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

- **Elite females in a dairy herd are used to produce replacement heifers**

- **Remaining females produce surplus dairy calves used as beef output**

  - **Breeding these females to beef bulls would enhance value of calves**

- **Important to evaluate fertility of breeding pair**

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Introduction

- **Measure of bull fertility**

  - **Previously ERCR (Clay and McDaniel, 2001), phenotypic evaluation by DRMS (Raleigh, NC)**

  - **Dr. Melvin Kuhn at USDA AIPL assumed responsibility for evaluations in 2006**

    - **Developed sire conception rate (SCR)**

    - **Heritability found to be nearly zero (Kuhn and Hutchison, 2008)**

    - **Currently used to evaluate US dairy bulls**

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- **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 and Methods

- **5,063 beef bull IDs of more than 50 recognized breeds (NAAB; Madison, WI)**

- **All dairy cow mating records in National Cooperators Database (CDCB, Bowie, MD)**

  - **2016-2019: 277,952 records available representing matings from 36 beef bull breeds to 7 dairy cow breeds**

    - **Compared to 2012-2015 → 111,515 records**

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- **Data edits**
  - **Keep the most recent 4 years of data**
  - **Remove herds with < 80% matings via AI**
  - **Remove herd-year contemporary groups with CR <10% or >90%**

- **Preliminary Results (2015-2019)**
  - **268,174 records remained**
    - **Majority (87%) were matings between Angus bull and Holstein cows**

SCR Model

- **Cow CR (y) estimated with nuisance variables and factors characterizing service bull using BLUP90IOD2 (Tsuruta et al., 2001)**

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

- **SCR Predictions**

  o **Expressed as deviations from the mean**

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

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SCR Interpretation

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

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**

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BLUP Model Solutions for Cow CR

Nuisance Variables	Mean	Std. Dev.	Minimum	Maximum
$HYSPR$	0.19	0.15	-0.73	0.94
$YrStMo$	0.19	0.20	-0.51	1.15
$lact$	0.20	0.05	0.16	0.27
$serv$	0.19	0.01	0.17	0.20
$ageGrp_{cow}$	0.15	0.09	0.02	0.27
$milkGrp$	0.19	0.02	0.16	0.22
$ShrtCycl$	0.15	0.06	0.10	0.19
PE_{cow}	0.00	0.01	-0.06	0.06
a_{cow}	0.00	0.01	-0.12	0.15

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BLUP Model Solutions for Cow CR

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

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

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	$\pm$47.3	3.0	$\pm$1.8
HO_c/HO_b	14,474,142	15,401	4,344,070	34.3	$\pm$47.5	2.1	$\pm$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	$\pm$49.9	2.8	$\pm$1.6
HO_h/HO_b	2,261,250	12,129	1,535,943	55.3	$\pm$49.7	1.9	$\pm$1.2

[1]HO_h = Holstein heifer

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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**

  - $\geq$ **100 total matings**

  - $\geq$ **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.**

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Conclusions

- **Frequency of beef bull semen used on dairy cows is increasing**

- **SCR provides valuable information about fertility of beef bulls when mated to dairy cows**

- **CR of cows mated Holstein and Angus sires does not differ greatly**

  – **Valuable cross-bred calves can be produced for beef output**

- **Further research on SCR for other beef breeds should be conducted as data are available**

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- , , and

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Questions?

Source: **photo by author, Taylor M. McWhorter**

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