Influence of Weaning Age on Pig Growth Performance

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Introduction

Multi-site production is a widely applied strategy in commercial pig production. Multi-site production has evolved through the implementation of an age segregated production technology called segregated early weaning (SEW). Segregated early weaning involves removing weaned pigs from the sow herd and rearing them separately from other age groups of pigs. In addition to segregation, it has been suggested that reducing weaning age decreases the transfer of pathogens to the offspring. Applying the concepts of SEW and multi-site production has improved pig performance in herds with low or high levels of endemic pathogens present. While the concepts of segregation and all-in all-out management (i.e., depopulating and cleaning of facilities between groups of pigs) appear to be essential for improvements in performance, the importance of younger weaning age is less clear. Therefore, the objective of our trials was to quantify the effects of weaning age on pig performance within a multi-site production system. A secondary objective was to evaluate the effects of weaning age on wean-to-finish costs and revenue in a multi-site production system. The intent was to bring any differences observed in down-stream costs or revenue back to a per pig weaned basis. Thus, enabling a clear determination of how weaning age affects weaned pig value within a multi-site production system.

Experimental procedures

Two trials were conducted with pigs in a multi-site production system containing a 7,300-head sow farm weaning pigs into geographically distinct nursery and finishing sites. The nursery

and finishing sites only received pigs from this single sow farm and were depopulated, cleaned, and disinfected before another group of pigs was placed in the site. In trial 1, treatments included weaning litters of pigs at 12, 15, 18, or 21 d of age, with all pigs fed a common nursery feeding program. Trial 1 was conducted in a randomized complete block design with four wean age treatments (12, 15, 18 or 21 d of age) in four blocks. In trial 2, litters were weaned at 15, 16, 18, 19, 21, or 22 d of age resulting in three categorized wean age treatments of 15.5, 18.5, and 21.5 d. Pigs within each wean age treatment were fed a nursery feeding program that was classified as either more or less complex. The nursery feeding program classifications were based upon the amount of lactose and spray-dried animal plasma in the diet and the quantity fed per pig. Because nursery diet complexity did not influence performance, only weaning age will be discussed in the results.

In both trials, litters were ear notched at birth (approximately 18 litters per day of weaning age in each block), and all pigs were subsequently individually ear-tagged, weighed, and gender recorded three days prior to weaning. Each block consisted of all weaning age treatments weaned on the same day into the same nursery. At weaning, pigs (PIC Line 280 × C22; 2,272 and 3,456 total pigs in trials 1 and 2, respectively) were individually allotted to nursery pens. Each of the four blocks had four randomly assigned pens per age (trial 1) or age by nursery feeding program combination (trial 2). Each pen contained an equal number of barrows and gilts. Using the individual pig age, weight and gender information, each pen was allotted to replicate the normal weight distribution of barrows and gilts weaned within each age group. Pens contained 36 pigs, with the exception that the first block in trial 1 had 34 pigs in each pen. Each

pig was weighed on d 42 post-weaning. Each block remained intact as pigs were transferred from nursery to finishing site.

Using the individual 42 d post-weaning weight and gender information, pigs (1,920 and 3,000 total pigs in trials 1 and 2, respectively) were individually reallotted within treatment group and block to the finishing phase of the evaluation. Reallotting was required due to different pen sizes in the nursery and finisher sites. As described for the nursery allotment, finishing pens were allotted such that each pen was a replicate of the population of feeder pigs being weighed out of the nursery at d 42 post-weaning specific for each treatment and block. In trial 1 (96 total pens), each finishing block had six randomly assigned pens per wean age treatment. In trial 2 (120 total pens), each block had five randomly assigned pens per wean age by nursery feeding program combination. In trial 1, pigs (20 pigs per pen; 10 barrows and 10 gilts) were placed in 2.29 m × 6.71 m finishing pens. In trial 2, pigs (25 pigs per pen; 13 gilts and 12 barrows) were placed in 2.90 m × 6.71 m finisher pens. Pens were weighed off-test on d 156 (trial 1) and d 153 (trial 2) post-weaning with individual weights being recorded. Data from the nursery and finishing phases were used to determine wean-to-finish performance.

Results

Wean-to-Finish Performance

Increasing weaning age (12, 15, 18, or 21 d; and 15.5, 18.5, or 21.5 d in trials 1 and 2, respectively) improved (linear, $P < 0.001$) ADG (299, 368, 409, 474 ± 7 g/d; 435, 482, 525 ± 13 g/d) and tended to decrease (linear, $P < 0.09$) mortality (5.25, 2.82, 2.11, 0.54 ± 0.76%; 2.17, 1.56, 1.30 ± 0.36%) in the initial 42 d post-weaning. Finishing ADG (722, 728, 736, 768 ± 11 g/d; 783, 790, 805 ± 11 g/d) also improved (linear, $P < 0.01$) with increasing weaning age.

Overall wean-to-finish ADG, average pig gain per day post-weaning, weight sold per pig weaned (linear, $P < 0.001$, Tables 1 and 2) and wean-to-finish mortality (linear, $P < 0.03$) improved as weaning age increased from 12 to 21 days or 15.5 to 21.5 days in trials 1 and 2, respectively. The improvements in mortality were due to decreased death loss during the nursery stage. The improvements in growth rate were evident in both the nursery and finisher phase.

Data from trials 1 and 2 were pooled to enable a collective estimate of the rate of linear improvement observed in post-weaning performance as weaning age increased from 12 to 21.5 days. These linear rates of improvement (slope) describe the effect of increasing weaning age on a per day increase in weaning age basis. For example, these studies indicate total weight sold per pig weaned will increase by 5.40 kg (1.80 kg × 3 day) as weaning age is increased from 18 to 21 days in this multi-site production system (Table 3). The estimated slopes for several primary response criteria are illustrated in Table 3. These modeled slopes are intended to provide a reference that succinctly illustrates the rate of linear improvement in growth performance observed in these studies as weaning age increased. Understanding these slopes (rate of improvement on a per day increase in weaning age basis) enables the implications of altering weaning age within a production system to be readily modeled.

On commercial farms, weaning age is generally an outcome determined secondarily from the number of sows farrowing each week, lactation space available, and how efficiently the lactation space available is being used. Furthermore, weaned pigs within commercial production systems are commonly considered of equal value and assumed to have similar post-weaning performance potential, as long as minimum quality standards are met. The performance differences observed in our studies strongly suggests that the weaning age has a significant

impact on the economic value of a weaned pig. Pigs that are weaned at an older age have more value than pigs weaned at a younger age due to the lower mortality and increased growth rate in the nursery and finisher periods.

It should be recognized that the improvements in wean-to-finish growth performance observed in these studies may vary between different multi-site production systems due to differences in health status, environment, or genotype. These studies suggest the magnitude of growth rate improvement observed with increasing wean age is rather predictable within a given multi-site production system. However, the magnitude of the mortality improvement likely depends on baseline mortality rates, as well as pig-flow, site, or other system specific challenges.

In these studies, wean-to-finish growth performance and productivity (as measured by ADG, mortality, off-test weight per day of age, and weight sold per pig weaned) improved as weaning age increased from 12 to 21 and 15.5 to 21.5 day of age. Linear improvements in growth and mortality rate largely occurred in the initial 42 d post-weaning period, with some ongoing growth improvements in finishing performance. These studies suggest increasing weaning age up to 21.5 d can be an effective production strategy to improve wean-to-finish growth performance in a multi-site production system.

Economic Impact

Growing Pig Costs and Revenue

Cost and revenue were calculated for each pen by applying a series of inputted economic assumptions to the biological performance observed in each pen. As described above, the intent of these studies was to determine the effect that weaning age has on the value of weaned pigs (or populations of weaned pigs) within a multi-site production system. Therefore, weaned pig costs

were considered equal across weaning age treatments, and all post-weaning costs and revenue were transferred back to a per pig weaned basis. Thus, enabling a determination of how weaning age effects weaned pig value. All monetary values used in the paper are expressed in United States dollars.

Because production systems are either short on grow-finish space, long on grow-finish space, or in somewhere in between, cost and revenue information were calculated under two different finishing space scenarios (limited or non-limiting). The limited finishing space analysis (or space short) assumes a restricted finishing capacity, and all age groups are sold after a fixed number of days after weaning (i.e., off-test weigh day in this analysis). Non-limiting finishing capacity (or space long) allows all age groups to be grown to an equal and predetermined average market weight, as post-weaning days to market is not a constraint. To enable the non-limited finishing space analysis, additional inputted assumptions need to be made for late-term finishing (> 156 and 153 days post-weaning in trials 1 and 2, respectively) daily growth rate (ADG), daily mortality rate, and a desired common market weight. The input assumptions used in these analyses are illustrated in Table 4.

In trial 1, feeder pig cost increased (quadratic, $P < 0.01$, Table 5) as weaning age increased due to a linear increase in nursery feed intake observed with increasing weaning age. Only the 21-day wean pigs had increased ($P < 0.05$) feeder pig costs, as compared to the other weaning age treatments. Quantitatively speaking, feeder pig costs were moderately flat as weaning age increased from 12 to 21 days due to the magnitude of mortality improvement observed with increasing weaning age. In trial 2, feeder pig costs increased (linear, $P < 0.001$) as

weaning age increased due to linearly improved nursery feed intake observed with increasing weaning age. This was the only response criteria that differed in shape between trials 1 and 2.

In both trials and finishing capacity scenarios (limited and non-limited), weight sold per pig weaned, wean-to-finish cost per hundred weight, and income over costs (margin) per pig weaned improved (linear, $P < 0.03$, Tables 5 and 6) as weaning age increased from 12 to 21 and 15.5 to 21.5 days in trials 1 and 2, respectively. When finishing capacity is non-limiting and all age groups could be marketed at an equal average pig weight, wean-to-finish costs per head sold and post-weaning days to a common market weight were decreased (linear, $P < 0.001$) as weaning age increased.

Data from each trial (trial 1 = 15, 18, and 21 day treatments; trial 2 = 15.5, 18.5, and 21.5 day treatments) were pooled into a single statistical model, to collectively estimate the linear effects of increasing weaning age from 15 to 21.5 days. These estimates were calculated for both limited and non-limited finishing capacity scenarios (Table 7). These estimates indicate the rate of linear improvement observed in post-weaning performance as weaning age increased from 15 to 21.5 days. For example, these studies indicate 42-day post-weaning weight will increase by 0.89 ± 0.02 kg for each day increase in weaning age. The estimated improvements due to increasing weaning age were also translated back to a per unit increase in weaning weight. For example, these studies indicate that 42-day post-weaning weight would increase by 3.48 kg for each 1 kg increase in weaning weight. However, these weaning age to weaning weight translations are only applicable when the increases in weaning weight are due to increasing lactation length within the range of 15 and 21.5 days.

The pooled data from trial 1 (15, 18, or 21 day treatments) and trial 2 (15.5, 18.5, and 21.5 day treatments) were modeled over a wide range of market prices and finishing space costs. These sensitivity analyses illustrate the effect of weaning age on wean-to-finish margin per pig weaned (or increase in weaned pig value per day increase in weaning age) over a wide range of market prices (Figure 1) and finishing space costs (Figure 2). In the limited finishing space scenario, the economic effects of weaning age are more sensitive to market price increasing from \$0.39 to \$1.13 per pig weaned/day increase in weaning age as market price increases from \$77/100kg (\$35/cwt) to \$121/100kg (\$55/cwt). When finishing space is non-limiting, the economic effects of weaning age are less sensitive to market price increasing only from \$0.33 to \$0.56 per pig weaned/day increase in weaning age over the same range of market price. The economic effects of weaning age are relatively insensitive to finishing space costs.

The improvements in wean-to-finish costs per unit of weight sold and margin per pig weaned are driven by the increased weight sold per pig weaned as weaning age increased to 21 and 21.5 days in trials 1 and 2, respectively. Weight sold per pig weaned is a function of weaning weight, growth rate, and livability in the nursery through finishing period. The growth performance responses observed in these trials compare to other studies evaluating weaning age has been previously reported. In brief, the observed improvements in weight sold per pig weaned were primarily due to linear improvements in both growth rate and livability that largely occurred in the initial 42-days post-weaning period, with some ongoing growth improvements in finishing. These studies suggest weaning age plays a primary role in nursery (day 0 to 42 post-weaning) growth performance achieved for pigs with a similar health status and environment,

and that increasing weaning age up to 21.5 days can be an effective production strategy to improve wean-to-finish growth performance in a multi-site production system.

The primary difference in the limited versus non-limited finishing space scenarios is that the value of increasing growth rate is more fully recognized when finishing spaces are limited. This is because the observed improvement in weight sold per pig weaned/day increase in weaning age is greater when finishing space is limited, as compared non-limited (i.e., as described in Table 7, 1.68 and 0.50 ± 0.14 kg increased weight sold per pig weaned for each day increase in weaning age in limited and non-limited finishing space scenarios, respectively). Due to seasonal trends in both finishing growth rates and sow reproductive performance that continue to commonly exist in pig production, production systems may differ in their finishing space scenario in different time periods of the year. For example, a production system may be limited in grow-finish space during July, August, and September as the implications of summer heat on finishing growth rate are realized. However, grow-finish space may be non-limiting in December, January, and February as the effects of accelerated fall growth rates are fully realized and potentially coupled with reduced output from the sow farms due to a dip in summer breeding herd performance. Therefore, the true economic value of weaning age likely lies between the limited and non-limiting space estimates.

Quantifying the effects of weaning age on weaned pig value demonstrates the need to identify lactation crate utilization inefficiencies or facility restrictions that may be constraining weaning age. There was a $2.34 (non-limited finishing space) to $3.48 (limited finishing space) difference in margin per weaned pig (or weaned pig value) as weaning age increased from 15 to 21 days. These data indicate that simply assessing a common value to wean pigs, regardless of

age or weight, may lead to incorrect conclusions concerning sow herd productivity or contribution to whole system profitability. Valuing populations of acceptable wean pigs equally regardless of age or weight at weaning fails to account for the substantial differences in down-stream value observed in these studies. Accounting for all acceptable pigs equally may also be inflating the perceived benefit of increasing breeding and gestation inventories without regard for the lactation space availability. These studies conservatively estimate the value of weaned pigs (as measured by income over wean-to-finish costs) increases $0.39 (non-limiting space) to $0.58 (limited finishing space) for each day increase in weaning age in a multi-site production system.

Once production system dependent rates of biologic and economic improvement due to increasing weaning age have been determined (Table 7), managers can use partial budgeting techniques to evaluate the cost-benefit relationships of altering weaning age. Partial budgeting is a well described tool used to illustrate the net effect of altering individual management strategies on whole system cost and revenue. Partial budgeting is an effective means of weighing the costs associated with increasing weaning age against the benefits. Increasing weaning age can be achieved by improving lactation space use efficiencies, adding lactation space, decreasing the number of sows that farrow each week, or by some combination of the above. Each of these options has costs and benefits that can be readily modeled to estimate the net impact of each option being considered.

The effect of weaning age on margin per pig weaned (or weaned pig value) is positively correlated with market price (Figure 1). This is because the value of the incremental improvements in weight sold per pig weaned increases with increasing market price while costs remain unchanged. Market price has a greater effect on margin per weaned pig (or weaned pig

value) when finishing space is limiting ($0.0168 and $0.005 increase per weaned pig/day increase in weaning age for each $1/100kg increase in live-weight market price in limited and non-limited finishing space scenarios, respectively). This is because the improvements in weight sold per pig weaned are greater when finishing space is limited as compared to non-limiting. Finishing space costs do not greatly affect the magnitude of the incremental value of weaning age (Figure 2). However, in the non-limited finishing scenario, the incremental value of weaning age modestly increases from $0.35 to 0.40 ± 0.06/weaned pig/day change in weaning age as finishing space costs increase from $28 to $40 per pig space. This modest increase is due to the cost savings associated with reducing days to a common market weight (Table 6) as weaning age is increased.

These studies illustrate the economic effects of weaning age on weaned pig value in a commercial multi-site production system. When evaluating potential shifts in weaning age within a production operation, it is likely important to understand the current complex of pathogens present, and which of these pathogens are being eliminated or controlled by current weaning strategies. It has been suggested that both age and variation in weaning age play a role in health improvements often seen with segregated pig production. Therefore if the mean weaning age is increased, controlling pig movement during lactation and understanding pig age variation at weaning is of utmost importance. Improving lactation crate utilization, decreasing week-to-week variability in the number of sows farrowed, altering weekly farrowing targets, or increasing lactation capacity are the primary means of increasing and maintaining consistency in weaning age.

Table 1. Influence of weaning age on wean-to-finish performance, Trial 1[a]

	Weaning age					Probability (P<)	
Item	12	15	18	21	SE	Linear	Quadratic
Allotment weight, kg[b]	3.42	4.26	4.89	5.75	0.05	0.001	0.68
Off-test weight, kg	103.9	109.1	112.1	117.3	0.81	0.001	0.94
ADG, g	580	616	637	687	8	0.001	0.36
Mortality, %	9.39	7.88	6.80	3.68	0.95	0.001	0.39
Average gain per d post-weaning, g	643	671	686	714	5	0.001	0.96
Weight sold per pig weaned, kg	94.1	100.5	104.4	113.1	1.30	0.001	0.35

[a]A total of 2272 pigs with 34 or 36 pigs per pen (50% barrows, 50% gilts), and 16 replications (pens) per treatment, or a total of 64 pens on test in the nursery and 1920 pigs with 20 pigs per pen and 24 replications (pens) per treatment, or a total of 96 pens on test in the finisher.
[b]Allotment weights were taken on all pigs 3 d prior to weaning.

Table 2. Influence of weaning age and nursery feeding program on wean-to-finish performance, Trial 2[a]

	Weaning age, d				Probability (P<)	
Item	15.5	18.5	21.5	SE	Linear	Quadratic
Allotment weight, kg[b]	4.08	4.78	5.64	0.09	0.001	0.001
Off-test weight, kg	112.0	115.6	119.2	1.33	0.001	0.91
ADG, g	675.5	697.5	721.5	7	0.001	0.78
Mortality, %	3.92	3.425	2.49	0.69	0.03	0.69
Average gain per d post-weaning, g	703.5	723.5	741	7	0.001	0.76
Weight sold per pig weaned, kg	107.6	111.6	116.2	1.2	0.001	0.70

[a]A total of 3456 pigs with 36 pigs per pen and 32 replications (pens) per weaning age, or a total of 96 pens on test in the nursery and 3000 pigs with 25 pigs per pen and 40 replications (pens) per weaning age, or a total of 120 pens on test in the finisher.
[b]Allotment weights were taken on all pigs 3 d prior to weaning.

Table 3. Modeling the linear rate of change observed as wean age increased from 12 to 21.5 days in trials 1 and 2[a]

	Rate of linear change per d increase in wean age	
Item	Change per d	SE
Allotment weight, kg[b]	0.257	0.003
d 42 post-weaning, kg	0.93	0.017
Off-test weight, kg	1.35	0.08
Wean-to-finish ADG, g	9.9	0.74
Wean-to-finish mortality, %	-0.47	0.09
Weight sold per pig weaned, kg	1.80	0.12

[a]Modeling the linear rate of change (magnitude of change per d increase in weaning age) in wean-to-finish performance observed as weaning age increased from 12 to 21.5 days (trial 1 = 96 finishing pens with 20 pigs per pen, and trial 2 = 120 finishing pens with 25 pigs per pen).

[b]Allotment weights were taken on all pigs 3 d prior to weaning.

Table 4. Economic assumptions applied to the biological performance observed in two trials evaluating the effects of weaning age on post-weaning performance.[1]

Input variable	Trial 1	Trial 2
Weaned pig cost, (US$)	$25.00	$25.00
Nursery space cost, (US$)/pig space/day [2]	$0.0822	$0.0822
Nursery idle days/turn [3]	5	5
SEW diet, (US$)/1000 kg [4]	-	$496.04
Phase I diet, (US$)/1000 kg [4]	$369.27	$449.74
Phase II diet, (US$)/1000 kg [4]	$261.25	$289.90
Phase III diet, (US$)/1000 kg [4]	$189.60	$213.85
Finisher space cost, (US$)/pig space/day [5]	$0.1041	$0.1041
Miscellaneous costs (transport, meds & supplies, management fees, genetic royalties, etc.), (US$)/100 kg	$11.02	$11.02
Finisher idle days/turn [3]	7	7
Baseline finishing feed cost, (US$)/kg of gain [6]	$0.331	$0.331
Live-weight market price, (US$)/100 kg [7]	$88.18	$88.18
Late finishing (> 111 kg) ADG, g/day [8]	726	726
Late term finishing daily mortality, %/day [8]	0.02%	0.02%
Non-limited grow-finish space, average market weight, kg [8]	120.2	120.2

[1]Operationally dependant cost and revenue assumptions were applied on two trials evaluating the effects of weaning age on growing pig costs and revenue.

[7] Assumptions of late-term finishing (>111 kg) ADG, daily mortality rate, and desired average market weight are needed to model effects of weaning age in production systems non-limited in grow-finish capacity, enabling all treatment groups to be grown to a common average pig weight.

Table 5. Influence of weaning age on post-weaning costs and revenue with limited finishing space[1,2]

	Trial 1							Trial 2					
	Weaning age					Probability (P<)		Weaning age				Probability (P<)	
Item	12	15	18	21	SE	Linear	Quad.	15.5	18.5	21.5	SE	Linear	Quad.
Allotment weight, kg [3]	3.42	4.26	4.89	5.75	0.05	0.001	0.77	4.08	4.78	5.64	0.09	0.001	0.002
Feeder pig weight, kg [4]	16.9	20.3	22.6	25.8	0.26	0.001	0.60	22.9	25.4	28.1	0.64	0.001	0.57
Off-test weight, kg [5]	103.9	109.1	112.1	117.3	0.81	0.001	0.94	112.0	115.6	119.2	1.29	0.001	0.91
Weight sold per pig weaned, kg [6]	94.1	100.5	104.4	113.1	1.31	0.001	0.35	107.6	111.6	116.2	1.07	0.001	0.70
Wean to finish mortality, %	9.39	7.88	6.80	3.64	0.95	0.001	0.39	3.92	3.43	2.49	0.50	0.03	0.69
Feeder pig cost, (US$) [7]	34.66	34.47	34.64	34.80	0.12	0.05	0.01	35.58	35.91	36.29	0.14	0.001	0.65
Cost per 100 kg sold, (US$)	84.35	82.47	81.33	79.16	0.42	0.001	0.73	80.66	79.81	78.74	0.21	0.001	0.62
Cost per head sold, (US$)	87.64	89.98	91.11	92.88	0.61	0.001	0.64	90.36	92.2	93.85	0.91	0.001	0.79
Revenue per pig weaned, (US$)	82.98	88.65	92.10	99.71	1.15	0.001	0.35	94.87	98.42	102.48	0.95	0.001	0.70
Costs per pig weaned, (US$)	79.27	82.77	84.83	89.43	0.70	0.001	0.32	86.74	89.02	91.48	0.66	0.001	0.81
Income over costs per pig weaned, (US$)	3.71	5.88	7.27	10.28	0.48	0.001	0.39	8.13	9.40	11.00	0.32	0.001	0.58

[1] Wean-to-finish cost and revenue data from two trials conducted evaluating effects of weaning age in a multi-site production system with limited finishing space. A total of 2,272 and 3,456 pigs were used in a randomized complete block design with 24 and 40 replications per weaning age treatment in trials 1 and 2 respectively.

[2] Limited finishing space is defined as having a fixed number of finishing spaces available. Therefore, analysis assumes all age groups have to be sold on a fixed number of days post-weaning, or off-test weigh day in this analysis.

[3] Allottment weight is the average pig weight attained 3 days prior to weaning.

[4] Feeder pig weight is the average pig weight at 42 days post-weaning.

[5] Off-test weight is the average pig weight at 156 and 153 days post-weaning for trials 1 and 2, respectively.

[6] Weight sold per pig weaned = off-test pen weight ÷ weaned pigs required to place finishing pen.

[7] Feeder pig cost = standardized weaned pig cost + all nursery costs.

Table 6. Influence of weaning age on cost and revenue with non-limiting finishing space[1,2]

	Trial 1							Trial 2					
	Weaning age					Probability (P<)		Weaning age				Probability (P<)	
Item	12	15	18	21	SE	Linear	Quad.	15.5	18.5	21.5	SE	Linear	Quad.
Allottment weight, kg [3]	3.42	4.26	4.89	5.75	0.05	0.001	0.77	4.08	4.78	5.64	0.09	0.001	0.002
Sale weight, kg	120.2	120.2	120.2	120.2	.	.	.	120.2	120.2	120.2	.	.	.
Weight sold per pig weaned, kg [4]	108.9	111.7	112.0	115.8	1.14	0.001	0.39	115.5	116.1	117.2	0.62	0.03	0.69
Post-weaning days to a common market weight	137	130	125	118	1.20	0.001	0.95	123	118	113	1.3	0.001	0.91
Wean-to-finish mortality, %	9.41	7.90	6.81	3.64	0.95	0.001	0.39	3.93	3.43	2.48	0.52	0.03	0.69
Cost per 100 kg sold, (US$)	82.61	81.55	80.74	79.02	0.38	0.001	0.38	80.11	79.53	78.67	0.17	0.001	0.48
Cost per head sold, (US$)	99.3	98.03	97.06	94.98	0.46	0.001	0.38	96.29	95.60	94.57	0.21	0.001	0.49
Revenue per pig weaned, (US$)	96.02	97.63	98.78	102.14	1.00	0.001	0.39	101.84	102.36	103.36	0.55	0.03	0.69
Costs per pig weaned, (US$)	89.86	90.16	90.35	91.45	0.54	0.04	0.54	92.47	92.28	92.20	0.38	0.49	0.87
Income over costs per pig weaned, (US$)	6.16	7.47	8.43	10.69	0.49	0.001	0.33	9.37	10.08	11.16	0.24	0.001	0.51

[1] Wean-to-finish cost and revenue data from two trials conducted evaluating effects of weaning age in a multi-site production system with non-limiting finishing space. A total of 2,272 and 3,456 pigs were used in a randomized complete block design with 24 and 40 replications per weaning age treatment in trials 1 and 2 respectively.

[2] Non-limiting finishing space is defined as having an unlimited number of finishing spaces available. Therefore, all age groups can be grown to an equal slaughter weight.

[3] Allottment weight is the average pig weight attained 3 days prior to weaning.

[4] Weight sold per pig weaned = off-test pen weight ÷ weaned pigs required to place finishing pen.

Table 7. Linear rates of change as wean age increases from 15 to 21.5 days at $88/100 kg ($40/cwt) live-weight market price[1]

Item	Rates of linear change per day increase in weaning age		Translating linear effects of weaning age to a change per unit increase in weaning weight	
	Change per day	SE	Change per kg at weaning	Change per lb at weaning
Allotment weight, kg [2]	0.256	0.004	1.00	0.454
42-day post-weaning weight, kg	0.89	0.02	3.48	1.58
Growth and economic performance, assuming limited grow-finish capacity [3]				
Off-test weight, kg	1.26	0.08	4.92	2.23
Weight sold per pig weaned, kg [4]	1.68	0.14	6.56	2.98
Cost per 100 kg, (US$)	-$0.41	$0.05	-$1.60	-$0.73
Income over costs per pig weaned, (US$)	$0.58	$0.06	$2.27	$1.03
Growth and economic performance, assuming non-limited grow-finish capacity [5]				
Post-weaning days to common market weight	-1.73	0.11	-6.76	-3.07
Weight sold per pig weaned, kg [4]	0.50	0.13	1.95	0.89
Cost per 100 kg at common market weight, (US$)	-$0.31	$0.04	-1.21	-0.55
Income over costs per pig weaned, (US$)	$0.39	$0.06	$1.52	$0.69
Cost per head sold at a common market weight, ($US)	-$0.37	$0.05	-$1.45	-$0.66

[1] Modeling the rate of linear change (slopes) in wean-to-finish throughput and financial performance observed as wean age increased from 15 to 21.5 days in a multi-site production system.

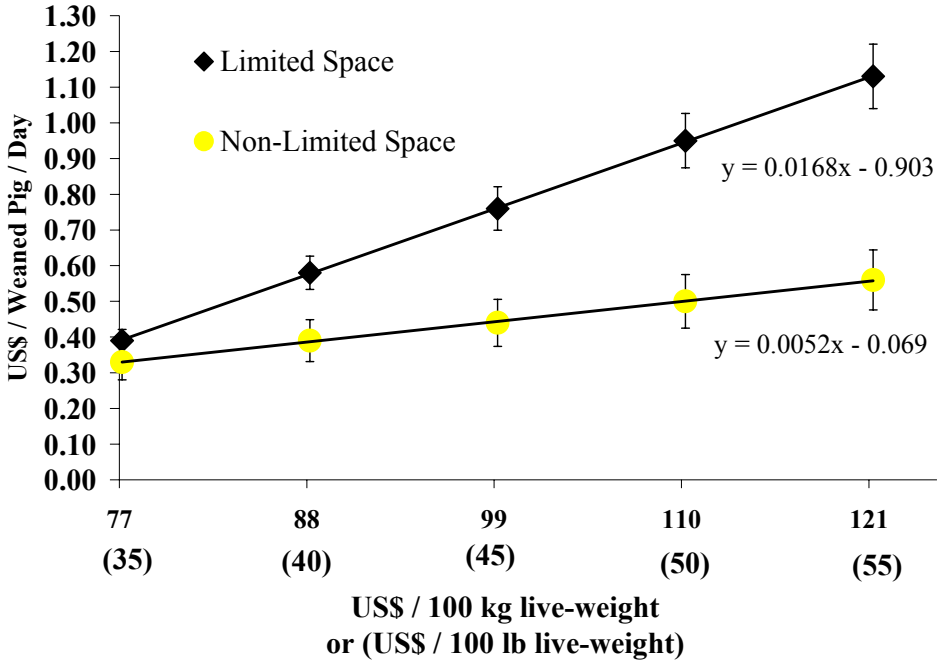
[2] Allotment weights were taken on all pigs 3 days prior to weaning.

[3] Limited finishing space is defined as having a fixed number of finishing spaces available. Therefore, analysis assumes all age groups have to be sold on a fixed number of days post-weaning, or off-test weigh day in this analysis.

[4] Weight sold per pig weaned = Off-test pen weight ÷ wean pigs required to place finishing pen.

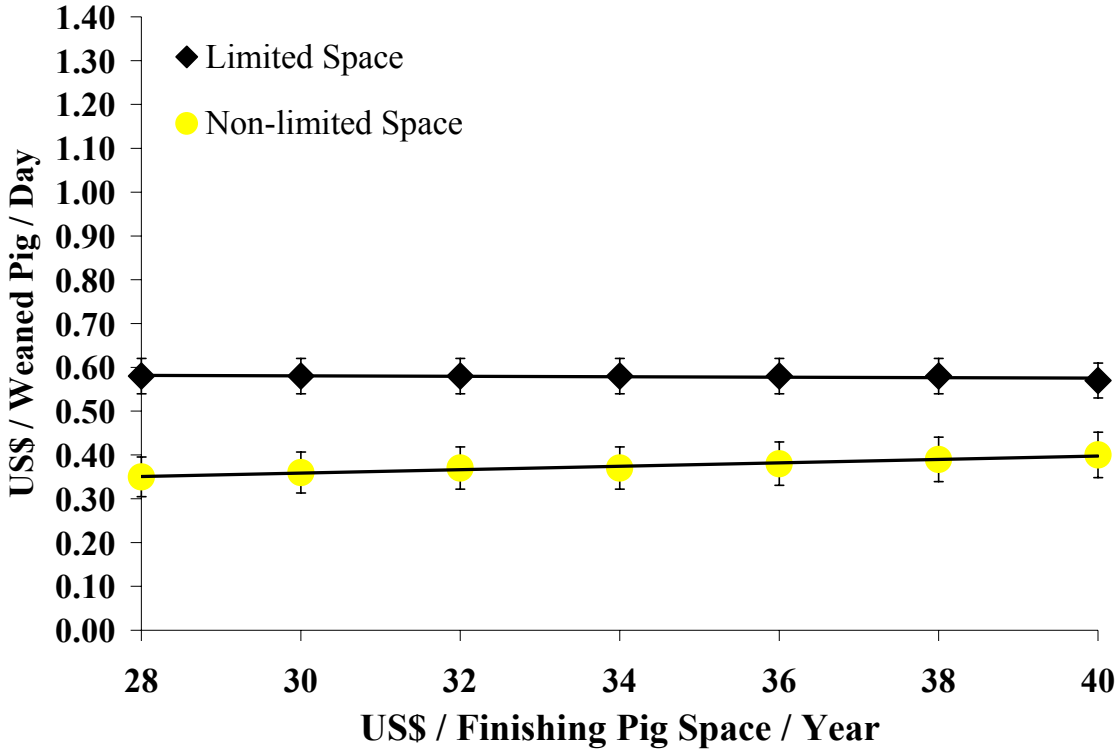
[5] Non-limiting finishing space is defined as having an unlimited number of finishing spaces available. Therefore, all age groups can be grown to an equal weight.

Figure 1. Effects of slaughter price on wean-to-finish margin / pig weaned / day increase in weaning age (15 to 21.5 days of age) were modeled over a wide range of market prices for both limited and non-limited finishing space scenarios.[1,2,3]



[1] Limited finishing space meaning a fixed amount of finishing spaces are available and all age groups have to be sold on a fixed number of days post-weaning, or off-test weigh day in this analysis.
[2] Non-limited finishing space means an unlimited amount of finishing spaces are available, and all age groups can be marketed at an equal average weight.
[3] Trend lines and associated standard errors are illustrated for reference. The regression equations shown describe how the improvement in margin / wean pig / day increasing in weaning age is affected by increasing live-weight market price by $1.00/100 kg.

Figure 2. Effects of finishing space costs on wean-to-finish margin / pig weaned / day increase in weaning age (15 to 21.5 days of age) were modeled over a wide range of finishing space costs for both limited and non-limited finishing space scenarios.[1,2,3]



[1] Limited finishing space meaning a fixed amount of finishing spaces are available and all age groups have to be sold on a fixed number of days post-weaning, or off-test weigh day in this analysis.
[2] Non-limited finishing space means an unlimited amount of finishing spaces are available, and all age groups can be marketed at an equal average weight.
[3] Trend lines and associated standard errors are illustrated for reference.