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GILT AND SOW MANAGEMENT GUIDELINES

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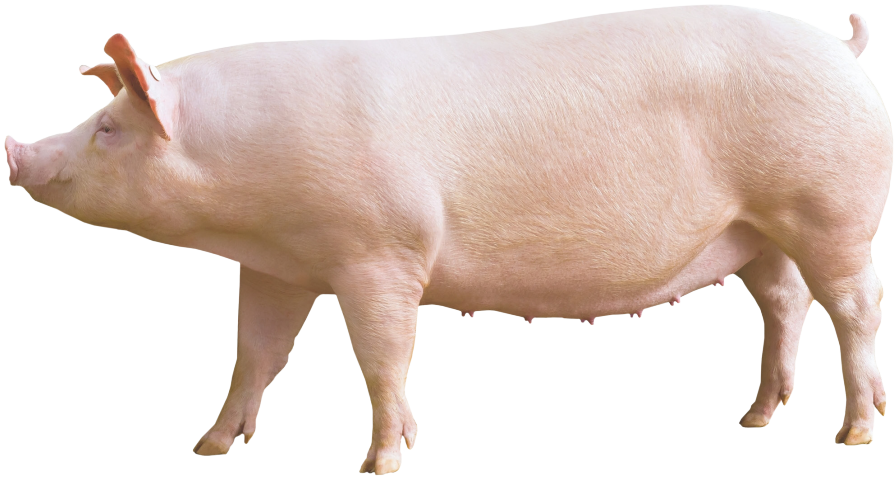
Welcome to the PIC Gilt and Sow Management Guidelines



We are pleased to present the PIC Gilt and Sow Management Guidelines. These guidelines are intended to provide recommendations for staff working at a commercial sow farm. In addition, these good management practices are also applicable to multipliers and production nucleus farms.

The guidelines are divided into seven sections that cover the different phases of production on a sow farm. Each section contains expectations, good management practices and advice for troubleshooting the most common issues. In order to simplify and speed up the search for the information, we have made a serious effort to replace long texts by tables.

The material has been reviewed by professionals and experts across the world to make it a global reference. The focus is on the biology of the animals, independent of the geographical location, size of operation, sow:worker ratio, facilities set up or use of specific feed ingredients. The guidelines focus on production management and we have chosen to leave out biosecurity and health protocols and acclimatization practices. We suggest you reach out to your herd veterinarian or our Health Assurance team to develop a tailored program based on your circumstances. Last, but not least, we have added separate sections for group housing and for batch farrowing.

We recognize that there are different ways to achieve the desired results so these guidelines do not reject other management strategies.

This document is intended to provide guidance and suggestions to our valued customers. At all times, please follow the best practices and appropriate standards with respect to animal welfare and health as outlined by the local governing body, within your country.

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Glossary of Terms & Acronyms

Section 1

PICpro100
An algorithm developed by PIC to remotely screen production processes, assigning then a score from 0 to 100.

Parity
Female age based on how many farrowings they have. Thus, Parity 0 is gilt that has been bred but still has not farrowed; parity 1 is a female that has farrowed once before.

Parity dip
It is when litter size drops from one parity to the next. Usually from parity 1 to parity 2.

Target
The numerical value of a goal.

Intervention level
The actual performance value that should trigger defined actions to break a performance trend and improve.

Breed back
Percentage of the weaned females that shows standing heat within a given period, usually 7 days.

Piglet conversion
Percentage of weaned pigs out of the total number of pigs born in a given period.

Pigs weaned/sow/year
Number of weaned pigs in a full year divided by the average inventory of mated females.

Average age at removal
Age of the sows, in number of parities, when the removal (death loss and culling) happens.

Section 2

Eligibility for breeding
A set of characteristics that make a group of gilts ready to be bred with no negative long term repercussions and optimized economics.

First breeding
The first insemination that a female gets in its life.

Lifetime performance
Average number of weaned (or marketed) pigs until the female is culled or dead.

Nursery
Usually the phase from weaning to 11 weeks of age.

Grower
Usually the phase from 11 weeks of age to 22 weeks of age.

GDU
It stands for gilt developer unit. It is usually the phase from 22 weeks of age to 28 to 30 weeks of age.

cfm
It stands for cubic feet per minute. It is an expression of the volume of air moving through a ventilation system or other space.

Sq. ft.
It stands for square foot, a non-metric unit of area, equivalent to 144 square inches.

Breeding interval length
Time elapsed from the moment the first female is bred until the moment when the last one is bred in the day.

AI/AO
It stands for all in-all out. It refers to the way a room or an entire building is loaded and emptied.

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Section 3

Meishan crosses
Any individual containing blood from Meishan genotypes. They are broadly utilized as heat detection boars.

Fostering
Action to relocate individual piglets to another sow to give them more chances to nurse.

Section 4

Pre-implantation
Flow where sows are moved to groups in early gestation, usually within 4 days after breeding.

Post-implantation
Flow where sows are usually moved to groups after spending the first 4 weeks of gestation in individual spaces.

Static
The group is constituted at once, social hierarchy stabilizes and the group is left intact for the duration of gestation.

Dynamic
The group is constantly changing by ~15 to 20% of the individuals. Essentially it is a continuous flow system that looks to optimize space utilization.

Catabolic period
A time where body weight is lost, due to lack of enough feed intake or diets that don't meet the required nutrient specifications for the age/weight/physiological status.

Section 5

ft.
It stands for feet, a non-metric unit of length.

Split-suckle
A practice to separate part of the litter for a defined period, to allow the remaining piglets full access to the udder, with no competition.

Runt litters
Litters created by placing small but viable piglets on a good nursing sow.

Parity structure
The combination of the different ages of the sow census.

PWM
It stands for preweaning mortality

Runt
Small but viable piglet

Section 6

Late weaners
Sows that don't show signs of estrus 7 days after weaning and beyond.

Non-productive days
Days where the sow is either not gestating nor lactating.

Section 1:

General Farm Review

This section provides checklists on key performance indicators related to general sow farm processes and performance. Comparing actual values versus target levels will help sow farm managers identify improvement opportunities to get the most value out of their operations. It will also indicate the need for intervention.

Process Review

It is essential to understand the processes that could potentially limit the expression of the genetic potential. PIC has developed the PICpro100 tool to objectively assess a producer's production practices. PICpro100 uses an algorithm developed by PIC that assign a score to 23 production practices most associated with high sow herd performance by comparing them against accepted good management practices. PICpro100 can be used to complement more traditional methods to review and evaluate sow herd performance. The PIC Technical Services Team or your PIC Account Manager can help you gain additional exposure to this tool.

Performance Review

In addition to reviewing production processes, it is important to review performance records by parity and over a period of minimum 13 weeks. Key indicators to watch are farrowing rate, litter size, pre-weaning mortality, sow mortality, breeds per week and how many weeks are off target, replacement rate, wean to service interval, presence of parity dip and number of doses per sow in estrus. Many other indicators can be reviewed but the first screening will suggest which indicators to review and/or what to watch for during a farm visit.

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Table 1.1: Gilt Management Program Targets

Key Performance Indicator	Target	Intervention Level
Mortality 3 to 25 weeks of age	≤ 3%	≥ 5%
Selection at 25 weeks of age	70 to 80%	≤ 65% and > 90%
Percentage of gilts bred at/after 2nd estrus	≥ 95%	≤ 90%
Recorded estrus on week 4 after beginning of boar exposure at 24-26 weeks of age	> 70%	≤ 50%
Parity 1 farrowing rate	> 93%	< 90%
Parity 1 litter size	≥ 15.5 total born ≥ 14.5 born alive ≥ 13.5 pigs weaned	≤ 14.5 total born ≤ 13.5 born alive ≤ 12.5 pigs weaned
Parity 1 breed back	≥ 90%	≤ 85%
Parity 1 wean to service interval	≤ 6 days	≥ 7 days
Retention rates (starting with 100 bred gilts)	≥ 95 parity 1 ≥ 85 parity 2 ≥ 75 parity 3	< 85 parity 1 < 75 parity 2 < 65 parity 3

Table 1.2: Entire Farm Targets

Key Performance Indicator	Target	Intervention Level	Target	Intervention Level
Lactation Length	21 days		28 days	
Farrowing Rate	> 92%	< 90%	> 92%	< 90%
Litters/Sow/Year	≥ 2.50	≤ 2.45	≥ 2.40	≤ 2.35
Avg Total Born	≥ 16.0	≤ 15.0	≥ 16.3	≤ 15.0
Avg Born Alive	≥ 15.0	≤ 13.8	≥ 15.3	≤ 13.8
Avg Weaned	≥ 14.0	≤ 12.5	≥ 14.3	≤ 12.5
Piglet Conversion	> 88%	< 83%	> 88%	< 83%
Breed-back	≥ 92%	≤ 88%	≥ 93%	≤ 89%
Avg Wean to Service Interval	< 5.5 days	> 7.0 days	< 5.0 days	> 7.0 days
Annual Sow Mortality	≤ 5%	≥ 8%	≤ 5%	≥ 8%
Pigs Weaned/Sow/Year	> 35.0	< 30.6	> 34.2	< 29.4
Pigs Weaned/Farrowing Space/Year	≥ 212	≤ 185	≥ 167	≤ 144
Pigs Weaned per Lifetime	≥ 67	≥ 59	≥ 66	≥ 56

Table 1.3: Specific Reproductive Targets

Key Performance Indicator	Target	Intervention Level
Breeding group variation, % above or below target	< 5%	> 10%
# of weeks off breeding target within last 13 weeks	< 2	> 3
Conception rate	> 97%	< 92%
Total return rate (includes regular, non-regular and late returns), as % of the breeds	< 5.0%	> 10%
Abort rate, as % of the breeds	< 1%	> 3%
Not-in-pig sows, as % of the breeds	< 0.5%	> 1%
Vaginal discharge, as % of the breeds	< 0.5%	> 1%
Other reproductive failure (including dead and destroyed while pregnant), as % of the breeds	< 1%	> 3%
Annual gestation feed usage per sow	1,550-1,650 lbs (700-750 kg)	> 1,700 lbs and < 1,500 lbs (> 770 kg and < 680 kg)
Feed usage in wean to service interval	> 50 lbs (> 45 lbs in Parity 1) > 23 kg (> 20 kg in Parity 1)	< 35 lbs (< 30 lbs in Parity 1) < 16 kg (< 13.5 kg in Parity 1)
Sows in ideal body condition by day 30 of gestation, as % of the group	> 85%	< 80%
Sows in ideal body condition going to farrowing, as % of the group	> 90%	< 85%

Table 1.4: Specific Farrowing Targets

Key Performance Indicator	Target	Intervention Level
Birth Weight	≥ 3.0 lbs/pig (≥ 1.35 kg/pig)	< 2.5 lbs/pig (< 1.1 kg/pig)
Pre-weaning mortality	< 10%	> 12%
Avg piglet weaning weight Lbs (kg) weaned/Sow/Year at 21-22 days of age	> 13 lbs/pig (> 6 kg/pig) > 455 lbs/sow/year (> 205 kg/sow/year)	< 12.0 lbs/pig (< 5.5 kg/pig) < 370 lbs/sow/year (< 168 kg/sow/year)
Avg piglet weaning weight Lbs (kg) weaned/Sow/Year at 28 days of age	> 16 lbs/pig (> 7.25 kg/pig) > 547 lbs/sow/year (> 248 kg/sow/year)	< 14.5 lbs/pig (< 6.5 kg/pig) < 426 lbs/sow/year (< 193 kg/sow/year)
Nurse sows, as % of the weekly farrowings	5%	> 10%

Table 1.5: Key Indicators Associated To Parity Structure On A Commercial Farm

Key Performance Indicator	PIC Targets	Intervention Level
Annual replacement rate	45 - 55%	< 40%; > 60%
Culling rate	40 - 50%	> 55%
Sow mortality, death rate, euthanized	< 5%, < 3%, < 2%	> 9%, > 6%, > 4%
Avg herd age	Parity 3.5	< Parity 3.0; > Parity 4.0
Avg age at removal	> Parity 5	< Parity 4.5; > Parity 6.3
Gilt utilization up to parity 1 (% of gilts farrowed out of arrived gilts with 20+ weeks of age)	> 95%	< 90%
Gilt utilization up to parity 2	> 85%	< 75%
Gilt utilization up to parity 3	> 75%	< 65%
Gilt utilization up to parity 6	> 55%	< 45%

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Financial Impact Of Key Performance Indicators

In addition to reviewing the production KPIs, we encourage the review of financials associated with these targets and any proposed management changes. This will help to understand where to prioritize efforts and deploy resources when attempting to address indicators that are not up to the expectations.

Farm Visit

The ultimate farm review is an in-person visit. It will help to confirm or rule out what is suspected from the records and remote review of the processes. It is also important to check that sick animals are timely treated and to discuss with the farm manager any concern about animal well-being.

Table 1.6: Signs/Symptoms To Watch When Visiting A Sow Farm

Key Performance Indicator	Healthy	Distress
Appetite	Consumes all feed	Off-feed, feed refusal
Body condition	Able to maintain it	Weight loss
Response to stimulus	Stand up	Won't stand up; Apathetic or lethargic
Soundness and structure	Bearing weight evenly on all four legs	Lameness
Skin and cover	Short and smooth hair; Pink skin	Long or rough hair; Yellow, pale, red or blue skin
Pregnancy	Able to maintain pregnancy; Mammary gland development	Abortion; No mammary gland development
Body temperature	Normal: up to 101.4°F (38.5°C) in gestation; Up to 104°F (40°C) while farrowing	Fever: > 101.4°F (38.5°C) in gestation; > 104°F (40°C) the day after farrowing
Respiratory	Normal frequency: 13-20/min	Coughing; Abnormal respiratory frequency
Feces	Manure is soft	Scours; Constipation
Urine	Long and strong urine stream	Short urine; White urine

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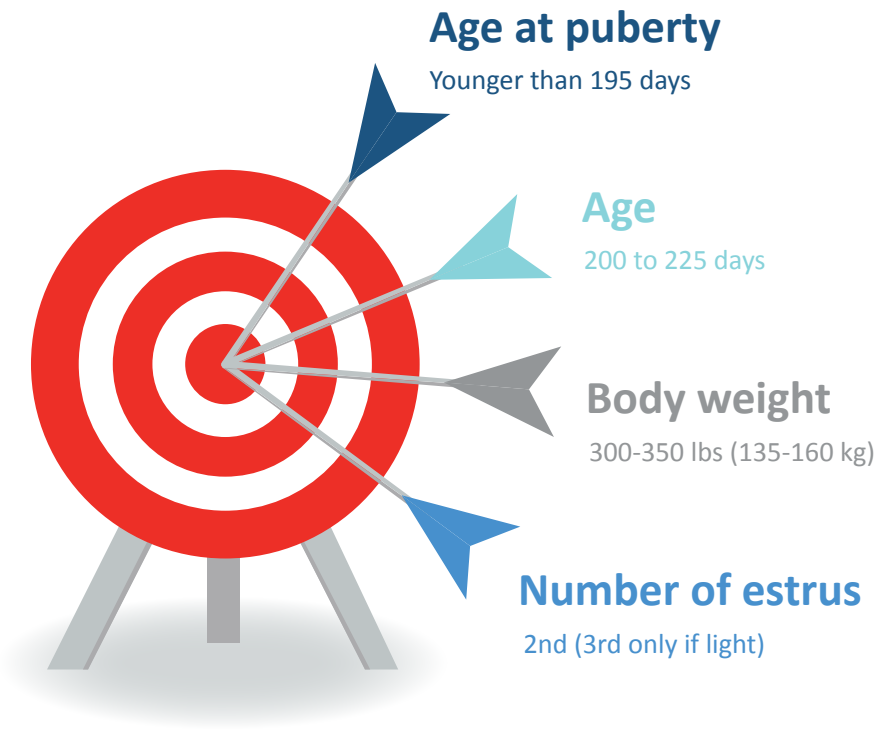
Section 2:

Gilt Management

This section provides recommendations and best practices for gilt management* to help producers prepare gilts to have high performance in their first parity while priming them for high lifetime performance.



*Gilt breeding eligibility targets have been updated based on a recent study, Data Driven PIC Gilts Eligibility for Optimized Lifetime Performance Collaborative Project by J. Patterson & J.C. Pinilla (2020).

Breeding Eligibility

Variation in performance across systems and within systems can partly be attributed to the quantity and quality of gilts at their first breeding. The gilt eligibility requirements associated with high performance in parity 1, high lifetime performance and optimized cost of production, are summarized in Table 2.1.

Table 2.1: Gilt Eligibility Requirements

Trait	Recommended Goal/Target
Age at puberty(*)	At least one recorded estrus: Camborough®: before 195 days in > 90% of gilts Purelines: before 195 days > 70% of gilts
Number of estrus at first breeding(*)	2nd estrus, third only if light 2+ in >90% of gilts < 5% at first estrus
Age at first breeding(*)	200 to 225 days >225 days gradually show lower retention rate and added cost
Body weight at first breeding(*)	>90% of gilts bred within the 300 to 350 lbs (135-160 kg) range Do not breed any gilt lighter than 300 lbs (135 kg)
Average daily gain from birth to first breeding	> 90% breed within the range 1.33 to 1.75 lbs/day (600-800 g) of lifetime weight gain
Immunity level	3+ effective weeks from last health procedure
Gilt selection/quality control	Do not breed gilts with any structural/conformational defects that affect walking or standing and ultimately farrowing and nursing
Feed intake pattern	Avoid feed outages; do not restrict feed in quantity nor quality within 14+ days prior to first breeding

(*) J. Patterson & J.C. Pinilla (2020). Data Driven PIC Gilts Eligibility for Optimized Lifetime Performance Collaborative Project. University of Alberta and PIC.

Determine Bodyweight at Breeding

Adequate body weight at first breeding is important to ensure adequate body reserves in the first lactation. Conversely, excess body weight will decrease longevity and lifetime productivity. Using a scale is the most accurate way to obtain body weight. However, when a scale is not available an indirect measure such as a flank-to-flank tape or a heart girth tape measurement can provide a a bodyweight estimate at breeding.

Take flank-to-flank measurements from the bottom of the left rear flank to the bottom of the right rear flank, running over the top of the sow (Figure 2.1). The measurement starts on one side where the fold of skin just above the mammary gland forms an angle with the skin from the leg. The measurement goes from the bottom of the rear left flank to the bottom of the right rear flank, running over the top of the sow.

Figure 2.1 – Flank-to-Flank Measurement

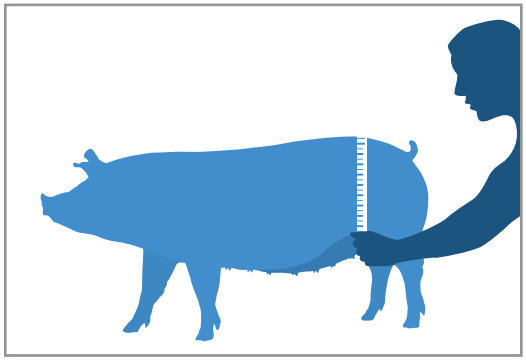


Table 2.2: Flank-to-Flank Measurements, Associated Bodyweights and Actions Related to Breeding

Flank-to-flank range, in	Flank-to-flank range, cm	Body weight, lb	Body weight, kg	Action
Less than 35.2	Less than 89.4	Below 300	Below 135	Avoid breeding. Postpone breeding to next estrus if body weight is < 300 lb or 135 kg
35.2 to 37.3	89.4 to 94.7	300 to 350	135 to 160	Breed in this estrus
More than 37.3	More than 94.7	Over 350	Over 160	Breed in this estrus. Flag female and feed the minimum daily feed allowance from breeding to the end of gestation.

Take heart girth measurements by wrapping the tape around the pig – just behind the animal's forelegs and shoulders and in front of the first mammary gland for sows (Figure 2.2). The tape should be snug.

Figure 2.2 – Heart Girth Measurement

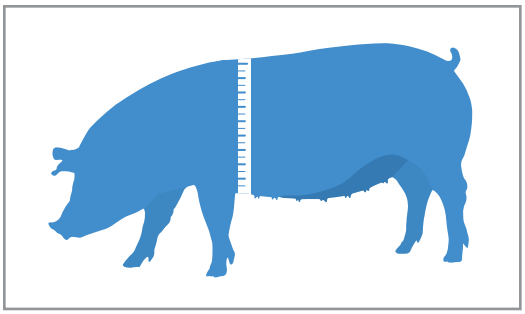


Table 2.3 Heart Girth Measurements, Associated Bodyweights and Actions Related to Breeding

Heart girth, in	Heart girth, cm	Body weight, lb	Body weight, kg	Action
Less than 49.7	Less than 126.2	Below 300	Below 135	Avoid breeding. Postpone breeding to next estrus if body weight is < 300 lb or 135 kg
49.7 to 54.6	126.2 to 138.7	300 to 350	135 to 160	Breed in this estrus
More than 54.6	More than 138.7	Over 350	Over 160	Breed in this estrus. Flag female and feed the minimum daily feed allowance from breeding to the end of gestation.

Good Management Practices

Under all circumstances, producers should adhere to the locally applicable laws that regulate management and housing practices, even if they differ from the recommendations presented in these guidelines. Find additional housing information in the PIC Wean-to-Finish Guidelines.

Table 2.4: General Housing Recommendations

Management Factor	Nursery Weaning - 70 Days of Age	Grower 70 Days of Age - Boar Exposure	GDU Boar Exposure - Breeding
Room temperature	Depends on weaning weight and age. To be on the safe side, consider room temperature ≥ 80°F (>26.5°C) Comfort can be achieved and/or managed with the use of mats and a heat source Mat should be 0.4 ft^2 (0.04m^2) per gilt at reception	70°F (21°C)	66°F (19°C)
Ventilation: no tunnel	Minimum ventilation (cold): 2-5 cfm/head Maximum ventilation: 40 cfm/head	Minimum ventilation (cold): 5-14 cfm/head Maximum ventilation: 120 cfm/head	Minimum ventilation (cold): 14-15 cfm/head Maximum ventilation: 150 cfm/head
Ventilation: tunnel	---	Tunnel speed: avg 300-400 FPM in 35-40 seconds	Tunnel speed: avg 300-400 FPM in 35-40 seconds
Gas levels		NH_3 <20ppm CO_2 <3,000 ppm CO <30ppm H_2S <5ppm	
Humidity		<65%	
Stocking density	≥3.5 ft^2 (0.32m^2)/gilt	≥7.5 ft^2 (0.7m^2)/gilt	≥12 ft^2 (1.1m^2) /gilt
Flooring	Plastic flooring only until end of the nursery phase Slatted floors: 1 inch (2.5 cm) or less opening, with straight edges Solid floors: sloped to avoid manure and liquid build-up Use bedding material when mandatory by law		

Table 2.5: General Feeding Recommendations

Management Factor	Nursery Weaning to 70 Days of Age	Grower 70 Days of Age to Boar Exposure	GDU Boar Exposure to Breeding
Water sources	Clean and fresh water always available 1 per every 10 gilts and no less than 2 water sources per pen Fixed nipple drinker height: Shoulder level of the smallest gilts Bowls are recommended for small pens (10 or less gilts) Lip height: 40% of shoulder level of smallest pig Swing nipple height: 2-3 inches (5-8 cm) above shoulder level		
Bowl drinker separation from feeders	24-26 inches (60-66 cm) spacing	36-48 inches (90-120 cm) spacing	
Swing nipples	Placed in the wet area		
Volumetric water flow rate	≥ 500 mL/minute	≥ 1 L/minute	
Diets	Specific for age/weight Use PIC Nutrition and Feeding Guidelines for more information		
Feeder space	Dry feeders: 1 inch (2.5 cm) linear feed space/gilt	Wet/dry feeders: 1.25 inches (3 cm) linear feeder space/gilt or 12 gilts/feeder space Consider placing a rubber mat at base of wet/dry feeders ending at a slat gap Dry Feeders: 2 inches (5 cm) linear space/gilt Feeder space width: 15-16 inches (38-41 cm) /feeder width	
Feeder	Consider feeder with solid divisions. Tube/round feeders aren't recommended.		
Feeding strategy	Full feed. Avoid feed disruptions/feed outages		
Feeder adjustment	50-60% coverage		

Table 2.6: Preliminary Gilt Selection: Nursery and Grower

(For a detailed description of the process of selection, refer to the PIC Selection Manual, or the gilt selection posters.)

	Nursery Weaning to 70 days of age	Grower
When	Not a routine	Thorough selection before transfer to the GDU
Goal	Avoid sending gilts to nursery with evident issues and/or defects	Avoid sending gilts to GDU with evident issues and/or defects
Traits		
Unthrifty, unsound, falling behind, sick or joint issues	Do not select	Do not select
Feet and legs	Usually no issues at this phase Fully weight bearing on all 4 legs. Do not select gilts with traumatized toes and infectious swellings.	Do not select gilts showing club foot, uneven toes, long dew claws, or severely cracked hooves
Teats	Gilts are too young to evaluate teats	If counted, avoid selecting gilts with less than 14 teats, especially at multiplication level

Table 2.7: Mandatory Gilt Selection: Last Opportunity to Perform Quality Control

(For a detailed description of the process of selection, refer to the PIC Selection Manual or the gilt selection posters)

Trait	GDU
Unthrifty, gaunt, unsound, falling behind, sick, or joint issues.	Do not select
Feet and legs	Do not select gilts showing club foot, uneven toes, long dew claws
Teats	Count carefully. Do not select with less than 14 teats
Heats	Define a protocol to deal with non-cyclers, if they are truly gilts not showing estrus

Perform mandatory selection anytime from 20-23 weeks of age, before boar exposure starts. Remove non-selects before first boar exposure, if possible.

Table 2.8: Boar Exposure, Heat Detection and Recording Recommendations

Trait	GDU
Starts at	From 24 weeks of age
Strategy	• Always complete in the morning • 1x daily; 7 days a week; after feeding in farms/regions where gilts are individually housed • Nose to nose contact, with boar inside the gilt pen or on BEAR(**), 15 minutes maximum per every 20-30 gilts • Keep written records available for inspection and review
Estimation of time needed	A 2,500-sow farm: 120 minutes/1 full-time employee/2 mature boars daily
Ratio of mature boars to gilts for boar exposure	• 1 mature (11+ months old) boar per every 100 gilts • Meishan crosses can be used from 8 months of age. • Do not work boars longer than 60 minutes • Replace 30-40% of the boars per year

(**): BEAR stands for boar exposure area. Source: Designing effective boar stimulation systems as a critical feature of the Gilt Development Unit. E. Beltranena, J. Patterson and G. Foxcroft. Leman Pre-Conference Reproduction Workshop Effective Management of Replacement Gilts (2005)

Table 2.9: Recommendations to Address Low Percentage of Gilts in Heat

Points to review and interventions when finding a low percentage of gilts with reported estrus

Potential Causes	Interventions
Hot weather	• Annual ventilation equipment and controls service • Clean and replace broken fan blades on an as-needed basis • Review cooling settings • Prevent moldy or spoiled feed build-up • Check water availability and quality (evaluate number of gilts per water source and flow ratio) See Table 2.4 • Plan for and maintain manpower during holidays and vacations • Perform heat detection in the earliest/coolest part of the working day
Reduced feed intake	• Severe restrictions can delay the group's beginning of estrus • Check water availability and quality (gilts per water source and flow ratio). See Table 2.5 • Check feeder space per gilt, feeder adjustment, and feed flowability • Evaluate stocking density and ensure gilts have adequate access to the feeder • If gilts are restricted because they are too heavy, review the flow. Early breeding may be advisable • Determine feed mycotoxin content and rule out as possible cause • Monitor humidity and gases
Low boar power	• Check if enough mature boars are available to perform both boar exposure and heat detection • Avoid working the boars for longer than 1 hour • Avoid over-worked/tired and/or too heavy boars. Keep the boars daily feed allowance controlled • Be aware that continuous exposure to the same boar(s) can be associated with poor gilt response
Low staffing	• Plan for and maintain manpower during holidays and vacations • Check effective staff hours spent on boar exposure and heat detection • Check weekend/holidays/vacation staffing • Labor qualification and expertise
Exacerbated and/or continuous stress	Avoid or mitigate stressors: gilts need water, feed, and to feel no fear
Health and health procedures	• Evaluate potential negative impacts of early health challenges on gilt development • Avoid vaccinations 3 weeks prior to the first breeding • If approved by regulatory entities, pharmacological interventions can be the last resource and diagnostic. Consult your herd veterinarian when it is advisable to consider this as an option. • Slaughter checks of the ovaries. Non-cycling ovaries are smooth structures while active ovaries show follicles and *corpus luteum* development. • A progesterone test can identify true vs. untrue anestrus, but it is not recommended for routine utilization. Consult your herd veterinarian.

Table 2.10: Recommendations to Address Low Litter Size and/or Low Farrowing Rates in Gilts

Points to review and interventions when improving reproductive results

Potential Causes	Interventions
Hot weather	See Table 2.9
Limited feed intake	Feed restriction 15 days prior breeding can hinder litter size
Limited boar power Low manpower	See Table 2.9
Exacerbated and/or continuous stress	See Table 2.9 Manage animal flow when there is a lack of parity segregation in group housing settings
Health procedures	• Avoid vaccinations in first 4 weeks of gestation • Review selection criteria and selection process when lameness is seen in recently bred, Parity 0 animals • After stocking new farms, new and abrasive floors can create hoof and sole issues • Avoid breeding animals that need individual treatment around the time of breeding or early gestation. • If this happens, review reasons for treatment and address them. Consider a more aggressive culling strategy.
Production flow	Avoid mixing and/or aggression from day 3 to 28 after breeding
Breeding interval length	The shorter the better without compromising the quality of the individual service, especially in hot weather
Semen quality	• Check with your supplier on any event that could be associated with poor performance • Check semen storage units and temperature logs • Do not carry any doses from the breeding barn back to semen storage.

Gilt Production Flows

Specific circumstances determine the best flow option to generate replacement gilts. Different options are shown for consideration.

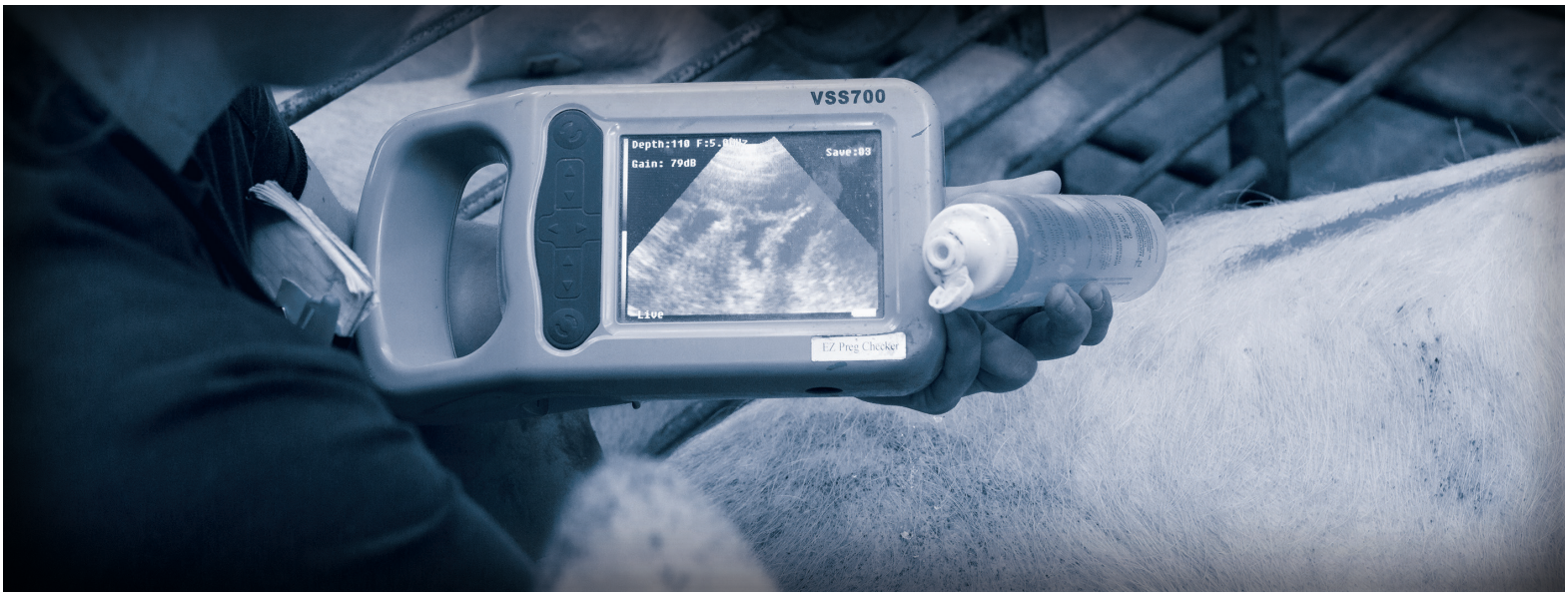
Table 2.11: Most common gilt flows

Gilt Source	External		Internal
	Continuous flow	AI/AO	
Implementation & execution of genetic program	+++		+ Oversized multiplication in smaller farms
Gilt flow control	++	+	+++
Acclimatization to sow herd	++	+	+++
Gilt usage rate & performance	Advantage in clean environments	Advantage in challenged environments (allow exposure management)	Advantage in clean environments
Biosecurity concerns	++	+++ Good when controlling PPRS or PED	++ Same as sow herd Hard to control or eliminate diseases
Transport costs	+ Higher		+++ None
Dedicated labor	System choice should not be decisive		
Labor cost efficiency	+		+++
Building costs	+ Depends on volume. Need ISO & Testing		+++ Lower
Ability to match diets to weights	+	+++	+

Key: + = unfavorable; ++ = less favorable; +++ = highly favorable

Section 3:

Breeding & Gestation



This section provides recommendations to realize superior reproductive performance. It also provides best practices on accomplishing a precise weekly breeding target which will help to establish a consistent pig flow downstream.

Good Management Practices

Producers must follow local and national regulations at any time and place. When regulation allows, consider the following recommendations.

Table 3.1: Housing Recommendations

Item	Recommendation
Temperature	65 – 68°F (18 – 20°C)
Ventilation	Minimum ventilation (cold): 12 cfm/head Maximum ventilation: 150 cfm/head
Humidity	< 65%

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Table 3.2: Weaned Sows Management Recommendation

Process	Recommendation
Culling	• Identify and mark cull sows in farrowing and avoid housing them with weaned sows
Movements	• Identify and mark sows that will need treatment after weaning; • Wean early in the morning and transfer weaned sows to the wean area on the same day
General strategy	• Maintain an organized wean area and identify late weaners by weekly lots; • Group all late weaners together in a specific area in the breeding barn; • If enough replacements are available consider culling every parity 3 and older that has not cycled after day 7 post-weaning; • Provide 16 hours of photoperiod and 250 lux (never fewer than 200 lux). Empirical experience suggests to have 150W light sources every 5 ft (1.5 m) linear; • If approved by law, pharmaceutical intervention can be used to support the production flow in critical seasons and get sows back to estrus in case of delays (always consult your herd veterinarian for details)
Feeding	• Review Table 3.4

Table 3.3: Recommendations To Consistently Achieve Breeding Target Integrity

Components	Recommendation
Weekly variations	• Avoid any disruption in your weekly gilt flow availability; • Maximum 5% over/under weekly breeding target to 1. keep your breeding flow consistent; 2. keep your weaning flow consistent; 3. minimize weaning age variation
Parity structure	• Only breed sows that are eligible to farrow and wean healthy piglets; • Do not breed lame or sick sows; • If enough replacements are available to preserve the breeding target, consider culling what is presented in Section 7 of these guidelines; • Try to solve reproductive issues by adjusting management strategies first. If approved by law, pharmaceutical intervention can be used to support the production flow on critical seasons and get sows back to estrus in case of delays (consult your herd veterinarian for details)

Table 3.4: General Feeding Recommendations

Components	Recommendation
Water availability	• Full availability and easy access; • 1 water source per 10 sows and 0.5 gallons (1.9 L) flow per minute in group housing
Diet	• For further information refer to the PIC Nutrient Specifications Manual 2021
Feeding strategy	• 3 Phases: 1. full feed on wean to service interval; 2. restricted feed based on body condition during gestation; 3. bump feed in late gestation for parity 0, only if body condition is thin; • Group gilts and sows according to body condition assessment in group housing to facilitate feeding management; • For further information refer to the PIC Nutrient Specifications Manual 2021
Body condition assessment	• Goal is to have > 85% of the females in an ideal body condition range by 28-35 days of gestation and > 90% going to farrowing; • The use of both body condition assessment systems (caliper and visual assessment) coupled with quarterly feed usage and performance data is preferred; • Ideal body condition with visual assessment means that the back, hip, and rib bones cannot be seen but can be felt when touching the sow with slight pressure; • Ideal condition with caliper assessment is between 12 to 15 units range; • Annualized gestation feed usage should be within 1,500 and 1,700 lbs (680 and 770 kg). An investigation is needed when the farm is above or below that range; • Annual sow mortality within below 9%; • Perform body condition assessment at weaning; • Perform body condition assessment at 30 days, 60 days and 90 days of gestation; • For individually housed facilities: two people are needed: one at the back of the sows who assesses body condition, the other one at the front adjusts the feeding boxes according to the nutritionist´s recommendation; • For further information refer to the PIC Nutrient Specifications Manual 2021
Body weight dynamic	• Not more than 100 lbs (45 kg) of net body weight gain at parity 0; • Not more than 50 lbs (23 kg) of net body weight gain from parity 1 and onwards

Table 3.5: Semen Doses Management Recommendations

Component	Recommendation
Storage capacity	• Semen storage device should be sized for weekly delivery; • Storage capacity equivalent to 0.16 gallon (0.6 L) per dose; • Batch farrowing systems might require more storage capacity than continuous flows; • Two small storage devices instead of one big can mitigate the risk of technical failures; • To improve safety, have surge protectors and battery backups in place
Space cooler – wall	• > 1 inch (> 2.5 cm)
Storage devices maintenance	• Once a year; preferable prior to summer
Temperature	• 61 – 64°F (16 – 18°C); • Record maximum and minimum temperature daily
Storage temperature Fluctuation	• < 1.8°F (< 1°C); • Every fluctuation > 1.8°F (> 1°C) can reduce semen dose shelf life up to 1 day
Deliveries	• 2x per week as minimum and 3x a week as optimum
Handling	• Store doses loose, unpacked, and horizontal; • First in - first out principle: use oldest doses first; • Rotate semen doses once a day
Semen age	• Optimum: < 3 days age (from semen collection); • Plan semen orders accordingly; • Every additional day of semen age can reduce total born by 0.3 pigs per farrowing
Transport to breeding and gestation barn	• Take doses to the breeding barn in an insulated container with gel packs to maintain temperature; • Have enough doses for maximum 1 hour of breeding; • One way road, no doses from breeding barn back to the refrigerator

Table 3.6: Boar Exposure And Heat Detection Recommendations

Component	Recommendation
Boar to sow ratio	• 1:200
Boar age	• ≥ 11-12 month; • Meishan crosses > 5-6 month
Annual boar replacement	• 30-40% (30% when using Meishan crosses)
Boar quality	• Use active, smelly boars with good salivation and optimum body condition
Heat checking	• Frequency: 1x daily; 7 days a week; • Order: Gilts - weaned sows - 21 day bred group - opportunity sows; • Allow nose-to-nose contact

Table 3.7: Breeding Recommendations (Conventional)

Process	Recommendation
Quality of female at breeding	• Keep the number of opportunity sows below 8% within each weekly mating group (in absence of major disease breaks)
Insemination timing	• Keep it simple; breed females just once daily
Hygiene	• Keep breeding area as dry/clean as possible; • Clean vulva with single-use dry paper towel; • If using lubricant, keep it clean and stored cool
Insemination	• Stimulation during the insemination with an adult boar and back pressure exercised by the breeder; • Do not squeeze the dose
Boar stimulation during insemination	• Mandatory, allow nose to nose contact during insemination; • Use 1 boar in front of 3-5 females and use as many boars as needed but always be cognizant of the risk of operating with boars
Boar stimulation after insemination	• Provide boar exposure for 1 hour right after insemination
Time spent breeding AI	• Individual time needed is unknown; • Average time should not be below 3 minutes per service
Move to breed interval	• Avoid any movement 2 hours prior to insemination; • Avoid any movement between services; • Avoid any movement beyond day 3 after first insemination until day 28
Refractoriness	• Do not breed females in refractory period; • Be aware of the relevance of finishing the breedings in the shortest time without compromising the quality of the individual breedings

Post Cervical Artificial Insemination (PCAI)

The major differences between PCAI and traditional insemination are the insemination technique, and the use of the catheter and dose of semen.

Table 3.8: Summary Of Main Areas To Review For PCAI Success

Process	Recommendation
Time between heat detection and breeding	• ≥ 2 hrs
Insemination timing	• Keep it simple, breed females once a day
Inner catheter insertion	• > 95% success in sows; • Wait at least 2 minutes from outer catheter insertion until attempt to insert the inner catheter; • Inner catheter should be fully inserted; • More challenging in younger parities; • If after 10 min. the inner rod does not go in completely do not force the passage; • AI the female with a boar in front, back pressure and a conventional semen dose
Insemination	• No stimulation needed; possibility to squeeze the dose; • No backflow during the insemination; • If backflow occurs check and correct inner rod position; • Change inner rod if bent or breed her AI with a boar in front, back pressure and a conventional semen dose
Boar stimulation during insemination	• Is not required but it could be part of the process without any detrimental effect

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Process	Recommendation
Boar stimulation after insemination	• Provide boar exposure for 1 hour right after insemination and assure all sows stand up
Time spend breeding post-cervical	• Not less than 1.5 min; • Not more than 10 min

Pregnancy Diagnosis

Pregnancy control can be done indirectly by detecting the return to estrus while exposed to a boar or directly by ultrasound. As a general strategy, the use of ultrasound should follow on positive pregnancy checks to validate results of the boar exposure. Sows that are already detected as returned to estrus do not need to be checked with ultrasound.

Table 3.9: Conventional Pregnancy Diagnostics

Technique	Timeframe	Standard
Boar exposure	Between 1 – 50 days after first insemination	• Use fresh boars: Change the boar if it has worked for 60 min; • Frequency: 1x daily, 7 days a week; • Although returns could appear at any time, special attention should be given to females between 18 – 24 days after first insemination
Ultrasound	Ultrasound between 21 -28 days after first insemination	• Should be used for confirmation of pregnancy after an adequate boar exposure

Reproductive Performance Below Expectations

Table 3.10: Pre-Implantation Events Leading To A Reproductive Failure

Result	On Farm Effect	Cause	Target (% of the females bred)
Early returns	Return 1 – 17 days after breeding	• Poor heat detection; • Inappropriate breeding timing	Rarely seen
Regular returns	Return 18 – 24 days after breeding	• No fertilization; • No pregnancy recognized at/around 14-16 days after breeding; • 100% embryo mortality pre-implantation; • Less than 5 embryos implanted	< 4%
	Return 36 -48 days after breeding	• No heat detection of returns on 18 – 24 days after breeding	<0.5%
Vaginal discharge	Discharge and return 1-3 days after	• Uterus infection at farrowing or, more often, at breeding; • Usually associated with 3 or more services and/or late insemination	< 0.5%

Table 3.11: Post-Implantation Events Leading To A Reproductive Failure

Result	On Farm Effect	Cause	Target (% of the females bred)
Irregular returns	Return 25-35 days after breeding	Embryo mortality 17/21 to 28/31 days	< 0.5%
Abort		Termination of gestation after 35 days of gestation	< 1%

Table 3.12: Controlling Longer Wean To Service Interval

Situation	Potential reason	Intervention
Management decisions	Skipping sows	• Understand the reasons why the staff is skipping sows; • Mitigate massive body weight losses in in farrowing; • Gilt body weight at first breeding within 300 to 350 lbs (135 to 160 kg); • Proper body conditioning; do not bump feed in late gestation, except gilts in ideal body condition; • Keep farrowing rooms cool; • Daily identification of non-eaters to implement individual treatments; • Group parity 1 females together after the weaning to focus efforts in feeding and boar exposure
Estrus in farrowing	Low number of pigs nursed; Litter scours; Massive and out of control fostering	• Challenge younger parity females with 14+ good piglets; • Room preparation and hygiene; • Vaccine program against digestive pathogens; • Reduce fostering events. Remember that no movement is better than wrong movement
Truly undetected estrus	Low boarpower; Low manpower	• House boars away from weaned sows; • Use well rested boars with high libido; • Make sure weaned sows are boar exposed and heat detected from the same day of weaning; • Farm management must ensure enough man-hours are being dedicated to boar expose and heat detection in wean area; • Weekends and holidays are always a challenge from the manpower point of view
Exacerbated and/or continuous stress	A female that is in fear won't show a good expression of its estrus	• Control/mitigate stressor(s)
Non-active ovaries	Mycotoxins in feed	• Rule mycotoxins out; • If found, ask your nutritionist for ways to control their effect

Table 3.13: Variations Above and Below Breed Target

Source of Variation	Intervention
Gilt flow	Raise gilts according to specifications; Farm management must know gilt availability for the next 3 and 6 weeks; Ensure the targeted number heat-no-services per week is met
Replacement rate	Transitory adjustments can be made
Sow mortality	Trigger interventions as soon as the intervention level is passed; Tweak culling process and gilt selection process

Table 3.14: Deviations From Normal/Ideal Body Condition

Condition	Interventions
Too heavy (> 20% of heavy females in gestation)	• Ideally use more than just one way to evaluate body condition (feed usage plus visual evaluation or caliper); • Adjust feed boxes to make it consistent with the nutritionists indications; • Do not bump feed in late gestation; • Minimize the number of skipped sows after weaning; • Control incidence of returns
Skinny	• Make sure the gilts are bred in the recommended body weight range (see Table 2.1); • Maximize feed intake in lactation: 1. Train gilts pre-farrow on how/where to drink starting the first day housed in farrowing; 2. Allow free access to fresh feed prior to farrowing (from 112 days of gestation); 3. Daily identification of non-eaters and treat fever post-farrowing; 4. Daily check of drinkers and cleaning up of feeders; • Maximize feed intake in weaned sows; • Evaluate chances to really improve body condition or decide to cull

3.15: General Interventions To Improve Farrowing Rate and/or Litter Size

Risk factor	Interventions
Production flow	• Make sure gilts get their last vaccine at least 3 weeks prior to the first breeding; • Avoid feed outages/feed restrictions in gilts prior to the first breeding; • Minimize the number of sows lactating less than 18 days; • Avoid creating conditions to have sows in estrus while in farrowing; • If working on batch farrowing, ensure the farm is properly staffed the weeks where high number of breeds are performed; • Skip/cull sows in heat 7 to 14 days after weaning; • Avoid transferring sows in between services
Breeding timing	• Make sure heat detection and breeding are both performed well every single day; • Breed only females in solid heat
Female	• Consider to cull females according to the culling criteria presented in Section 7
Stress	• Provide air, water, feed and absence of fear; • If aggressions are seen, identify the aggressor and separate to place where no animal can be injured; • Separate injured animals and treat them according to your herd veterinarian instructions

Section 4:

Group Housing

This section gives an overview of sow housing options. There are different types of group housing systems and each has pros and cons. Regardless of the type of sow housing, PIC recommends to have the same production targets as in individually housed facilities.

Table 4.1: Comparison Between Different Group Housing Systems

Trait	Individual	Free Access	Floor Feeding	Stanchions	ESF	Outdoor
Body Condition Management	++++	+++	++	+++	++++	+
Aggressions	x	x	xxx	xx	xx	x
Building / Retro Fitting Costs	x	xxx	x	x	xxx	x
Running Costs	x	xx	xx	xx	xx	xx
Ease of Management	++++	+++	+++	+++	++	+
Gestation feed usage/sow/year	x	xx	xxx	xx	x	xxxx
Space per sow	x	xxx	xx	xx	xx	xxx

Key: + Poor, ++ Acceptable, +++ Good, ++++Very good;
x Lower, xx Moderate, xxx Higher.

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Flows and Group Size

Different flows can be implemented to optimize the performance in each type of group housing system. The flows can differ in terms of mixing time (pre- or post-implantation) and group integrity (static or dynamic). The size of the farm and breeding groups will also be a factor for optimal performance.

Table 4.2: Comparison Between Pre- and Post-Implantation Flows

Pre-Implantation	Post-Implantation
• Maximum utilization of pens during gestation (16 weeks); • Less forgiving – Problems within 1st 4 weeks of gestation tend to be more impacting; • Small window of time to load pens; • Important processes done differently: no time to recover body condition, find space for returns, heat checking, preg check	• Fair utilization of pens during gestation (12 or less weeks); • More forgiving – moving during a time when pregnancy is more stable; • Important processes (heat/preg check) still done in individual spaces

Table 4.3: Comparison Between Static and Dynamic Flows

Static	Dynamic
• Less optimization of space compared to dynamic; • Easier to manage; • Retains physical integrity of breeding group	• Better usage of space; • Physical integrity of the breeding group is disrupted; • Perhaps easier on the animals (larger dynamic pens)

Table 4.4: Comparison Between Different Group Sizes

Group Size	Characteristics
More than 150 individuals	• The group is large enough to minimize or eliminate social hierarchy; • Frequently used with ESF pre-implantation dynamic flows
20 to 150 individuals	• Structured to match either the size of a breeding group and/or the capacity of a particular feeding unit; • Frequently used with ESF post-implantation; • Static flows and free access
5 to 20 individuals	• Group is typically chosen to have similar body condition, parity and weight, and to have similar feed requirements; • Frequently used with floor feeding and stanchions

ESF

ESF, or Electronic Sow Feeding, is one of the available options of feeding in group housing in the industry. This system can also be a platform on top of which more technology for the daily farm management can be applied.

Table 4.5: ESF Key Points

Key Points	Justification
Proper gilt training	• Gestation feed intake disruptions avoidance; • Promote gilt retention rate and consistency in breeding target; • The key in the process is to NOT stress the gilts; • Consider training maximum of 40 gilts per station; • Expect a maximum of 3% un-trainable gilts
Gilt full feed prior breeding	• Gilts tend to go through catabolic period due to feed restriction during training; • After gilts are trained, it is crucial to allow 2 or more weeks of full feed prior breeding to achieve full performance
Daily non-eater checking	• Feed disruptions along the gestation will lead to reproductive failures. The sooner the farm has an action with a non-eater sow, the better the outcome; • Consider checking the non-eater no later than the next day
Feeding management	• Although they are group housed, they are fed individually, following preplanned feeding curves; • Calibrate feed stations in a monthly basis or in every feed change, adjust feed curves based on body condition on every 30 days of gestation; • If wet feeding is utilized, it should have the consistency of oatmeal in the bowl
Feed station maintenance	• Without the proper ESF station functioning, the sows will have difficulties to accomplish all necessary feed intake; • Check on a daily basis the water and feed dilution, feed dropping from the bin, movement sensor working, # of sows missing to eat every day, and the antennas reading tags
Daily pen checking	• More than only checking non-eaters, farm should have daily individual sow care. Check for lameness, abortions, vulva biting,sows in heat, fight scars, sick or dead animals and any sow in need of assistance
People profile	• With the technology applied, the mindset should be changed to run the ESF farm. Successful farms have people open to changes, pro-active profile, disciplined, open to new ways to produce and with belief in the system
Proper flow and facilities	• Projects considering less than 20 sq. ft. (1.9 m²) require another look, with more projects being designed to consider 22 sq. ft. (2 m²) for gilts and 24 sq. ft. (2.25 m²) for adult sows; • Gilt segregation will increase chances to accomplish full performance in P1s; • Avoid mixing sows in the embryonic implantation period (after day 4 to 28 of gestation). Have in mind that more sows per feed station will bring more chances to have more non-eater sows on a daily basis
Selection and culling practices	• Gilt selection and culling practices should not be different from what should be the standards in individual housed sows but a less thorough selection and culling process are less forgiving in ESF and group housing settings; • In pre-implantation flows, consider a maximum of 10% of removals per group and 5% in post-implantation flows

Trouble-shooting

The most common issues reported by producers across the globe in group housing are (1) aggressions, (2) low retention and (3) poor farrowing rate.

Table 4.6: Strategies To Mitigate Aggressions

Risk factor	Intervention
Feed/appetite	• Have feed available when loading the pen; • Full feed for 2 days; • Start feeding process at the same time every day
Age/weight	• If farm size allows, group by body condition, parity and in some situations by genetic line
Nervousness	• Have a mature vasectomized (older than 11 months of age) boar in the pen for the first 1 or 2 days; • Have solid partitions to create safety areas; • If not possible to segregate by weight and parity, load younger females first and later in the day the older ones; • Hanging chains or other “toys” have created some helpful distraction
General environment	• Check water availability; • Aggressive ventilation can help sometimes

Table 4.7: Strategies To Mitigate Low Sow Retention and Low Farrowing Rate

Risk factor	Intervention
Gilt program	• Thorough selection based on leg structure and hoof integrity; • Maximize the proportion of gilts meeting the requirements for eligibility and bred at/after second heat
Problem sows	• Proactively identify sows that are lame or don’t eat and treat them according to your herd veterinarian instructions. Segregate the individual to a recovery space; • Avoid marginal sows at breeding; • Skip heat on the youngest females if there are enough females to hit breeding target

Section 5:

Farrowing Management

This section provides recommendations for farrowing management. These recommendations aim to optimize throughput and quality of weaned pigs, while managing sows in a way that will allow quick and efficient return to estrus post-weaning.

Good Management Practices

Executing the right management at the right time has become more important to maximize piglet conversion with good quality pigs at weaning.

Table 5.1: Setting the Farrowing Environment

Area	Goal
Cleanliness & Disinfection	• Manage rooms under AI/AO system; • Use hot water and detergent when washing farrowing facilities; • Use disinfectant in the dose recommended by the supplier; • Facility dried prior to loading sows
Heat sources	• All functional; • Heat lamp's bulbs cleaned for maximum energy efficiency; • Creep area set to the right temperature (90-95°F; 32-35°C)
Mats	• Mats are cleaned, disinfected, dried and in place
Equipment	• All fans, heat sources, nipple drinkers, feed distribution and feeders functioning before loading; • Hot boxes, if present are cleaned, disinfected and dried
Ventilation/temperature control system	• Rooms with desired temperature and air flow; • Controls are reset for newly farrowed piglets
Supplies	• In place, stored in a clean container, complete and ready to be used (medicines, syringes, plastic sleeves, lube, towels)

Table 5.2: Housing Recommendations

Management	Recommendation
Room temperature	• 70-74°F (21-23°C) at farrowing. 74-76°F (23-24.5°C) on deep pitt rooms; • From the day after farrowing, gradually dropping room temperature to 66°F (19°C) by day 7-10 of age and onward
Ventilation	• Cold weather: 20 cfm/head; • Hot weather: 650 cfm/head
Humidity	• < 65 %
Farrowing space	• 6 ft wide x 8 ft (1.8 m wide x 2.4 m) most common in new facilities for 22-24 day old weaned pig
Flooring	• It seems like cast iron is the preferred material for sows but other material can also work well; • Woven wire and plastic are both broadly utilized for the piglet area

Table 5.3: Feeding Recommendations

Management	Recommendation
Water sources	• Clean, fresh and available (> ½ gallon per minute; > 2 L per minute); • Ensure > 5 gallons (20 L) per day per head; • If nipple drinker, avoid spary water by controlling high pressure
Diet	• Lactation

Management	Recommendation
Feeding strategy	• Unrestricted access to fresh feed, even from 2-3 days prior to farrowing, when sows arrived with the right body condition

Table 5.4: Piglet Early Care

Management	Recommendation
Teat count	• Count and record on the sow's ID card to avoid having a sow nursing more piglets than that number
Farrowing induction and use of oxytocin	• Avoid inducing more than 30% of sows, focusing on sows parity 5 and up, sows with history of having stillborns; • Last sows of the room to tighten up farrowings and weaning age; • Consider the farm gestation length before implementing farowing induction as a tool. In general, we do not recommend inducing before 115 days of gestation; • Oxytocin dose is 10 UI, applied 2x maximum, with shots 2 hours apart
Sow body temperature	• Rectal temperature > 103.5°F (40°C) must be treated to contain fever
Farrowing assistance	• Monitor sows every 20 minutes; • If no new wet pig(s) is/are found, consider sleeving. When sow is having normal contractions and is not being exhausted sleeving could be considered to be postponed to 20 minutes later
Chilling prevention and control	• To have 2 heat sources (fully operative) and 2 mats; • Temperature in the creep area must 90-95°F (35-38°C); • > 90% of piglets born while staff is present should be dried off
Colostrum intake	• As long as the staff is present, ensure colostrum intake within the first 30 minutes after birth; • Only split-suckle extreme litters (more pigs than functional teats) within 24 hours from farrowing. Larger piglets should be separated for 90 minutes in hot boxes; • 200 cc of colostrum on day 1 seems to increase survivability of lighter pigs by 4 to 5 times
Runt litters	• Take 15-16 runts from different litters and place them on a parity 2 female with small teats; • Runt piglets must be healthy and active

Table 5.5: Day 1 Processing

Management	Recommendation
Teeth	• If managing teeth, prefer grinding; • Do it immediately after birth
Umbilical cord	• Prefer to keep it long (3 to 5 inches; 7 to 13 cm); • Avoid pulling it; • Disinfection by dipping it on iodine solution
Drying pigs off	• Use disposable paper, towel and/or dehydrant powder
Ear notching/tattooing	• If possible, try to avoid it for the first 48 of hours of life with the exception of Production Nucleus farms.

Table 5.6: Day 3 to 5 Processing

The following table includes general recommendations. Make sure the processing you follow respect local regulations.

Management	Recommendation
Iron	• Applied to every single piglet; • Basic dose is 200 mg but your herd veterinarian may suggest another dose
Tail docking	• Performed to every piglet; • Length should be about ¼ inches (0.6 cm) unless otherwise stated by different company policies or local laws
Castration	• All male piglets should be castrated, unless otherwise stated by company policies or local laws
Anti-coccidia	• When coccidial scour is confirmed prevalent, implement a treatment after asking your herd veterinarian

Weaning Age/Lactation Length

The topic of weaning age and lactation length usually generates debate and it is unlikely that consensus will be achieved soon. It is generally accepted that longer lactations tend to produce a heavier piglet at weaning and a better reproductive performance in the sow's subsequent cycle. PIC adds a complementary view: higher feed intake in lactation is the factor most correlated with high performance in the subsequent cycle. Our recommendation is avoid weaning individual piglets before 18 days of lactation, with a minimum average of 21-23 days.

Trouble-shooting Checklists

It is very common to find the following three concerns or issues in the farrowing house: low water/feed intake in sows, scours and elevated PWM.

Table 5.7: Trouble-shooting Poor Feed Intake and Low Milk Production

Risk Factor	Recommendation
Herd Age	• If too young, understand why the herd is having low retention rate and control culling and mortality; • If too old, work on increasing replacement rate
Environment	• Right temperature (follow temperature curve); • Enough fresh water available; • Good quality feed; • Feeders minimize wastage; • Avoid excessive fostering events; • Avoid noisy farrowing rooms
Health	• Healthy farm and healthy animals; • Hoof integrity optimized; • Farrowing assistance program to avoid retained pigs/placenta; • Scrape manure daily until 3 days after farrowing

Table 5.8: Trouble-shooting Laid-ons

Risk Factor	Recommendation
Herd Age	• If too young, understand why the herd is having low retention rate and control culling and mortality; • If too old, work on increasing replacement rate
Body Condition	• Make sure >90% of sows going to farrowing are in ideal body condition
Environment	• Avoid jumpy sows by providing feed, water, and ventilation; • Avoid excessive fostering events; • Avoid noisy farrowing rooms
Health	• Hoof integrity optimized

Table 5.9: Trouble-shooting Scours

Risk Factor	Recommendation
Herd Age	• If too young, understand why the herd is having low retention rate and control culling and mortality
Environment	• Right piglet micro-environment in terms of temperature and absence of air drafts; • Heat and ventilation sources working consistently; • Avoid excessive fostering events; • Do not step into the farrowing space; • Disinfect mats overnight with chlorine; • Materials and equipment must be disinfected
Health	• Ask your herd veterinarian how to maximize immunity against digestive pathogens; • Ensure colostrum intake

Section 6:

Batch Farrowing

Batch farrowing is the concentration of farrowings in a specific week. It is important to understand the potential benefits and costs required for the execution of a batch farrowing flow to ensure the return exceeds the investment. This section summarizes pros and cons of batch farrowing as well as best practices to optimize performance in systems that farrow in batches.

Table 6.1: Batch Farrowing Pros and Cons

Pros	Cons
• Wean more pigs in a shorter period of time to load finishing barns quicker and with pigs of similar age; • Control the effect of certain pathogens in farrowing, nursery and finishing; • Efficiencies on labor utilization, animal transport and semen deliveries	• Synchronization of gilts, returns and late weaners; • Increased non-productive-days; • Less flexible breeding target; • Potential drop on number of weaned pigs; • Fall behind piglet management; • Adjustment to new semen production schedule

Type of Batches

Although it is possible to have batch farrowing in 2, 3, 4, and 5 weeks flow, the most common are the 3 and 4 weeks flow. The resulting lactation length and differences among space and flow will impact the decision of which one to implement.

Table 6.2: Comparison Among Different Batch Farrowing Flows

Trait	2 Weeks Flow	3 Weeks Flow	4 Weeks Flow	5 Weeks Flow
Lactation length, days	19-20	26-27	19-20	26-27
Total # of batches	10	7	5	4
# of batches in lactation at the same time	2	2	1	1
Annual farrowing space turns per year	13	9	13	10
Labor distribution spreading	Over a 4 weeks period	Over a 3 weeks period	In 2 out of the 4 weeks	in 2 out of the 5 weeks

Reconverting From Weekly Flow To Batch Farrowing

When changing from weekly flow to batch farrowing, some processes will have to be changed as well. Prior to implementation, it is important to check the points in the checklist below to avoid getting surprises of unexpected struggles that can jeopardize the process.

Check-list Key points to check prior to batch farrowing implementation

- ☐ Coordinate with semen supplier to ensure the larger number of doses will be available and supplied in a shorter time.
- ☐ Ensure that there is enough semen cooler storage capacity to hold the large number of doses the farm will need in the insemination period.
- ☐ Check the necessity of extra space in gestation to wean a larger number of sows per time than usual.
- ☐ Check water availability to account for all the water needed to power wash the rooms at once.
- ☐ Make sure electric circuit is able to handle more power washers than usual at once.
- ☐ Consider lactation feed bins to account for differences in feed intake pattern.
- ☐ If synchronizing animals with synthetic progestagen, have a clear plan about how and where to utilize it.

Key Points

The key points below are crucial to the success of batch farrowing in a sow farm. Generally speaking, proper husbandry practices continue to be important to the success of the flow.

Table 6.3: Key Points In Batch Farrowing

Key Points	Recommendation
Gilt synchronization	• Need to assure the full intake of the product; • Need to administer it at the same time every day; • Ideal to place gilts in individual stalls; • Ensure the product's intake by pouring it on a slice of bread
Wean to service interval	• Assure females are in proper body condition during gestation; • Have proper feed and water intake in lactation; • Have proper feed and water intake in wean to service interval; • Make sure teaser boars are in proper quantity and quality
Breeding target accomplishment	• Review gilt delivery numbers in case of not retaining open sows or fixing breeding target holes; • Check "Gilt Synchronization" above; • Check "Wean to Service Interval" above
Removal strategy	• Following culling protocols will be even more important in the case of having open sows showing heat outside of the breeding group; • Have the sow farm data properly organized; • Use sow records to take decisions on a daily basis
Labor distribution	• Have full team in the weeks when chores are concentrated; • Use weeks with lower workload to provide vacations and time off for employees; • If implementing batch farrowing in more than one farm, exchange people among farms. Have a good identification of potential candidates in advance and make sure biosecurity rules are followed; • Consider using gestation people in farrowing and vice-versa

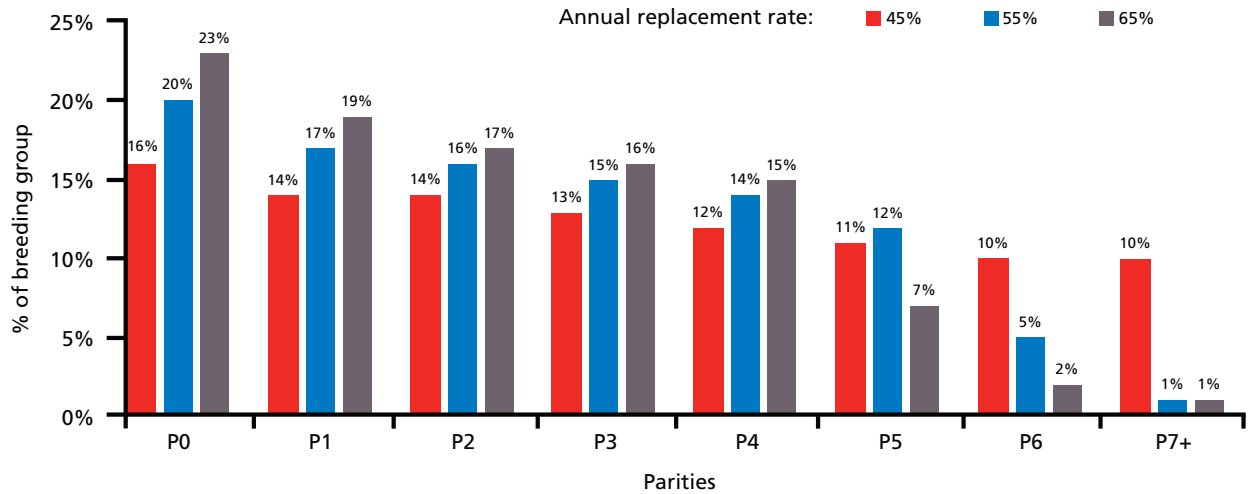
Section 7:

Parity Structure

Parity structure is the balance of sow mortality rate, culling rate and replacement rate against hog market price and feed cost.

Parity structure can influence both biological and economical performance. Therefore it is important to have a good understanding of the factors involved to better manage parity structures and, ultimately, maximize long term profitability. This section provides best practices to optimize parity structures as a performance lever.

Graph 7.1: Calculated Breeding Group Structure By Different Replacement Rates



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Good Management Practices

Success or failure of establishing the best parity structure depends on how proactive and prepared the system is to retain the right animals or cull the potentially risky or unpredictable ones. The key points to consider are gilt availability, gilt selection rate, individual sow care and culling strategy.

Gilt Availability

Gilt availability is the first element to achieve the proper replacement rate and parity structure in the system. The proper multiplication size to supply the required number of gilts is usually around 10% to 12% of the commercial sow herd inventory. It is important to be realistic with the performance of a multiplication unit. Beyond multiplication size, the critical control points below will also contribute to optimized gilt availability in the system:

Timeline 7.1: Critical Control Points On Gilt Availability Coming From The Multiplication Unit.

Gilt Selection

Gilt selection plays an essential role in the process of entering the right animals to the sow farm, so the best sows can be retained for a longer time. For more information, review Tables 2.4 and 2.5 in the Gilt Management Section.

Individual Sow Care

The population should be inspected at least once a day to identify early issues that can potentially affect the performance and well-being of the sows.

Even in healthy and age-stable farms, every week many individual sows are treated against specific threatening conditions to prevent mortality and production flow shortages. PIC advises to be properly set up in terms of supplies and manpower. When the individual treatment rate is below or above the intervention level, further investigation is advised to better understand the cause. Keep in mind that many variables can influence the treatment rate, such as health status, body condition, productivity, facilities, type and quality of floor, environment, just to name a few.

Table 7.1: Individual Treatments In A Sow Farms

Individual Treatments	
Expected number of treatments initiated every week	2-3% of the average sow inventory
Further investigation is needed	< 1% or > 4%

When the number of affected animals is greater than 10% of the population, it may be necessary to apply group treatment by water or feed adjustments. Always ask you herd veterinarian for directions.

Culling Strategy

Culling is the main opportunity to eliminate animals that are not producing according to the expectations or that have a considerable potential to bring future issues and are not needed to maintain the throughput. It is always important to have the breeding target in mind when making decisions about culling, so the farm does not run out of breeding sows.

Table 7.2: Basic Culling Strategy Guidelines

Culling Type	Culling Reason	Strategy
Voluntary	Old age (P7+)	Cull
	Low Performance	< 20 Total Born last 2 parities
Involuntary	1x Return	Cull P3+
	2x Return Discharges Aborts and NIPs Severe mastitis Lame at breeding Gilts not in heat 6 wks after the beginning of boar exposure Poor body condition	Cull
	Late weaners or early weaners	Cull parity 3 and older

Table 7.3: Annual Culling Targets and Expected Voluntary/Involuntary Culling Distribution

Criteria	Target - out of the average sow inventory
Voluntary	< 30%
Reproductive failure	< 10%
Unsoundness & others	< 5%
Total Culling	40 to 50%

Trouble Shooting High Sow Mortality And Low Retention Rate

High sow mortality and low retention rate unbalance the farm's parity structure, leading to
(1) retention of marginal sows;
(2) a lower selection pressure of the replacement gilts;
(3) decreased sow inventory, and/or
(4) higher costs with extra gilt entries.

Table 7.4: Sow Mortality and Poor Retention Rate Causes, and Points To Review

Causes	Impact	Points to review	
Gilts with no heat	Poor retention rate up to parity 3	• Gilt square footage; • Boar exposure; • Feeding management; • Water availability; • Gilt acclimation; • Gilt growth; • Quality of heat detection process, including staffing	
Lameness	High sow mortality and poor retention rate	• Gilt selection; • Gilt weight at breeding; • Size/weight of heat detecting boars in gilt pens; • Gilt body weight gain in gestation; • Sow body condition; • Feed adjustments over gestation phase; • Individual sow care; • Floor quality and maintenance; • Ventilation	
Gastric ulcers; pneumonia; mycotoxins in feed	High sow mortality and poor retention rate	• Gilt acclimation; • Individual sow care; • Feed: feed particle size; feed quality (moldy?); • Feed disruptions/outages; • Ventilation specifications; • Vaccination process	
Reproductive failures	Poor retention rate	Late weaners	• Body condition prior to farrowing; • Feeding management from farrowing to breeding; • Individual sow care; • Number/weight of nursed piglets; • Boar exposure and heat detection process quality; • Water availability
		Returns	• Semen quality; • Heat detection process; • Insemination process; • Feeding management in all phases; • Movements, mixing and fighting after breeding
		Vaginal Discharge	• Heat detection process; • Hygiene during insemination process; • Water availability; • Semen quality; • Insemination timing; • Too many third services; • Quality of feed (moldy?)
		Abortions	• Movements, mixing and fighting after breeding; • Gilt immunity; • Water and feed availability; • Individual sow care; • Vaccination process; • Ventilation specifications

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GILT AND SOW MANAGEMENT GUIDELINES

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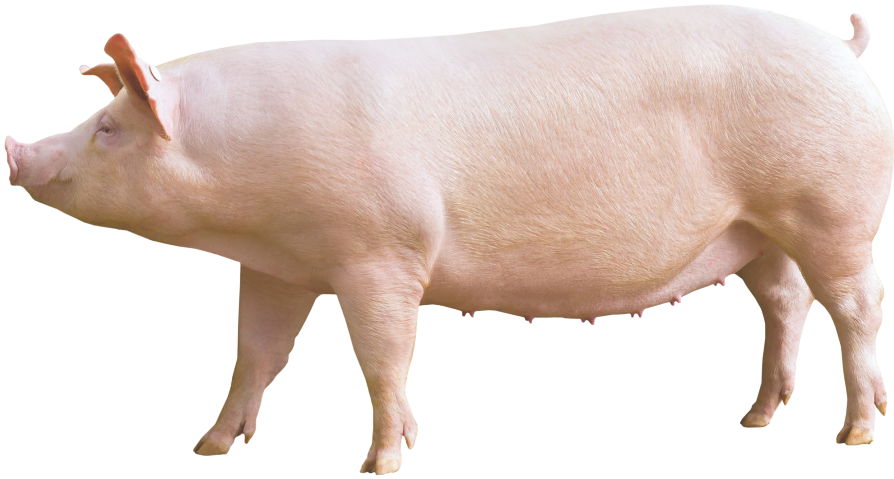
Welcome to the PIC Gilt and Sow Management Guidelines



We are pleased to present the PIC Gilt and Sow Management Guidelines. These guidelines are intended to provide recommendations for staff working at a commercial sow farm. In addition, these good management practices are also applicable to multipliers and production nucleus farms.

The guidelines are divided into seven sections that cover the different phases of production on a sow farm. Each section contains expectations, good management practices and advice for troubleshooting the most common issues. In order to simplify and speed up the search for the information, we have made a serious effort to replace long texts by tables.

The material has been reviewed by professionals and experts across the world to make it a global reference. The focus is on the biology of the animals, independent of the geographical location, size of operation, sow:worker ratio, facilities set up or use of specific feed ingredients. The guidelines focus on production management and we have chosen to leave out biosecurity and health protocols and acclimatization practices. We suggest you reach out to your herd veterinarian or our Health Assurance team to develop a tailored program based on your circumstances. Last, but not least, we have added separate sections for group housing and for batch farrowing.

We recognize that there are different ways to achieve the desired results so these guidelines do not reject other management strategies.

This document is intended to provide guidance and suggestions to our valued customers. At all times, please follow the best practices and appropriate standards with respect to animal welfare and health as outlined by the local governing body, within your country.

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Glossary of Terms & Acronyms

Section 1

PICpro100
An algorithm developed by PIC to remotely screen production processes, assigning then a score from 0 to 100.

Parity
Female age based on how many farrowings they have. Thus, Parity 0 is gilt that has been bred but still has not farrowed; parity 1 is a female that has farrowed once before.

Parity dip
It is when litter size drops from one parity to the next. Usually from parity 1 to parity 2.

Target
The numerical value of a goal.

Intervention level
The actual performance value that should trigger defined actions to break a performance trend and improve.

Breed back
Percentage of the weaned females that shows standing heat within a given period, usually 7 days.

Piglet conversion
Percentage of weaned pigs out of the total number of pigs born in a given period.

Pigs weaned/sow/year
Number of weaned pigs in a full year divided by the average inventory of mated females.

Average age at removal
Age of the sows, in number of parities, when the removal (death loss and culling) happens.

Section 2

Eligibility for breeding
A set of characteristics that make a group of gilts ready to be bred with no negative long term repercussions and optimized economics.

First breeding
The first insemination that a female gets in its life.

Lifetime performance
Average number of weaned (or marketed) pigs until the female is culled or dead.

Nursery
Usually the phase from weaning to 11 weeks of age.

Grower
Usually the phase from 11 weeks of age to 22 weeks of age.

GDU
It stands for gilt developer unit. It is usually the phase from 22 weeks of age to 28 to 30 weeks of age.

cfm
It stands for cubic feet per minute. It is an expression of the volume of air moving through a ventilation system or other space.

Sq. ft.
It stands for square foot, a non-metric unit of area, equivalent to 144 square inches.

Breeding interval length
Time elapsed from the moment the first female is bred until the moment when the last one is bred in the day.

AI/AO
It stands for all in-all out. It refers to the way a room or an entire building is loaded and emptied.

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Section 3

Meishan crosses
Any individual containing blood from Meishan genotypes. They are broadly utilized as heat detection boars.

Fostering
Action to relocate individual piglets to another sow to give them more chances to nurse.

Section 4

Pre-implantation
Flow where sows are moved to groups in early gestation, usually within 4 days after breeding.

Post-implantation
Flow where sows are usually moved to groups after spending the first 4 weeks of gestation in individual spaces.

Static
The group is constituted at once, social hierarchy stabilizes and the group is left intact for the duration of gestation.

Dynamic
The group is constantly changing by ~15 to 20% of the individuals. Essentially it is a continuous flow system that looks to optimize space utilization.

Catabolic period
A time where body weight is lost, due to lack of enough feed intake or diets that don't meet the required nutrient specifications for the age/weight/physiological status.

Section 5

ft.
It stands for feet, a non-metric unit of length.

Split-suckle
A practice to separate part of the litter for a defined period, to allow the remaining piglets full access to the udder, with no competition.

Runt litters
Litters created by placing small but viable piglets on a good nursing sow.

Parity structure
The combination of the different ages of the sow census.

PWM
It stands for preweaning mortality

Runt
Small but viable piglet

Section 6

Late weaners
Sows that don't show signs of estrus 7 days after weaning and beyond.

Non-productive days
Days where the sow is either not gestating nor lactating.

Section 1:

General Farm Review

This section provides checklists on key performance indicators related to general sow farm processes and performance. Comparing actual values versus target levels will help sow farm managers identify improvement opportunities to get the most value out of their operations. It will also indicate the need for intervention.

Process Review

It is essential to understand the processes that could potentially limit the expression of the genetic potential. PIC has developed the PICpro100 tool to objectively assess a producer's production practices. PICpro100 uses an algorithm developed by PIC that assign a score to 23 production practices most associated with high sow herd performance by comparing them against accepted good management practices. PICpro100 can be used to complement more traditional methods to review and evaluate sow herd performance. The PIC Technical Services Team or your PIC Account Manager can help you gain additional exposure to this tool.

Performance Review

In addition to reviewing production processes, it is important to review performance records by parity and over a period of minimum 13 weeks. Key indicators to watch are farrowing rate, litter size, pre-weaning mortality, sow mortality, breeds per week and how many weeks are off target, replacement rate, wean to service interval, presence of parity dip and number of doses per sow in estrus. Many other indicators can be reviewed but the first screening will suggest which indicators to review and/or what to watch for during a farm visit.

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Table 1.1: Gilt Management Program Targets

Key Performance Indicator	Target	Intervention Level
Mortality 3 to 25 weeks of age	≤ 3%	≥ 5%
Selection at 25 weeks of age	70 to 80%	≤ 65% and > 90%
Percentage of gilts bred at/after 2nd estrus	≥ 95%	≤ 90%
Recorded estrus on week 4 after beginning of boar exposure at 24-26 weeks of age	> 70%	≤ 50%
Parity 1 farrowing rate	> 93%	< 90%
Parity 1 litter size	≥ 15.5 total born ≥ 14.5 born alive ≥ 13.5 pigs weaned	≤ 14.5 total born ≤ 13.5 born alive ≤ 12.5 pigs weaned
Parity 1 breed back	≥ 90%	≤ 85%
Parity 1 wean to service interval	≤ 6 days	≥ 7 days
Retention rates (starting with 100 bred gilts)	≥ 95 parity 1 ≥ 85 parity 2 ≥ 75 parity 3	< 85 parity 1 < 75 parity 2 < 65 parity 3

Table 1.2: Entire Farm Targets

Key Performance Indicator	Target	Intervention Level	Target	Intervention Level
Lactation Length	21 days		28 days	
Farrowing Rate	> 92%	< 90%	> 92%	< 90%
Litters/Sow/Year	≥ 2.50	≤ 2.45	≥ 2.40	≤ 2.35
Avg Total Born	≥ 16.0	≤ 15.0	≥ 16.3	≤ 15.0
Avg Born Alive	≥ 15.0	≤ 13.8	≥ 15.3	≤ 13.8
Avg Weaned	≥ 14.0	≤ 12.5	≥ 14.3	≤ 12.5
Piglet Conversion	> 88%	< 83%	> 88%	< 83%
Breed-back	≥ 92%	≤ 88%	≥ 93%	≤ 89%
Avg Wean to Service Interval	< 5.5 days	> 7.0 days	< 5.0 days	> 7.0 days
Annual Sow Mortality	≤ 5%	≥ 8%	≤ 5%	≥ 8%
Pigs Weaned/Sow/Year	> 35.0	< 30.6	> 34.2	< 29.4
Pigs Weaned/Farrowing Space/Year	≥ 212	≤ 185	≥ 167	≤ 144
Pigs Weaned per Lifetime	≥ 67	≥ 59	≥ 66	≥ 56

Table 1.3: Specific Reproductive Targets

Key Performance Indicator	Target	Intervention Level
Breeding group variation, % above or below target	< 5%	> 10%
# of weeks off breeding target within last 13 weeks	< 2	> 3
Conception rate	> 97%	< 92%
Total return rate (includes regular, non-regular and late returns), as % of the breeds	< 5.0%	> 10%
Abort rate, as % of the breeds	< 1%	> 3%
Not-in-pig sows, as % of the breeds	< 0.5%	> 1%
Vaginal discharge, as % of the breeds	< 0.5%	> 1%
Other reproductive failure (including dead and destroyed while pregnant), as % of the breeds	< 1%	> 3%
Annual gestation feed usage per sow	1,550-1,650 lbs (700-750 kg)	> 1,700 lbs and < 1,500 lbs (> 770 kg and < 680 kg)
Feed usage in wean to service interval	> 50 lbs (> 45 lbs in Parity 1) > 23 kg (> 20 kg in Parity 1)	< 35 lbs (< 30 lbs in Parity 1) < 16 kg (< 13.5 kg in Parity 1)
Sows in ideal body condition by day 30 of gestation, as % of the group	> 85%	< 80%
Sows in ideal body condition going to farrowing, as % of the group	> 90%	< 85%

Table 1.4: Specific Farrowing Targets

Key Performance Indicator	Target	Intervention Level
Birth Weight	≥ 3.0 lbs/pig (≥ 1.35 kg/pig)	< 2.5 lbs/pig (< 1.1 kg/pig)
Pre-weaning mortality	< 10%	> 12%
Avg piglet weaning weight Lbs (kg) weaned/Sow/Year at 21-22 days of age	> 13 lbs/pig (> 6 kg/pig) > 455 lbs/sow/year (> 205 kg/sow/year)	< 12.0 lbs/pig (< 5.5 kg/pig) < 370 lbs/sow/year (< 168 kg/sow/year)
Avg piglet weaning weight Lbs (kg) weaned/Sow/Year at 28 days of age	> 16 lbs/pig (> 7.25 kg/pig) > 547 lbs/sow/year (> 248 kg/sow/year)	< 14.5 lbs/pig (< 6.5 kg/pig) < 426 lbs/sow/year (< 193 kg/sow/year)
Nurse sows, as % of the weekly farrowings	5%	> 10%

Table 1.5: Key Indicators Associated To Parity Structure On A Commercial Farm

Key Performance Indicator	PIC Targets	Intervention Level
Annual replacement rate	45 - 55%	< 40%; > 60%
Culling rate	40 - 50%	> 55%
Sow mortality, death rate, euthanized	< 5%, < 3%, < 2%	> 9%, > 6%, > 4%
Avg herd age	Parity 3.5	< Parity 3.0; > Parity 4.0
Avg age at removal	> Parity 5	< Parity 4.5; > Parity 6.3
Gilt utilization up to parity 1 (% of gilts farrowed out of arrived gilts with 20+ weeks of age)	> 95%	< 90%
Gilt utilization up to parity 2	> 85%	< 75%
Gilt utilization up to parity 3	> 75%	< 65%
Gilt utilization up to parity 6	> 55%	< 45%

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Financial Impact Of Key Performance Indicators

In addition to reviewing the production KPIs, we encourage the review of financials associated with these targets and any proposed management changes. This will help to understand where to prioritize efforts and deploy resources when attempting to address indicators that are not up to the expectations.

Farm Visit

The ultimate farm review is an in-person visit. It will help to confirm or rule out what is suspected from the records and remote review of the processes. It is also important to check that sick animals are timely treated and to discuss with the farm manager any concern about animal well-being.

Table 1.6: Signs/Symptoms To Watch When Visiting A Sow Farm

Key Performance Indicator	Healthy	Distress
Appetite	Consumes all feed	Off-feed, feed refusal
Body condition	Able to maintain it	Weight loss
Response to stimulus	Stand up	Won't stand up; Apathetic or lethargic
Soundness and structure	Bearing weight evenly on all four legs	Lameness
Skin and cover	Short and smooth hair; Pink skin	Long or rough hair; Yellow, pale, red or blue skin
Pregnancy	Able to maintain pregnancy; Mammary gland development	Abortion; No mammary gland development
Body temperature	Normal: up to 101.4°F (38.5°C) in gestation; Up to 104°F (40°C) while farrowing	Fever: > 101.4°F (38.5°C) in gestation; > 104°F (40°C) the day after farrowing
Respiratory	Normal frequency: 13-20/min	Coughing; Abnormal respiratory frequency
Feces	Manure is soft	Scours; Constipation
Urine	Long and strong urine stream	Short urine; White urine

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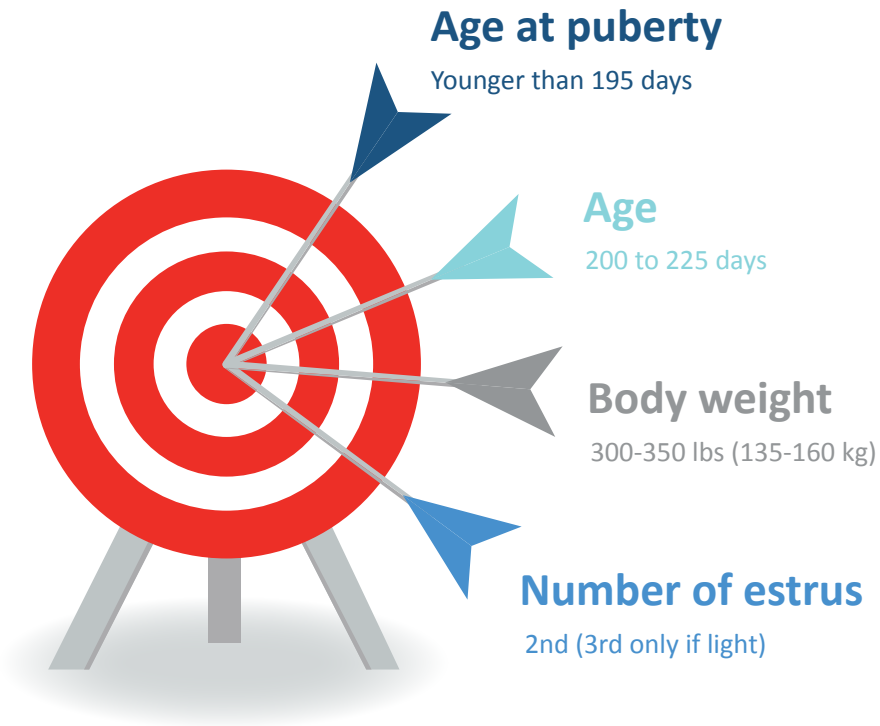
Section 2:

Gilt Management

This section provides recommendations and best practices for gilt management* to help producers prepare gilts to have high performance in their first parity while priming them for high lifetime performance.



*Gilt breeding eligibility targets have been updated based on a recent study, Data Driven PIC Gilts Eligibility for Optimized Lifetime Performance Collaborative Project by J. Patterson & J.C. Pinilla (2020).

Breeding Eligibility

Variation in performance across systems and within systems can partly be attributed to the quantity and quality of gilts at their first breeding. The gilt eligibility requirements associated with high performance in parity 1, high lifetime performance and optimized cost of production, are summarized in Table 2.1.

Table 2.1: Gilt Eligibility Requirements

Trait	Recommended Goal/Target
Age at puberty(*)	At least one recorded estrus: Camborough®: before 195 days in > 90% of gilts Purelines: before 195 days > 70% of gilts
Number of estrus at first breeding(*)	2nd estrus, third only if light 2+ in >90% of gilts < 5% at first estrus
Age at first breeding(*)	200 to 225 days >225 days gradually show lower retention rate and added cost
Body weight at first breeding(*)	>90% of gilts bred within the 300 to 350 lbs (135-160 kg) range Do not breed any gilt lighter than 300 lbs (135 kg)
Average daily gain from birth to first breeding	> 90% breed within the range 1.33 to 1.75 lbs/day (600-800 g) of lifetime weight gain
Immunity level	3+ effective weeks from last health procedure
Gilt selection/quality control	Do not breed gilts with any structural/conformational defects that affect walking or standing and ultimately farrowing and nursing
Feed intake pattern	Avoid feed outages; do not restrict feed in quantity nor quality within 14+ days prior to first breeding

(*) J. Patterson & J.C. Pinilla (2020). Data Driven PIC Gilts Eligibility for Optimized Lifetime Performance Collaborative Project. University of Alberta and PIC.

Determine Bodyweight at Breeding

Adequate body weight at first breeding is important to ensure adequate body reserves in the first lactation. Conversely, excess body weight will decrease longevity and lifetime productivity. Using a scale is the most accurate way to obtain body weight. However, when a scale is not available an indirect measure such as a flank-to-flank tape or a heart girth tape measurement can provide a a bodyweight estimate at breeding.

Take flank-to-flank measurements from the bottom of the left rear flank to the bottom of the right rear flank, running over the top of the sow (Figure 2.1). The measurement starts on one side where the fold of skin just above the mammary gland forms an angle with the skin from the leg. The measurement goes from the bottom of the rear left flank to the bottom of the right rear flank, running over the top of the sow.

Figure 2.1 – Flank-to-Flank Measurement

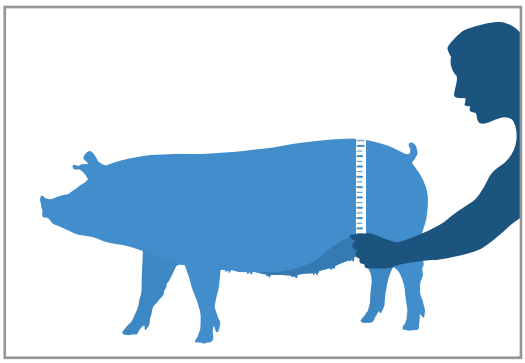


Table 2.2: Flank-to-Flank Measurements, Associated Bodyweights and Actions Related to Breeding

Flank-to-flank range, in	Flank-to-flank range, cm	Body weight, lb	Body weight, kg	Action
Less than 35.2	Less than 89.4	Below 300	Below 135	Avoid breeding. Postpone breeding to next estrus if body weight is < 300 lb or 135 kg
35.2 to 37.3	89.4 to 94.7	300 to 350	135 to 160	Breed in this estrus
More than 37.3	More than 94.7	Over 350	Over 160	Breed in this estrus. Flag female and feed the minimum daily feed allowance from breeding to the end of gestation.

Take heart girth measurements by wrapping the tape around the pig – just behind the animal's forelegs and shoulders and in front of the first mammary gland for sows (Figure 2.2). The tape should be snug.

Figure 2.2 – Heart Girth Measurement

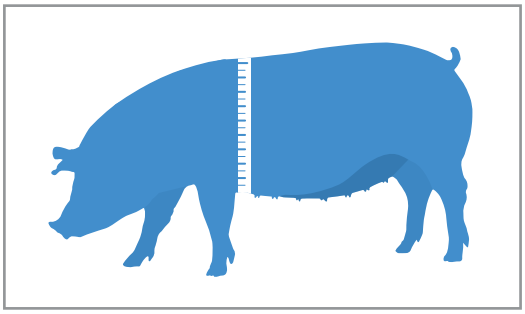


Table 2.3 Heart Girth Measurements, Associated Bodyweights and Actions Related to Breeding

Heart girth, in	Heart girth, cm	Body weight, lb	Body weight, kg	Action
Less than 49.7	Less than 126.2	Below 300	Below 135	Avoid breeding. Postpone breeding to next estrus if body weight is < 300 lb or 135 kg
49.7 to 54.6	126.2 to 138.7	300 to 350	135 to 160	Breed in this estrus
More than 54.6	More than 138.7	Over 350	Over 160	Breed in this estrus. Flag female and feed the minimum daily feed allowance from breeding to the end of gestation.

Good Management Practices

Under all circumstances, producers should adhere to the locally applicable laws that regulate management and housing practices, even if they differ from the recommendations presented in these guidelines. Find additional housing information in the PIC Wean-to-Finish Guidelines.

Table 2.4: General Housing Recommendations

Management Factor	Nursery Weaning - 70 Days of Age	Grower 70 Days of Age - Boar Exposure	GDU Boar Exposure - Breeding
Room temperature	Depends on weaning weight and age. To be on the safe side, consider room temperature ≥ 80°F (>26.5°C) Comfort can be achieved and/or managed with the use of mats and a heat source Mat should be 0.4 ft^2 (0.04m^2) per gilt at reception	70°F (21°C)	66°F (19°C)
Ventilation: no tunnel	Minimum ventilation (cold): 2-5 cfm/head Maximum ventilation: 40 cfm/head	Minimum ventilation (cold): 5-14 cfm/head Maximum ventilation: 120 cfm/head	Minimum ventilation (cold): 14-15 cfm/head Maximum ventilation: 150 cfm/head
Ventilation: tunnel	---	Tunnel speed: avg 300-400 FPM in 35-40 seconds	Tunnel speed: avg 300-400 FPM in 35-40 seconds
Gas levels		NH_3 <20ppm CO_2 <3,000 ppm CO <30ppm H_2S <5ppm	
Humidity		<65%	
Stocking density	≥3.5 ft^2 (0.32m^2)/gilt	≥7.5 ft^2 (0.7m^2)/gilt	≥12 ft^2 (1.1m^2) /gilt
Flooring	Plastic flooring only until end of the nursery phase Slatted floors: 1 inch (2.5 cm) or less opening, with straight edges Solid floors: sloped to avoid manure and liquid build-up Use bedding material when mandatory by law		

Table 2.5: General Feeding Recommendations

Management Factor	Nursery Weaning to 70 Days of Age	Grower 70 Days of Age to Boar Exposure	GDU Boar Exposure to Breeding
Water sources	Clean and fresh water always available 1 per every 10 gilts and no less than 2 water sources per pen Fixed nipple drinker height: Shoulder level of the smallest gilts Bowls are recommended for small pens (10 or less gilts) Lip height: 40% of shoulder level of smallest pig Swing nipple height: 2-3 inches (5-8 cm) above shoulder level		
Bowl drinker separation from feeders	24-26 inches (60-66 cm) spacing	36-48 inches (90-120 cm) spacing	
Swing nipples	Placed in the wet area		
Volumetric water flow rate	≥ 500 mL/minute	≥ 1 L/minute	
Diets	Specific for age/weight Use PIC Nutrition and Feeding Guidelines for more information		
Feeder space	Dry feeders: 1 inch (2.5 cm) linear feed space/gilt	Wet/dry feeders: 1.25 inches (3 cm) linear feeder space/gilt or 12 gilts/feeder space Consider placing a rubber mat at base of wet/dry feeders ending at a slat gap Dry Feeders: 2 inches (5 cm) linear space/gilt Feeder space width: 15-16 inches (38-41 cm) /feeder width	
Feeder	Consider feeder with solid divisions. Tube/round feeders aren't recommended.		
Feeding strategy	Full feed. Avoid feed disruptions/feed outages		
Feeder adjustment	50-60% coverage		

Table 2.6: Preliminary Gilt Selection: Nursery and Grower

(For a detailed description of the process of selection, refer to the PIC Selection Manual, or the gilt selection posters.)

	Nursery Weaning to 70 days of age	Grower
When	Not a routine	Thorough selection before transfer to the GDU
Goal	Avoid sending gilts to nursery with evident issues and/or defects	Avoid sending gilts to GDU with evident issues and/or defects
Traits		
Unthrifty, unsound, falling behind, sick or joint issues	Do not select	Do not select
Feet and legs	Usually no issues at this phase Fully weight bearing on all 4 legs. Do not select gilts with traumatized toes and infectious swellings.	Do not select gilts showing club foot, uneven toes, long dew claws, or severely cracked hooves
Teats	Gilts are too young to evaluate teats	If counted, avoid selecting gilts with less than 14 teats, especially at multiplication level

Table 2.7: Mandatory Gilt Selection: Last Opportunity to Perform Quality Control

(For a detailed description of the process of selection, refer to the PIC Selection Manual or the gilt selection posters)

Trait	GDU
Unthrifty, gaunt, unsound, falling behind, sick, or joint issues.	Do not select
Feet and legs	Do not select gilts showing club foot, uneven toes, long dew claws
Teats	Count carefully. Do not select with less than 14 teats
Heats	Define a protocol to deal with non-cyclers, if they are truly gilts not showing estrus

Perform mandatory selection anytime from 20-23 weeks of age, before boar exposure starts. Remove non-selects before first boar exposure, if possible.

Table 2.8: Boar Exposure, Heat Detection and Recording Recommendations

Trait	GDU
Starts at	From 24 weeks of age
Strategy	• Always complete in the morning • 1x daily; 7 days a week; after feeding in farms/regions where gilts are individually housed • Nose to nose contact, with boar inside the gilt pen or on BEAR(**), 15 minutes maximum per every 20-30 gilts • Keep written records available for inspection and review
Estimation of time needed	A 2,500-sow farm: 120 minutes/1 full-time employee/2 mature boars daily
Ratio of mature boars to gilts for boar exposure	• 1 mature (11+ months old) boar per every 100 gilts • Meishan crosses can be used from 8 months of age. • Do not work boars longer than 60 minutes • Replace 30-40% of the boars per year

(**): BEAR stands for boar exposure area. Source: Designing effective boar stimulation systems as a critical feature of the Gilt Development Unit. E. Beltranena, J. Patterson and G. Foxcroft. Leman Pre-Conference Reproduction Workshop Effective Management of Replacement Gilts (2005)

Table 2.9: Recommendations to Address Low Percentage of Gilts in Heat

Points to review and interventions when finding a low percentage of gilts with reported estrus

Potential Causes	Interventions
Hot weather	• Annual ventilation equipment and controls service • Clean and replace broken fan blades on an as-needed basis • Review cooling settings • Prevent moldy or spoiled feed build-up • Check water availability and quality (evaluate number of gilts per water source and flow ratio) See Table 2.4 • Plan for and maintain manpower during holidays and vacations • Perform heat detection in the earliest/coolest part of the working day
Reduced feed intake	• Severe restrictions can delay the group's beginning of estrus • Check water availability and quality (gilts per water source and flow ratio). See Table 2.5 • Check feeder space per gilt, feeder adjustment, and feed flowability • Evaluate stocking density and ensure gilts have adequate access to the feeder • If gilts are restricted because they are too heavy, review the flow. Early breeding may be advisable • Determine feed mycotoxin content and rule out as possible cause • Monitor humidity and gases
Low boar power	• Check if enough mature boars are available to perform both boar exposure and heat detection • Avoid working the boars for longer than 1 hour • Avoid over-worked/tired and/or too heavy boars. Keep the boars daily feed allowance controlled • Be aware that continuous exposure to the same boar(s) can be associated with poor gilt response
Low staffing	• Plan for and maintain manpower during holidays and vacations • Check effective staff hours spent on boar exposure and heat detection • Check weekend/holidays/vacation staffing • Labor qualification and expertise
Exacerbated and/or continuous stress	Avoid or mitigate stressors: gilts need water, feed, and to feel no fear
Health and health procedures	• Evaluate potential negative impacts of early health challenges on gilt development • Avoid vaccinations 3 weeks prior to the first breeding • If approved by regulatory entities, pharmacological interventions can be the last resource and diagnostic. Consult your herd veterinarian when it is advisable to consider this as an option. • Slaughter checks of the ovaries. Non-cycling ovaries are smooth structures while active ovaries show follicles and *corpus luteum* development. • A progesterone test can identify true vs. untrue anestrus, but it is not recommended for routine utilization. Consult your herd veterinarian.

Table 2.10: Recommendations to Address Low Litter Size and/or Low Farrowing Rates in Gilts

Points to review and interventions when improving reproductive results

Potential Causes	Interventions
Hot weather	See Table 2.9
Limited feed intake	Feed restriction 15 days prior breeding can hinder litter size
Limited boar power Low manpower	See Table 2.9
Exacerbated and/or continuous stress	See Table 2.9 Manage animal flow when there is a lack of parity segregation in group housing settings
Health procedures	• Avoid vaccinations in first 4 weeks of gestation • Review selection criteria and selection process when lameness is seen in recently bred, Parity 0 animals • After stocking new farms, new and abrasive floors can create hoof and sole issues • Avoid breeding animals that need individual treatment around the time of breeding or early gestation. • If this happens, review reasons for treatment and address them. Consider a more aggressive culling strategy.
Production flow	Avoid mixing and/or aggression from day 3 to 28 after breeding
Breeding interval length	The shorter the better without compromising the quality of the individual service, especially in hot weather
Semen quality	• Check with your supplier on any event that could be associated with poor performance • Check semen storage units and temperature logs • Do not carry any doses from the breeding barn back to semen storage.

Gilt Production Flows

Specific circumstances determine the best flow option to generate replacement gilts. Different options are shown for consideration.

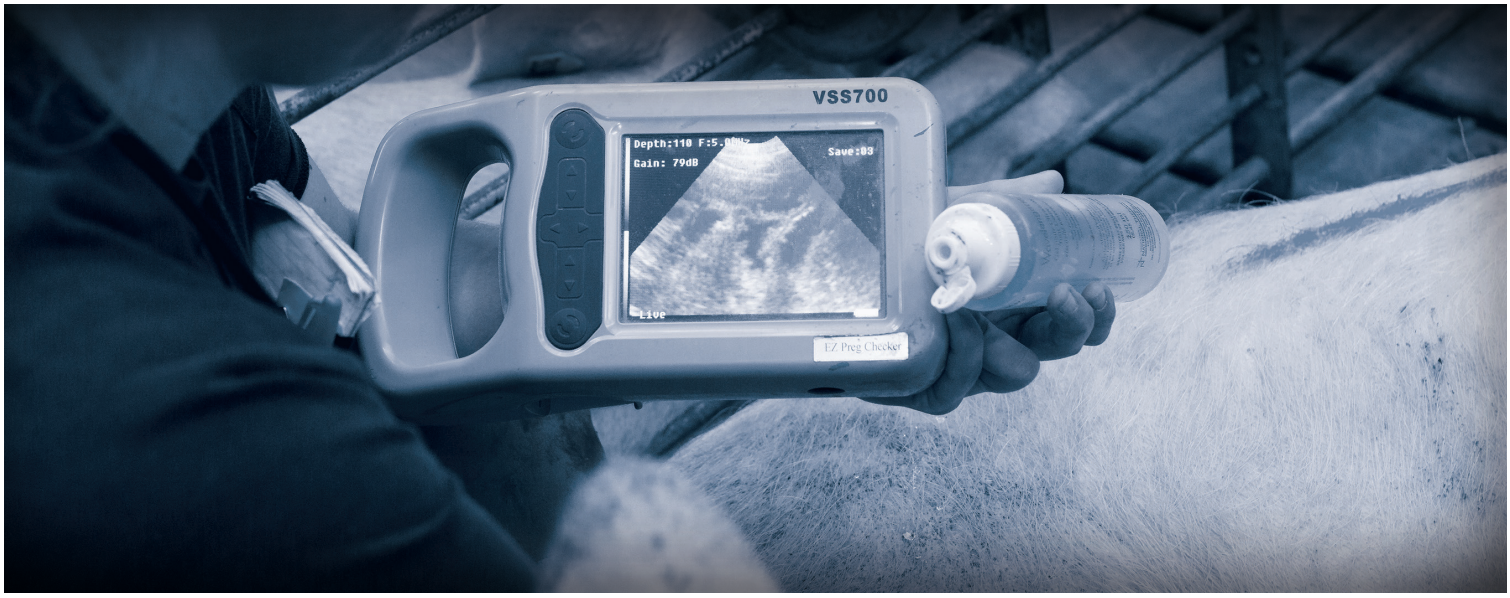
Table 2.11: Most common gilt flows

Gilt Source	External		Internal
	Continuous flow	AI/AO	
Implementation & execution of genetic program	+++		+ Oversized multiplication in smaller farms
Gilt flow control	++	+	+++
Acclimatization to sow herd	++	+	+++
Gilt usage rate & performance	Advantage in clean environments	Advantage in challenged environments (allow exposure management)	Advantage in clean environments
Biosecurity concerns	++	+++ Good when controlling PPRS or PED	++ Same as sow herd Hard to control or eliminate diseases
Transport costs	+ Higher		+++ None
Dedicated labor	System choice should not be decisive		
Labor cost efficiency	+		+++
Building costs	+ Depends on volume. Need ISO & Testing		+++ Lower
Ability to match diets to weights	+	+++	+

Key: + = unfavorable; ++ = less favorable; +++ = highly favorable

Section 3:

Breeding & Gestation



This section provides recommendations to realize superior reproductive performance. It also provides best practices on accomplishing a precise weekly breeding target which will help to establish a consistent pig flow downstream.

Good Management Practices

Producers must follow local and national regulations at any time and place. When regulation allows, consider the following recommendations.

Table 3.1: Housing Recommendations

Item	Recommendation
Temperature	65 – 68°F (18 – 20°C)
Ventilation	Minimum ventilation (cold): 12 cfm/head Maximum ventilation: 150 cfm/head
Humidity	< 65%

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Table 3.2: Weaned Sows Management Recommendation

Process	Recommendation
Culling	• Identify and mark cull sows in farrowing and avoid housing them with weaned sows
Movements	• Identify and mark sows that will need treatment after weaning; • Wean early in the morning and transfer weaned sows to the wean area on the same day
General strategy	• Maintain an organized wean area and identify late weaners by weekly lots; • Group all late weaners together in a specific area in the breeding barn; • If enough replacements are available consider culling every parity 3 and older that has not cycled after day 7 post-weaning; • Provide 16 hours of photoperiod and 250 lux (never fewer than 200 lux). Empirical experience suggests to have 150W light sources every 5 ft (1.5 m) linear; • If approved by law, pharmaceutical intervention can be used to support the production flow in critical seasons and get sows back to estrus in case of delays (always consult your herd veterinarian for details)
Feeding	• Review Table 3.4

Table 3.3: Recommendations To Consistently Achieve Breeding Target Integrity

Components	Recommendation
Weekly variations	• Avoid any disruption in your weekly gilt flow availability; • Maximum 5% over/under weekly breeding target to 1. keep your breeding flow consistent; 2. keep your weaning flow consistent; 3. minimize weaning age variation
Parity structure	• Only breed sows that are eligible to farrow and wean healthy piglets; • Do not breed lame or sick sows; • If enough replacements are available to preserve the breeding target, consider culling what is presented in Section 7 of these guidelines; • Try to solve reproductive issues by adjusting management strategies first. If approved by law, pharmaceutical intervention can be used to support the production flow on critical seasons and get sows back to estrus in case of delays (consult your herd veterinarian for details)

Table 3.4: General Feeding Recommendations

Components	Recommendation
Water availability	• Full availability and easy access; • 1 water source per 10 sows and 0.5 gallons (1.9 L) flow per minute in group housing
Diet	• For further information refer to the PIC Nutrient Specifications Manual 2021
Feeding strategy	• 3 Phases: 1. full feed on wean to service interval; 2. restricted feed based on body condition during gestation; 3. bump feed in late gestation for parity 0, only if body condition is thin; • Group gilts and sows according to body condition assessment in group housing to facilitate feeding management; • For further information refer to the PIC Nutrient Specifications Manual 2021
Body condition assessment	• Goal is to have > 85% of the females in an ideal body condition range by 28-35 days of gestation and > 90% going to farrowing; • The use of both body condition assessment systems (caliper and visual assessment) coupled with quarterly feed usage and performance data is preferred; • Ideal body condition with visual assessment means that the back, hip, and rib bones cannot be seen but can be felt when touching the sow with slight pressure; • Ideal condition with caliper assessment is between 12 to 15 units range; • Annualized gestation feed usage should be within 1,500 and 1,700 lbs (680 and 770 kg). An investigation is needed when the farm is above or below that range; • Annual sow mortality within below 9%; • Perform body condition assessment at weaning; • Perform body condition assessment at 30 days, 60 days and 90 days of gestation; • For individually housed facilities: two people are needed: one at the back of the sows who assesses body condition, the other one at the front adjusts the feeding boxes according to the nutritionist´s recommendation; • For further information refer to the PIC Nutrient Specifications Manual 2021
Body weight dynamic	• Not more than 100 lbs (45 kg) of net body weight gain at parity 0; • Not more than 50 lbs (23 kg) of net body weight gain from parity 1 and onwards

Table 3.5: Semen Doses Management Recommendations

Component	Recommendation
Storage capacity	• Semen storage device should be sized for weekly delivery; • Storage capacity equivalent to 0.16 gallon (0.6 L) per dose; • Batch farrowing systems might require more storage capacity than continuous flows; • Two small storage devices instead of one big can mitigate the risk of technical failures; • To improve safety, have surge protectors and battery backups in place
Space cooler – wall	• > 1 inch (> 2.5 cm)
Storage devices maintenance	• Once a year; preferable prior to summer
Temperature	• 61 – 64°F (16 – 18°C); • Record maximum and minimum temperature daily
Storage temperature Fluctuation	• < 1.8°F (< 1°C); • Every fluctuation > 1.8°F (> 1°C) can reduce semen dose shelf life up to 1 day
Deliveries	• 2x per week as minimum and 3x a week as optimum
Handling	• Store doses loose, unpacked, and horizontal; • First in - first out principle: use oldest doses first; • Rotate semen doses once a day
Semen age	• Optimum: < 3 days age (from semen collection); • Plan semen orders accordingly; • Every additional day of semen age can reduce total born by 0.3 pigs per farrowing
Transport to breeding and gestation barn	• Take doses to the breeding barn in an insulated container with gel packs to maintain temperature; • Have enough doses for maximum 1 hour of breeding; • One way road, no doses from breeding barn back to the refrigerator

Table 3.6: Boar Exposure And Heat Detection Recommendations

Component	Recommendation
Boar to sow ratio	• 1:200
Boar age	• ≥ 11-12 month; • Meishan crosses > 5-6 month
Annual boar replacement	• 30-40% (30% when using Meishan crosses)
Boar quality	• Use active, smelly boars with good salivation and optimum body condition
Heat checking	• Frequency: 1x daily; 7 days a week; • Order: Gilts - weaned sows - 21 day bred group - opportunity sows; • Allow nose-to-nose contact

Table 3.7: Breeding Recommendations (Conventional)

Process	Recommendation
Quality of female at breeding	• Keep the number of opportunity sows below 8% within each weekly mating group (in absence of major disease breaks)
Insemination timing	• Keep it simple; breed females just once daily
Hygiene	• Keep breeding area as dry/clean as possible; • Clean vulva with single-use dry paper towel; • If using lubricant, keep it clean and stored cool
Insemination	• Stimulation during the insemination with an adult boar and back pressure exercised by the breeder; • Do not squeeze the dose
Boar stimulation during insemination	• Mandatory, allow nose to nose contact during insemination; • Use 1 boar in front of 3-5 females and use as many boars as needed but always be cognizant of the risk of operating with boars
Boar stimulation after insemination	• Provide boar exposure for 1 hour right after insemination
Time spent breeding AI	• Individual time needed is unknown; • Average time should not be below 3 minutes per service
Move to breed interval	• Avoid any movement 2 hours prior to insemination; • Avoid any movement between services; • Avoid any movement beyond day 3 after first insemination until day 28
Refractoriness	• Do not breed females in refractory period; • Be aware of the relevance of finishing the breedings in the shortest time without compromising the quality of the individual breedings

Post Cervical Artificial Insemination (PCAI)

The major differences between PCAI and traditional insemination are the insemination technique, and the use of the catheter and dose of semen.

Table 3.8: Summary Of Main Areas To Review For PCAI Success

Process	Recommendation
Time between heat detection and breeding	• ≥ 2 hrs
Insemination timing	• Keep it simple, breed females once a day
Inner catheter insertion	• > 95% success in sows; • Wait at least 2 minutes from outer catheter insertion until attempt to insert the inner catheter; • Inner catheter should be fully inserted; • More challenging in younger parities; • If after 10 min. the inner rod does not go in completely do not force the passage; • AI the female with a boar in front, back pressure and a conventional semen dose
Insemination	• No stimulation needed; possibility to squeeze the dose; • No backflow during the insemination; • If backflow occurs check and correct inner rod position; • Change inner rod if bent or breed her AI with a boar in front, back pressure and a conventional semen dose
Boar stimulation during insemination	• Is not required but it could be part of the process without any detrimental effect

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Process	Recommendation
Boar stimulation after insemination	• Provide boar exposure for 1 hour right after insemination and assure all sows stand up
Time spend breeding post-cervical	• Not less than 1.5 min; • Not more than 10 min

Pregnancy Diagnosis

Pregnancy control can be done indirectly by detecting the return to estrus while exposed to a boar or directly by ultrasound. As a general strategy, the use of ultrasound should follow on positive pregnancy checks to validate results of the boar exposure. Sows that are already detected as returned to estrus do not need to be checked with ultrasound.

Table 3.9: Conventional Pregnancy Diagnostics

Technique	Timeframe	Standard
Boar exposure	Between 1 – 50 days after first insemination	• Use fresh boars: Change the boar if it has worked for 60 min; • Frequency: 1x daily, 7 days a week; • Although returns could appear at any time, special attention should be given to females between 18 – 24 days after first insemination
Ultrasound	Ultrasound between 21 -28 days after first insemination	• Should be used for confirmation of pregnancy after an adequate boar exposure

Reproductive Performance Below Expectations

Table 3.10: Pre-Implantation Events Leading To A Reproductive Failure

Result	On Farm Effect	Cause	Target (% of the females bred)
Early returns	Return 1 – 17 days after breeding	• Poor heat detection; • Inappropriate breeding timing	Rarely seen
Regular returns	Return 18 – 24 days after breeding	• No fertilization; • No pregnancy recognized at/around 14-16 days after breeding; • 100% embryo mortality pre-implantation; • Less than 5 embryos implanted	< 4%
	Return 36 -48 days after breeding	• No heat detection of returns on 18 – 24 days after breeding	<0.5%
Vaginal discharge	Discharge and return 1-3 days after	• Uterus infection at farrowing or, more often, at breeding; • Usually associated with 3 or more services and/or late insemination	< 0.5%

Table 3.11: Post-Implantation Events Leading To A Reproductive Failure

Result	On Farm Effect	Cause	Target (% of the females bred)
Irregular returns	Return 25-35 days after breeding	Embryo mortality 17/21 to 28/31 days	< 0.5%
Abort		Termination of gestation after 35 days of gestation	< 1%

Table 3.12: Controlling Longer Wean To Service Interval

Situation	Potential reason	Intervention
Management decisions	Skipping sows	• Understand the reasons why the staff is skipping sows; • Mitigate massive body weight losses in in farrowing; • Gilt body weight at first breeding within 300 to 350 lbs (135 to 160 kg); • Proper body conditioning; do not bump feed in late gestation, except gilts in ideal body condition; • Keep farrowing rooms cool; • Daily identification of non-eaters to implement individual treatments; • Group parity 1 females together after the weaning to focus efforts in feeding and boar exposure
Estrus in farrowing	Low number of pigs nursed; Litter scours; Massive and out of control fostering	• Challenge younger parity females with 14+ good piglets; • Room preparation and hygiene; • Vaccine program against digestive pathogens; • Reduce fostering events. Remember that no movement is better than wrong movement
Truly undetected estrus	Low boarpower; Low manpower	• House boars away from weaned sows; • Use well rested boars with high libido; • Make sure weaned sows are boar exposed and heat detected from the same day of weaning; • Farm management must ensure enough man-hours are being dedicated to boar expose and heat detection in wean area; • Weekends and holidays are always a challenge from the manpower point of view
Exacerbated and/or continuous stress	A female that is in fear won't show a good expression of its estrus	• Control/mitigate stressor(s)
Non-active ovaries	Mycotoxins in feed	• Rule mycotoxins out; • If found, ask your nutritionist for ways to control their effect

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Table 3.13: Variations Above and Below Breed Target

Source of Variation	Intervention
Gilt flow	Raise gilts according to specifications; Farm management must know gilt availability for the next 3 and 6 weeks; Ensure the targeted number heat-no-services per week is met
Replacement rate	Transitory adjustments can be made
Sow mortality	Trigger interventions as soon as the intervention level is passed; Tweak culling process and gilt selection process

Table 3.14: Deviations From Normal/Ideal Body Condition

Condition	Interventions
Too heavy (> 20% of heavy females in gestation)	• Ideally use more than just one way to evaluate body condition (feed usage plus visual evaluation or caliper); • Adjust feed boxes to make it consistent with the nutritionists indications; • Do not bump feed in late gestation; • Minimize the number of skipped sows after weaning; • Control incidence of returns
Skinny	• Make sure the gilts are bred in the recommended body weight range (see Table 2.1); • Maximize feed intake in lactation: 1. Train gilts pre-farrow on how/where to drink starting the first day housed in farrowing; 2. Allow free access to fresh feed prior to farrowing (from 112 days of gestation); 3. Daily identification of non-eaters and treat fever post-farrowing; 4. Daily check of drinkers and cleaning up of feeders; • Maximize feed intake in weaned sows; • Evaluate chances to really improve body condition or decide to cull

3.15: General Interventions To Improve Farrowing Rate and/or Litter Size

Risk factor	Interventions
Production flow	• Make sure gilts get their last vaccine at least 3 weeks prior to the first breeding; • Avoid feed outages/feed restrictions in gilts prior to the first breeding; • Minimize the number of sows lactating less than 18 days; • Avoid creating conditions to have sows in estrus while in farrowing; • If working on batch farrowing, ensure the farm is properly staffed the weeks where high number of breeds are performed; • Skip/cull sows in heat 7 to 14 days after weaning; • Avoid transferring sows in between services
Breeding timing	• Make sure heat detection and breeding are both performed well every single day; • Breed only females in solid heat
Female	• Consider to cull females according to the culling criteria presented in Section 7
Stress	• Provide air, water, feed and absence of fear; • If aggressions are seen, identify the aggressor and separate to place where no animal can be injured; • Separate injured animals and treat them according to your herd veterinarian instructions

Section 4:

Group Housing

This section gives an overview of sow housing options. There are different types of group housing systems and each has pros and cons. Regardless of the type of sow housing, PIC recommends to have the same production targets as in individually housed facilities.

Table 4.1: Comparison Between Different Group Housing Systems

Trait	Individual	Free Access	Floor Feeding	Stanchions	ESF	Outdoor
Body Condition Management	++++	+++	++	+++	++++	+
Aggressions	x	x	xxx	xx	xx	x
Building / Retro Fitting Costs	x	xxx	x	x	xxx	x
Running Costs	x	xx	xx	xx	xx	xx
Ease of Management	++++	+++	+++	+++	++	+
Gestation feed usage/sow/year	x	xx	xxx	xx	x	xxxx
Space per sow	x	xxx	xx	xx	xx	xxx

Key: + Poor, ++ Acceptable, +++ Good, ++++Very good;
x Lower, xx Moderate, xxx Higher.

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Flows and Group Size

Different flows can be implemented to optimize the performance in each type of group housing system. The flows can differ in terms of mixing time (pre- or post-implantation) and group integrity (static or dynamic). The size of the farm and breeding groups will also be a factor for optimal performance.

Table 4.2: Comparison Between Pre- and Post-Implantation Flows

Pre-Implantation	Post-Implantation
• Maximum utilization of pens during gestation (16 weeks); • Less forgiving – Problems within 1st 4 weeks of gestation tend to be more impacting; • Small window of time to load pens; • Important processes done differently: no time to recover body condition, find space for returns, heat checking, preg check	• Fair utilization of pens during gestation (12 or less weeks); • More forgiving – moving during a time when pregnancy is more stable; • Important processes (heat/preg check) still done in individual spaces

Table 4.3: Comparison Between Static and Dynamic Flows

Static	Dynamic
• Less optimization of space compared to dynamic; • Easier to manage; • Retains physical integrity of breeding group	• Better usage of space; • Physical integrity of the breeding group is disrupted; • Perhaps easier on the animals (larger dynamic pens)

Table 4.4: Comparison Between Different Group Sizes

Group Size	Characteristics
More than 150 individuals	• The group is large enough to minimize or eliminate social hierarchy; • Frequently used with ESF pre-implantation dynamic flows
20 to 150 individuals	• Structured to match either the size of a breeding group and/or the capacity of a particular feeding unit; • Frequently used with ESF post-implantation; • Static flows and free access
5 to 20 individuals	• Group is typically chosen to have similar body condition, parity and weight, and to have similar feed requirements; • Frequently used with floor feeding and stanchions

ESF

ESF, or Electronic Sow Feeding, is one of the available options of feeding in group housing in the industry. This system can also be a platform on top of which more technology for the daily farm management can be applied.

Table 4.5: ESF Key Points

Key Points	Justification
Proper gilt training	• Gestation feed intake disruptions avoidance; • Promote gilt retention rate and consistency in breeding target; • The key in the process is to NOT stress the gilts; • Consider training maximum of 40 gilts per station; • Expect a maximum of 3% un-trainable gilts
Gilt full feed prior breeding	• Gilts tend to go through catabolic period due to feed restriction during training; • After gilts are trained, it is crucial to allow 2 or more weeks of full feed prior breeding to achieve full performance
Daily non-eater checking	• Feed disruptions along the gestation will lead to reproductive failures. The sooner the farm has an action with a non-eater sow, the better the outcome; • Consider checking the non-eater no later than the next day
Feeding management	• Although they are group housed, they are fed individually, following preplanned feeding curves; • Calibrate feed stations in a monthly basis or in every feed change, adjust feed curves based on body condition on every 30 days of gestation; • If wet feeding is utilized, it should have the consistency of oatmeal in the bowl
Feed station maintenance	• Without the proper ESF station functioning, the sows will have difficulties to accomplish all necessary feed intake; • Check on a daily basis the water and feed dilution, feed dropping from the bin, movement sensor working, # of sows missing to eat every day, and the antennas reading tags
Daily pen checking	• More than only checking non-eaters, farm should have daily individual sow care. Check for lameness, abortions, vulva biting,sows in heat, fight scars, sick or dead animals and any sow in need of assistance
People profile	• With the technology applied, the mindset should be changed to run the ESF farm. Successful farms have people open to changes, pro-active profile, disciplined, open to new ways to produce and with belief in the system
Proper flow and facilities	• Projects considering less than 20 sq. ft. (1.9 m²) require another look, with more projects being designed to consider 22 sq. ft. (2 m²) for gilts and 24 sq. ft. (2.25 m²) for adult sows; • Gilt segregation will increase chances to accomplish full performance in P1s; • Avoid mixing sows in the embryonic implantation period (after day 4 to 28 of gestation). Have in mind that more sows per feed station will bring more chances to have more non-eater sows on a daily basis
Selection and culling practices	• Gilt selection and culling practices should not be different from what should be the standards in individual housed sows but a less thorough selection and culling process are less forgiving in ESF and group housing settings; • In pre-implantation flows, consider a maximum of 10% of removals per group and 5% in post-implantation flows

Trouble-shooting

The most common issues reported by producers across the globe in group housing are (1) aggressions, (2) low retention and (3) poor farrowing rate.

Table 4.6: Strategies To Mitigate Aggressions

Risk factor	Intervention
Feed/appetite	• Have feed available when loading the pen; • Full feed for 2 days; • Start feeding process at the same time every day
Age/weight	• If farm size allows, group by body condition, parity and in some situations by genetic line
Nervousness	• Have a mature vasectomized (older than 11 months of age) boar in the pen for the first 1 or 2 days; • Have solid partitions to create safety areas; • If not possible to segregate by weight and parity, load younger females first and later in the day the older ones; • Hanging chains or other “toys” have created some helpful distraction
General environment	• Check water availability; • Aggressive ventilation can help sometimes

Table 4.7: Strategies To Mitigate Low Sow Retention and Low Farrowing Rate

Risk factor	Intervention
Gilt program	• Thorough selection based on leg structure and hoof integrity; • Maximize the proportion of gilts meeting the requirements for eligibility and bred at/after second heat
Problem sows	• Proactively identify sows that are lame or don’t eat and treat them according to your herd veterinarian instructions. Segregate the individual to a recovery space; • Avoid marginal sows at breeding; • Skip heat on the youngest females if there are enough females to hit breeding target

Section 5:

Farrowing Management

This section provides recommendations for farrowing management. These recommendations aim to optimize throughput and quality of weaned pigs, while managing sows in a way that will allow quick and efficient return to estrus post-weaning.

Good Management Practices

Executing the right management at the right time has become more important to maximize piglet conversion with good quality pigs at weaning.

Table 5.1: Setting the Farrowing Environment

Area	Goal
Cleanliness & Disinfection	• Manage rooms under AI/AO system; • Use hot water and detergent when washing farrowing facilities; • Use disinfectant in the dose recommended by the supplier; • Facility dried prior to loading sows
Heat sources	• All functional; • Heat lamp's bulbs cleaned for maximum energy efficiency; • Creep area set to the right temperature (90-95°F; 32-35°C)
Mats	• Mats are cleaned, disinfected, dried and in place
Equipment	• All fans, heat sources, nipple drinkers, feed distribution and feeders functioning before loading; • Hot boxes, if present are cleaned, disinfected and dried
Ventilation/temperature control system	• Rooms with desired temperature and air flow; • Controls are reset for newly farrowed piglets
Supplies	• In place, stored in a clean container, complete and ready to be used (medicines, syringes, plastic sleeves, lube, towels)

Table 5.2: Housing Recommendations

Management	Recommendation
Room temperature	• 70-74°F (21-23°C) at farrowing. 74-76°F (23-24.5°C) on deep pitt rooms; • From the day after farrowing, gradually dropping room temperature to 66°F (19°C) by day 7-10 of age and onward
Ventilation	• Cold weather: 20 cfm/head; • Hot weather: 650 cfm/head
Humidity	• < 65 %
Farrowing space	• 6 ft wide x 8 ft (1.8 m wide x 2.4 m) most common in new facilities for 22-24 day old weaned pig
Flooring	• It seems like cast iron is the preferred material for sows but other material can also work well; • Woven wire and plastic are both broadly utilized for the piglet area

Table 5.3: Feeding Recommendations

Management	Recommendation
Water sources	• Clean, fresh and available (> ½ gallon per minute; > 2 L per minute); • Ensure > 5 gallons (20 L) per day per head; • If nipple drinker, avoid spary water by controlling high pressure
Diet	• Lactation

Management	Recommendation
Feeding strategy	• Unrestricted access to fresh feed, even from 2-3 days prior to farrowing, when sows arrived with the right body condition

Table 5.4: Piglet Early Care

Management	Recommendation
Teat count	• Count and record on the sow's ID card to avoid having a sow nursing more piglets than that number
Farrowing induction and use of oxytocin	• Avoid inducing more than 30% of sows, focusing on sows parity 5 and up, sows with history of having stillborns; • Last sows of the room to tighten up farrowings and weaning age; • Consider the farm gestation length before implementing farowing induction as a tool. In general, we do not recommend inducing before 115 days of gestation; • Oxytocin dose is 10 UI, applied 2x maximum, with shots 2 hours apart
Sow body temperature	• Rectal temperature > 103.5°F (40°C) must be treated to contain fever
Farrowing assistance	• Monitor sows every 20 minutes; • If no new wet pig(s) is/are found, consider sleeving. When sow is having normal contractions and is not being exhausted sleeving could be considered to be postponed to 20 minutes later
Chilling prevention and control	• To have 2 heat sources (fully operative) and 2 mats; • Temperature in the creep area must 90-95°F (35-38°C); • > 90% of piglets born while staff is present should be dried off
Colostrum intake	• As long as the staff is present, ensure colostrum intake within the first 30 minutes after birth; • Only split-suckle extreme litters (more pigs than functional teats) within 24 hours from farrowing. Larger piglets should be separated for 90 minutes in hot boxes; • 200 cc of colostrum on day 1 seems to increase survivability of lighter pigs by 4 to 5 times
Runt litters	• Take 15-16 runts from different litters and place them on a parity 2 female with small teats; • Runt piglets must be healthy and active

Table 5.5: Day 1 Processing

Management	Recommendation
Teeth	• If managing teeth, prefer grinding; • Do it immediately after birth
Umbilical cord	• Prefer to keep it long (3 to 5 inches; 7 to 13 cm); • Avoid pulling it; • Disinfection by dipping it on iodine solution
Drying pigs off	• Use disposable paper, towel and/or dehydrant powder
Ear notching/tattooing	• If possible, try to avoid it for the first 48 of hours of life with the exception of Production Nucleus farms.

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Table 5.6: Day 3 to 5 Processing

The following table includes general recommendations. Make sure the processing you follow respect local regulations.

Management	Recommendation
Iron	• Applied to every single piglet; • Basic dose is 200 mg but your herd veterinarian may suggest another dose
Tail docking	• Performed to every piglet; • Length should be about ¼ inches (0.6 cm) unless otherwise stated by different company policies or local laws
Castration	• All male piglets should be castrated, unless otherwise stated by company policies or local laws
Anti-coccidia	• When coccidial scour is confirmed prevalent, implement a treatment after asking your herd veterinarian

Weaning Age/Lactation Length

The topic of weaning age and lactation length usually generates debate and it is unlikely that consensus will be achieved soon. It is generally accepted that longer lactations tend to produce a heavier piglet at weaning and a better reproductive performance in the sow's subsequent cycle. PIC adds a complementary view: higher feed intake in lactation is the factor most correlated with high performance in the subsequent cycle. Our recommendation is avoid weaning individual piglets before 18 days of lactation, with a minimum average of 21-23 days.

Trouble-shooting Checklists

It is very common to find the following three concerns or issues in the farrowing house: low water/feed intake in sows, scours and elevated PWM.

Table 5.7: Trouble-shooting Poor Feed Intake and Low Milk Production

Risk Factor	Recommendation
Herd Age	• If too young, understand why the herd is having low retention rate and control culling and mortality; • If too old, work on increasing replacement rate
Environment	• Right temperature (follow temperature curve); • Enough fresh water available; • Good quality feed; • Feeders minimize wastage; • Avoid excessive fostering events; • Avoid noisy farrowing rooms
Health	• Healthy farm and healthy animals; • Hoof integrity optimized; • Farrowing assistance program to avoid retained pigs/placenta; • Scrape manure daily until 3 days after farrowing

Table 5.8: Trouble-shooting Laid-ons

Risk Factor	Recommendation
Herd Age	• If too young, understand why the herd is having low retention rate and control culling and mortality; • If too old, work on increasing replacement rate
Body Condition	• Make sure >90% of sows going to farrowing are in ideal body condition
Environment	• Avoid jumpy sows by providing feed, water, and ventilation; • Avoid excessive fostering events; • Avoid noisy farrowing rooms
Health	• Hoof integrity optimized

Table 5.9: Trouble-shooting Scours

Risk Factor	Recommendation
Herd Age	• If too young, understand why the herd is having low retention rate and control culling and mortality
Environment	• Right piglet micro-environment in terms of temperature and absence of air drafts; • Heat and ventilation sources working consistently; • Avoid excessive fostering events; • Do not step into the farrowing space; • Disinfect mats overnight with chlorine; • Materials and equipment must be disinfected
Health	• Ask your herd veterinarian how to maximize immunity against digestive pathogens; • Ensure colostrum intake

Section 6:

Batch Farrowing

Batch farrowing is the concentration of farrowings in a specific week. It is important to understand the potential benefits and costs required for the execution of a batch farrowing flow to ensure the return exceeds the investment. This section summarizes pros and cons of batch farrowing as well as best practices to optimize performance in systems that farrow in batches.

Table 6.1: Batch Farrowing Pros and Cons

Pros	Cons
• Wean more pigs in a shorter period of time to load finishing barns quicker and with pigs of similar age; • Control the effect of certain pathogens in farrowing, nursery and finishing; • Efficiencies on labor utilization, animal transport and semen deliveries	• Synchronization of gilts, returns and late weaners; • Increased non-productive-days; • Less flexible breeding target; • Potential drop on number of weaned pigs; • Fall behind piglet management; • Adjustment to new semen production schedule

Type of Batches

Although it is possible to have batch farrowing in 2, 3, 4, and 5 weeks flow, the most common are the 3 and 4 weeks flow. The resulting lactation length and differences among space and flow will impact the decision of which one to implement.

Table 6.2: Comparison Among Different Batch Farrowing Flows

Trait	2 Weeks Flow	3 Weeks Flow	4 Weeks Flow	5 Weeks Flow
Lactation length, days	19-20	26-27	19-20	26-27
Total # of batches	10	7	5	4
# of batches in lactation at the same time	2	2	1	1
Annual farrowing space turns per year	13	9	13	10
Labor distribution spreading	Over a 4 weeks period	Over a 3 weeks period	In 2 out of the 4 weeks	in 2 out of the 5 weeks

Reconverting From Weekly Flow To Batch Farrowing

When changing from weekly flow to batch farrowing, some processes will have to be changed as well. Prior to implementation, it is important to check the points in the checklist below to avoid getting surprises of unexpected struggles that can jeopardize the process.

Check-list Key points to check prior to batch farrowing implementation

- ☐ Coordinate with semen supplier to ensure the larger number of doses will be available and supplied in a shorter time.
- ☐ Ensure that there is enough semen cooler storage capacity to hold the large number of doses the farm will need in the insemination period.
- ☐ Check the necessity of extra space in gestation to wean a larger number of sows per time than usual.
- ☐ Check water availability to account for all the water needed to power wash the rooms at once.
- ☐ Make sure electric circuit is able to handle more power washers than usual at once.
- ☐ Consider lactation feed bins to account for differences in feed intake pattern.
- ☐ If synchronizing animals with synthetic progestagen, have a clear plan about how and where to utilize it.

Key Points

The key points below are crucial to the success of batch farrowing in a sow farm. Generally speaking, proper husbandry practices continue to be important to the success of the flow.

Table 6.3: Key Points In Batch Farrowing

Key Points	Recommendation
Gilt synchronization	• Need to assure the full intake of the product; • Need to administer it at the same time every day; • Ideal to place gilts in individual stalls; • Ensure the product's intake by pouring it on a slice of bread
Wean to service interval	• Assure females are in proper body condition during gestation; • Have proper feed and water intake in lactation; • Have proper feed and water intake in wean to service interval; • Make sure teaser boars are in proper quantity and quality
Breeding target accomplishment	• Review gilt delivery numbers in case of not retaining open sows or fixing breeding target holes; • Check "Gilt Synchronization" above; • Check "Wean to Service Interval" above
Removal strategy	• Following culling protocols will be even more important in the case of having open sows showing heat outside of the breeding group; • Have the sow farm data properly organized; • Use sow records to take decisions on a daily basis
Labor distribution	• Have full team in the weeks when chores are concentrated; • Use weeks with lower workload to provide vacations and time off for employees; • If implementing batch farrowing in more than one farm, exchange people among farms. Have a good identification of potential candidates in advance and make sure biosecurity rules are followed; • Consider using gestation people in farrowing and vice-versa

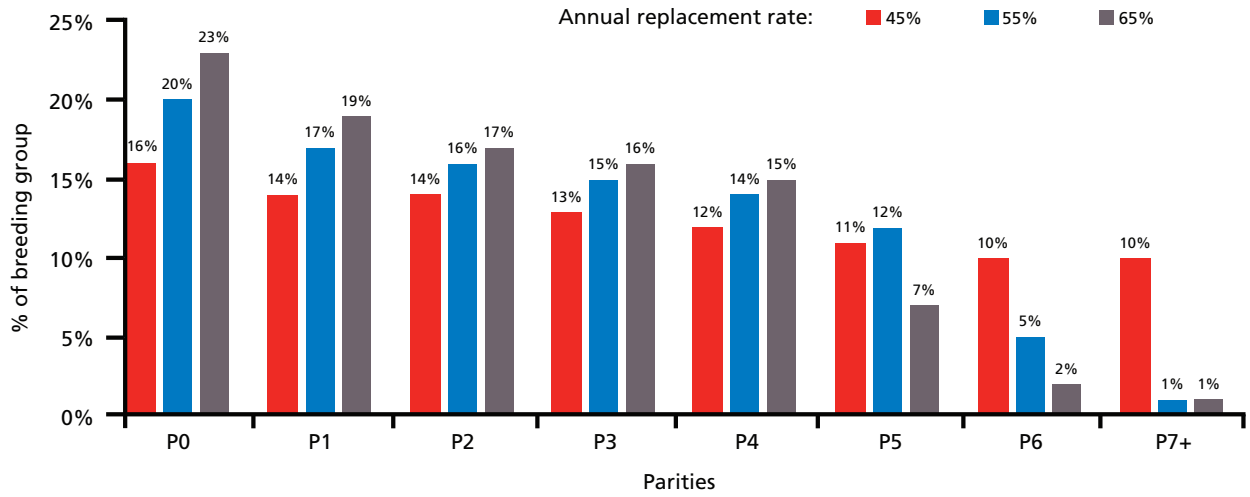
Section 7:

Parity Structure

Parity structure is the balance of sow mortality rate, culling rate and replacement rate against hog market price and feed cost.

Parity structure can influence both biological and economical performance. Therefore it is important to have a good understanding of the factors involved to better manage parity structures and, ultimately, maximize long term profitability. This section provides best practices to optimize parity structures as a performance lever.

Graph 7.1: Calculated Breeding Group Structure By Different Replacement Rates



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Good Management Practices

Success or failure of establishing the best parity structure depends on how proactive and prepared the system is to retain the right animals or cull the potentially risky or unpredictable ones. The key points to consider are gilt availability, gilt selection rate, individual sow care and culling strategy.

Gilt Availability

Gilt availability is the first element to achieve the proper replacement rate and parity structure in the system. The proper multiplication size to supply the required number of gilts is usually around 10% to 12% of the commercial sow herd inventory. It is important to be realistic with the performance of a multiplication unit. Beyond multiplication size, the critical control points below will also contribute to optimized gilt availability in the system:

Timeline 7.1: Critical Control Points On Gilt Availability Coming From The Multiplication Unit.

Gilt Selection

Gilt selection plays an essential role in the process of entering the right animals to the sow farm, so the best sows can be retained for a longer time. For more information, review Tables 2.4 and 2.5 in the Gilt Management Section.

Individual Sow Care

The population should be inspected at least once a day to identify early issues that can potentially affect the performance and well-being of the sows.

Even in healthy and age-stable farms, every week many individual sows are treated against specific threatening conditions to prevent mortality and production flow shortages. PIC advises to be properly set up in terms of supplies and manpower. When the individual treatment rate is below or above the intervention level, further investigation is advised to better understand the cause. Keep in mind that many variables can influence the treatment rate, such as health status, body condition, productivity, facilities, type and quality of floor, environment, just to name a few.

Table 7.1: Individual Treatments In A Sow Farms

Individual Treatments	
Expected number of treatments initiated every week	2-3% of the average sow inventory
Further investigation is needed	< 1% or > 4%

When the number of affected animals is greater than 10% of the population, it may be necessary to apply group treatment by water or feed adjustments. Always ask you herd veterinarian for directions.

Culling Strategy

Culling is the main opportunity to eliminate animals that are not producing according to the expectations or that have a considerable potential to bring future issues and are not needed to maintain the throughput. It is always important to have the breeding target in mind when making decisions about culling, so the farm does not run out of breeding sows.

Table 7.2: Basic Culling Strategy Guidelines

Culling Type	Culling Reason	Strategy
Voluntary	Old age (P7+)	Cull
	Low Performance	< 20 Total Born last 2 parities
Involuntary	1x Return	Cull P3+
	2x Return Discharges Aborts and NIPs Severe mastitis Lame at breeding Gilts not in heat 6 wks after the beginning of boar exposure Poor body condition	Cull
	Late weaners or early weaners	Cull parity 3 and older

Table 7.3: Annual Culling Targets and Expected Voluntary/Involuntary Culling Distribution

Criteria	Target - out of the average sow inventory
Voluntary	< 30%
Reproductive failure	< 10%
Unsoundness & others	< 5%
Total Culling	40 to 50%

Trouble Shooting High Sow Mortality And Low Retention Rate

High sow mortality and low retention rate unbalance the farm's parity structure, leading to
(1) retention of marginal sows;
(2) a lower selection pressure of the replacement gilts;
(3) decreased sow inventory, and/or
(4) higher costs with extra gilt entries.

Table 7.4: Sow Mortality and Poor Retention Rate Causes, and Points To Review

Causes	Impact	Points to review	
Gilts with no heat	Poor retention rate up to parity 3	• Gilt square footage; • Boar exposure; • Feeding management; • Water availability; • Gilt acclimation; • Gilt growth; • Quality of heat detection process, including staffing	
Lameness	High sow mortality and poor retention rate	• Gilt selection; • Gilt weight at breeding; • Size/weight of heat detecting boars in gilt pens; • Gilt body weight gain in gestation; • Sow body condition; • Feed adjustments over gestation phase; • Individual sow care; • Floor quality and maintenance; • Ventilation	
Gastric ulcers; pneumonia; mycotoxins in feed	High sow mortality and poor retention rate	• Gilt acclimation; • Individual sow care; • Feed: feed particle size; feed quality (moldy?); • Feed disruptions/outages; • Ventilation specifications; • Vaccination process	
Reproductive failures	Poor retention rate	Late weaners	• Body condition prior to farrowing; • Feeding management from farrowing to breeding; • Individual sow care; • Number/weight of nursed piglets; • Boar exposure and heat detection process quality; • Water availability
		Returns	• Semen quality; • Heat detection process; • Insemination process; • Feeding management in all phases; • Movements, mixing and fighting after breeding
		Vaginal Discharge	• Heat detection process; • Hygiene during insemination process; • Water availability; • Semen quality; • Insemination timing; • Too many third services; • Quality of feed (moldy?)
		Abortions	• Movements, mixing and fighting after breeding; • Gilt immunity; • Water and feed availability; • Individual sow care; • Vaccination process; • Ventilation specifications

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