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Your Partner in Boosting Production,
Reducing Costs and Improving Profitability.

Feeding Sows in Group Housing

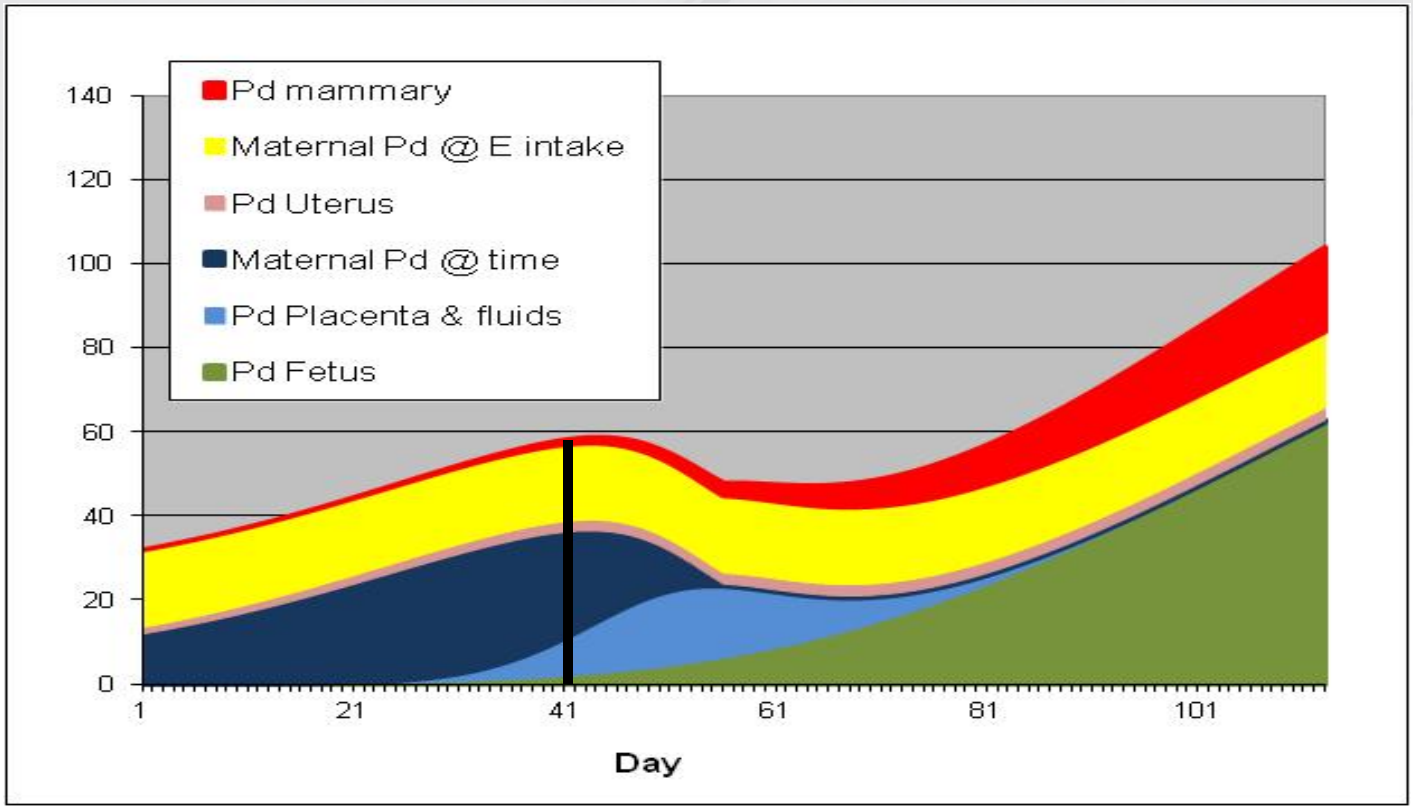
Outline

- Gestation Feeding Requirements
- Advantages and Disadvantages of Group Housing
- Differences in Group Housing Systems
- Training and Management
- Summary

Gestation Feeding Requirements

Protein Requirements in Early Gestation

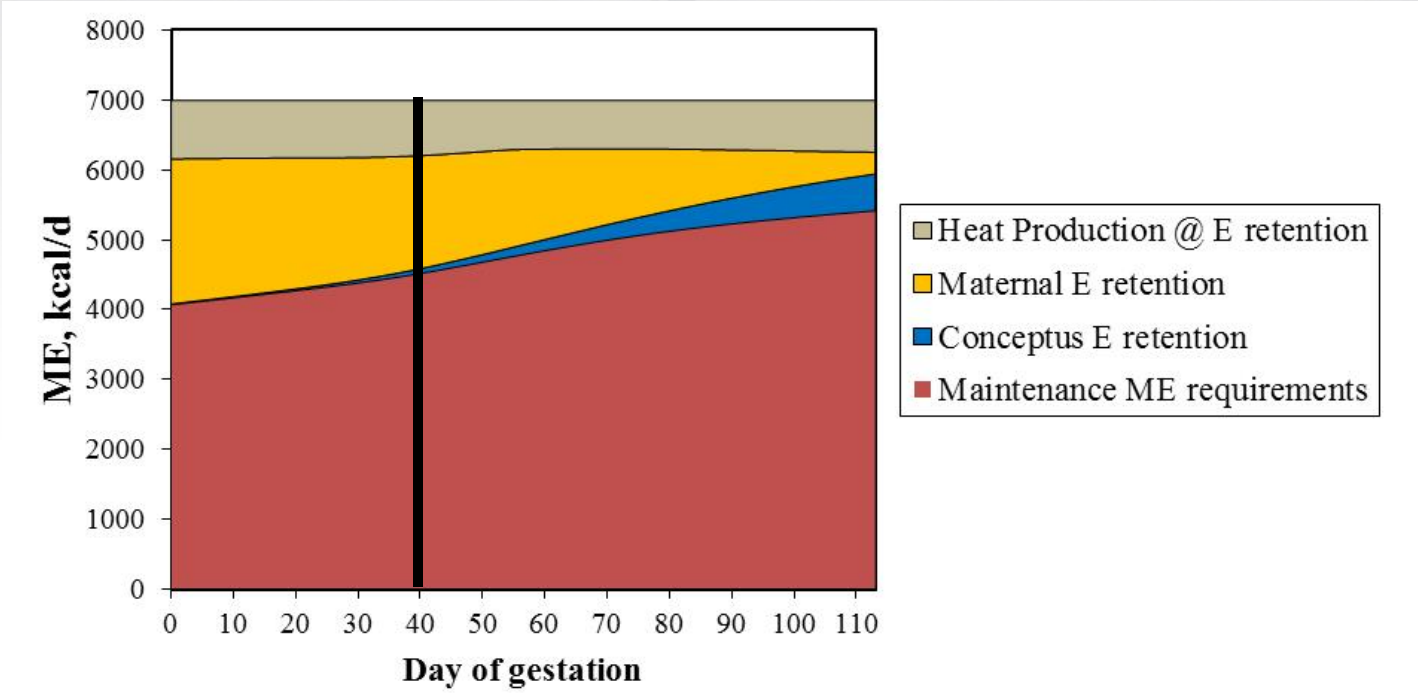
Contribution of tissues to total body protein in gestating sows (g/d)



Gestation Feeding Requirements

Energy Requirements in Early Gestation

Energy utilization: Maintenance requirements in gestating sows

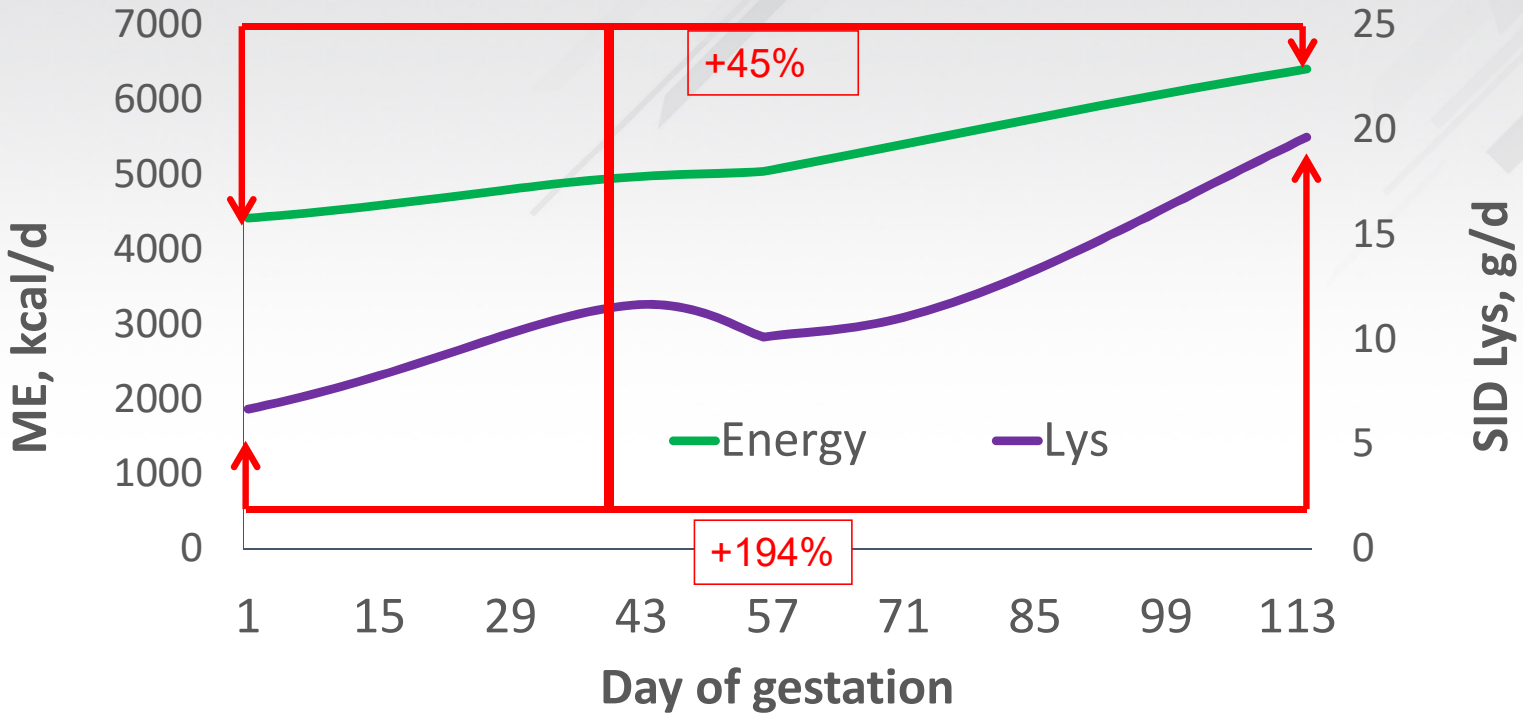


Maintenance is the main determinant of E requirements for gestating sows

Gestation Feeding Requirements

Gilt Requirements in Early Gestation

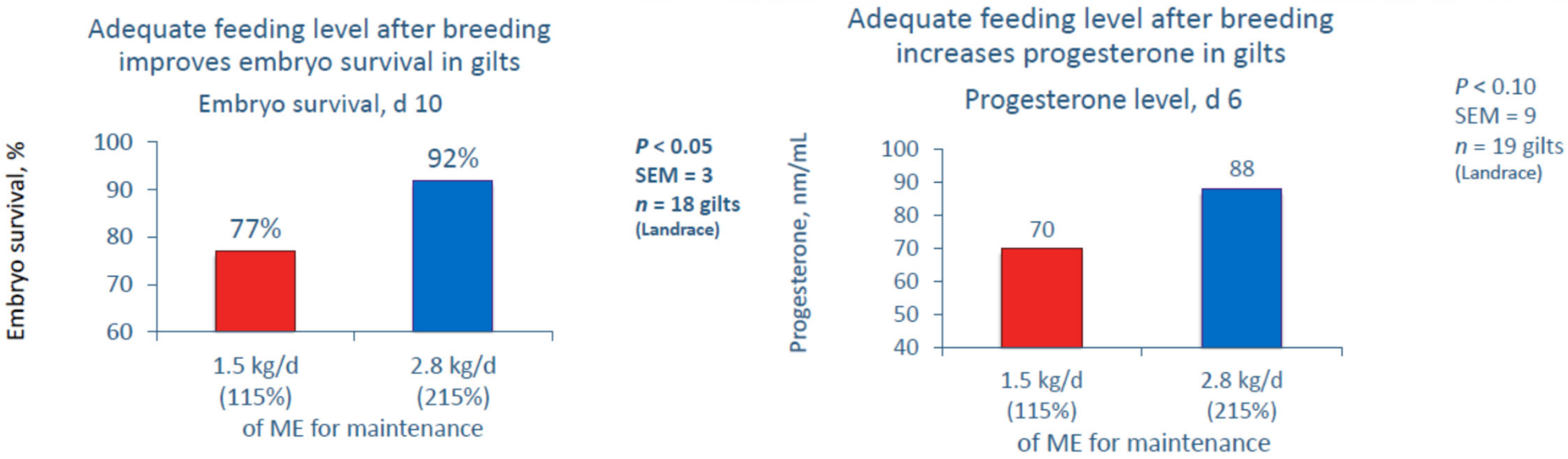
Estimated E and Lys requirements for gestating gilts*



*Completed with a modified NRC (2012) model from Q.Buis et al., 2016

Gestation Feeding Requirements

Gilt Requirements

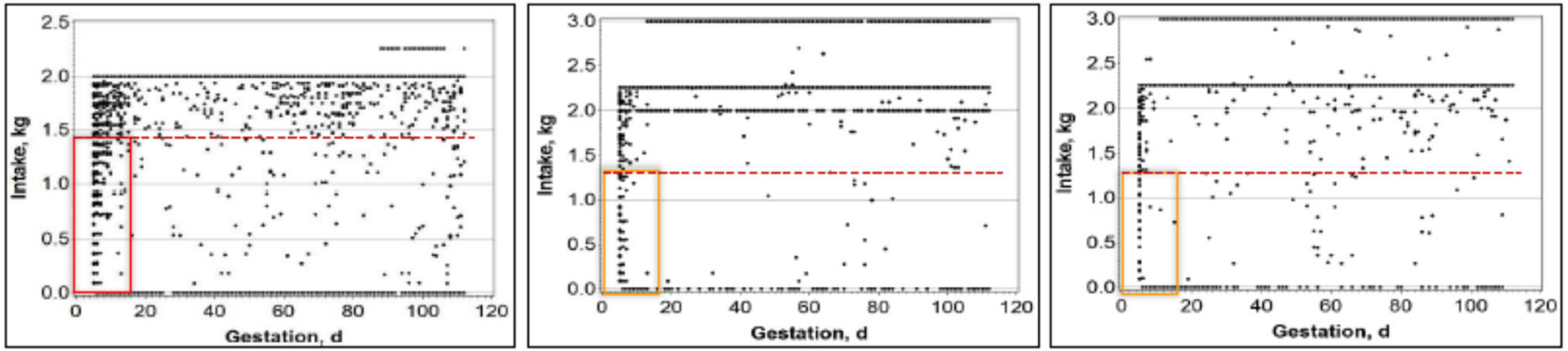


Athorn et al, 2013, Reprod Fertil Dev

Gestation Feeding Requirements

The concern is that group-housed gilts and sows fed via ESF struggle to consume their full feed allowance in early gestation

Intake records: *n* = 74,114 (PIC 1050, PIC®)



Gilts | Parity 1 sows | Parity 2+ sows

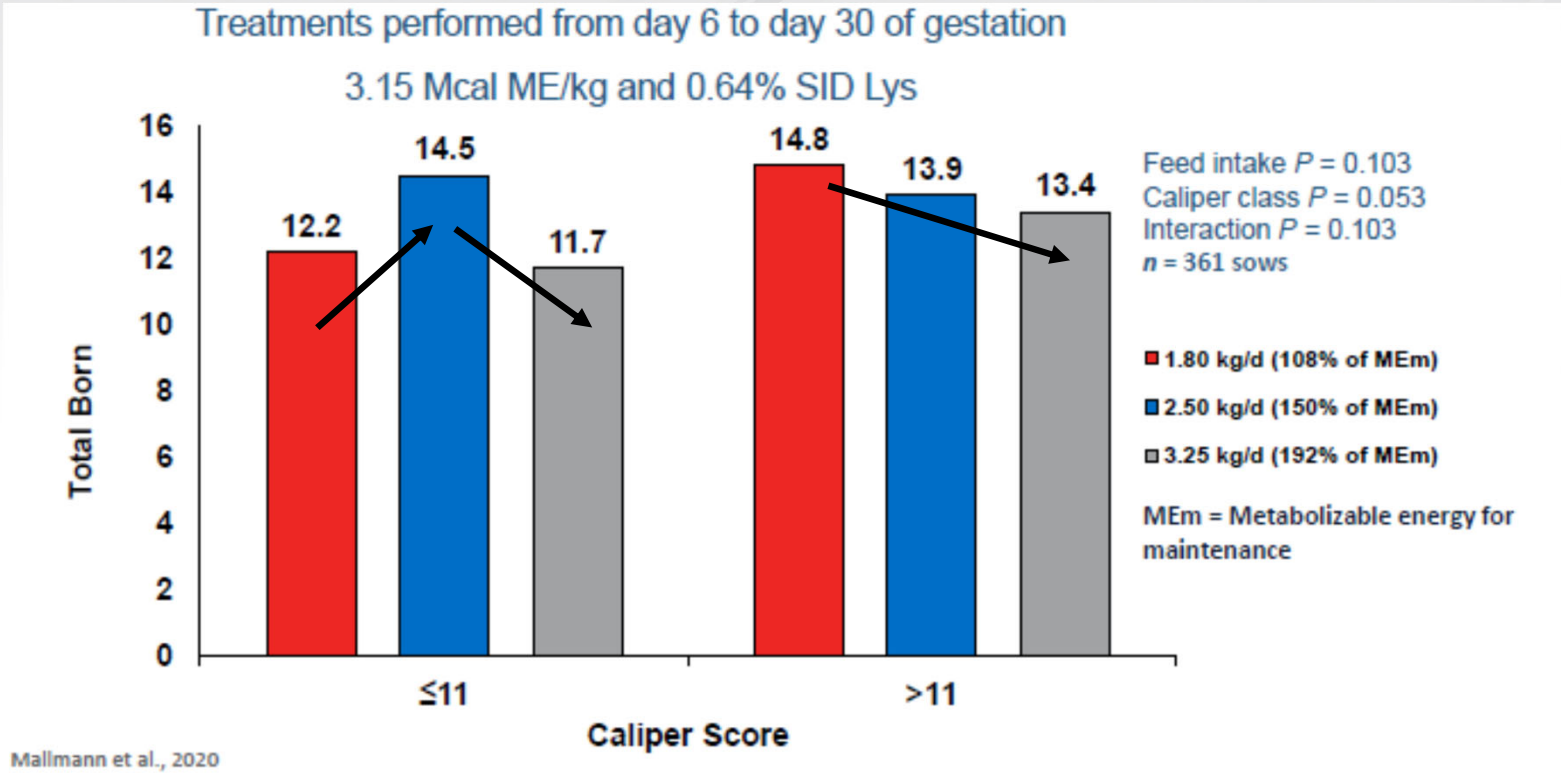
Average gilt and sow weight = 165 kg

ME for maintenance= 4.60 Mcal of ME/day which is equivalent to 1.43 kg/d

Thomas et al., 2016

Gestation Feeding Requirements

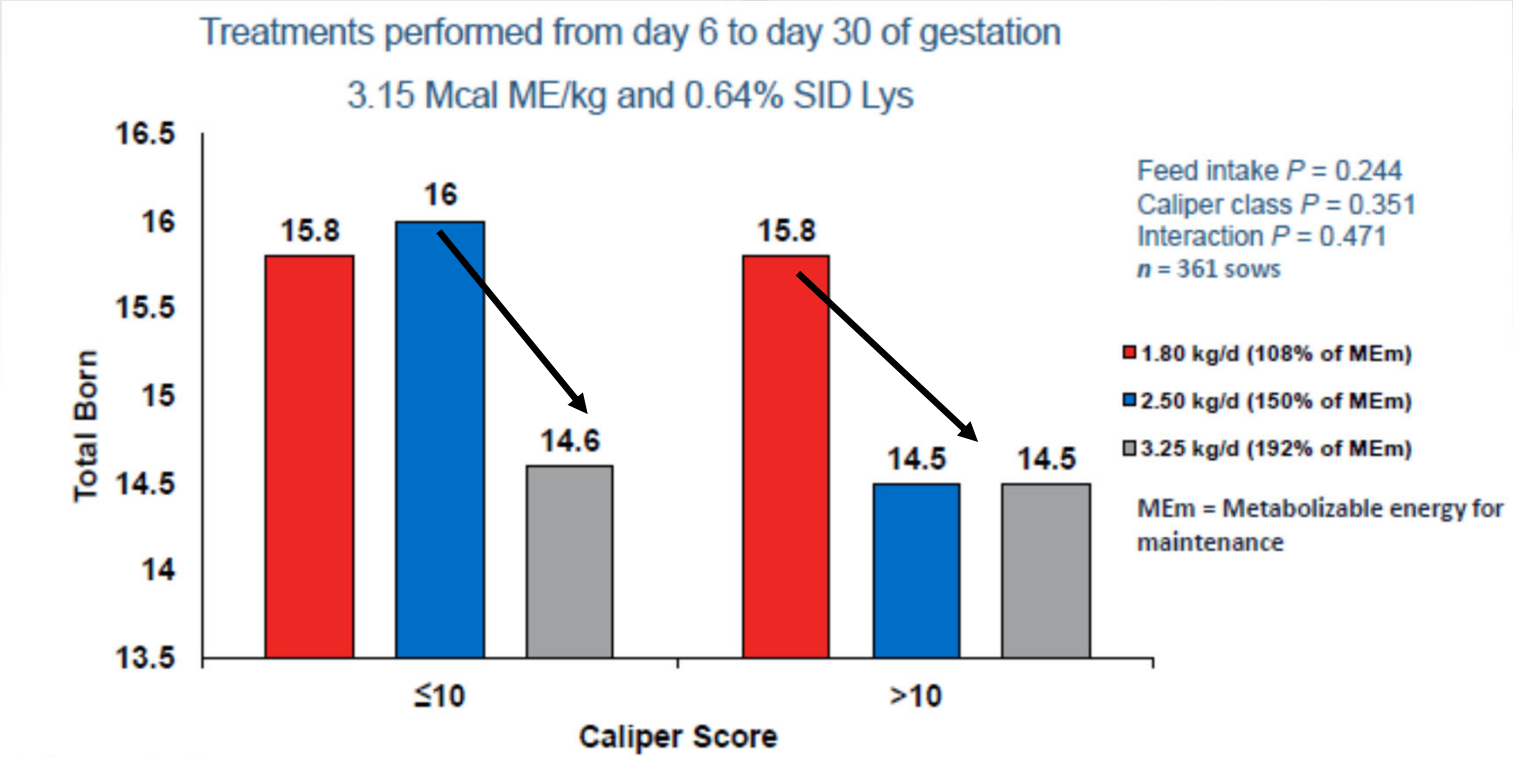
Thin parity 1 responded best to intermediate feeding levels of 2.5kg/d



Mallmann et al., 2020

Gestation Feeding Requirements

Parity 2 no statistical differences for feeding levels



Mallmann et al., 2020

Gestation Feeding Requirements

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Descriptive summary of different early gestation feeding levels on embryo survivability and hormone secretion of gilts and sows

Reference	Gestation days	Weight at weaning or breeding, kg	ME_m, Mcal/d	Feeding level, kg/d		% of ME_m		% difference for response criteria (TRT. Compared to CON.)		
				CON.	TRT.	CON.	TRT.	Embryo survivability	Farrowing rate	Total born
Jindal et al., 1996[a]	1 – 15	116	3.52	1.91	2.59	146	200	-17.9	-	-
Wu et al., 2009[a]	1 – 35	-	-	-	-	120	200	-18.7	-	-
Athorn et al., 2013[a]	0 – 10	126	3.76	1.50	2.81	115	215	19.5	-	-
Langendijk et al., 2015[a]	10 – 11	103	3.22	0.00	2.49	0	223	-	-	23.9
Virolainen et al., 2005[b]	1 – 35	252	6.32	2.00	3.99	89	179	-34.8	-	-
Hoving, 2012[b]	3 – 35	170	4.71	2.49	3.31	165	215	-	-14.7	15.2
Mallmann et al, 2020[b]	6 – 30	197	5.26	1.81	2.49	108	150	-	0.9	0.0
Mallmann et al, 2020[b]	6 – 30	197	5.26	1.81	3.22	108	192	-	-7.1	-7.5
Ribas et al., 2022[b,c]	5 – 30	213	5.58	1.59	2.81	85	150	-	-8.4	1.9
Ribas et al., 2022[b]	5 – 30	200	5.31	1.81	2.72	100	175	-	2.0	0.7
Lu et al., 2022[b]	6 – 30	216	5.65	1.59	3.22	85	175	-	4.4	-2.5

[a]The trial was conducted with gilts only.
[b]The trial was conducted with sows only.
[c]The trial was conducted with terminal sire line sows.

Gestation Feeding Requirements

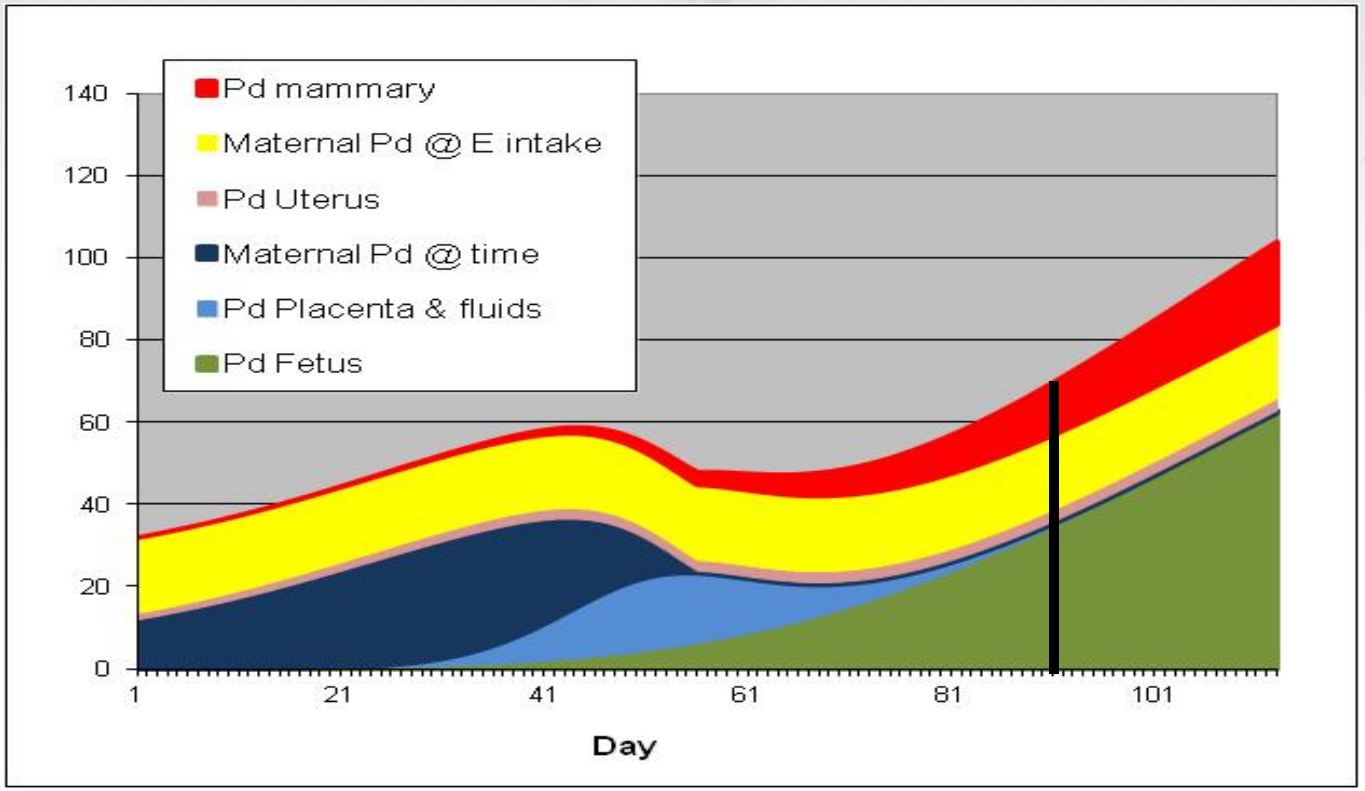
Early Gestation

- Feeding below base level during the first few days after breeding will lead to reduced embryo survival
- However, excessive feed intake (>10 Mcal of ME/day) has a negative impact in total born over all parities
- For group gestating gilts/sows:
  - ESF: Monitor individual feed intake
  - Floor feeding/station: Provide up to 3kg feed/day but no longer than 5 days, if aggression present.

Gestation Feeding Requirements

Protein Requirements in Late Gestation

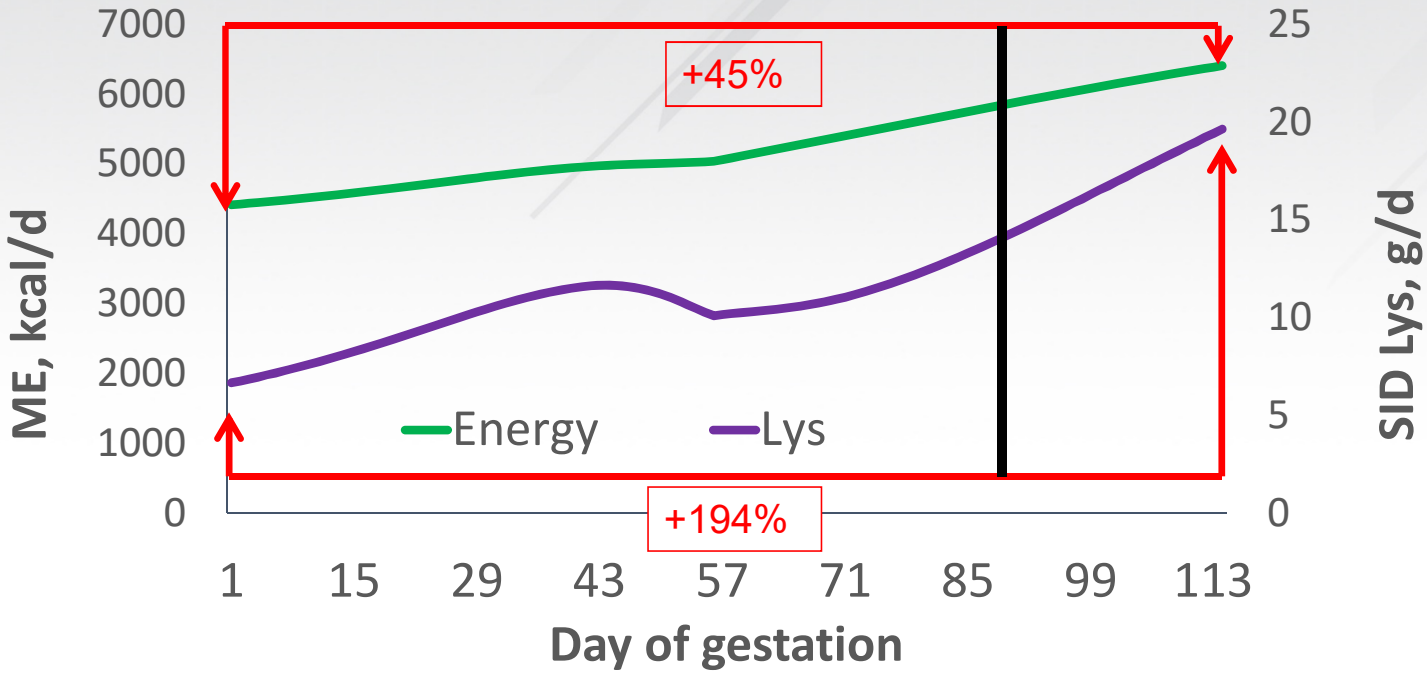
Contribution of tissues to total body protein in gestating sows (g/d)



Gestation Feeding Requirements

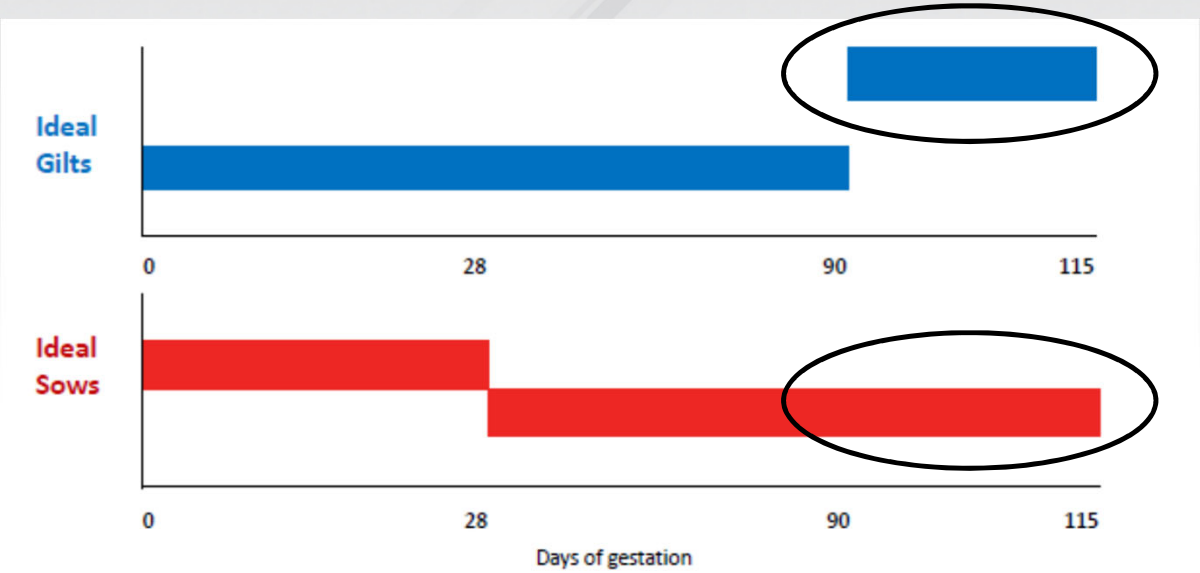
Gilt Requirements in Late Gestation

Estimated E and Lys requirements for gestating gilts*



*Completed with a modified NRC (2012) model from Q.Buis *et al.*, 2016

Gestation Feeding Requirements



Gestation Feeding Requirements

Late Gestation Requirements

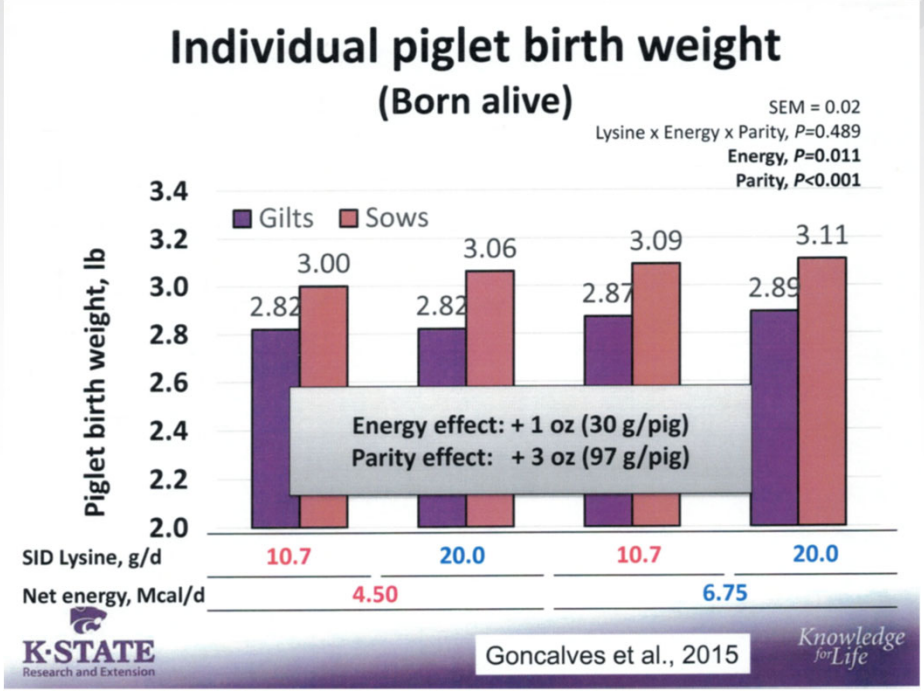
Bump Feeding Experiments in Sows

Reference	Start, day of gestation	Litters per treatment, n	Total born, n	Control, Mcal ME/day	Control, g SID Lys/day	Increased feed intake, Mcal ME/day	Increased feed intake,g SID Lys/day	Increased by treatment	
								Female BW gain, kg/ kg of extra daily feed	Piglet birth weight, g
Shelton et al., 2009	90	32	12.4	7.9	11.9	11.4	19.9	4.9	-109
Soto et al., 2011	100	51	12.9	7.9	11.2	13.9	19.5	NR	-69
Goncalves et al., 2016	90	181	15.1	5.9	10.7	8.9	10.7	9.0	47
Goncalves et al., 2016	90	181	15.3	5.9	20.0	8.9	20.0	10.8	19
Greiner et al., 2016	95	128	14.7	5.9	9.0	8.8	14.0	7.1	-40
Mallmann et al., 2018	90	221	15.4	5.9	11.7	7.2	14.3	9.0	-4
Weighted Average[a]	---	---	**14.3**	**6.6**	**12.4**	**9.9**	**16.4**	**8.9 ± 1.6**	**-1.3 ± 44.2**

[a]Weighted based on the number of litters in each study.

Gestation Feeding Requirements

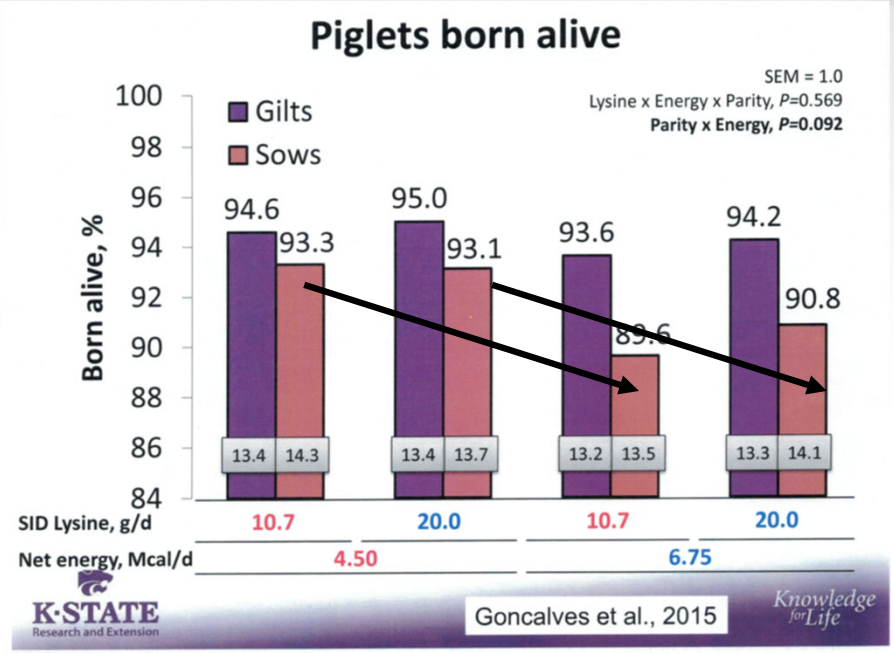
Late Gestation Requirements

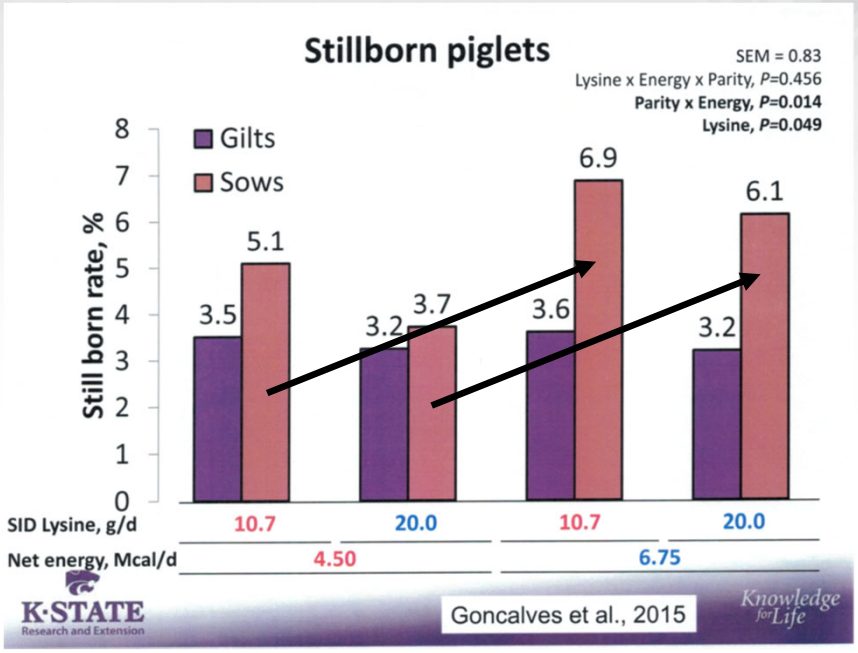


- In this study, there was no difference in total litter weight between dietary treatments
- Average piglet birth weight increased by 30g in females fed high energy
- Feed cost per piglet weaned increased by $0.21 when sows were fed 6lb compared to 4lb of feed in late gestation

Gestation Feeding Requirements

Late Gestation Requirements





Gestation Feeding Requirements

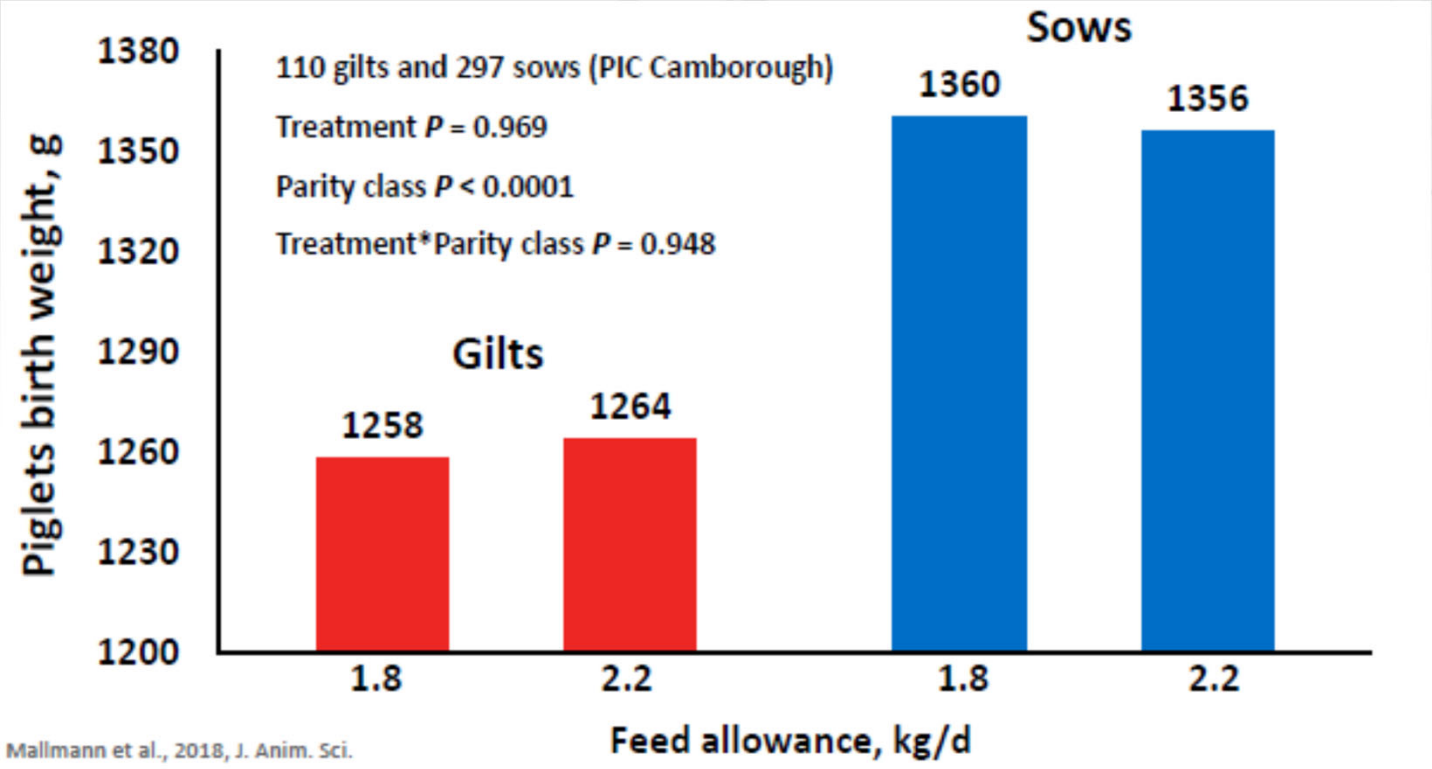
Late Gestation Requirements

Bump Feeding Experiments in Gilts

Reference	Start, day of gestation	Litters per treatment, n	Total born, n	Control, Mcal ME/day	Control, g SID Lys/day	Increased feed intake, Mcal ME/day	Increased feed intake,g SID Lys/day	Increased by treatment	
								Female BW gain, kg/ kg of extra daily feed	Piglet birth weight, g
Shelton et al., 2009	90	21	14.3	6.8	11.9	9.8	17.1	6.6	86
Soto et al., 2011	100	24	12.5	7.0	9.87	12.9	18.2	NR	126
Goncalves et al., 2016	90	371	14.2	5.9	10.7	8.9	10.7	5.6	24
Goncalves et al., 2016	90	371	14.2	5.9	20.0	8.9	20.0	9.1	28
Greiner et al., 2016	100	65	13.4	5.9	9.0	8.8	14.0	NR	-120
Ampaire and Levesque, 2016	90	17	13.4	7.2	12.3	8.6	14.5	24	-10
Mallmann et al., 2018	90	50	14.4	5.9	11.7	7.2	14.3	6.5	6
Mallmann et al., 2019	90	243	14.1	5.9	11.5	7.6	14.7	6.4	26
Mallmann et al., 2019	90	242	14.3	5.9	11.5	9.2	17.9	8.8	-1
Mallmann et al., 2019	90	246	14.3	5.9	11.5	10.9	21.1	7.9	-11
Weighted Average[a]	---	---	**13.9**	**6.0**	**12.0**	**9.3**	**16.3**	**7.7 ± 2.4**	**12 ± 36.1**

Gestation Feeding Requirements

Late Gestation Requirements



Mallmann et al., 2018, J. Anim. Sci.

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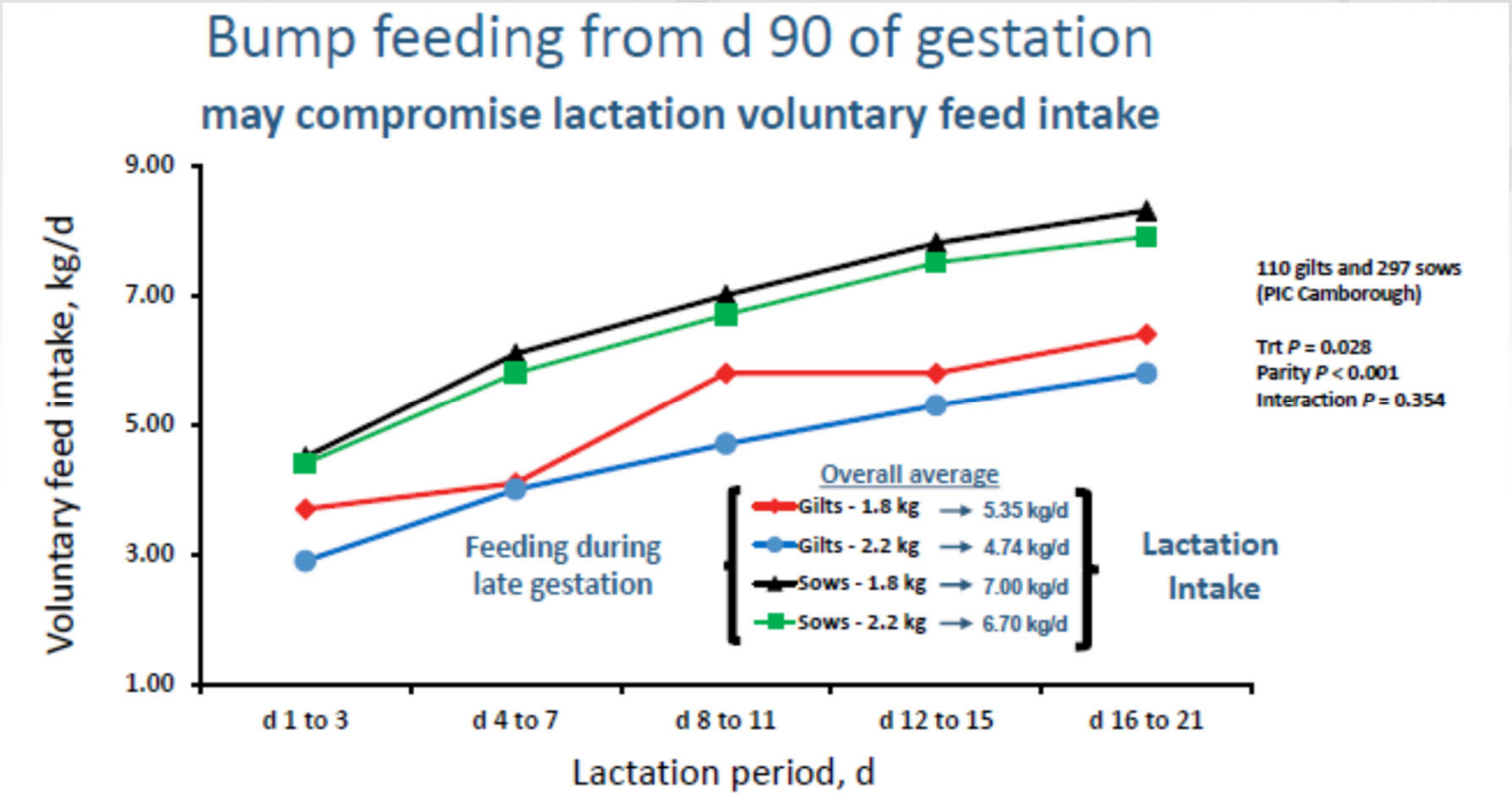

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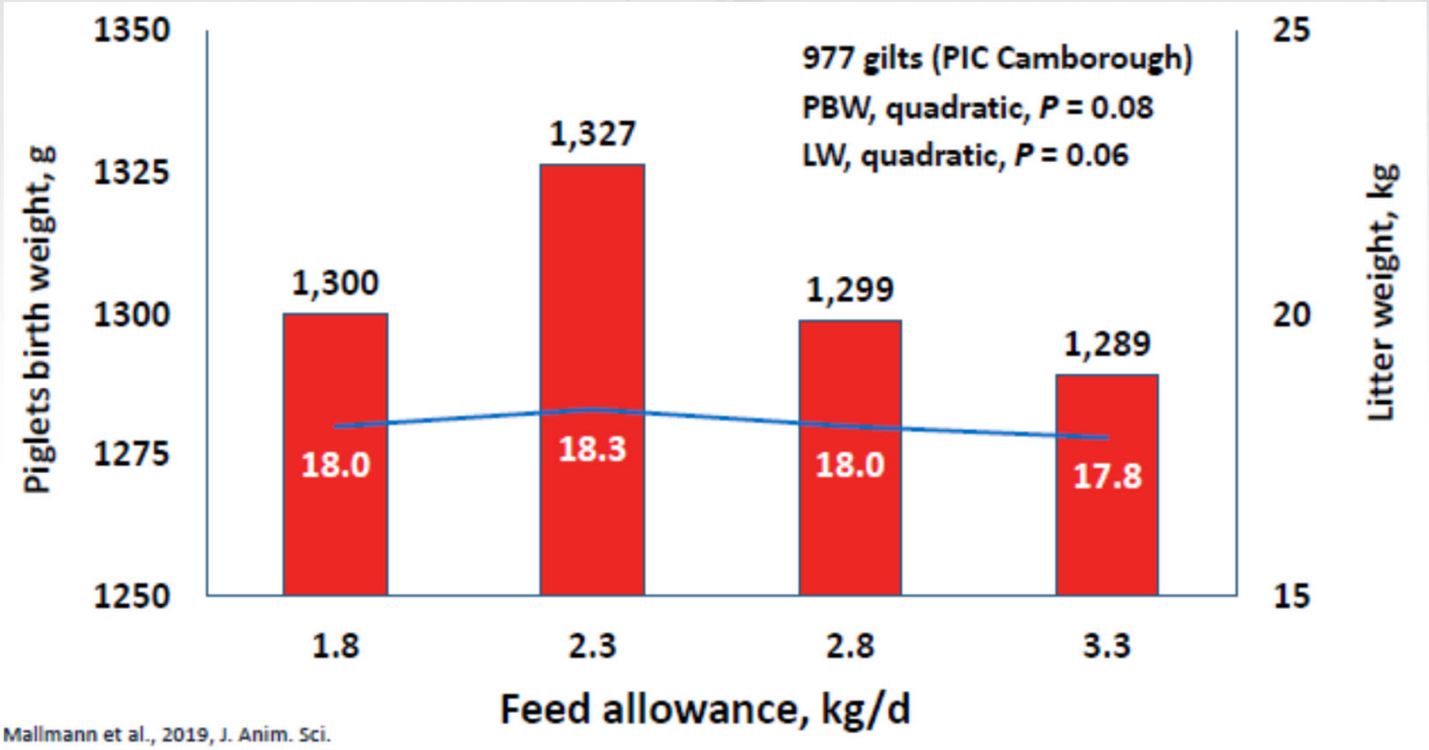

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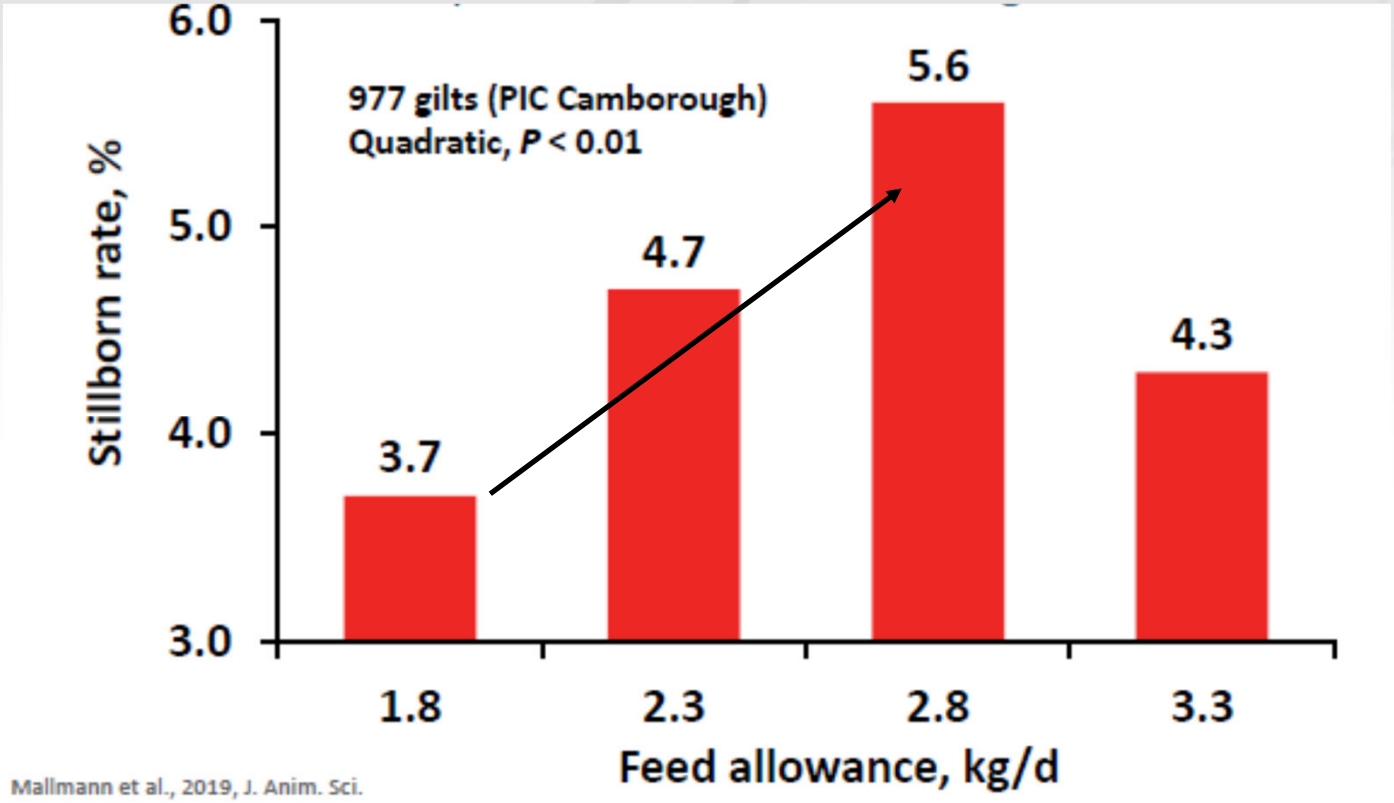

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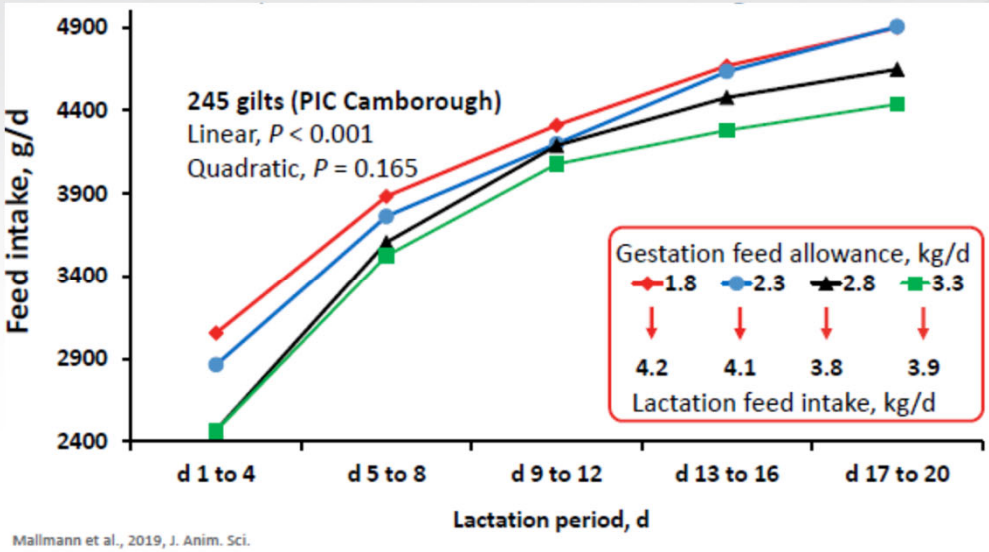

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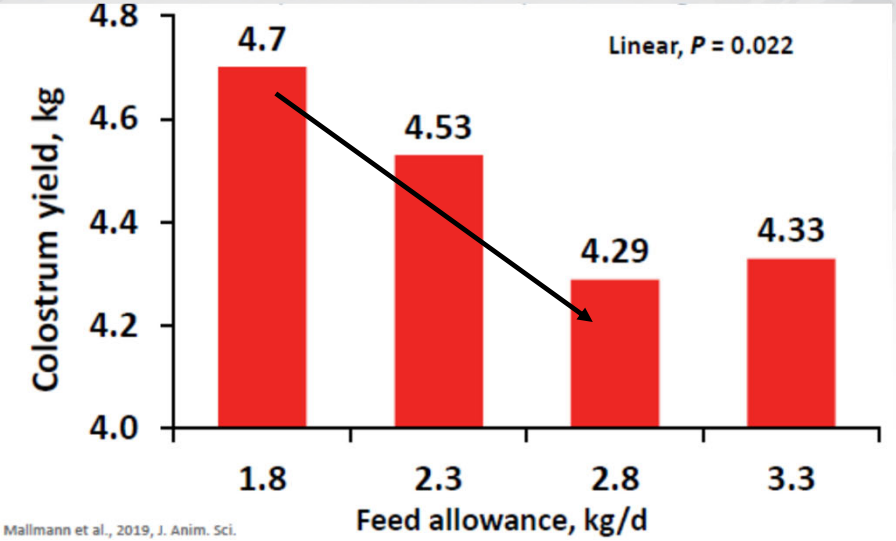

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Gestation Feeding Requirements

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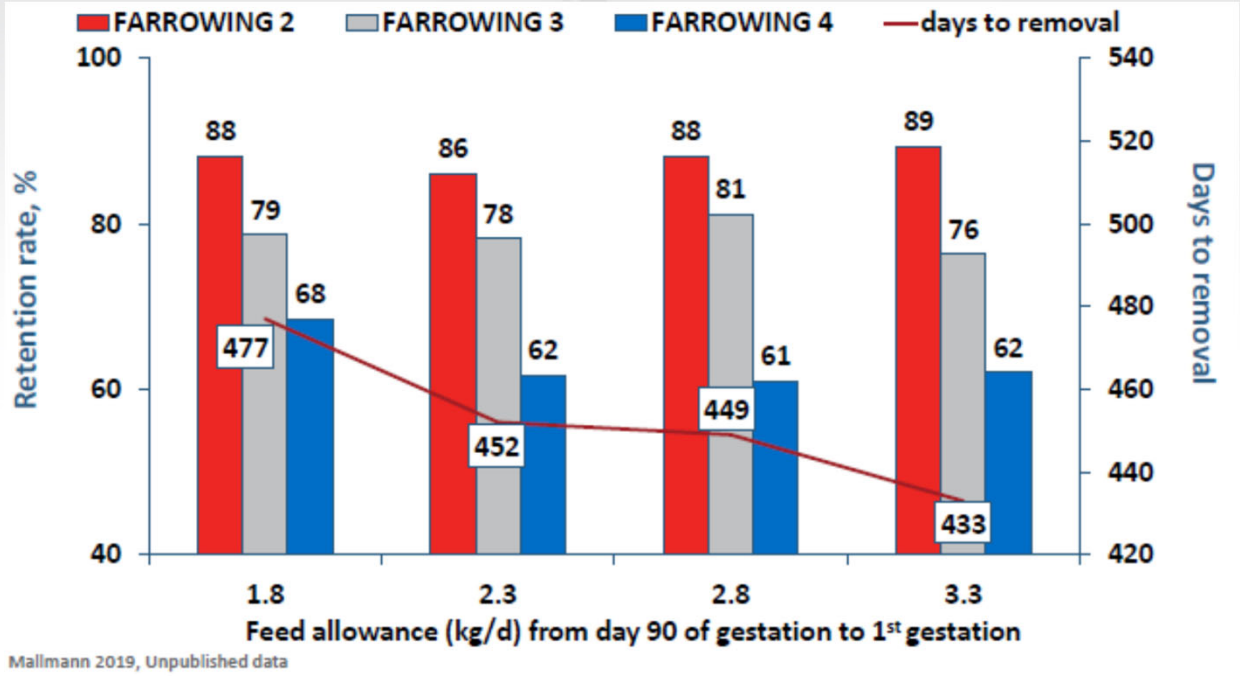
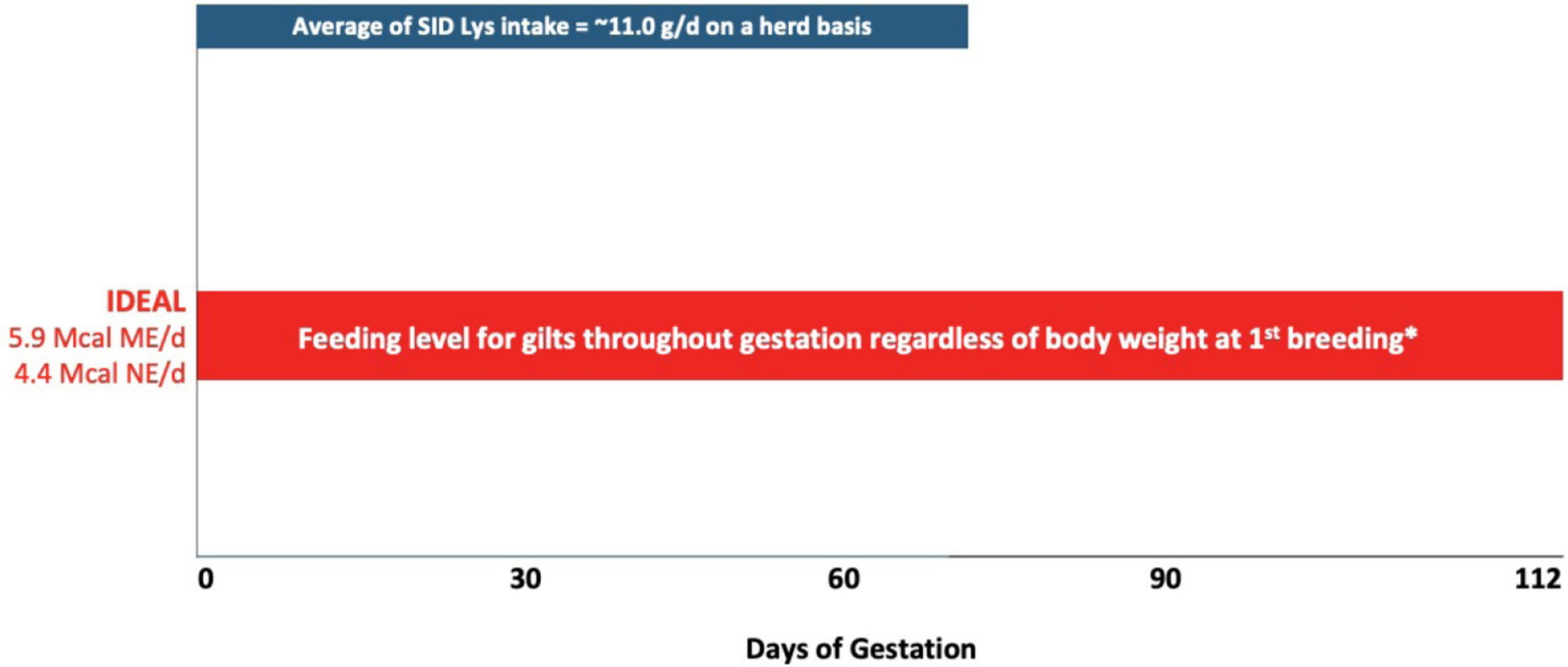


Mallmann 2019, Unpublished data

Gestation Feeding Requirements



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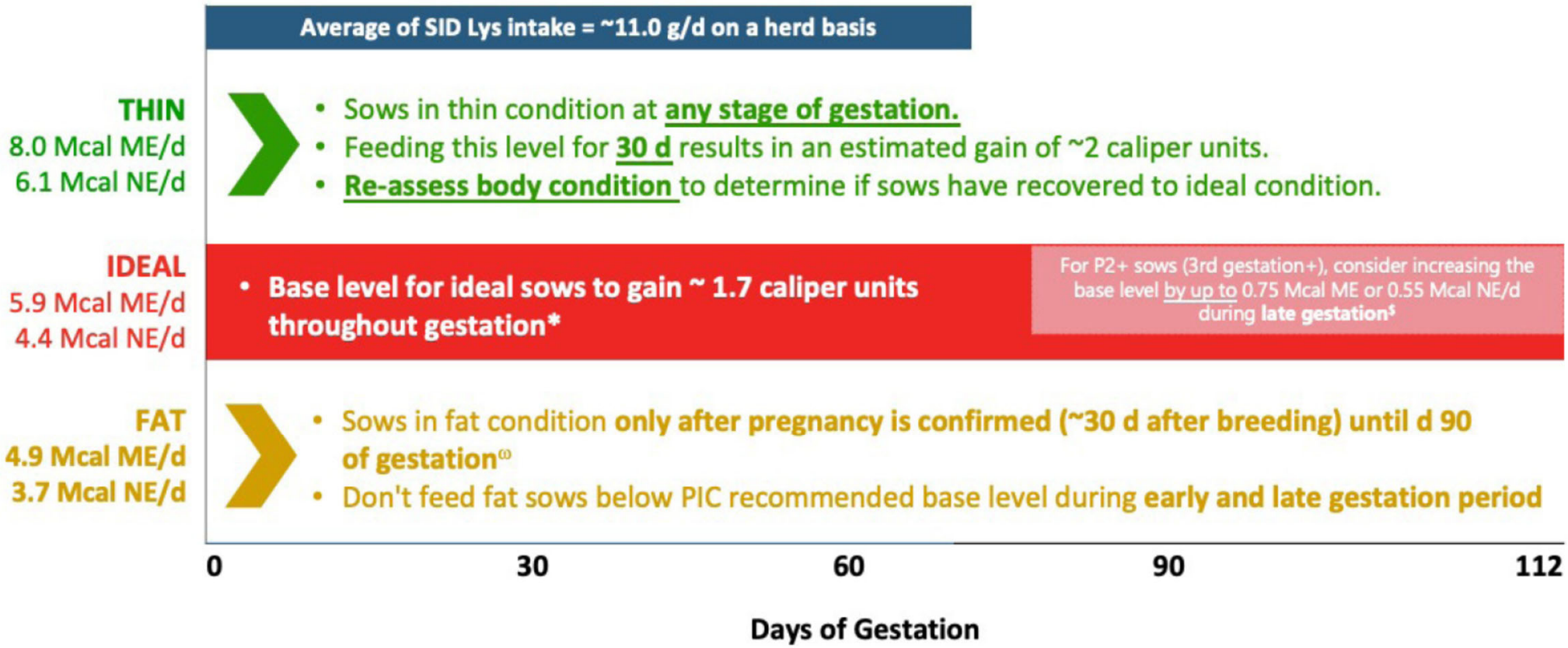

Gestation Feeding Requirements

Late Gestation

- Bump feeding results in
  - Little improvement in piglet birth weight from gilts
  - No improvement in piglet birth weight from sows
  - Higher % of stillborns in gilts and sows
  - Decreased lactation feed intake
  - Reduced retention rate

Stop Bump Feeding for both gilts and sows**

Feed adequate levels of lysine -11g/d minimum during gestation

Consider increasing base feeding level by up to 0.55 Mcal NE/d for P2+ sows due to higher maintenance requirements

**except those with a caliper reading of thin at d90

Advantages and Disadvantages of Group Housing and Feeder Systems

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

Key: + Poor, ++ Acceptable, +++ Good, ++++Very good;

x Lower, xx Moderate, xxx Higher.

Group Housing Systems

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Group Housing Systems

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Group Housing Systems

Important Considerations

- Mixing Time
  - Pre-Implantation
    - Problems within 1st 4 weeks tend to be more impacting
    - No time to recover BCS
    - Important to find space for returns, heat checking, preg checking
  - Post-Implantation
    - More forgiving –pregnancy is more stable
    - Important processes are still done in individual spaces (heat/preg checking)

Group Housing Systems

Important Considerations

- Group Integrity
  - Static
    - Easier to manage
    - Retains physical integrity of breeding groups
  - Dynamic
    - Better use of space
    - Perhaps easier on the animals (large dynamic pens = less aggression)

Group Housing Systems

Important Considerations

- Group Size
  - Small -5 -20 individuals
    - Typically grouped based on similar BCS, parity and weight = similar feed req'ments
    - Generally floor fed or stanchions
  - Medium -20-150 individuals
    - Typically matched to either breeding group or max capacity of particular feeding unit
    - Generally static flow and free access feed
  - Large >150 individuals
    - Group large enough to minimize social hierarchy
    - Generally dynamic flow with ESF

Group Housing Systems

Important Considerations

- Time allotment for feeding
  - Important to consider the speed at which feed is dropped
    - Too fast: sow eats quickly, don't feel full, circle back to the feeder
    - Too slow: doesn't allow enough time for all sows to visit feeder

Group Housing Systems

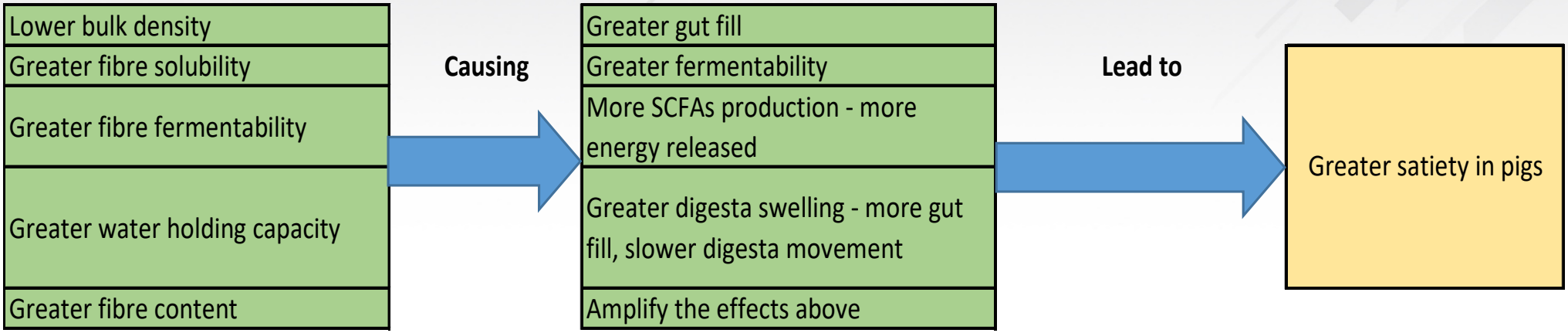
Important Considerations

- Fiber content and type
  - Historically, fiber was considered a diluent
  - Today we know that fiber is important for digestion, health and animal welfare
    - Improves intestinal passage rate, improves defecation
    - Supports intestinal health and immune competence, reduces diarrhea
    - Shortens farrowing time in the sow

    All related to the various properties of fiber –viscosity, solubility, fermentability, water holding capacity

Group Housing Systems

- Fiber content and type



Group Housing Systems

- Fiber content and type

Fibre source	Fermentability	Solubility	Water holding capacity	Bulk density, kg/m3	Total fibre content, %	Satiety
Barley	+++	+++	++	400	14.2	**
Oats	+	+	+	430	33.9	**
Oat hulls	+	+	+	130	>70	**
Soy hulls	+++	+++	++	400	83.9	****
Millrun/shorts	++	++	++	220	41.0	***
Beet pulp	++++	++++	+++	290	65.6	*****
(Leeuw et al, 2008)				BinMaster		

Training and Management -ESFs

- Proper Gilt Training
  - Avoids disruptions in gestation feed intake
  - Promotes gilt retention rate and consistency in breeding target
  - Crucial to NOT stress the gilts
    - Consider training no more than 40 gilts per station
    - Expect 3% failure rate

Training and Management -ESFs

- Gilt Full Feeding Prior to Breed
  - During training, gilts experience a catabolic period due to feed restriction
  - After training, crucial to allow 2+ weeks of full feed prior to breeding to achieve full performance

Training and Management -ESFs

- Daily check for non-eaters
  - Feed disruptions in gestation lead to reproductive failures
    - Catching them early = better outcome
  - Consider checking the non-eater no later than the next day

Training and Management -ESFs

- Feeding Management
  - Although sows are group housed, they are fed individually following pre-planned curves
  - Calibrate stations monthly or after every feed change
    - Adjust feed curves based on BCS every 30 days of gestation

Training and Management -ESFs

- Feeding Station Management
  - Check on a daily basis
    - the water and feed dilution
    - That feed is actually dropping from the bin
    - Movement sensor is working and antenna is reading tags
    - # of sows missing to eat every day
  - Feed Station maintenance

Training and Management -ESFs

- Daily Pen Checks –daily individual sow care
  - Lameness
  - Abortions
  - Vulva biting
  - Sows in heat
  - Fight scars
  - Sick or dead animals
  - Sows in need of assistance

Training and Management -ESFs

- Proper flow and facilities
  - Aim for 22 sq ft for gilts and 24 sq ft for adult sows
  - Gilt segregation increases changes of full performance in P1s
  - Avoid mixing sows in embryonic implantation period (d 4-28 of gestation)
  - Keep in mind that more sows per feed station = more chances of non-eater sows

Training and Management -ESFs

- Selection and culling practices
  - Gilt selection and culling practices should not be different from current standards
    - However, less thorough selection/culling practices are less forgiving in ESF and group housed settings
  - Aim for
    - Max 10% removals per group –pre-implantation flow
    - Max 5% removals per group –post-implantation flow

Training and Management -ESFs

- People profile
  - Successful farms have people
    - open to changes
    - pro-active profile
    - disciplined
    - open to new ways to produce
    - believe in the system

Training and Management –ESFs

Trouble Shooting

- Feed/Appetite
  - Have feed available when loading pens
  - Full feed for 2d
  - Feed at same time every day

- Age/weight
  - If size allows, group by BCS, parity and genetic line

Training and Management –ESFs

Trouble Shooting

- Nervousness
  - Have a mature boar in the pen for first 1-2d
  - Solid partitions to create safety areas
  - If not sorting, load younger females first and older females a day later
  - Chains/toys for distraction

- General Environment
  - Check water availability
  - Aggressive ventilation can sometimes help

Training and Management –ESFs

General Environment

- Ventilation
  - Lower Critical Temperature
    - individual sows on concrete: 20C
    - group-housed sows on concrete: 16C
    - group-housed sows in straw: 12C
  - Solid vs. Slatted Flooring

Gestation Feeding Requirements

Energy Requirements

Contributions to maintenance energy requirements

- Sow BW: 140 kg vs 205 kg = +0.41 kg feed intake per day
- Animal activity – hours standing: 1 hr vs 6 hr = +0.31 kg feed intake per day
- Thermal environment: neutral vs 5°C too cold = +0.17 kg feed intake per day
- Note: lower critical temperature depends on housing
  - individual sows on concrete: 20°C
  - group-housed sows on concrete: 16°C
  - group-housed sows in straw: 12°C

*corn-SBM diet (ME 3300 kcal/kg); NRC (2012)

Summary

- Group housing sows requires
  - careful planning of system and setup
  - daily checks of sows and system
  - feed formulation to support adequate nutrient intake and satiety

Acknowledgements

- Colleagues Gowans & Western Ag
  - Natalie Litvak
  - Dan Sotto
  - Joaquin Sanchez

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Thank You!