FRI		SAT		SUN		MON		TUE		WED		THU		FRI																					
	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P																				
			12	24	36	48	60	(Each sow in estrus 60 hrs)																																				
1			1 ^d	1 ^e	1	2	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																				
2																																												
3																																												
4																																												
Total Sows in estrus			1	3	3	4	5	8	7	6	7	9	8	6	7	9	8	6	6	6	5	2	2	1	1																			

^aAll sub-groups are placed into one breeding pen; 100% of the weaned sows cycle within 7 days after weaning; and all sows are in estrus 60 hours.

^bFirst group of 5 sows is weaned on previous Thursday.

$$c_A = AM; P = PM$$

^d20 percent of weaned sows are first found in estrus on day 4 (5 sows x 20% = 1 sow cycled).

^e40 percent of weaned sows are first found in estrus on day 5 (5 sows x 40% = 2 sows cycled).

f 20 percent of weaned sows are first found in estrus on day 6 (5 sows x 20% = 1 sow cycled).

^g20 percent of weaned sows are first found in estrus on day 7 (5 sows x 20% = 1 sow cycled).

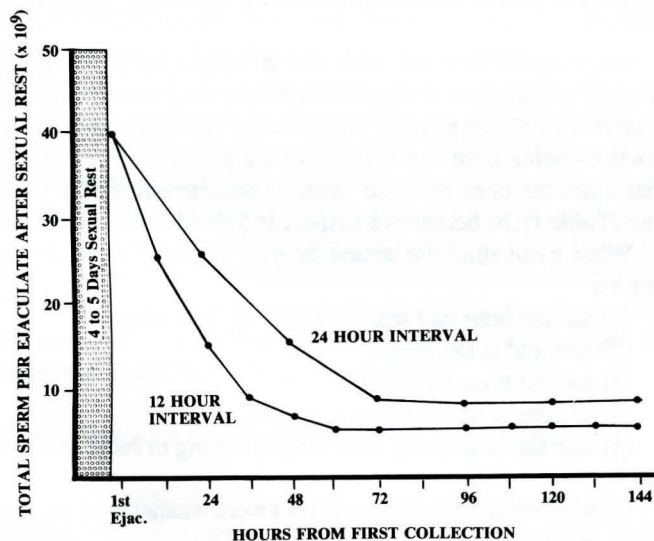


Figure 5. Sperm production at two collection intervals (mature boars, 12+ months old).

collection frequencies of 12 or 24 hours, regardless of boar age. Generally, the sperm number tends to stabilize after five ejaculations. The important question is, "At what level of sperm output (fertile, sub-fertile, or infertile) do they stabilize?"

The number of motile sperm required for good fertility will vary from boar to boar. It is believed that 3 billion mature, motile sperm are needed for high (90 to 95%) fertilization of ova.

How Should Group-Housed Boars Be Sexually Rested?

Group-housed boars should be sexually rested out of sight and sound of estrous sows and working boars. This procedure substantially reduces homosexual activity during the resting period which can deplete sperm reserves.

Should Boars Be Assisted with Intromission?

The main advantages of helping boars make entry into the sow are:

- (1) it speeds up the breeding process,
- (2) prevents boars and sows from getting over-heated,
- (3) prevents anal ejaculations, and
- (4) helps prevent penile injuries.

Why Do Some Boars Have Inadequate Sexual Behavior?

Inadequate sex drive in boars such as, their lack of willingness and eagerness to pursue, mount, and attempt service of sows is influenced by

- (1) high environmental temperature ($85^{\circ} + F$),
- (2) previous rearing environment (isolation),
- (3) domination by other boars or larger sows,
- (4) poor nutrition,
- (5) lameness,
- (6) hormonal deficiencies,
- (7) distraction in the breeding area,
- (8) bad breeding experience when first used (psychological),

- (9) over-use,
- (10) sickness,
- (11) inexperience and immaturity,
- (12) excessive body condition,
- (13) old age, and
- (14) inadequate stimuli where permanently housed.

Can Hormone Treatments Be Used to Increase Sexual Behavior?

Although injections of testosterone may result in increased libido in some boars, it is not recommended. Testosterone reduces secretion of gonadotropic hormones by the pituitary gland which are needed for sperm production; therefore, testosterone treatment may increase the sexual behavior of some boars, but the boars may become infertile due to a reduction in sperm numbers.

Many mature boars can be sexually stimulated by allowing a few minutes of fence line contact with a mature, sexually-aggressive boar before being moved to the breeding pen. However, human safety precautions need to be observed when moving a sexually stimulated boar. A hand held hurdle should always be used when moving boars.

Should a Feeding and Breeding Routine Be Established When Hand Mating?

Yes. Boars should be fed before being used to breed sows; otherwise, they will tend to stop and eat the spilled feed in the alley. Never try to breed sows and feed other sows in the vicinity at the same time.

Should Reproductive Performance Records be Kept on Boars?

Collecting and evaluating boar reproductive records is questionable because only large differences in pregnancy rate and number of piglets born live per litter can be detected between boars. Also, for an analysis to be meaningful the sow can only be mated to a single sire. It is difficult to detect differences for many reasons which have nothing to do with true boar effects, i.e., sow age, parity, season of breeding and farrowing, genetics of sow, and frequency of boar usage. The natural variation expected in farrowing rate and litter size born live in a herd with ten boars of equal merit is shown in Table 6. The difference expected between

the best and worst boar, after each boar has sired 10 litters, is 38 percent for farrowing rate and 2.72 for live piglets per litter. Therefore, producers should be cautious about culling boars based on farrowing rate and litter size born live.

How Should Boars Be Fed Before, During And After The Breeding Season?

Boars can be limit-fed any of the gestation diets provided to sows. As with sows, the daily feeding rate must change to reflect differences due to season, condition and workload of the boar. Boars being used heavily should be fed about 6 lb of a corn/milo-soybean meal diet daily. Those not in service can be maintained with 4 to 4.5 lb of feed per day.

Should Testes Size Be Monitored?

Since the testes are the sperm-producing organs, it is best to monitor and compare for significant changes over time in size, consistency, and shape of testes. Boars with degenerating testicles, may be fertile for several services before entering a period of low fertility or sterility which is followed by normal fertility. The condition is progressive, but the boar may go through several sterile/fertile phases before becoming totally sterile. As time passes the testicle(s) become firmer on handling and the epididymis becomes very hard. Strict attention to service records and detection of severe reduction in testicular size are good ways of detecting this problem.

Should the Semen of Mature Boars Be Routinely Evaluated?

No, unless a boar has been sick or suspected of being heat stressed. If a decrease in litter size and farrowing rate is occurring, a semen evaluation plus an evaluation of the boar management practices being used can help solve the problem. If the mature boar ejaculate does not meet semen characteristics of a young boar (Table 1), he becomes a suspect and should be re-evaluated.

When evaluating the semen sample, consider the following factors:

- (1) has the boar had sexual rest, if so, how long?,
- (2) how old is the boar?,
- (3) has the boar been sick?,
- (4) has the boar been heat stressed?,
- (5) was the boar being used for pen mating or hand mating?, and
- (6) if pen mating, how many sows were weaned and possibly mated per day?

Is Artificial Insemination Practical for Swine?

Artificial insemination (A.I.) is being used successfully by many pork producers. Artificial insemination with fresh semen is being used primarily to

- (1) extend boar power when sows are synchronized,
- (2) extend use of genetically superior sires,
- (3) introduce new genetic material,
- (4) overcome size differences between boar and sow,

Table 6. Variation expected due to 'chance alone' in performance for 10 boars of equal merit

	Number of Litters per Boar				
	10	20	30	40	50
Difference between the best and worst boar in:					
Livebirths/Litter	2.72	1.92	1.58	1.36	1.22
Farrowing Rate	38%	28%	22%	20%	18%

*Note: Assume average of 11 pigs born/litter and 80% farrowing rate
Reference: Pigtales, Pig Topics Series 2, No. 6, 1989.*

(5) breed sows to injured boars, and

(6) circumvent certain diseases.

Careful attention to details is required to prevent a decrease in fertility. Additional information on artificial insemination can be found in the University of Nebraska circular, *Artificial Insemination of Swine* (EC 89-264).

When using frozen semen to introduce genetic material, a 30 percent reduction in farrowing rate and a decrease of 1.5 to 2 pigs per litter can be expected with the current technology. A further decrease in fertility will occur if procedures for using frozen semen are not followed correctly.

SOW MANAGEMENT - FARROWING AND LACTATION

How Should Sows Be Fed During Lactation?

Sows should be full-fed during lactation to obtain maximum milk production. To assure continued optimum reproductive performance, sows should consume an average of at least 10 to 11 lb of a corn/milo-soybean meal diet daily during lactation. A good goal would be to have lactating females consume 4 lb of feed daily plus 1 lb for each pig nursed.

Hand-feeding sows to appetite during the first 2 to 3 days after farrowing may help detect milking problems. Sows going off feed and constipation are two early symptoms of the mastitis-metritis-agalactia complex. At a minimum, sows should receive 1 to 2 lb of feed the day of farrowing. Each day thereafter they should receive an additional 3 lb of feed until they are on full feed. If sows will consume more feed than suggested, they should be allowed to do so. Feeding sows twice daily seems to encourage eating and is believed to encourage maximum feed intake.

Several studies show that adding fat to the lactation diet slightly increases energy consumption by sows. Adding fat to a lactation diet is more cost-effective in the summertime and when sows consume less than 10 to 11 lb of feed daily during lactation.

Sows should begin receiving a lactation diet 3 to 4 days before farrowing. Producers should consider using fibrous feedstuffs or chemical laxatives in the pre-farrowing/farrowing diet to alleviate possible constipation problems. See *Nebraska Swine Diet Suggestions* (EC 88-210) for more details.

What Factors Affect Appetite During Lactation?

Environmental Temperature. Sows will consume about 13 percent more feed per day when the room temperature is 70°F instead of 80°F. To encourage maximum feed intake, maintain farrowing house temperatures between 65° and 75°F. A hovered and heated creep area should be provided for the piglets. Dripping water on the sow's shoulder is effective in encouraging feed intake when temperatures exceed 75°F.

Feeding Frequency. Sows may consume more feed if hand fed twice per day instead of once.

Liquid Feeds. Sows may consume more feed in a wet rather than a dry form particularly during hot weather. Do not let molds develop when using wet feed.

Gestation Feed Intake. A sow fed too liberally during gesta-

tion may have a reduced appetite in lactation. Thus, the general aim for feeding sows during gestation is to have them in fit but not fat condition at farrowing.

Water intake. Feed intake can be depressed because of inadequate water access by sows. Waterers should be checked daily to see that they are in working condition. As a guide, water flow rate through nipple waterers should be about one-half gallon per minute. Nipple waterers should be mounted slightly higher than shoulder height of the animal and pointed down at a 45° angle. This height prevents sows from rubbing on the nipple and discourages sows from playing with the nipple and wasting water.

What is Mastitis-Metritis-Agalactia (MMA) Syndrome and How Is It Treated?

Mastitis (inflammation of mammary gland), metritis (inflammation of reproductive tract) and agalactia (non-secretion of milk) are disorders occurring in the sow after farrowing. The clinical signs are:

- (1) agalactia,
- (2) hypogalactia (reduced milk production),
- (3) visually sick with a fever and may or may not have a vaginal discharge,
- (4) mammary glands are swollen, discolored, congested, and hard,
- (5) rapid breathing,
- (6) lethargic or depressed,
- (7) lack of desire to eat and drink, and
- (8) lies shivering and trembling on her abdomen and refuses to allow hungry piglets to nurse.

While genetics, nutrition, constipation, mycotoxins, high environmental temperatures, early initiation of lactation, and wet and dirty floors have been blamed as causative agents of MMA, the primary cause is still unknown. Current research suggests that coliform bacteria (*Escherichia coli*, *Klebsiella pneumoniae* or similar organisms) may cause agalactia. Endotoxins produced from coliform bacteria have been shown to decrease secretion of prolactin, a hormone necessary for milk secretion.

Diagnosis of agalactia is not difficult, but proving the cause is difficult. The disease must be differentiated from diseases with similar clinical signs, especially those affecting the piglets. It may be difficult to determine which occurred first-whether the sow's milk glands dried up and the pigs starved, or the pigs stopped nursing and the glands dried up. Culturing of microorganisms from milk samples collected with a sterile technique by a veterinarian may be helpful in diagnosing mastitis.

Treatment must be directed toward re-establishment of normal milk flow. An injection of 10 units of oxytocin will cause the release of any milk already secreted into the alveoli to flow down the milk ducts of the nipples. Because the effectiveness of oxytocin only last 6 to 7 minutes, it needs to be injected at 2-hour intervals to coincide more closely with the nursing habits of piglets. Preventive programs may include:

- (1) avoid wet, dirty, cold floors in farrowing crates,
- (2) prevent high temperatures and relative humidities in farrowing facilities,
- (3) prevent thin sows and reduce physical stress throughout

gestation, especially near farrowing,

(4) use an autogenous bacterin based on the sow herd's infected milk, and

(5) selecting gilts with the genetic and physical abilities to produce milk and with a mastitis-free history in that line of breeding.

What Causes "Downer Sows"?

"Downer sows" are those sows that show various forms of posterior paralysis (fractured pelvis or vertebrae), lameness (fractured femur) or stiffness. This condition generally occurs within 1 to 4 days after weaning when excessive fighting, exercise or estrous activity occurs.

One cause of downer sows is a diet deficient in calcium, phosphorus and vitamin D or one having an improper ratio of calcium and phosphorus particularly during gilt development and gestation. During lactation the bones of the sow are decalcified to meet the heavy demands of calcium and phosphorus for milk production. Therefore, bones are weakened and unable to withstand any sudden muscle contractions or support the weight of mounted boars and sows. The condition may be prevented by feeding gilts and sows 16 g of calcium and 14.5 g of phosphorus daily during development and gestation. At a feeding rate of 4 lb per day, the diet should contain .9 percent calcium and .8 percent phosphorus.

A second cause of downer sows is the lack of muscle tone after a 4- to 5-week lactation period. Individually housing weaned sows in a small pen for 1 to 3 days after weaning may reduce or prevent the problem. Another contributing factor to downer sow problems in the post-weaning period is the boar, especially in pen-mating situations. Often times the problem arises when boars repeatedly court and mate the first few sows that express estrus in a group. Producers can overcome this problem by not introducing boars into the sow pen until the evening of the fourth day after weaning. At this time, several more sows should be in estrus thus decreasing the chance that any one sow will be abused by the boars.

Does Supplemental Light During and After Lactation Influence Sow Performance?

When sows are exposed to 16 hours of supplemental light per day during a 4-week lactation, a more synchronous post-weaning estrus occurs. No improvement was observed, however, in total number of sows returning to estrus within 10 days. Increased litter weight was also observed. This increase apparently resulted from increased milk yields.

SOW MANAGEMENT — WEANING TO ESTRUS

Why Do Some Sows Fail to Recycle After Weaning?

This problem is greatest in sows weaning their first litter. Excessive weight loss during lactation, especially the first lactation, contributes to the problem. First litter sows have more limited capacity and also may not have sufficient appetite to consume adequate amounts of energy and protein for maintenance, growth,

milk production and reproduction. Possible solutions are:

(1) breed gilts that are in good condition,

(2) during gestation, feed gilts so they are still gaining weight,

(3) feed a high energy diet (1500 kcal/lb of diet) during the first lactation,

(4) avoid high farrowing house temperatures (above 80°F) as they suppress appetite and indirectly reduce milk production,

(5) reduce suckling intensity on thin sows by weaning the heavier half of the litter 2-3 days before weaning the lighter half,

(6) do not reduce amount of feed offered to sows before weaning,

(7) feed thin sows about 8 lb daily after weaning, especially first litter sows, and

(8) check the adequacy of your feeding program by weighing sows at mating time and again after weaning.

Since sows continue to mature until about the fifth litter, they should gain about 22 to 33 pounds from weaning to weaning during each of the first four reproductive cycles (Figure 6).

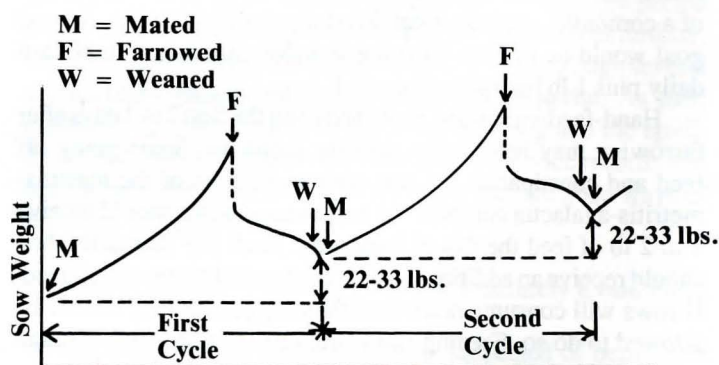


Figure 6. Example of sow weight changes during first two reproductive cycles.

Should Sows Be Deprived of Feed and Water After Weaning to Stimulate Estrus?

No. Research data show that fasting sows after weaning can have detrimental effects on days to estrus and ovulation. In fact, providing 6 to 8 pounds of feed after weaning decreases rebreeding interval and increase subsequent litter size in first litter sows and in thin, older sows.

Should Sows Be Flushed After Weaning?

Although gilts respond to flushing, there will be no response to flushing if sows are weaned in good condition. The flushing interval is insufficient to obtain a maximum effect of high energy intake on ovulation rate for those sows returning to estrus in 4 to 8 days after weaning. The recommendation is to feed 4 to 4.5 lb per head per day to weaned sows; however, feeding extra feed (8 lb or more per day) to very thin sows at weaning can be justified in getting them to return to estrus.

Should Antibiotics Be Fed At Breeding Time?

Antibiotics are most effectively used to combat specific problems. In some herds with histories of breeding problems, the use of oral antibiotics at therapeutic levels has improved breeding performance. Specific problems in herds with histories of small litters should be diagnosed and treated by a veterinarian. If antibiotics are fed in the breeding diet, discontinue them within two or three weeks after breeding.

Should Sows Be Group Penned Or Individually Stalled After Weaning?

A limited number of investigations have been conducted to compare reproductive performance of sows penned as a group or individually after weaning. The results are inconclusive and conflicting. The difference in results appear to be affected by the management and husbandry systems of the individual farms, rather than by the particular housing system. However, the data tend to favor group penning on weaning-to-estrus interval and litter size. When sows are grouped following weaning after leaving farrowing crates, it is best to allow them a few hours to regain muscle control before they are subjected to the fight and flight responses associated with establishment of peck order in the new group.

Should Sows Have Boar Contact After Weaning?

Weaned sows may need boar contact for 2 to 3 days after weaning, but not continuous boar contact during the breeding period. Providing continuous boar contact for the first three days after weaning and then housing the boars away from the weaned sows during the breeding period has worked well for hand mating programs. A much stronger immobilization response will be found if sows do not have continuous boar contact during the actual breeding period.

Does Breed Influence The Weaning-to-Estrus Interval?

Differences in weaning-to-estrus interval among breeds and crosses do exist. The problem seems to be most pronounced in genetic stocks that are extremely lean and that produce large and heavy litters at weaning. However, since the weaning to estrus interval, like other reproductive traits, is controlled less by the action of genes than by environment, the improvement in the weaning-to-estrus interval can be made mainly through improving the management and environment.

Does Season Influence Weaning-to-Estrus Interval?

Sows exhibit a seasonal breeding pattern characterized in part, by a 20 to 30 percent decrease in the rate of early return (7 to 10 days) to post-weaning estrus from June to October compared to the other months of the year. The magnitude of anestrus problem during the summer months varies within herds from year to year, between herds, with parity, with housing systems, and probably from other management and environmental factors.

Can Hormones Be Used To Induce Estrus And Ovulation?

Hormone preparations are available which will induce estrus and ovulation, but their use is not generally recommended because of availability, cost, and the requirement of precise timing of administration for a predictable response. Hormone treatments are recommended only in situations where a high incidence of anestrus occurs or where precise timing of ovulation is needed for fixed-time artificial insemination. Consult with your local veterinarian about which hormones to use and when they should be administered.

SOW MANAGEMENT — BREEDING PERIOD

What Are The Signs Of Estrus (Heat) In Pigs?

The onset and disappearance of estrus is gradual in the pig (Figure 7). The various symptoms of estrus are:

- (1) restlessness,
- (2) loss of appetite,
- (3) change in coloration of vulva,

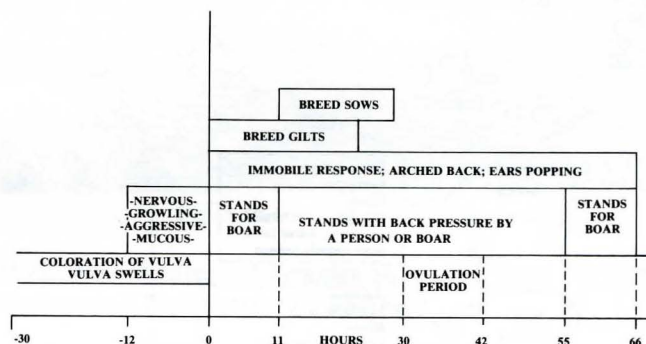


Figure 7. Signs of estrus in sows.

- (4) swelling of the vulva,
- (5) frequent sniffing of genitals of pen mates,
- (6) often emitting a peculiar growling or roaring sound like a boar,
- (7) relatively clear mucous discharge from vulva,
- (8) adopting male-like sexual behavior by pursuing, nosing flanks and mounting other females,
- (9) an arched back, rigid immovable receptive stance,
- (10) "ear popping", where the ears will repeatedly move toward an erect position, and
- (11) listening with her head cocked slightly to the side with her ears pricked. The duration of heat is shorter in gilts than in sows and can vary from 12 to 96 hours.

Is The Boar Needed For Estrous Detection?

Yes. The degree of swelling of the vulva alone is unreliable because this indicates only that the female is coming into, is

already in, or has been in estrus. Also, many of the estrous females may not stand (20% for sows; 40 to 50% for gilts) for the back pressure test in the absence of a boar. Effective heat detection requires an aggressive boar and facilities which allow the boar to undergo his courtship rituals of

- (1) head-to-head contact with the female,
- (2) champing and salivating,
- (3) chanting,
- (4) nosing the flank, and
- (5) mounting of side and rear.

Remember, a more intense and immediate estrous response will occur if the sows have not had boar contact for a few hours prior to actual heat detection.

Why Are Estrous Sows Missed When Heat Checking?

Many sows that are not detected in estrus are actually cycling with normal ovaries. These sows are either behaviorally anestrus or have not been given the correct stimulus at the proper time to detect them in estrus. Figure 8 shows the various factors that contribute to sows not being detected in estrus. Detection of estrus is a bigger problem in gilts than sows. Therefore, heat check gilts and problem sows for 15 to 20 minutes in the physical presence of a boar, and without having boar contact 1 to 2 hours before actual heat detection.

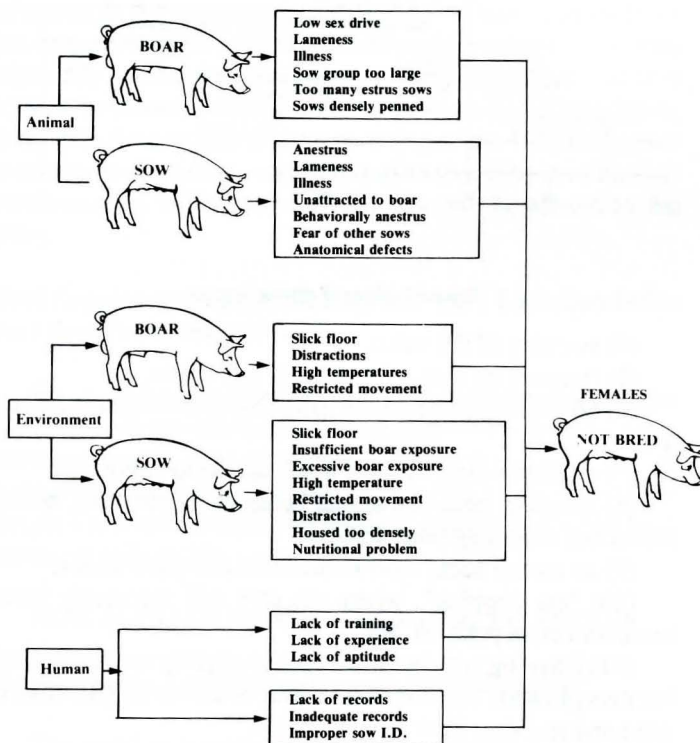


Figure 8. Possible reasons why sows and gilts are not detected in estrus.

At What Stage In The Estrous Period Should The Sow Or Gilt Be Bred When Hand Mating?

While a single service at the optimum time (4 to 12 hours before ovulation) should be sufficient for high conception rate and litter size, the observation of estrous onset is seldom accurate enough to enable the service to be delayed 18 to 24 hours after first detecting estrus. With once-a-day heat detection, the sows should be bred once on each of the first three consecutive days of estrus. With twice-a-day detection, breed at 12 and 24 or 36 hours after onset of estrus. Breeding sows three times has been shown to increase pregnancy 3.4 percent (Table 7) and average litter size born alive by .5 to 1.3 piglets (Table 8) when compared to two services. If estrus in some gilts in a group lasts only 12 to 24 hours, breed all others in the group as soon as they show standing heat, then again 12 hours later if still in heat.

Table 7. Influence of number of services per estrus on subsequent farrowing rate.

No. Services	No. Sows Bred	Pregnancy Rate
1	815	70.4
2	3927	86.1
3	7464	89.5
4 +	1762	89.6

Reference: Pigtales, Pig Topics, Series 2, No. 6, 1989.

Table 8. Number Born Alive as Related to Time and Frequency of Service (S)

						No Born Live
S----->	S----->	S----->	S----->	S----->	S----->	9.8
S----->	S----->	S----->	S----->	S----->	S----->	11.1
S----->	S----->	S----->	S----->	S----->	S----->	10.3
S----->	S----->	S----->	S----->	S----->	S----->	10.5
0800 AM	1600 PM	0800 AM	1600 PM	0800 AM		
FIRST DAY OF HEAT		SECOND DAY OF HEAT		THIRD DAY OF HEAT		

Anim. Prod. 34:279; 1982.

Should Sows Be Bred On The First Estrous Period After Weaning?

Yes, except when weaning occurs prior to 21 days of lactation. The two problems most encountered when weaning at less than 21 days of lactation are a reduction in subsequent litter size (Figure 9) and an increase in the weaning to estrus interval by 2 to 3 days. The reduction in subsequent litter size can range from .2 pig per litter to more than 1 pig per litter, depending on how many days less than 21 that weaning occurs. The reduction in subsequent litter size is caused by an increase in embryonic death.

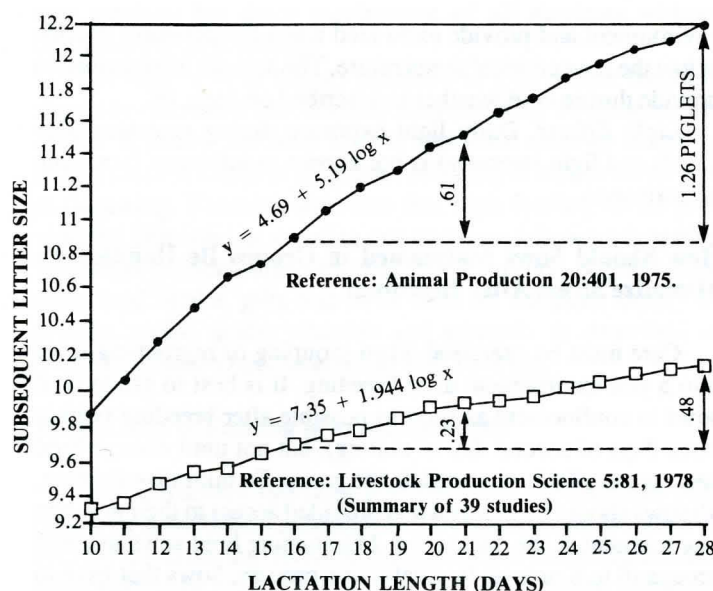


Figure 9. The effect of lactation length on subsequent litter size on multiparous sows.

What Are The Advantages of Hand Mating?

Hand mating provides several advantages:

- (1) exact breeding dates are known,
- (2) can make sure sows are bred once or twice at the proper time,
- (3) can control boar use which allows more females to be bred by him,
- (4) more control over correct crossbreeding or purebred breeding programs,
- (5) can control size incompatibility between the boar and sow,
- (6) less time spent checking close-up sows,
- (7) induced farrowing is possible,
- (8) can identify boars with anatomical defects or reduced sexual behavior,
- (9) helps identify infertile boars,
- (10) helps prevent bite wound to penis, and
- (11) should simplify management.

What Problems Are Encountered When Pen Mating?

All the previously mentioned advantages for hand mating become disadvantages when pen mating. The major problems encountered when pen mating are:

- 1) accumulation of sows in standing estrus (Figure 4),
- 2) boars usually breed the same sow many times,
- 3) boars may lose sexual interest in estrous sows due to sexual fatigue,
- 4) a decrease in pregnancy rate and litter size occurs due to boars breeding too frequently,
- 5) penile injuries are more frequent,
- 6) dominant boars may not let other boars breed when more than one boar is in the breeding pen,
- 7) boars breed the same female as the previous boar when they

are rotated for sexual rest, and

8) it is difficult or impossible to track good and bad traits in the offspring back to their sire when more than one boar is used in the breeding pen.

Can Pen Mating Be Practiced In Confinement Systems?

Pen mating can be successfully used with confinement; however, it is not as efficient as hand mating. The breeding pens should have 18 to 20 square feet per animal with the width of pen being at least 8 feet. Imprinting the floor with a 4 to 6 inch diamond pattern 1/2 inch deep provides a much needed, nonslick surface when pen mating (Figure 10). Feeding on the floor also helps keep the floor clean and dry. Keep the number of weaned sows per pen small with the boars being rotated for sexual rest.

Pen mating should not be used in a production or financial situation where there is little room for error.



Figure 10. Diamond pattern in floor.

How Many Additional Females Should Be Bred Per Month To Insure A Full Farrowing Facility?

Base the number of additional sows to breed to reduce the risk of empty farrowing crates on each farm's own calculated monthly breeding factor (MBF). For example, if the estimated farrowing rate for sows bred in January is 86 percent, one would need to breed 116 percent of the number of sows needed to fill available farrowing crates. MBF was calculated by dividing the expected farrowing rate for January bred sows (Table 9) into 100 percent ($100\%/86\% = 1.16$). Thus, one would need to breed 35 females (1.16×30 crates) in January to insure that all 30 crates are filled when they farrow. If previous records on farrowing rate have not been kept, Table 9 illustrates the general farrowing rate trend and its corresponding monthly breeding factor.

SOW MANAGEMENT — GESTATION PERIOD

How Effective Is Pregnancy Testing With Ultrasonics?

Ultrasonic pregnancy testers are designed to detect fluids in the uterus or detect sound waves produced by the uterine artery and fetal heart beat. Pregnancy can be detected at about 30 days of gestation in sows, but accuracy for gilts improves when tested

Table 9. Calculated monthly breeding factors.^a

<i>Month bred</i>	<i>Estimated farrowing rate (%)</i>	<i>MBF</i>
Jan	86	1.16
Feb	89	1.12
Mar	90	1.11
Apr	88	1.14
May	87	1.15
Jun	81	1.23
Jul	77	1.30
Aug	76	1.32
Sep	74	1.35
Oct	81	1.23
Nov	85	1.18
Dec	86	1.16

^aVaries from farm to farm due to management and environment.

at 40 to 45 days. The accuracy and effectiveness depends on the skill of the operator. These machines can be at least 90 percent accurate when used properly.

Why Is Management Critical During The First 30 Days of Pregnancy?

This is the stage of gestation when most prenatal mortality occurs. Embryos develop from the two-cell stage into highly differentiated, complex organisms and become attached to the uterus. During this period, 20 to 30 percent of the embryos are lost. No single cause of embryonic mortality has been identified, but several factors under the control of management have been demonstrated to cause increased embryonic mortality. These include heat stress, type of housing, sow handling, disease and mycotoxins.

What Aspects of The Environment Should Be of Greatest Concern?

Temperature. Heat stress (above 85°F), causes increased embryonic mortality during early gestation (first 2 to 3 weeks of pregnancy) and increased fetal mortality and incidence of abortion and stillbirths during late pregnancy. Pregnant females may also suffer heat stress when they become sick and develop a fever.

Closely monitor sows for heat stress and provide relief when ambient temperatures exceed 80°F or when respiratory rates increase to greater than 50 breaths per minute. A combination of shade and sprinklers appears to counteract heat stress experienced outside whereas shade alone may not be adequate. Evaporative cooling in well insulated, totally enclosed confinement buildings and thermostatically controlled sprinklers in curtain-sided buildings with insulation overhead, will usually provide adequate relief from heat stress.

Low environmental temperatures have little influence on sow performance unless sows are subjected to an uncomfortable (wet and/or cold) environment. Sows maintained outside should be provided adequate shelter and bedding to protect them from extreme cold and provided extra feed to compensate for increased heat loss. Maintain sows in confinement in a dry, draft-free

environment and provide extra feed when temperatures decline below the lower critical temperature. The amount of extra feed to provide during cold weather is described on page 19.

Light Effects. Daily light exposure during gestation (day length and light intensity) is not known to influence farrowing performance.

How Should Sows Maintained in Groups Be Handled To Minimize Stress After Breeding?

Care must be exercised when grouping or regrouping sows into a pen environment after breeding. It is best to group bred sows in confinement as soon as possible after breeding (within three days of second day of mating), but not until enough bred sows are available to complete the group. To minimize fighting, all sows should be grouped and provided access to their new pen environment at the same time. Maintaining bred sows in small groups (6 to 8 or less) facilitates this process. Sows that have to be moved to stalls after breeding because of facility design should be relocated after the second day of breeding.

Type of Housing. Sows may be housed successfully in either pens or stalls during gestation. Recent evidence indicates, however, that sows maintained in small groups (4 or 5/pen) during the first 30 days of gestation had higher farrowing rates and produced larger litters than sows maintained in stalls.

Keep group size in confinement small (6 to 8 or less) to minimize the stress associated with peck-order fighting. Larger groups (15 to 20) can be maintained outside where there is more opportunity for flight from aggression. The key to success with group-housed sows is to use a feeding system that will control feed intake and body condition of sows and minimize aggression.

Sows maintained outside during gestation are typically kept in larger groups (15 to 20 sows/pen) and, although desirable, it often is not possible to complete the group and provide access to the gestation pen at the same time. Consequently, sows may need to be added to the group over time until the capacity of the pen is reached. Some fighting and re-establishment of peck order will continue as long as newly bred sows (after second day of mating) are added to the group, but the problem is manageable under outside conditions where sows have a better opportunity to escape the aggressive actions of other sows.

Another approach to the problem of assembling larger groups is to keep sows in smaller groups until after three weeks of gestation and then combine together two smaller groups in a new pen after the critical period of prenatal mortality has passed.

What are the Effects of Disease on Embryo Mortality?

Several types of viral and bacterial infection can cause whole or partial litter loss during gestation. A local veterinarian should be consulted for current advice on availability of vaccines to immunize gilts and sow 2 or 3 weeks before breeding.

Should Gilts and Sows Be Limit-Fed During Gestation?

Yes. Limit-feeding restricts the energy intake of gestating gilts and sows. A good limit-feeding program ensures that each

sow receives her daily requirement of all nutrients without consuming excess energy.

The high level of energy provided to gilts before breeding should be decreased immediately after breeding. Feeding excess energy is costly and may lead to increased embryo mortality during the first month of pregnancy resulting in reduced litter size at farrowing. Research indicates that high feeding levels provided to thin sows at weaning can continue following breeding without any adverse affects on embryonic survival. Regardless of daily feed intake, gilts and sows need an adequate supply of protein, amino acids, vitamins and minerals as described in *Nebraska Swine Diet Suggestions* (EC 88-210).

What Level of Feeding is Recommended?

Recent research indicates that long-term reproductive efficiency in sows is best accomplished by minimizing weight and backfat losses during lactation. Such a scheme would require that sows gain only moderate amounts of weight during gestation. Sows gaining moderate amounts of weight during gestation will eat more feed and lose less weight during lactation. Sow weight gain is controlled by restricting feed intake during gestation.

In general, feed gilts and sows 4 to 4.5 lb of a corn/milo-soybean meal diet daily during gestation. The degree of feed restriction must be tailored to the environmental conditions (see next question), condition of sow at breeding and energy density of the diet. Feed sows that are thin at breeding, especially first-litter sows, a higher level of feed (5 to 8 lb daily) until they have gained back needed condition. Feed sows that are in good body condition at breeding at the lower side of the recommended feeding level so that they do not gain excessive weight. Sows receiving gestation diets containing bulky feedstuffs, for example alfalfa hay or meal and oats, should be given additional feed to provide the estimated 6,000 kcal of metabolizable energy needed each day by gestating gilts and sows.

How Does Cold Weather Affect Feed Requirements?

When temperatures fall below the sow's lower critical temperature, (65°F for sows in gestation crates, and 55 to 60°F for group-housed sows) extra feed must be provided to meet increased maintenance needs. Otherwise, less energy will be available for body weight gain and development of the litter.

As a guide, sows in gestation crates without access to bedding need an extra 0.6 lb of a corn/milo-soybean meal diet daily for each 10°F drop in ambient temperature below 65°F. Thus, if 4 lb of feed kept sows in good condition at 65°F, then at 55°F they would need 4.6 lb of feed daily to maintain body condition. Group-housed sows without access to bedding do not need extra feed for maintenance until the temperature drops below 60°F. For every 10°F drop in temperature below 60°F, group-housed sows without access to bedding need an extra 0.3 lb of feed daily for maintenance. Sows with access to dry bedding usually do not need extra feed for maintenance until temperatures drop below 55°F. When adjusting feed intake for sows housed outside during the winter, remember that the temperature surrounding them is usually higher than the temperature outside on a cold, windy day if their sleeping area is well-bedded and draft-free.

It is important to remember that wet floors, drafts and poor building insulation will increase the sow's lower critical temperature thus further increasing the feed requirement for maintenance. Also, thin sows will need slightly more feed (0.25 lb per day) than sows in better condition at the same ambient temperature since they have less thermal insulation to reduce body heat loss.

Does Limit-Feeding Require Extra Management?

Yes. The purpose of limit-feeding is to provide enough feed to meet the sow's nutrient requirements but no more. Hence, it is important to ensure that every sow gets her share of feed. The small amount of added management saves a large amount of feed and enhances reproductive performance. Limit-fed sows will act hungry; therefore, durable fences and feeders are required.

How Can Limit-Feeding Be Accomplished?

The common methods of restricting energy intake during gestation are

- 1) daily individual hand-feeding,
- 2) daily group hand-feeding and
- 3) interval-feeding in groups.

Individual Hand-Feeding. Sows may be maintained in individual stalls or be maintained in group pens and fed in individual feeding stalls (Figure 11). This method provides the opportunity of feeding according to the individual needs of the sow and prevents boss sows from monopolizing the feed. Each sow is allowed to consume her allotment of feed regardless of how fast she eats. For best results, feeding stalls should allow a group of sows to be locked in until the slowest-eating sow is finished. Stalls for mature sows with lock-in devices should have a clearance of 20 inches inside and be 6 feet long. Stalls should not exceed 18 inches in width to prevent smaller gilts from turning around.

Group Hand-Feeding. In situations where individual stalls

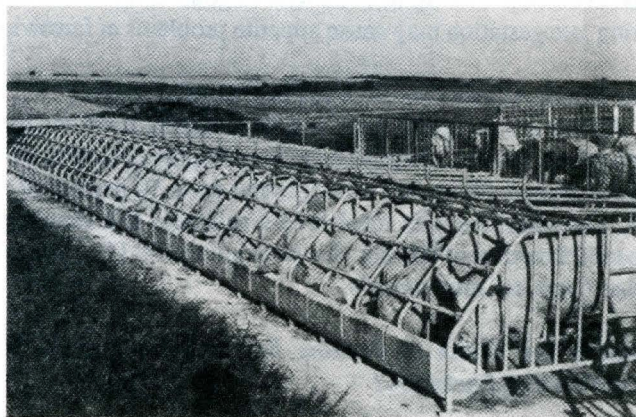


Figure 11. Feeding stalls.

are not available, sows may be limit-fed in a group by providing the daily feed required by the whole group in a common feed trough or on a concrete slab. This method is not preferred because it does not allow as good of control over sow weight and condition as individual feeding. Boss sows tend to overeat and timid and/or slow-eating sows tend to consume too little feed. Variation in feed consumption can be reduced by providing plenty of feeding space and by grouping sows according to age, size, condition and aggressiveness. More fighting among sows is observed with this method.

Interval Feeding. With interval feeding, sows are allowed to consume two or three days worth of feed in one day and then wait two or three days before being provided access to feed again. This system allows every sow in the pen to eat her fill even if she is a slow eater. Adjustments in average daily feed intake are made by altering either time on the feeder (2 to 12 hours) or time off the feeder (2 or 3 days). One self-feeder can serve several pens of sows by alternating the time fed, or the self-feeder in a pen can be paneled off and opened only when needed. If time on the feeder is restricted, one feeder hole per sow is needed. Every third day feeding of gilts is not recommended. Research has shown a decrease in pigs born alive, weaned and protein utilization when gilts were fed every third day. Sows perform well when fed every third day.

Interval feeding saves labor and results in more contented sows between feedings. It does not provide as good of control over sow weight and condition as individual feeding. It also may cause managers to be less conscientious in observing sows for problems on days they are not turned into the feeder.

Should Feed Level Increase Toward the End of Gestation?

Increasing the amount of feed provided to sows by 2 to 3 lb per day beginning 21 days before farrowing should allow them to support normal fetal growth without further depleting their body reserves before lactation. Although the sows will lose weight during lactation, this added reserve may help them complete lactation without becoming so thin that they will not recycle after weaning or experience reduced litter size problems later. Thin sows farrowing lightweight pigs (2.5 lb or less) may be more responsive to increased feed during late gestation than ones in good condition. Providing extra feed to good-conditioned sows during late gestation may cause appetite problems at farrowing.

How Much Alfalfa Can Be Used in Gestation Diets?

Alfalfa is a good alternate feed for gestating sows and gilts. With proper protein, vitamin and mineral supplementation, good quality ground alfalfa hay can represent up to 50 percent of the diet. Dehydrated alfalfa meal is less palatable and should not exceed 25 percent of the diet. See NebGuide G74-117, *Alfalfa in Swine Diets*, for more details.

What is the Effect of Feeding Fat to Sows During Late Gestation and Lactation?

Adding fat to the sow's diet during late gestation and early lactation may improve survival rate of pigs to weaning. On the

average, litter size at weaning has been increased by 0.3 pigs per litter. Overall, added fat primarily increases milk energy density and yield, thereby providing a greater opportunity for newborn pigs to obtain nutrients before their limited body reserves are exhausted.

To obtain the greatest response to added fat, sows should consume at least 2.5 lb of extra fat before farrowing. For example, feeding a diet with 5 percent added fat at the rate of 5 lb per day for 10 days before farrowing would be sufficient. The extra fat should be provided beginning at least one week before farrowing. A greater response to fat will occur in cases where more than two pigs per litter die before weaning.

Can Raw Soybeans Be Used In Sow Diets?

Yes. Gestation diets using raw soybeans to replace soybean meal have supported acceptable performance. Experiments using raw soybeans as the sole source of supplemental protein in lactation diets have indicated reductions in sow feed intake, greater sow weight losses and reductions in pig weaning weights. If raw soybeans are fed, they should be ground and incorporated as part of the complete diet. Soybeans should be ground and diets mixed at frequent intervals to prevent problems with rancidity.

Will Moldy Feed Interfere with Normal Reproduction?

Do not feed moldy ration ingredients to the breeding herd. Moldy feed can cause abnormal estrous cycles, lower conception rates, and reduce litter size and pig vitality at birth. Moldy corn containing zearalanone can cause embryonic mortality and other problems when present in sufficient concentrations (3 to 10 ppm).

BREEDING HERD PERFORMANCE

Breeding herd performance can be evaluated from either a biological or financial perspective. It is best to use both perspectives when evaluating the success of a pork production business. To make appropriate biological and financial decisions, an accurate records program is essential. Biological data to evaluate the success of a swine enterprise may include such factors as litters/sow/year, piglets born/litter, piglets weaned/sow/year, piglets/crate/year, etc. Biological targets for intensive, well-managed operations are shown in Table 10. Maximizing biological function may not maximize profit; therefore, management changes for increasing biological function should be in an area to maximize profit at an optimal biological function.

Financial evaluations are made from such factors as net profit and return to management, margin overall costs per hundred pounds of pork produced, net profit per year per female maintained, net profit per year per crate maintained, etc. The biological factors to consider for improving profit will vary from farm to farm due to type of facilities and level of fixed and variable costs. Table 11 indicates the spread between producers in their ability to be competitive. The Iowa State University Swine Records Program has consistently shown that 80 percent of the variation in profit between operators is due to production costs and less than 20 percent is due to market price received.

Table 10. Biological Production targets for intensive, well-managed pork production units

<i>Item</i>	<i>Target</i>
FEMALES	
Normal repeat services, %	5
Multiple mated (Hand Mating), %	100
Bred within 10 d of weaning, %	
First litter sows	90
Multiple litter sows	95
Weaning to 1st service interval, days	
First litter sows	9
Multiple litter sows	7
Interval, farrowing to farrowing, days	
3 week weaning	145
5 week weaning	160
Farrowing rate, first service, %	
females farrowed	90
females exposed	x 100
Litters/female/year	
3 week weaning	2.4
5 week weaning	2.3
Litters with less than 8 pigs, %	10
Female deaths, % of annual inventory	2
PIGS	
Born alive/litter farrowed	
Sows	11.5
Gilts	10.5
Adjusted 21 day pig weight, lb	15 +
Stillborns/litter farrowed, no.	.5
Mummies/litter farrowed, no.	< .1
Deaths birth to weaning, %	10
Pigs weaned/litter farrowed	
Sows	10
Gilts	9
Pigs weaned/inventoried female/year	20 +

Table 11. Summary of Iowa State University's 1988 Records for Far-row to Finish Swine Enterprises

<i>Item</i>	<i>High^a profit (99 farms)</i>	<i>Low profit (99 farms)</i>	<i>Averages of 295 farms</i>
Average female inventory, no. of head	101	95	115
No. of litters weaned/female/year	1.84	1.79	1.83
No. of pigs weaned/litter	8.30	8.00	8.15
No. of pigs weaned/female/year	15.25	14.38	14.97
No. of litters weaned/crate/year	7.13	7.49	7.54
No. of pigs weaned/crate/year	59	60	61
Pig death loss, birth to weaning (%)	13.47	16.73	14.99
Pig death loss, weaning to market (%)	5.43	6.22	6.04
Breeding stock death loss (%)	4.74	5.34	4.85
Total pounds of feed/cwt of pork produced	364	397	378
Net profit/year/female maintained (\$)	201.33	-118.69	45.43
Net profit/year/crate maintained (\$)	791.76	-463.53	188.99
Margin over all costs/head sold (\$)	14.62	-9.89	2.93
Total cost/cwt of pork produced (\$)	36.28	45.76	40.85
Grain price/bushel (\$)	2.17	2.21	2.19

^aMargin over all costs were used to partition high and low profit farms.

