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## MAXIMIZING FARROWING RATE

D. G. Levis<sup>1</sup>

### Summary

Farrowing rate can be defined as: 1) the number of mated females that farrow within a contemporary group per total number of MATED females for this group or 2) the number of females that farrow within a contemporary group per total number of EXPOSED females for this group. Generally, the first definition is used when hand-mating, whereas the second definition has to be used when pen-mating. Regardless of the definition, farrowing rate can be maximized only by taking total control of the breeding herd. High farrowing rates will result when fertility is high in boars, sows, and gilts; however, excellent management must be used to maintain high fertility in males and females.

North Carolina State University data have shown a high correlation between farrowing rate and live pigs born per bred sow per year (Figure 1). Their data show that for each 10% increase in farrowing rate of bred sows, there is a corresponding increase of 2.63 live pigs born per sow per year. In light of these data, pork producers should strive to maximize farrowing rate. This can be done by providing good management during prebreeding, breeding, and gestation phases. The purpose of this article is to provide information on possible management practices to use during each of these phases.

(Key Words: Farrowing Rate, Sow Management, Boar Management, Hand-Mating.)

### Prebreeding Phase

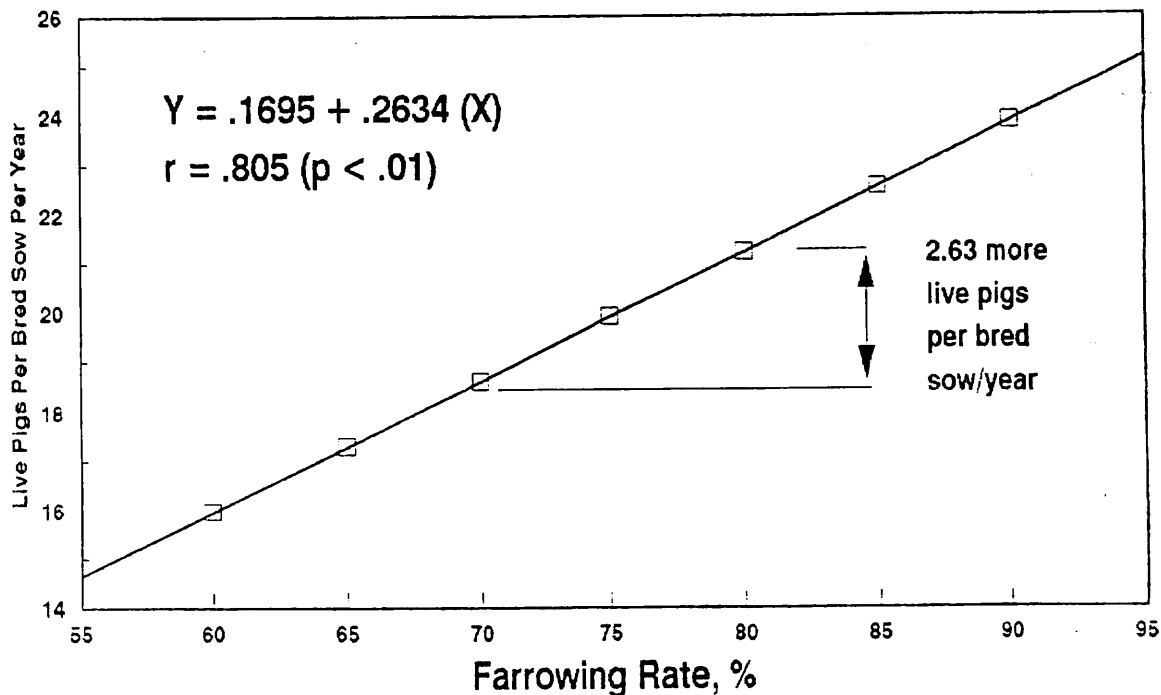
The three areas producers should be especially concerned with during the prebreeding phase are breeding soundness of replacement boars, environmental factors influencing boar fertility (e.g., heat stress), and body condition of sows at weaning to prevent anestrus (e.g., eliminating thin sows). A breeding soundness evaluation (Table 1) of replacement boars should include: 1) a physical soundness and health examination, 2) a sexual behavior evaluation, 3) an examination of the reproductive tract, and 4) a semen evaluation.

### Breeding Phase

It is absolutely essential for pork producers to provide a high level of management during the breeding phase, especially when a group of weaned sows is expected to be bred within one estrous cycle. A high farrowing rate is accomplished only when estrous sows are

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**Figure 1.** Relationship between farrowing rate and live pigs born per bred sow per year at the North Carolina Swine Development Center (1972-86).

bred at the appropriate time by fertile boars. Farrowing rate and litter size are influenced by time of mating, number of matings, boar usage, heat stress, and method of mating (pen-mating vs hand-mating).

**Time of Mating.** The most important factor in achieving a high farrowing rate and good litter size is the time of service in relation to the time of ovulation. When mating occurs too early or too late, pregnancy rate and litter size drop rapidly (Figure 2). The life expectancy of sperm cells in the female reproductive tract is about 24 h; therefore, when they are placed into the female reproductive tract too early before ovulation, they start to die before the eggs are ovulated. When sperm cells are placed in the reproductive tract too late after ovulation, the eggs start to die before the sperm cells arrive. Fertilization rate is also decreased when sperm cells arrive late, because they have to undergo biochemical changes for about 4 h before they are capable of fertilizing an egg. Since the exact time of ovulation cannot be determined in practical situations, best fertilization results are obtained by breeding sows more than one time during estrus.

**Number of Matings.** For maximum performance, all sows and gilts should be serviced at least twice during their heat period (Table 2). Breeding sows three times instead of twice has given only a slight increase in farrowing rate; however, litter size has been shown to be increased by .5 to 1.3 piglets (Table 3). With once-a-day estrus detection, breed sows once on each of the first three consecutive days of estrus. With twice-a-day estrus detection, breed sows 12 h after onset of estrus and again 12 or 24 h after first service. If estrus in gilts seems to last only 12 to 24 h, breed gilts as soon as they show standing estrus, then again 12 h later, if still in heat.

**Table 1. Components of a Breeding Soundness Evaluation**

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|                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Examination                                                                                                                                                                                                                                                                                                   |
| A. Visual observation of: <ul style="list-style-type: none"><li>1. body condition (too fat or too thin)</li><li>2. structural soundness of feet and legs</li><li>3. sickness and disease</li><li>4. presence of external parasites</li></ul>                                                                  |
| II. Sexual Behavior Evaluation                                                                                                                                                                                                                                                                                |
| A. Visually observe a boar's desire to pursue a female and his ability to mount and copulate.                                                                                                                                                                                                                 |
| B. While the boar is mounted, closely observe for any injuries to the penis or any problems with erection and intromission.                                                                                                                                                                                   |
| III. Reproductive Tract Examination                                                                                                                                                                                                                                                                           |
| A. Visually examine penis for: <ul style="list-style-type: none"><li>1. tied penis (unable to extend penis)</li><li>2. limp penis (unable to achieve or maintain an adequate erection)</li><li>3. bite wounds</li><li>4. irritation and abscesses</li></ul>                                                   |
| B. Examine testes and epididymides for: <ul style="list-style-type: none"><li>1. firmness and resiliency (recover in size after compression) by palpating through the scrotum</li><li>2. symmetrical size of each organ</li><li>3. soft or firm nodules or masses that indicate pathologic problems</li></ul> |
| IV. Semen Evaluation                                                                                                                                                                                                                                                                                          |
| A laboratory evaluation of semen provides an estimate of sperm number (concentration), motility, morphology, and volume and not absolute fertility.                                                                                                                                                           |

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**Boar Usage.** It is difficult to make an absolute recommendation for number of services per boar per day or week because age, breed, season, health, and frequency of ejaculation (mating) have an influence on sperm production and fertility. It is known that sperm output of active boars decreases rapidly (Figure 3). This rapid decrease occurs at mating frequencies of 12 or 24 h, regardless of boar age or how long the boars have been sexually rested. Generally, the sperm number tends to stabilize after five matings. The important question is, "Are the boars stabilizing at a fertile, sub-fertile, or infertile level of sperm output?" To reduce the risk of

**Table 2. Influence of Number of Services per Estrus on Subsequent Farrowing Rate**

| Number of services | Farrowing rate |         |
|--------------------|----------------|---------|
|                    | Study 1        | Study 2 |
| 1                  | 70.4           | 79.6    |
| 2                  | 86.1           | 89.6    |
| 3                  | 89.5           | --      |
| 4+                 | 89.6           | --      |

**Table 3. Number Born Alive as Related to Time and Frequency of Service (S)**

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

Anim. Prod. 34:279; 1982.

using sub-fertile or infertile boars, it is recommended that boars be limited to the number of services shown in Table 4.

**Heat Stress.** It is well known that elevated ambient temperatures reduce farrowing rate, litter size, and boar fertility. Therefore, pork producers should closely monitor sows and boars for heat stress and provide relief when ambient temperatures exceed 80°F or when respiratory rates increase to greater than 50 breaths per minute.

**Method of Mating.** Surveys consistently show that 75 to 80% of pork producers pen-mate sows. An underlying assumption when pen-mating is that "nature" will take care of the breeding area. This is not a valid assumption, when trying to achieve a high farrowing rate and litter size from the first estrus after weaning. The "typical" farrowing rate from FIRST ESTRUS AFTER WEANING on many farms I visit that pen-mate is shown in Table 5. These farm data are

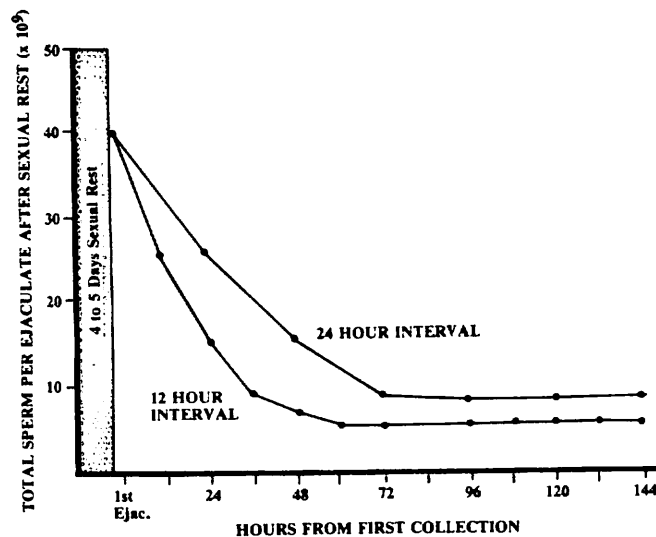
|                                          | SPERM ARE DYING<br>(24 HR LIFE) |                                       |      |                                                                                   | OVA ARE DYING<br>(6 TO 8 HR LIFE)        |      |
|------------------------------------------|---------------------------------|---------------------------------------|------|-----------------------------------------------------------------------------------|------------------------------------------|------|
| % PREG.                                  | 70.2                            | 80.0                                  | 84.2 | 81.8                                                                              | 58.3                                     | 30.8 |
| LITTER SIZE                              | 9.8                             | 10.6                                  | 11.2 | 12.6                                                                              | 9.7                                      | 8.4  |
| ESTRUS                                   |                                 |                                       |      |  | *                                        |      |
| GILTS WERE BRED WHEN STOOD FOR BOAR ONLY |                                 | GILTS WERE BRED WHEN STOOD FOR HUMANS |      |                                                                                   | GILTS WERE BRED WHEN STOOD FOR BOAR ONLY |      |
| 0                                        | 10                              | 20                                    | 30   | 40                                                                                | 50                                       | 60   |
| HOURS IN ESTRUS                          |                                 |                                       |      |                                                                                   |                                          |      |

**Figure 2.** Influence of time of a single insemination on farrowing rate and litter size.

| Boar age (months)   | No. services |        |                 |
|---------------------|--------------|--------|-----------------|
|                     | Daily        | Weekly | Monthly         |
| Young (8 1/2 to 12) | 1            | 5      | 20              |
| Mature (over 12)    | 2            | 7      | 28 <sup>a</sup> |

presented only to show the reality of how erratic farrowing rate can be both between and within three breeding pens. Although numerous differences existed between breeding pens (number of boards, age of boars, weaned sows per boar), a low farrowing rate occurred in all three pens. The average farrowing rates for 10 breeding periods were 59.5% (range: 33.3 to 87.5) in pen 1, 67.2% (range: 40.0 to 85.7) in pen 2, and 67.8% (range: 50 to 100) in pen 3. There was also much variation in farrowing rate between pens within date weaned. During 6 of the 10 breeding periods, the range in farrowing rate between breeding pens was at least 33%. Two of the six breeding periods (12/12 and 1/8) had a range of 40% in farrowing rate between breeding pens.

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

environment. A good ratio for pen-mating seems to be one boar in a pen with two to three weaned sows. Therefore, we placed one boar in a pen with three sows (two sows in estrus, one sow not in estrus) and recorded mating activity in the pen continuously for 113 h. Of the nine boars that were expected to mate both sows, only three boars actually did (Table 6). Five other boars mated the same sow four or five times. This study suggests that there is not a simple way to pen-mate sows and be absolutely sure that all sows are bred as a group during their first estrus after weaning.

Additional problems involved with pen-mating are: 1) sows in standing estrus can accumulate (Figure 4), 2) boars may lose sexual interest in estrous sows because of fatigue, 3) penile injuries occur more frequently, 4) dominant boars may not let other boars breed when more than one boar is in the breeding pen, and 5) boars breed the same female as the previous boar when they are rotated for sexual rest. When the following 10 questions are honestly evaluated with a given management scheme for pen-mating, the cause of the low fertility problem is generally mismanagement. The questions are: 1) How many sows are weaned the same day? 2) How many sows are weaned on the same day and put in the same breeding pen? 3) How many boars are being used with each group of weaned sows? 4) Are the boars being rotated for sexual rest, or rotated between pens? 5) How long are the boars given a sexual rest? 6) How long are the sows in standing heat? 7) What percentage of the weaned sows are found in heat for the first time on each day? 8) What is the total number of sows in standing heat each day? 9) How many boars are known to be working? and 10) Are resting boars housed individually or in a group?

Table 5. Farrowing Rate from First Estrus after Weaning When Pen-Mating<sup>a</sup>

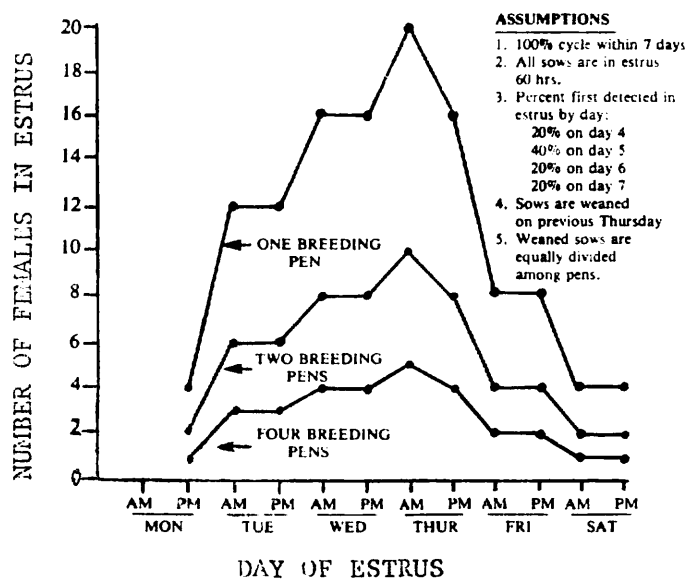
| Date weaned | Two Duroc boars<br>Pen 1 (mature age) |              |            | Two crossbred boars<br>Pen 2 (young age) |              |            | Three crossbred boars<br>Pen 3 (mature age) |              |            |
|-------------|---------------------------------------|--------------|------------|------------------------------------------|--------------|------------|---------------------------------------------|--------------|------------|
|             | No. weaned                            | No. farrowed | % farrowed | No. weaned                               | No. farrowed | % farrowed | No. weaned                                  | No. farrowed | % farrowed |
| 09/30       | 8                                     | 5            | 62.5       | 7                                        | 4            | 57.1       | 7                                           | 5            | 71.4       |
| 11/06       | 9                                     | 4            | 44.4       | 6                                        | 5            | 83.3       | 6                                           | 4            | 66.7       |
| 12/12       | 7                                     | 3            | 42.9       | 6                                        | 5            | 83.3       | 4                                           | 2            | 50.0       |
| 01/18       | 6                                     | 4            | 66.7       | 5                                        | 3            | 60.0       | 4                                           | 4            | 100.0      |
| 02/23       | 8                                     | 4            | 50.0       | 5                                        | 3            | 60.0       | 6                                           | 5            | 83.3       |
| 04/01       | 6                                     | 5            | 83.3       | 6                                        | 4            | 66.7       | 8                                           | 4            | 50.0       |
| 05/07       | 8                                     | 7            | 87.5       | 5                                        | 3            | 60.0       | 7                                           | 5            | 71.4       |
| 06/13       | 6                                     | 5            | 83.3       | 7                                        | 6            | 85.7       | 5                                           | 4            | 80.0       |
| 07/19       | 9                                     | 3            | 33.3       | 6                                        | 4            | 66.7       | 7                                           | 4            | 57.1       |
| 08/21       | 7                                     | 4            | 57.1       | 5                                        | 2            | 40.0       | 5                                           | 3            | 60.0       |
| Totals      | 74                                    | 44           | 59.5       | 58                                       | 39           | 67.2       | 59                                          | 40           | 67.8       |

<sup>a</sup>All sows were weaned into a boar pen and remained in the pen until farrowing.

**Table 6. Number of Matings per Boar and Number of Different Estrous Females Mated by Each Boar during Pen Mating<sup>a</sup>**

| Boar Number | Number of times boar mated | Number of sows mated | Number of sows in heat | Percentage sows mated |
|-------------|----------------------------|----------------------|------------------------|-----------------------|
| 1           | 9                          | 2                    | 2                      | 100                   |
| 2           | 4                          | 1                    | 2                      | 50                    |
| 3           | 5                          | 1                    | 2                      | 50                    |
| 4           | 4                          | 2                    | 2                      | 100                   |
| 5           | 1                          | 1                    | 2                      | 50                    |
| 6           | 5                          | 1                    | 2                      | 50                    |
| 7           | 0                          | 0                    | 2                      | 0                     |
| 8           | 7                          | 2                    | 2                      | 100                   |
| 9           | <u>5</u>                   | <u>1</u>             | <u>2</u>               | <u>50</u>             |
|             | 40                         | 11                   | 18                     | 61                    |

<sup>a</sup>The boar was placed in a pen containing two sows in heat and one sow not in heat.



**Figure 4.** Number of sows in estrus on each day when pen-mated in one, two, or four breeding pens (20 weaned sows).

Problems encountered with pen-mating can be reduced by hand-mating. Table 7 shows that farrowing rates were increased by 10 to 32% on five swine farms that changed from pen-mating to hand-mating. Another article in this Swine Day Report entitled "New Concepts in Breeding Barn Design" briefly describes how to design an efficient swine breeding facility.

**Table 7. Effect of Hand-Mating on Farrowing Rate from First Estrus After Weaning**

| Farm | Pen-mating | Hand-mating |
|------|------------|-------------|
| 1    | 71.0%      | 85.0%       |
| 2    | 72.0       | 92.0        |
| 3    | 72.0       | 84.0        |
| 4    | 45.0       | 77.0        |
| 5    | 76.0       | 86.0        |

#### **Gestation Phase**

Pork producers need to be sure they are adequately feeding their sows a good quality diet during gestation, especially in cold weather, to prevent abortions by thin sows. Producers also need to heat check during gestation and appropriately cull or rebreed open sows. Good heat check records need to be maintained, because some sows are problem breeders. When sows return to estrus after breeding, their chances of farrowing from subsequent matings dramatically decreases (Table 8).

**Table 8. Farrowing Rate of Sows that Return to Estrus**

| Service       | Farrowing rate, % |
|---------------|-------------------|
| First service | 83.6              |
| First return  | 65.6              |
| Second return | 44.8              |

Pig Farming Supplement, 1984.