Selection for sow longevity: where we are – where to go

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Outline

• Introduction
• Alternative methods to select for sow longevity
• Genetic associations between SPL and other important traits
• Need for further research
Introduction

• Presence of censoring makes BV estimation challenging
  – Best sows still alive --> no full record
  – how to handle this type of data?
  – information from earlier recordable, correlated traits (prolificacy, leg conformation)
Censoring

Culling

1st insemination or farrowing

time

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Censoring

1\textsuperscript{st} insemination or farrowing

Culling

Time
Censoring

1st insemination or farrowing

Culling

BREEDING VALUE ESTIMATION

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Alternatives for BV estimation
Stayability

• Simple and practical
  – Did sow reach $n^{th}$ parity or not? (0 / 1)
  – censored observations treated as missing information

• Multiple trait models easy to implement

• Loss of information
  – low $h^2$ (0.02 - 0.09)
  – censored records as missing information
Repeated stayability records
(Meuwissen et al., 2002)

- Every nth month binary information
  - is sow still alive
  - binary data analyzed with repeatability or random regression model
- Accounts for time dependent effects
- Worked relatively well in simulation
- Nobody has really studied with pig data
Survival analysis

- Probability of sow removal at any given time point \((t)\) given that she is alive at time \(t-1\)
- **Proportional** hazard model
Survival analysis

• Well accepted method to analyze longevity data
• Time dependent effects accounted for
  – e.g. culling policy of farm differs between the years
• The Survival Kit (Ducrocq & Sölkner, 2001)
• Multiple trait analysis not possible in the practice
  – genetic associations with earlier recordable traits
Right censored Gaussian trait

(Korsgaard et al., 2003)

• Treat longevity as normally distributed trait
• Data augmentation utilized for censored records
• Multiple trait models easy to implement
• Time dependent effects not properly accounted for
Right censored Gaussian trait

- LPL modeled well, and censoring properly accounted for
  - $h_2$ estimates moderate (~0.20)
- Possible to give different definitions to survival in the multiple trait setting
  - e.g. soundnessLPL & fertilityLPL
Age at 1st farrowing and number weaned normally distributed traits
Log(LPL) treated as right censored Gaussian trait
Leg conformation and wean-to-insemination interval categorical traits

**Wean-to-insemination**
1: < 16 d
2: 16 – 40 d
3: > 40 d

Censored records and liabilities augmented from truncated normal distribution as described by Korsgaard et al. (2003)
- Implemented by modifying C++ programs from a workshop given by Fernando and Kachman (2005)
| $h^2$ | 0.22 |
| $f^2$ | 0.23 |
| $r_{g \text{ leg score}}$ | 0.14 |
| $r_{g \text{ AFF}}$ | -0.20 |
| $r_{g \text{ NW}}$ | 0.36 |
| $r_{g \text{ WTI}}$ | -0.05 |
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Leg conformation

- Overall leg action favorably associated with LPL
- Buck knedd on fore legs
- Weak hind legs

López-Serrano et al., 2000; Serenius et al., 2001, 2006; Serenius & Stalder, 2004
FORE LEGS

small inner claws

legs turned out / in

buck kneed

legs turned out / in

HIND LEGS

small inner claws

weak / upright hind legs

upright / weak pasterns

legs turned out / in
Prolificacy traits

- Age at first farrowing, farrowing interval & weaning to estrus interval favorably associated with LPL
- Litter size estimates vary between the populations

Serenius et al., 2006; Serenius & Stalder, 2004; Tholen et al., 1996
ADG, FCR, carcass quality

- Slightly unfavorably associated with sow longevity
- Strength (and sign) of associations vary between populations

López-Serrano et al., 2000; Serenius & Stalder, 2004; Tholen et al., 1996
Summary – genetic correlations

Carcass quality

ADG, FCR

Meat Quality

Leg conformation

Prolificacy

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Best way to?

• Estimate breeding values for sow longevity
  – time dependent effects vs. multiple trait analysis

• Data collection?
  – only from commercial crossbred farms?
  – trait definition (censoring options)

• Trait under selection?
  – length of productive life, lifetime prolificacy, stayability, No. parities, ...
Further research

- Genetic parameters vary between the populations
  - implications populationwise
- G x E?
1st insemination or farrowing

BREEDING VALUE ESTIMATION

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8th parity with 23 piglets born
Any questions??