

Sire conception rate of beef service sires bred to dairy cows and heifers

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ADSA 2020 Oral Presentation Title Slide

Investigating conception rate for beef service sires bred to dairy cows

Beef bulls ranked by sire conception rate will provide dairy producers with information about the fertility of each bull when mated to a dairy dam.

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Introduction

- Top females in a dairy herd selected to produce replacement heifers
- Remaining females produce surplus dairy calves used as beef output
 - Breeding these females to beef bulls would result in more valuable F1 (50% beef x 50% dairy) calves
- Important to evaluate fertility of breeding pair



Bull fertility (phenotypic ranking)

- **Previously, estimated relative conception rate (ERCR)**
 - Phenotypic evaluation by DRMS (Raleigh, NC)
 - Based on 70-day nonreturn rate (NRR)
- **In 2006, USDA AIPL assumed responsibility for evaluations**
 - Dr. Melvin Kuhn developed sire conception rate (SCR)
 - Heritability found to be nearly zero (Kuhn and Hutchison, 2008)
 - Currently used to evaluate US dairy bulls

Objectives

- **Provide a tool for dairy producers to evaluate beef service sires**
- **To evaluate sire conception rate when beef breeds are used as service sires on dairy cows in the US**

Materials

- **5,063 beef bull IDs of more than 50 recognized breeds (NAAB; Madison, WI)**
 - 46% of IDs were Angus bulls
- **All dairy cow mating records in National Cooperators Database (CDCB, Bowie, MD)**
 - 2016–2019 → 277,952 records
 - Representing matings from 36 beef bull breeds to 7 dairy cow breeds
 - 2012–2015 → 111,515 records



Materials (*cont.*)

- **Preliminary Results (2016–2019 evaluation)**
 - **268,174 records after edits**
 - **Majority (87%) were matings between Angus bull and Holstein cows**

Materials: Data Included

- **Only AI with pregnancy status confirmation (success or failure)**
- **Inseminations 1-7 for cows in lactations 1-5 (heifers separate)**
- **Cow age of 2-8 years**
- **Standardized milk yield (4,536 kg)**
- **Most recent 4 years of breeding records**

Materials: Data Excluded

- Embryo-transfer donors
- Sexed semen
- Consecutive services within 10 days of each other
- Service sire <1 year old
- Herds with < 80% matings via AI
- Herd-year contemporary groups with <10% or >90% CR

Methods: SCR Model

- Cow CR (y) estimated with factors characterizing cow and **factors characterizing service bull**

$$y = HYSR + YrStMo + lact + serv + ageGrp_{cow} + milkGrp + ShrtCycl + \beta_1(F_{bull})^0 + \beta_2(F_{mating})^0 + ageGrp_{sire} + StudYr + SSR + PE_{cow} + a_{cow} + e$$

- SCR Predictions

- Expressed as deviations from the mean

$$Predict\ SCR, \% = \left[\beta_1(F_{bull})^0 + \beta_2(F_{mating})^0 + ageGrp_{sire} + StudYr + SSR \right] * 100$$

Results: Frequency of breedings, cow CR, and service number

| Model ¹ | No. Inseminations | No. Bulls | No. Dams | CR, % | | Service Number | |
|--------------------|-------------------|-----------|-----------|-------|-------|----------------|------|
| | | | | Mean | SD | Mean | SD |
| HO_c/AN_b | 233,379 | 1,344 | 163,919 | 33.8 | ±47.3 | 3.0 | ±1.8 |
| HO_c/HO_b | 14,474,142 | 15,401 | 4,344,070 | 34.3 | ±47.5 | 2.1 | ±1.4 |

¹ HO_c = Holstein cow, AN_b = Angus bull, HO_b = Holstein bull.

| | | | | | | | |
|-------------|-----------|--------|-----------|------|-------|-----|------|
| HO_h/AN_b | 19,437 | 443 | 15,971 | 53.0 | ±49.9 | 2.8 | ±1.6 |
| HO_h/HO_b | 2,261,250 | 12,129 | 1,535,943 | 55.3 | ±49.7 | 1.9 | ±1.2 |

¹ HO_h = Holstein heifer



Results: BLUP Model Solutions for Cow CR

$$\text{Predict SCR, \%} = [\text{ageGrp}_{\text{sire}} + \text{StudYr} + \text{SSR}] * 100$$

| Factors Characterizing Service Bulls | Mean | Std. Dev. | Minimum | Maximum |
|--------------------------------------|------|-----------|---------|---------|
| <i>ageGrp_{sire}</i> | 0.00 | 0.49 | -0.55 | 0.40 |
| <i>StudYr</i> | 0.00 | 0.23 | -0.45 | 0.82 |
| <i>SSR</i> | 0.00 | 0.78 | -4.97 | 4.52 |

SCR Interpretation

$$\text{Predict SCR, \%} = [\text{ageGrp}_{\text{sire}} + \text{StudYr} + \text{SSR}] * 100$$

| Bull | SCR Prediction, % |
|------|-------------------|
| A | 0.0 |
| B | 4.0 |
| C | - 4.0 |

- Bull B is expected to have a 4% higher conception rate than an average bull
- Bull B is expected to have an 8% higher conception rate than Bull C

SCR Interpretation (*cont.*)

EXAMPLE.

| Bull | SCR Prediction, % |
|------|-------------------|
| A | 0.0 |
| B | 4.0 |
| C | - 4.0 |

Average CR of dairy herd: 34%

– Bull A: $34\% + 0\% = 34\%$

– Bull B: $34\% + 4\% = 38\%$

– Bull C: $34\% + (-4\%) = 30\%$

Results: Publishable Bulls

- 233,379 matings between 1,344 Angus bulls and 163,919 Holstein cows
- However, for a service sire to be considered a publishable bulls
 - ≥ 100 total matings
 - ≥ 10 matings in the most recent 12 months
 - Breedings in at least 5 herds

| Model ¹ | Publishable Bulls, n | Matings/bull, n | SCR, % | | | | Reliability, % | |
|--------------------|----------------------|-----------------|--------|-----|-------|-----|----------------|------|
| | | | Mean | SD | Min | Max | Mean | Max |
| HO_c/AN_b | 116 | 1,574 | 0.005 | 1.8 | -5.1 | 4.4 | 64.5 | 99.0 |
| HO_c/HO_b | 1,707 | 4,847 | 0.000 | 1.9 | -18.2 | 4.2 | 86.3 | 99.0 |

¹ HO_c = Holstein cow, AN_b = Angus bull, HO_b = Holstein bull.



Conclusions

- **SCR is a useful tool that provides valuable information about fertility of beef bulls when mated to dairy cows**
- **Frequency of beef bull semen used on dairy cows is increasing**
- **CR of cows mated Holstein and Angus sires does not differ greatly**
 - **Valuable cross-bred calves can be produced for beef output**

Further Research

- **SCR for other beef breeds could be evaluated as data are available**
- **Investigate CR between dairy and beef bulls when bred to the same service number**
- **CDCB will review whether they should implement SCR for beef bulls as a new trait into their evaluation**



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-  ,  , and 

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Thank You!

