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WEAN TO FINISH GUIDELINES

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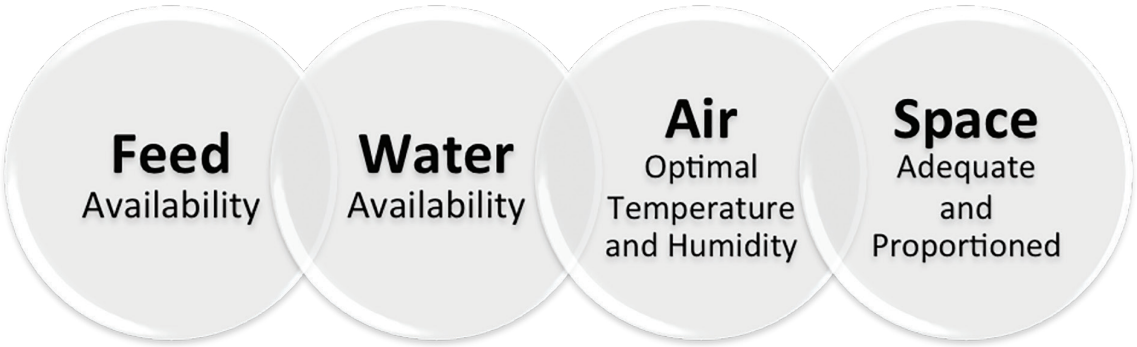
Welcome to the 2019 Edition of the PIC Wean to Finish Guidelines



We are pleased to present the 2019 PIC Wean to Finish Guidelines. The 2019 edition is an update to the 2014 edition and includes the latest available knowledge and technology.

The goal of this manual is to share practical recommendations in an easy-to-digest format. We have structured this manual into seven main sections. Each section contains information about expectations or targets, best management practices and detailed information on critical areas of importance. These guidelines focus on production management. Biosecurity and health protocols are also strategically important drivers of success; however, we have chosen to leave out these components. We suggest you reach out to your herd veterinarian or the PIC Health Assurance team to help develop a tailored program based on your circumstances.

This manual is meant to be broadly applicable across the global industry. The intent is to provide useful information regardless of your geographical location, operation size, facilities or technical equipment. We recognize that there are different ways to achieve the same results, so these guidelines do not reject other management strategies. At all times, please follow the best practices and appropriate standards with respect to animal health and welfare as outlined by the local governing body within your country of operation.

We hope these guidelines help you further improve the performance of your operations. In case you have questions please reach out to your PIC account manager or technical services contact at any time.

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Section 1:

PIC Performance Targets

Performance targets for PIC Full Program Genetics are outlined in table 1.1. Optimized Performance reflects optimized health and environment. Expected Performance demonstrates today's system averages and should be repeatable. Intervention Levels represent thresholds where detailed troubleshooting and specific action planning should be considered.

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Table 1.1: Performance Targets (PIC Full Program)

NURSERY = 12-63 LBS (5.5-28.6 KG) GROW-FINISH = 63-277 LBS (27.2-126 KG)	TARGET	AVERAGE PERFORMANCE	INTERVENTION LEVEL
Average Daily Gain			
Nursery, lbs/day (kg/day)	1.07 (0.487)	1.04 (0.473)	0.84 (0.383)
Grow-Finish, lbs/day (kg/day)	2.10 (0.955)	2.04 (0.927)	1.84 (0.835)
Wean-to-Finish, lbs/day (kg/day)	1.77 (0.805)	1.72 (0.782)	1.55 (0.704)
Feed Conversion (lbs:lbs or kg:kg)			
Nursery	1.31	1.46	1.66
Grow-Finish	2.33	2.59	2.80
1,560 Kcal ME Diet	2.25	2.50	2.70
1,470 Kcal ME Diet	2.42	2.69	2.91
Wean-to-Finish	2.13	2.37	2.56
Energy Conversion (1,516 Kcal/lb)			
Nursery	1,982	2,202	2,356
Grow-Finish	3,539	3,932	4,207
Wean-to-Finish	3,239	3,599	3,851
Losses			
Nursery Mortality %	1.5%	2.0%	3.0%
Grow-Finish Mortality %	2.0%	2.5%	4.0%
Wean-to-Finish	3.5%	4.5%	7.0%
Cull Rate	0.5%	1.0%	2.0%
Defects, % of all Pigs			
Scrotal Hernias	0.50%	1.00%	1.50%
Rigs (retained testicle)	0.13%	0.25%	0.50%
Umbilical Hernias	0.40%	0.80%	1.50%
Transport Loss, %			
DOA's (Dead on arrival)	0.06%	0.13%	0.20%
NAI/NANI's (Injured/Fatigued)	0.08%	0.15%	0.25%

Section 2:

Feed

Feed costs represent 60-65% of the total cost of raising a weaned pig up to market weight. Factors to reduce feed waste and improving the efficiency of the process include:

- Feeders:
  - Feeder type
  - Feeder space
  - Pan coverage or feeder adjustment
  - Feeder capacity
- Feed form[a]
- Particle size[a]
- Feed quality[a]

[a]For information on these factors please refer to the PIC Nutrient Specification Manual at https://www.pic.com/resources.

Feeder Type

Although feeders, by design, aim to minimize waste while serving feed to the pig, there are several adjustments that can be made to optimize the process and your return on investment. Table 2.1 shows feeder recommendations for nursery and grow-finish pigs.

Table 2.1: Feeder Recommendations for Growing Pigs

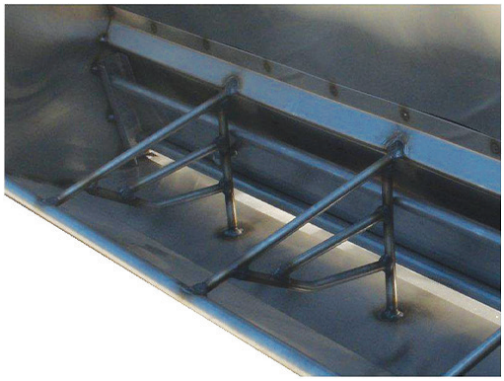
INDICATORS		NURSERY 0-60 LBS (0-27 KG)	GROW-FINISH 60 LBS (27 KG)-MARKET
Feeder Space Width	Feeder Space Width per Head	----	≥15 inches (38 cm)
Dry Feeders	Linear Feeder Space Per Head	1.0 inch (2.5 cm)	1.88 – 2.0 inches (4.7-5.0 cm)
	# Pigs Per 15-inch (38 cm) Feeder Hole	15	8
Wet/Dry Feeders	Linear Feeder Space Per Head	1.0 inch (2.5 cm)	1.15-1.25 inches (2.9-3.1 cm)
	# Pigs Per Individual Feeder Space	----	12-13
Pan Coverage[a]	During Feed Intake Training Period	Day 0-3 =50-70%	45-50% (1-2 days)[b]
	After Training	Day > 3 = 40 - 50%	35 - 50%
Feeder - Feed Capacity Per Pig	1 day of feed per head	2.5 lbs (1.1 Kg)	7.0 lbs (3.2 Kg)

[a] Pan coverage can vary based on objectives for ADG and FCR.

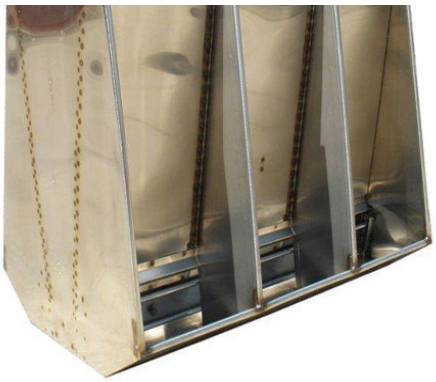
[b] In case pigs are moved from nursery sites to finishing site or feeder type is changed.

Feeders come in various shapes and sizes. The recommendations shown above consider several different feeder types. Some examples of common feeder types are shown here.

Picture 2.1: Low Profile Feeder Hole Dividers



Picture 2.2: Feeders With Sight Guards



Picture 2.3: Wet-Dry Feeder

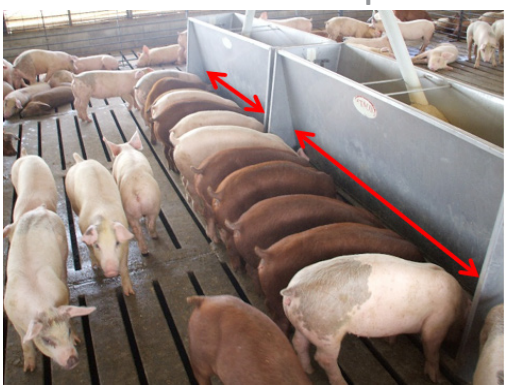
Feeder Space

Feeder space width is defined as "The width measured in linear inches (or cm) of each single feeder space or trough space at the feeder." Each feeder space is generally separated by a partition from the next feeder space. A single-feeder space should be at least 15 inches (38 cm) wide (Tables 2.1 and 2.2) and allows one finisher to eat comfortably (Picture 2.4).

Linear feeder space per pig is defined as "the linear inches (or cm) of feeder available per pig within a pen" (Total Feeder Length per Pen/ Total Pigs per Pen, Picture 2.5 and Table 2.1). Recommendations of linear feeder space are related to the stocking density of the pen. Linear feeder space can have an impact ADG and FCR.

Picture 2.4: Feeder Space width

Picture 2.5: Linear Feeder Space



What drives these feeder space recommendations?

- Allow appropriate feeder space width to allow multiple animals to eat at the same time in a feeder with multiple feeder spaces. Pig shoulder width is used as reference for feeder space width A reference for different production stages can be found in table 2.2 (Brumm, 2012).
- The general guideline of 1.88 – 2.00 inches (4.70 - 5 cm)/pig (dry) and 1.15 – 1.25 inches (2.9-3.1 cm)/pig (wet-dry) allows the feeder to be appropriately adjusted to minimize the feed waste without decreasing the pigs' average daily feed intake.

Table 2.2: Estimated Pig Shoulder Width and Required Feeder Space Width for Different Pig Weights (adapted from Brumm, 2012)

Pig Weight (lbs)	Shoulder Width (inch)	Feeder Space Width (inch)	Pig Weight (kg)	Shoulder Width (cm)	Feeder Space Width (cm)
44	6.8	7.5	20	18	19
88	8.5	9.4	40	22	24
132	9.7	10.7	60	25	27
176	10.7	11.8	80	28	30
220	11.5	12.7	100	30	32
275	12.4	13.6	125	32	35
300	12.8	14.0	135	33	36
320	13.3	15.0	145	34	38

Practical Considerations

1. Consider future market weight goals when making feeder investments.
2. Linear feeder space has large impact when stocking density is challenged.
3. Linear feeder space and stocking density must be evaluated side-by-side.
4. Feeder adjustment of wet-dry feeders could create difficulties with less than 10-11 pigs/ feeder space width.

Feeder Adjustment and Pan Coverage

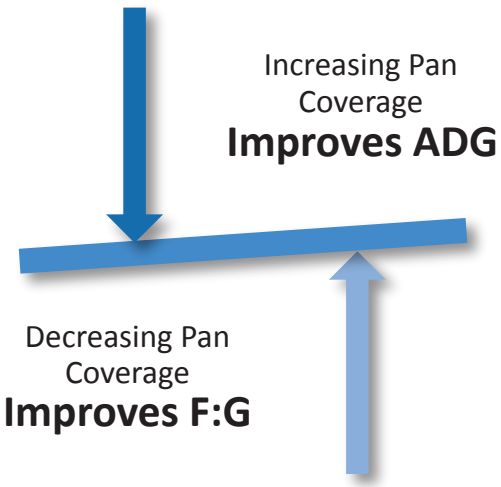
The best way to evaluate feeder adjustment is by checking pan coverage. Pan coverage refers to the percentage of the feed pan's flat portion that is covered by feed. Each speck, dusting or mound of feed counts in the pan coverage percentage.

Ideal feeder adjustment settings depend on several factors such as:

- Market Condition (Feed Cost and Market Pig Price)
- Market Pig Weight
- Stocking Density
- Feeder Space
- Feeder Type
- Energy in Diets
- Temperature
- Feed Intake Behavior
- Feed Training Period

Pan coverage guidelines reflect several considerations:

- Optimal pan coverage with appropriate linear feeder space ensures both feed access and minimal waste.
- Appropriate linear feeder space minimizes the creation of fines or destroyed pellets when giving pelleted feeds.
- Appropriate pan coverage minimizes plugging of feeders, which could cause feed outage events within a pen or feeder.
- Feeder settings are designed to achieve optimal pan coverage and are determined largely by feed form or particle size. Evaluate and manage feed pan coverage daily to maintain constant pan coverage and optimized performance.
- Pan coverage's impact on feed efficiency and average daily gain are inverse and should be considered for each operation.



Practical considerations for feeder adjustment and pan coverage:

1. If pigs are not eating their daily caloric requirements to achieve optimal growth due to temperature, diet design, or compromised pen or linear feeder space, consider the following adjustments:
   - Increase pan coverage to achieve appropriate feed intake. Negative side effects may include:
     - Deteriorated pellet quality and increased amount of fines, leading to sorting and associated consequences.
     - Compromised feed conversion independent of feed form.
   - Install short-term supplemental feeders to provide additional linear feeder space.
2. Wet-dry feeders and dry feeders don't follow the same considerations. For instance a wet-dry feeder can be fully filled with feed but if there is no water available adjustment is needed.
3. Feeder adjustment should follow the rule "Every Day, Every Pen, Every Feeder." If in good adjustment, expect to adjust only 10% of feeders per day.
4. Feeder adjustment must be done based on pan coverage and not on feeder setting.

Feeder Capacity

Feeder capacity can be one of the largest limiting factors compromising feed availability.
Feeder capacity recommendations are made with the following considerations in mind:

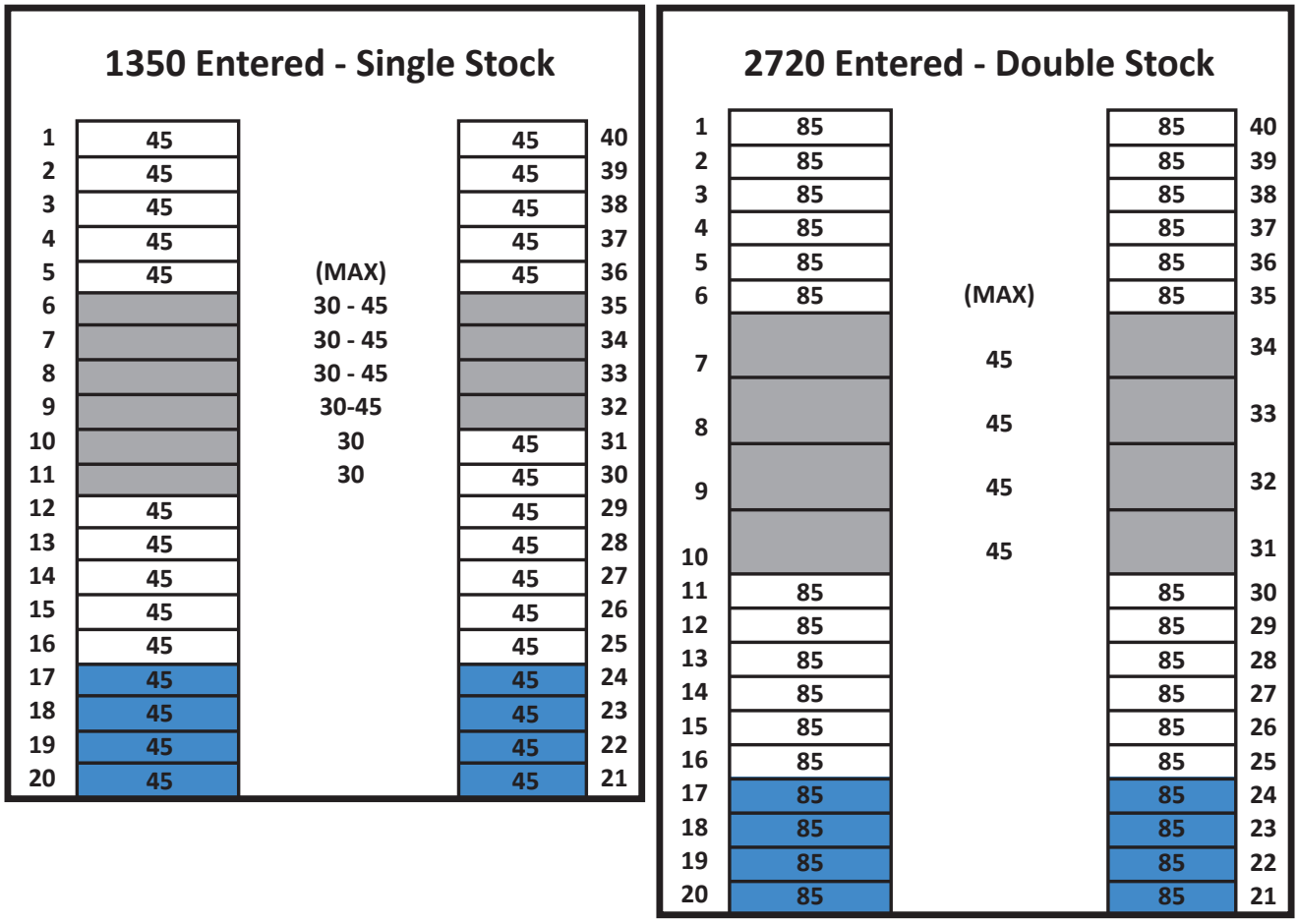
- 24 hour/day feed availability to allow ad-libitum intake on non-liquid feeding systems.
- Detect feed system maintenance issues timely without compromising feed availability.
- Be able to transition between diets and feed-form changes without blending.
- Improve feed flow by removing large volumes of feed from outside bins during each filling cycle
- Feed pigs during peak intake hours, which vary seasonally.
- Minimize out-of-feed events to minimize or eliminate hemorrhagic bowel syndrome, twisted gut, ulcers and tail-biting.
- Promote a predictable feed ordering pattern as well as minimized variable daily feed intake.

Practical Considerations for Feeder Capacity

- Allot 7 lbs (3.2 kg) feeder capacity to each pig during the finishing phase (or one day of feed intake per pig):
- With 60 pigs/pen: This means a 60 inch (152 cm) double-sided feeder. 60 head; 2 inches (5 cm) of bunk space per pig (7x60=420 lbs, 3.2x60 =192 kgs of feed).
  - If feeders are short on capacity and are not rated for a 7 lbs (3.2 kg) feeder capacity:
    - Consider installing multiple tubes — 2-3 per feeder to optimize the manufactured capacity by distributing feed across the entire width of the feeder.
    - Consider installing feeder extensions to appropriately size the feeder to recommended capacity.
    - Consider installing surge hoppers within barns to assure that at minimum the feed is out of the bin and inside the barn for on-demand delivery.

- Optimize management:
  - Service mechanical components of the feed system routinely.
  - Avoid feed spoilage and diet blending. Use the oldest feed first by rotating tandem bins appropriately.
  - Keep bins in proper repair to avoid the presence of moisture and pests.
  - Utilize auger controllers appropriately.
  - Use delay and auger run-time controls to minimize the number of times the auger fills per day, while maximizing the auger run time to assure proper fill.
  - Keep the last 2 feeders of each auger, as indicated in blue in Picture 2.6, fully stocked until marketing to assure proper feeding of the site.

Picture 2.6: Stocking Plan, Keep Blue Pens Fully Stocked.



Section 3:

Water

Water is the most critical nutrient to sustain life. It is the largest single component of body composition and represents between 50-80% of body content depending on age.

Generally, pigs will consume 2 to 3 lbs. of water for every pound of feed eaten per day or 0.9 – 1.4 kg of water for every kg of feed eaten per day. Feed intake and subsequent growth performance will be reduced if the pig does not ingest an adequate amount of water. Therefore, detailed water management is very important to achieve targeted levels of performance. The three main points of water management include water availability, water quality and water temperature.

Water Availability

Table 3.1: Water Availability Guidelines for Maintaining Optimal Pig Health and Growth

	NURSERY 0-60 LBS (0-23 KG)	GROW-FINISH 60 LBS- MARKET (23 KG- MARKET)
Pigs Per Water Source	10	10-12
Water Flow Rate (L/minute)	0.5	1.0
Water Pressure	<20 PSI	15-40 PSI

Table 3.2: Drinker Height Guidelines

	NIPPLE Angle 90°	NIPPLE Angle 60°	BOWL
Drinker Height a) Based on smallest pig in pen b) Nipples: Traditional or Swing	Equal to shoulder level	2-3 inches above shoulder level	Bowl lip height should be 40% of the pig height

Table 3.3: Water Intake Reference
(Adapted from Brumm et al., 2000)

Pig weight	Water:Feed		Pig Weight	Water:Feed		Pig Weight	Water:Feed	
	Swing	Bowl		Nipple	Swing		Dry	Wet-Dry
37-57 lbs. (17-26 kg)	3.26	2.11	40-68 lbs. (18-31 kg)	3.34	2.89	42-55 lbs. (19-25 kg)	3.36	2.11
57-81 lbs. (26-37 kg)	2.75	2.02	68-103 lbs. (31-47 kg)	2.73	2.42	55-75 lbs. (25-34 kg)	3.45	2.16
81-114 lbs. (37-52 kg)	2.33	2.02	103-125 lbs. (47-57 kg)	2.64	2.31	75-97 lbs. (34-44 kg)	2.93	2.34
114-167 lbs. (52-76 kg)	1.90	2.30	125-147 lbs. (57-67 kg)	2.67	2.44	97-136 lbs. (44-62 kg)	2.71	1.73
167-198 lbs. (76-90 kg)	2.45	1.76	147-174 lbs. (67-79 kg)	2.35	2.04	136-176 lbs. (62-80 kg)	2.61	1.62
198-224 lbs. (90-102 kg)	2.11	1.77	174-198 lbs. (79-90 kg)	2.57	2.29	176-216 lbs. (80-98 kg)	2.58	1.50
			198-209 lbs. (90-95 kg)	2.27	2.05			

Water Quality

- Water quality is variable based on geographic region, source and ph.
- Always consider water quality when encountering problems with feed intake, diarrhea or unexplained challenged performance.
- Water temperature is 60-65°F (16-18°C)
- For information on water quality factors, please refer to PIC Nutrient Specification Manual at https://www.pic.com/resources.

Practical Considerations

- During overstocking, pens in wean-to-finish barns will not provide adequate water availability (10-12 pigs/water source):
  - Use extra swinging nipples, gate mounted nipples or water bars (several nipples on a pipe) during overstocking.
- Early hydration of weaned pigs is critical to early success as the transition from the sow can cause dehydration due to an unfamiliar environment:
  - Consider trickling water out of nipples or cups to entice pigs to take water early.
  - Add extra water troughs or bowls during the first 24 hours to entice pigs to take water early.
- Monitor water flow rates using a 4-ounce cup (125 mL) timed to 8 seconds to get ideal water flow rates within finishing or wean-to-finish barns. Audit water flow rate in 5-10% of the drinkers weekly during the growing period.
- Assure that 100% of nipples or bowls are flowing properly between groups. Review drinkers routinely.
- Daily monitor the water meter of a barn as changes in daily water intake can indicate changes in health status or water waste.
- Monitor water pressure during early nursery stages closely. Target is 500mL/min, too high pressure (>1 L/min) could reduce water intake.

Section 4:

Environment

The management of environmental conditions within the barn is critical to optimize performance. Ideal temperature and humidity encourages feed intake, avoids excessive burning of calories to maintain body temperature and can minimize the growth of disease.

Major environmental conditions include:

- Barn temperature
- Moisture level (humidity)
- Barn temperature uniformity
- Air speed across animals
- Airborne dust and disease organism levels
- Odor and gas concentrations
- Combustion fumes from unvented heaters
- Moisture and condensation on surfaces
- Air exchange rate

Heat & Humidity Removal

The removal of heat and humidity are essential to maintain optimal barn conditions. Keep humidity below 65% at all times. Recommended barn temperatures and minimum air exchange rates for the growing pig are shown in Table 4.1 (please note with the use of brooders, the room's desired temperature can be decreased). Further recommendations are available in Appendix A of this manual.

Note: CFM is defined as Cubic Feet of Air Exchanged Per Minute. Recommended CFM is a calculated estimation of the required air exchange to maintain humidity and temperature.

Table 4.1: Recommended Barn Temperatures and Minimum Air Exchange Rates per Days on Feed (Dry Slat, Solid Sided Barn, Fully Stocked With Pigs)

Days Weaned	Average Barn Weight lbs. (kg)	Desired Room Temp. °F(°C)	Winter Setpoint °F(°C)	Summer Setpoint °F(°C)
1 without brooder or mats	12(5.4)	85(29.4)	87(30.6)	85(29.4)
1 with brooder and mats	12(5.4)	74(23.3)	76(24.4)	74(23.3)
14 without brooder or mats	18(8.2)	81(27.2)	82(27.8)	81(27.2)
14 with brooder and mats	18(8.2)	70(21.1)	71(21.7)	70(21.1)
30*	32(14.5)	75(23.9)	73(22.8)	73(22.8)
44	53(24)	70(21.1)	70(21.1)	68(20.0)
58	75(34)	67(19.4)	66(18.9)	64(17.8)
72	102(46)	64(17.8)	63(17.2)	61(16.1)
86	129(58)	62(16.7)	61(16.1)	59(15.0)
100	158(72)	61(16.1)	60(15.6)	59(15.0)
114	188(85)	59(15.0)	59(15.0)	58(14.4)
128	217(98)	58(14.4)	58(14.4)	57(13.9)
142	245(111)	58(14.4)	58(14.4)	57(13.9)
156	274(124)	58(14.4)	58(14.4)	57(13.9)
170	299(135)	58(14.4)	58(14.4)	57(13.9)
184	324(147)	58(14.4)	58(14.4)	57(13.9

(*) brooders and mat have been removed, DRT should be adjusted according to pig weight.

Practical Considerations

- As the pig grows, it produces more heat:
  - For each 60-80 lbs (27-36 kg) of growth a pig produces an additional 200 btu/hr. (Brown-Brandl et al. 2004 - Figure 4.1)
- To maintain desired room temperatures, CFM needs to increase to properly exhaust the excess heat and replace with cooler, dryer air.

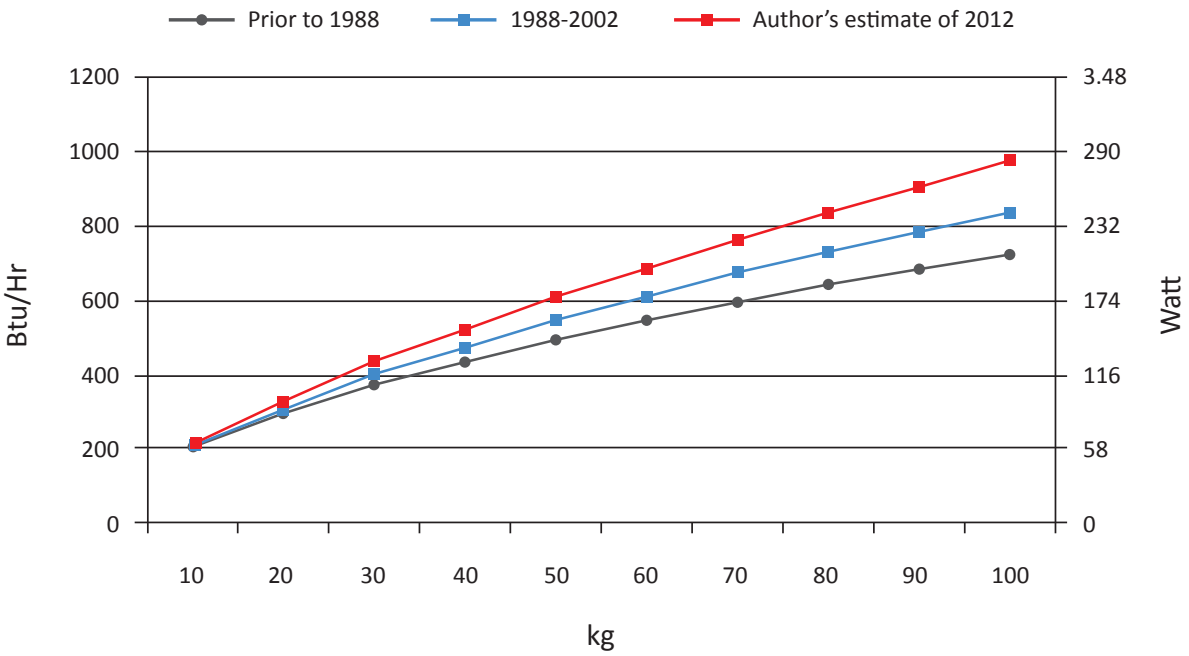


Figure 4.1: Estimated Total Heat Production for Growing Pigs per kg of Body Weight, Sensible Plus Latent Heat (adapted from: Brown-Brandl, et al Transactions of the ASAE 47(1):259-270)

Relative Humidity

Relative humidity is the amount of water vapor present in air expressed as a percentage of the amount needed for saturation at the same temperature. As temperature rises, the water holding capacity of air increases. Figure 4.2 shows the water holding capacity for different air temperatures.

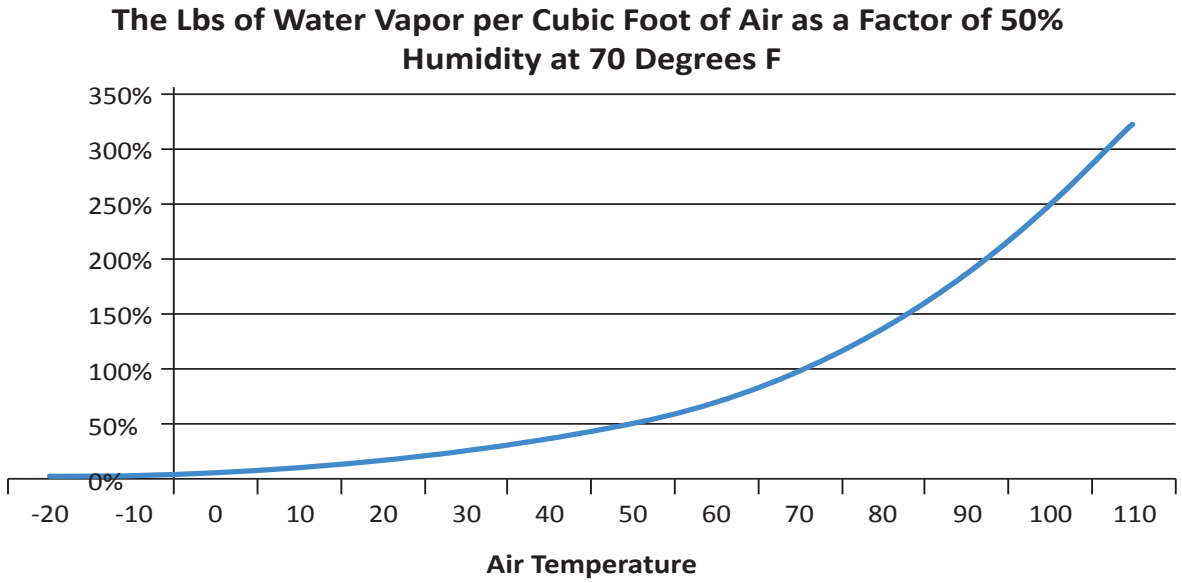


Figure 4.2. Water Holding Capacity per Degree of Air Temperature

Humidity and Temperature

Pig performance is impacted by the interaction between humidity and temperature. Feed intake will be more affected with high temperatures and high relative humidity versus high temperatures with lower humidity. Figures 4.3 and 4.4 demonstrate the impact of ADG and FCR when temperature exceeds 79°F (26°C).

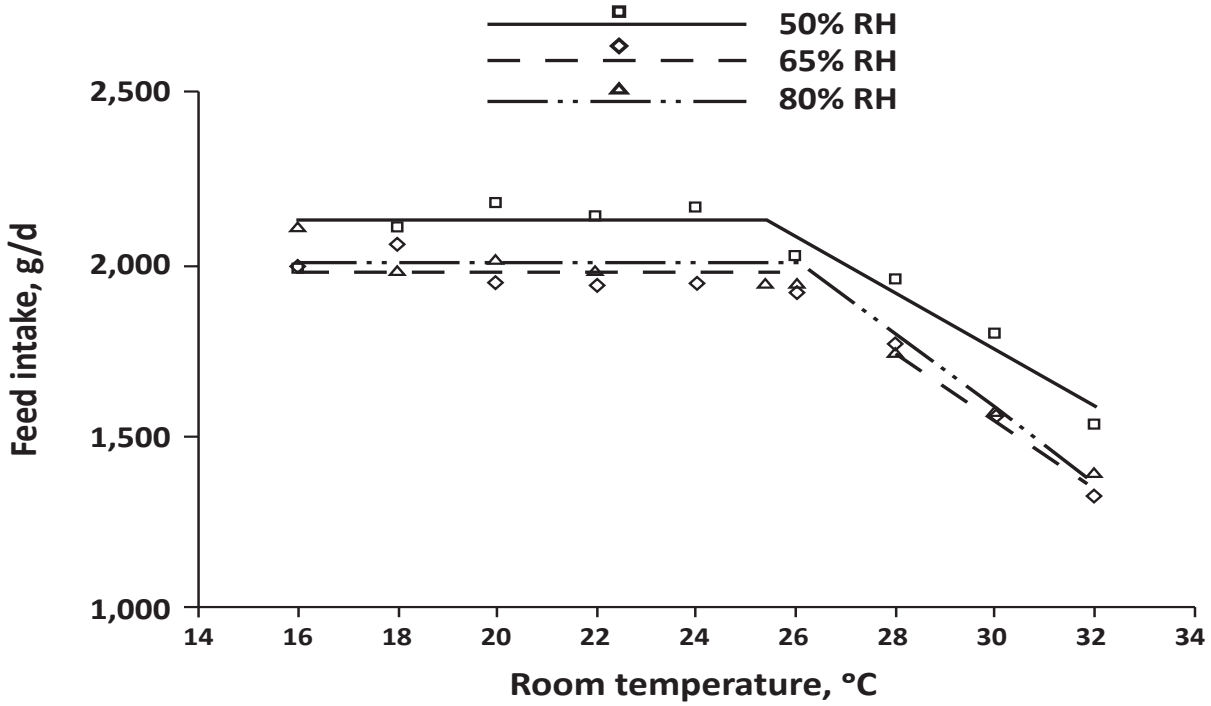


Figure 4.3 Humidity Impact on Feed Intake at Different Room Temperatures
(source: Huynh et al., 2005)

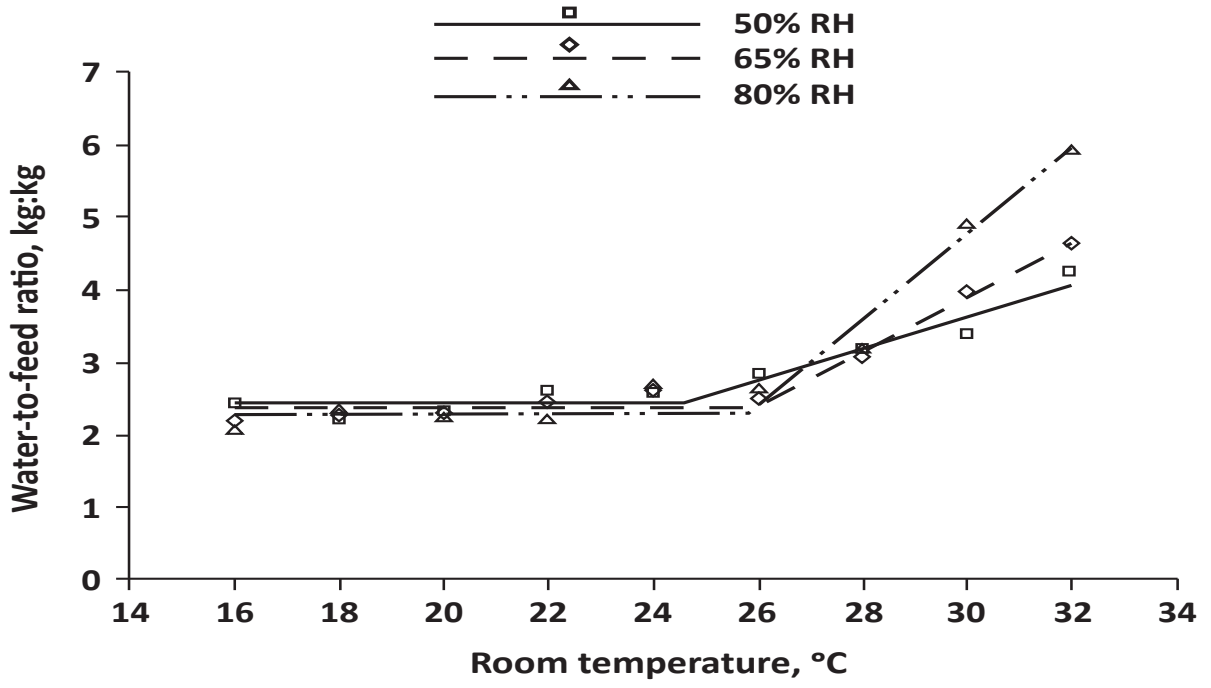


Figure 4.4 Humidity Impact on Water to Feed Ratio at Different Room Temperatures
(source: Huynh et al., 2005)

Practical Consideration

When humidity levels are greater than 65% and outside temperatures are below the set point, ventilation rates need to be increased to decrease humidity within the barn. When outside temperature exceeds desired room temperature, increasing ventilation rates will not decrease humidity within the barn.

Air Speed

Maintain enough air speed to mix cooler air sourced from inlets. This will eliminate drafts and areas of condensation on the slats.

- Air speed is measured in feet per minute (FPM).
- Optimal air speed at inlet is 800 FPM for elevated fan stages; while 400 FPM is much more practical in minimum ventilation stages.
- Evaluate air speed coming from inlets routinely to ensure proper mixing of air within the facility.
- Maximum Ventilation Reference:
  - In tunnel-ventilated barns a standard air exchange is 35-40 seconds with a standard velocity of 300-400 FPM (measure in tunnel).
  - Controlled ventilated barns without tunnel could consider a standard of 120-150 CFM per finishing pig (depending on pig weight and weather).

Heating

In regions with periods of cold weather, facilities should be designed with the addition of supplemental heaters to assure the control of lower critical temperatures. This is particularly important with:

- Young pigs.
- Barns with inadequate insulation.
- Low outside winter temperatures.
- Decreased stocking rates (during filling and marketing periods).

General recommendations for heaters are:

- Three 250,000 Btu Heaters/1200 wean-to-finish spaces.
- Two 250,000 Btu Heaters/1200 grow-to-finish spaces.
- One 17,000 Btu Brooder/120-160 Hd (2 wean–to-finish pens).

Avoid excess use of heaters (heater overshoot):

- Heaters set too close to set point will result in excessive liquid propane or natural gas usage.
  - A minimum of 2-degree Fahrenheit spacing of heater offset below the set point is recommended.
    - Example: If the set point is 70°F (21°C), then heaters turn on at 67°F (19°C) and off at 68°F (20°C).

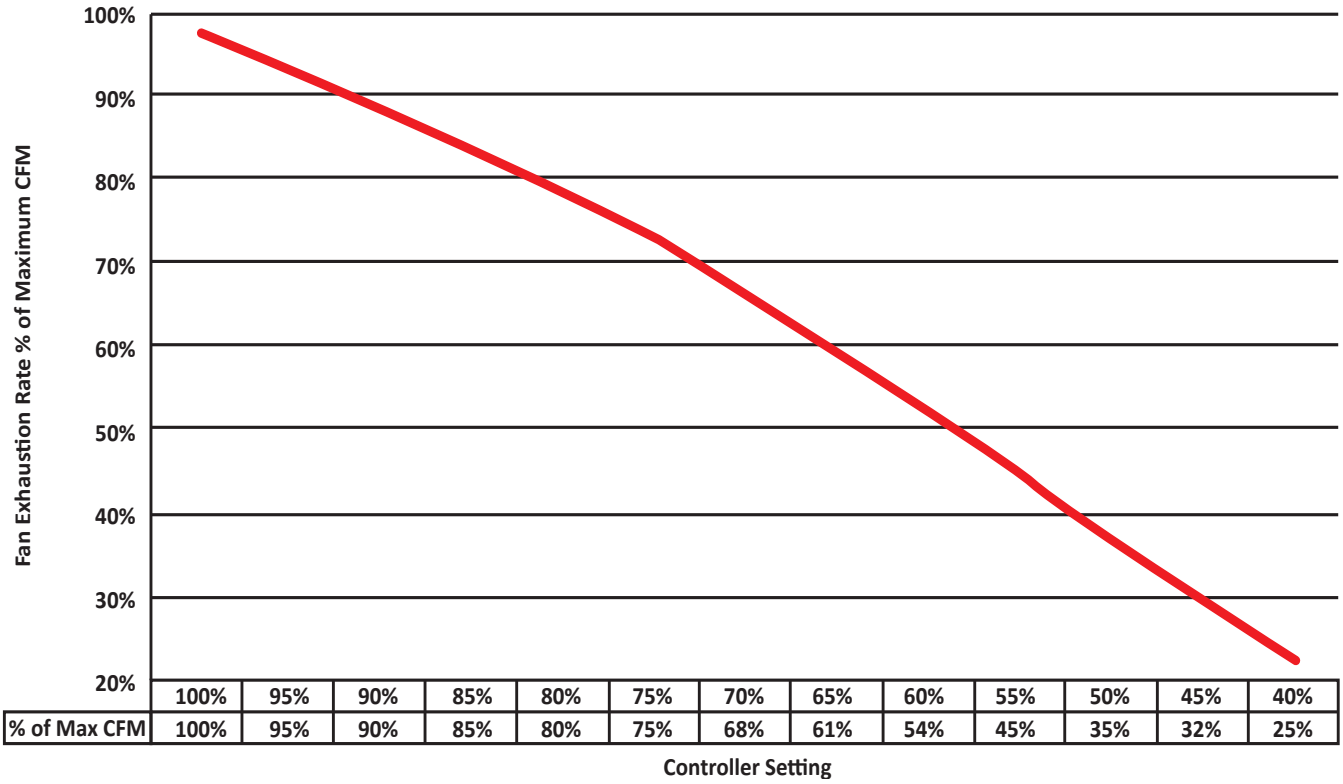
Brooder & Mat Use:

- By using mats and brooders, producers can decrease room temperatures without compromising piglet comfort.
- Ideal mat temperature = 95°F (35°C) for 7-21 days on feed, directly beneath the brooder.
- Weaned pigs require 0.4 ft² (0.04 m²) of mat space per pig to maximize comfort and eliminate drafting.

Fan Stages

Variable speed fans are used during minimum ventilation and early fan stages. Important considerations for fan use are:

- 50% fan speed setting does not equal 50% CFM (fan output) (Figure 4.5).
- Motor curve is defined as the relationship between the voltage supplied to the motor and the resulting RPM.
- When motor curve and fan size are incorrectly matched, one of two things can happen:
  - The fan may burn up.
  - A 60% fan speed setting may result in 90% fan speed.
- Fan staging is designed to progressively remove more heat and humidity as the barn warms. Increased air exchange rates are typically required as the following occurs:
  - Rise in outside temperature throughout the day.
  - Increased heat production and decreased optimal temperature throughout the pigs' growth.
  - Increasing heat production due to activity from resting state (evening) to elevated activity (day).
  - Rising outside temperatures from winter (cold) to summer (hot) months.
- Consider fan sizes and their CFM exhaust rates when staging fans.
- When outside temperatures are below typical desired room temperatures (DRT):
  - Increase CFM moderately across stages.
  - Avoid exceeding the doubling of CFM across early stages (minimum-first stage).
- When outside temperatures exceed set-point as daily highs:
  - Address heat removal across stages aggressively.
  - Table 4.2 describes the rated CFM for variable fan sizes.



	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%
% of Max CFM	100%	95%	90%	85%	80%	75%	68%	61%	54%	45%	35%	32%	25%

Figure 4.5: Variable Fan Performance

Table 4.2: Rated CFM for Variable Fan Sizes (Reference in ~0.1 of Static Pressure)

FAN SIZE INCHES (CM)	CFM OUTPUT	CFM OUTPUT WITH CONE
8 (20.3)	450	500
10 (25.4)	1,100	1,200
12 (30.5)	1,500	1,600
18 (45.7)	3,500	3,600
24 (61.0)	5,700	6,000
36 (91.4)	9,700	10,000
48 (121.9)	17,000	18,000
50 (127.0)	22,000	23,000
55 (139.7)	23,000	24,000

A practical example for staging fans and the facility requirement to support effective cooling is shown in table 4.3.

Table 4.3: Staging Fans & Requirements for Effective Cooling (Example)

FAN SIZE INCHES (CM)	24 (61)	36 (91)	48 (122)	CFM TOTAL	CFM PER PIG	TOTAL IN² (M²) INLET	TOTAL IN² (M²) EAVE
CFM/Fan	6,000	10,000	18,000				
Stage 1	2			12,000	10	2,667 (1.72)	4,800 (3.10)
Stage 2	4			24,000	20	5,333 (3.44)	9,600 (6.19)
Stage 3	4	1		34,000	28	7,556 (4.87)	13,600 (8.77)
Stage 4	4		1	42,000	35	9,333 (6.02)	16,800 (10.84)
Stage 5	4	1	1	52,000	43	11,556 (7.46)	20,800 (13.42)
Double Wide				**104,000**		**23,111 (14.91)**	**41,600 (26.84)**

- 1 inch² (6.5 cm²) of ceiling inlet provides approximately 4.5 CFM.
- 1 inch² (6.5 cm²) of eave inlet provides the attic 2.5 CFM.
- Providing the optimal environment for pigs requires multiple aspects to operate in harmony. Critical items to measure are:
  - Available attic inlet area.
  - Room inlets area and air speed.
  - Fan staging (CFM) vs. room temperature.

Upon request PIC can provide customers with a ventilation diagnostic modeling program.

Water Use for Cooling

Using water can be an effective cooling method through evaporative heat loss. Sprinklers are recommended over misters/foggers as these have been found to be most effective (Figure 4.5).

General guidelines for water-cooling are:

- Pigs should be over 100 lbs (45 kg) in weight. Avoid use on nursery pigs, if needed evaluate on a case-by-case basis.
- Size and plumb nozzles to wet to a maximum of approximately 50-60% of the pen area.
- Apply water 18 (9°C) (curtain barn) to 20°F (10°C) (tunnel barn) above set point of 60-62°F (16-17°C) for pigs above 200 lbs (90 kg).
- Slats need to be nearly dry before the next application of water.
- Keep the ratio to 30 - 35 pigs per sprinkler or nozzle to avoid competition.
- Have at least one sprinkler or nozzle per pen.

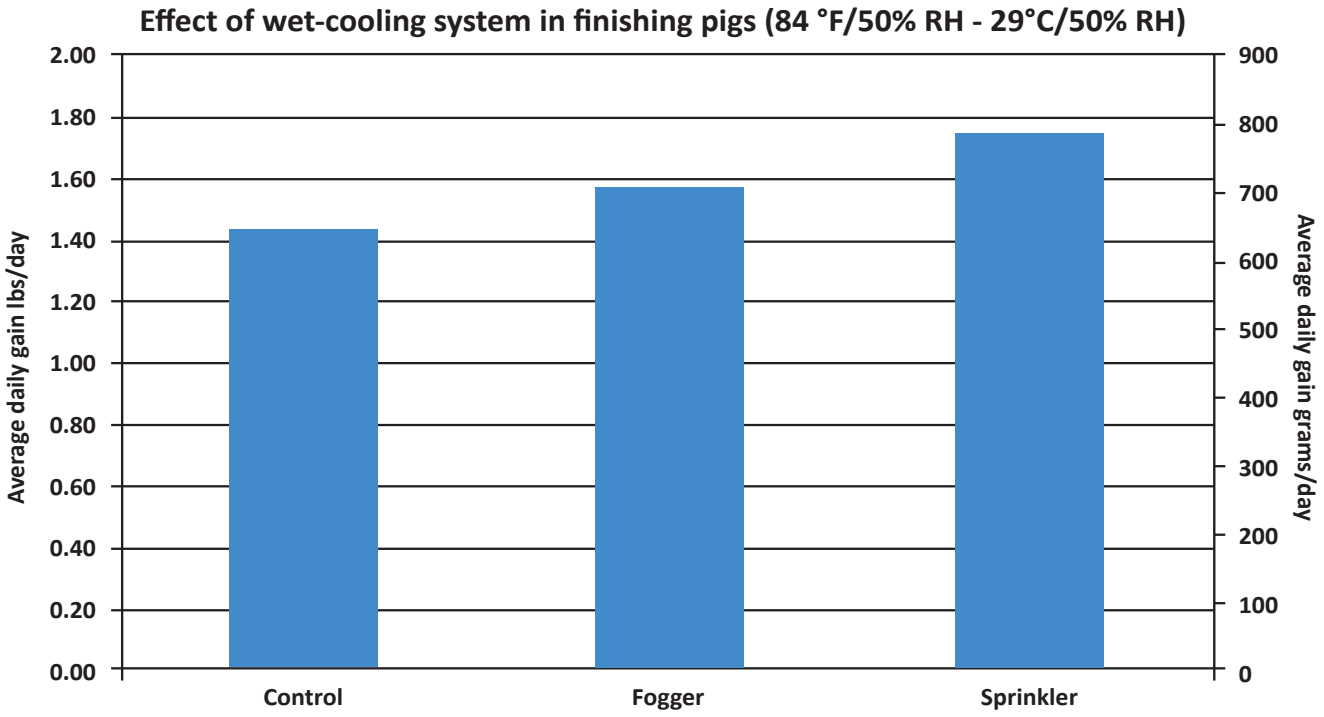


Figure 4.6: Impact of Wet-Cooling System
(adapted from: R. Myer and R. Bucklin, 2001)

Troubleshooting Fans

When evaluating fans and their exhaustive output, there are several factors to consider and troubleshoot:

- Dirty louvers and fan blades may decrease fan efficiency by as much as 30%.
- Leaking pit pump-out covers drastically affect the exhaustion of air from the barn.
- Adding fan cones improves the fan's output CFM by 10-20%.
- Excessive static pressure >1000 ft/min (5m/s) air speed or >0.1 inches (0.25 cm) of water severely reduces a fan's exhaustive CFM rating.
- Wet floors:
  - Wet floors can make pigs feel 9°F (5°C) cooler with the same air temperature. To solve this challenge, consider increasing the minimum ventilation rates, assure proper air speed from inlets and increase barn temperature until the wet floors are properly dried.
- Slipping fan belts decrease RPM and thus decrease exhaustive output. Detect this issue with the use of an infrared thermometer. If the pulley is 7°F (3-4°C) warmer than room temperature, the belt is slipping and this needs to be addressed.

Seasonal ventilation check lists and troubleshooting items can be found in appendix B and C.

Natural Ventilation

Natural ventilation depends on wind flow across a barn and on temperature differences between the inside and the outside of the barn. During correct operation conditions, natural ventilation can provide good quality air to pigs but airflow control (speed and direction) can be challenging. Natural ventilated barns depend on the weather and during calm days, the barn will be under ventilated and on windy days the barn could be over ventilated. Automatic curtains are strongly recommended in this kind of barn for reducing the weather impact, especially in places with large temperature swings.

1. Natural ventilation depends mainly on wind direction. Barn orientation depends on the prevailing wind direction.
2. The location of a barn where wind is deflected or blocked is undesired. Objects can block air movement for 3-4 times the obstacle's height (example; next barn height). Place barns on a high rather than low site and consider at least 100 ft (30 m) of distance between barn and windbreaks (prevailing winds).
3. Ventilation is better in barns without ceilings that have openings at the eaves and continuously across ridge (peak). A continuous ridge opening is needed for year-round ventilation control. The open ridge allows a chimney effect due to suction force created while wind blows across the ridge. The opening acts as an exhaust to allow warm, moist air to exit the building. This is extremely important for winter ventilation when there is no cross ventilation through the building. It also allows air movement through the barn on calm hot days when there is little or no cross ventilation due to wind.
4. Natural ventilation loses efficiency with barn widths greater than 35-37 ft (10-11 m), especially if the ridge is closed. Maximum width for natural ventilated barns is approximately 40-45 ft (12-14 m).
5. Curtain sided barns have less insulation than solid sided barns therefore the desired room temperatures need to be increased by at least 2-3°F (1-2°C).
6. Curtains should overlap the upper and side part of the wall by 6-15 inches (15-38 cm) to allow for a tight seal when the curtain is closed. Ideally, the barn will have additional curtain protection on the prevailing wind side to avoid chilling the pigs in exposed pens.
7. Natural ventilated barns need to have enough eaves to protect pigs from rain and direct sunlight.
8. Spring and fall have wide temperature swings, so the curtain opening should be adjusted several times per day. An automatic curtain system is a good measure to help manage the environment and to save energy.
9. Continuous temperature swings in naturally ventilated barns increase the chance of respiratory and scour problems.
10. Hybrid natural/tunnel ventilated barns are a good alternative as there is good wind speed, but utility costs will be greater. The hybrid system requires a higher level of management.

Winter considerations for natural ventilation:

- Winter is difficult, as the curtains need to be closed leaving a tiny opening to keep the temperature up and to remove humidity, but not allowing gasses to be trapped. There is no minimum ventilation in this type of barn, so air exchange should be checked several times per day.
- If humidity control is a challenge in winter, reduce water waste by using correct drinker type and drinker adjustment for accurate water flow.
- Double curtains may help to increase the barn insulation. The objective is to improve the air-exchange and keeping the temperature inside the building without chilling of the pigs. The second curtain is fixed to the wall, allowing free movement of primary curtain, and should not cover 100% of the primary curtain.

Summer considerations for natural ventilation:

- Under heat stress conditions, natural ventilation works by temperature differences and natural wind flow. The success in removing the excess temperature and humidity depends therefore on the weather conditions.
- The open ridge vent allows a chimney effect and helps to increase the heat losses by convection.
- Stir fans and sprinklers can reduce heat stress by increasing convection and evaporation. However, the effectiveness of water usage to reduce heat stress depends on outside humidity.

Table 4.4: Five Key Points for Natural Ventilated Barns

Key Point	Comments
Windbreaks	Avoid windbreaks in the prevailing wind direction. Keep air entries clean and free of objects.
Barn Insulation	Good maintenance of the building is critical especially before winter and summer time. Consider higher desired room temperature than in solid sided barns.
Barn Eaves	Good condition of eaves provides sunlight and rain protection for the pigs.
Training People	Train staff regularly on ventilation and have tools available for environmental control (thermometers, air speed meters, temperatures curves, etc).
Technology	Automatic curtains are recommended. Stir fans and sprinklers can help in heat stress conditions*.

**Review the costs of fully equipped natural ventilated barns vs tunnel ventilated barns.*

Gas levels

Minimum ventilation is not only important for humidity removal but also for keeping gases at acceptable levels. Therefore, it is important to know what gases should be measured and what maximum levels should be allowed inside pig barns. Below some references that can be used in pig barns:

- NH3 <20ppm
- CO2 <3,000ppm
- CO <30ppm
- H2S <5ppm

The above gas levels could be higher than human tolerance when people are exposed 8 hours a day, 40 hours a week. At all times, please adhere to the locally applicable laws even if they differ from the recommendations presented above.

Gas level measurement can be a powerful tool to measure ventilation in naturally ventilated barns where ventilation rate can't be controlled. Even in mechanical ventilated barns it can be an accurate tool to use for reviewing ventilation rates.

Section 5:

Stocking Density and Placement Planning

Placement planning and stocking density are critical to drive overall performance.

Stocking Density

Recommendations for stocking densities are shown in Table 5.1. At all times, please adhere to the locally applicable laws that regulate management and housing practices, even if they differ from the recommendations presented in these guidelines.

Table 5.1: PIC Recommended Stocking Densities for Commercial Market Pigs

Flooring Type	Weight of pig			
	Weaning to 60 lbs (23 kg)	60 -75 lbs (23-34 kg)	75-265 lbs (34-120 kg)	>265 lbs (>120 kg)
Slatted floor	min. 2.8 ft² (0.26 m²)	3.65 ft² (0.34 m²)	min. 7.3 ft² (0.68 m²)	min. 7.5-8.1 ft² (0.70-0.75 m²)
Solid floor	-	-	min. 9.7 ft² (0.9 m²)	min. 10.8 ft² (1.0 m²)

The recommended stocking densities are based upon internal research to provide strong performance and optimal economic return per pig. Each time barn-stocking density changes in relation to the original floor space/pig the barn was designed for, there is a subsequent change in feeder space, water availability, ventilation rates, etc. and pig performance can be impacted.

Compromising your stocking densities can cause below issues:

- Decreased growth
- Increased feed conversion
- Increased aggression and associated vices
- Increased mortality and morbidity rates
- Ventilation problems
- Manure storage problems
- Maintenance challenges

Relationship Between Stocking Density and Feeder Space

PIC has demonstrated a direct relationship between stocking density and feeder space. Figure 5.1 and 5.2 illustrate the impact of different stocking density and feeder space levels on ADG and FCR. The yellow shaded area represents the optimum economic recommendations from our study developed in 2013.

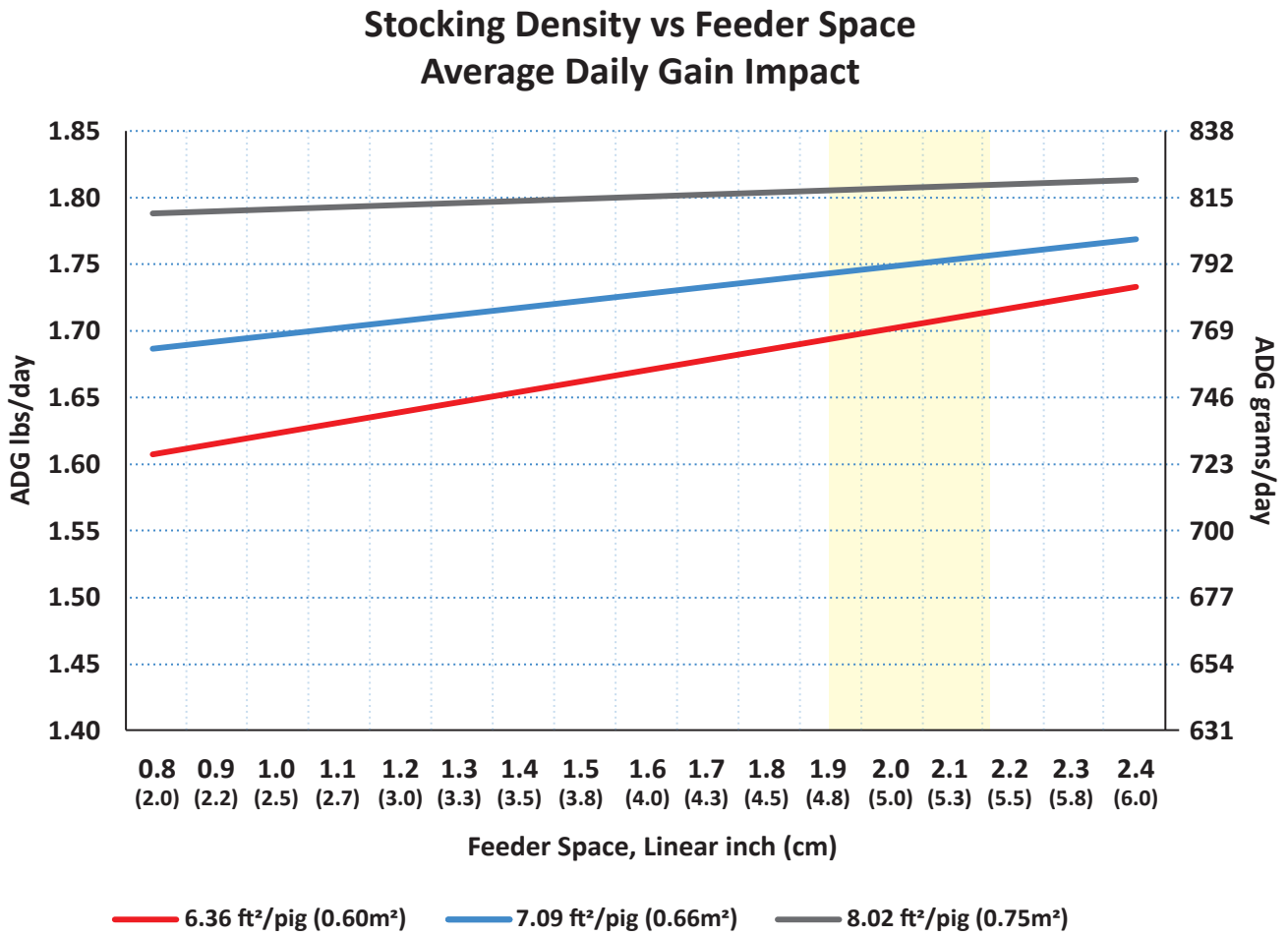


Figure 5.1: Impact of Linear Feeder Space (dry) and Floor Space Allowances on Average Daily Gain (ADG)

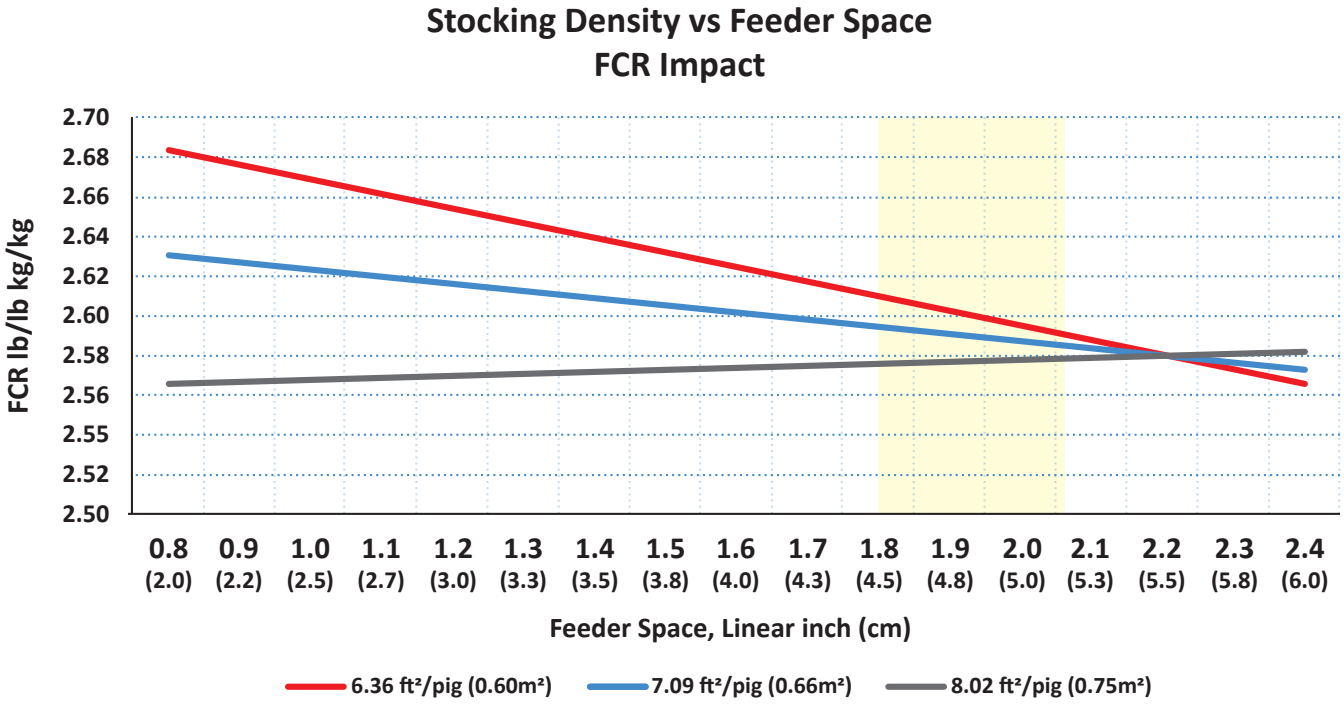


Figure 5.2. Impact of Linear Feeder Space (dry) and Floor Space Allowances on Finishing Feed Conversion Rate (FCR)

Practical Considerations

Create a stocking plan prior to the pigs' arrival. Factors to keep in mind are:

- Calculate stocking density by pen. If hospital pens or empty pens are included in the barn stocking calculation, consider that your stocking density might be slightly off as equal removal of pigs from general pens cannot be guaranteed.
- All-in-all-out by site is preferred. If all-in-all-out by site is not possible, all-in-all-out by barn is a minimum requirement.
- Keep fill time of the barn as short as possible. An age spread of 7 days or less within a room or barn is preferred. If a greater age spread is unavoidable, there should be a maximum age spread of 7 days on one feed line. Pigs may be either overfed or short on nutrients otherwise. If there is a greater than 14-day age spread within a common airspace (barn or room), the environment and diets can be difficult to manage, particularly in extreme weather conditions.
- Knowledge of age and weight to assure that the proper diet and feed budget is provided for incoming pigs:
  - The removal of previous turn's associated feed should be complete prior to arrival to insure initial access to high quality feed of the right composition.
- If multiple barns are to be filled with a known capacity, planning can be made for proper inventory within each barn.
- Knowledge of pig weight and associated health status to assure that optimal temperature and minimum ventilation considerations are made in the facility.
  - This includes the vaccination status and understanding any further requirements of protocols to be completed.

- Utilization of a barn map:
  - See Appendix D for an outline of a barn mapping strategy.
  - Begin with a known inventory.
  - Know the number of pens to be initially filled and the number of pens to be saved for intensive care.
  - Calculate the number of pigs per pen before the initial pull.
  - Count pigs into each pen, adjusting when necessary.
  - Fill initially some of the hospital pens.
  - Count the inventory per pen within the barn and balance pen inventories to assure uniform stocking densities (one feed line at a time during extended fills).
- Repeat the stocking plan when, and if, overstocked pigs are removed — essentially reclassifying the site.
- Allow enough hospital pens to ensure you can implement a daily husbandry precaution if needed
  - Include the removal of pigs to an improved environment.
- Place hospital pens toward the center of the barn where there is more consistent/stable temperature and in generally warmer as the health-challenged pig requires.
- Even a minimal variation in stocking density can have a large impact. Adding as few as 3 pigs to a pen of 30 can change the stocking density by 10%, resulting in compromised performance.
- Do not use pens as storage areas as this compromises optimal economic return. In many systems, one pen of 30 pigs may cost $1,200 annually, resulting in no pork marketed and the barns stocking density to be elevated by 2.5% (40 pen barn).
- Do not return hospitalized pigs back to the general population as this may re-aggravate stress, injury or a health condition. Place these pigs into a graduate pen.

Pen Size

- Smaller pen size is recommended as it positively affects growth rate, feed conversion and reduces lesions.
- Figures 5.3, 5.4 and 5.5 below, show results from Iowa State University, Gesing et al., and Bates, comparing the performance of large pens (>200 pigs/pen) vs. small pens (32 pigs/pen) performance.
- Based on this trial and others, group size should be limited to 25-35 head per pen to optimize performance.

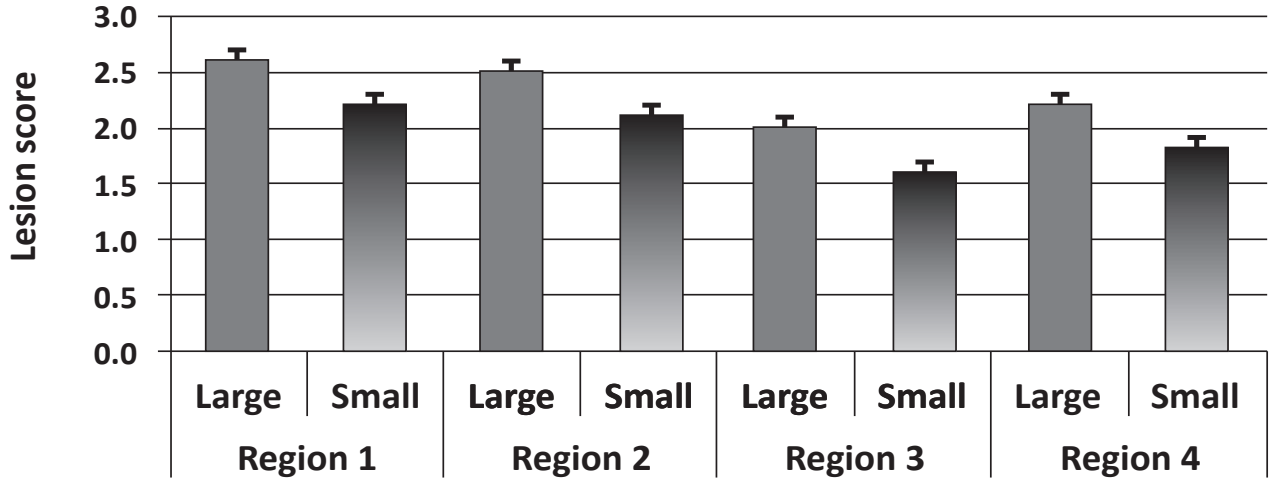


Figure 5.3: Lesion Score by Region. Region-1 Head and Jowl, Region-2 Shoulder, Region-3 Side & Loin, Region-4 Ham (Gesing et al., 2012)

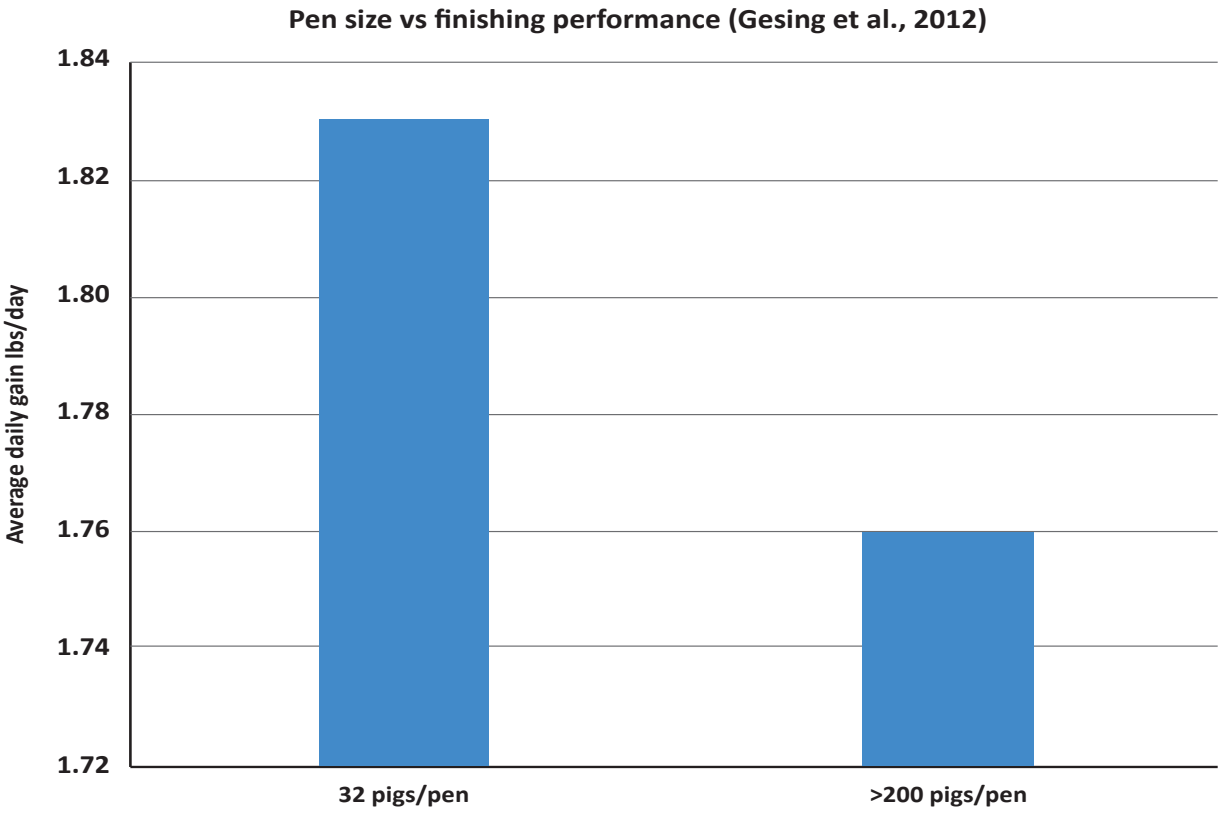


Figure 5.4: Finishing Pen Size and Average Daily Gain (Source: Gesing et al., 2012)

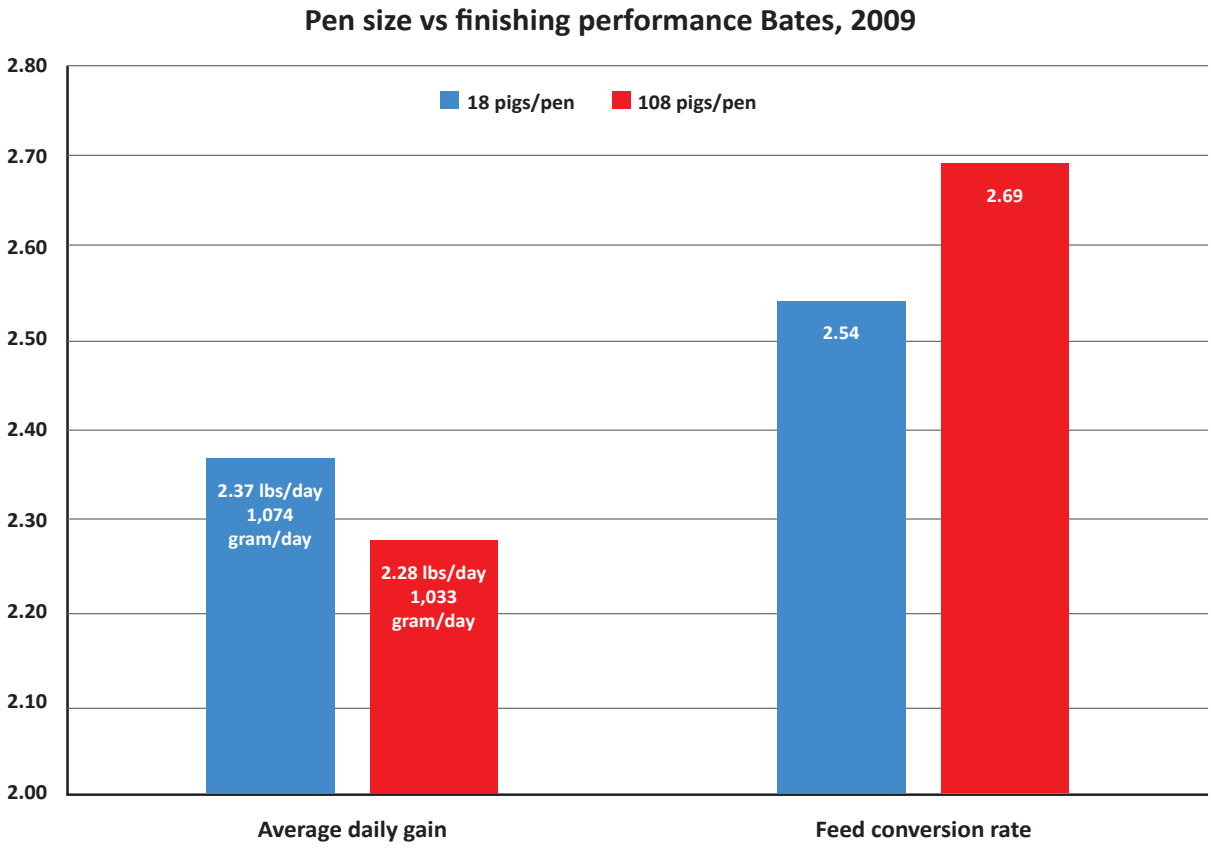


Figure 5.5: Number of Pigs per Pen and Daily Gain and FCR (source: Bates, 2009)

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Section 6:

Early Pig Care

Many producers are exposed to weaned pigs only twice a year. The following recommendations provide a base framework of strategies to begin a successful wean-to-finish cycle.

Early pig care includes all procedures to ensure a good start of pigs during their first 7-10 days after weaning. During this period focus on animal care to achieve optimal production levels and reduce losses due to failure to thrive syndrome, fallback pigs or removals and treatments.

Objectives of early pig care procedures are:

- Good feed training procedures to maximize early feed intake.
- Have plenty of water access by pigs per drinker, drinker adjustment and water flow.
- Support for pigs that are poor competitors.
- Treat in a timely manner.
- Control temperature to avoid chilled pigs.

Early Pig Care should focus on:

1. Reception
2. Environmental control and comfort zone
3. Early feed intake
4. Daily Pig Care

Reception

At all times, adhere to the locally applicable laws that regulate management and housing practices, even if they differ from the recommendations presented here.

- Clean & Dry barn
  - Pathogens left by the previous group can present a challenge that newly weaned pigs are poorly equipped to handle therefore:
    - Clean, disinfect, inspect and dry rooms prior to receiving a new load of weaned piglets. Remember: Disinfectant only works if barns are dry.
    - Clean all clothing and equipment, as well as the office, between groups.
    - Wash and disinfect the loading/unloading chute after the building is emptied and prior to receiving a new load of weaned piglets. Refer to Appendix E to review critical control points.
    - Clean & disinfection procedures must include:
      - Follow All-in All-out procedures.
      - Scrape and remove all large organic material.
      - Maximize surface areas for soaking (remove as many equipment as possible).
      - Soak the room (use sprinkler system).
      - Apply acid wash (foaming gun is recommended).
      - Power wash with hot water.
      - Have 3rd party inspection.
      - Apply disinfectant (foaming gun is recommended).
- Pig sources
  - Receive pigs directly off the sow if possible (preferably from one sow farm). This minimizes staging nursery requirements when used in combination to a twice per week weaning strategy.
    - Multiple weaning events create added stressors. Our goal is to achieve stable health status within the barn quickly.
- Placement plan and space requirements
  - Never receive pigs in wet barns.
  - Space requirement per weaned pig is 2.8 ft2 (0.26 m2) until pigs reach 60 lbs (27.3 kg). During the extended nursery period (60-75 lbs/27.3-34 kg), allow 3.65 ft2 (0.34 m2) per pig.
  - At placement sort out the bottom 10 - 20% of small pigs depending on health status. For all other pigs, PIC doesn't recommend sorting them by size.
  - Inventory within pens:
    - Allow ample space to pull pigs from the general population into a specific intensive care area.
    - Locate the intensive care area toward the center of the barn, to minimize temperature variation throughout the day.
    - Removals from general population should take place at different times:
      - Place any challenged piglets at placement immediately in intensive care pens.
      - Pull animals with compromised body condition to the intensive care area for both treatment and gruel feeding daily.
  - An example of a strategy for filling the barn and leaving available space open for intensive care treatment is shown in Figure 6.1.

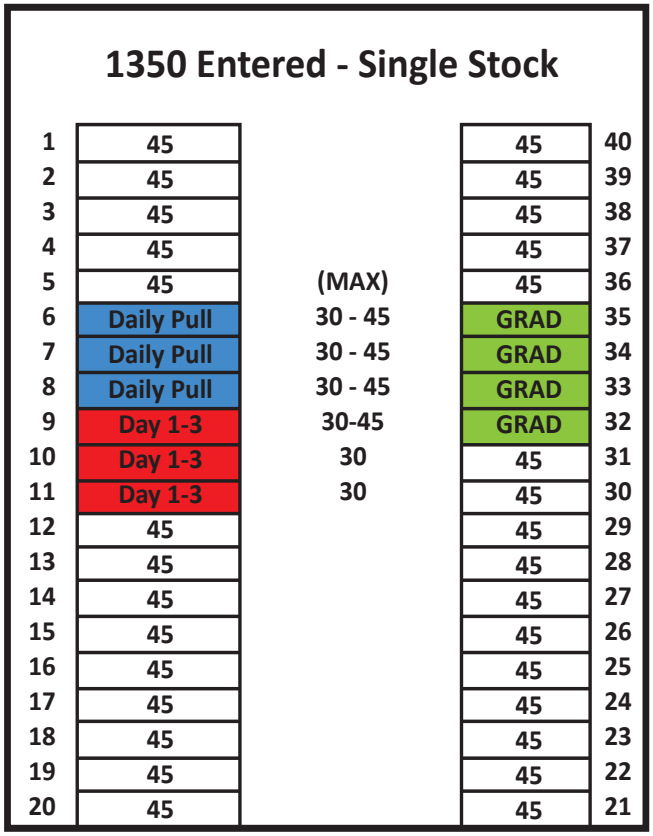
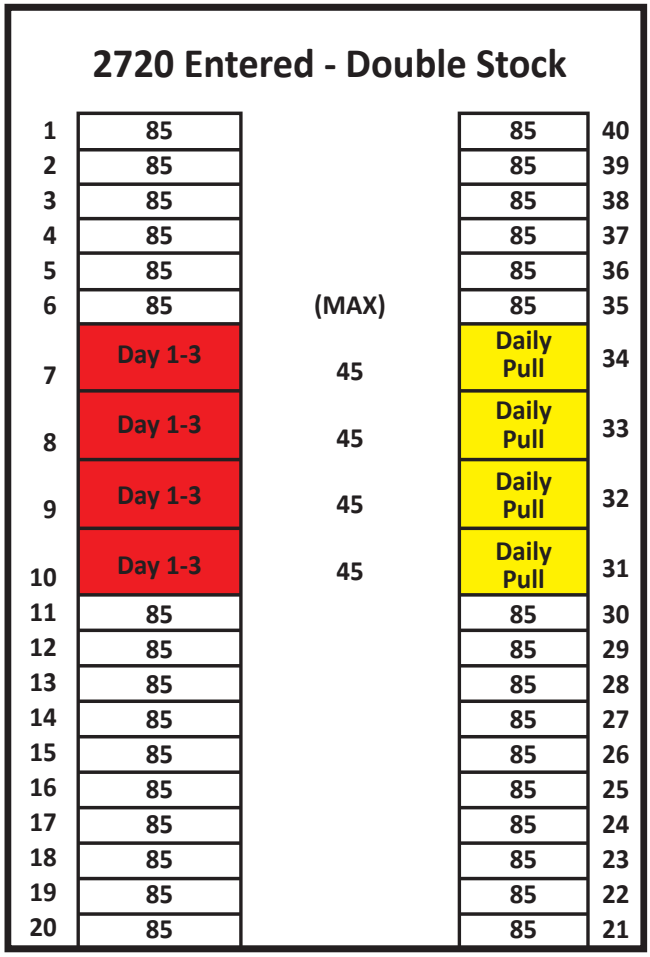


Figure 6.1: Barn Map Example of Placement Plan



- Water Availability
  - Have 1 water source per 10 head within pen (cup, nipple, etc) flowing at 4 oz./16 seconds or 500 ml/minute.
  - Wean-to-finish facilities may choose 4 oz./8 seconds or 1L/minute as pigs over 50 lbs (23 kg) require this water flow rate.
  - Have water dripping on the slat for 6 hours post arrival to allow pigs to find the water.
  - Move pigs toward the water source to ensure all pigs have found water for the first three days post-delivery.
  - Check for dehydration during the first week of placement. Signs of dehydration are sunken eyes or lack of moisture on nose. Add electrolytes for a day after arrival when piglets have been transported longer than 6 hours to restore the saline equilibrium faster.
- Feed Availability
  - Ensure 1 inch (2.5 cm) of feeder space per pig (dry or wet-dry feeders).
  - Ensure enough feed availability in the feeder pan during the feed training period.
- Comfort Zone Concept
  - Purpose of the comfort zone is that pigs are warm, dry and comfortable.
  - Pigs need properly functioning brooders producing temperatures around 95°F (35°C) directly beneath them and ample mat space (0.4 ft2/pig or 0.04m2/pig). Mat temperatures may need to be extended beyond 95°F (35°C) to accomplish pig comfort.
  - Pigs should lay touching each other with heads on neighbors' flanks directly under the heater.
  - General rule for zone heating in the creep area is that pigs should lay 1 ½ deep. If pigs are piled 2-3 layers deep they are too cold and zone heaters should be turned up or lowered closer to the floor.

Correct

Incorrect

- If pigs are lying in a doughnut shaped ring avoiding the area under the heater then the area is too hot, and the heater should be turned down or raised up.
- If mats become wet or caked with feed or manure; flip mats over to regain a dry, black surface that effectively absorbs heat.
- In many cases, pigs are exposed to too high room temperatures, which depress appetite and daily feed intake.
- Brooders should be in place and functional for 14 to 21 days depending on pig comfort and severity of disease.
- Mats should be removed when pigs no longer use them, or pigs begin using the mat as a dunging area, typically 1 to 2 weeks post placement.
- Brooders should be in place within intensive care pens throughout grueling period.
- Heat lamps usually reach 85-90°F (29-32°C) and don't achieve 95°F (35°C), therefore room temperature should be adjusted based on pig behavior when they rest below it.

• Desired room temperature (DRT)
  - Desired room temperature depends on pig weight, floor type, barn insulation and comfort zone quality. Appendix A shows DRT references for different situations.
  - Warm the facility fully to desired room temperature for a minimum of 12 hours before arrival.
    - If brooders and mats are in use, mat temperatures should be at 95°F (35°C) and dry at arrival.
    - This process may require reduced minimum ventilation and the activation of heaters and brooders 4-6 hours prior to arrival.
    - Health-challenged pigs often require a 2- 5°F (1-2.7°C) increase in desired room temperature.
• Ventilation:
  - At placement 2 CFM/pig is recommended, however in the case of health challenged pigs (PRRS, PED, etc) pigs it may be necessary to remove air at a higher exhaustion rate to achieve less than 65% humidity.
  - Critical components of ventilation include:
    - Humidity control: Keep humidity below 65%.
    - Warm & dry floors and mats.
    - Air exchange (minimum ventilation).

Early Feed Intake

After weaning, piglets must adapt from sow milk to dry pelleted or mash diets. This can be a challenge and may result in a reduction of feed intake after weaning, which in turn impacts their digestive system and subsequent growth rate. Two tools can help in this transition: mat feed training and gruel feeding strategy.

- Mat Feed Training Considerations:
  - The goal of mat feeding is to stimulate the pigs and act as a "dinner bell" to get them up and eat.
  - The transition from a sow's daily feeding frequency to an ad-libitum environment sometimes stalls piglet feed intake. Key is to increase the pigs' activity level and to identify any poor competitors and sick pigs early.
  - More activity will lead to more feed and water intake since the pigs move from their comfort zone.
  - Caution: The purpose of mat feeding is to stimulate the pigs' appetite, so that they start looking for feed when the mat is cleaned. Creep/mat feeding for too long or with too much feed, trains the pigs to wait for the caretaker.
- Gruel Feed Considerations:
  - Use at placement with poor-doers and smaller pigs for the first 2-3 days and within intensive care pens for 7 days. This step is highly labor intensive but serves as a positive step in early acclimation to a new environment for an already challenged pig. Field results have shown positive economic and performance results.
  - Use as support and not as a substitute because it is 70% water and it will fill the stomach with water more than feed.
  - Gruel feed is properly administered when the pigs consume the entire mixture within 1 hour.
- Mat Feeding and Gruel Feeding should take place:
  - At the beginning of AM chores
  - At the end of AM chores
  - Noon
  - At the beginning of PM chores

Table 6.2: Recommendations for Mat and Gruel Feeding

Mat training	Recommendation	Gruel	Recommendation
Recipe	1 lbs of feed (0.5 kg) per 40 pigs / day	Recipe	8 oz (0.25 L) feed & 24 oz (0.75 L) water / 15 pigs
Space/pig	0.4 ft² / 0.04 m²	Space/pig	3 inches (7.6 cm) of linear feeder space/pig
Frequency	4-6 times/day for 3-7 days	Frequency	3 times/day @ 2-3 days consumed within 1 hour.
Result expected	Reduction in sorted pigs. Less scours and better nursery performance.	Result expected	Improve feed intake in smaller and poor competitors.
Goal	Achieve a feed intake of 3-4 lbs (1.5-2 kg) in the first week and identify pigs that are not competing well.	Goal	Avoid starve outs and recover body competition in poor competitors.

Placement Plan

Finally, the placement plan is completed and outlines how the pigs should be penned and which tools will be used (Figure 6.2).

Pigs	1200
# Pigs/pen	60
Total Pen	20.0

	Bottom Pigs	Hospital	Fall Back 1-3 DOF	Daily Pul / Graduate Pigs	Normal Population
% Pigs	10%	5%	10%	5%	70%
# pigs	120	60	120	60	840
# pens	2.0	1.0	2.0	1.0	14.0
Mat Feeding	3x/day & 3ds	4x/day & 5ds	4x/day & 5ds	Depend on Age	3x/day & 3ds
Gruel Feeding	3x/day & 3ds	Yes	3x/day & 5ds		------
Additional Water Availability	------	Yes	Temporally		------
Additional Mat Space	------	Yes	Yes		------
Additional Temperature	Warm Place	Yes+Warm Place	Yes+Warm Place		------

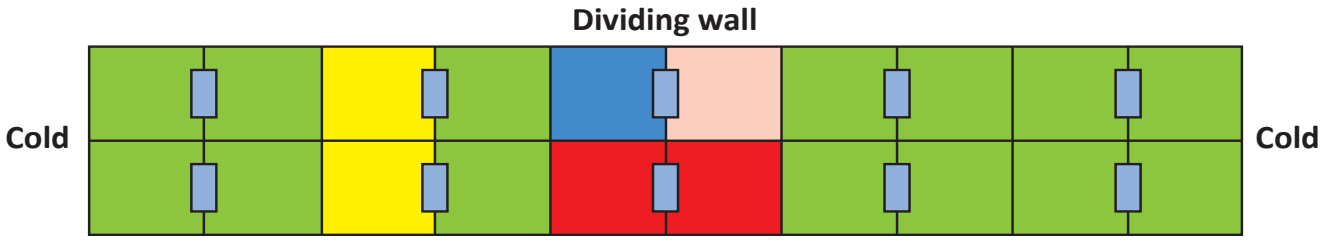


Figure 6.2: Example of a Barn Placement Plan Including Early Pig Care Management

Double Stocking Considerations

If double stocking strategy is used, the following recommendations should be considered. Table 6.1 shows considerations for double stocking.

Table 6.1: Double Stocking Considerations During Nursery Phase in Wean-to-Finish Barns

Indicator	Considerations
Feeders	• Dry feeders are practical, because if normal finishing feeder space planned was 2 inches/pig (5 cm/pig), the feeder space during double stocking will be 1 inch/pig (2.5 cm/pig), which is similar to PIC recommendations. • Achieve 1 inch/pig (2.5 cm/pig) in feeder space for pens with wet-dry feeders
Water Availability	• Provide additional drinkers to accommodate one drinker per 10-12 pigs • Additional drinker types could be: - Swing nipples: Easy adjustment and avoid water waste. - Nipple bar: Not preferable as they can't be adjusted and have high water waste. - Pan waterers: Not preferable as it is hard to keep clean during summer.
Comfort Zone	• Consider adding more mat area and adjusting desired room temperature if brooder capacity is exceeded. • Mat area should be >0.4 ft²/pig (0.04 m²/pig) to allow the pigs to spread out. • If additional brooders or heat lamps are added, have two comfort areas where both heat patterns are touching peripherally.
Air Speed by Inlets	• Set minimum ventilation at 2 CFM/Pig. • In minimum ventilation mode, variable speed fans should be working no less than 50%. • An air speed of 600-800 FPM at inlets is recommended.
Tunnel Mode	• Use caution when last stages of tunnel mode are used, it could be too much air for younger pigs.
Labor	• Have extra personnel, especially during first 10 days. • Keep the same pigs/person/hr as for single stocking.

Section 7:

Standard Animal Care

Daily pig care is the cornerstone to overall performance and optimization of production goals. Daily, weekly, monthly and between turn routines produce repeatable results and optimal animal welfare.

Daily Routines:

- Allocate the proper time to achieve success:
  - Allow approximately 2 seconds/head or approximately 30 minutes/1,000 head to individually evaluate each pig within the facility.
  - Allow a minimum of 1 hour/1,000 head for the evaluation of waterers, feeders, ventilation and associated tasks.
- Enter pens daily to assure a proper pig evaluation and an understanding of water and feed availability.
- Producers should be equipped with the tools that support efficient care.
  - Syringes, medication and needles
  - Marking device (aerosol or paint sticks)
  - Pen and Notebook
  - Hydrometer, anemometer and thermometer (to measure humidity and temperature)
  - Panel to sort ill or injured pigs

- Evaluations include:
  - Identification of ill or injured pigs to treat or move to a hospital pen.
  - Execution of PQA and AASV euthanasia decision making trees.
  - Evaluation and adjustment to produce proper water flow and feed pan coverage.
  - Recording of daily water consumption and temperature variation (highs and lows).
  - Evaluation of humidity and airspeed to determine modifications in ventilation strategy.
  - Recording of the number of pigs treated with associated medication and dose.
  - Evaluation of feed inventory and associated intake to predict upcoming feed orders.
  - Evaluation of properly functioning fans and heaters to produce optimal environments.
  - Manure storage capacity.
- Daily Communication
  - Communication of health challenge/change with Veterinarian and accountable production personnel.
  - Feed quality or quantity concerns.

Weekly Routines

- Evaluate daily data to understand trends or patterns related to:
  - Water intake
  - Health changes
  - Feed intakes
  - Utility use (liquid propane levels, heater run times, temperature probes)
  - Assurance of proper back-up devices (heater back up thermostats, fan back up thermostats, curtain drop thermostats, high/low alarm thermostats)
  - Visitor logs
  - Biosecurity of the site – clean shower, entryway and associated equipment
  - Biosecurity and cleanliness of mortality disposal equipment or compost management
  - Measurement of remaining manure storage capacity

Monthly Routines

- Test Emergency Devices
  - Curtain drops
  - Alarms
  - Back-up heaters and fans
  - Generators (if available)
- Monthly Maintenance
  - Grease bearings.
  - Check fan belts.
  - Clean temperature probes.
  - Check for sagging curtains or inlet repairs.

Between Turns

There are critical items between finishing turns to consider which will have an impact on the next batch of pigs within the facility.

- Cleaning
  - Clean the facility inside and out.
  - Clean, dry and disinfect interior including office, shower and all fans and ventilation equipment.
  - Inspect after cleaning and before disinfection.
  - Clean pit fans, attic inlets, feed pads and bulk bins.
  - Remove completed compost material.
- Maintenance
  - Grease all pulleys and gears.
  - Reset all backup devices mindful of upcoming change of ventilation parameters.
  - Test ventilation equipment after cleaning.
  - Potentially winterize the site (insulation etc.).
  - Review ventilation probe accuracy.

Pen Walking & Fall Back/Sick Pig Identification

Walk pens daily to:

- Check feeders.
- View every pig from snout to tail, head to toe; rule of thumb is to spend 2 seconds per pig.
- Identify and pull fall-backs.
- Identify, pull and treat sick pigs.
- Check water flow rates.
- Mat feed (when applied).
- Gruel feed (when applied to high intensive care pens).

Provide extra care to sick pigs or fall-backs. This starts with timely identification. Signs of falling back are:

- Rough hair coat or fuzzy appearance.
- Obvious empty abdomen. Pick up the pig up and feel for gut fill. A rough looking pig with a full gut is probably okay.
- Tucked-in flanks and stomach are a good indication that a pig has not been eating.
- Depressed or lethargic. Head down or droopy.
- Not active or competing. Often these pigs will be huddled together or off by themselves.
- Rectal temperature above 102°F (39°C).
- There are often several causes of these conditions:
  - Lameness
  - Bacterial or viral infection
  - Anemia
  - Cold temperatures within the site or pen
  - Often the largest weaned pigs are the slowest to adapt to a new environment
- Observe condition, activity and dunging patterns to evaluate piglet health rather than size.
- Getting pigs up several times per day is a critical step to effective transition from the sow to the nursery.

Healthy Pigs:

Some pigs have rough hair coats — which is typical 3-6 days post weaning — if bellies are round this indicates that the pigs are on feed and doing well.

Highly Health-Challenged Pigs:

Different strategies of care are required for varying health statuses. Below are factors to consider for highly health-challenged pigs, as well as healthy pigs based upon results relative to goals:

- Optimal temperature and humidity: Health-challenged pigs require higher room temperatures and humidity control (which may result in elevated utility costs).
- Be highly sensitive to humidity and environmental changes within the barn.
- Effective timing and efficient application of critical care.
- Challenged pigs require intensive and frequent husbandry. Be prepared to increase the labor effort and oversight accordingly.
- Use gruel feeding strategies and equipment, health challenged pigs will respond favorably.
- Facilitation of communication among all levels of the production team. Reaction time to achieve best results is critical.
- Weaned pigs' progress can change rapidly, and producers should respond quickly.
- Critical personnel include veterinarian, field person and producer.

Veterinary Support and Treatment Strategy

- Utilize the Veterinary-Client relationship during health challenges.
- Utilize a combination of water medications, feed grade medications and injectables when faced with a health challenge.
- Daily chores include:
  - New needles daily, and assessments and treatments in accordance with National Pork Board PQA+ (for the US).
  - Treat intensive care pens at the end of the day.
  - Assessment 2-3 times per week of site and progress by field man in collaboration with caretaker.
  - Daily communication of percent treated, percent daily mortality, and percent pulled to intensive care area.

Section 8:

Transport Recommendations

Transportation represents the conclusion and realization of food production, but also a change for pigs, which should be managed to eliminate stress and ensure safety. At all times, adhere to the locally applicable laws even if they differ from the recommendations presented here.

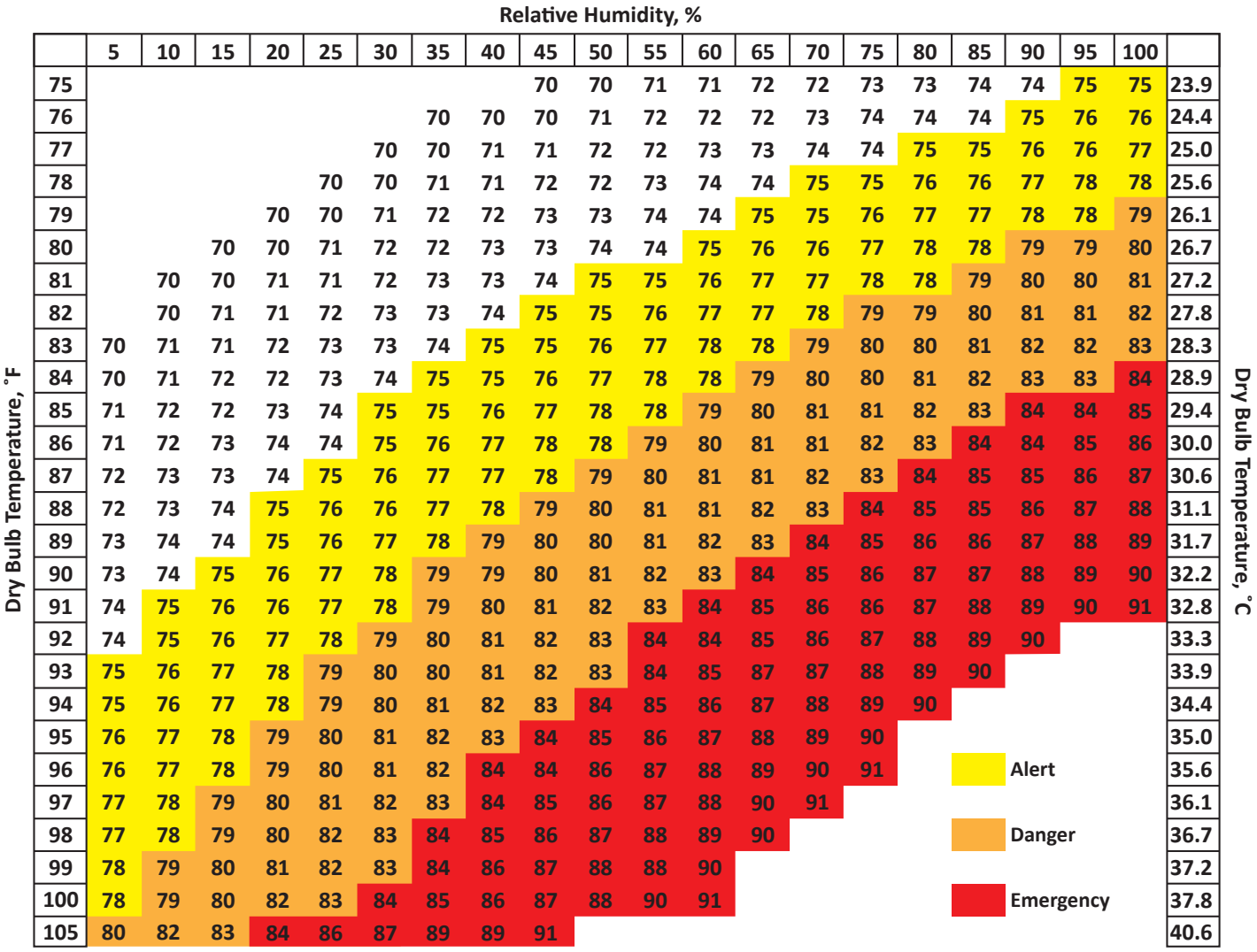
Preparing to Load

- Proper handling starts with a good understanding of the pig and its behavior in order to anticipate its reaction and respond using appropriate handling techniques and tools.
  - The pig – field of vision, sense of smell, curiosity, memory, herding characteristics.
  - Tools – physical/visual barrier (sorting board), audio stimulant (rattle can or rattle paddle), visual stimulant (flag), electric prod use.
- Animals within the facility should have good acclimation to people through daily walking of pens and husbandry done within pens.
- Presorting is a viable option for some. Only presort pigs from large pens (90 or more head) as they typically have minimal fighting when mixed.
- Feed withdrawal can improve handling, dressing percentage and associated feed savings, but pigs need full access to water.
- Feed withdrawal time on farm should be at least 6 hours prior to loading.
- Total feed withdrawal time should not be more than 24 hours prior to stunning.
- The final pull or cut from a facility should always have feed removed to improve handling, minimize challenges at the harvesting facility and improvements in dressing percentage.

- Facilitate movement by minimizing abrupt transitions and providing a pathway that is obvious to the pig and as distraction free as possible (flooring, lighting, temperature, humidity, air speed/flow & building pressures).
- Evaluate facilities and equipment design & layout and modify whenever possible to reduce stress and improve pig movement. Key areas for barns, ramps and trucks include:
  - Minimize distance from pen to truck. In one study open mouth breathing was more than double for pens >150 ft (45 m) vs pens <80 ft (24 m) from the truck.
  - Non-slip flooring.
  - Walkways and ramps that are at least 2 pigs wide (36-40 inch / 90-102 cm).
  - Open corners rather than "blind" 90° turns.
  - Uniform, diffused and sufficiently bright lighting (minimum 85 lux).
  - Wide enough pen gates (≥ 6 ft / ≥1.8 m) to provide an easily visible route.
  - Ramps with a maximum 20° incline and correctly sized & spaced cleats.
  - Solid pen fronts in alleyways near doors (temporary is okay).
  - Trucks with correctly sized pens & adequate ventilation adjustment to enhance pig comfort.
- Have a water source available at every loading chute so pigs or bedding can be sprinkled with water just prior to leaving during hot weather.

Loading

- Move pigs in small groups based on pig type/weight, prior movements and facility design (3-5 market pigs/20 nursery pigs).
- Handler should be able to reach the lead pig.
- Use two people to sort pigs out of pens, with only one person moving at a time.
- Lower curtains if needed to create equal air pressure inside and outside of the barn. Pigs do not like to walk into strong head winds created by negative ventilation.
- Use appropriate equipment, such as sort boards, folding capes and rattle paddles.
- Move animals in a calm, steady manner.
- Do not force animals to move faster than normal walking pace. Maintain flow at the pig's pace using the application and release of pressure:
  - Pressure is any action that increases the level of attention a pig feels they need to dedicate to their handler (proximity, noise, touching, etc.).
  - Too much pressure, constant pressure and/or pressure at the wrong time can have a negative impact on pig movement.
- Load animals furthest from the chute onto the bottom deck. Load animals closest to the chute onto the top deck. This reduces stress on animals in the back of the barn that have the farthest to walk.
- Do not send an animal that is unable to walk, ill, or significantly injured to market channels.
- PIC does not recommend the electric prods use; however; some minimum considerations must be taken when it is used:
  - If a pig must be prodded more than twice, reevaluate loading procedures and facilities.
  - Prod pigs in the center of the back, behind the shoulder blades for less than one second and no more than 2x in a 5-minute period.
- Use the trailer sprinkler system or a garden hose to wet pigs and bedding before leaving the farm, if the livestock weather safety index is >= 77 (Figure 8.1).



	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
75									70	70	71	71	72	72	73	73	74	74	75	75	23.9
76							70	70	70	71	72	72	72	73	74	74	74	75	76	76	24.4
77						70	70	71	71	72	72	73	73	74	74	75	75	76	76	77	25.0
78					70	70	71	71	72	72	73	74	74	75	75	76	76	77	78	78	25.6
79				70	70	71	72	72	73	73	74	74	75	75	76	77	77	78	78	79	26.1
80			70	70	71	72	72	73	73	74	74	75	76	76	77	78	78	79	79	80	26.7
81		70	70	71	71	72	73	73	74	75	75	76	77	77	78	78	79	80	80	81	27.2
82		70	71	71	72	73	73	74	75	75	76	77	77	78	79	79	80	81	81	82	27.8
83	70	71	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	82	83	28.3
84	70	71	72	72	73	74	75	75	76	77	78	78	79	80	80	81	82	83	83	84	28.9
85	71	72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84	84	85	29.4
86	71	72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84	84	85	86	30.0
87	72	73	73	74	75	76	77	77	78	79	80	81	81	82	83	84	85	85	86	87	30.6
88	72	73	74	75	76	76	77	78	79	80	81	81	82	83	84	85	85	86	87	88	31.1
89	73	74	74	75	76	77	78	79	80	80	81	82	83	84	85	86	86	87	88	89	31.7
90	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	87	87	88	89	90	32.2
91	74	75	76	76	77	78	79	80	81	82	83	84	85	86	86	87	88	89	90	91	32.8
92	74	75	76	77	78	79	80	81	82	83	84	84	85	86	87	88	89	90			33.3
93	75	76	77	78	79	80	80	81	82	83	84	85	87	87	88	89	90				33.9
94	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90					34.4
95	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90						35.0
96	76	77	78	79	80	81	82	84	84	86	87	88	89	90	91						35.6
97	77	78	79	80	81	82	83	84	85	86	87	88	90	91							36.1
98	77	78	79	80	82	83	84	85	86	87	88	89	90								36.7
99	78	79	80	81	82	83	84	86	87	88	88	90									37.2
100	78	79	80	82	83	84	85	86	87	88	90	91									37.8
105	80	82	83	84	86	87	89	89	91												40.6

Figure 8.1: Livestock Heat Hazard Guide With Temperature Humidity Index (THI) Values

Space Requirements on Trucks

At all times, adhere to the locally applicable laws even if they differ from the recommendations presented here.

- Calculate available space (ft²/m²) for every trailer type.
- Calculate available space (ft²/m²) of every compartment and load accordingly.
- Do not calculate available space by simply multiplying trailer width by length.
- Provide correct truck stocking density and bedding level based on season, weather conditions and pig size (Table 7.1 and 7.2).
  - PIC recommends 58 lbs/ft2 (283 kg/m2) with additional space based on increasing temperatures and travel distance.
- Do not exceed legal load weights.
- Never crowd the trailer.
- Provide appropriate ventilation and bedding for weather conditions.
- Adjust load times for weather conditions.
- Transport animals at a steady pace, avoiding sudden stops or starts.
- Keep animals on a trailer for as little time as possible.

Table 8.1: Transport Space, Example of Output From PIC Transport Space Calculator 2017

MARKET HOG TRANSPORT SPACE CALCULATOR PIC

Space per pig

Input data in green shaded cells

Weight, lb	lb/ft² (55–58) 58	Adjusted ft² / Pig 30° – 90°F	>90°F	>90°F & >250 miles	
250	4.31	4.74	5.17	6.20	Area / Pig
260	4.48	4.93	5.37	6.45	
270	4.66	5.12	5.58	6.70	
280	4.83	5.31	5.79	6.95	
290	5.00	5.50	5.99	7.19	
300	5.17	5.69	6.20	7.44	
310	5.34	5.88	6.41	7.69	
320	5.52	6.07	6.61	7.94	
330	5.69	6.26	6.82	8.19	

This table shows the space in ft² per pig recommended based on weight, lb/ft², temperature range, and/or distance to market.

Version 1 April 2017

MARKET HOG TRANSPORT SPACE CALCULATOR PIC

Space per pig

Input data in green shaded cells

Weight/Peso	kg/m² (268 - 283) 283	Adjusted m² / Pig m² / Cerdo Ajustado 27° - 32°C	>32°C	>32°C & >400 km	
110	0.39	0.43	0.47	0.56	Area / Pig
115	0.41	0.45	0.49	0.58	
120	0.42	0.47	0.51	0.61	
125	0.44	0.49	0.53	0.64	
130	0.46	0.51	0.55	0.66	
135	0.48	0.52	0.57	0.69	
140	0.49	0.54	0.59	0.71	
145	0.51	0.56	0.61	0.74	
150	0.53	0.58	0.64	0.76	

This table shows the space in m² per pig recommended based on weight, density (kg/m²), temperature range, and/or distance to market.

Table 8.2: Guidelines for Trailer Ventilation and Bedding to use for Market Hogs at Different Temperatures (source: Pork Checkoff)

Recommended Truck Setup Procedures Based on outside Air Temperatures (Market Pigs)		
Estimated Air Temperature	**Bedding* (recommended bags/trailer)**	**Side-Slats**
<10°F (-12°C)	Heavy (6 bags)	90 - 95% closed
11–20°F (-11.7 - -6.6°C)	Heavy (4-6 bags)	75 - 90% Closed
21-30°F (-6.1- -1.1°C)	Heavy (4-6 bags)	50 - 75% Closed
31-40°F (-0.6-4.4°C)	Medium (3-4 bags)	50 - 75% Closed
41-60°F (5-15.6°C)	Medium (3-4 bags)	25 - 50% Closed
61-90°F (16-32.2°C)	Medium (3-4 bags)	0% Closed
> 90°F (>32.2°C)	Light (1-2 bags)	0% Closed

**Refers to a 50 lbs (25 kg) bag of shavings*

Unloading

- Unload animals at a slow and steady pace.
- Unload animals in manageable groups to avoid piling.
- Inform the plant before unloading if there is a down animal on the trailer.
- Never use electric prods during unloading.

System Improvement and Troubleshooting

Reducing pig losses during transport is one of the most significant opportunities for bottom-line profit. These losses are expressed as Death-On-Arrival (DOA) and Non-Ambulatory-Non-Injured (NANI) and can be caused by different factors throughout the transportation process. It is good practice to evaluate results and inputs to understand the underlying factors influencing results.

Potential factors influencing pig losses:

- Building type and alley length
- Pen inventory
- Chute type and angle to truck
- Loading time
- Loading crew
- Which load or cut-out of the site
- Lighting
- Alley width
- Outside temperature
- Trucker
- Inventory per compartment and compartment size
- Duration of feed withdrawal
- Pig weight
- Nutrition
- Health

Evaluating above factors can reveal the ideal conditions and personnel that repeatedly produce exceptional transportation results. From those factors, build a plan to improve or eliminate the largest issues and the system will improve overall results.

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Appendix A

Desired Room Temperature and Setpoint Recommendations

Table A-1: Recommendations for Curtain-Sided Barns Utilizing Brooders and No Mats With Slatted Floors

DAYS ON FEED	WEIGHT	DESIRED ROOM TEMPERATURE	WINTER SETPOINT	SUMMER SETPOINT	WINTER CFM
1	12 lbs (5.4 kg)	81°F (27.2°C)	83°F (28.3°C)	81°F (27.2°C)	2
8	15 lbs (6.8 kg)	79°F (26.1°C)	80°F (26.7°C)	79°F (26.1°C)	2
15	19 lbs (8.6 kg)	77°F (25°C)	78°F (25.5°C)	77°F (25.0°C)	2
22	24 lbs (10.9 kg)	78°F (25.5°C)	79°F (26.1°C)	76°F (24.4°C)	2
29	31 lbs (14.1 kg)	78°F (25.5°C)	76°F (24.4°C)	76°F (24.4°C)	2.2
36	41 lbs (18.6 kg)	76°F (24.4°C)	74°F (23.3°C)	74°F (23.3°C)	2.6
43	51 lbs (23.1 kg)	73°F (22.7°C)	73°F (22.7°C)	71°F (21.7°C)	2.9
50	62 lbs (28.1 kg)	72°F (22.2°C)	72°F (22.2°C)	69°F (20.5°C)	3.3
57	73 lbs (33.1 kg)	70°F (21.1°C)	69°F (20.5°C)	67°F (19.4°C)	3.9
64	86 lbs (39.0 kg)	69°F (20.5°C)	68°F (20.0°C)	66°F (18.8°C)	4.5
71	100 lbs (45.4 kg)	67°F (19.4°C)	66°F (18.8°C)	64°F (17.7°C)	5.1
78	113 lbs (51.3 kg)	67°F (19.4°C)	66°F (18.8°C)	64°F (17.7°C)	5.4
85	127 lbs (57.6 kg)	66°F (18.9°C)	65°F (18.3°C)	63°F (17.2°C)	5.9
92	142 lbs (64.4 kg)	65°F (18.3°C)	64°F (17.7°C)	63°F (17.2°C)	6.6
99	156 lbs (70.8 kg)	64°F (17.8°C)	63°F (17.2°C)	62°F (16.7°C)	7.1
106	171 lbs (77.6 kg)	63°F (17.2°C)	62°F (16.7°C)	62°F (16.7°C)	7.8
113	186 lbs (84.4 kg)	62°F (16.7°C)	62°F (16.7°C)	61°F (16.1°C)	8.5
120	200 lbs (90.7 kg)	61°F (16.1°C)	61°F (16.1°C)	61°F (16.1°C)	9.2
127	215 lbs (97.5 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	9.9
134	230 lbs (104.3 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	10.6
141	243 lbs (110.2 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	11.2
148	258 lbs (117 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	11.9
155	272 lbs (123.4 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	12.6
162	284 lbs (128.8 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	13.3
169	297 lbs (134.7 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	13.9
176	310 lbs (140.6 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	14.6

Table A-2: Recommendations for Curtain-Sided Barns Utilizing Brooders and Mats With Concrete Slatted Floors

DAYS ON FEED	WEIGHT	DESIRED ROOM TEMPERATURE	WINTER SETPOINT	SUMMER SETPOINT	WINTER CFM
1	12 lbs (5.4 kg)	77°F (25°C)	79°F (26.1°C)	77°F (25°C)	2
8	15 lbs (6.8 kg)	75°F (24.9°C)	76°F (24.4°C)	75°F (24.9°C)	2
15	19 lbs (8.6 kg)	73°F (22.7°C)	74°F (23.3°C)	73°F (22.7°C)	2
22	24 lbs (10.9 kg)	78°F (25.5°C)	76°F (24.4°C)	76°F (24.4°C)	2
29	31 lbs (14.1 kg)	78°F (25.5°C)	76°F (24.4°C)	76°F (24.4°C)	2.2
36	41 lbs (18.6 kg)	76°F (24.4°C)	74°F (23.3°C)	74°F (23.3°C)	2.6
43	51 lbs (23.1 kg)	73°F (22.7°C)	73°F (22.7°C)	71°F (21.7°C)	2.9
50	62 lbs (28.1 kg)	72°F (22.2°C)	72°F (22.2°C)	69°F (20.5°C)	3.3
57	73 lbs (33.1 kg)	70°F (21.1°C)	69°F (20.5°C)	67°F (19.4°C)	3.9
64	86 lbs (39.0 kg)	69°F (20.5°C)	68°F (20.0°C)	66°F (18.9°C)	4.5
71	100 lbs (45.4 kg)	67°F (19.4°C)	66°F (18.9°C)	64°F (17.7°C)	5.1
78	113 lbs (51.3 kg)	67°F (19.4°C)	66°F (18.9°C)	64°F (17.7°C)	5.4
85	127 lbs (57.6 kg)	66°F (18.9°C)	65°F (18.3°C)	62°F (16.7°C)	5.9
92	142 lbs (64.4 kg)	65°F (18.3°C)	64°F (17.7°C)	62°F (16.7°C)	6.6
99	156 lbs (70.8 kg)	64°F (17.8°C)	63°F (17.2°C)	62°F (16.7°C)	7.1
106	171 lbs (77.6 kg)	63°F (17.2°C)	63°F (17.2°C)	62°F (16.7°C)	7.8
113	186 lbs (84.4 kg)	62°F (16.7°C)	62°F (16.7°C)	61°F (16.1°C)	8.5
120	200 lbs (90.7 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	9.2
127	215 lbs (97.5 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	9.9
134	230 lbs (104.3 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	10.6
141	243 lbs (110.2 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	11.2
148	258 lbs (117 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	11.9
155	272 lbs (123.4 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	12.6
162	284 lbs (128.8 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	13.3
169	297 lbs (134.7 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	13.9
176	310 lbs (140.6 kg)	61°F (16.1°C)	61°F (16.1°C)	60°F (15.5°C)	14.6

Table A-3: Recommendations for Solid-Sided Barns With Slated Floors Utilizing Both Brooders and Mats

DAYS ON FEED	WEIGHT	DESIRED ROOM TEMPERATURE	WINTER SETPOINT	SUMMER SETPOINT	WINTER CFM
1	12 lbs (5.4 kg)	74°F (23.3°C)	76°F (24.4°C)	74°F (23.3°C)	2
8	15 lbs (6.8 kg)	72°F (22.2°C)	74°F (23.3°C)	72°F (22.2°C)	2
15	19 lbs (8.6 kg)	70°F (21.1°C)	71°F (21.7°C)	70°F (21.1°C)	2
22	24 lbs (10.9 kg)	75°F (24.9°C)	73°F (22.7°C)	73°F (22.7°C)	2
29	31 lbs (14.1 kg)	75°F (24.9°C)	73°F (22.7°C)	73°F (22.7°C)	2.2
36	41 lbs (18.6 kg)	73°F (22.7°C)	71°F (21.7°C)	71°F (21.7°C)	2.6
43	51 lbs (23.1 kg)	70°F (21.1°C)	70°F (21.1°C)	68°F (20.0°C)	2.9
50	62 lbs (28.1 kg)	69°F (20.5°C)	68°F (20°C)	67°F (19.4°C)	3.3
57	73 lbs (33.1 kg)	67°F (19.4°C)	66°F (18.8°C)	64°F (17.7°C)	3.9
64	86 lbs (39.0 kg)	66°F (18.9°C)	65°F (18.3°C)	63°F (17.2°C)	4.5
71	100 lbs (45.4 kg)	64°F (17.8°C)	63°F (17.2°C)	61°F (16.1°C)	5.1
78	113 lbs (51.3 kg)	64°F (17.8°C)	64°F (17.8°C)	61°F (16.1°C)	5.4
85	127 lbs (57.6 kg)	63°F (17.2°C)	62°F (16.7°C)	59°F (15°C)	5.9
92	142 lbs (64.4 kg)	62°F (16.7°C)	61°F (16.1°C)	59°F (15°C)	6.6
99	156 lbs (70.8 kg)	61°F (16.1°C)	60°F (15.5°C)	59°F (15°C)	7.1
106	171 lbs (77.6 kg)	60°F (15.5°C)	60°F (15.5°C)	59°F (15°C)	7.8
113	186 lbs (84.4 kg)	59°F (15°C)	59°F (15°C)	58°F (14.4°C)	8.5
120	200 lbs (90.7 kg)	58°F (14.4°C)	57°F (13.9°C)	58°F (14.4°C)	9.2
127	215 lbs (97.5 kg)	58°F (14.4°C)	58°F (14.4°C)	57°F (13.9°C)	9.9
134	230 lbs (104.3 kg)	58°F (14.4°C)	58°F (14.4°C)	57°F (13.9°C)	10.6
141	243 lbs (110.2 kg)	58°F (14.4°C)	58°F (14.4°C)	57°F (13.9°C)	11.2
148	258 lbs (117 kg)	58°F (14.4°C)	58°F (14.4°C)	57°F (13.9°C)	11.9
155	272 lbs (123.4 kg)	58°F (14.4°C)	58°F (14.4°C)	57°F (13.9°C)	12.6
162	284 lbs (128.8 kg)	58°F (14.4°C)	58°F (14.4°C)	57°F (13.9°C)	13.3
169	297 lbs (134.7 kg)	58°F (14.4°C)	58°F (14.4°C)	57°F (13.9°C)	13.9
176	310 lbs (140.6 kg)	58°F (14.4°C)	58°F (14.4°C)	57°F (13.9°C)	14.6

Appendix B

Weekly Ventilation Checklist

Warm Season

Never Stop Improving *Ventilation.*

When checking system, ensure all doors are closed and facility is in normal operation. Remember to establish goals and keep targets in mind.

Fans	1. Check fan blades, louvers, blinds and frames; clean, seal, patch or replace as needed to improve efficiency and minimize infiltration	○
	2. Verify proper shutter opening according to fan power and controller setting; check that voltage match, cone integrity and attic and inlet capacity are unrestricted	○
	3. Check belt tension; replace belt or adjust pulley as needed	○
	4. Check frames and blinds for infiltration points; seal, patch and replace areas as needed	○
	5. Ensure manure is at a level (>2 ft below base) that doesn't impact pit fan power; pump manure or increase ventilation rates if needed	○
	6. Check cones; replace or patch as needed	○
Soffits	7. Ensure there is 2x more soffit opening than maximum inlet opening to reduce restriction; add fresh air inlet as needed	○
	8. Clean air entry of dust; replace bird wire if necessary	○
Inlets	9. Use anemometer to ensure desired air speed is achieved per the goal (std: 600-800 FPM); review controller setting, fan power, fan efficiency, inlet openings and fix any infiltration	○
	10. To ensure blinds have proper opening, use an anemometer and adjust inlet opening to achieve the desired air speed at each fan	○
	11. If ceiling inlets are entering warmer air than the curtain, they should be closed Note: *It may be beneficial to leave a small opening to reduce hot air dumping into barn when transitioning from curtain to inlets*	○
Curtains	12. Check for infiltration problems; patch any holes, tighten tensioning rope and replace as needed	○
	13. Use anemometer and adjust curtain controller to achieve the desired air speed	○
	14. Check movement per cycle and adjust curtain controller to achieve correct opening between stages (std: 2-4" per cycle)	○
	15. Check ropes; tighten or replace as necessary	○
Cooling Pad	16. Use anemometer to check that the desired air speed goal is being achieved (std: 350-400 FPM); also use infrared thermometer to determine cooling of entering air matches proper temperature reduction goal. If issue is still not corrected, the cool cell area may need to be recalculated and pads added or removed to achieve the desired air speed	○
	17. Check cooling pad for infiltration problems; if in framework patch or replace, if in pad simply replace as needed	○
	18. Confirm pad is wet and free of dry spots; if dry spots are present flush and clean drip system, a water treatment or filtration system may be beneficial in reducing future occurrences	○
	19. Check for calcification and algae build up, clean and replace pad as needed; various pad treatment products are available to extend the time between cleanings and the life of the pad	○
Environmental	20. Adjust controller and curve to achieve the desired room temperature; especially important when starting a new turn of pigs (see PIC Wean to Finish Manual for recommended curves)	○
	21. To achieve the ideal pig thermoneutral zone and reduce major fluctuation between stages, check inlet opening, fan power, bandwidth and infiltration to achieve proper air exchange and maintain desired room temperature	○
	22. Set bandwidth on controller at desired level between 1.0°F and 1.5°F for variable speed fans	○
	23. If doors stick or involuntarily slam, then static pressure is too high; adjust fan power and/or inlet opening for the desired air speed	○
	24. Ensure probes are clean, accurate and placed just out of pigs reach and not directly in front of heaters, cool cells or any major air drafts; minimum of three probes/barn	○
	25. Use humidity probe to ensure humidity is below 65%; if greater check fan power, inlet/curtain opening, controller setting and air speed to improve air exchange rates	○
	26. Confirm that slats are dry throughout the entire pen (comfort zone); adjust water pressure (nursery: 500ml/min, finishing: 1000ml/min) and locate over slats; improve air exchange rates as mentioned above	○
	27. Ensure gas levels are within an acceptable range (ammonium level) and dust build up is minimal; improve air exchange as needed	○

Humidity _____ Air Speed _____ Temperature _____

PIC®

Name of Evaluator _____ Date _____

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Appendix C

Weekly Ventilation Checklist

Cold Season

Never Stop Improving *Ventilation.*

When checking system, ensure all doors are closed and facility is in normal operation. Remember to establish goals and keep targets in mind.

Fans	1. Check fan blades, louvers, blinds and frames; clean, seal, patch or replace as needed to improve efficiency and minimize infiltration	○
	2. Verify proper shutter opening according to fan power and controller setting; check that voltage match, cone integrity and attic and inlet capacity are unrestricted	○
	3. Check belt tension; replace belt or adjust pulley as needed	○
	4. Ensure manure is at a level (>2 ft below base) that doesn't impact fan power; pump manure or increase ventilation rates if needed	○
	5. Ensure plastic or commercial fan covers are installed over unused fans	○
Soffits	6. Ensure there is 2x more soffit opening than maximum inlet opening; open or close soffit sides determined by wind direction to reduce drafts while maintaining 2x opening	○
	7. Clean air entry of dust; replace bird wire if necessary	○
Inlets	8. Use anemometer to ensure desired air speed is achieved per the goal (std: 600-800 FPM); review controller setting, fan power, fan efficiency, inlet openings and fix any infiltration	○
	9. Use anemometer and adjust controller to achieve desired air speed at each stage; when using a static pressure controlled inlet, adjust counter balances, curtain controllers and blades accordingly	○
	10. Check that all inlet blinds are clean, intact and open uniformly; clean and replace as needed	○
	11. Clear any obstructions; if frozen, thaw/maintain an inlet opening of at least 0.5 -1.0" to prevent future freezing	○
Curtains	12. Check for infiltration problems; patch any holes, tighten tensioning rope and replace as needed	○
	13. Use anemometer and adjust curtain controller to achieve the desired air speed	○
	14. Prevent air drafts by checking curtain seal at the top (2-3" of overlap); adjust curtain up and/or add additional top plate as needed	○
	15. Check movement per cycle and adjust curtain controller to achieve correct opening between stages (std: 2-4" per cycle)	○
	16. Check ropes; tighten or replace as necessary	○
	17. Check insulation; add bubble wrap or other insulation along curtain as needed	○
Cooling Pad	18. Check cooling pad for infiltration problems; if in framework patch or replace, if in pad simply replace as needed	○
	19. To prepare for winter, flush and clean entire system to eliminate possibility of freezing, add insulation along inside of cool cell and curtain to reduce drafts	○
Environmental	20. Adjust controller and curve to achieve the desired room temperature; especially important when starting a new turn of pigs (see PIC Wean to Finish Manual for recommended curves)	○
	21. To achieve the ideal pig thermoneutral zone and reduce major fluctuation between stages, check inlet opening, fan power, bandwidth and infiltration to achieve proper air exchange and maintain desired room temperature	○
	22. Set bandwidth on controller at desired level at or above 1.5°F for variable speed fans	○
	23. Use humidity probe to ensure humidity is below 65%; if greater check fan power, inlet/curtain opening, controller setting and air speed to improve air exchange rates	○
	24. Ensure enough time between heaters or fans shutting off before fans or heaters turn on to allow for proper air distribution; set heater offset at ≥ 2.0°F and adjust probe positioning as needed	○
	25. If doors stick or involuntarily slam, then static pressure is too high; adjust fan power and/or inlet opening to achieve the desired air speed	○
	26. Confirm that slats are dry throughout the entire pen (comfort zone); adjust water pressure (nursery: 500ml/min, finishing: 1000ml/min) and locate over slats; improve air exchange rates as mentioned above	○
	27. Ensure probes are clean, accurate and placed just out of pigs reach and not directly in front of heaters, cool cells or any major air drafts; minimum of three probes/barn	○
	28. Ensure gas levels are within an acceptable range (ammonium level) and dust build up is minimal; improve air exchange as needed	○

Humidity _____ Air Speed _____ Temperature _____

PIC®

Name of Evaluator _____ Date _____

Appendix D

Site Map

Source **Health Status** **Planned Inventory** **Desired Room Temperature**

Head Received= /General Population Pens = Head/Pen

PEN	IC Y/N	Receiving	After Initial Sort	Feeder Pig Phase	ALLEY	PEN	IC Y/N	Receiving	After Initial Sort	Feeder Pig Phase
1						21				
2						22				
3						23				
4						24				
5						25				
6						26				
7						27				
8						28				
9						29				
10						30				
11						31				
12						32				
13						33				
14						34				
15						35				
16						36				
17						37				
18						38				
19						39				
20						40				
					TOTALS					

Appendix E

Site Inspection Checklist

Cleaning Preparation Review		Interior Inspection	
Was the Wash Crew Approved and Trained	Y N	Has the building been washed?	Y N
Was the washing equipment clean and disinfected before arriving to site?	Y N	Is building bird free?	Y N
		Are ceilings clean?	Y N
Last group's known pathogens?		Are feed lines clean?	Y N
		Are water lines and nipples clean?	Y N
		Are all heaters and brooders clean?	Y N
		Is the penning clean?	Y N
Date that the last pig was in site?		Are the feeders/gruel pans clean?	Y N
Date when all previous mortalities removed?		Are the pen side walls and end walls clean?	Y N
Planned site downtime?		Are the slats clean?	Y N
Date that Wash Crew Began?		Are all mats clean and water removed?	Y N
Date that the Wash Crew completed?		Are control panels clean?	Y N
Is the entire site cleaned prior to pig entry?	Y N	Are all wall fans louvers and blades clean?	Y N
Are feed bins cleaned prior to pig entry?	Y N	Are the curtains clean?	Y N
Exterior Inspection		Are sort panels clean?	Y N
Fans Cleaned?	Y N	Is building disinfected?	Y N
Is exterior debris and harborage removed?	Y N	Will building be dry at pig placement?	Y N
Vegitation trimmed and maintained?	Y N	Is the load--out area clean?	Y N
3ft/1m rock perimeter maintained?	Y N	Notes and Opportunities	
Pit Pump--Outs covered Properly	Y N		
Attic Soffits Clean?	Y N		
Bin Pads Clean?	Y N		
Mortality Management Device Clean & Operational?	Y N		
Bait Maintained?	Y N		
Bin Pads Clean?	Y N		
Loading Chute Clean?	Y N		
Is the Loading Chute Shared?	Y N		
Curtains and Exterior in Good Order?	Y N		
Office Inspection			
Boots Cleaned?	Y N		
Coveralls Cleaned?	Y N		
Shower and Floor Clean?	Y N		
Previous Turn's Garbage Removed?	Y N		
Proper Documents and Postings in Place?	Y N		
Are all necessary supplies in place?	Y N		

Appendix F

Vices Checklist

Check Point		Target	Comments
Diets	Ensure feed micotoxin are kept a minimum	Review PIC Nutrition Manual	
	Check Salt concentration in feed	Review PIC Nutrition Manual	
	Amino Acid Profile	Review PIC Nutrition Manual	
	Real Feed Intake vs. Budget	% Accomplisment	
Feed	Pellets Fines	< 20% in the feeder Pan	
	Particle Size	<30% <300 & < 7.5% <150 microns	
	Feeder Pan Coverage	40-50%	
	Feeder Spaces (Stress or poor availability)*	1 in. NRY & 2 in. FIN (dry)	
	Feed Outage Event	Aviod. Last 3 events?	
Temp.	Room Temperature	Based: Pig Weight, Barn Design and Health	
	Temperature fluctuations during 24hrs	Daily Information Max. and Min.	
Environmental	Gases Quality: NH3 & H2S & CO2 & CO	<20ppm & <5ppm & <3,000ppm & <30ppm	
	Evidences of drafts in pigs level	Pigs Behavoir	
	Inlet Air Speed	600-800 FPM	
	Tunnel Air Speed	300-400 FPM	
Barn	Humidity	< 65%	
	Light Intensity and Hour On and Off	16 hrs with quality light and 8 hrs dark	
	Stray Voltage	Technical Measures	
Water	Pigs/Drinker	10-12 pigs/drinker	
	Water Pressure	NRY; 0.5lt/min; FIN;1.0 lt/min	
	Water Quality	Review PIC Nutrition Manual	
Pens	Stocking Density*	2.85-3.65sqft/pig NRY & 7.5-8.0 sqft/pig FIN	
	Wet Pens	Dry Pens	
	New Concrete or change on floor surface	Foot Trauma	
	Objects provided for enrichment (Dirty?)	Effectively In Use	
	Split Sexing	Barrows have more activity	
	Parity Implication	Gilt progeny evaluated	
	Mixing Pigs	Mix produce more fighting	
Pigs	Tail Length in particular variability	1/4 inch goal at processing	
	Diseases (Respiratory, PRRS or Greasy Pigs)	Diseases predispose vices	

* Nursery 12-50/75 lbs. FIN> 265lbs

Appendix G

Early Pig Care Daily Checklist

HOUSING

1. Place pigs in clean, dry pens with 4’ x 8’ mat per 60 head
2. Pre-warm barn to 70-75°F (21-24°C) and have brooders lit
3. Maintain a room temp of 74-76°F (23-24°C) at stocking
    a. Create a comfort zone of 95°F (35°C) directly below brooder
    b. Brooders and mats are needed for 2-4 weeks
    c. 0.4 ft^2 per head zone heat
    d. Two (2) CFM per head minimum ventilation
    e. Drop zone temps two (2) degrees weekly, until no longer needed
    f. Pigs should lay 1½ deep
    g. Goal: 70°F (21°C) room temp by 8-weeks placed
4. 2.8 ft^2 per head up to 50 lbs (23 kg)
    a. 3.65 ft^2 after 50 lbs (23 kg), if double stocking
5. 10% of space for fall behinds and sick pens
6. Feeder space
    a. 1” Feeder space per pig
    b. When using wet-dry feeders – leave water in the feeder off for the first few weeks
    c. Have supplemental drinkers in the pen

WATER

7. Nipple height should be at the top of the shoulders for the smallest pig in the pen
8. One nipple per 10 head or one cup per 10 head
9. CLEAN OUT, DISINFECT and fill with fresh water
10. Drip nipples or cups for first 3-6 hours on arrival

FEED

11. High quality starter ration
    a. Have fresh feed stocked when pigs are placed
    b. Only fill feeders being used – No more than two (2) days’ worth of feed
12. Creep feeding – goal is to stimulate eating
    a. Approximately 8 ounces of feed on mat per 30 pigs, 3-6 times per day
13. Gruel feeding – useful for hard starters
    a. 3:1 ratio of feed to water to be consumed within 30-minutes
    b. Three (3) inches of feeder space per pig to assure that all pigs may consume gruel simultaneously

Appendix H

Treatment Log

Treatment

PIC

Site		Turn ID		Fieldman		
Source		Caretaker		Date Range		

Week		Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.	Weekly Total	Cumulative Total
	Number Treated									
	Drug									
	Dose									
	Number Treated									
	Drug									
	Dose									
	Hi Temp									
	Low Temp									
	Water Consumed									
	Hd. Pulled									
	Initials									
	Number Treated									
	Drug									
	Dose									
	Number Treated									
	Drug									
	Dose									
	Hi Temp									
	Low Temp									
	Water Conusmed									
	Hd. Pulled									
	Initials									
	Number Treated									
	Drug									
	Dose									
	Number Treated									
	Drug									
	Dose									
	Hi Temp									
	Low Temp									
	Water Conusmed									
	Hd. Pulled									
	Initials									
	Number Treated									
	Drug									
	Dose									
	Number Treated									
	Drug									
	Dose									
	Hi Temp									
	Low Temp									
	Water Conusmed									
	Hd. Pulled									
	Initials									

Appendix I

Mortality Log

Mortality Sheet

PIC

Site		Turn ID		Fieldman	
Source		Wt. In		Inventory In	
Date In		Health Status		Day 1 Setpoint	

Week	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.	Weekly Total	Cumulative Total
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									

Appendix J

Reference of Growth and Feed Intake Curve for PIC Sired Pigs From Weaning to 28 Weeks of Age

(Check with a PIC representative for specific curves)

Age days/weeks	Weight lbs (kg)	Average daily gain lbs (gr)	Weekly feed intake lbs (kg)	Cumulative average daily gain lbs (gr)/day	Cumulative feed intake lbs (kg)	Cumulative feed conversion
21/3	13.1(5.9)					
28/4	16.1(7.3)	0.42(190)	3.1(1.4)	0.42(190)	3(1.4)	1.05
35/5	20.9(9.5)	0.69(313)	5.8(2.6)	0.56(254)	9(4.0)	1.14
42/6	27.0(12.2)	0.87(394)	7.9(3.6)	0.66(299)	17(7.6)	1.21
49/7	34.0(15.4)	1.01(458)	9.9(4.5)	0.75(340)	27(12.1)	1.27
56/8	43.7(19.8)	1.37(621)	14.2(6.4)	0.87(394)	41(18.5)	1.33
63/9	54.5(24.7)	1.54(698)	17.1(7.8)	0.98(444)	58(26.3)	1.40
70/10	65.9(29.9)	1.63(738)	19.2(8.7)	1.08(489)	77(35.0)	1.46
77/11	78.2(35.4)	1.75(793)	22.4(10.1)	1.16(525)	100(45.1)	1.53
84/12	91.2(41.3)	1.86(843)	25.5(11.6)	1.24(562)	125(56.7)	1.60
91/13	104.9(47.5)	1.96(888)	28.6(12.9)	1.31(593)	154(69.6)	1.68
98/14	119.1(54.0)	2.02(915)	31.4(14.2)	1.37(621)	185(83.8)	1.75
105/15	133.6(60.5)	2.08(942)	33.9(15.4)	1.43(648)	219(99.2)	1.82
112/16	148.5(67.3)	2.13(965)	36.2(16.4)	1.49(675)	255(115.6)	1.88
119/17	163.6(74.1)	2.15(974)	38.2(17.3)	1.54(698)	293(132.9)	1.95
126/18	178.7(81.0)	2.16(978)	39.9(18.1)	1.58(716)	333(151.0)	2.01
133/19	193.8(87.8)	2.16(978)	41.4(18.8)	1.62(734)	375(169.8)	2.08
140/20	208.9(94.6)	2.15(974)	42.7(19.4)	1.65(747)	417(189.1)	2.13
147/21	223.8(101.4)	2.12(960)	43.8(19.8)	1.67(757)	461(208.9)	2.19
154/22	238.4(108.0)	2.10(951)	44.7(20.3)	1.70(770)	506(229.2)	2.25
161/23	252.8(114.5)	2.05(929)	45.5(20.6)	1.71(775)	551(249.8)	2.30
168/24	267.0(121.0)	2.02(915)	46.2(20.9)	1.73(784)	598(270.7)	2.35
175/25	280.7(127.2)	1.96(888)	46.7(21.2)	1.74(788)	644(291.9)	2.41
182/26	294.1(133.2)	1.91(865)	47.2(21.4)	1.74(788)	692(313.3)	2.46
189/27	307.0(139.1)	1.85(838)	47.6(21.6)	1.75(793)	739(334.8)	2.51
196/28	319.6(144.8)	1.80(815)	48.0(21.7)	1.75(793)	787(356.6)	2.57

Appendix K

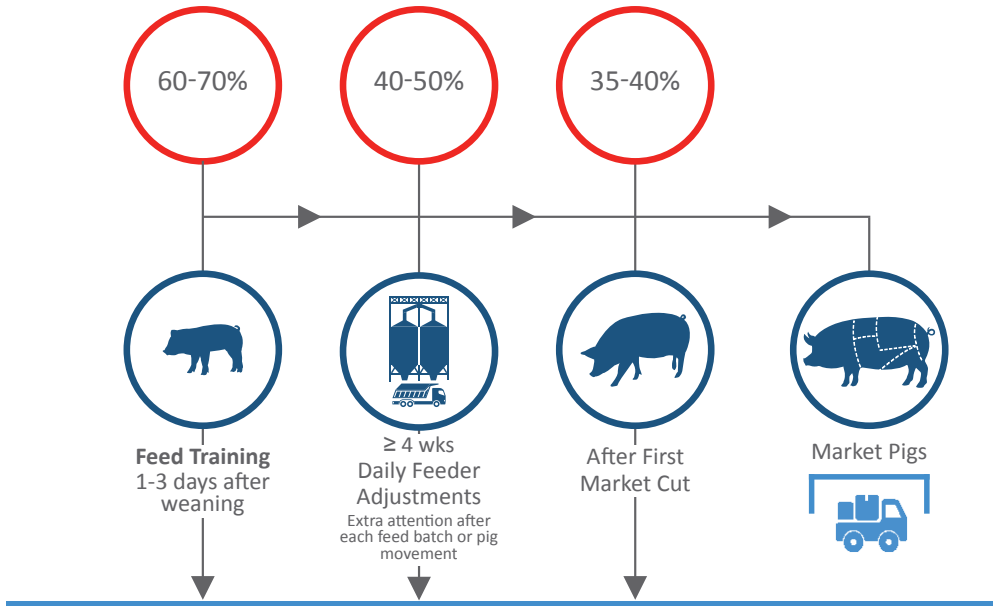
Wet-Dry Feeder Adjustments

Never Stop Improving *Your Success.*

Proper feeder adjustment is critical for optimum average daily gain and feed conversion.
If feeder adjustment is too tight, growth and FCR are compromised.
When feeders are too open, feed is wasted.

PAN COVERAGE: PERCENTAGE OF THE FEED PAN'S FLAT PORTION COVERED BY FEED. EACH SPECK, DUSTING OR MOUND OF FEED COUNTS. WET-DRY FEEDER = WET FEED IN PAN

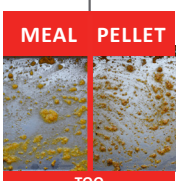
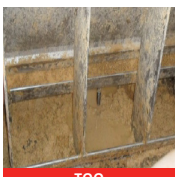
PAN COVERAGE RECOMMENDED



DRINKERS & WATER FLOW (ml/min)

Feeder Nipples On/Off	Feeder Nipples On
If off: Auxiliary water source, 1 drinker/10-12 pigs If on: Water flow 500-600 ml/min	≥ 4 weeks feeder nipples on Water flow 800-1,000 ml/min

Examples of Wet-Dry Feeder Adjustment Situations

MEAL PELLET	MEAL PELLET	MEAL PELLET	MEAL PELLET		MEAL PELLET
					
TOO TIGHT	**TOO OPEN**	**DESIRABLE ADJUSTMENT**	**DESIRABLE ADJUSTMENT AFTER FIRST MARKET CUT**	**WATER FLOW PROBLEMS/WRONG NIPPLE**	**TOO DRY**
Pan coverage 20% ADG and FCR negative impact No moistened feed	Feed accumulation Spoiled feed FCR impact and water availability problems	Pan coverage 50% Good activity. Pigs are drinking and eating Wet feed pan	Pan coverage 35-40% Good activity. Pigs are drinking and eating Wet feed pan	Incorrect water access and feed can't be properly moistened Check water pressure and flow	Lost WD feeder advantage Feeder space could be restricted

PIC RECOMMENDS:

Linear feeder space per pig: 1.15- 1.25 inch · Individual feeder space: 15 inches/pig · 12-13 pigs per feeder space and drinker

Auxiliary water sources especially with pigs > 180 lbs. and temperatures > 85°F

Whenever <10 pigs/feeder space, more attention in feeder adjustment is needed.

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Appendix L

Dry Feeder Adjustments

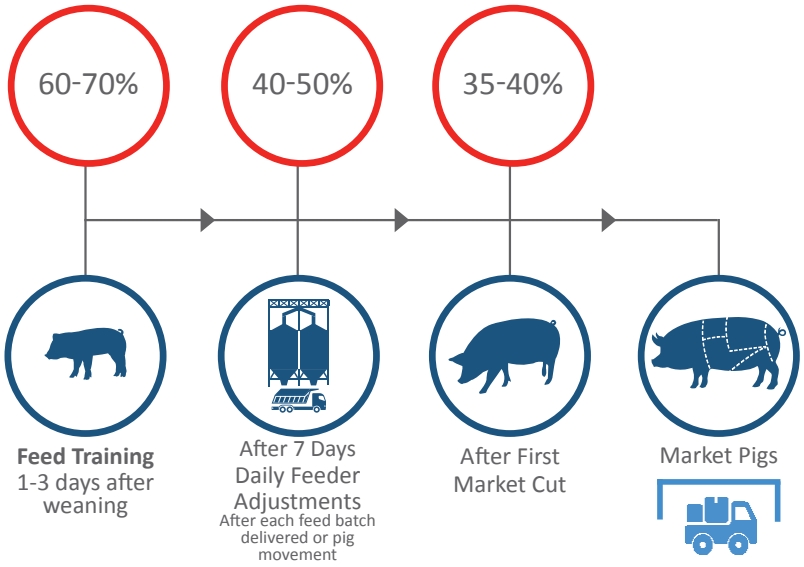
Never Stop Improving Your Success.

Proper feeder adjustment is critical for optimum average daily gain and feed conversion.
If feeder adjustment is too tight, growth and FCR are compromised.
When feeders are too open, feed is wasted.

PAN COVERAGE: PERCENTAGE OF THE FEED PAN'S FLAT PORTION COVERED BY FEED. EACH SPECK, DUSTING OR MOUND OF FEED COUNTS.

↑ PAN COVERAGE	↓ PAN COVERAGE
Relieve feeder pressure in short linear feeder space and/or high stocking density scenarios	To avoid feed wastage in greater than recommended linear feeder space and/or low stocking density scenarios.

PAN COVERAGE RECOMMENDED



Examples of Dry Feeder Adjustment Situations

TOO TIGHT
PAN COVERAGE 20%

- Minimal feed access
- Negative impact on feed conversion & average daily gain
- Potential vices problems

DESIRABLE ADJUSTMENT
PAN COVERAGE 40-50%

- Desirable pan coverage
- Target: Tighter adjustment as pigs grow

DESIRABLE ADJUSTMENT AFTER FIRST MARKET CUT
PAN COVERAGE 35-40%

- Desirable pan coverage after first market cut

TOO OPEN

- Adjust feeder
- Feed accumulation
  Negative impact on feed conversion rate
- No benefits in average daily gain

PIC RECOMMENDS:

Individual feeder space
15 inches/ feeder space width

Linear feeder space
Nursery = 1 inch/pig
Finishing = 1.88 - 2.0 inches/pig

Wean-to-Finish feeder depth
8 - 12 inches

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