CORPORA LUTEA CHARACTERISTICS
AS PREDICTORS OF
LITTER SIZE AND QUALITY
IN PIGS

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Session 6: Feeding the gestating and lactating sow
Sascha Smits, Wageningen University

INTRODUCTION

Meishan sow

Selection for litter size

- 0.2 piglets per litter per year

- Risk of adverse (genetic) responses
  - Lower birth weight
  - More variation in birth weight (Knol et al., 2002; Quesnel et al., 2008; Rothschild and Ruvinsky, 2011; Campos et al., 2012)
  - Lower piglet survival (Milligan et al., 2002)

Corpora lutea characteristics as predictors of
litter size and quality
in pigs

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Situation in The Netherlands
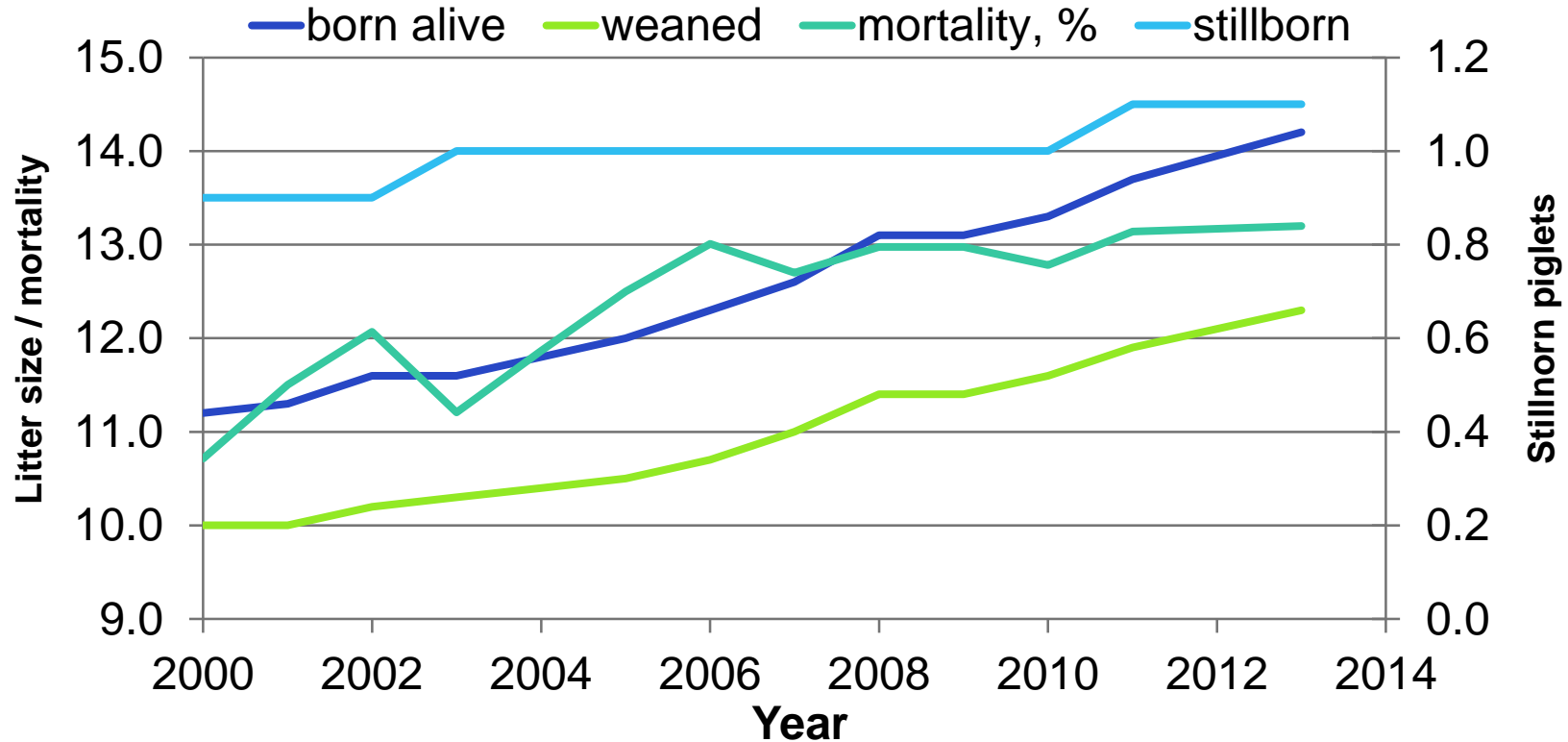
Source: Agrovision BV, 2014

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INTRODUCTION

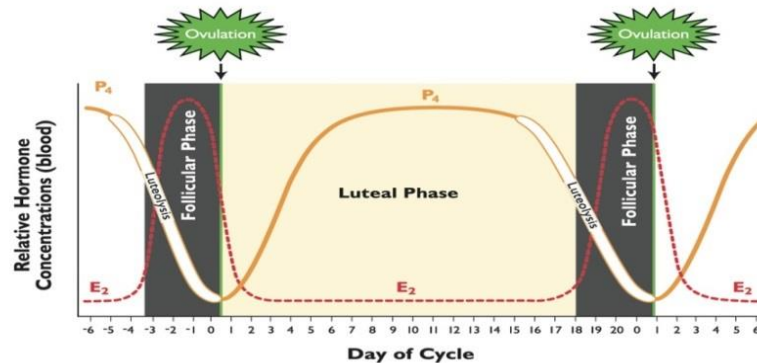Increase litter size ⟶ increase ovulation rate (OvR)

↓

Piglet quality?

Corpora lutea
characteristics
as predictors of
litter size and quality
in pigs

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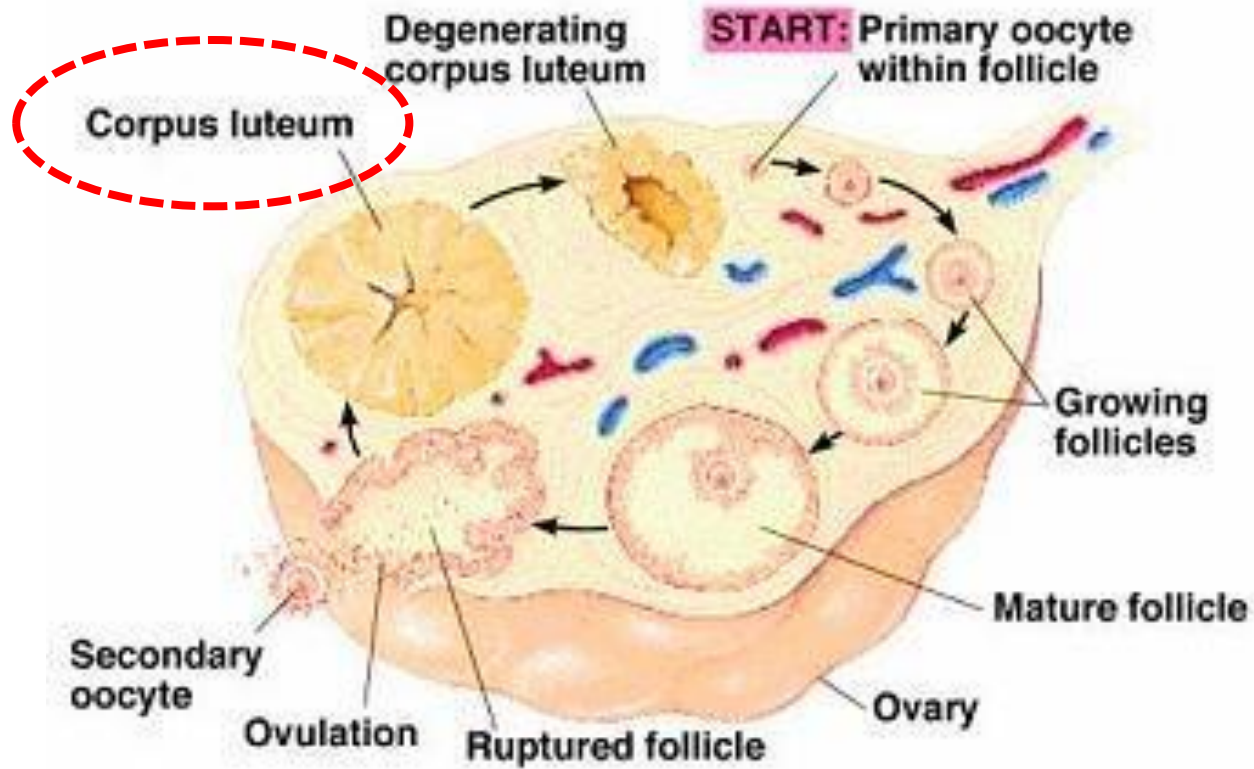Associated with intra-uterine crowding

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Number of corpora lutea (CL) as a measure for OvR

But, what is a CL?

- "Yellow body" formed during luteal phase
  - After ovulation
  - 80% of estrous cycle

Source: Senger 2005

Degenerating corpus luteum

START: Primary oocyte within follicle

Corpus luteum

Growing follicles

Mature follicle
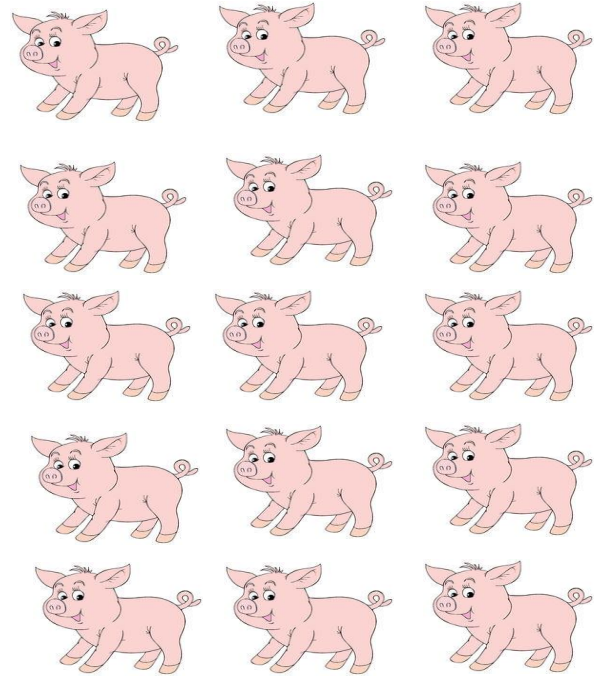
Secondary oocyte

Ovulation

Ruptured follicle

Ovary

OBJECTIVE

To investigate relationships between CL number/size **and**

1) Litter size
2) Average piglet and litter birth weight
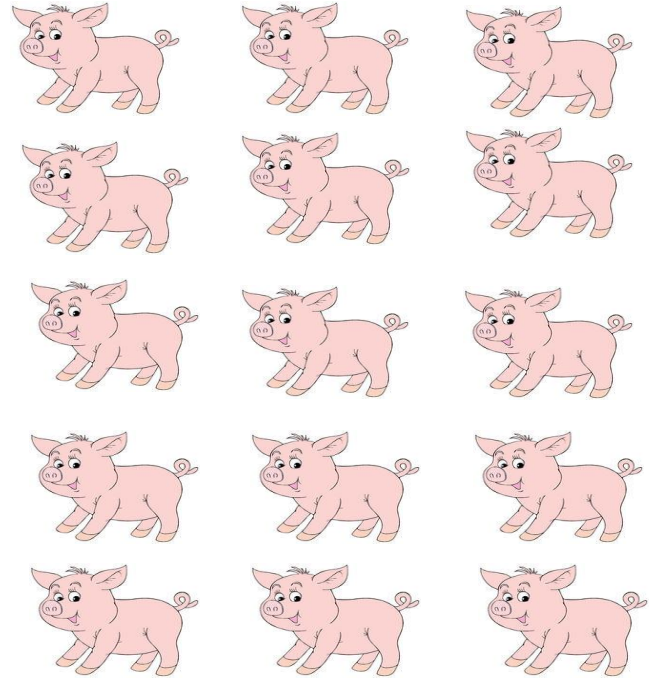3) Within litter birth weight uniformity

MORTALITY?

16 corpora lutea $\longrightarrow$
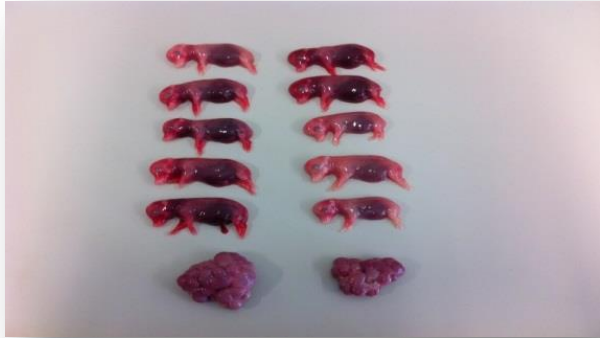
15 piglets

MORTALITY?

30 corpora lutea ⟶

15 piglets

WHY?

- Current practice to count num~~ber~~
  ~~slaughter~~ ~~ani~~~~method~~
  - ~~Good~~ estimation of CL with ultrasound?

Advantage = no slaughtering

Source: Carolina Lima Alvares da Silva, 2014

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MATERIAL AND METHODS

How can you visualize CL?

Transrectal ultrasonography
- Early pregnancy (D23-D30 gestation)
- Both ovaries
- Counting
- Size measurements (diameter)
  - Three largest (based on follicle experiments)

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Material and methods

○ Backfat thickness

- After ultrasound

MATERIAL AND METHODS

Body condition score

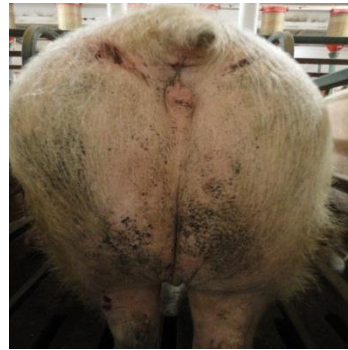BCS 1   BCS 2   BCS 3   BCS 4   BCS 5

Method based on: Muirhead and Alexander, 1997

MATERIAL AND METHODS

- 171 Large-White sows
  - ≥2nd parity
- Individual breeding values

- Compare to current litter
- Compare to previous litter
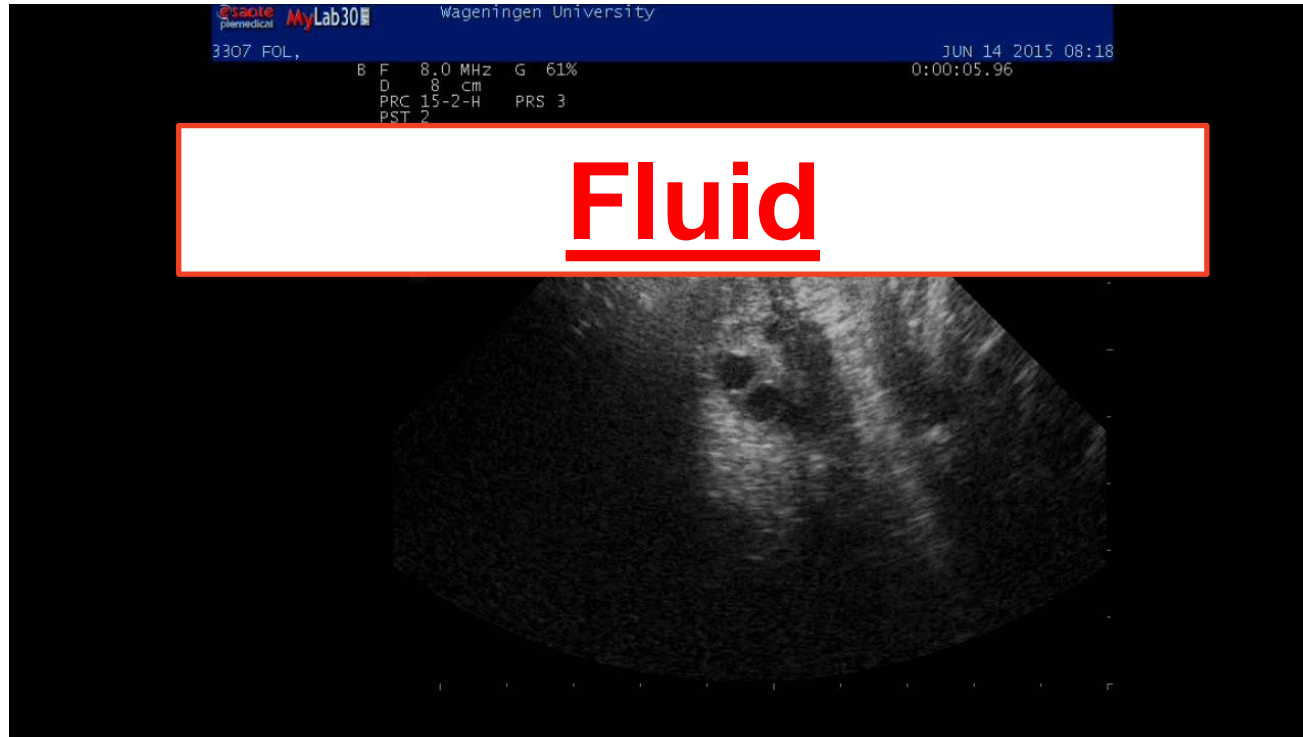 - Effect of for instance TNB and no. piglets weaned on ovulation rate next parity?
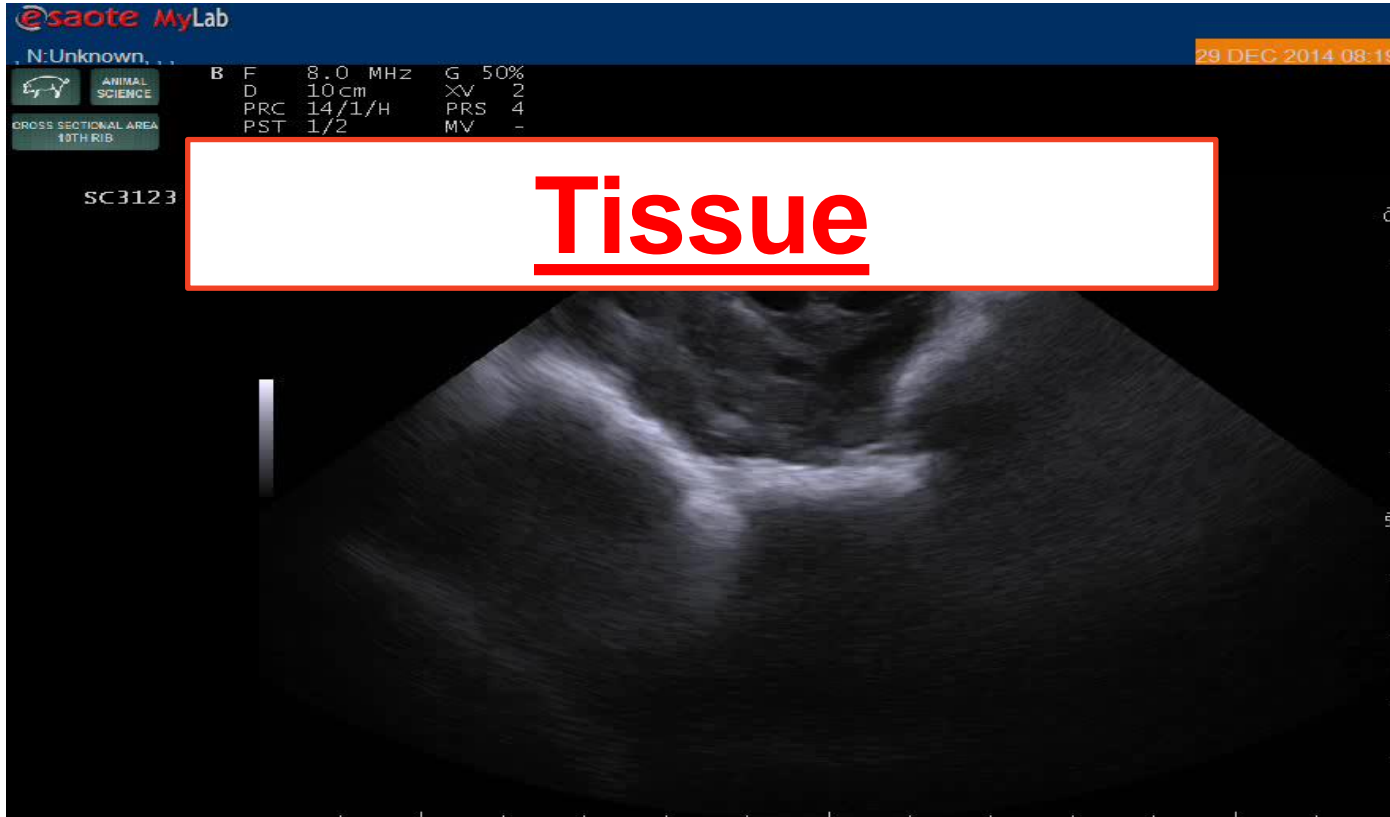
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MATERIAL AND METHODS

Genetic nucleus farm

What about the phenotype?

FOLLICLES

Fluid

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CORPORA LUTEA

Tissue

DESCRIPTIVE STATISTICS – CURRENT LITTER (N = 108)

Variables	Mean	Std	Min	Max
Ovulation rate (OvR)	23.80	3.25	17	33
Total no. piglets born	15.38	3.33	5	20
No. born alive	14.10	3.26	3	20
Prenatal mortality, %	34.18	17.21	-5.26	79.17
Litter weight at birth (kg)	19.20	4.15	6.80	26.64

RESULTS - OVR

- No effect of parity class on ovulation rate ($P = 0.42$)

- No relation of OvR on litter characteristics, except for:

  - Prenatal mortality, %
    - $$\frac{\text{Total number of corpora lutea} - \text{total number born}}{\text{Total number of corpora lutea}} * 100$$
    - Each extra CL resulted in 2.69% more CL that did not correspond for a piglet ($P < 0.0001$)

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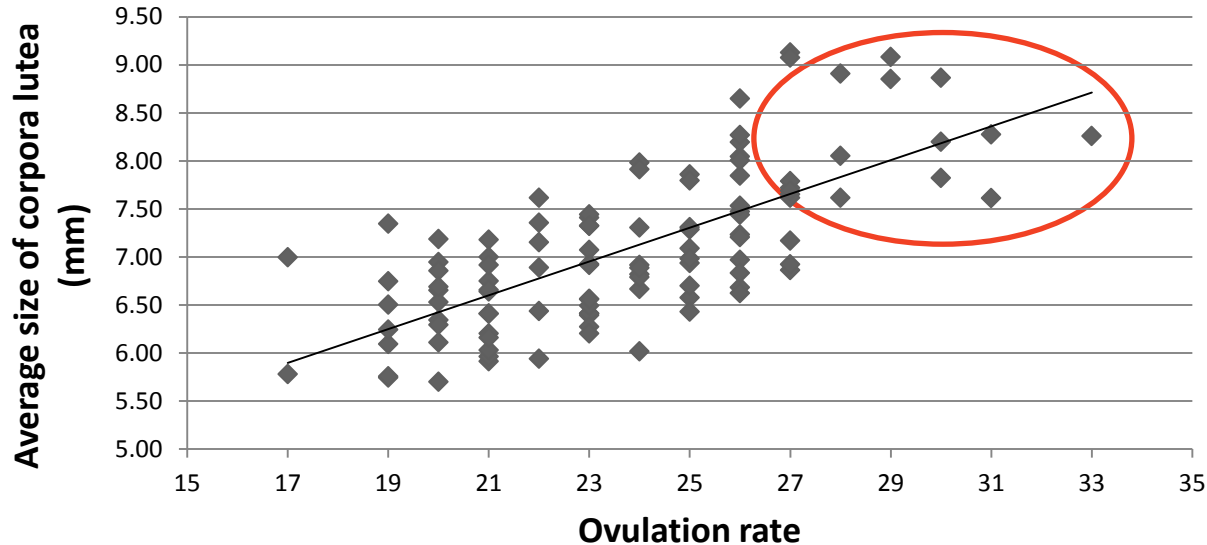
RESULTS

Fit Plot for PerPNMort
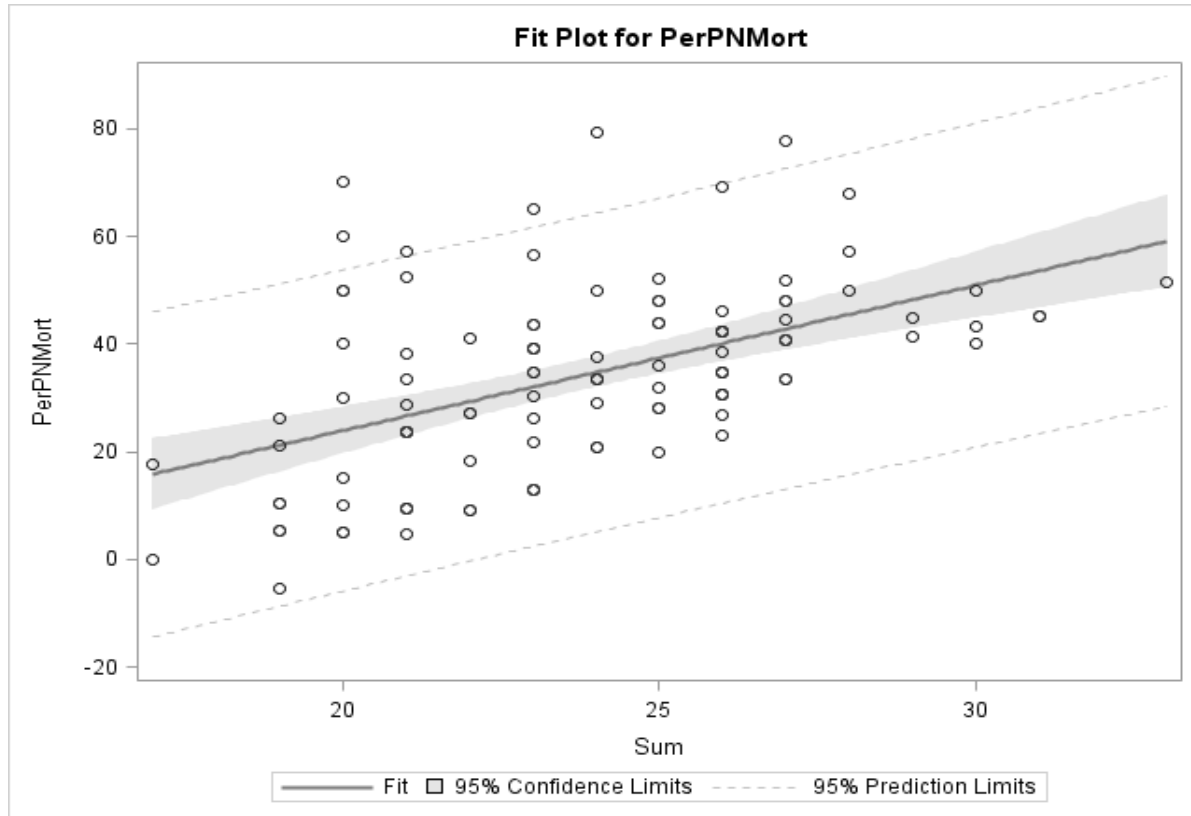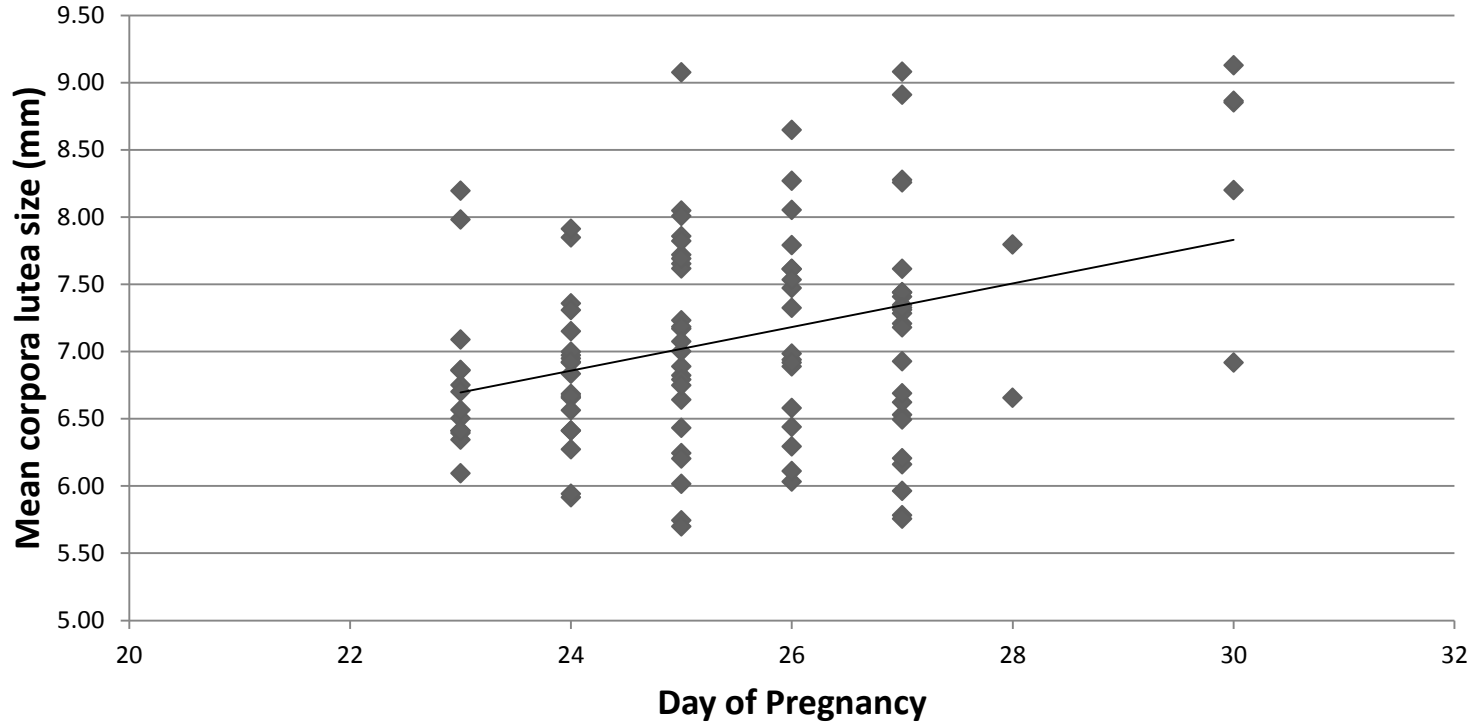
RESULTS - OTHER

- No effect of backfat thickness ($P = 0.76$) and BCS ($P = 0.15$)

- Average CL size – Prenatal mortality
  - Positive relationship ($\beta = 2.68$, $P < 0.0001$)

- Day of pregnancy (D23-D30)
  - Relationship with the size of the CL ($P = 0.03$)

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RESULTS

○ OvR positively correlated with the average size of CL (β = 0.18 mm/CL, *P* <0.0001)
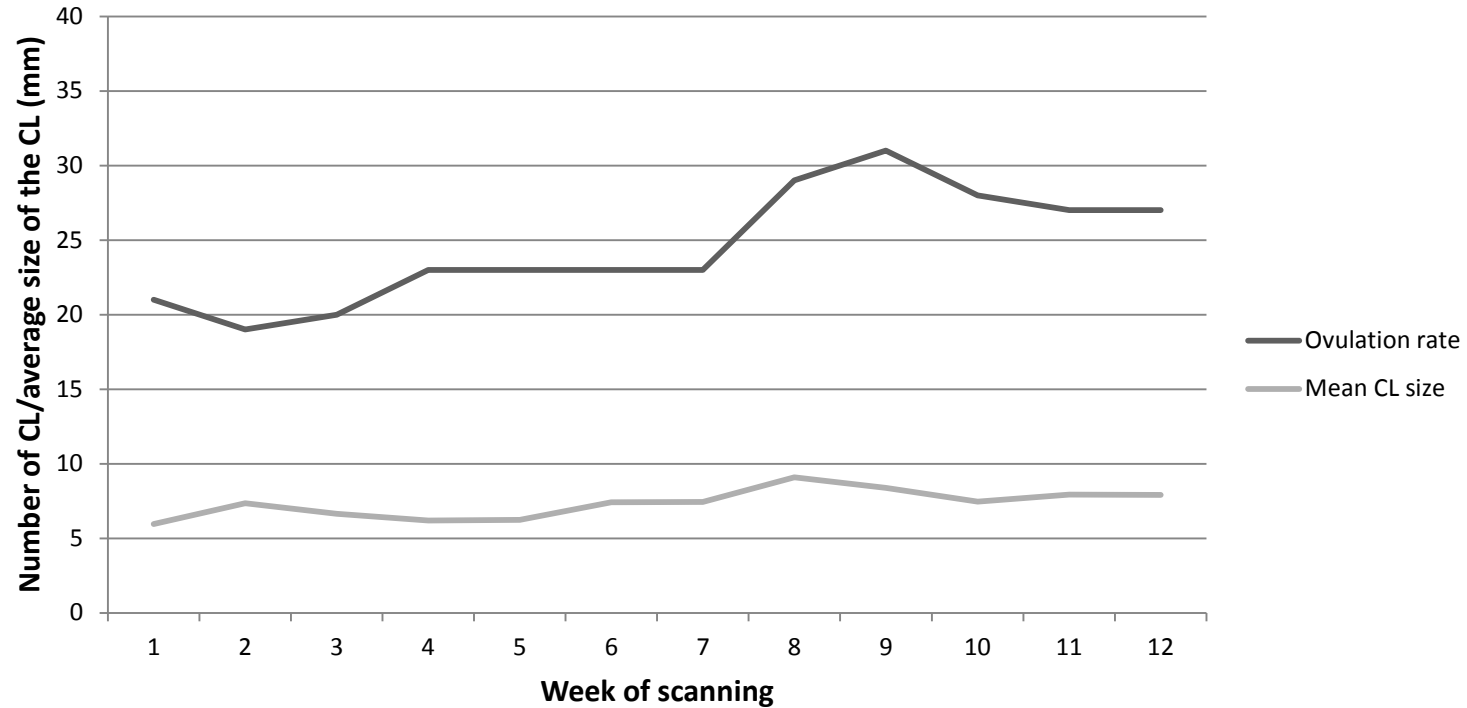
RESULTS

RESULTS

- Previous litter (n = 171)
  - No relationship between litter characteristics previous parity and OvR next parity
    - TNB
    - TNB including mummies
    - Number born alive
    - Litter weight
    - Number of piglets weaned

MY SCANNING SKILLS OVER THE WHOLE PERIOD

DISCUSSION

Ovulation rate and size of the CL

- New technique used
  - Increased experience over time?

- Influenced by season?
  - Day length
    - Reduced → altered melatonin secretion → ↓ GnRH → ↓ LH → ↓ CL funtion (Bertoldo et al., 2012)
    - But no differences of production traits in this period

- New lamps in the breeding unit (week 6)
 - Related to melatonin secretion

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DISCUSSION

- No effect of OvR on:
  - Total number born (more CL ≠ more piglets born)
  - Litter weight (related to TNB?)

- Do we capture all CL on the ovaries?
  - Validation trial
    - Relationship number/size of CL by scanning before D35, slaughter at D35

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DISCUSSION

Prenatal mortality versus OvR

- Combination of factors:
  - Fertilization rate ≠ 100

  - Disease in previous parity

  - Insemination technique

  - Unfavourable uterine environment
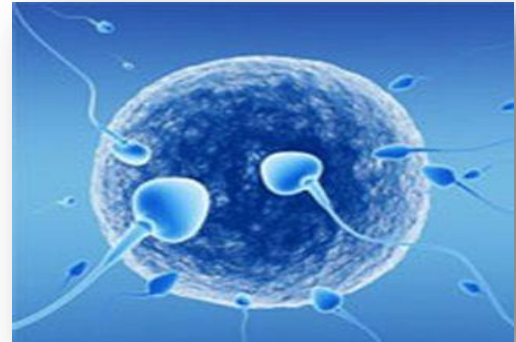
TAKE HOME MESSAGES

- First study that investigated the possible relationships between OvR and litter characteristics
  - By transrectal ultrasonography
  - New insights regarding litter size

- Researcher needs to have experience with transrectal ultrasonography for CL counting

ACKNOWLEDGEMENTS

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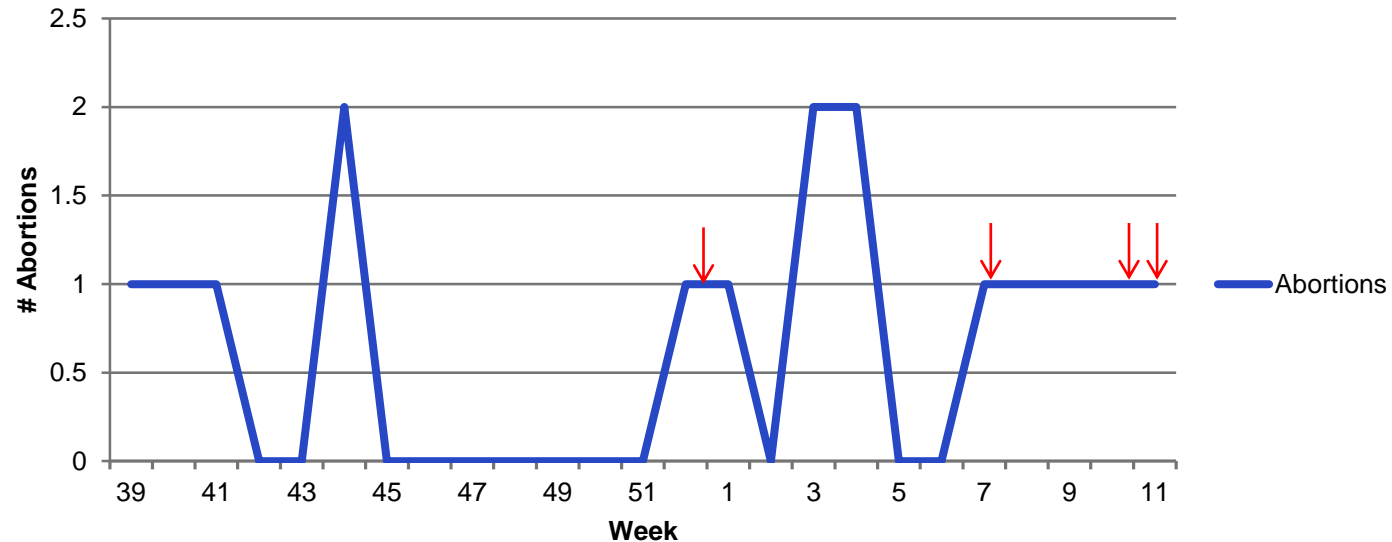 - C. Lima Alvares da Silva MSc (PhD candidate WUR)

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Thanks for your attention

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ABORTION RATE

- Number of abortions not affected (4 abortions)

Abort rate PV

Smaller size

- Size of CL (mm) smaller in this experiment

	This experiment	Miller et al. (2003)
Day 22	6.80	8.90
Day 24	6.90	8.70

- Difference purebred versus crossbred?

- Resulting in better quality piglets?