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Donald G. Levis
University of Nebraska-Lincoln, donlevis@hotmail.com

Dwane R. Zimmerman

Alex Hogg

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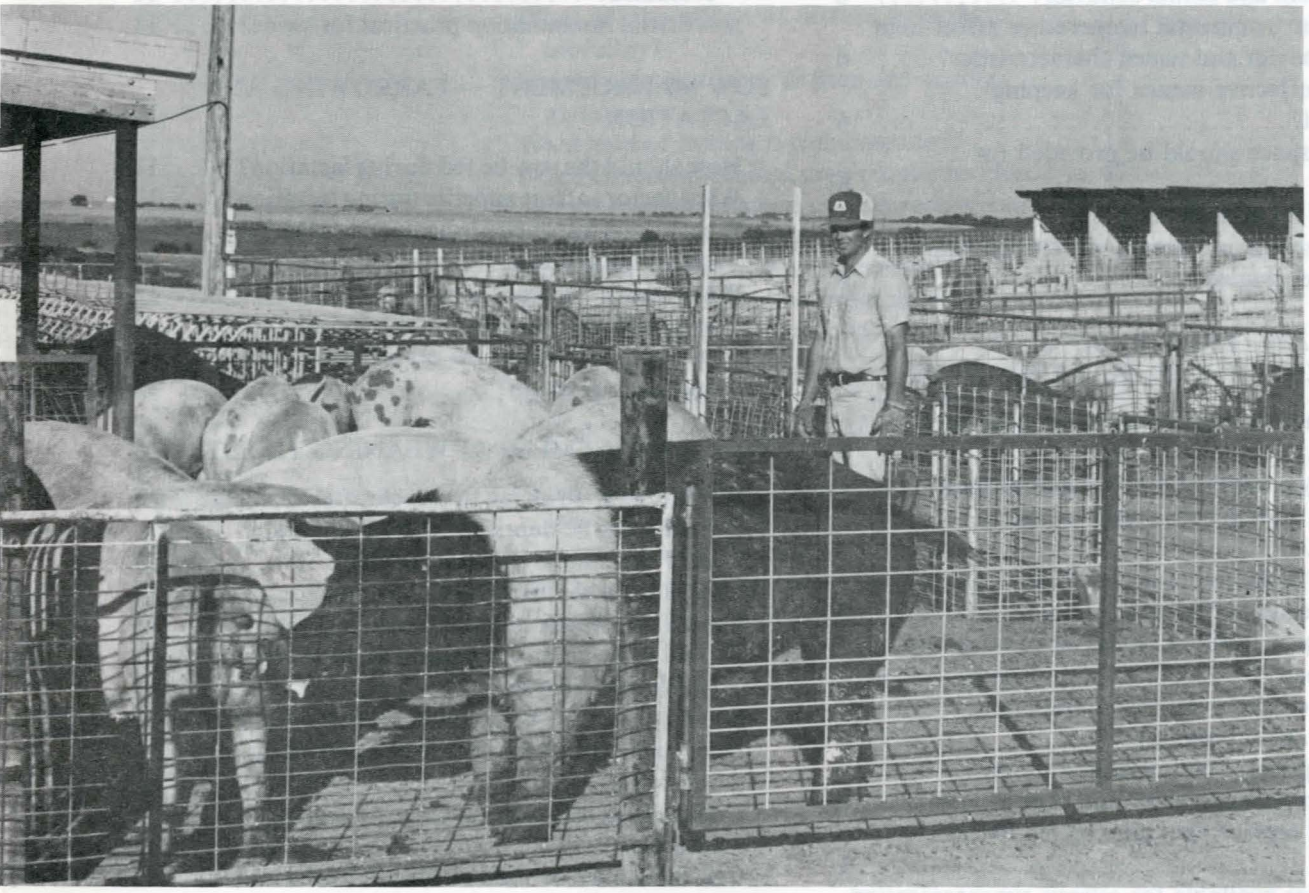
SWINE REPRODUCTIVE MANAGEMENT



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CONTENTS

INTRODUCTION

BOAR SELECTION AND PREBREEDING MANAGEMENT

What is the economic value of boar selection? 4
What factors should be considered in boar selection? 4
Can crossbred boars be used successfully? 4
What age should boars be when first used? 5
When should boars be purchased? 5
How should newly purchased replacement boars be managed and introduced to the breeding herd? 5
Why is prebreeding exposure to females and fecal material exchange between boar and sow herd necessary? 5
How can replacement boars be evaluated for sexual behavior? 5
Does confinement rearing affect boar development and sexual behavior? 6
Does high environmental temperature affect boar sexual behavior and semen characteristics? 6
What is an effective means for keeping boars cool? 6
How much space should be provided for the boar? 6
How should the boar be fed? 6
Should the semen of recently purchased boars be semen evaluated? 6

SELECTION AND PREBREEDING MANAGEMENT OF REPLACEMENT GILTS

When and how should replacement gilts be selected? 6
What is early puberty and why is it important? 7
What effect does genetics have on age at puberty? 7
How should replacement gilts be fed? 7
Does confinement affect age at puberty? 7
Does rearing intensity or social isolation affect age at puberty? 8
What are the effects of season and photoperiod on age at puberty? 8
Can earlier puberty be stimulated by the "transport phenomenon" and boar exposure? . 8
How should replacement gilts be fed before breeding? 8
Are hormones available for estrous synchronization in gilts? 8
What is the value of a replacement gilt pool? 9
How should the gilt pool be managed? 9
To protect gilts during gestation, what vaccines should be used and when should they be given? 9

BOAR MANAGEMENT — BREEDING PHASE

What is the maximum number of services and/or sows per boar? 9
How should boars be managed when pen mated as a group? 10
Why do boars need sexual rest? 10
Should boars be assisted with intromission? 10
Why do some boars have inadequate sexual behavior? 10
Can hormone treatments be used to increase sexual behavior? 10
Should a feeding and breeding routine be established when hand mating? 10
How should boars be fed before, during, and after the breeding season? 11
What type of records should be kept on boars? 11
Should testis size be monitored? 11
Should semen of mature boars be routinely evaluated? 11
Is artificial insemination practical for swine? 11

SOW MANAGEMENT — FARROWING AND LACTATION

How should the sow be fed during lactation? 11
What factors affect appetite during lactation? 12
What is mastitis-metritis-agalactia (MMA) syndrome and how is it treated? 12
What causes "downer sows"? 12
Does supplemental light during and after lactation influence sow performance during and after lactation? 12

SOW MANAGEMENT — WEANING TO ESTRUS

Why do some sows fail to recycle after weaning? . 13
Should sows be deprived of feed and water after weaning to stimulate estrus? 13
Should sows be flushed after weaning? 13
Should antibiotics be fed at breeding time? 13
Should sows be group penned or individually stalled after weaning? 13
Should sows have boar contact after weaning? 13
Does breed influence the weaning-to-estrus interval? 13
Does season influence weaning-to-estrus interval? 14
Can hormones be used to induce estrus and ovulation? 14

SOW MANAGEMENT — BREEDING PHASE

What are the signs of estrus (heat) in pigs? 14
Is the boar needed for estrus detection? 14

Why do cycling sows get missed when heat checking? 14
At what stage in the estrous period should the sow or gilt be bred when hand mating? 14
Should sows be bred on the first estrous period after weaning? 15
What are the advantages of hand mating? 15
What problems are encountered when pen mating? 15
Can pen mating be practiced in confinement systems? 15
How many additional sows should be bred per month to insure a full farrowing facility? 15

SOW MANAGEMENT — GESTATION

How effective is pregnancy testing with ultrasonics? 15
Why is management critical during the first 30 days of pregnancy? 16
What aspects of the environment should be of greatest concern? 16
How should sows be handled to minimize stress after breeding? 16
What are the effects of disease on embryo mortality? 16
Should gilts and sows be limit-fed during gestation? 16
What level of feeding is recommended? 17
Do confinement-housed sows require less feed? 17
Should sows maintained outside receive extra feed during cold weather? 17
Does limit feeding take extra management? 17
How can limit feeding be accomplished? 17
Should feed level be increased toward the end of gestation? 18
How much alfalfa can be used in gestation diets? 18
Will moldy feed interfere with normal reproduction? 18
What is the effect of feeding fat to sows during late gestation and lactation? 18
Can raw soybeans be used in sow diets? 18
When and how should sows be changed from a gestating to a lactating diet? 19

GOALS FOR REPRODUCTIVE EFFICIENCY . . . 19

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

INTRODUCTION

Approximately 20 to 30 percent of the total feed cost of producing pork is involved in maintenance of the breeding herd. Therefore, obtaining maximum farrowing rate, litter size, and number of pigs weaned is essential to achieving maximum profits in a swine enterprise. Pork producers can improve sow productivity through a better understanding of how reproductive physiology, genetics, nutrition, health, environment, and management influence sow productivity. This publication has answers to many of the questions concerning the management of boars, sows, and gilts.

BOAR SELECTION AND PREBREEDING MANAGEMENT

What Is the Economic Value of Boar Selection?

Boars provide the foundation for herd improvement in both purebred and commercial herds. When replacement gilts are selected from within commercial herds, the boars introduced into the herd during the last three generations have contributed 87.5% of the genetic material to the third generation pig crop. The genetic material from the original sows will only be 12.5 percent (Figure 1). Also, selecting boars which have large testes and the potential to be skillful, aggressive breeders will consistently result in high farrowing rates and litter sizes.

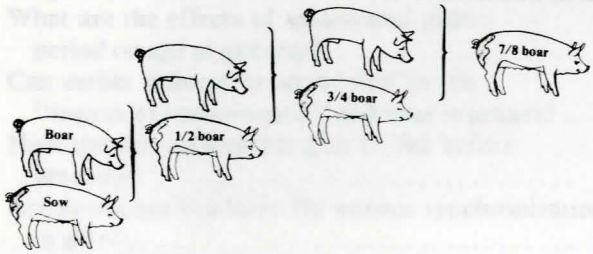

Figure 1. The genetic contribution of the boar after three generations of selecting replacements from within a commercial herd.

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 a source of boars, consider health, breed, and genetic improvement programs. Individually, consider soundness, sexual behavior, and genetic merit. Buy the fastest growing, leanest boar you can afford that meets your selection criteria.

Health. Buy boars from sources which represent minimum health risk to your herd. Buy from a brucellosis free herd that is 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. Breed choice will affect breeding performance of the boars you buy as well as the reproductive rates of the gilt they sire. Carefully following the crossbreeding program will maintain high levels of heterosis and good pig survival. Whether purebred or crossbred boars are used, choose the breed or breed type appropriate for your crossbreeding system.

Genetic Improvement Programs. Boars produced by comprehensive testing and improvement programs are recommended. The improvement programs should be aimed at improving those traits of economic importance, such as rate of gain, feed efficiency, litter size in sow lines and carcass value. Breeders who test and use test results in their own selection programs are the preferred source.

Soundness. Unsoundness of feet and legs is the main problem encountered with young boars. Closely observe the breeder's herd for signs of lameness, especially among market weight hogs. It is often best to purchase boars that have been reared in an environment similar to the purchaser's operation.

Examine boars for testicle development. Both testicles should be the same size with the epididymis being prominent at the top of the scrotum. The testicles should feel firm but not hard. Other reproductive organs which cannot be seen or examined will probably be anatomically sound and functional when testicles are normal.

Can Crossbred Boars Be Used Successfully?

There is considerable interest among commercial

swine producers in the use of high quality terminal crossbred boars. Research with young crossbred boars (7-9 months of age) has shown a significant improvement over the average of the breeds involved in size of scrotum and testes, quantity and quality of sperm, and sperm storage capacity. They reach puberty and exhibit excellent sexual behavior at a younger age than purebred boars. Performance data in commercial herds indicate 10-15% higher farrowing rates. The economic advantages of using crossbred boars are realized with well-designed and managed breeding programs. The selection of breeds to use, and their order of use, is important to maximizing heterosis. Crossbreeding systems using crossbred boars can maintain high heterosis levels and excellent performance.

What Age Should Boars Be When First Used?

Don't use boars before they are 7.5 to 8 months old. Some boars show sexual development as early as five months of age; however, they are not ready for service. Sexual development is a gradual process and age is a better indication of sexual maturity than is body size. As age increases, semen volume and total sperm production gradually increase.

When Should Boars Be Purchased?

For best results, buy new boars (5.5 - 6.0 months old) 60 days before they are needed. The 60-day period allows the boar to be isolated, retested, and gradually exposed to microorganisms on the farm. If a problem arises, there is time for semen quality and fertility to recover 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 28 days and observe for signs of any infectious disease. Following this schedule will minimize the chances of diseases being introduced with purchased boars:

Time (days)	Management Procedure
Before purchase	Blood test for leptospirosis (5 species) and pseudorabies (if boar did not originate from a pseudorabies qualified herd).
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 of 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. If the boar is going to a herd infected with pseudorabies, he should be vaccinated.
8-14	Remain in isolation; treat for lice and mange (10 days after first treatment); to provide a broader contact with the microflora present in the breeding herd, place fecal material from the sow lots in the boar's pen or provide physical contact to cull animals.
15-21	Remain in isolation; expose to sow's fecal material or provide physical contact to cull animals.
22-28	Remain in isolation, retest for pseudorabies, evaluate sexual behavior with cull gilts by using procedure on page 6.
29-56	Provide fence-line contact to nonpregnant sows and to gilts to be bred; plus, feed the boar's fecal material to these females. Evaluate sexual behavior; semen evaluation (36-42 days).
57-63	Begin breeding (Boar is 7.5 - 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 what has been called SMEDI syndrome. It is unfortunate that the term "SMEDI" is used to imply a disease as it is not a disease but rather a group of signs that are produced by several viruses. The letters in SMEDI stand for: Stillborn, Mummified fetus, Early Embryonic Death, and Infertility.

Nearly all of the so-called SMEDI virus problems are due to parvovirus or one or more of eight enteroviruses. Parvovirus is the culprit in the majority of SMEDI problems. One or more of the eight 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 SMEDI 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 and an estrous gilt or small sow in a pen by themselves. The boars should be evaluated at 4 different times (2 consecutive days each week) for 15-20 minutes each time.

Boar Behavior	Rating
Breeds gilts—check to be sure penis doesn't fall out.	Satisfactory - if successfully mates at least 2 of 4 females.
Mounts gilt, thrusts, extends penis, no copulation.	Questionable - boar may need assistance (assist first 2 times, but do not assist last 2 times)
Mounts gilt, thrusts, doesn't extend penis.	Unsatisfactory - check anatomy for abnormal development.
Repeatedly noses gilt, doesn't mount, very aggressive.	Unsatisfactory - retest. Provide an area where he can see successful matings before retesting.
No interest 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. It appears that social environment during rearing should be of more concern than whether the boar is confined or not confined, regardless of type of housing. Preliminary 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 (15-16 hours) reach puberty at a younger age than boars reared under a shorter day length, and (5) sexual behavior during rearing may be related to mating behavior after puberty.

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

All boars are not affected to the same degree 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 ceased. Since boar fertility influences many matings, a management system must be designed to maintain maximum fertility in all boars. Boars tend to be 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 in combination with sprinklers and fans can be used to cool boars. Thermal stress causes minimal perspiring in swine, so evaporative cooling of the body is limited unless water is sprinkled on the animals. It is imperative 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 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 35-50 sq. ft., or stalls measuring 28 inches by 7 feet. Housing boars together is not recommended.

Non-confinement. Individual boars being maintained in outside open lots should have 20 sq. ft. 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, 20-24 inches of feed trough space per boar, and 1 cup or nipple waterer for each 3 boars.

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?

The newly purchased boar will generally have a loss of appetite for a few days after arrival due to the exposure to the new environment, facilities, and management. If possible, get a bag of feed from the supplier of the boar so that the boar will recognize the diet. Start feed sparingly (2 lb the first day) and then gradually increase it to the level for maintaining good body condition (normally 4 lb/day). It is not a good practice to allow the boar to get fat.

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 on the basis of marginal semen characteristics. Sperm number continues to increase until the boars are 10-12 months old.

SELECTION AND PREBREEDING MANAGEMENT OF REPLACEMENT GILTS

When and How Should Replacement Gilts Be Selected?

Birth. Replacement gilts should have 14 teats and

should be chosen from the best sows on the basis of litter size and mothering ability. At birth, ear notch at least twice as many gilts as will be needed. A record should be kept of the ear notch, the date of birth, and the breed composition of the gilt. Recording the breed composition will make it easier to maintain the crossbreeding program.

Once the gilts have been permanently identified, barrows in large litters should be fostered to other sows. Data suggest that gilts reared in small litter groups will produce larger litters than those reared in large litter groups. It should be understood that this does not mean that gilts should be selected from small litters. It simply means that gilts born to large litters and raised in large litters may not be able to express their genetic potential for litter size.

Weaning. Remove from the candidate list daughters of sows which have not milked well.

Finishing. Make final selections at 175-200 lb based on growth rate, back fat, mammary system, skeleton, and vulva development.

Skeleton. Choose replacement gilts which can move about freely.

Mammary System. Choose replacement gilts which have 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 replacement gilts with normal appearing external genitalia. Most anatomical defects of the reproductive system are not visible, but avoid gilts which do not show proper development of the external genitalia. Increased prominence of the vulva and mammary system as the gilt nears puberty is an indicator of a normal system.

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 (7-9 months) since more eggs are ovulated and larger litters can result. Litter size in gilts receiving adequate energy will be increased approximately two pigs per litter by breeding at second estrus rather than at first estrus. Gilts that express first estrus at a young age (< 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 (average 200 days). Crossbred gilts generally express first estrus earlier (1-4 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. 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 25-35%.

How Should Replacement Gilts Be Fed?

Most gilts are developed to 175-200 lb (4 1/2 - 6 months) by self-feeding growing-finishing diets that promote normal growth and development. Although this practice is necessary to obtain satisfactory individual growth and backfat records for use in selection, do not continue self-feeding after the performance test is completed.

Energy intake can be restricted after 175-200 lb without delaying puberty. This restriction can be accomplished by hand feeding daily each gilt 5-6 lb of a well-balanced, 14% protein diet. Energy restriction not only saves on feed costs but also prevents that accumulation of unneeded weight and body condition which may decrease longevity of production and be a contributing factor in the development of unsoundness in young as well as older breeding females. When intake is restricted, supply protein, vitamins, and minerals in the diet in amounts that provide the daily allowance as suggested in the Nebraska Swine Diet Suggestions publication.

Beginning at 175-200 lb, when the gilts are selected, it is recommended that the diet contain .9% calcium and .8% phosphorus.

Other factors which must be considered in the proper management of a limited feeding program are animal activity and temperature. Gilts maintained in confinement require approximately 10% less feed (.5 lb/head daily) than gilts maintained outside. Requirements are approximately 25% greater (1 lb/head daily) during the extreme cold of winter than during warmer seasons. The requirement differences are adjusted by amount of energy intake.

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 (7-9 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 (>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 space or elbow room, and there is more competition for available space. The recommended density for finishing pigs (8 sq. ft./pig) appears adequate for normal puberal development up to the time gilts are selected for replacement (4½-6 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.

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

Seasonal Effects. Slaughterhouse data and controlled experiments have demonstrted that winter- and spring-born gilts are delayed in expressing first estrus as compared to gilts born in summer or fall. The causative factor(s) responsible for the delay are not known. High environmental temperature (>85 °F) does interfere with the expression of behavioral estrus, reduce feed intake, and lower ovulation rate in cycling gilts. Protect replacement gilts from high environmental temperature (>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 and fans 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' refers to the mixing of unfamiliar gilts and their transport and relocation to a new environment. This stimulus is capable of triggering a synchronous first estrus in 15-30% of gilts nearing puberty. Most gilts that respond show estrus 3-10 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 provided with once daily or continuous contact (fence line or physical) with a sexually mature (>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 in 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 (30-90% of gilts in estrus in 3-10 days).

To maximize the estrous synchrony response, relocate gilts outside so they receive once daily 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 (175-190 days of age) will normally show a more rapid estrous response than younger gilts (160-175 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.

How Should Replacement Gilts Be Fed Before Breeding?

End the restricted feeding program and replace by a moderate or high level of energy (increase feed intake 50-100%) 7-10 days before breeding so that gilts are in an improved nutritional state and gaining weight before breeding. High energy feeding ("flushing," essentially full-feeding) will maximize the number of eggs released by the ovaries.

Are Hormones Available for Estrus Synchronization in Gilts?

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

What Is the Value of a Replacement Gilt Pool?

The gilt pool is the only part of the female breeding herd that can supply the necessary number of females to replace sows culled from the herd.

How Should the Gilt Pool Be Managed?

Producers should establish a gilt pool that works for their production schedule. The gilt pool must be organized to adequately meet the demands for replacements but yet minimize the investment in feed, labor, and facilities. The goal should be to provide replacement gilts in estrus at the proper time when sows are being replaced in the farrowing group.

Gilts selected, developed, and maintained for the gilt pool should be managed to optimize reproductive efficiency and be utilized as efficiently as possible. This requires once daily observation for estrous activity whether gilts in the pool are being bred or not. Gilts in the pool that are not detected in estrus within 30 days of being added to the pool are either cycling abnormally or late maturing and should be identified and culled. Hand mating should be practiced to conserve the gilt pool and for obtaining the needed number of bred replacement females. For planning purposes, the number mated should exceed the number of replacements needed since farrowing rate is less than 100% (industry-wide average is 70%).

The size of the gilt pool for a given herd will depend on the herd replacement rate. Decreased recycling and farrowing rates in the summertime may make it necessary to increase the size of the gilt pool.

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 (5 species). If the herd is infected with pseudorabies or there is pseudorabies in nearby herds, include pseudorabies vaccination in commercial swine herds. Seedstock producers maintaining pseudorabies qualified herds will not be able to use vaccine since to do so will cause positive blood tests.

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 Maximum Number of Services and/or Sows per Boar?

The maximum use of boars in a breeding program depends on their sperm production and output rate. Factors such as age, breed, season, health, and frequency of ejaculation have an influence on sperm production and fertility.

A conservative approach must be taken when pen mating weaned sows and replacement gilts. As can be seen in Figure 2, the number of sows in standing estrus accumulates over time when all weaned sows are placed in one pen. This problem can lead to overworked boars. Some overworked boars have a decrease in sexual behavior but an aggressive boar may continue to breed after his sperm supply is depleted. Temporary sterility occurs when the sperm supply is depleted. It is also important to remember that a higher proportion of sows return to estrus when bred by overworked boars. This may lead to a more severe overload for the boars if the next group of sows happen to be in estrus at the same time as the recycling sows.

Table 1 provides a guideline for **maximum** number of services or sows per boar.

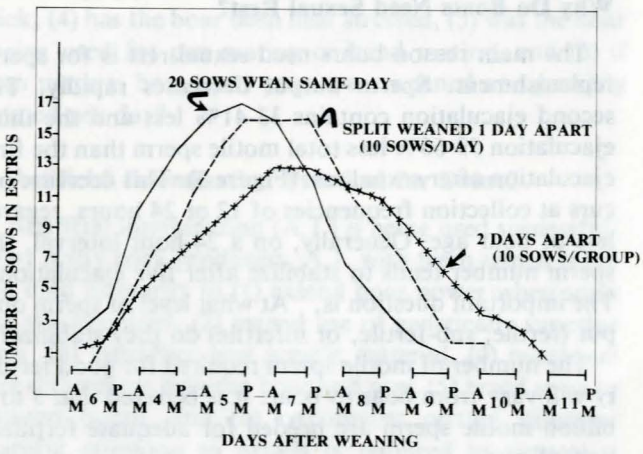

Figure 2. Number of weaned sows in estrus when pen mated (20 sows/group—90% cycle).

Table 1. Maximum number of services or females per boar, by age.

	Group weaned sows					
	Hand-mating			*Pen mating*		*Non-synchronized*
Boar age	*No. services*			*No. sows*		*replacement gilts*
(months)	*Daily*	*Weekly*	*Monthly*	*Weekly*	*Monthly*	*3-week period*
Young (8 1/2 - 12)	1	5	20	3	12	12
Mature (Over 12)	2	7	28	5	20	

How Should Boars Be Managed When Pen Mated as a Group?

Regardless of the number of boars needed when pen mating, keep them in small groups, preferably 2 to 3 boars per pen. This will reduce the stress of dominant and subordinate relationships among boars. Smaller groups also provide management and financial flexibility. For example, it is easier to replace both boars of a pair when one becomes injured than it is to try to add one or two boars to a larger group.

When using groups of boars (2-3 per pen) for pen mating, divide weaned sows into groups of 10-15 and rotate two groups of boars with each group of sows. Provide a ratio of 2.5 weaned sows per boar. The percentage of multiple matings will increase if the boars are rotated every 12-24 hours for a sexual rest. A simple system needs to be devised so anyone can tell which boars are being used in each pen and what order they are being rotated. Training boars to a rotation system can be easily accomplished by not feeding them until they have changed pens or by only feeding them in their own pen. If boars are not given a sexual rest, rotating groups of boars between sow pens will stimulate their sexual behavior.

Observe boars frequently for bite wounds of the penis, traumatic irritation of corkscrew tip, and bloody semen since these injuries are more frequent when several boars are penned and worked together.

Why Do Boars Need Sexual Rest?

The main reason boars need sexual rest is for sperm replenishment. Sperm output decreases rapidly. The second ejaculation contains 33-41% less and the third ejaculation 59-66% less total motile sperm than the first ejaculation after sexual rest (Figure 3). This decrease occurs at collection frequencies of 12 or 24 hours, regardless of boar age. Generally, on a 24-hour interval, 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 to 6 billion motile sperm are needed for adequate fertilization of ova.

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. Assisting boars with their first 2-3 matings does not make young boars better breeders.

Why Do Some Boars Have Inadequate Sexual Behavior?

The lack of willingness and eagerness for boars to pursue, mount, and attempt service of sows can be influenced by (1) high environmental temperature (85°+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) inactivity due to condition and age, and (13) inadequate stimuli where permanently housed.

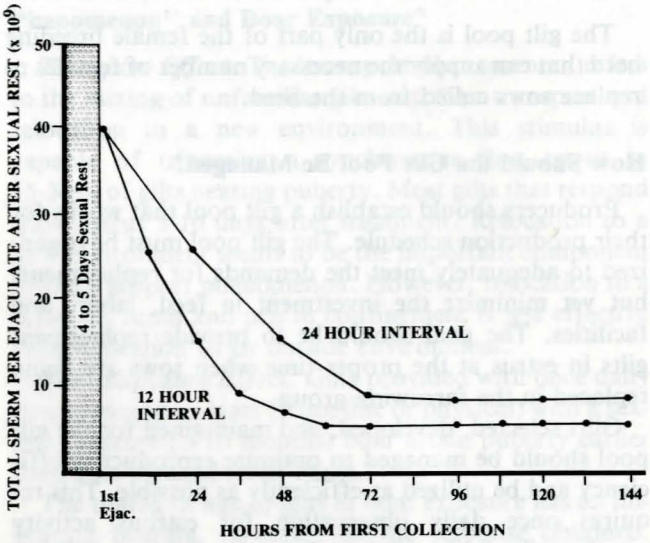

Figure 3. Sperm production at two collection intervals (mature boars, 12+ months old).

Can Hormone Treatments Be Used to Increase Sexual Behavior?

Although injections of testosterone may result in increased libido in some boars, it should not be given. Besides the desire and ability to ejaculate, boars must also produce adequate number of fertile sperm. Testosterone has an effect on the pituitary gland which can cause a reduction or elimination of 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 fenceline contact (Figure 4) with a mature, sexually-aggressive boar before being moved to the breeding pen. However, **great care** needs to be taken when moving a sexually stimulated boar.

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

Yes. It is recommended that boars be fed before being used to breed sows; otherwise, they will have a tendency 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.

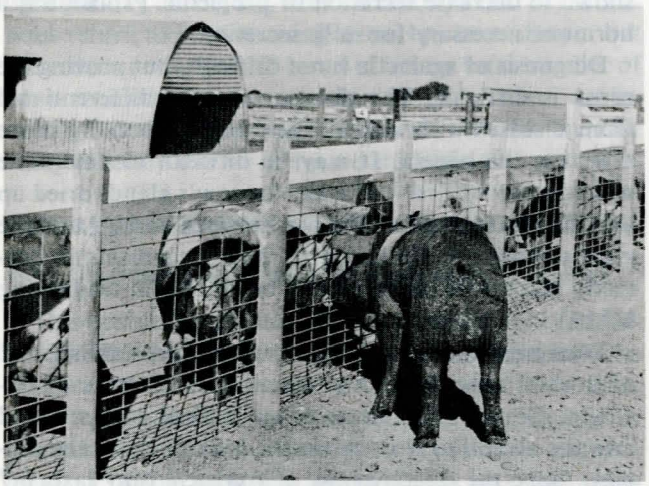

Figure 4. Fenceline contact.

How Should Boars Be Fed Before, During, and After the Breeding Season?

Depending on the age and condition, the herd boar heading into the breeding season within two weeks should receive between 4 to 6 pounds of a balanced 14% crude protein diet per day—5-6 pounds for the young boars; 4-5 pounds for the older ones. Also, depending on work load, consideration may have to be given to increasing the feed level during the breeding period.

Adequate nutrition is equally important **after** the breeding season. How much feed is required depends on the boar's body condition and the amount of time between breeding periods. Generally, an average conditioned boar not in service can be maintained on about 4 pounds daily of a balanced 14% crude protein ration.

Formulation of special boar diets may be justified when several boars are to be maintained. However, in most herds, the diet fed to the sow herd is adequate. When limit feeding to reduce the energy intake, be certain that adequate levels of protein, vitamins, and minerals are present to meet the boar's requirements for these nutrients.

What Type of Records Should Be Kept on Boars?

Due to the economic impact the boar has on reproductive efficiency, his reproductive performance record is many times more important than that of the female. To keep meaningful reproductive records on a boar, the sow cannot be mated to two different boars. Records of importance to keep are (1) litter size born, (2) farrowing rate, (3) boar fecundity index (farrowing rate x litter size), and (4) percentage of litters farrowed with 8 or less pigs. A comparison among boars can be made once the records have been accumulated over time. In addition, when hand mating, record the number of services per day and week.

Should Testes Size Be Monitored?

Since the testes are the sperm-producing organs, monitor and compare for significant changes over time for size, consistency, and shape. With degenerating testicles, the boar will be fertile for several services followed by a period of sterility. He may then return to fertility again. 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 the only ways of detecting this problem.

Should the Semen of Mature Boars Be Routinely Evaluated?

No. 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 the characteristics of average ejaculates (sperm concentration: 200-300 million/ml; sperm motility: 70%; morphologically normal sperm: 80%; Gel-free volume: 150-200 ml), he becomes a suspect and should be reevaluated.

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. A.I. 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, (5) breed sows to injured boars, and (6) circumvent certain diseases. Careful attention to details is required to prevent a decrease in fertility.

When using frozen semen to introduce genetic material, a reduction of 30% in farrowing rate and 1.5 to 2 pigs less 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 the Sow Be Fed During Lactation?

The sow's nutrient requirements at farrowing and during lactation are critical. Yet many sows have limited

appetites the first day or so following farrowing. Hand-feeding to appetite twice daily for the first week after farrowing is an acceptable method of feeding. This provides adequate supervision and appetite stimulation, prevents overeating, and allows the sow to be on full feed by the end of the first week. It takes more labor to do this. Fresh water should always be available.

Full feeding is less labor intense and allows adequate milk production to start a large litter and restores the reproductive tract to normal. Sows nursing fewer than 8 pigs may be fed a basic amount of feed (6 lb/day) with an added allotment of 0.5 lb for each pig being nursed. Fostering pigs helps to equalize litter size and feed requirements among sows.

What Factors Affect Appetite During Lactation?

Environmental Temperature. Sows will consume about 13% more feed per day when the room temperature is at 70°F instead of 80°F. A hovered and heated creep area should be provided for the piglets.

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

Physical Form of Feed. If sows are not eating ground feed, switching to cubes or pellets may help to increase consumption. Trial and error may be the only solution to getting sows back on feed.

Liquid Feeds. Sows will sometimes consume more feed in wet (about 1 part feed to 2 1/2 parts water) than in dry form.

Gestational Feed Intake. A sow which is fed too liberally during gestation will have a reduced apetite in lactation. Thus, the general aim for gestational feeding is to have the sows in fit but not fat condition at farrowing.

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 signs and symptoms 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 stomach 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 pneumonia, or other similar organisms) may be the cause of agalactia. Endotoxins produced from coliform bacteria have been shown to decrease secretion of prolactin. Prolactin is 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 symptoms, especially those affecting the piglets. It may be difficult to determine which occurred first—whether the sow's glands dried up and the pigs starved, or the pigs stopped nursing and the glands dried up. Culturing of microorganisms in correctly taken milk samples may be helpful in diagnosing MMA.

Treatment must be directed toward reestablishment of normal milk flow. An injection of 20 units of oxytocin will cause the release of any milk already secreted into the alveoli to flow down the milk ducts to the nipples. Since the effectiveness of oxytocin only lasts 6-7 minutes, it needs to be injected at 2-hour intervals to coincide more closely with the nursing habit of piglets.

Preventative programs may include: (1) preventing sows from lying on wet, fecal-contaminated farrowing floors, (2) preventing high temperatures and relative humidities in farrowing facilities, (3) preventing thin sows and reducing physical stress throughout gestation, especially near farrowing, (4) using a prepared bacterin based on the actual sow herd's infected milk, and (5) selecting gilts with the genetic and physical abilities to produce milk.

What Causes "Downer Sows?"

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

One cause of downer sows is due to diet deficient in calcium, phosphorus, vitamin D, or an improper ratio of calcium and phosphorus particularly during gestation. During lactation the bones of the sow are decalcified to meet the heavy Ca and P demand for milk production. Therefore, the bones are weakened and are unable to withstand any sudden contractions of the powerful back muscles or support the weight of mounted boars and sows. The condition may be prevented by feeding a diet containing .9% calcium and .8% phosphorus during gestation and lactation. Regardless of feeding level, gilts and sows should receive 16 grams of total calcium and 14.5 grams of total phosphorus daily during gestation. A second cause of downer sows is a lack of muscle tone after a 4 to 5 week lactation period. Individually housing weanedsows in a small pen for one to three days after weaning reduces or may prevent the problem.

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 return to post-weaning estrus has been shown; but there does not appear to be an effect on total number of sows returning to estrus within 10 days. Also, an increase in litter weight has been shown with this increase being possibly due to 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 a limited appetite which is inadequate for maintenance, growth, and milk production requirements. 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 K cal/lb of diet) during the first lactation, (4) avoid high farrowing house temperatures (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 sow feed on thin 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 5).

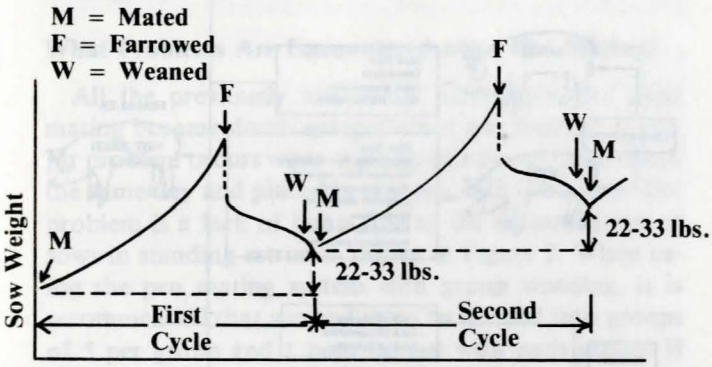

Figure 5. Example of sow weight changes during first two reproductive cycles.

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

No. Research data indicate that fasting sows after weaning is not beneficial and can have detrimental effects on days to estrus and ovulation. In fact, providing 6 to 8 pounds of feed after weaning has been shown to decrease rebreeding interval and increase subsequent litter size in first litter sows and in thin older sows.

Should Sows Be Flushed after Weaning?

Although gilts repond 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 lb per head per day to weaned sows; however, feeding extra feed 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 carried out to compare reproductive performance for 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 indicate minor effects in favor of group penning on weaning-to-estrus interval and litter size.

Should Sows Have Boar Contact after Weaning?

Weaned sows need boar contact, 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. 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 among breeds and crosses are the main genetic cause of difference in the weaning-to-estrus interval. 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 which is characterized in part, by a 20-30% decrease in the rate of early return (7-10 days) to post-weaning estrus from June to October compared to the other months of the year. The magnitude of anestrus problems 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.

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 6). The various changes in behavior are: (1) restlessness, (2) loss of appetite, (3) change in coloration of vulva, (4) swelling of the vulva, (5) frequent sniffing of genitals of pen mates, (6) often emiting a peculiar growling or roaring sound like a boar, (7) cloudy 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.

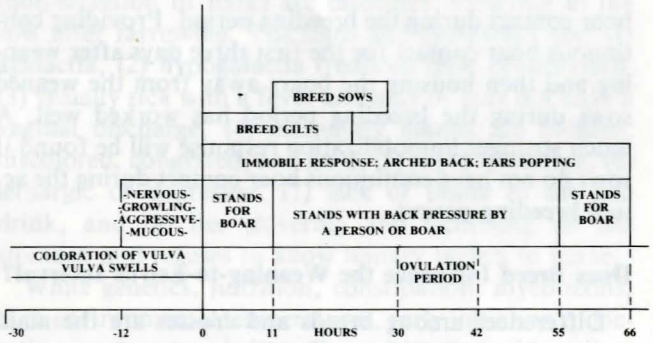

Figure 6. Signs of estrus in sows.

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; 40-50% 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) nosing the flank, (4) chanting, (5) genital sniffing, and (6) mounting of side and rear. Remember, a more intense and immediate estrus response will occur if the sows have not had boar contact 1-2 hours prior to actual heat detection.

Why Do Cycling Sows Get Missed when Heat Checking?

The majority of 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 allow them to express estrus. Figure 7 shows the various factors that can be involved in why sows are not detected in estrus. Detection of estrus is a bigger problem in gilts than sows. Therefore, heat check gilts and problem sows for 15-20 minutes in the physical presence of a boar, and without having boar contact 1-2 hours before actual heat detection.

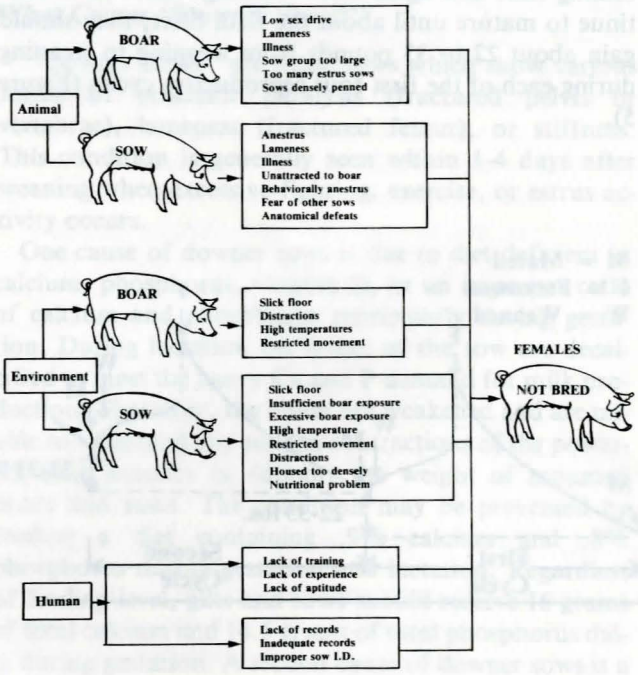

Figure 7. Possible reasons why sows and gilts are not detected in estrus.

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 18-24 hours after first detected in 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. If estrus in some gilts in a group lasts only 12-24 hours, breed others in the group as soon as they show standing heat, then again 12 hours later if still in heat.

Should Sows Be Bred on the First Estrus Period after Weaning?

Yes, except when weaning occurs prior to 21 days of lactation. The most important problem encountered when weaning at less than 21 days of lactation is a reduction in subsequent litter size. The reduction is caused by an increase in embryonic death and not ovulation rate. The size of reduction 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.

What Are the Advantages of Hand Mating?

Hand mating provides the following 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 differentials between the boar and sow, (6) less time spent checking close-up sows, (7) induced farrowing 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. A major problem occurs when a group of sows are all weaned the same day and placed in one pen with the boars. The problem is a lack of boars due to the accumulation of sows in standing estrus as shown in Figure 2. When using the pen mating system with group weaning, it is recommended that weaned sows be divided into groups of 5 per group and 1 boar be put with each group. If split weaning is practiced, distribute the weaned sows equally among the breeding pens. There should be two boars assigned to each group of sows, with each boar being rotated every 24 hours for sexual rest. If more than one boar is used in each pen, social interaction between boars can affect results. Since boars establish a social order, the dominant boar may not let the other boar breed.

Alternating boars does allow for one boar to cover up for the other's infertility but makes it difficult to track good or bad traits in the offspring back to their sire.

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 18-20 square feet per animal with the width of pen being at least 8 feet. Imprinting the 6-8" diamond pattern in the floor provides a much needed, nonslick surface when pen mating. Feeding on the floor also helps keep the floor clean and dry. Keep the number of weaned sows per pen small (6-10) with the boars being rotated for sexual rest.

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

How Many Additional Sows 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). The monthly breeding factor can be calculated as shown in Equation 1 and then multiplied by the desired number of farrowings. If previous records on farrowing rate have not been kept, Table 2 illustrates the general farrowing rate trend and its corresponding monthly breeding factor.

Equation 1.

$$\text{MBF} = \frac{100}{\text{Determined Farrowing Rate per month}}$$

Table 2. Calculated monthly breeding factors.[a]

Month bred	*Estimated farrowing rate (%)*	*MBF*
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

[a] *Varies from farm to farm due to management and environment.*

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 at 40-45 days. The accuracy and effectiveness depends on the skill of the operator. These machines can be at least 90% 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, 20-30% 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, and disease.

What Aspects of the Environment Should Be of Greatest Concern?

Temperature. Heat stress (above 85°F), causes increased embryonic mortality during early gestation (first 2-3 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. Provide sows maintained outside adequate shelter and bedding to protect them from extreme cold and provide extra feed to compensate for increased heat loss (see page 17). Maintain sows in confinement in a dry, draft-free environment and provide extra feed when temperatures decline below the lower critical temperature (see page 17).

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

How Should Sows Be Handled to Minimize Stress after Breeding?

Whether sows are maintained in pens or stalls after weaning, they are normally relocated to a different environment (stalls or pens) 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, 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 moved to stalls after breeding 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 fighting. The key to success with group-housed sows is to utilize a feeding system that will control feed intake and body condition of sows.

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 reestablishment 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. Immunization (see page 9) and procedures that insure a common immunity (see page 5) to viruses causing the SMEDI syndrome should be followed before breeding.

Should Gilts and Sows Be Limit-Fed During Gestation?

Limit-feeding restricts the energy intake of gestating sows and gilts. It is a combination of a feeding system and diet formulation which insures that each sow meets her daily requirements for all nutrients without consuming excess energy.

The high level of energy provided 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 term. Provide protein (especially the amino acid lysine), minerals and vitamins to meet the daily requirements of the sow whenever limit feeding is practiced.

What Level of Feeding Is Recommended

The general recommendation is to feed 4 to 5 lb per head daily of a corn-soybean meal diet (1450 K cal/lb) throughout gestation. The degree of restriction must be tailored, however, to the environmental conditions, condition of the 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 (5-6 lb daily) until they have gained back needed body condition. Feed sows that are good in body condition at breeding at the lower side of the recommended feeding level so they do not gain additional condition. Sows receiving gestation diets containing bulky feedstuffs, e.g., alfalfa hay or meal, wheat bran, oats, etc., and having less energy density than conventional C-SBM diets may require 5 to 6 lb of feed to provide the estimated 6000 K cal ME/day needed by gestating females.

Do Confinement-Housed Sows Require Less Feed?

Confinement-housed sows have restricted physical activity and are in a more stable thermal environment. They can usually be maintained in proper body condition on .5 lb/day less feed than sows maintained in outside drylots under similar temperature conditions.

An exception to this rule of thumb is in the severe winter months when, in order to save fuel, the ambient temperature of the gestation unit is maintained below the lower critical temperature (70°F for individually housed sows) or the floor surface is cold and wet due to inadequate insulation. Heat loss is increased and some increase in feed (described below for cold weather) will be required to maintain body weight and condition.

Should Sows Maintained Outside Receive Extra Feed During Cold Weather?

Sows housed outdoors must be provided good shelter and plenty of dry bedding to reduce heat loss and maintain animal comfort during the winter months. Increase feed intake by about 3/4 lb per head per day for each 20°F drop in ambient temperature below the lower critical temperature (70°F). Thus, sows maintained on 4 lb of feed when temperatures are at 70°F would require 4.75 lb of feed at 50°F and 5.5 lb when daily ambient temperatures average 30°F. Thin sows require more feed than sows in good condition to compensate for temperatures below lower critical temperature. Thin sows would require about 1.3 lb more feed at 50°F and 2.6 lb at 30°F to maintain proper body weight and condition. Under these conditions, it is especially important that each individual gilt and sow receive their fair share of feed.

Does Limit-Feeding Take Extra Management?

Limit-feeding requires an added level of sow management. The idea of limit-feeding is to feed enough to meet the sow's requirements, but no more. Hence, it is important to insure that every sow gets her share of the feed. The small amount of added management saves a large amount of feed and could greatly enhance reproductive performance. Limit-fed sows may act hungry; therefore, durable fences and feeders are required.

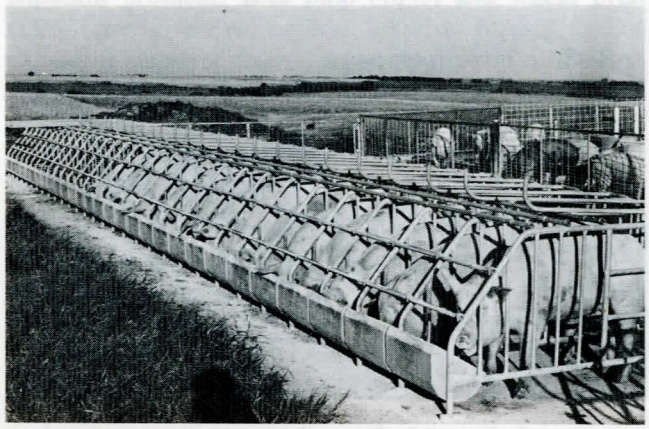

Figure 8. Feeding stalls.

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, (3) interval feeding in groups, and (4) self feeding high fiber diets in groups.

Individual Hand Feeding. Sows may be maintained in individual stalls or be maintained in group pens and fed in individual feeding stalls. This method provides the opportunity of feeding according to the individual needs of the sow and prevents boss sows from monopolizing the feed provided. Each sow is allowed to consume the amount of feed needed, regardless of how fast they eat or how aggressive they are. For best results, design feeding stalls to allow the group of sows to be locked in until the slowest-eating sow is through eating. Stalls should not exceed 16-18 inches in width to prevent smaller gilts from turning around (Figure 8).

Group Hand Feeding. In situations where individual stalls are not available, sows are sometimes limit-fed in a group by hand feeding 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 the control over sow weight and condition provided by individual feeding. Boss sows tend to overeat and timid and/or slow-eating sows tend to consume too little feed. Variation can be reduced by providing extra feeding space and by grouping females according to age, size, and aggressiveness. More fighting among sows is observed with this method.

Interval Feeding. With interval feeding, sows are allowed to consume 2 or 3 days of feed in one day, then wait 2 or 3 days before 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

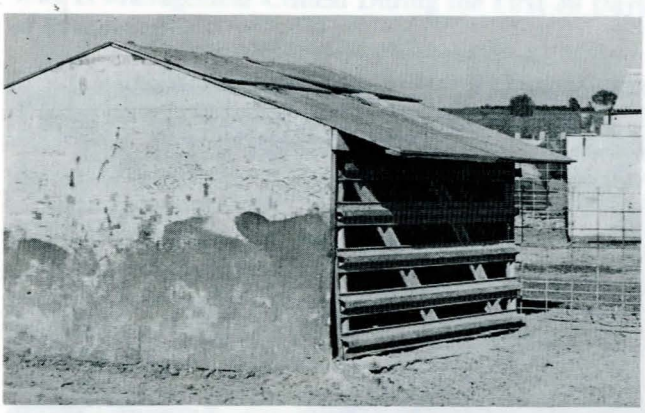

Figure 9. Interval feeding setup—panels around feeder.

intake are made by altering either the time on the feeder (2 to 12 hours) or the 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 (Figure 9). 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 live, 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 the control of sow weight and condition, however, that individual feeding provides. It also may cause managers to be less religious in observing sows for problems on days they are not turned onto the feeder.

Self-feeding High Fiber Diets. Self-feeding gestating sows is an alternative method of feeding. However, sows tend to overeat and become over-conditioned when allowed to self-feed. Feed costs also increase. Self-feeding gestating sows can be utilized if bulky ingredients such as hay, corn stalks, straw, or corn cobs are included in the diet to lower the energy intake. Special feed formulation is necessary for this feeding system. The cost of most high fiber ingredients, grinding, storage, and mixing usually makes self-feeding impractical.

Variations of this system involve feeding silage, whole plant pellets, alfalfa, or diets containing appetite inhibitors. Corn silage requires supplementation with about 1/2 pound of a 40% protein supplement, or 1 to 1 1/4 pounds of a special 20-22% protein silage supplement. Grass silage requires the feeding of 1 to 2 pounds of grain per day in addition to the protein supplement. Daily mineral and vitamin needs should be met.

Should Feed Level Be Increased Toward the End of Gestation?

Early studies demonstrated that average birth weight is increased by feeding sows higher levels of energy during gestation and that postnatal survival tends to increase as the birth weight of pigs increases. Since the majority of fetal weight is added during the last three weeks of gestation, the concept has evolved that providing higher levels of energy during the last three to four weeks of gestation should increase pig birth weight and, in turn, improve pig survival. However, recent studies indicate that pig birth weights are not consistently increased by increasing energy intake toward the end of gestation and this practice cannot be justified for this purpose alone. This practice is recommended only in cases where sows are thin. Increasing the feed level of thin sows will allow them to support normal fetal growth without further depleting their body reserves before entering lactation. Although they will lose weight during lactation, this added reserve may help them complete lactation without becoming so depleted that they will not cycle after weaning.

How Much Alfalfa Can Be Used in Gestation Diets?

Alfalfa is a good nutrient source for gestating gilts and sows. With proper protein, vitamin and mineral supplementation, good quality ground alfalfa hay can be recommended up to 50% of the diet. Dehydrated alfalfa meal is less palatable and should not exceed 25% of the diet. Because of lower energy density, higher daily feed intake is recommended for sows consuming alfalfa diets.

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. Although many of the molds found on feed grains are not harmful, the difficulty in identifying molds which are harmful makes feeding moldy ingredients to breeding animals risky.

What Is the Effect of Feeding Fat to Sows during Late Gestation and Lactation?

Recent research indicates that adding fat to the sow's diet one to two weeks before farrowing and during lactation will increase the fat content of sow's milk, baby pig survival, and possibly pig weaning weight. This can be accomplished by incorporating 5% fat in the diet for two weeks or 10% fat for one week before farrowing and 5% fat in the lactation diet. Top dressing of the regular diet with 1/4 pound melted fat or dried fat product or with 1 lb of ground soybeans for 14 days before farrowing can be used. Remember, some dried fat products contain as little as 50% fat; levels given above are based on total fat intake.

Can Raw Soybeans Be Used in Sow Diets?

Recent research at the UN-L North Platte Station indicates that gestating gilts and sows can utilize raw soybeans during the gestation and lactation. Results indicate that sows receiving diets containing raw soybeans during gestation and lactation perform as well as sows

receiving diets containing soybean meal formulated with comparable protein content. Raw soybeans should be ground and fed in a complete diet for gestating and lactating sows.

When and How Should Sows Be Changed from a Gestating to a Lactating Diet?

Start sows on the lactation diet, but giving the same amount of feed as in gestation, when they are moved into the farrowing unit, 3-4 days before farrowing. Sows that are constipated after allowing time for passage of the gestation diet, soil, etc., may need to have bulky or laxative feedstuffs added to the diet to correct the constipation problem. Beet pulp (10%) and wheat bran (15%) are effective natural laxative feedstuffs but should be removed from the diet by the end of the first week of lactation. Potassium chloride is of little benefit.

GOALS FOR REPRODUCTIVE EFFICIENCY

The achievement of maximum profitability depends on management efficiency. It is helpful for managers to plan and establish targets and intervention levels for improving production efficiency. The following may seem high to some producers, but they are realistic production targets.

Item	Target	Intervention level
SOWS		
Average No. in herd	As determined	97% of target
Average age	2-2 1/2 years	3 years
Age at first farrowing	11 months	12 1/2 months
Avg. weaning-to-service interval	7 days	10 days
Normal repeat services, %	5	8
Abnormal repeat services, %	3	4
Abortions, %	1	2.5
Sows found open at farrowing, %	2	5
Sow deaths, %	2	8
Farrowing rate, %	90	80
Sows Farrowed / Sows Exposed		
Litters/sow/year		
3-week weaning	2.4	2.1
4-week weaning	2.3	2.0
5-week weaning	2.3	2.0
BOARS		
Average age (months)	20	30
Boar litter scatter (%)[a]	15	25
Litter size	9.8-10.8	Boar Comparison
Boar—Farrowing rate	90	80
PIGS		
No. born alive/litter		
Sows	11.5	9.5
Gilts	10.5	8.5
Born dead (%)	3	7
Mummified (%)	<.5	>1
Deaths to weaning (%)	8-12	13
No. weaned/litter	10.0	<8.5
Litter scatter (%)[a]	10	18
Pig mortality:		
Laid on (%)	5	7
Congenital defects (%)	.5	1.5
Low viability (%)	1.5	3
Starvation (%)	1	3
Death scour (%)	.5	2
Miscellaneous deaths (%)	3	5
Nursery (%)	2	3
Growing-finishg (%)	1	3
Pigs/sow/year	20	18
FEED		
Feed/sow (Ton/yr)	<1.1	>1.2
Feed/boar (Ton/yr)	< .9	>1.1

[a]*Percentage of litters with 8 or less pigs.*