Using DNA paternity testing to evaluate commercial bull performance

Daniel Drake, UC Cooperative Extension, CA
Kristina Weber, Ph.D. student, UC Davis, CA

Alison Van Eenennaam*, Animal Genomics and Biotechnology Cooperative Extension Specialist, UC Davis
alvaneenennaam@ucdavis.edu
Outline

- Overview of CA commercial ranch project
- Prolificacy of commercial sires
- Selection for prolificacy
- Calving pattern of prolific sires
- Selective genotyping for prolificacy

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California Commercial Ranch Project

Three ranches:
- Ranch A (900 cows)
- Ranch B (500 cows)
- Ranch C (700 cows)

Approximately 120 Angus bulls, 15 “other” breed bulls and 6000 calves were enrolled on the project.

Objective: Evaluate bull performance in multi-sire breeding pastures.

Data collection:
- AAA EPD & pedigree

Sample collection:
- For genotyping

MBV
- Meat Animal Research Center

Assessment of DNA-enabled approaches for predicting the genetic merit of herd sires on commercial beef ranches.
Materials and Methods

- Hair samples were collected on calves from natural service multi-sire breeding pastures from 3 commercial ranches in northern CA representing 15 calf crops over 3 years.

- Samples were genotyped using the SeekSire parentage panel (Geneseek, a Neogen Co., Lincoln, NE), including between 96-99 SNP.

- A sire was assigned a calf if it was the only bull with none or one opposite homozygous genotype (i.e. mismatches) with the calf genotype.

- Single sire matches were called on 5,052 calves (~98% of the samples genotyped from these 3 ranches).
Cowley Ranch

~20 bulls/season
Kuck Ranch
~ 10 bulls/season
### Natural service bull reproductive performance on 3 California commercial beef ranches (A, B and C) in multi-sire breeding pastures

<table>
<thead>
<tr>
<th>Ranch</th>
<th>Year</th>
<th>Calf crop</th>
<th># of sires</th>
<th>Mean bull age±SEM</th>
<th>Total # of calves</th>
<th>Min # calves</th>
<th>Max # calves</th>
<th>Mean # calves±SEM</th>
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<tbody>
<tr>
<td>A</td>
<td>2009</td>
<td>Spring</td>
<td>18</td>
<td>4.3±0.3</td>
<td>353</td>
<td>3</td>
<td>47</td>
<td>19.9±3.8</td>
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<td>19</td>
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<td>47</td>
<td>19.6±18.2</td>
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<td>Fall</td>
<td>38</td>
<td>5.5±0.9</td>
<td>573</td>
<td>1</td>
<td>64</td>
<td>14.4±5.7</td>
</tr>
</tbody>
</table>

|        | A, B, C | 2009-2011 | 263 | 4.4±1.7 | 5052 | 1 | 64 | 18.9±13.1 |

**Per bull**: Mean bull age±SEM.
Number of calves per bull (CB)

- Reproductive failure, i.e. no calves produced, occurred in 4.4% of the bulls (12/275 bull breeding season opportunities)
- The overall mean number of calves per bull (CB) was 18.9±13.1, with little variation between ranches
- Calf crop mean CB showed little variation (P=.51) ranging from 14.4±5.7 to 26.5±14.4
- Similarly differences between years (19.9±3.8, 20.1±1.9 and 19.7±7.7, P=.96), and season (spring 20.5±12.2, fall 19.2±5.0, P=.94) for CB were small.
- However, mean CB per bull varied widely (P<.01) ranging from means of 3.3±6.3 to 39.1±10.9 CB.
- Total adjusted 205d weight differed significantly between bulls ranging from **676 – 8,838** kg per bull per calf crop (P<.01)
The mean number of calves per bull (CB) per calf crop varied widely (P<.01). Average Individual 205d sex adjusted wt (I205) or Total 205d sex adjusted weight (T205) also differed (P<.01) between bulls.
Prolificacy was curvilinear for bull age (P=.03) with the peak CB at about 5 years of age for bulls from 2 to 11 years of age.
About 12% of the variation in prolificacy ($R^2 = 0.12$) was explained by SC EPD.
LS mean adjusted calves born per week of the calving season across all calf crops. Means with different letters P < .05.
Bulls categorized into equal groups based on their number of progeny for a calf crop had different calving distributions.
High Prolificacy: Bulls misassigned if using various reduced sampling strategies.
Medium Prolificacy: Bulls misassigned if using various reduced sampling strategies
Low Prolificacy: Bulls misassigned if using various reduced sampling strategies
Recap

- Bulls produced on average about 20 calves per calf crop
- Prolificacy varied from 0 (~4.4%) - 64 calves per season
- No single factored completely predicted bull prolificacy
  - tended to increase up to about 5 years of age and then declined.
  - Bulls with larger SC EPDs tended to be more prolific
- Bull contribution to total ranch income (total saleable weaning 205d weight) was very highly correlated to prolificacy and only a small amount to average 205d weaning weight
- Repeatability of DNA paternity determined prolificacy was 0.33 – 0.37 over 3 years under our intensive conditions
- Prolificacy assessments from testing only week 3 calves were closely related to prolificacy assessments based on the total calf crop
Questions?

Happy California Bulls

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