Development of a genomic testing decision support tool for Jersey dairy calves

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Summary of project
What will be done

Develop a state-of-the-art decision support tool to:

• Help Jersey dairy farmers decide whether to use genomic testing on their heifer calves and if so,

• Find out the economically optimal testing management strategy that includes the proportion of animals to test and the selection pressure based on test results.
Online decision support tool to be available at:

• **Greenbook.USJersey.com**
• **InfoJersey.com**
• **USJersey.com**, and
• **DairyMGT.info**: Tools (University of Wisconsin Dairy Management Website)
Summary of project
Important characteristic of the tool

Capacity to perform farm-specific analyses:

• Farmers or consultants will be able to:
  • Enter their own herd information
  • Devise best management strategies for their conditions
Methodology
Step 1: Selection pressure

 Depends on farm-specific capacity for generating extra female calves:

• Closed herd
  • Replacements < culls
    • No selection possible
  • Replacements > culls
    • Selection possible

• Non-closed herd
  • Decisions of buying (and selling) animals from (to) other farms

• More gain when more selection possible (e.g., use of sexed semen)
Methodology
Step 1: Selection pressure

Methodology
Step 2: Maximum gain lifetime net merit breeding value

Assuming opportunity for selection, genotyping is cost effective

• Greatest gains when selection performed in heifer calves

• Depends on:
  • Reliability of genomic of predicted transmitted abilities
  • Potential parentage errors on farm data
Methodology

Step 2: Maximum gain lifetime net merit breeding value

Optimal genotyping strategy: A=all, T=top 50%, and B=bottom 50% for genomic vs. traditional selection. Adapted from Weigel et al. (2012). Similar results are expected when using the Jersey Performance Index (JPI).

E.g., Gain $140 when selecting top 60% calves after testing all of them when no pedigree is known.
Farm-specific, interactive, and dynamic

• Interactively determines excess of heifers (%)

• Under a maximum farm investment, the tool finds iteratively:

  • Strategy of greatest $ gain according to:
    • Genotyping and
    • Selection
Research design
Conceptual framework of decision support tool

Ovals = starting and ending actions, parallelograms = user-entered information, diamonds = binary decisions (yes/no), and rectangles = results calculated by the decision support system. JPI = Jersey Performance Index.
Some progress
Advancements

**JPI → NM**
Jersey data (AJCA)
14,000 records
Regression ($R^2=0.87$)

**JPI_{rel} → NM_{rel}**
Jersey data (AJCA)
14,000 records
Regression ($R^2=0.99$)

**priorNM_{rel} → PosNM_{rel}**
Zoetis data
Thanks to J. Osterstock
Thousands of records
Regression ($R^2=0.46$)
Prototype
Decision support tool

Integrated Genomic Testing for Heifer Calf
Decision Support Tool

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Overview  Genomics Calculator

Step 1: Generate Data

Download Data Entry Excel File
Download Data Entry File

Upload Data Entry as Excel File
Select Spreadsheet:
Choose File  no file selected

Please generate data first.

Number Heifers in Selection Level

Cow ID  JPI  Reliability Before (%)
5750  84  34
5751  96  33
5752  112  34
5753  114  32
5754  87  33
5755  124  34
5756  88  31
5757  67  31
5758  140  32
5759  107  32
5760  139  32
5761  49  29
5762  140  35
5763  126  39
5764  82  29
Prototype
Decision support tool

Step 2: Calculate the Selection Level
- Herd Turnover Ratio, %/year: 35
- 21-d Pregnancy Rate, %: 20
- Females with Conventional Semen, %: 47
- Heifer Conception Rate, %: 55
- Services Using Sexed Semen: 0
- Sexed Semen Conception Rate, %: 44
- Females With Sexed Semen, %: 90
- Estimated Calves to Maintain Herd Size, %: 72.03

Step 3: Find the Best Policy Investment
- Required Calves to Maintain Herd Size, %: 72.03
- Cost Per Test, $: 40
- Total Investment, $: 5000

Generating Results... This may take 1 minute...
Prototype
Decision support tool
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