Sow housing and economics workshop

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The brief

- World Animal Protection Society works to improve pig welfare in China, Brazil and at an International level
- Encourage adoption of group housing options
- Need a better understanding of the economics of sow housing
- Which factors affect farmer/company decisions about sow housing?
  - financial, environmental, other resources, legislation

Overarching questions

Q1: To what extent is choice of housing a financial decision, and to what extent is it affected by other factors such as attitude (including risk sensitivity) and concern for animals?

A1: WHILST THE OTHER FACTORS ARE IMPORTANT, YOU HAVE TO HAVE THE MONEY IN THE FIRST PLACE.

Overarching questions

Q2: In discussing finances, is the following structure (general, costs, management, income) helpful or obstructive? Can decisions be understood by breaking them down in this way, or in some other way, or is the process different (for example, first the decision, then post hoc justification)?

A2: The decision is based on a cost-benefit analysis. Farm economists have tools for investment appraisal:

- ASSESS THE CAPITAL
- AMORTISE THIS OVER A DEFINED TIME PERIOD
- ADD THIS TO THE RECURRENT COSTS (e.g. labour)
- COMPARE AGAINST INCOME ⇨ ANNUAL CASHFLOW AND PROFIT OVER THE WRITE-OFF PERIOD.

Other factors:
Sow performance prediction.
Market opportunity.
Personal preference.

Talk structure

- Global pork production
- Current state of play in sow housing globally
- Challenges for moving to group and farmer decisions
- How to model costs of production
- Systems available + Pros and Cons of systems
  - For the animal (beh, phys, longevity)
  - For the stock-worker (labour)
  - For productivity (see above)
  - For the environment

Economically

Background – ~110m tonnes per year from 20 largest pork producing nations

Figures from BPEX Meat Facts 2013

Background

Figures from BPEX Meat Facts 2013

Background

Figures from BPEX Meat Facts 2013

~ 6 parities
= 810 days

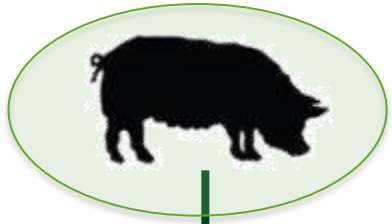
Gestation

Parturition

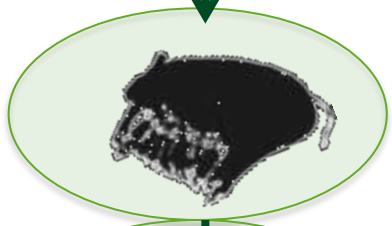
Neonatal & Lactation

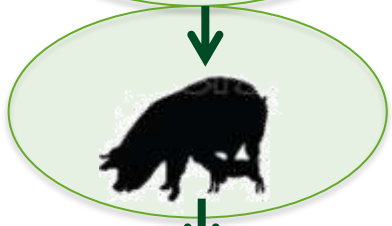
Weaning ⇨ Growing ⇨ Finishing

Selection for rebreeding ⇨ Gestation

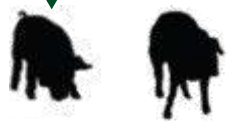


~ 5 days oestrus
115 days pregnant

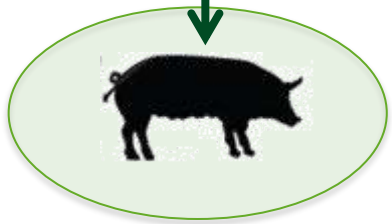




~ 5 days pre-farrow
~ 28 days to weaning
(assuming not nurse sows!)



~ 180 days to slaughter weight



~ selected at about 100 days, served at 240 days

Gestation stalls - why/why not?

- Why?
  - Efficiency – ease of management
  - Protection of the pregnant animal
    - Protection of unborn piglets
    - No aggression
    - Nutrition – no “waste” – everything directed towards maintaining pregnancy (but higher feed intake needed due to LCT)

- Why not?
  - Barren environment + extreme restriction
    - ➢ Abnormal behaviour
    - ➢ Weakened joints, hoof health issues
    - ➢ Injury – pressure sores
    - ➢ Respiratory disease
  - Chronic nutritional and psychological stress ⇨ Impact on fetal HPA development
  - Human-Animal Relationship almost non-existent

What are health and welfare issues with changing gestational units?

- Health and welfare problems
  - High stocking density and restricted feed
  - Aggression → injury, lesions
  - Stress → delayed return to oestrus (can compromise longevity in the herd)
  - Monitoring and treating health issues
    - Animals can go unchecked
  - Dynamic mixing is common – gilts in with sows

Gestation stalls – State of play

- Tethers banned 2006 – EU
- Stalls/Gestation crates banned by EU from 1st January 2013
  - UK, Sweden, Norway and Switzerland already banned (1999)
  - The Netherlands banned 2008
  - DK 25% “UK production” since 1999

- Council Directive 2008/120/EC requires:
- Sows and gilts must be kept in groups from 4 weeks after service to one week before the expected farrowing date (holdings of <10 sows may use individual housing)
- Minimum unobstructed floor area allowance of 1.64m^2 (gilts) and 2.25m^2 (sows)
  - Group size <6 requires 10% more space/animal
  - Group size >40 may have 10% less space/animal

Gestation stall ban – Drivers for change

- What have been the drivers towards removal of stalls in the EU?
  - Public opinion of animal welfare
  - Scientific evidence
  - Legislation
  - Financial (e.g. exports – DK to UK)

Gestation stalls – State of play

- Australia – Partial (4-6 weeks stalled post service) **voluntary** ban by 2017, aim to move to full ban
- NZ – Partial (allowed around service) **voluntary** ban by 2015

- Canada will "phase" out over next 10 years
- USA – Smithfields will partially "phase" out stalls by 2017

BUT:

  - Problems with space restrictions on Smithfield farms on East coast of USA
  - Large back-lash by producers saying they would not comply

Gestation stall ban – Drivers for change

- What will push/drive change?
  - Voluntary ban – consumer pressure (public opinion of animal welfare), retailer pressure therefore financial
  - Export – Brazil wants to export to Europe
  - Cultural differences may change priorities (e.g. China – finance and environment likely to dominate)

More from next talks!

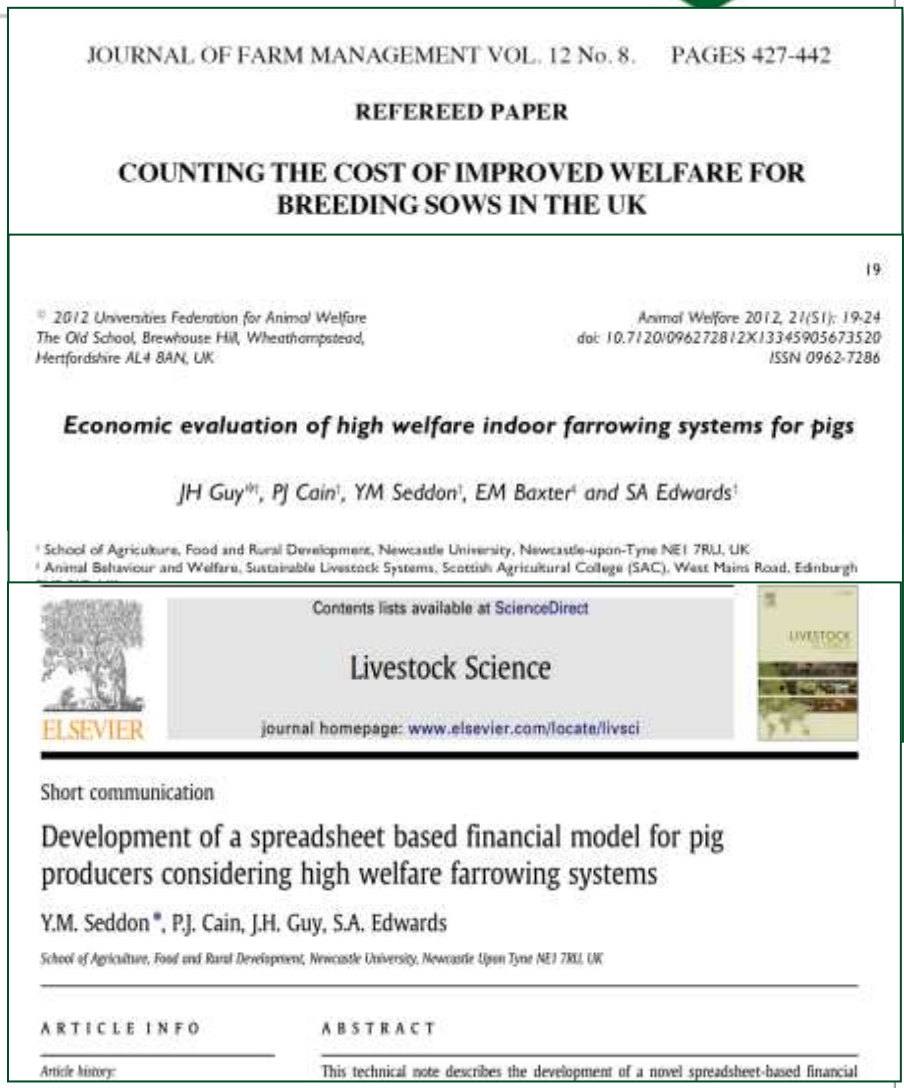
Group housing: challenges

Demands placed on farmers

- Group size and space provision
- Provision of resources to minimise stress
  - Types of feeding system
  - Design of feeding systems
- Management of satiety
- NOT a comparison of gestation stalls versus group housing
- Finances – how do you cost a new/converted system?

Methods to estimate costs of production

- Pregnant housing systems cannot be stand-alone costs.
- Must combine dry sow and farrowing accommodation.
- Aim = calculate the costs of production per sow and per weaner for the different systems used.
- Spreadsheet format – Decision support tool = different types of information feed into each other to give costs of production



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REFEREED PAPER

COUNTING THE COST OF IMPROVED WELFARE FOR BREEDING SOWS IN THE UK

19

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Economic evaluation of high welfare indoor farrowing systems for pigs

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Short communication

Development of a spreadsheet based financial model for pig producers considering high welfare farrowing systems

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ARTICLE INFO

Article history:

ABSTRACT

This technical note describes the development of a novel spreadsheet-based financial

Cain and Guy 2006, Guy et a. 2012, Seddon et al. 2013

Spreadsheet models (Cain & Guy)

Model pig unit specs

Sheet 1

Sow places

Herd performance

Buildings data

Sheet 2

Costs

Resource use

Standard unit costs (per unit of resource)

Sheet 3

Labour

Power

Feed

Dry sow sys physical performance

Sheet 4

e.g. % successful service

Sow cull rate

Sow replacement rate

Non-productive days

Farrowing sys physical performance

Sheet 5

e.g. Born alive

BD

% PWM

Total production cost £

Sheet 6

Per sow and per weaner combination

Decision support tool - five sheets feed information into the final sheet which estimates the total costs of production per sow and weaned piglet for each particular combination of dry/farrowing sow system

Spreadsheet 1 – Pig Unit specs

Gather data about the farm – e.g. average UK

- 545 breeding sows
- 2.35 litters per year
- 28 day weaned

Dry sow places needed = 483

+ service area

Farrowing places = 115 (for any costings given in this talk assume conventional farrowing crates used)

Spreadsheet 2 – Buildings data

- What are the costs of building construction, estimated annual repair costs, etc…?
  - Space used = large capital investment
  - Flooring
  - Manure management system
  - Ventilation
  - Furniture – e.g. feeding system

Spreadsheet 3 – Standard Unit Costs

- What are the costs of labour, power, feed, bedding, machinery
  - System dependent
  - Feed – home grown? Bought in – market dependent
  - Bedding – home grown? Competition between industries
  - Machinery – manure management

Spreadsheet 4 – Dry Sow Performance

- How well does your dry sow herd perform?
  - Farrowing rate/Successful service %
  - Sow mortality, cull rate
  - Sow replacement rate
  - Non-productive days

All sensitive to type of system and management

Spreadsheet 5 – Farrowing house performance

- How well is your farrowing performance?
  - Numbers born alive
  - Numbers born dead
  - Numbers weaned
  - Pre-weaning mortality
  - Weaning weights
  - Sow feed intake

Sensitive to system, management and dry sow house system

Spreadsheet 6 – Costs of production

Sheet 6

Total production cost £

Per sow and per weaner combination

Gestation system	Cost per weaner using conventional farrowing crate (£)
Yard & dump feeder  	?
Yard & ESF  	?
Kennel & individual feeder  	?

Housing type – decisions?

- Major decisions centre around:
  - **Feeding system**
  - **Floor type and bedding**
  - **Space allowance and arrangement of space**
  - **Group size and stability**

  - Both direct and indirect cost implications

Housing type – decisions?

- Minimise competition for limited resources to reduce aggression and chronic stress
  - Adequate floor space and appropriate group size
  - Adequate resource provision
  - Choice of feeding system
  - Design of feeding system
  - Management of satiety

Converting stall to group

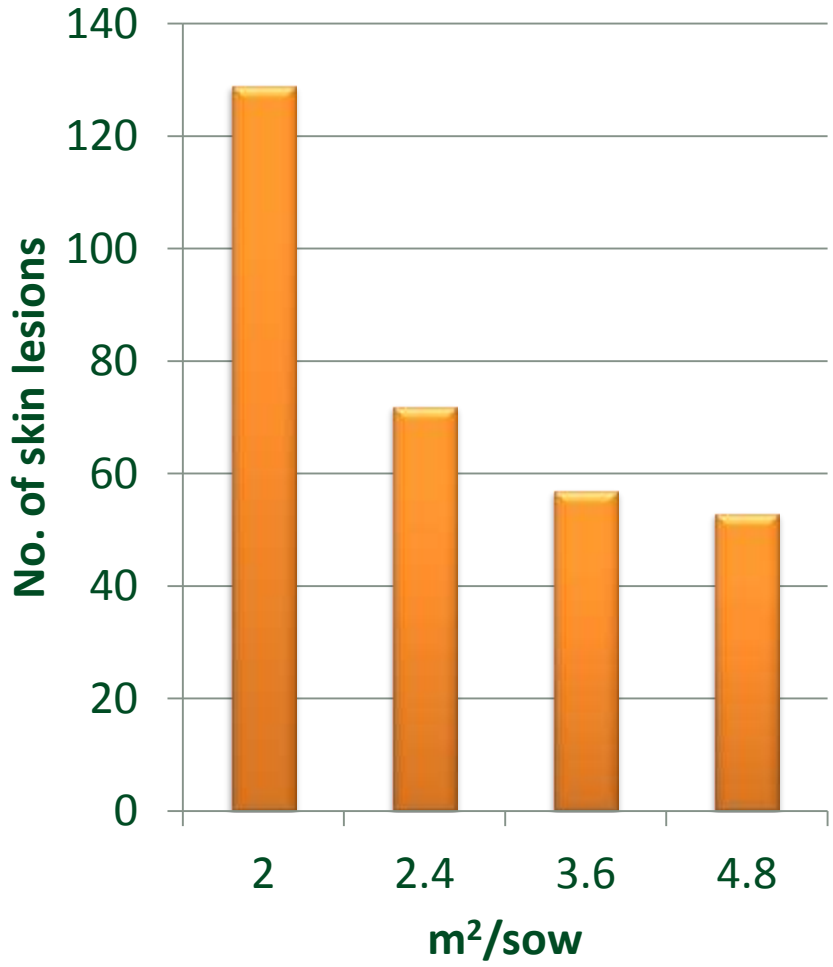
"Simplest" options – remove corridors, halve the stalls

"Simplest" options – remove all stalls and put up pens

Group housing challenges: space and group size

How much space and at what stocking density?

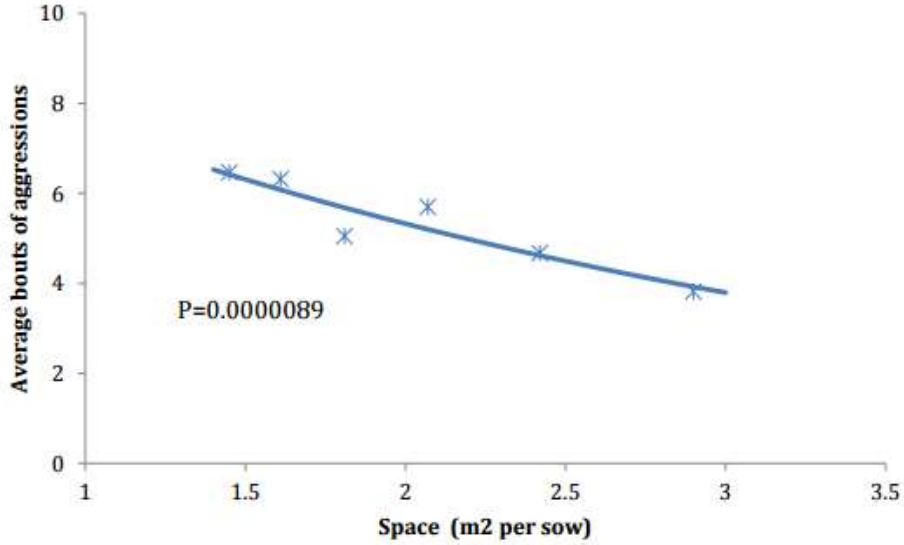
- Often confounded with feeding system in empirical studies
- General messages:
  - Increasing space reduces aggression and cortisol
    - Effect probably plateaus around legal minimum floor space in the EU



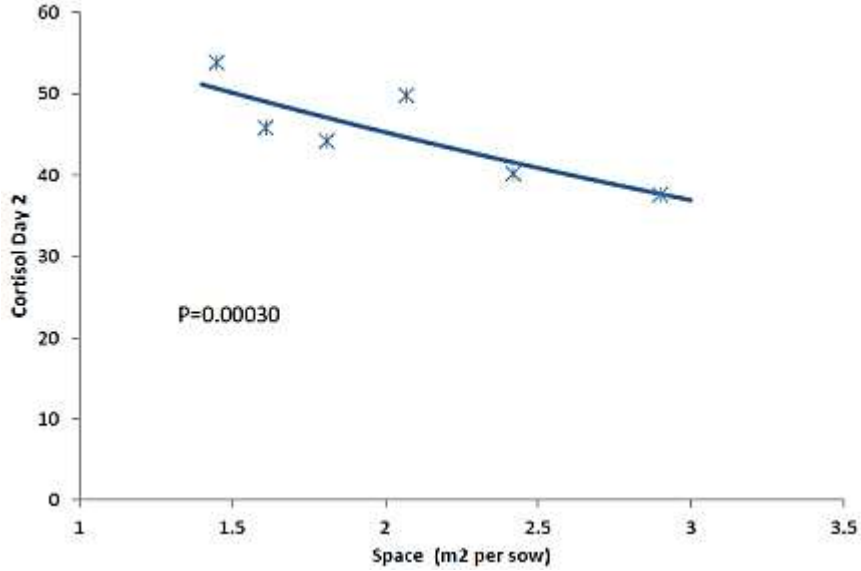
Weng et al. 1995 Stable groups, feeding in stalls

Group housing challenges: space and group size

- More recent data from Australia where the current minimum for group housed sows is 1.4m^2 per sow



- Hemsworth et al. 2013 largest body of evidence from commercial sows (3,120 sows studied) – sows dump fed (x4 times per day).



Hemsworth et al. 2015. Floor feeding

Group housing challenges: space and group size

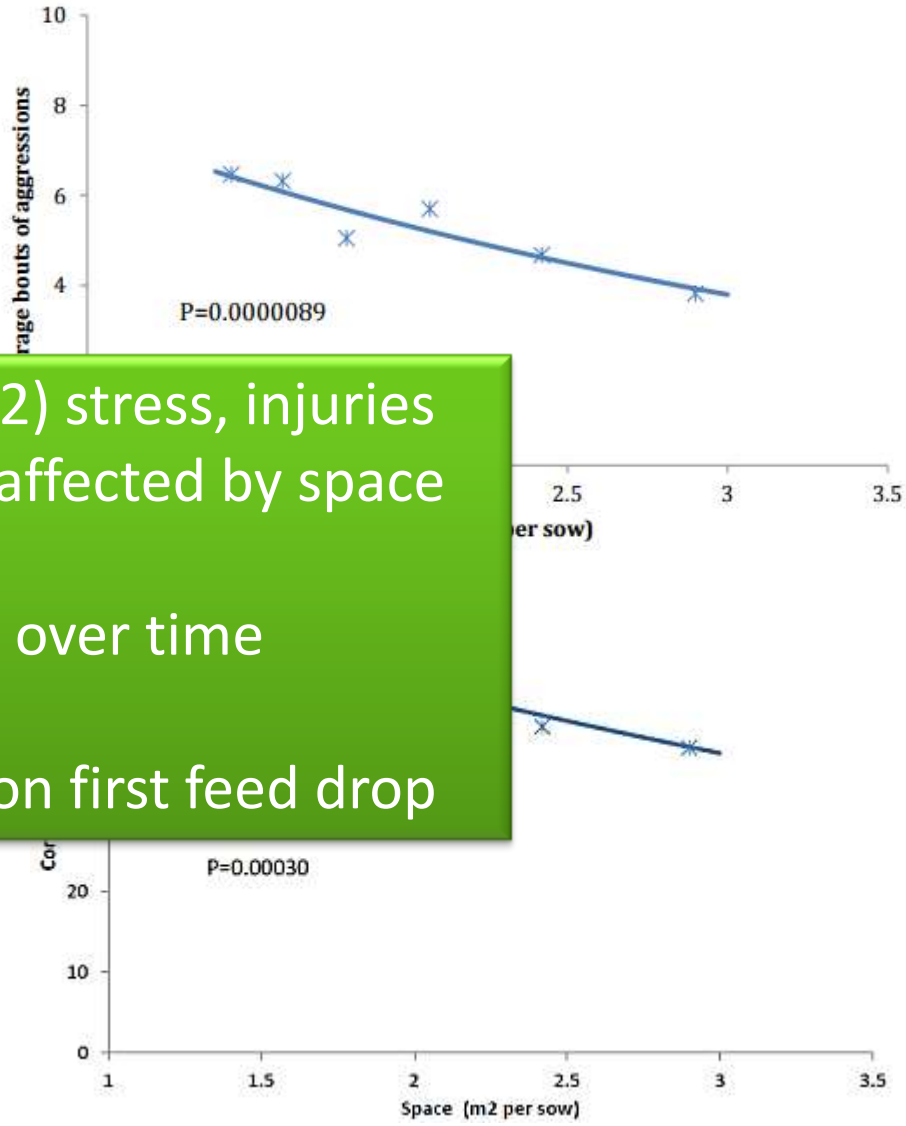
- More recent data from Australia where the current minimum for group housed sows is 1.4m^2 per sow

- Hemsworth
  body of evi
  commercia
  studied) –
  times per day).

After mixing (day 2) stress, injuries and performance affected by space

Adaptation over time

More aggression on first feed drop



Hemsworth et al. 2015. Floor feeding

Group housing challenges: space and group size

- Aggression will increase as a function of group size

(sounders are naturally small, hierarchy easily established)

- Aggression at grouping expected – function to establish hierarchy. Once established serves to decrease aggression

- Large groups – individual recognition more problematic

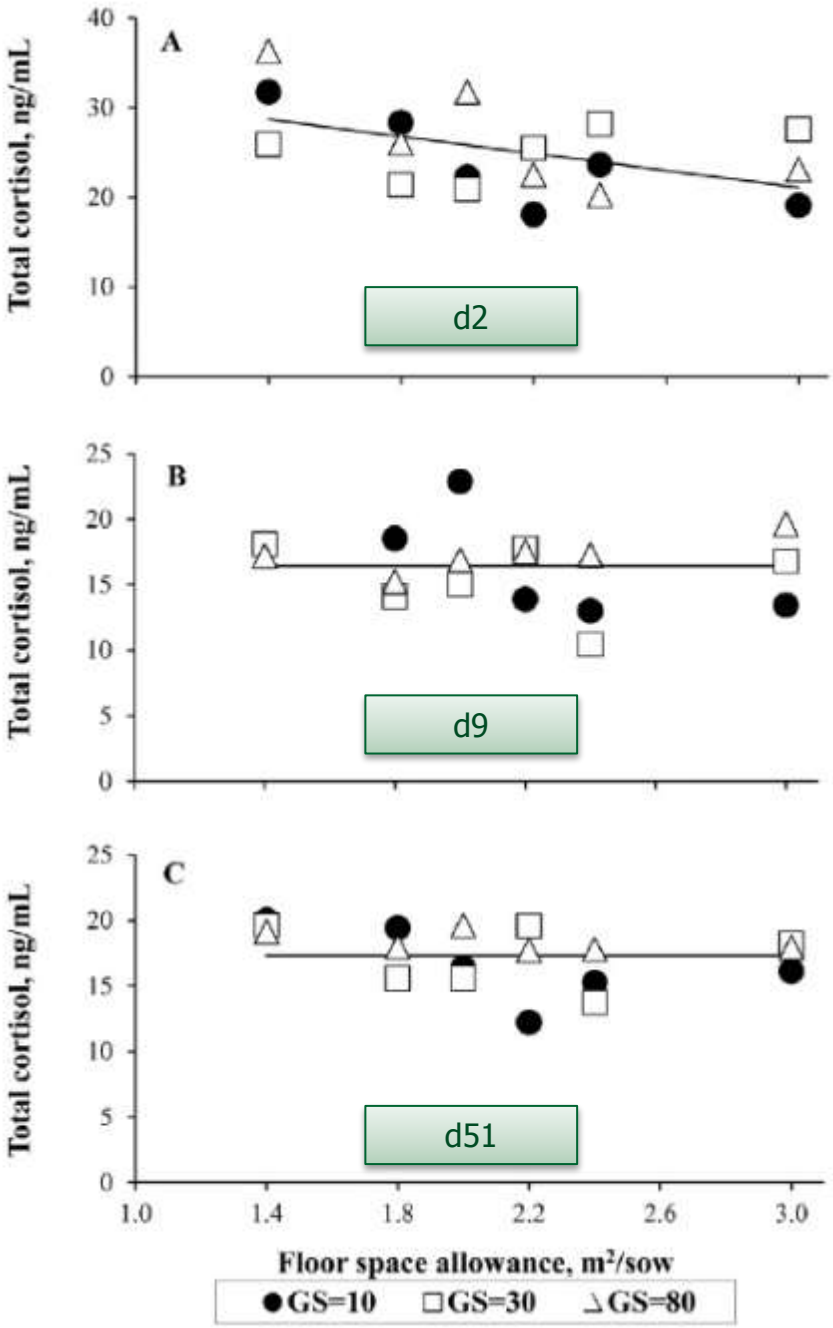
➢ new strategies needed to est. hierarchies (large groups maybe advantageous)

- Facilities to allow alternative strategies will be necessary (e.g. enough avoidance space, barriers, etc…)

Group housing challenges: space and group size

	Number of sows in group			
	5	10	20	40
Total injuries	32	41	35	40
Farrowing rate (%)	90	94	90	94
Litter size	11	11	10.9	10.9

Taylor et al. 1997



No influence of group size on total cortisol levels.

Adaptation over time

Study conducted in stable groups

Dynamic groups space more of a factor

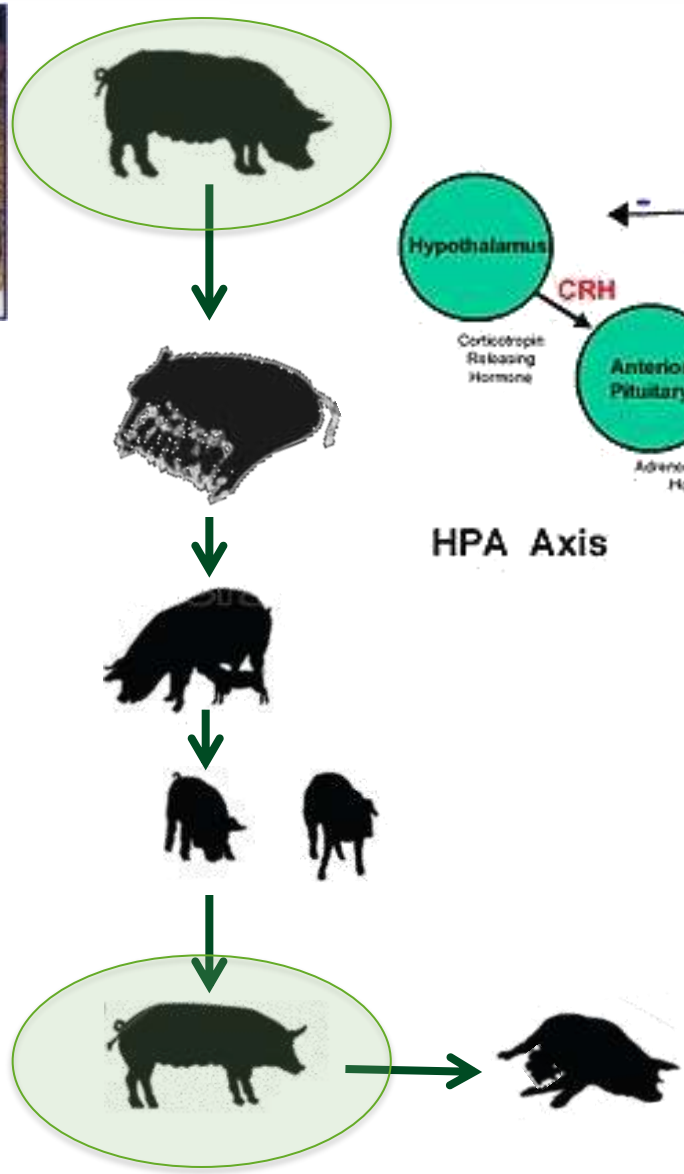
Hemsworth et al. 2013

The hidden costs – prenatal stress

Gestation

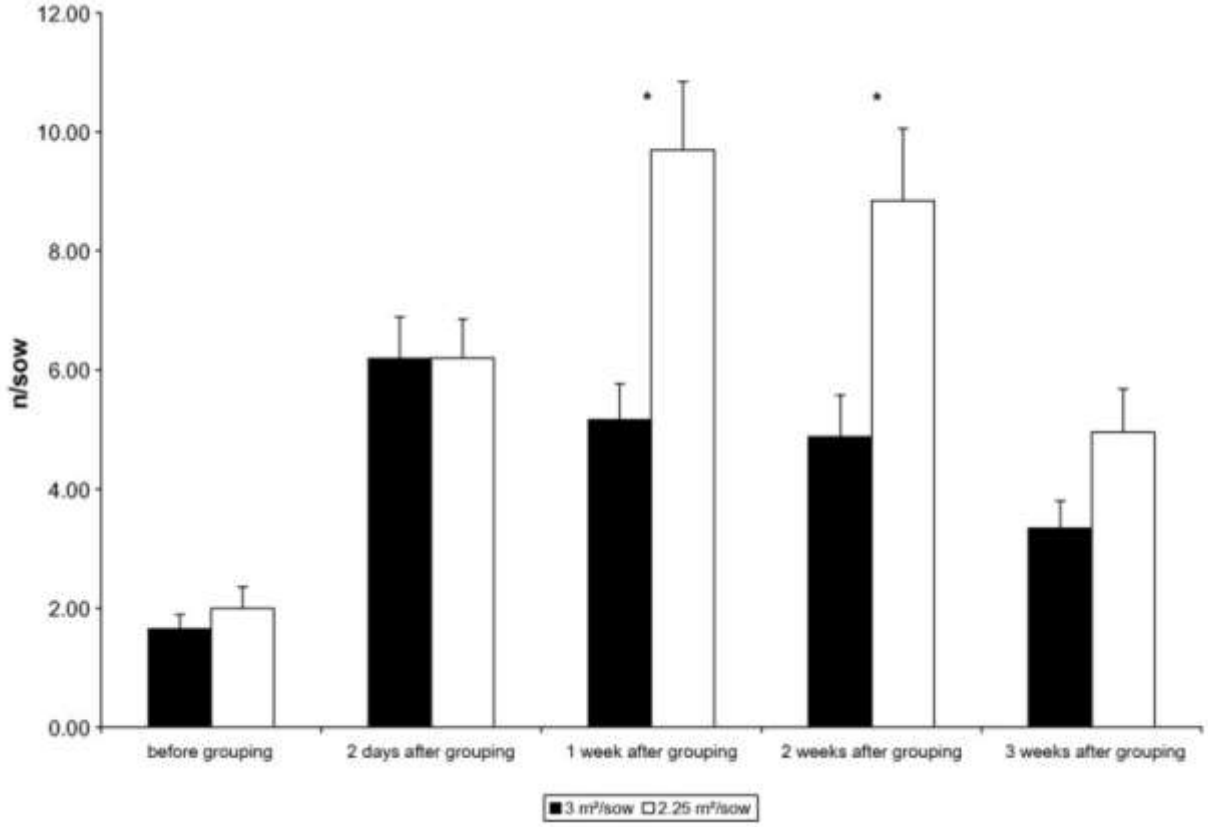
Dynamic mixing can have long-term effects on the developing fetus:

- ⇧Stress reactivity
- Poor growth rates
- Poor maternal behaviour



Selection for rebreeding ⇨ Gestation

Group housing challenges: space and group size



Dynamic groups
Aggression, lesions higher in smaller space
Prolonged aggression

3m^2 vs. 2.25m^2 per sow with ESF

Remience et al. 2008

Group housing challenges: space and group size

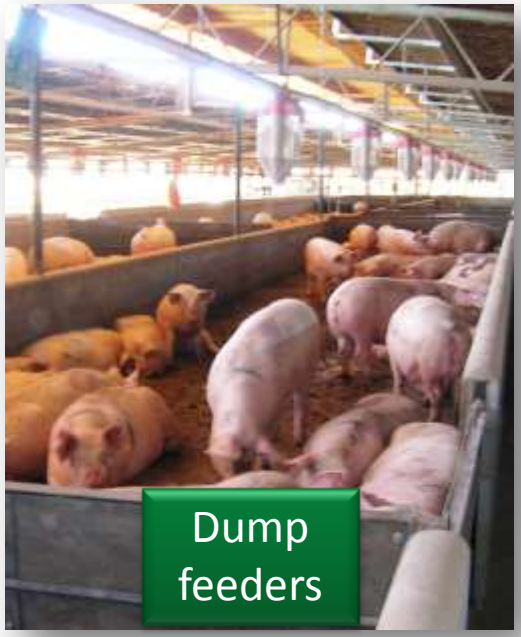
Large groups can work as well as small groups if managed well

- Large groups
- Advantages:
  - More functional space
    - 36% more functional unoccupied space in groups of 80 than 20 (McGlone and Newby 1994)
  - Cheaper, more flexible housing
  - Possibility for a sow to physically distance herself from an aggressor
  - Labour saving e.g. for bedding and cleaning
- Disadvantages:
  - Likely to have very large weight differences
  - More difficult to inspect every sow properly
  - Often dynamic groups
  - Requires careful management of ventilation and zoning of pen

Housing type – decisions?

- Minimise competition for limited resources to reduce chronic stress
  - Adequate floor space and appropriate group size
  - Adequate resource provision
  - Choice of feeding system
  - Design of feeding system
  - Management of satiety

Group housing: choice of feeding system



Dump feeders

Spin feeders

Trickle feeders

Free-access partial stalls

Full length stalls (with back gate)

ESF

Group housing: choice of feeding system

Trickle feeders

Du
feed

A compromise between capital cost, labour cost and costs of competition

Free-access partial stalls

Full length stalls (with back gate)

ESF

Dump/Drop feeding – Pros and Cons

- Floor feeding (dump or spin feeders)
- Advantages:
  - Simple, low cost, easy conversion – can be thought of as baseline group system (i.e. 100% relative cost)
- Disadvantages:
  - Variability in feed access
  - 10% “loser” sows
  - Aggression
  - Feed wastage

Dump/Drop feeding – Pros and Cons

Feed wastage with floor feeding:

	Group feeding	Individual feeding	ESF
No of herds	42	58	18
Pigs/sow/year	21.2	22.0	21.2
Feed use (t/s/y)	1.35	1.26	1.27

Data from MLC, 1996.

Floor feeding – improvements?

- Multiple feeds?
- Schneider et al. (2007) some indication that sequential feed drops (every hour) reduced aggression and knock-on effects on lameness

Frequency of feeding per day	2	6
Skin lesions	1.5	1.34
Vulva lesions	1.08	1.03
Feet and leg soundness	1.21	1.12

Individual lock-in stalls (+Kennels) – Pros and Cons

- Individual manual lock-in feeding stalls
- Advantages:
  - Minimal aggression
  - Precision feeding
- Disadvantages:
  - Space (typically 3.5-4.0m^2/sow)
  - Labour
  - Capital cost
  - Deterioration

Free access stalls with voluntary gates = more capital but less labour after gilts trained

Prairie Swine Centre

Cubicles and free-access stalls –Pros and Cons

- Cubicles and free-access stalls (no back gates)
- Advantages:
  - Less space, less complex
  - Less labour than manual stalls
- Disadvantages:
  - Greater risk of bullying than manual stalls
  - Less opportunity for precision feeding
  - Still costly
- Even sizing of pigs is more important

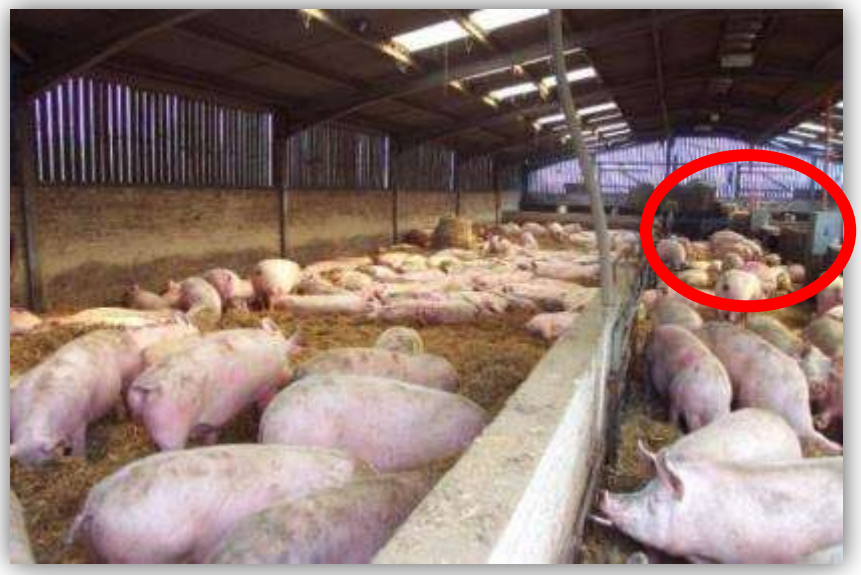
Partial stalls + trickle feeding – Pros and Cons

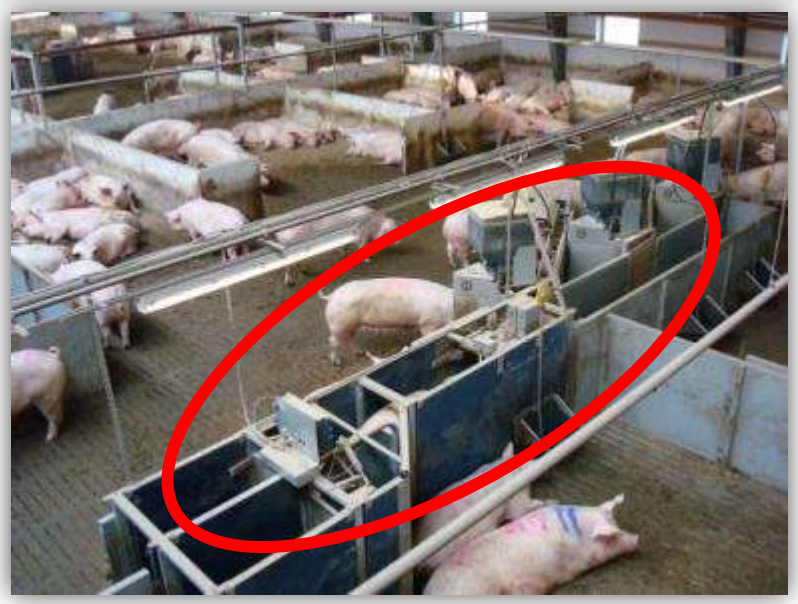
- Partial stall systems (trickle or wet feeding)
- Advantages:
  - Very low space requirement (2.5-3.0 m^2/sow)
  - Wet feeding gives gut fill
- Disadvantages
  - Cost of feed delivery system
  - Imprecise feeding
  - Pen cleanliness when wet feeding
  - Correct trickle rate when trickle feeding

Electronic sow feeders

Source: Meristem

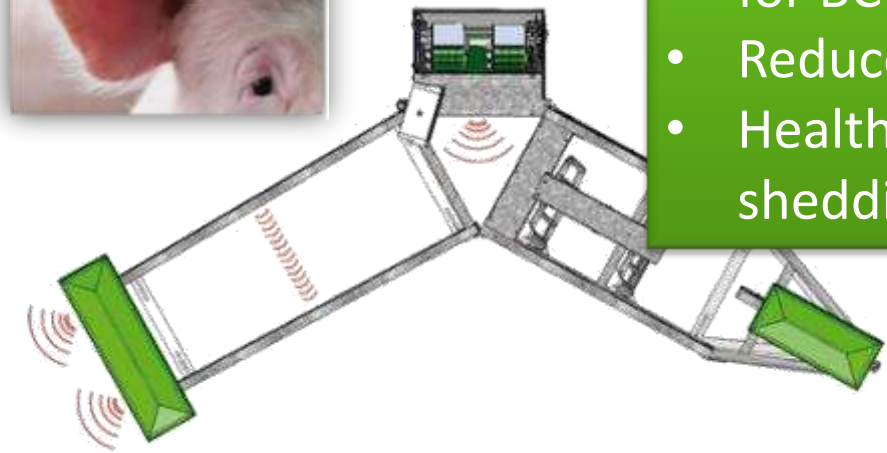
Electronic sow feeders





Source: Meristem

Electronic sow feeders – how do they work?



Advantages:

- Allows individual feeding
- Monitor intake and adjust for BC
- Reduce bullying
- Health checks easier – shedding function

Images = AGCO and PigTek

Electronic sow feeders – how do they work?

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- Allows individual feeding
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Images = AGCO and PigTek

ESFs: DESIGN DETAILS ARE CRUCIAL

Group housing: DESIGN DETAILS ARE CRUCIAL

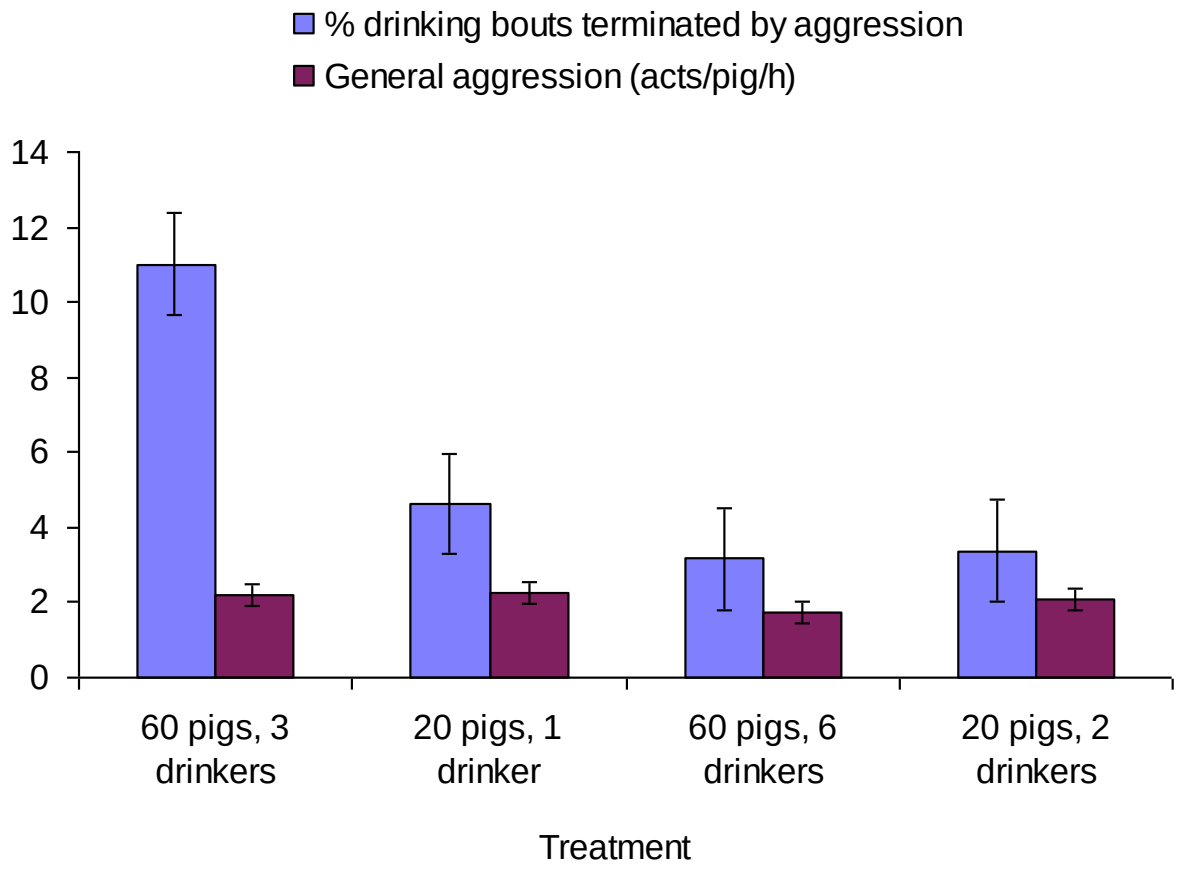
Which one of these demonstrates better practice?

Group housing: DESIGN DETAILS ARE CRUCIAL

Which one of these demonstrates better practice?

- Multiple feeders for large dynamic groups
- Deep straw bedding away from feeders = resource attracts dominants away from feeder
- Long walk to exit feeders
- Drinkers away from feeders
- Resources less likely to be guarded

Resource provision



Group housing: ANIMAL MANAGEMENT CRUCIAL

Training crucial

Important to have good human animal relationship and train gilts to use the system

Visit: http://en.nedap-livestockmanagement.com/solutions/pigs-and-pig-farm-management/electronic-sow-feeding.html for videos on ESF systems

ESFs – Pros and Cons

- Electronic sow feeders (ESF)
- Advantages:
  - Precise rationing
  - Shared use by many sows (40-80)
  - Flexible housing
  - Low space requirement (2.5-3.0m^2/sow)
  - Cost (lower than most alternatives)
- Disadvantages
  - Mechanical breakdown
  - Competition
  - Often dynamic groups
  - Labour - training

Examples of costings

Survey of gestation systems (Gloag, 2002)

Gestation system	% sows in national herd	Suggested change since 2002: JG
Outdoor paddocks	25.6	⇧ to 41%
Stalls	0.5	0
Yard and dump feeder	7.2	⇧ + spin feeding
Yard and ESF	18.4	⇧ + wet feeding
Kennel and individual feeder	23.6	⇩
Kennel and wet feeder	3.3	⇩
Trickle feeder	-	0.5%?

Estimation of production costs

Sheet 1 — Model pig unit specs
- Sow places
- Herd performance

Sheet 2 — Buildings data
- Costs
- Resource use

Sheet 3 — Standard unit costs (per unit of resource)
- Labour
- Power
- Feed

Sheet 4 — Dry sow sys physical performance
- e.g. % successful service
- Sow cull rate
- Sow replacement rate
- Non-productive days

Sheet 5 — Farrowing sys physical performance
- e.g. Born alive
- BD
- % PWM

Sheet 6 — Total production cost £
- Per sow and per weaner combination

Costings based on 545 sow herd

Input data: estimated capital costs

Gestation system	Cost per sow place (£)	Cost relative to stalls (%)
Outdoor paddocks	176	18
Stalls	976	100
Yard and dump feeder	754	77
Yard and ESF	767	79
Kennel and individual feeder	1042	107

Input data: estimated running costs

- For current UK systems, thus no stalls
- Waste disposal costs relate to how system handles liquid/solids
- Dump feeding has higher feed costs due to greater wastage
- Indoors - **assumes optimum levels of management, same sow performance and costs for AI, vet & medicine and sow replacement**

Input data: Pig performance

- E.g. Specific farm data can be used for pig performance

Parameter	ESF Yard plus Part-slatted Farrowing Crate
Number of litters/sow/year	2.28
Number of piglets born alive/litter	12.5
Number of piglets born dead/litter	0.5
Mortality of live-born piglets (%)	8.0
Number of pigs reared/litter	11.5
Number of piglets/sow/year	26.2
Av. Piglet weaning weight (kg)	8.0
Av. Weaning age (days)	25

Estimated cost of production – Nov 2014

Gestation system	Cost per weaner using conventional farrowing crate (£)
Yard & dump feeder  	29.53
Yard & ESF  	29.72
Kennel & individual feeder  	30.82

Total production cost £

Per sow and per weaner combination

Sheet 6

Conclusions for indoor economics

- Production without stalls is more costly – at least 9% higher in the 2006 study.
- Gestation systems modelled had a 5% range in weaner production cost, given relatively few differences in pig performance/inputs.
- Opportunities to reduce labour & feed costs drive any investment in new systems.

Group housing: Recommendations

Suggested requirements:

- Extra space - Increased space with design features to minimise bullying (2.8m^2 per sow minimum recommendation)
- Mixing space/pen (~4m^2/sow) with non-slip flooring, safe zones but no confined spaces, no protruding objects, turnaround space, passing space, visual barriers (separate from side walls) and flush feeding
  - Reduced injuries
  - Low risk of return
  - Reduced guarding of resources

Group housing: Recommendations

Suggested requirements:

- Individual feeders or ESFs (well designed and spaced)
- Consider stable or dynamic based on space available

- Higher fibre content in diets and substrate for foraging
- Multiple feeds? Potentially good idea in dump feeding systems

Conclusions

- Group systems do not have to be costly in terms of performance
- Success factors = good planning and attention to detail

- Minimising competition for limited resources to reduce chronic stress involves getting the space, feeding system, group size and management right (getting it wrong is costly)

- Points not covered – sow satiety and genetics
- Farrowing systems!

Sow satiety

Problem:

- Pregnant domestic sows get 2-3kg of concentrate feed once a day. Consumption time = max 20 minutes = ~1% of their day eating
- Natural behaviour = 50 % of the day sleeping or resting, 15 % eating, rooting or drinking and 30 % “traveling”.
- Food restricted to 50-60% of what they would normally choose to eat ad libitum

Sow satiety: Recommendations

Management of satiety

- Council Directive 2008/120/EC states that: ‘to satisfy their hunger and given the need to chew, all dry pregnant sows and gilts must be given a sufficient quantity of bulky or high-fibre food as well as high-energy food’

Sow satiety: Recommendations

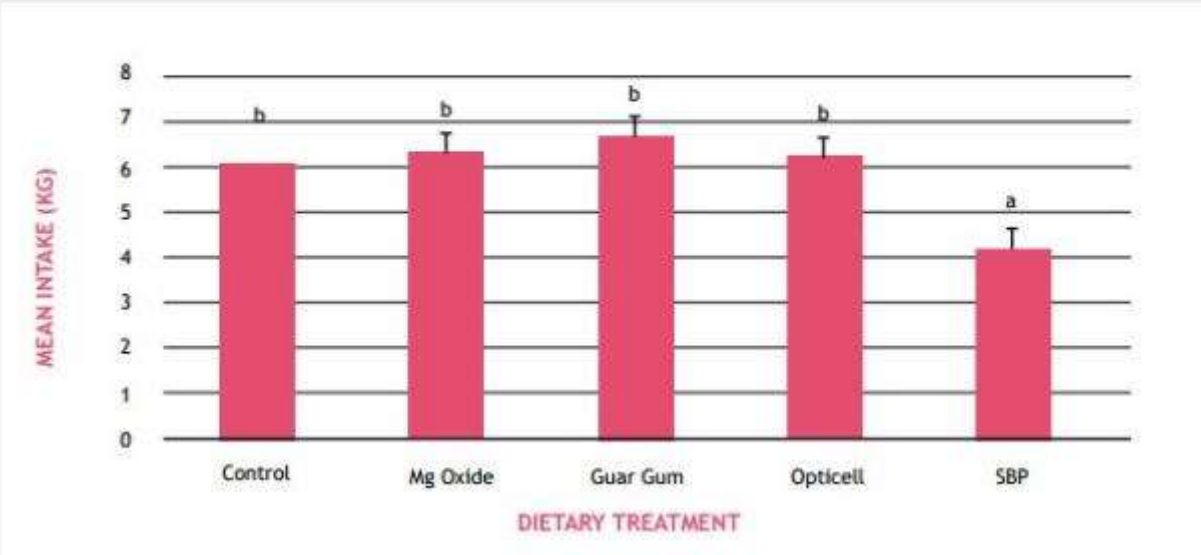
Management of satiety

– C… 20/EC… …heir
h… …ed to … …ows
a… suffic… …high-
f… …-energ…

Likely to reduce competition when sows fed simultaneously

Could be a problem when sows fed sequentially – e.g. ESFs

FIGURE 2. Mean voluntary feed intake (kg/d) of sows offered a frequent feeding regime fed a control diet or a diet containing 0.5% Guar gum, 4 % Opticell®, 0.1 % Magnesium oxide (MgO) or 20 % Sugarbeet pulp (SBP).



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Genetics – do we need specific sows for group housing?

- Increased robustness – physically and behaviourally
- Reduced aggression?

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