Council on Dairy Cattle Breeding

Genomics in the U.S. Dairy Industry: current and future challenges

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Starting off on the right foot

- Presentation totally off topic for this session
- CDCB interaction with producers is not direct, so no *direct* herd management involvement
CDCB collaborators’ database

• Central to US Dairy Industry. Data received from all industry sources, and used to provide services to all industry (especially dairy producers).
  • Collaborative effort
  • Maintained and controlled by CDCB (not owned)
  • Used to provide services to US dairy industry (genetic and genomic evaluations are one example)
• Only approved partners (quality-certified) can submit records to the CDCB collaborator’s database.
• In this talk: genomics only (a part of the CDCB collaborators’ database)
Genomics in numbers

- 2,372,681 genotypes in total (Jan’18)
- ~2.1 mln used in evaluation (Jan’18)
  - Sex ratio: 90/10 % (F/M)
- 30 SNP arrays currently validated

~ 550,000 new (usable) genotypes in 2017
New usable genotype counts by week (Nov-Dec 2017)

(110k new animals getting G-evaluations)
Edits to every genotype received

- Each genotype received is evaluated for:
  - Call rate
  - Sex
  - Portion of heterozygous
  - Parent-progeny consistency
  - Grand-parent likelihood
  - Undeclared or potential relationships (meaning all vs. all comparison)
  - Approximate breed check
  - Other

AGIL and CDCB are actively working on methods to reduce computation burden without impacting data quality

- More controls prior to process
- MGS candidates (G.Wiggans’ talk)
- SNP sets used (G.Wiggans’ talk)
- Timing of processing (G.Wiggans’ talk)
- Interaction with partners
Genomic Evaluations

- In December 2015, CDCB took charge of the U.S. dairy evaluation service. AGIL still provides R&D to the U.S. dairy Industry:
  - Weekly, monthly and tri-annual evaluations (traditional/genomics)
  - 35 genomic traits for HOL, JER, BSW, AYR, GUE
    - Note1: HOL traditional type traits are run by HAUSA
    - Note2: Although breed-association specific selection indexes (TPI, JPI, etc) are obtained using CDCB evaluations, they are not CDCB products.
Genomic Evaluations – Traits

• New traits in 2017: Livability and Gestation Length

• Health trait evaluations will be published in April 2018: Hypocalcemia / milk fever, Displaced abomasum, Ketosis, Mastitis, Metritis, Retained placenta
  • Industry collaboration success story. Whole country input data.
  • HT will not be included in April’s NM$.
  • For more information, visit CDCB website (Genetic Evaluations)
  • K. Gaddis (service) + J.Cole (research) talk @WCGALP

• In research (AGIL / CDCB):
  • Feed efficiency (Residual feed intake) – P. VanRaden’s talk @WCGALP
  • Multi-breed evaluations
Genomic Evaluations

- 60,671 SNPs used.
  - Research undergone to increase the # of SNPs to 77,000
    - update on informative SNPs
    - Encouraging preliminary results: increasing genomic REL 1.4% across traits
    - Final phase: testing timing and computation impact.
- More than genomic evaluation:
  - 12 haplotypes that affect fertility
    - Dec. 2017: AH2 (Ayrshire second haplotype affecting fertility)
  - Genomic inbreeding
  - Breed Base Representation
  - Etc
Reliance on Genomic Evaluations

- In 2016, 67% of breedings through AI were to bulls with no milking progeny.
- All of top 10 young (genomic) Holstein/Jersey bulls in 2014 have AI sons (up to 260 AI sons – Supersire) in 2017 (not seen in proven bulls!)
- The age of parents at bull birth has dropped to just over 2 years, nearly the biological minimum.
- This reduction in generation interval has led to almost doubling the annual genetic improvement.
CDCB opportunities for the future

1. Continue to take ownership of the evaluation system
   • Documentation of business rules
   • Standardizing/rewriting processes
2. Improving public documentation and enhancing integration with available tools.
3. Clearer (and stricter) rules to accept files from partners
   • Pre-checks, requires 2) to be completed
4. New software, new traits and new evaluations
   • New IT infrastructure, documentation system and website in 2017
   • New querying system in 2018/2019.
5. New and old data pipelines
   • Recruiting a CDO and a Genomic Data Manager
6. Improving communication with industry and dairy producers.
THANK YOU FOR YOUR ATTENTION