Effect of weaning age on nursery pig and sow reproductive performance

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Summary

Objectives: To determine the effect of weaning age on nursery-pig and sow reproductive performance.

Materials and methods: A total of 2467 crossbred barrows and gilts from 339 litters produced in a commercial multiplication herd were randomly allocated to pens by weaning age. Average weaning-age treatments were 15 days (14, 15, and 16 days) and 20 days (19, 20, and 21 days). To evaluate the effect of weaning age on nursery-pig performance, average daily gain (ADG), average daily feed intake (ADFI), gain:feed ratio, and feed cost per kg gain were evaluated. Subsequent sow reproductive performance evaluated included wean-to-first-service interval (WSI), wean-to-conception interval, total number of piglets born, and total live-born piglets.

Results: Mean 42-day weight was greater (21.8 ± 0.16 versus 18.7 ± 0.11 kg; $P < .001$), nursery ADG was greater (0.79 ± .01 versus 0.71 ± 0.04 kg per day; $P < .01$), ADFI was greater (0.64 ± 0.01 versus 0.57 ± 0.01 kg per day; $P < .001$), and 1.06 % fewer pigs were removed from test ($P < .05$) in pigs weaned at average 20 days of age than in pigs weaned at average 15 days of age. Sow reproductive traits did not differ between the two weaning-age treatment groups. Parity was a significant source of variation for WSI and total live-born piglets.

Implications: Weaning age between 15 and 20 days may have no effect on sow reproductive traits, but may significantly impact nursery growth rate.

Keywords: swine, pigs, weaning age, sows, wean-to-first-service interval

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Resumen - Efecto de la edad al destete en el desempeño de los lechones en el destete y reproductivo de hembras

Objetivo: Determinar el efecto de la edad al destete en los lechones en el destete y el desempeño reproductivo de hembras.

Materiales y métodos: Un total de 2467 machos y primerizas de 339 camadas producidas en un hato de multiplicación comercial, se asignaron al azar en corrales por edad de destete. Los tratamientos de edad de destete promedio fueron de 15 días (14, 15, y 16 días) y 20 días (19, 20, y 21 días). Para evaluar el efecto de la edad de destete en el desempeño de cerdos de lactancia, se evaluaron: ganancia diaria promedio (ADG por sus siglas en inglés), consumo de alimento diario promedio (ADFI por sus siglas en inglés), índice de ganancia:alimento, y costo de alimento por kilo ganado. La evaluación subsecuente del desempeño reproductivo de las hembras incluyó el intervalo de destete a primer servicio (WSI por sus siglas en inglés), el intervalo de destete a concepción, número total de lechones nacidos y total de lechones nacidos vivos.

Resultados: El peso promedio a los 42 días fue mayor (21.8 ± 0.16 contra 18.7 ± 0.11 kg; $P < .001$), la ADG de lactancia fue mayor (0.79 ± 0.01 contra 0.71 ± 0.04 kg; $P < .01$), el ADFI fue mayor (0.64 ± 0.01 contra 0.57 ± 0.01 kg; $P < .001$), y se eliminaron 1.06 % menos cerdos de la prueba ($P < .05$) en los cerdos destetados a un promedio de 20 días de edad comparado con los cerdos destetados a un promedio de 15 días de edad. El desempeño reproductivo de las hembras no difirió entre los dos grupos de tratamiento de edad de destete. La paridad fue una fuente importante de variación en el WSI y en el total de lechones nacidos vivos.

Implicaciones: La edad de destete entre los 15 y los 20 días puede no tener efecto en el desempeño reproductivo de las hembras, pero puede impactar seriamente el índice de crecimiento en el destete.

Résumé - Effet de l'âge du sevrage sur les porcs en pouponnière et les performances de reproduction des truies

Objectif: Déterminer les effets de l'âge du sevrage sur les porcs en pouponnière et les performances de reproduction des truies.

Matériels et méthodes: Un total de 2467 porcs castrés et cochettes croisés provenant de 339 portées dans un troupeau multiplicateur commercial ont été assignés au hasard à des parcs en fonction de l'âge du sevrage. Les moyennes d'âge du sevrage étaient de 15 jours (14, 15, et 16 jours) et 20 jours (19, 20, et 21 jours). Afin d'évaluer les effets de l'âge du sevrage sur les performances des porcelets en pouponnière, le gain moyen quotidien (ADG), l'ingestion quotidienne moyenne de nourriture (ADFI), le ratio gain:nourriture, et le coût de nourriture par kg de gain ont été évalués. Les performances de reproduction subséquentes des truies ont été évaluées et incluaient l'intervalle sevrage:première saillie (WSI), l'intervalle sevrage:conception, nombre total de porcelets nés, et total de porcelets nés vivants.

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Résultats: Le poids moyen à 42 jours était supérieur (21.8 ± 0.16 versus 18.7 ± 0.11 kg; *P* < .001), l'ADG en pouponnière était plus grand (0.79 ± 0.01 versus 0.71 ± 0.04 kg; *P* < .01), l'ADFI était plus grand (0.64 ± 0.01 versus 0.57 ± 0.01 kg; *P* < .001), et 1.06% moins de porcs ont été retirés de l'expérimentation (*P* < .05) chez les animaux sevrés à 20 jours d'âge comparativement à ceux sevrés à 15 jours d'âge. Les performances de reproduction des truies n'étaient pas différentes entre les deux groupes de traitement. La parité était une source importante de variation pour le WSI et le nombre total de porcelets nés vivants.

Implications: Le sevrage entre 15 et 20 jours d'âge pourrait n'avoir aucun effet sur les performances de reproduction des truies, mais pourrait avoir un impact significatif sur le taux de croissance des porcelets en pouponnière.

The swine industry has shifted to earlier weaning to improve farrowing-crate utilization, increase numbers of pigs born per sow per year, improve piglet health, and increase the number of pigs produced at a facility in a year.[1] Many producers and scientists are re-evaluating weaning-age decisions, comparing growth differences and herd-health issues among pigs weaned at different ages. Lactation length (weaning age) can impact both nursery growth and sow fertility and should be optimized so that producers can maximize profitability of their pork operations.

Segregated early weaning (SEW) was developed to minimize transmission of pathogens from sow to piglet. This process consists of farrowing sows on the same site as the rest of the breeding herd, weaning piglets at 10 to 21 days of age, and as a result decreasing the amount of medication needed.[1] Applying these management practices improves piglet health, but also impacts piglet growth and sow reproductive performance. Even though most of the benefits of weaning at a later age are observed during the early postweaning period, the effect has been reported to persist through the grow-finish phase.[2]

Sow reproductive performance is dependent upon various factors, eg, sow breed, parity, and environment, but management decisions such as lactation length also influence fertility. Short lactations may negatively affect measures such as weaning-to-first-service interval (WSI).[3] However, others have reported that lactation length has no effect on WSI and subsequent litter size.[4] Sow performance differences observed are likely the result of the range in lactation length.

Limited research has been conducted to determine the weaning age that results in optimum performance of the pig in the early stages of its development and in reproductive performance of the sow. The objectives of this research were to determine the effect of weaning age on nursery-pig performance and sow reproductive performance.

Materials and methods

Study animals

Data was collected over a period of 1 year in a 600-sow farrow-to-finish operation farrowing approximately 25 litters per week. The study included Danbred N.A. (Columbus, Nebraska) Yorkshire × Landrace barrows and gilts (n = 2467) from a commercial maternal-line multiplication herd (H&K Enterprises, Nevada, Iowa). All pigs were produced by purebred Landrace sows in their first to eleventh parities, divided into six parity classes for the purposes of this study. Parities > 5 were combined into a single parity class.

Study design

Each piglet was identified and weighed and sex was determined within 24 hours of birth. Within 3 days post farrowing, litter size was standardized to 10 to 11 piglets per litter by cross-fostering individuals within treatment. By 7 days of age, all boars were castrated.

Each litter was assigned at birth to one of two weaning-age or lactation-length treatments, ie, the same groups were described differently for application to different populations of animals (pigs and sows). The first weaning-age (lactation-length) treatment, average 15 days of age at weaning, included pigs that were weaned at 14, 15, and 16 days of age. The second treatment, average 20 days of age at weaning, included pigs weaned at 19, 20, and 21 days of age. A weighted average weaning age, based on the number of pigs weaned at each age, was also calculated. Weighted average weaning-age (lactation-length) treatments were 14.9 days of age and 20.2 days of age.

Litters were weaned once a week, at which time piglets in each treatment group were weighed and randomly assigned by treatment to a nursery pen. Pigs remained in their pens until 42 days post weaning, when they were weighed and removed from test (off-test weight). Seven or eight pens of pigs (three or four pens per treatment) were evaluated per replication. A total of 12 replications were completed, including a total of 89 pens of pigs evaluated (45 and 44 pens of average 15 days and average 20 days at weaning, respectively).

The experimental protocol followed the operation's production practices and met or exceeded requirements in *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching*.[5]

Exclusion criteria

Individual pigs that were substandard or non-ambulatory at weaning were not included in the nursery portion of the trial. A substandard pig was defined as a pig falling outside a target market-weight range and substantially discounted from an established base price or value.[6] Pigs were removed from test pens prior to 42 days post weaning due to mortality or if a health condition existed in which the pig did not respond to medical treatment. Morbidity was defined as pigs appearing ill, diseased, unthrifty, or characterized by loss of body weight.[7]

Housing and feeding

Pigs were housed at 26 to 28 per pen (n = 2467). Each nursery room contained eight pens, four for each weaning-age treatment, and nursery pens (2.44 × 3.05 m) provided 0.27 to 0.29 m^2 per pig. Each pen was equipped with a single-sided stainless steel self-feeder (Chore-Time, Milford, Indiana; 76.2 cm linear trough space per pen, 2.72 to 2.93 cm per pig) and two nipple drinkers, providing ad libitum access to feed and water. In both weaning-age groups, pigs were fed a four-phase diet regime from weaning to 42 days post weaning. A feed budget was developed in which each pig was provided 1.25 kg of a 1.70% lysine pelleted diet, 6.14 kg of a 1.50% lysine meal diet, and 12.57 kg of a 1.30% lysine meal diet, with the remainder a 1.20% lysine meal diet (as-fed basis). Feed disappearance was recorded on a pen basis every day of the trial.

Data management

Nursery performance data was collected and entered into Microsoft Excel (1999; Microsoft Corporation, Redmond, Washington). Growth and feed efficiency were calculated using body weight at weaning and 42 days post weaning.

For sow reproductive performance, breeding, farrowing, and weaning information was recorded in PigWIN (Version 5, 2005; Decision Power Inc, Little Canada, Minnesota), and relevant data was extracted from that program for analysis.

Sow management

A total of 339 purebred Landrace sows were included in this experiment (Table 1). Sows were mated using pooled-sire semen resulting in Yorkshire × Landrace crossbred pigs. At weaning, sows were housed in breeding stalls (55.9 cm × 182.9 cm) in mechanically ventilated buildings. Each breeding stall was equipped with a water trough that was filled twice daily, providing ad libitum access to water. While in the breeding stall, each sow was fed 2.7 kg per day of a 14.4% crude protein, 0.7% lysine diet (as-fed basis) (Table 2).

Estrus detection began 4 days post weaning and was performed once daily at approximately 7:30 AM by providing stall-line contact with a mature boar. Estrus detection continued until each sow was mated or the decision to cull an individual sow was made. Sows were mated by artificial insemination 24 and 48 hours post estrus detection.

Approximately 2 days post mating, sows were moved from the breeding stalls into pens with partially slatted concrete floors in mechanically ventilated facilities. Bred sows were grouped by size and penned with five to nine other females, with 1.26 m^2 to 1.30 m^2 per sow. Each pen was equipped with a nipple drinker that provided ad libitum access to water. Sows were fed 2.7 kg per day of the gestation diet described (Table 2).

Pregnancy detection was performed 28 days post first mating using real-time ultrasound (Alliance Medical Inc, Montreal, Quebec, Canada). Sows detected not pregnant were moved back to the breeding area for estrus detection and mating. Pregnant sows were housed in the same pens until approximately 5 days before farrowing, when they were moved to farrowing facilities.

Sows farrowed in mechanically ventilated buildings in farrowing stalls (55.9 cm × 182.9 cm) that were each equipped with a nipple drinker providing ad libitum access to water. Lactating sows were fed a diet containing 18.3% crude protein and 1% lysine (as-fed basis; Table 2) three times daily in a step-up program that started with 0.9 kg per feeding immediately after farrowing and was slowly increased as the sow fully consumed the feed provided, to a maximum intake of approximately 8.2 kg per day.

Table 1: Number of sows by parity in a study of the effects of two different lactation-length treatments on subsequent sow reproductive performance

Parity	Lactation-length* 15 days	Lactation-length* 20 days	Total
1	48	42	90
2	25	32	57
3	20	18	38
4	17	25	42
5	17	16	33
> 5	36	43	79
Total	163	176	339

* Average lactation length 15 days included sows weaned at 14, 15, and 16 days. Average lactation length 20 days included sows weaned at 19, 20, and 21 days.

Table 2: Calculated nutrient analysis (as-fed) of diets fed to sows in a study of two lactation lengths*

Calculated analysis	Production phase: Gestation†	Production phase: Lactation
Crude protein (%)	14.40	18.27
Lysine (%)	0.72	1.00
Threonine (%)	0.16	0.73
Tryptophane (%)	0.16	0.23
Calcium (%)	0.86	0.89
Available phosphorus (%)	0.68	0.72
Fat (%)	2.97	2.70
Metabolizable energy (kcal/kg)	3242	3233

* Average lactation length 15 days included sows weaned at 14, 15, and 16 days. Average lactation length 20 days included sows weaned at 19, 20, and 21 days.

† Gestation diet fed to sows before they farrowed the pigs included in the study.

Calculations and statistical analysis

Data were analyzed by analysis of variance using PROC MIXED of SAS (SAS, 2003, Cary, North Carolina). Variables included number of pigs, weaning weight, average daily gain (ADG), average daily feed intake (ADFI), gain:feed ratio (G:F), 42-day weight, feed costs per kg of gain, wean-to-service interval (WSI), total number of piglets born, and total number born alive. Variables and residuals were tested for normality. When fixed effects were a significant source of variation, differences were determined using the PDIFF option of SAS. A chi-square test for proportions was utilized to evaluate mortality and morbidity differences between the two weaning-age treatment groups. The number of days from weaning until the sow conceived her next litter (weaning-to-conception interval; WCI) was used as a measure of the sow's reproductive performance. If the sow conceived on the first breeding after weaning, the WSI and WCI were considered the same (PigWIN). If the sow failed to conceive on the first postweaning estrus (repeat breeder) and was bred again on the next estrus and became pregnant, WCI was counted from the day of weaning to the second breeding.

A chi-square test for proportions was utilized to evaluate the number of sows removed from the herd versus those retained in the herd and the number of sows with normal WSI (≤ 10 days)[8] versus those with abnormal WSI (> 10 days), comparing the two lactation-length treatments.

Immediately after completion of the trial, pig data were subjected to a distribution evaluation. Records with off-test weights > 33.6 kg (one pig) or < 5.9 kg (26 pigs) or ADG > 1.54 kg day (14 pigs) or < -0.08 kg per day (15 pigs) were excluded from the analysis, as these outliers were likely related to management factors (for example, failure to remove pigs falling behind or to identify sick animals in a timely manner) or errors in measurement. Records were deleted by simply removing from analysis the animals having extreme outlying data. This resulted in a total of 2411 pigs included in the statistical analysis.

Pig was the experimental unit for all variables measured in the individual animal. Pen was the experimental unit for G:F, ADFI, and feed cost per kg gain. Fixed effects of weaning-age treatment, parity of dam, and pen within weaning-age treatment were included in the model for ADG, and birth weight was included as a linear covariate. Sow ID and group ID were initially included as random effects; however, they had little impact (extremely low variance) and were excluded from the analysis model for ADG. The two-way interactions between fixed effects were tested but were dropped from the models because they were not a significant source of variation. Fixed effects of weaning-age treatment and pen within weaning-age group were included in the models for ADFI and G:F.

Sows with records for WSI and WCI were removed according to the following criteria: WSI > 50 days (four sows) and WCI > 100 days (eight sows). A binary response variable was created for evaluation of culling rate: removed from the herd (0), or retained in the herd (1). Culled sows were included in the analysis only if they were culled for reproductive failure for reasons that were likely the result of a treatment effect. Sows culled because of management decisions or other factors not related to the treatments were excluded from the analysis. Weaning-to-first-service interval was also modeled using a binary response variable: WSI >10 days (2) or WSI ≤ 10 days (1).

Fixed effects of weaning month, lactation-length treatment, and parity of the sow were included in the analysis of WSI, WCI, total born, and total born alive. A covariate for WSI was included in the model used to analyze WCI. The two-way interactions between fixed effects were tested but were dropped from the models because they were not significant sources of variation for the traits evaluated.

Results

Nursery-pig performance

In the group weaned at average 20 days of age, pigs were 1.53 kg heavier at weaning, nursery ADG was greater by 0.08 kg per day, and ADFI was greater by 0.07 kg per day than in pigs weaned at average 15 days of age (Table 3). A linear birth-weight covariate ($P < .01$) stated that for every 1-kg increase in birth weight there was a 0.18-kg increase in ADG. Off-test weight was greater in the group weaned at average 20 days of age (Table 3).

Morbidity in pigs weaned at average 20 days of age was lower than in pigs weaned at average 15 days of age (Table 3). Mortality rates did not differ between the weaning-age treatments (Table 3).

Gain-to-feed ratio was similar for pigs in the two weaning-age treatments, but feed cost per kg gain was greater by $0.03 in the average 15 days weaning-age group than in the average 20 days group (Table 3). This reflects the higher ADG and lower morbidity observed in the pigs weaned at an average of 20 days of age.

Sow performance

A total of 239 sows were included in the statistical analysis. Sixty sows were culled for the following reasons: 31 for reproductive failure, 17 for body condition, seven for old age, and five for miscellaneous reasons. An additional 40 sows that farrowed during the weaning-age treatment either died or were not included in the analysis due to reasons unrelated to the weaning-age treatment.

No significant lactation-length treatment differences between the 15-day and 20-day lactation lengths were observed for WSI (7.98 versus 8.38 days, SD 0.78), WCI (15.65 versus 16.93 days, SD 2.56), total born (11.15 versus 10.97, SD 0.41), total born alive (9.28 versus 9.41, SD 0.56), and culling rate (6.06% versus 7.95%) ($P > .05$). A linear WSI covariate ($P < .01$) stated

Table 3: Influence of weaning age on nursery performance in a study comparing two weaning-age (lactation-length) groups (average 15 days and average 20 days)*

Variable	Weaning age		*P*†
	15 days	20 days	
Number of pigs	1205	1206	NA
Weaning weight (kg)‡	5.15 ± 0.03^a	6.68 ± 0.05^b	< .001
Weaning weight CV (%)	19.44	18.49	ND
ADG (kg/d)‡	0.71 ± 0.04^a	0.79 ± 0.01^b	< .01
ADFI (kg/d)‡	0.57 ± 0.01^a	0.64 ± 0.01^b	< .001
G:F†	0.55 ± 0.05	0.56 ± 0.0	.85
Mortality (%)§	0.95	0.58	.14
Morbidity (%)§	2.07	1.01	.03
42-day weight (kg)‡	18.7 ± 0.11^a	21.8 ± 0.16^b	< .001
Feed costs/kg gain ($US)‡	0.47 ± 0.04^a	0.44 ± 0.01^b	< .001

* Average daily feed intake (ADFI), gain:feed (G:F), and feed cost/kg gain were calculated on a pen basis, using weight 42 days post weaning and actual pig days.

† Analysis of variance.

‡ Mean ± SD.

§ A chi-square test for proportions was utilized to evaluate mortality and morbidity differences between the two weaning-age treatment groups.

ab Means within a row with different superscripts differ ($P < .05$).

NA = not applicable; CV = coefficient of variation; ND = not done.

that for every 1-day increase in WSI there was a 0.7-day increase in WCI. No differences were observed ($P > .05$) between the treatment groups in the numbers of sows with normal WSI (≤ 10 days) and abnormal WSI (> 10 days). Sows in the average 15 days group included 98 with normal and 23 with abnormal WSI. Sows in the average 20 days group included 100 with normal and 18 with abnormal WSI. However, the coefficient of variation for WSI decreased as lactation length increased when sows with normal WSI (198 sows) and abnormal WSI (41 sows) were compared (data not shown).

Parity differences for WSI, total born, and total born alive were observed (Table 4). Mean WSI was greater in Parity 2 sows ($P < .01$) than parities higher than 2. Total born and total born alive were greater in Parity 2 and Parity 4 sows than in sows of parity > 5 ($P < .01$; Table 4). Total born alive was greater in Parity 2 and 4 sows than in Parity 3 and 6 sows ($P < .01$). As parity increased, WSI decreased, and there was a linear decrease in total born alive in parities ≥ 4. There was no difference in culling rate for reproductive failure between sows weaned at average 15 days (6.06%) and those weaned at average 20 days (7.95%) ($P = .43$).

Table 4: Influence of parity on sow reproductive performance in a study comparing two lactation-length treatments*

Parity	No. of sows	WSI (days)	Total born	Total live born
2	72	12.8[a]	11.1[a]	10.1[a]
3	45	7.2[b]	10.6[ab]	9.5[ab]
4	32	6.7[bc]	12.2[a]	11.0[a]
≥ 5	90	6.0[c]	10.4[b]	8.4[b]

* Average lactation length 15 days included sows weaned when piglets were 14, 15, and 16 days of age. Average lactation length 20 days included sows weaned when piglets were 19, 20, and 21 days of age.

[abc] Means within a column with no common superscript differ ($P < .05$; ANOVA).

WSI = wean-to-service interval (no. of days from weaning until a sow's first mating).

Discussion

The results of this study agree with those of Wolter and Ellis[9] and Himmelberg et al,[10] who reported a favorable correlation between weaning weight and weaning age. Wolter and Ellis[9] studied pigs from the Pig Improvement Company (PIC) and reported that pigs heavier at weaning were heavier at birth and at 56 days of age and reached slaughter weight 8.6 days sooner. Mahan and Lepine[11] and Roberts[12] also reported that weaning weight was predicative of overall pig performance and days to market weight in crossbred pigs. Studies[2,10] have shown that feed intake and rate of gain during the nursery period increase with weight at weaning. Main et al[2] also reported highly favorable correlations between weaning age, ADG, and weight sold per pig weaned in a multi-site system utilizing crossbred pigs.

Pigs weaned in the average 20 days group were 3.13 kg heavier than pigs weaned in the average 15 days group. The heavier weights obtained by the average 20 days weaning-age group might have been influenced by the fact that both treatment groups were fed alike, receiving budgeted feed amounts geared to meet the needs of the average 15 days weaning-age group. Main et al,[2] studying pigs from a commercial PIC operation, also observed a significantly higher nursery off-test weight (greater by 5.5 kg) in pigs weaned at 20 days of age than in those weaned at 15 days of age. The results of the current study reported on weights only through 42 days post weaning, because the production system where the trial was conducted typically sold many of the pigs at this point and further data collection was not possible. Main et al[2] and Powell and Aberle[13] reported that the higher ADG and lower mortality that were a result of weaning at an older age largely occurred in the initial 42 days after weaning, with some further improvements in ADG and lower mortality through finishing.

Results for ADG and ADFI are consistent with those of Himmelberg et al[10] and Leibbrandt et al,[14] who reported that ADG and ADFI were significantly greater throughout the nursery and grow-finish phases of production in pigs that were heavier at weaning than in their lighter littermates. Hohenshell et al[15] also observed lower post-weaning weight gains associated with early weaning. Additionally, Main et al[2] and Fangman et al[16] reported greater nursery ADG and ADFI as weaning age increased from 12 days to 21 days.

Weaning age is an important driver of nursery costs, but mortality and morbidity within weaning age are important factors in determining the optimal weaning age for individual pork operations. However, in this study, mortality and morbidity in both treatments would be considered above average by current industry standards.[17] These results are consistent with those reported by Main et al,[2] who found that mortality was 2.82% in pigs weaned at 15 days of age and 0.54% in pigs weaned at 20 days of age. The greater mortality observed in pigs weaned at younger ages represents a substantial reduction of net income through lost revenue from pigs that died and increased expenses of feeding the pigs until they died. In a study by Deen,[18] variability in profits due to cull, dead, and lightweight pigs was > 50%, while the variability in ADG was > 15% and the variability in G:F was > 30%. This variability in profitability of cull, dead, and lightweight pigs reveals the importance of minimizing numbers of these pigs in any production system. Mortality and morbidity in the nursery are largely a function of entry and exit weights, and weaning age significantly impacts both of these weights.

Mahan et al[19] also reported similar feed conversion ratios for pigs with different weaning weights. The current study showed that weaning age and weaning weight are related. Main et al[2] reported that G:F ratios were lower in pigs weaned at 12 days than in pigs weaned at 21 days. Additionally, the same study found that G:F ratios were similar among pigs weaned at 15 days, 18 days, and 21 days. Schinckel and de Lange[20] portray the relationships between pig genotype and environmental factors. These relationships are essential in order to evaluate and implement different management strategies such as weaning age. The relationship between feed efficiency and body-weight gain was similar in the two weaning-age groups in the present study because their growth curves during the nursery phase of production were essentially the same.

Main et al[21] reported that income over costs per pig weaned increased from $3.71 for pigs weaned at 12 days of age to $10.28 for pigs weaned at 21 days of age. Feed cost per kg of gain was not directly measured in this study. The current results demonstrate the importance of ADG, morbidity, and weaning age to profitability in the nursery phase of production in a pork operation.

Parities > 5 were combined in this study for two specific reasons. Subsequent reproductive performance for parties 6, 7, 8, 9, 10, and 11 was similar, and combining parities provided a more normal distribution of sows in each parity class across lactation-length treatment.[6] Including the parity classes in the study provided results consistent with those reported by Tantasuparuk et al,[4] who also utilized purebred females and evaluated a similar range of lactation lengths (17 to 24 days), compared to a range of 14 to 21 days in this study.

Previous studies have reported that increasing lactation length decreases WSI and increases subsequent litter sizes.[3,22,23] These studies analyzed sow records retrospectively, whereas in this study, determining effects of lactation length on sow productivity was an objective of the trial. The results of the previous studies[3,22,23] differ from those of the present investigation, likely due to differences in lactation length and the use of purebred sows versus crossbred sows in some cases. The results of the present study agree with those of Le Cozler et al,[3] who reported that sow WSI decreased with increasing lactation length. However, in contrast to the present study, previous studies[4,23] reported that longer lactation lengths were associated with larger subsequent litter size. This difference is likely due to the relatively small range of the lactation-length treatments. Breed is an important source of variation in litter size, as purebred sows generally have lower prolificacy[3] than crossbred females.[24] Since purebred Landrace females were utilized in this study, values for some reproductive traits may be lower than expected for crossbred females.

In a study by Xue et al,[25] parity affected WSI, total born, and total born alive, and average litter size was lower for parity 2 sows than for later parities. The relatively low number of observations in the parity subclasses in each weaning-age treatment in the present study might explain differences between the present and previous investigations. Thus, when analyzing the association between parity and the named traits, it is important to look at the correlation between WSI, WCI, and litter size by parity.

Previous studies have reported that sow longevity is adversely affected by reducing lactation length.[26,27] Xue et al[27] reported that lactation length was shorter (< 15 days) in sows removed from the herd than in sows that remained in the herd (> 16 days). Sows culled for reasons unrelated to reproduction were included in the Xue et al[27] study. Results may have been biased because culling might have been the result of factors other than lactation length.

The present study evaluated the difference between two average lactation lengths, 15 and 20 days, that are commonly implemented in commercial swine production systems today.[1] Mabray et al[28] reported that a lactation length < 14 days had a negative impact on subsequent performance and caused more variability in sow performance. Lactation lengths < 14 days were not included in the present study due to the possibility of a negative impact on subsequent sow performance. Other operations using different genetic lines or management systems may find different results and should develop their own qualifications for measuring subsequent sow reproductive performance.

Implications

- Weaning pigs at ≥ 20 days of age may prove advantageous in commercial operations because of improvements in nursery growth performance.
- Under the conditions of this study, feed costs in the first 42 days post weaning are lower when pigs are weaned at an average age of 20 days than at an average age of 15 days.
- Weaning ages in the range of 14 to 21 days may not adversely impact sow reproductive performance.
- Parity of dam influences both piglet weights in subsequent phases of production and subsequent reproductive performance of the sow.
- The effects of different weaning ages should be assessed in the context of each operation.

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