Genomic testing decision support tool for Jersey dairy calves

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Genomic tool

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.
Characteristics of the tool

Capacity to perform farm-specific analyses:

• Farmers or consultants are 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

Cabrera, 2012
Methodology
Step 1: Selection pressure


E.g., A 20% 21-d pregnancy rate & 35% culling rate herd would have 31% excess of calves.
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
    - 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.
Overview

This Genomic Test Tool is designed 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 a proportion of heifer calves to test and the selection pressure based on test results. The tool allows farmers or consultants to enter farm specific and calf-level information to perform custom-tailored analyses that will devise the best management strategies for defined conditions and data entered. Research has demonstrated that best strategies of genetic selection are those for heifer calves.

Selection depends on farm capacity for generating on-farm extra female calves, which is a function of heifer and calf reproductive efficiency and herd replacement ratio. Potential gains of genomic testing increases when the number of produced replacements is higher than required replacements (Cabrera, 2012). Hence a higher capacity to select more aggressively, a higher selection pressure towards the best genetic heifer calves. We recommend to run this analysis once a year. It is assumed that the herd size and structure is stable but can be modified.

The value of genotyping depends on: 1) relationship between reliability of predicted transmitted abilities (pedigree information) and reliability of genomic test, and 2) potential parentage errors on farm data (Weigel et al., 2011).

The practical value of the Genomic Test Tool includes: 1) improved farm profitability by selecting best quality animals based upon genomics; 2) improved factors affecting the economic impact of Jerseys regarding to efficiency, net income, longevity, and lifetime profit; and 3) enhanced genetic basis of Jersey herds.

If you are an AJCA REAP herd owner, use HerdView at InfoJersey.com to generate a file with Jersey Performance Index (JPI) values. Select the Genomics Calculator Heifer Inventory report from the pull down options under Select A Quick Report To Begin:

Select A Quick Report To Begin:
Genomics Calculator Heifer Inventory

The resulting file can be imported into the Genomics Calculator to use JPI as basis for decisions. Contact the AJCA cwolfe@usjersey for assistance.

Acknowledgement

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Select data type

**Step 1: Enter your Data**

- Data from Heifer Calves < 12 Months old.
- JPI ○ NM$  

**Download Data Entry Excel File**
- Download Data Entry File

**Upload Data Entry as Excel File**
- Select Spreadsheet

Download generated Data
- Data generated.

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**Total Number of Animals = 480**

- Bar chart showing distribution of data across different percentile levels.

**Average Value:**
- 60-70: Average Value: 231

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Download template

Upload data

Explore data distribution
Define herd characteristics

**Step 2: Calculate Percentage of Calves to Maintain Herd Size**

<table>
<thead>
<tr>
<th>Herd Turnover Ratio, %/year</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Cows 21-d Pregnancy Rate, %</td>
<td>25</td>
</tr>
<tr>
<td>Females with Conventional Semen, %</td>
<td>47</td>
</tr>
<tr>
<td>Heifer Conception Rate, %</td>
<td>60</td>
</tr>
<tr>
<td>Services Heifers using Sexed Semen</td>
<td>0</td>
</tr>
<tr>
<td>Sexed Semen Conception Rate, %</td>
<td>44</td>
</tr>
<tr>
<td>Females Offspring Ratio Sexed Semen, %</td>
<td>90</td>
</tr>
<tr>
<td>Premium Cost Sexed Semen, $</td>
<td>10</td>
</tr>
</tbody>
</table>

Estimated Calves to Maintain Herd Size, %: 60.53

Estimate proportion of calves needed
Confirm proportion of calves needed

Enter cost of genomic test

Estimate parentage error on data records
Optimize Animals to test

Find net value

Find net profit

Have a list of animals to test
Define which animals to test

Find net value

Find net profit

Have a list of animals to test
Practical value

• **Improved farm profitability by selecting best quality animals based upon genomics**

• **Improve factors affecting the economic impact: efficiency, net income, longevity, and lifetime profit**

• **Enhancing the genetic basis of Jersey (and other breeds)**
Acknowledgement

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