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Effect of Lactation Length on Sow Reproductive Performance



by Donald G. Levis
Extension Swine Specialist



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Summary

As lactation length decreases there is an increase in the weaning-to-estrus interval, a decrease in farrowing rate, a decrease in subsequent litter size and an increase in pigs weaned per sow per year. Because of herd-to-herd differences in the influence of lactation length on reproductive performance, each farm should conduct a preliminary study to evaluate the effect of the lactation length being considered before implementing the “new” weaning age of piglets.

Introduction

Weaning pigs younger than 21-days of age has become popular in pork production because segregated early weaning can prevent vertical transmission of some diseases pigs encounter from their mothers. Nursery mortality can be less than 1.5 percent when segregated early weaned pigs are weaned into an off-site, single-stage nursery and provided nutrient-rich, highly palatable diets. In addition, the growth performance of early weaned pigs can be in excess of .44 lb per day during the first week after weaning and over .88 lb per day from weaning to 10 weeks of age. Although pig performance is enhanced by using segregated early weaning, reproductive performance of individual sows may be compromised when they lactate for less than 21 days.

Weaning-To-Estrus Interval

Lactation length. Seven scientifically controlled experiments indicate the weaning-to-estrus interval decreases as lactation length increases (*Figure 1A*). An analysis of PigCHAMP® data found the relationship between lactation length and weaning-to-estrus interval to be curvilinear when lactation ranges from eight to 25 days (*Figure 1B*). Sows weaned at eight to 10 days of lactation had a significantly greater weaning-to-estrus interval than sows weaned at 11 to 25 days. Sows weaned at 14 to 16 days of lactation had a significantly greater weaning-to-estrus interval than sows weaned at 20 to 25 days. Some pork producers wean sows shortly after birth (at birth to two days after birth) to maximize the number of piglets nursing each sow in the farrowing facility. The weaning-to-estrus interval for multiparous sows weaned within

24 hours after farrowing has ranged from 3.2 to 19.7 days. A problem with this method is the possible formation of cystic follicles, which occur because both luteinizing hormone and follicle stimulating hormone have not been suppressed. It takes two to three days of nursing to suppress luteinizing hormone and follicle stimulating hormone. Sows having cystic follicles are characterized by one or more of the following: (1) prolonged and unpredictable return to estrus, (2) constant estrus, (3) prolonged anestrus and (4) irregular estrus. Scientific literature on how parity affects the weaning-to-estrus interval in sows weaned at less than two days of lactation could not be located.

Daily feed intake. The weaning-to-estrus interval is influenced by average daily feed intake during lactation. Sows eating an average of less than 9.2 lb of feed per day during a 10- to 19-day lactation have a longer weaning-to-estrus interval than sows eating an average of 9.2 to 12.5 lb of feed per day. The weaning-to-estrus interval for lactation lengths of 10 to 19 days is similar when sows eat an average of 12.5 lb or more per day. An Australian study indicates lactation feed intake is also important for first-litter sows lactating for 28 days. When first-litter sows consumed an average of 6.6 or 11.0 lb of feed per day during a 28-day lactation, the weaning-to-estrus interval was 20 and nine days, respectively.

Parities. An analysis of PigCHAMP® data by the University of Minnesota indicates the weaning-to-estrus interval to increase in a curvilinear manner as lactation length decreases for parities 1, 2, 3 to 6 and 6+. The Minnesota researchers also found that as lactation length decreased the rate of increase in the weaning-to-estrus interval was greatest for first-litter sows. The delayed weaning-to-estrus interval for first-litter females may be related to feed intake during lactation. Additional research is needed to clarify how lactation length and lactation feed intake within parity influences the weaning-to-estrus interval.

Genetic lines. The weaning-to-estrus interval for all evaluated genetic lines increases in a curvilinear fashion with decreasing lactation length. Because the weaning-to-estrus interval of some genetic lines is less responsive to changes in lactation length than others, it is important for each producer to evaluate the effect of lactation length on the weaning-to-estrus interval.

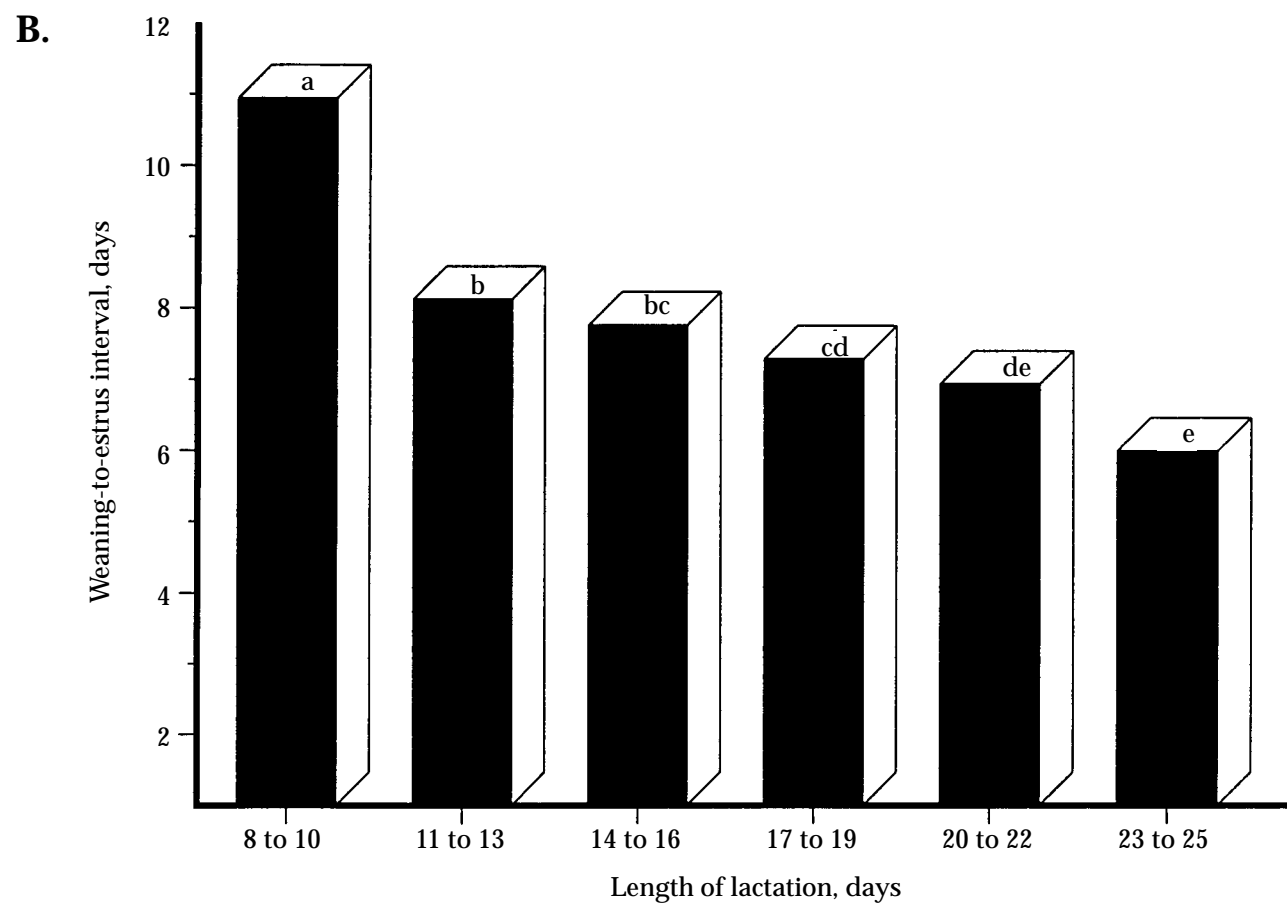
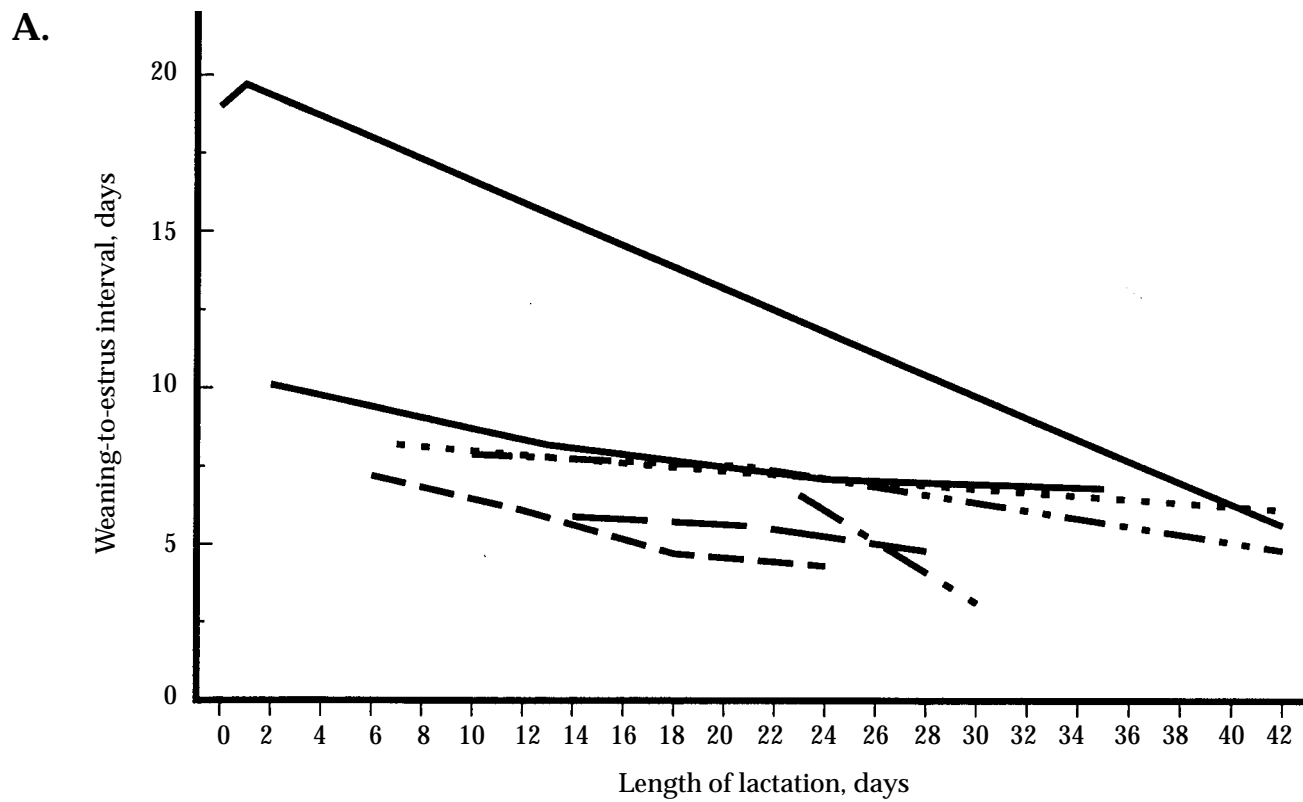


Figure 1. The influence of lactation length on weaning-to-estrus interval (Panel B from Dial et al., 1995, University of Minnesota). Columns with different letters differ ($P < .05$).

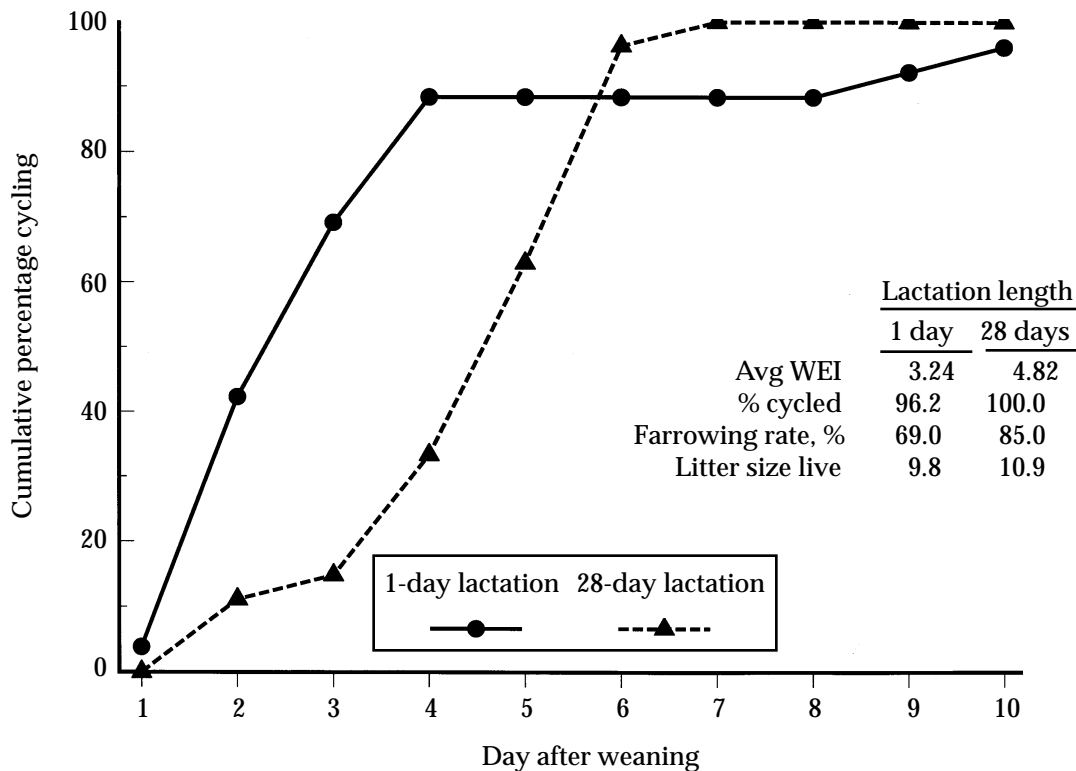


Figure 2. Cumulative percentage of weaned sows cycling after a 1- or 28-day lactation.

Litter size nursed. Data on the influence of number of pigs nursed at various days of lactation on weaning-to-estrus interval could not be located. Some practices, such as split-weaning, may be beneficial in enhancing the secretion of luteinizing hormone and follicle stimulating hormone on shortening the weaning-to-estrus interval. Split-weaning is most effective if the interval from weaning the heaviest half of the pigs to weaning the lightest half is about two days. If the interval exceeds two or three days, the remaining pigs begin to nurse the vacated nipples, and there is a decline in the secretion of luteinizing hormone and follicle stimulating hormone. This reduces the beneficial effect of split-weaning on the weaning-to-estrus interval. Studies have shown sows with litter size reduced from eight to three pigs during the last five days of a 27.5 day lactation to be in estrus sooner after weaning than sows with litters of eight or 13.

Percentage of Sows Cycling after Weaning

It is also important to know what effect lactation length has on the percentage of sows cycling within 10 days after weaning as well as the percentage of sows cycling on each of the first 10 days after weaning. Unfortunately, a scientific study reporting the percentage of sows cycling on each of the first 10 days after weaning for lactation lengths of seven, 14, 21 or 28 days could not be located. Two scientific studies

indicate 91 to 99% of sows weaned at six to 12 days of lactation will cycle within 20 to 30 days after weaning. *Figure 2* indicates the occurrence of postweaning estrus in sows weaned within 24 hours of parturition or at 28 days of lactation. Although 96.2% of sows weaned within 24 hours of farrowing did cycle within 10 days after weaning, their farrowing rate was 69% compared to an 85% farrowing rate for sows weaned at 28 days of lactation.

Farrowing Rate

A University of Minnesota study shows farrowing rate decreases as weaning age decreases (*Figure 3*). The study indicates farrowing rate is significantly lower for lactation lengths of 11 to 19 days compared to lactation lengths of 23 to 25 days. A substantial amount of variation occurred when sows were weaned at eight to 10 days of lactation, so there is not a significant difference when comparing an eight to 10 day lactation period with other lactation periods. Regardless of whether pork producers are ranked as being average, in the top 33% or in the top 10% of pigs reared per sow per year, data compiled from the Meat and Livestock Commission in England indicates a slight decrease in farrowing rate as lactation length decreases from four to two weeks (*Table 1*). The decrease in farrowing rate will vary between farms due to management factors and the number of days between lactation lengths being compared.

Table I. Effect of lactation length on farrowing rate

Lactation length, days	Farrowing rate		
	Average	Top 33% ^a	Top 10% ^a
14 to 18	84.9	85.5	86.3
19 to 25	85.2	87.2	88.5
26 to 32	86.0	87.8	88.7

^aTop 33% and top 10% on the basis of pigs reared per sow per year.

Subsequent Litter Size

A University of Kentucky study indicates that subsequent litter size (piglets born live) for sows weaned at six, 12, 18 or 24 days of lactation was 8.8, 9.0, 10.2 and 10.4 pigs, respectively. Subsequent litter size increased ($P < .05$) in a sigmoidal manner. There was a relatively small difference in litter size between sows lactating six or 12 days, a marked increase between sows lactating 12 or 18 days and a plateauing of litter size between sows lactating 18 or 24 days. An analysis of PigCHAMP® data by the University of Minnesota found a curvilinear relationship between lactation length and subsequent litter size born for sows conceiving on first estrus after weaning (*Figure*

4). Substantial variation was found in subsequent litter size for sows weaned at eight to 10 days of lactation. Subsequent litter size was significantly reduced when sows lactated for 11 to 13 days, as compared to lactation lengths of 14 to 25 days. Subsequent litter size was not significantly different, however, between lactation lengths of 14 to 22 days. Subsequent litter size was significantly lower when sows lactated for 14 to 22 days, when compared to sows lactating for 23 to 25 days.

Factors that might influence subsequent litter size of early weaned sows are: (1) duration of time needed for the uterus to undergo involution, (2) ovulation rate, (3) fertilization rate of ova and (4) rate of embryo survival.

Uterine involution. In order for the sow to breed back satisfactorily, the uterus must undergo involution after parturition. Although the uterus undergoes the greatest weight loss during the first seven days after farrowing, it continues to decrease in weight and length until 21 to 28 days after farrowing (*Figure 5*). It has been suggested the endometrium of the uterus is capable of receiving and implanting an embryo 18 days after farrowing.

Ovulation rate. Six scientific studies indicate length of lactation does not significantly influence

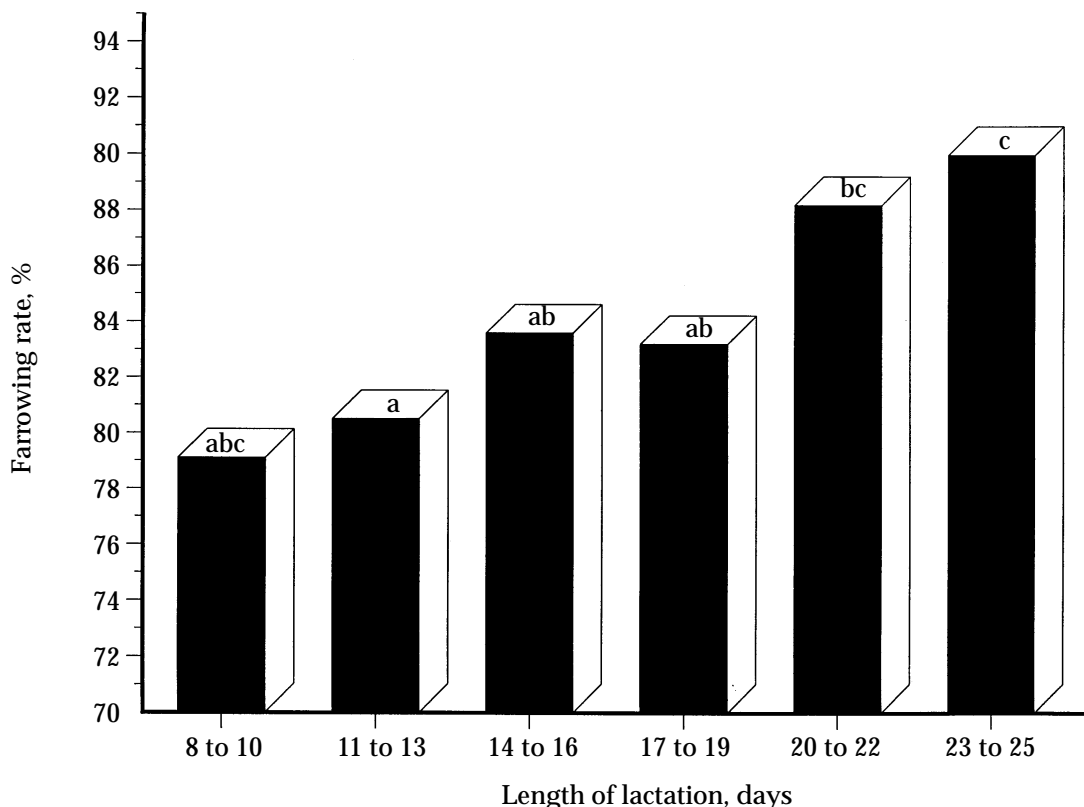


Figure 3. The influence of lactation length on farrowing rate (Dial et al., 1995, University of Minnesota). Columns with different letters differ ($P < .05$).

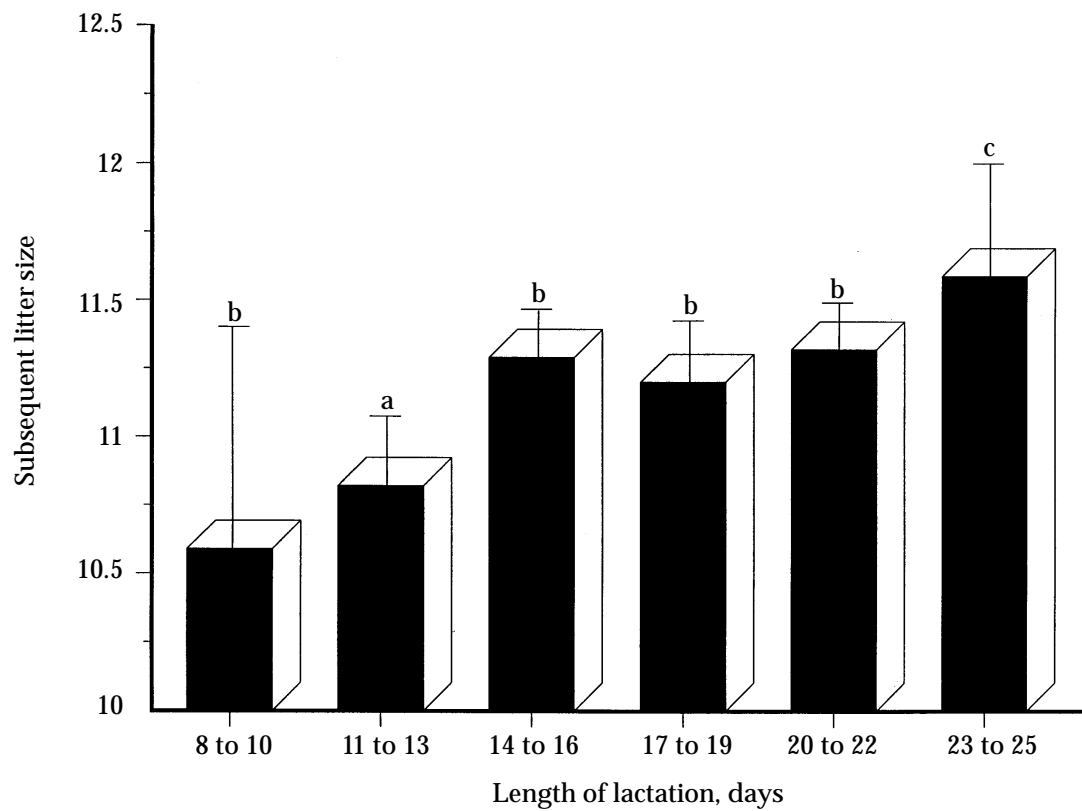


Figure 4. The influence of lactation length on subsequent litter size (Dial et al., 1995, University of Minnesota). Columns with different letters differ ($P < .05$).

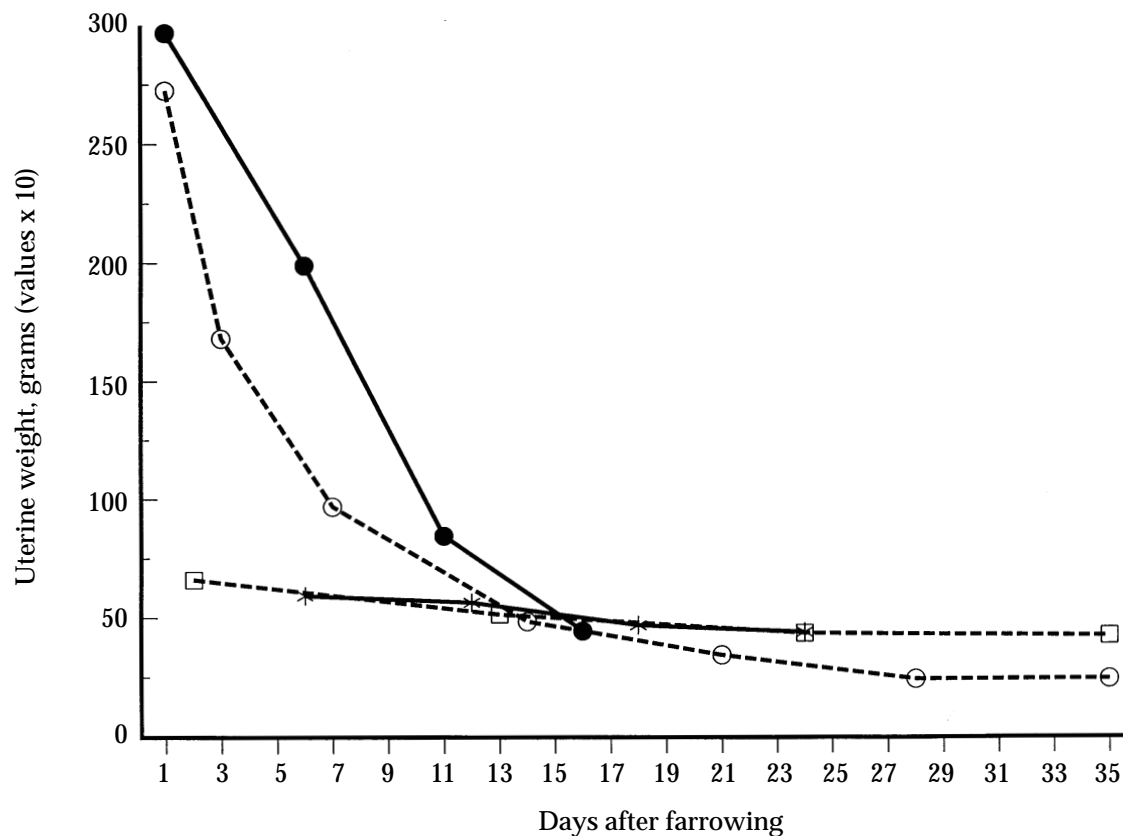


Figure 5. The influence of the number of days after weaning on uterine weight. Data from four experiments.

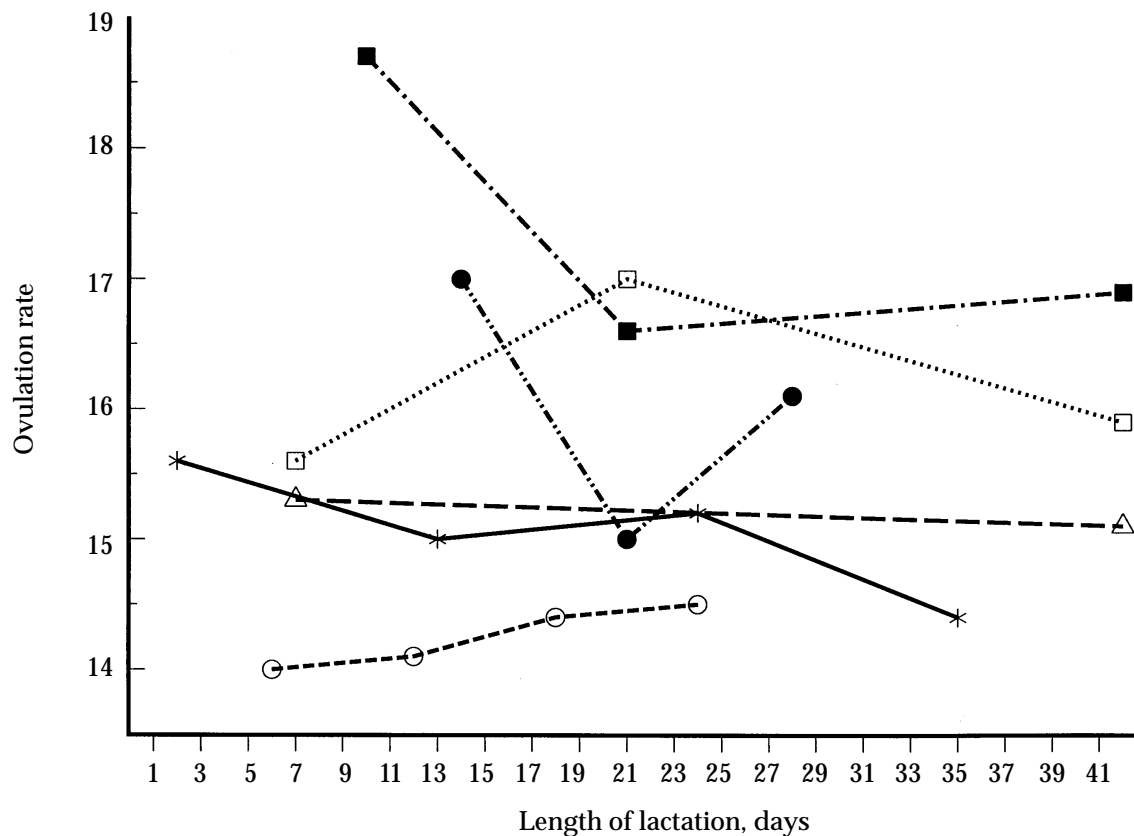


Figure 6. The influence of lactation length on ovulation rate. Data from six studies.

ovulation rate (Figure 6). However, a recent study at Kansas State University found sows weaned at five to 11 days of lactation had a lower ovulation rate ($P < .05$) than sows weaned at 23 to 31 days of lactation (15.9 versus 24.0 ova).

Fertilization rate of ova. A University of Kentucky experiment found a linear decrease ($P < .05$) in percentage of ova fertilized when sows were weaned at two (81.9%), 13 (86.3%), 24 (96.5%) and 35 (98.0%) days of lactation. In contrast, a second Kentucky study did not show a significant decrease in percentage of ova fertilized when sows were weaned at six (90.7%), 12 (94.1%), 18 (95.1%) and 24 (95.1%) days of lactation. However, the percentage of fertilized ova increased numerically as lactation length increased from 6 to 18 days.

Embryo survival. Five scientific studies show embryo survival decreases as lactation length decreases (Figure 7). It is possible the lower embryonic survival rate of sows with a lactation length less than 21 days is related to incomplete restoration of the uterine endometrium.

Sow Longevity

There are two basic theories about how lactation length might influence sow longevity. First, that sows

with short lactation periods have less body weight loss during lactation, allowing them to survive longer due to the reduction of detrimental metabolic effects on vital tissues. Second, sows with short lactation periods would farrow more frequently per year, resulting in higher culling rates due to a greater metabolic demand on their bodies. An analysis of PigCHAMP® data by the University of Minnesota found average parity at removal and average herd parity are lower for herds using shorter lactation lengths, when compared to herds using longer lactation lengths (Figure 8). Additional research is needed to confirm this suggestion.

Pigs Weaned Per Sow Per Year

The number of pigs weaned per sow per year is influenced by litter size born live, preweaning mortality and litters per female per year. British researchers evaluated the influence of a 10- or 25-day lactation length on number of pigs born live and weaned over five parities (Figure 9). The number of pigs born live per litter decreased from parity 1 to parity 4 and then increased in parity 5 to the same level as parity 1 for sows weaned at 10 days of lactation. In contrast, sows weaned at 25 days of lactation had an increase in number of pigs born live between parity 1 and 3, no increase between parities 3 and 4 and a decrease between parities 4 and 5. When the total number of

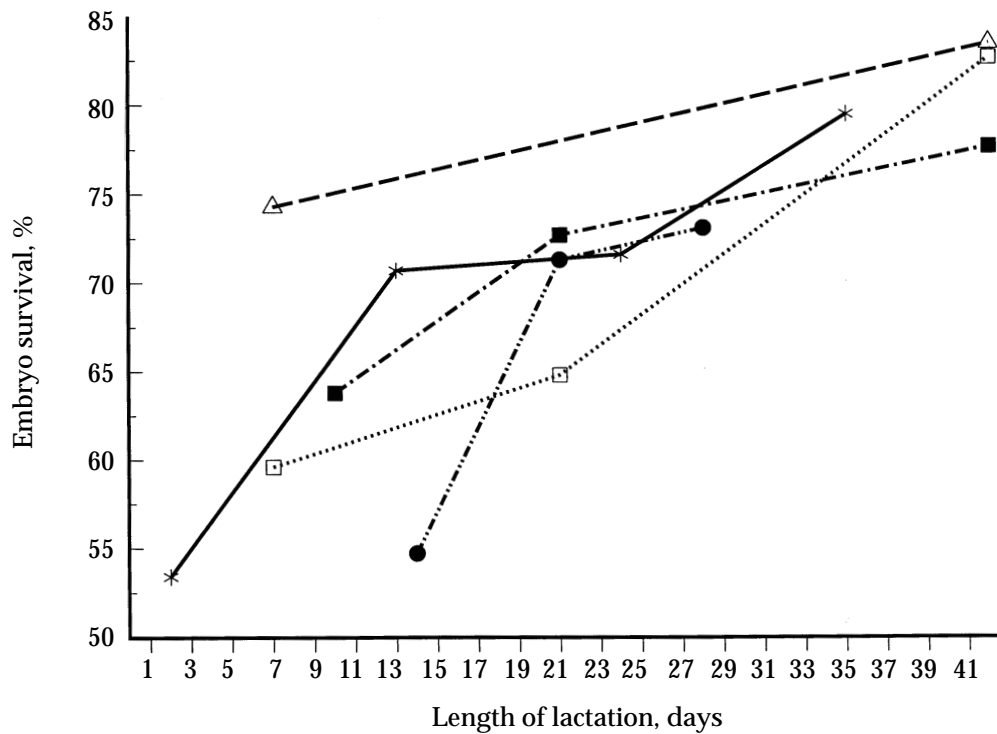


Figure 7. The influence of lactation length on embryo survival. Data from five studies.

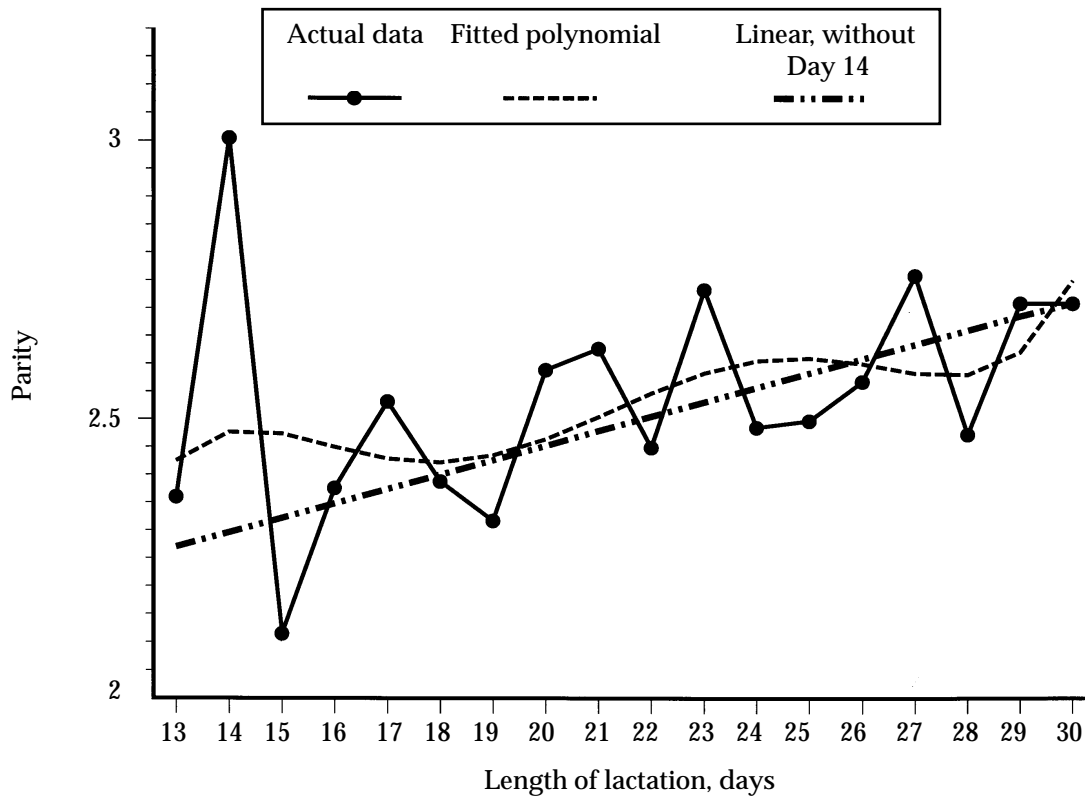


Figure 8. Herd-level analysis of the influence of lactation length on average parity of herds (Dial et al., 1995, University of Minnesota).

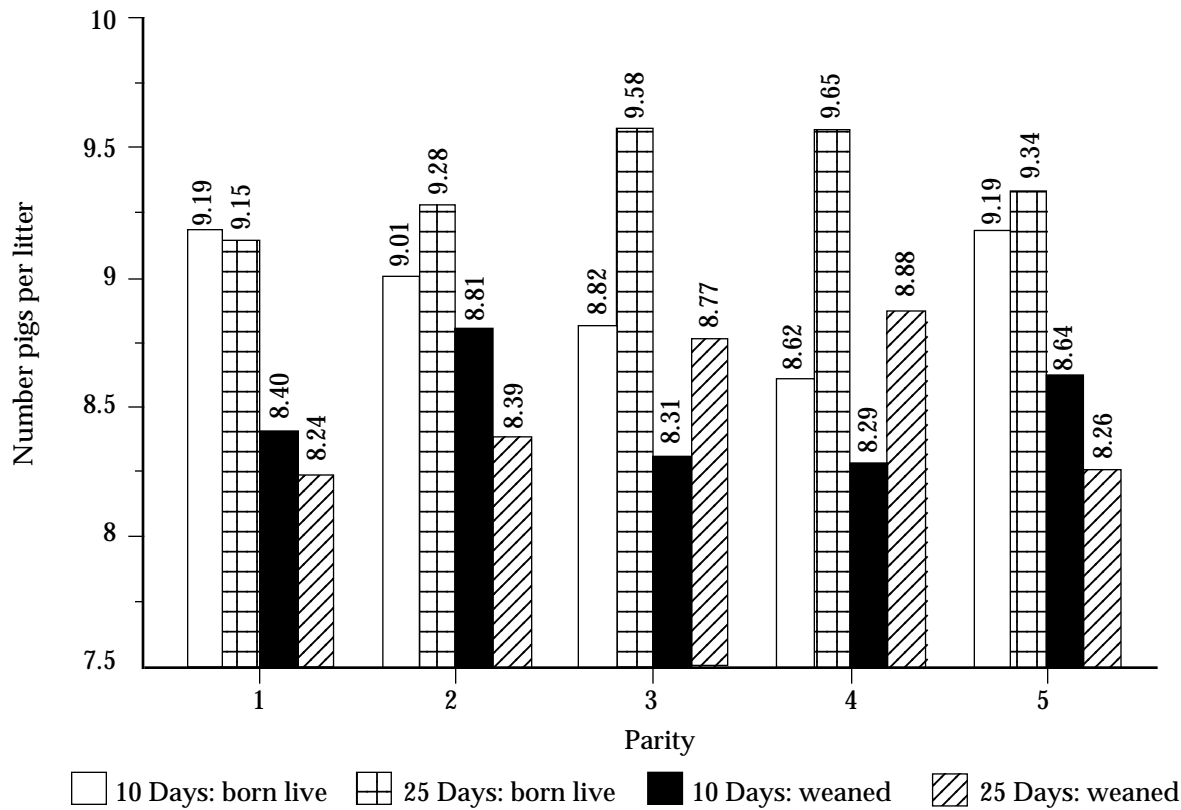


Figure 9. The average number of piglets born live and weaned at each parity of sows weaned after successive lactations of 10 or 25 days.

pigs born live and weaned are summed for parities 1 through 5, sows lactating for 10 days had 2.17 fewer pigs born live than sows lactating 25 days (44.83 versus 47.00). At weaning time, however, sows lactating for 10 days only had .09 less pigs than sows lactating 25 days (42.45 versus 42.54). Preweaning mortality was 5.31% for sows lactating 10 days and 9.49% for sows lactating 25 days. The

difference in preweaning mortality may be due to the pigs having more days at risk for dying with longer lactation lengths. A farm-level analysis of PigCHAMP® data by the University of Minnesota found the number of pigs weaned per inventoried female per year increased as lactation length decreased from 25 to 13 days (Figure 10).

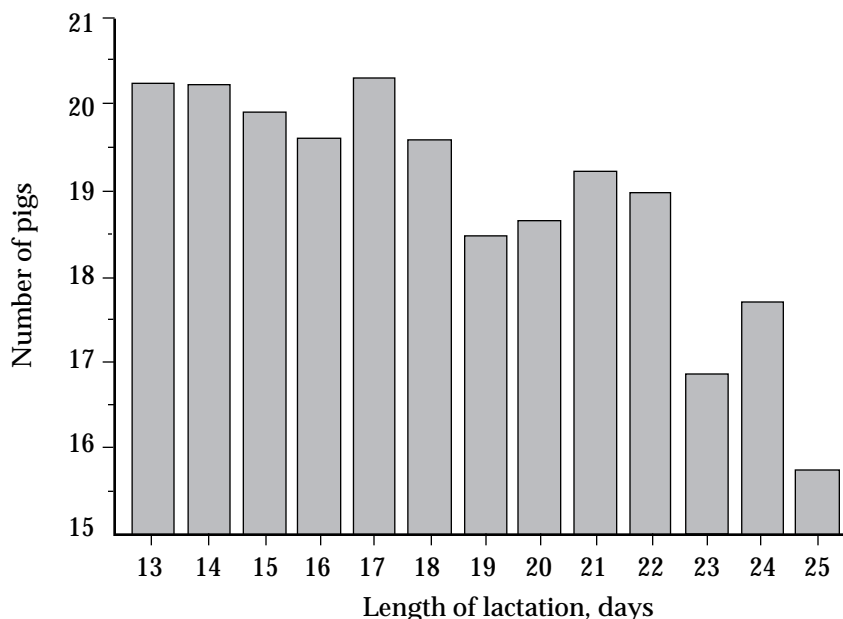


Figure 10. The influence of lactation length on the number of piglets weaned per inventoried female per year (Dial et al., 1995, University of Minnesota).

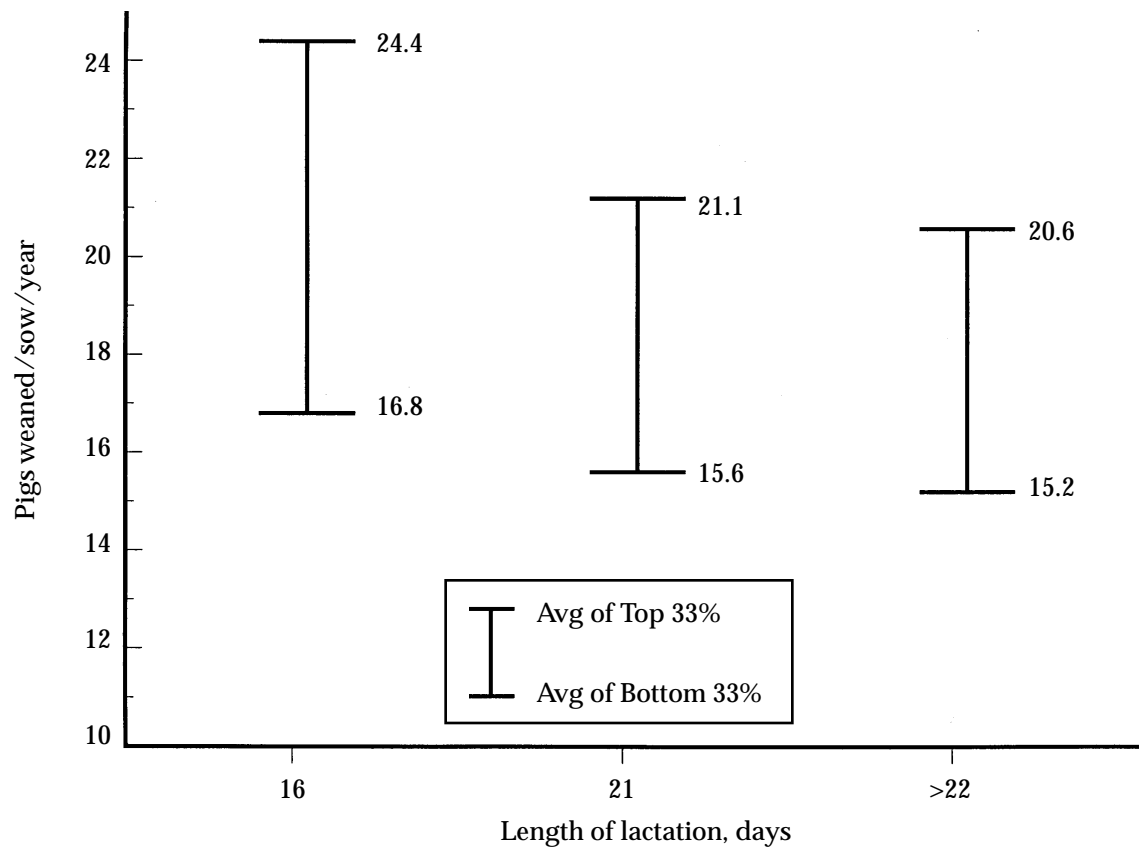


Figure 11. Variation of pigs weaned per sow per year within different lactation lengths.

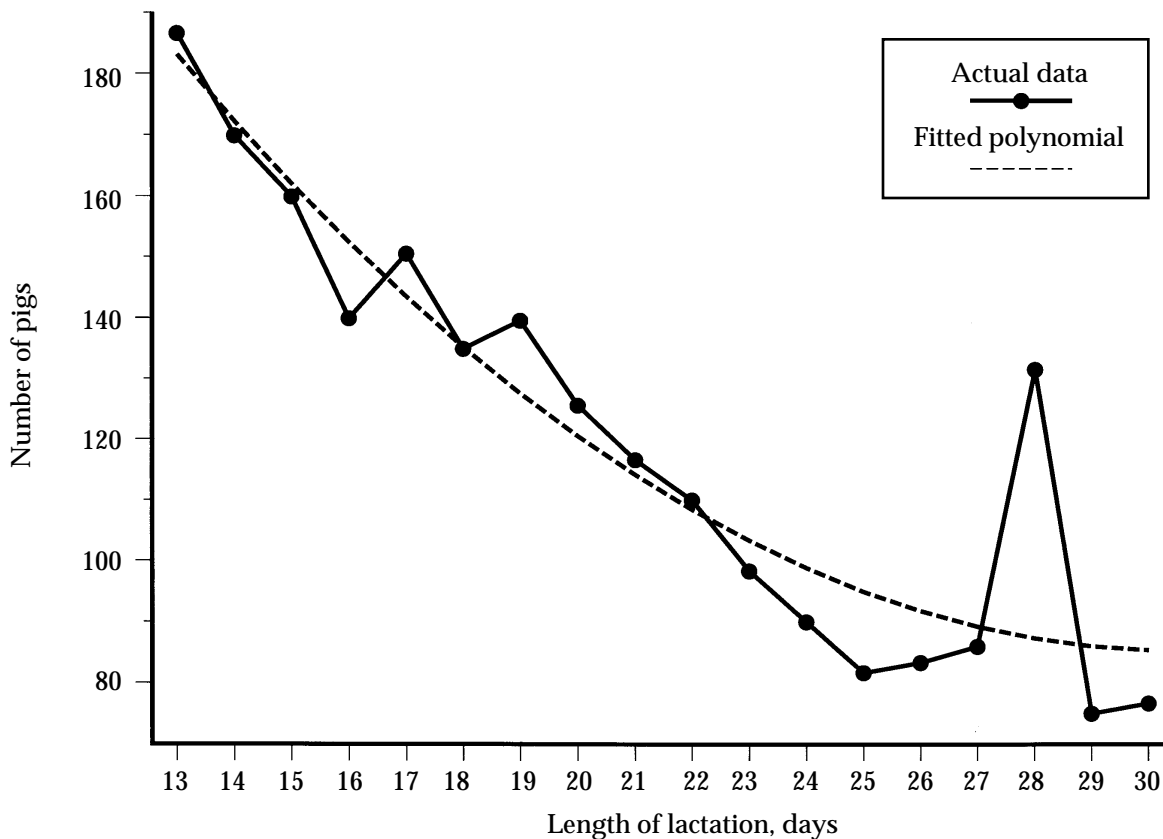


Figure 12. Herd-level analysis of the influence of lactation length on the number of pigs weaned per farrowing crate per year (Dial et al., 1995, University of Minnesota).

Remember, a substantial amount of variation exists between farms concerning number of pigs weaned per sow per year, regardless of lactation length. For example, a pork producer weaning sows at 16 days of lactation and averages 16.8 pigs weaned per sow per year is producing 4.3 less pigs than a pork producer who weans at 21 days of lactation and averages 21.1 pigs weaned per sow per year (*Figure 11, Pigtales, Pig Topics, Series 7, Number 4*).

Pigs Weaned per Farrowing Crate per Year

Farrowing facilities are the most expensive buildings involving the breeding herd. Because farrowing crates can be used more times per year as lactation length decreases, the number of pigs weaned per farrowing crate per year increases (*Figure 12*).

However, increased farrowing crate utilization requires both a greater number of farrowing groups and a larger female inventory.

The assumption that the only way to increase the number of pigs per crate per year is to wean earlier is not always true. By changing the production schedule, the number of pigs per crate per year can be increased on some farms without early weaning. Consider the following example. A farm is currently on a 35-day farrowing interval, using four groups of sows, using one farrowing unit (four rooms of 24 crates each) and weans piglets at 14 to 23 days of age (*Table II*).

SCENARIO 1: If this same farm would use 10 groups of sows, partition the farrowing unit into two units (two rooms of 24 crates each), farrow every 14 days, wean at 16 to 23 days of lactation and increase the total number of females from 442 to 552 sows, the

Table II. Influence of production schedule and lactation length on breeding herd inventory and production of pigs.

Active groups of sows, number	4	10	19	20
Farrowing units, number	1	2	3	4
Farrowing rooms per unit	4	2	2	1
Farrowing crates per room	24	24	16	24
Total number farrowing crates	96	96	96	96
Farrowing interval, days	35	14	7	7
Farrowing room use, days				
Sows moved in early	4	3	3	3
Longest lactation	23	23	16	23
Cleaning time	2	2	2	2
Idle time	6	0	0	0
Farrowing crates per group	96	48	32	24
Crate Utilization, %	100	100	100	100
Nonproductive sow days	55	55	65	55
Inactive females, % ^a	15.1	15.1	18.0	15.1
Groups of sows, total ^b	4.60	11.51	22.38	23.01
Total female inventory ^c	442	552	716	552
Weaning age, days ^d				
Oldest	23	23	16	23
Youngest	14	16	10 ^e	16
Number of weaned pigs:				
Yearly potential	9,511	11,889	15,851	11,889
Pigs per female per year	21.52	21.53	22.14	21.53
Pigs per crate per year	99.07	123.84	165.11	123.84

^a% inactive females = (nonproductive sows days ÷ 365 days/year)

^bTotal number of groups = number of active groups x (1 + % inactive group)

^cTotal female inventory = total number of groups of sows x number farrowing crates per group x % farrowing crate capacity

^dAll females within a farrowing group are weaned on the same day. Assumes all sows gestate for 114 days; however, gestation length ranges from 108 to 122 days.

^eIf wean twice per week, the pigs weaned on Monday will be 14 to 16 days of age and the pigs weaned on Thursday will be 13 to 16 days of age.

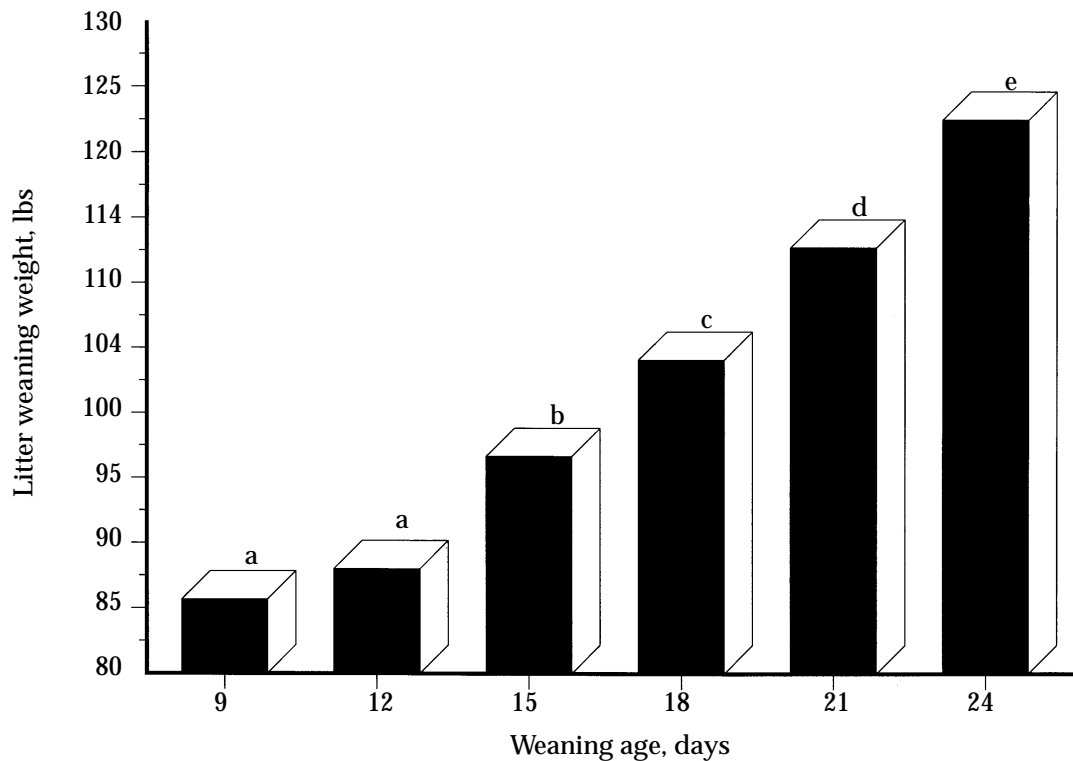


Figure 13. Influence of lactation length on average litter weaning weight (Dial et al., 1995, University of Minnesota). Columns with different letters differ ($P < .05$). The weaning age contains one day on each side of the value, such as, day 9 contains days 8, 9 and 10.

number of pigs per crate per year would increase from 99 to 124. The number of potential weaned pigs per year would increase from 9,511 to 11,889.

SCENARIO 2: If this same farm would use 19 groups of sows, partition the farrowing unit into three units (one room of 32 crates or two rooms of 16 crates each), farrow every seven days, wean at 10 to 16 days of lactation and increase the total number of females from 442 to 716 sows, the number of pigs per crate per year would increase from 99 to 165. The number of potential weaned pigs per year would increase from 9,511 to 15,851.

Litter weaning weight

As expected, sows allowed to lactate longer will produce heavier litter weaning weights. The University of Minnesota found a curvilinear relationship between lactation length and average litter weaning weight for sows weaned from nine to 24 days of lactation (*Figure 13*). Litter weaning weight was not statistically different when piglets were weaned at an average of nine (day 8, 9 and 10) or 12 (day 11, 12 and 13) days of age. Average litter weaning weight increased significantly at 15, 18, 21 and 24 days of lactation.