Dairy Management

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Genomic testing decision support tool for Jersey dairy calves

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Project supported by the AJCC Research Foundation

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

Cabrera, 2012

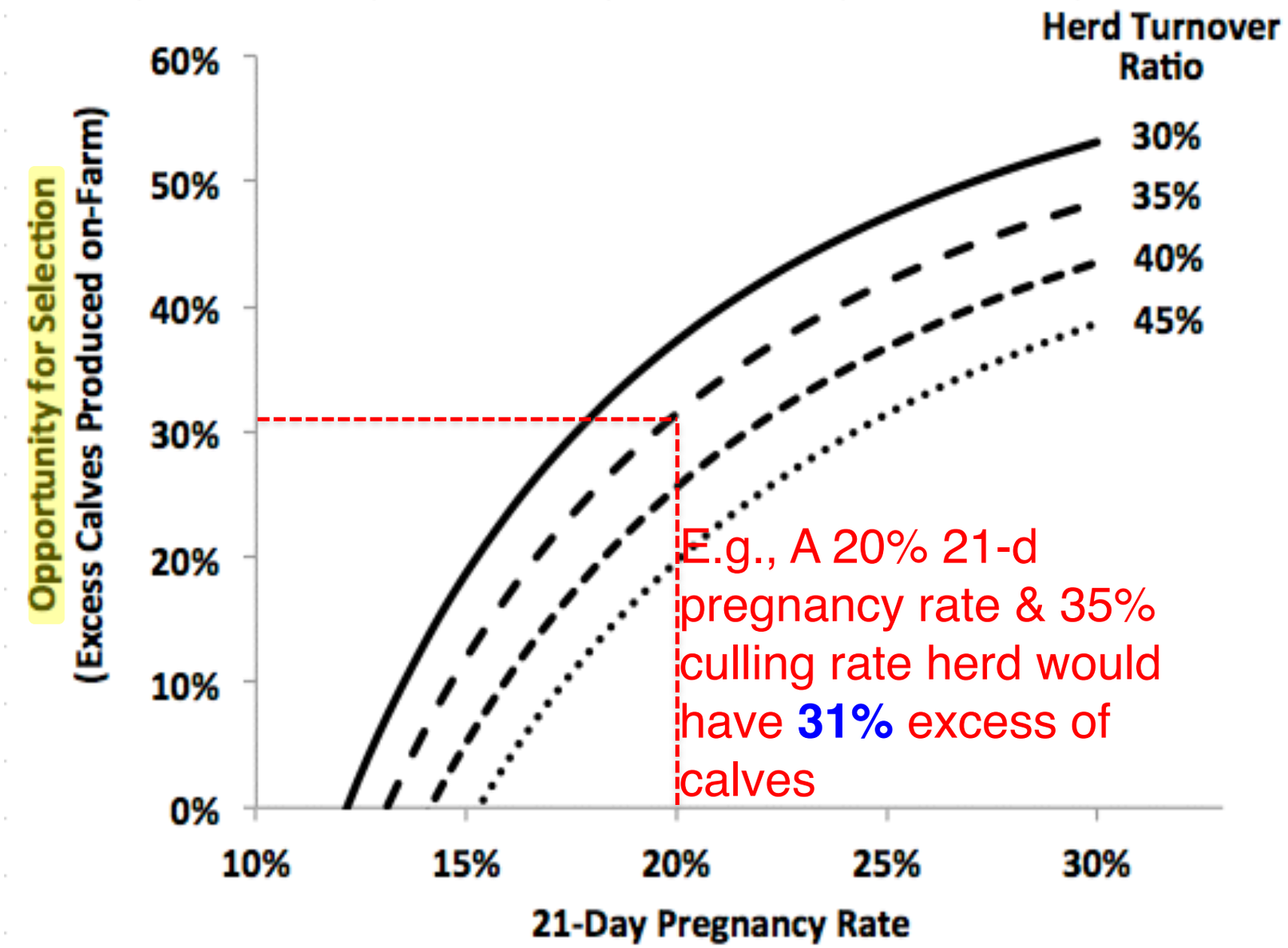
Depends on farm-specific capacity for generating extra female calves:

- 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**

Methodology

Step 1: Selection pressure



Predicted excess female calves as a function of reproductive performance and culling management. Predictions performed using Cabrera (2012) Markov-chain model assuming 47% female-born calves and 5% heifer reproductive culling

Methodology

Step 2: Maximum gain lifetime net merit breeding value

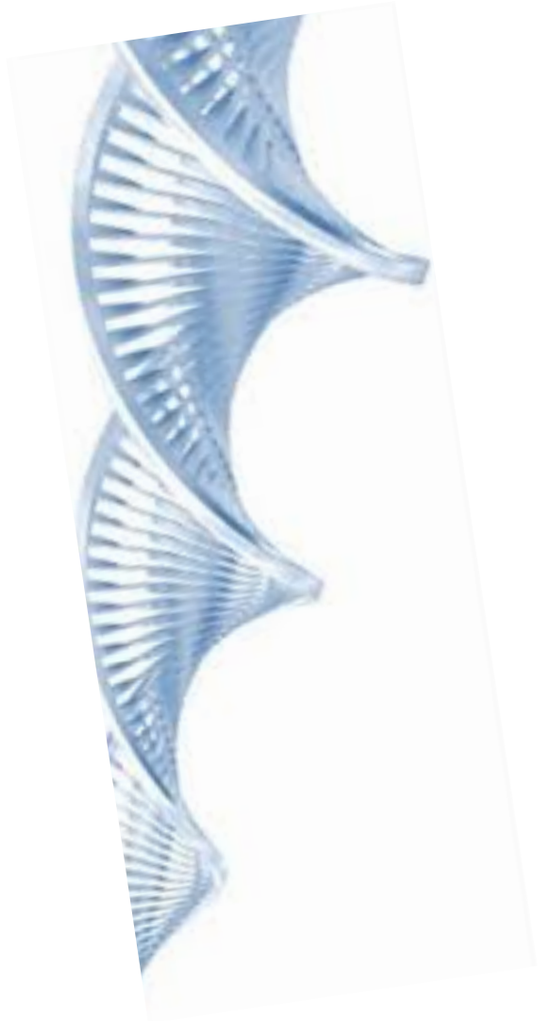
Assuming opportunity for selection, genotyping is cost effective

- Greatest gains when selection performed in heifer calves

- **Depends on:**

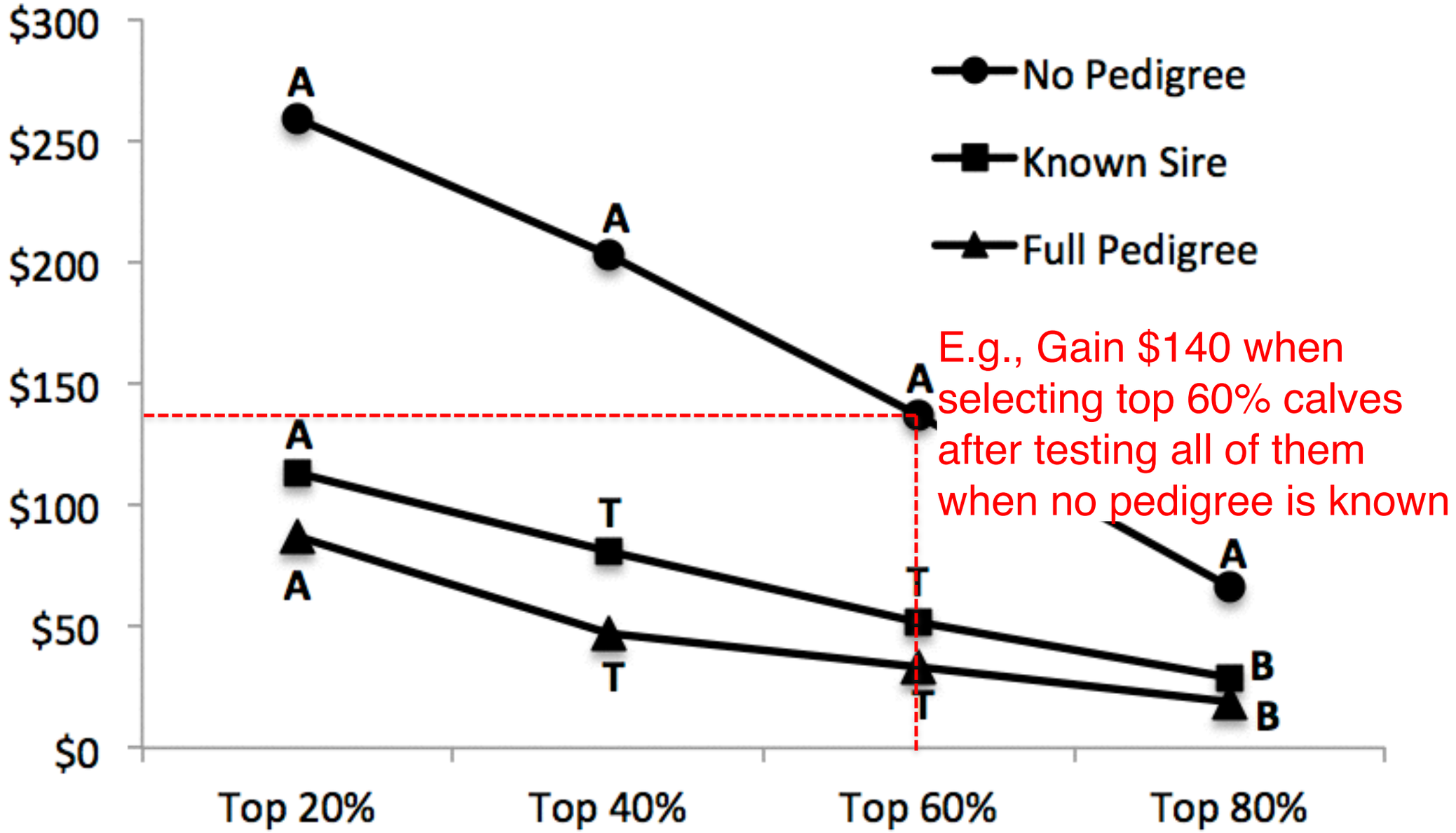
  - **Reliability of genomic of predicted transmitted abilities**

  - **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).

Research design

Conceptual framework of decision support tool

Farm-specific, interactive, and dynamic

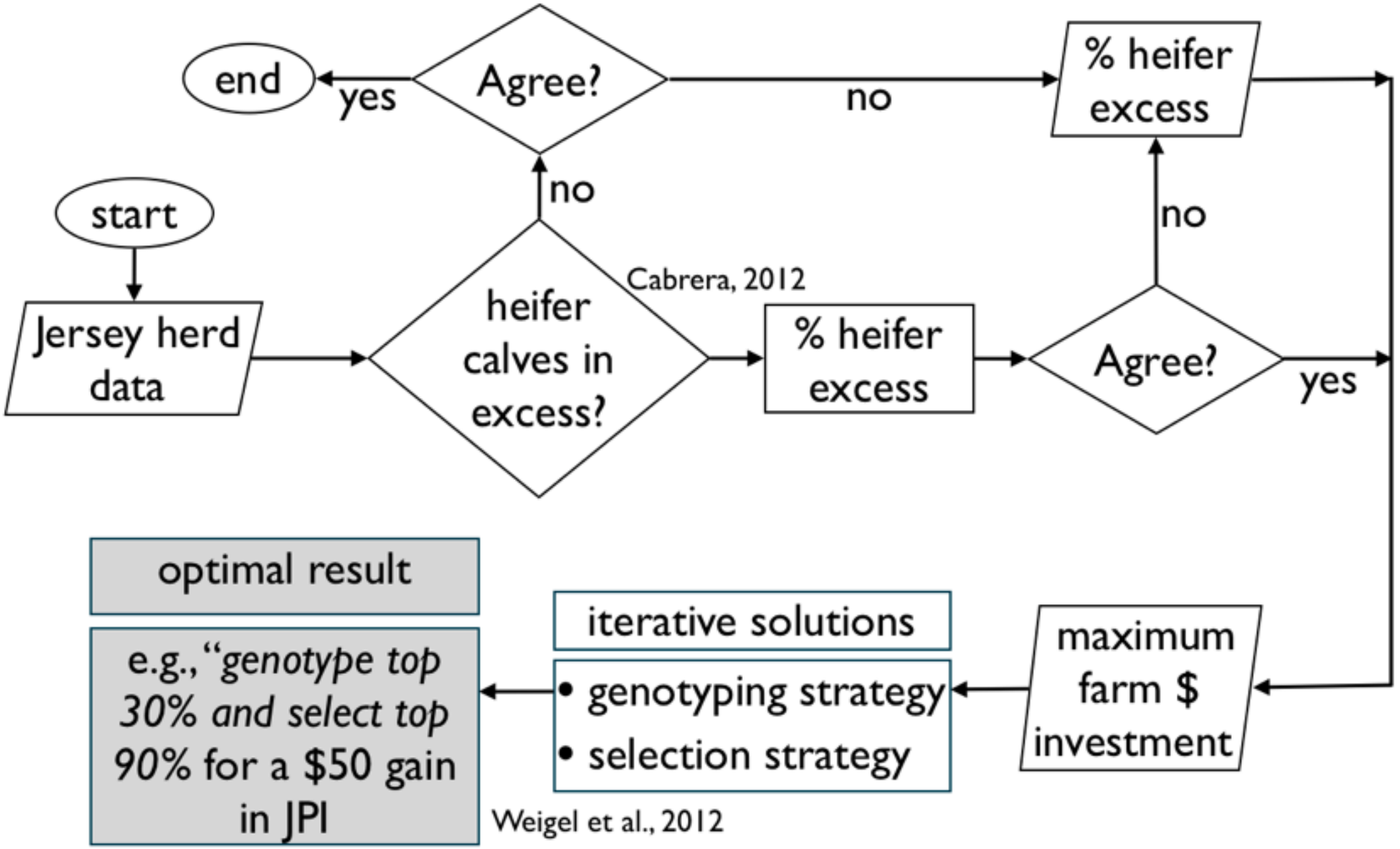
•Interactively determines excess of heifers (%)

•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.

Integrated Genomic Testing for Jersey Heifer Calf Decision Support Tool

V.E. Cabrera and K.A. Weigel, Department of Dairy Science

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 aggresively, 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

This project is supported by the AJCC Research Foundation to V.E. Cabrera and K.A. Weigel.

Select data type

Step 1: Enter your Data

Data from Heifer Calves < 12 Months old.

JPI NM$

Download Data Entry Excel File

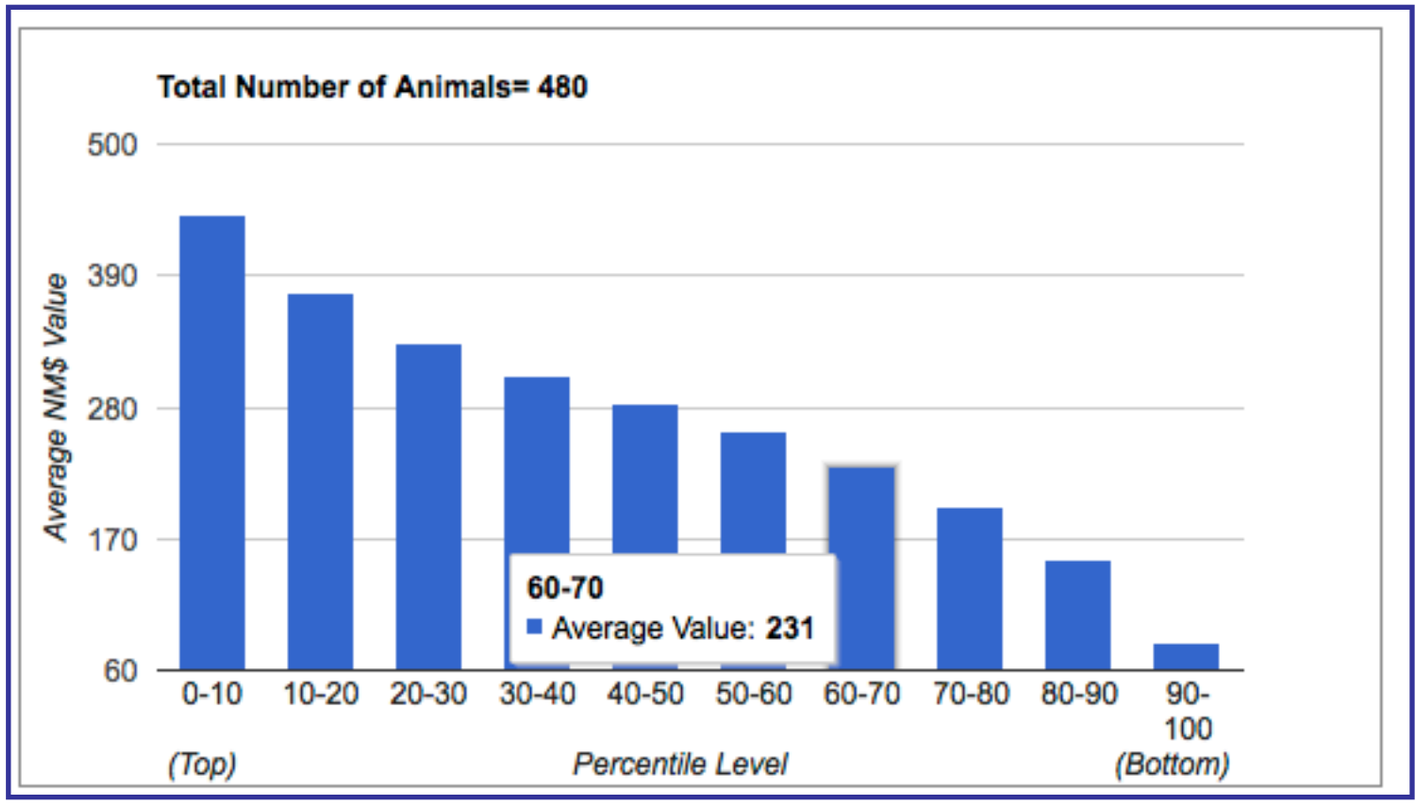
Download Data Entry File

Upload Data Entry as Excel File

Select Spreadsheet

Download generated Data

Data generated.



Download template
Upload data

Explore data distribution

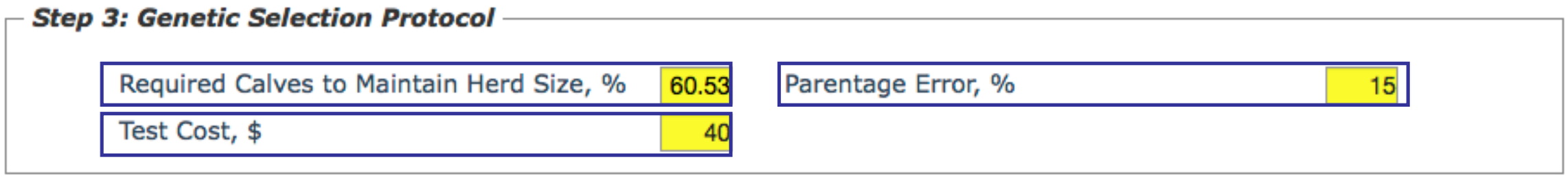
Define herd characteristics

Step 2: Calculate Percentage of Calves to Maintain Herd Size

Herd Turnover Ratio, %/year	35	Services Heifers using Sexed Semen	0
Adult Cows 21-d Pregnancy Rate, %	25	Sexed Semen Conception Rate, %	44
Females with Conventional Semen, %	47	Females Offspring Ratio Sexed Semen, %	90
Heifer Conception Rate, %	60	Premium Cost Sexed Semen, $	10
		Estimated Calves to Maintain Herd Size, %:	60.53

Estimate proportion of calves needed

Confirm proportion of calves needed

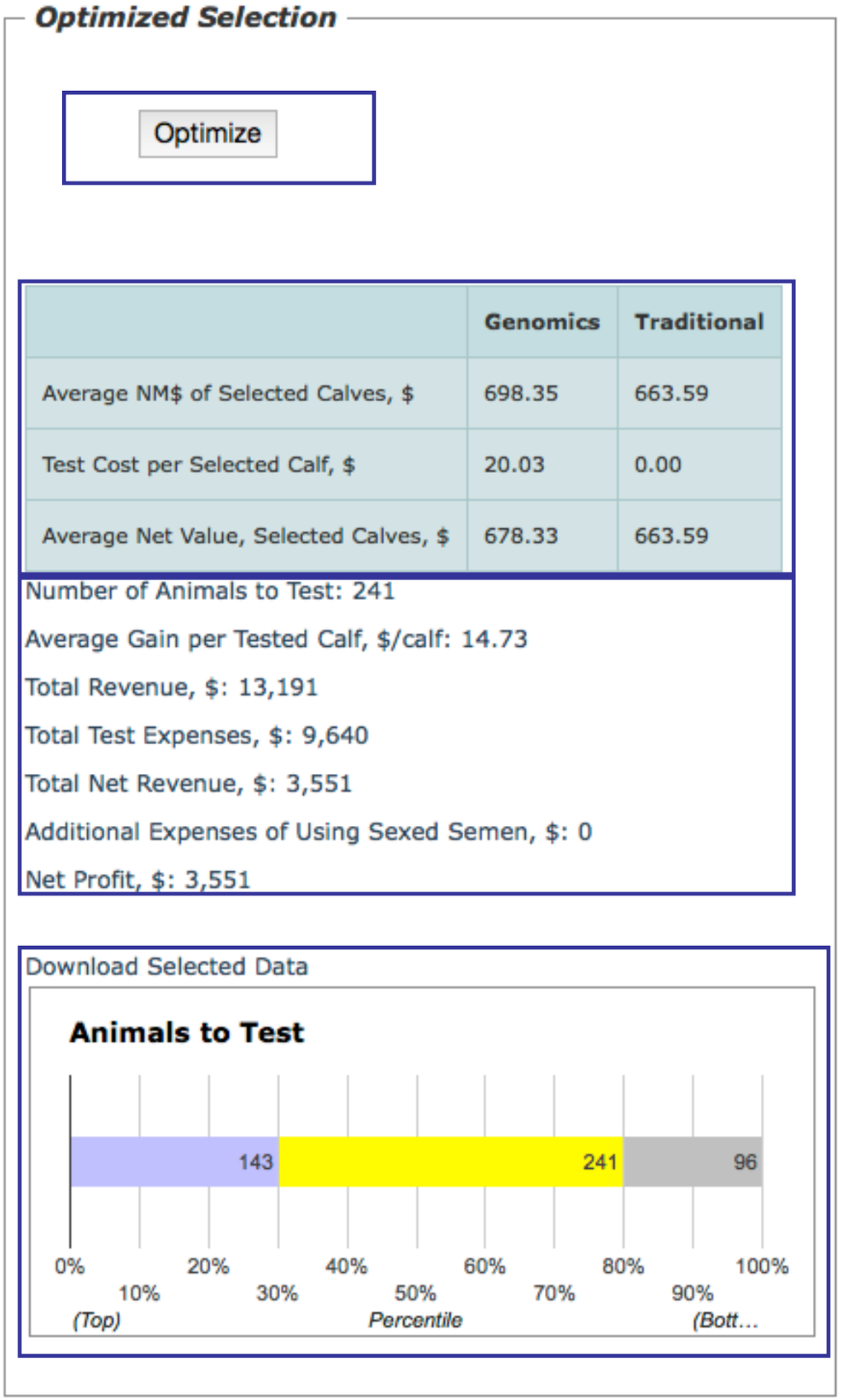


Enter cost of genomic test

Estimate parentage error on data records

Optimize Animals to test

Find net profit

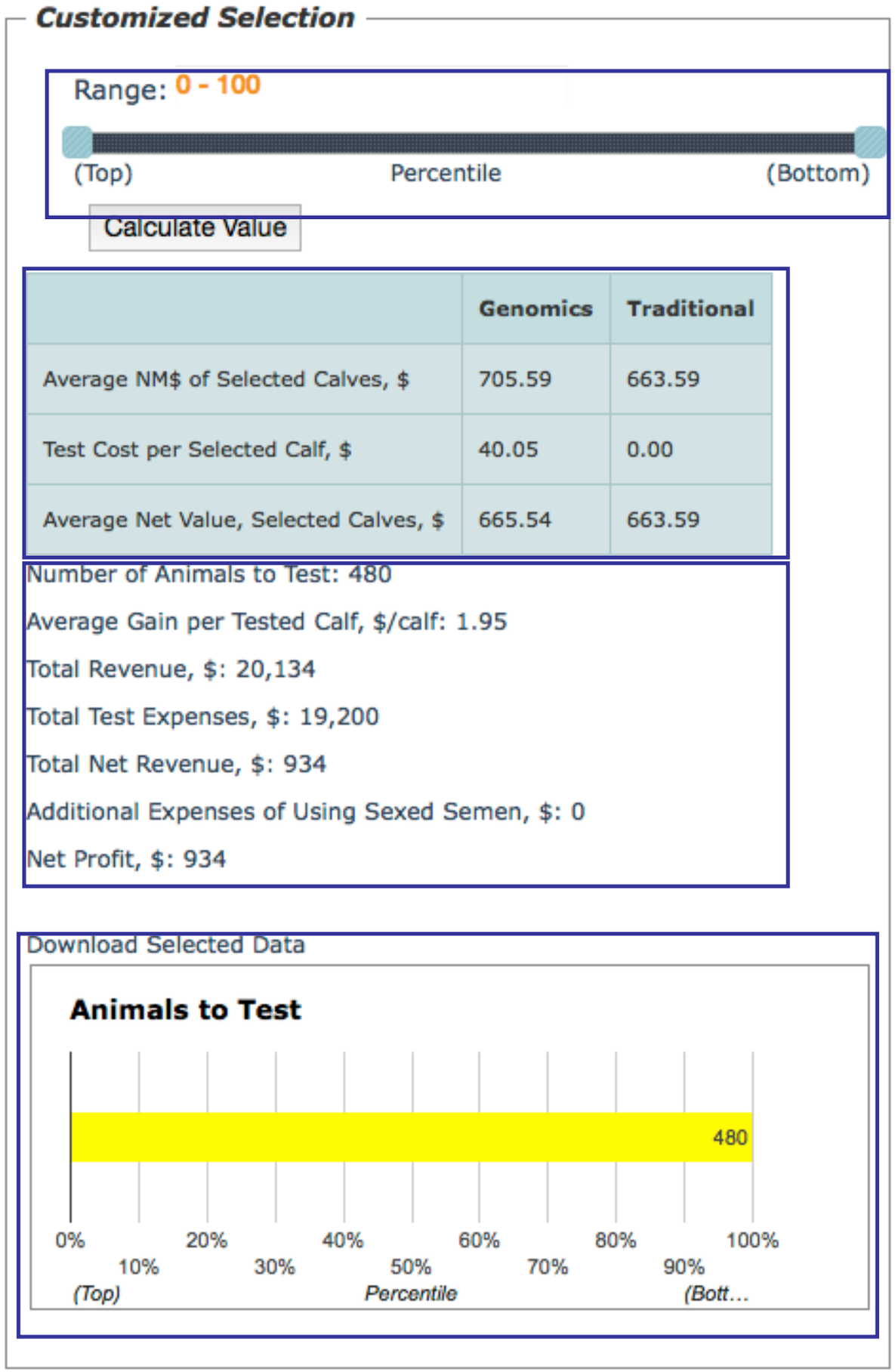


Find net value

Have a list of animals to test

Define which animals to test

Find net profit



Find net value

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

Funding support

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