

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



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Summary of project

What will be done

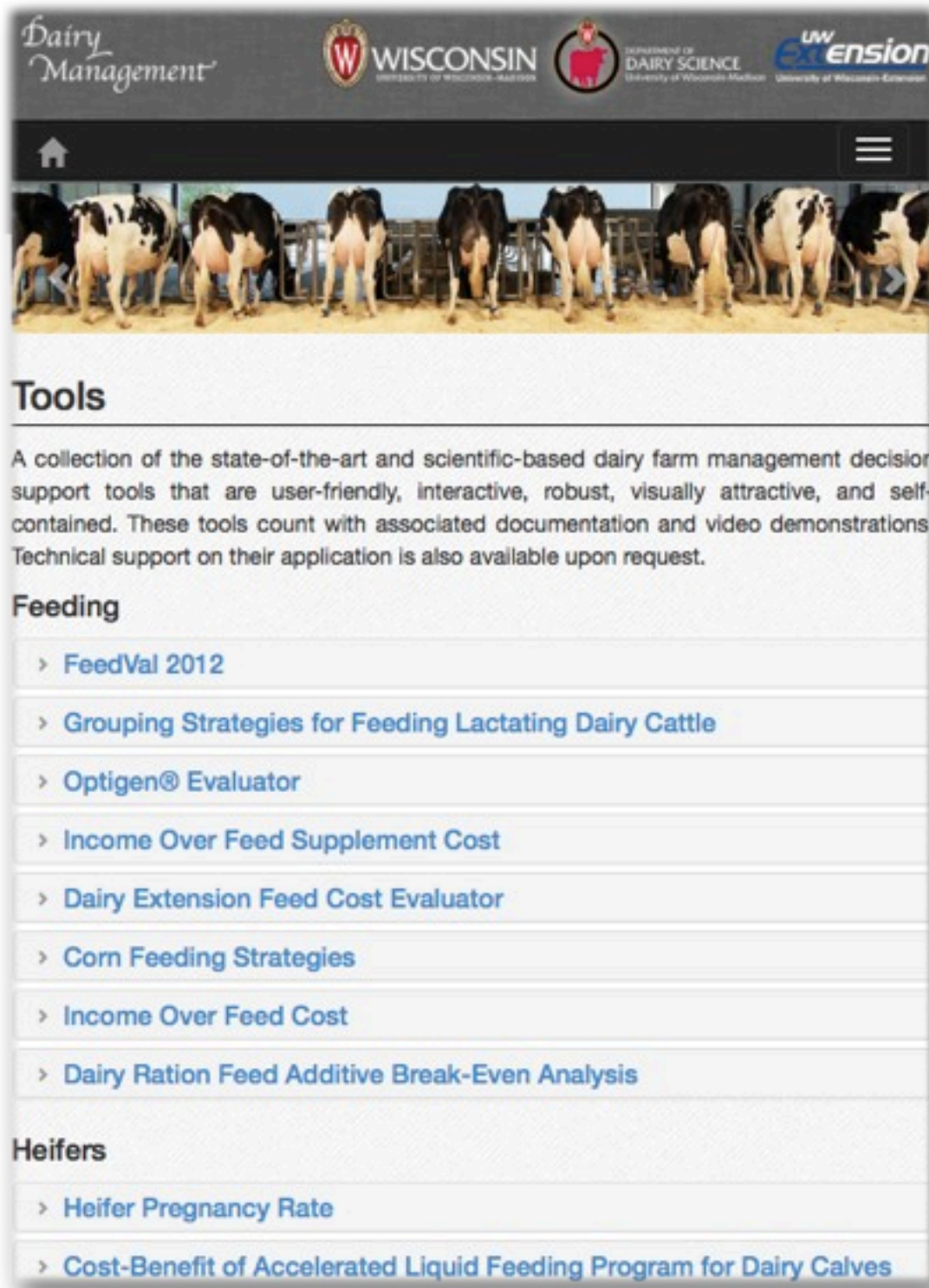
Develop a state-of-the-art decision support tool to:

- 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.



Summary of project

Availability of main deliverable



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

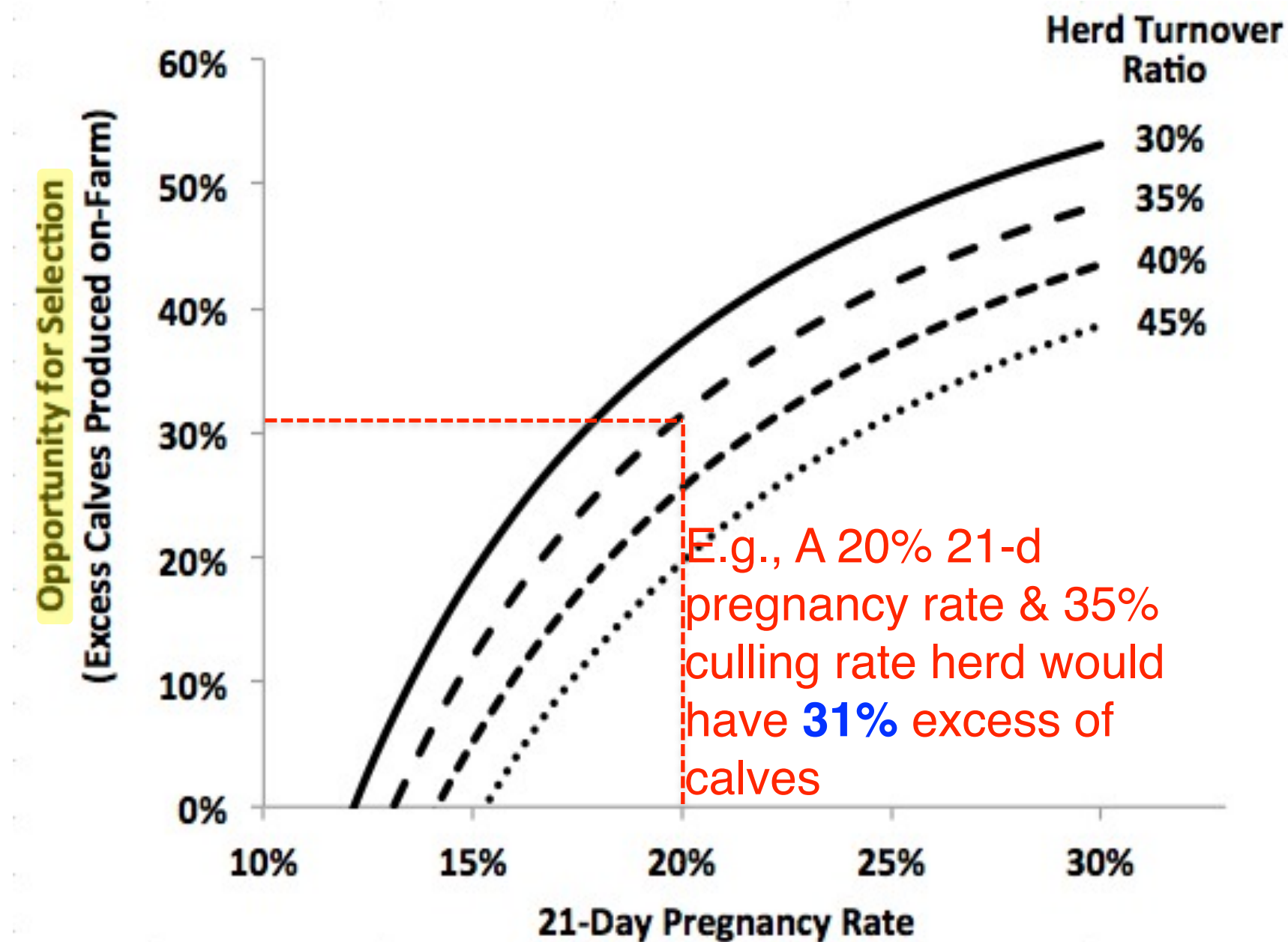


Depends on farm-specific capacity for generating extra female calves:

- 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



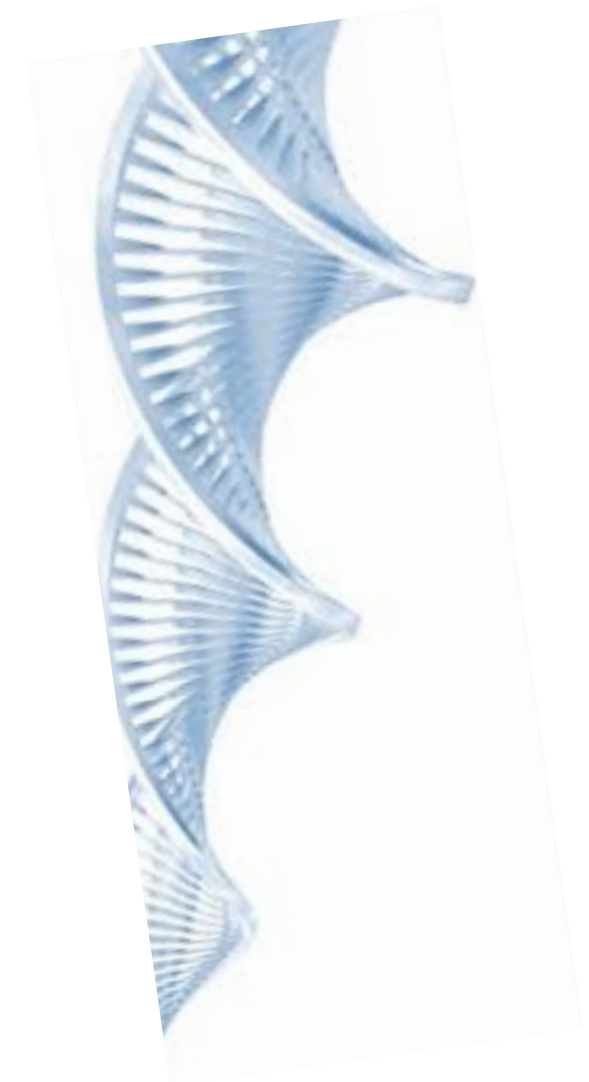
Predicted excess female calves as a function of reproductive performance and culling management. Predictions performed using Cabrera (2012) Markov-chain model assuming 47% female-born calves and 5% heifer reproductive culling

Methodology

Step 2: Maximum gain lifetime net merit breeding value

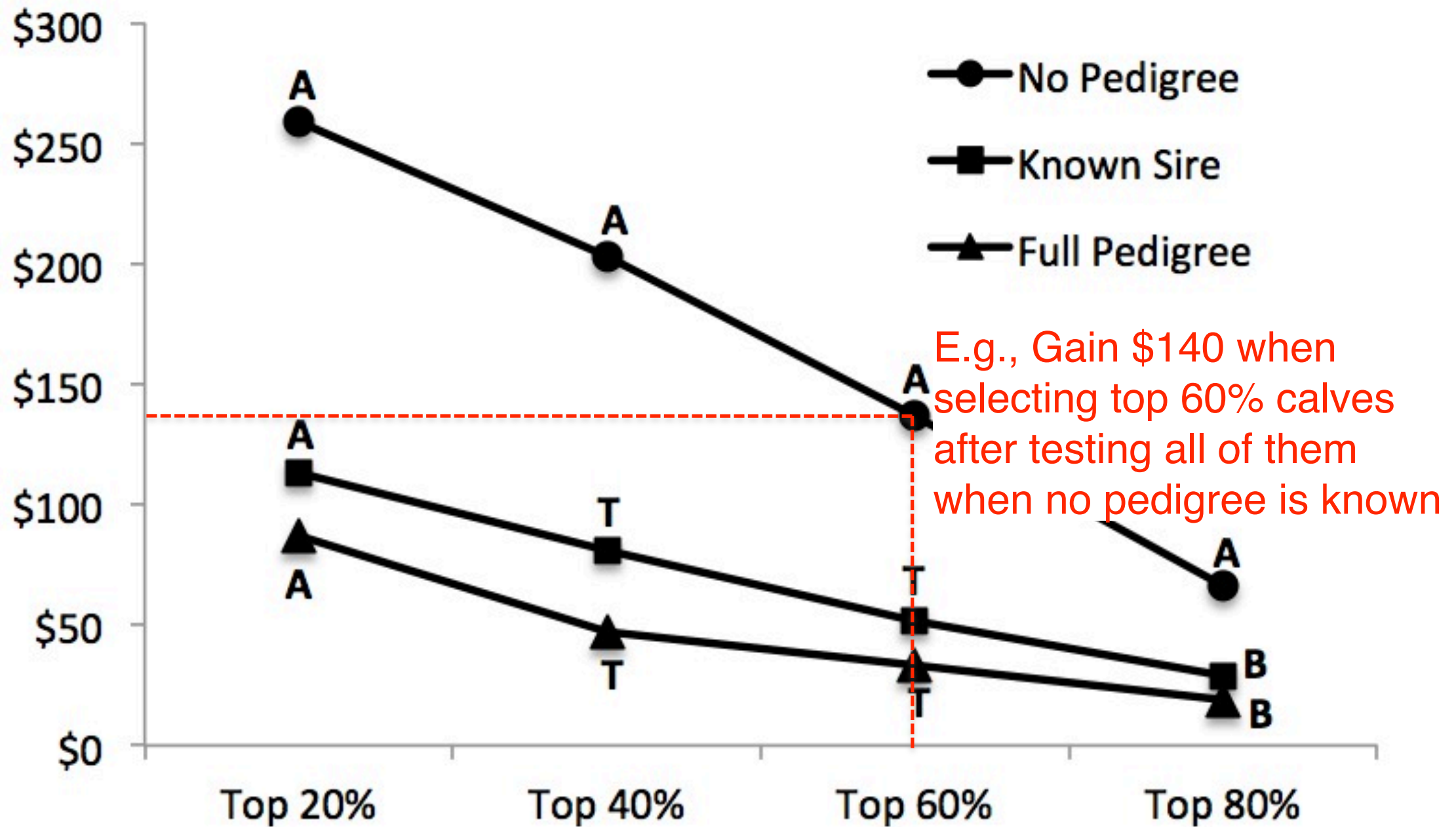
Assuming opportunity for selection, genotyping is cost effective

- 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:**

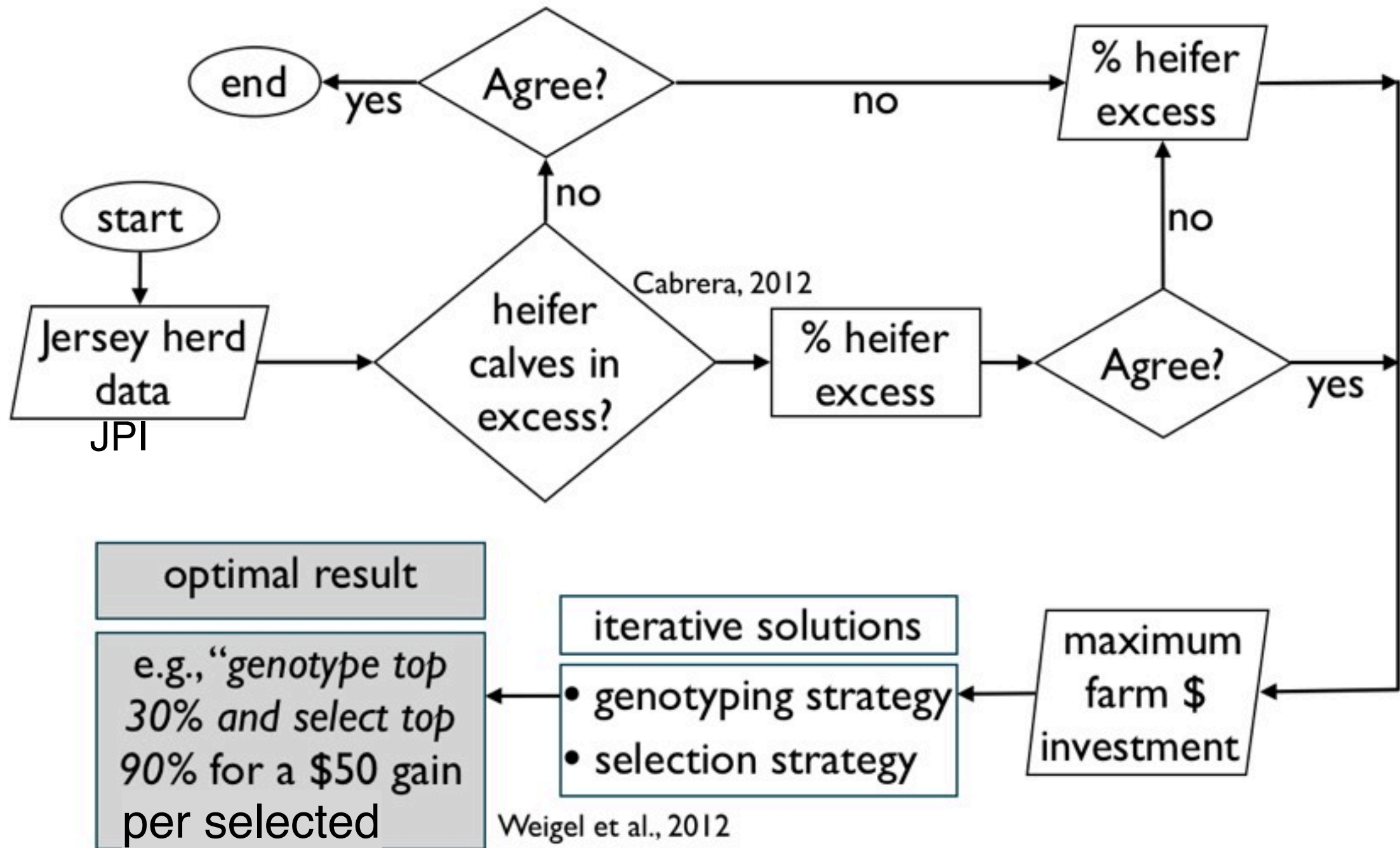
- **Genotyping and**

- **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.

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

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



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

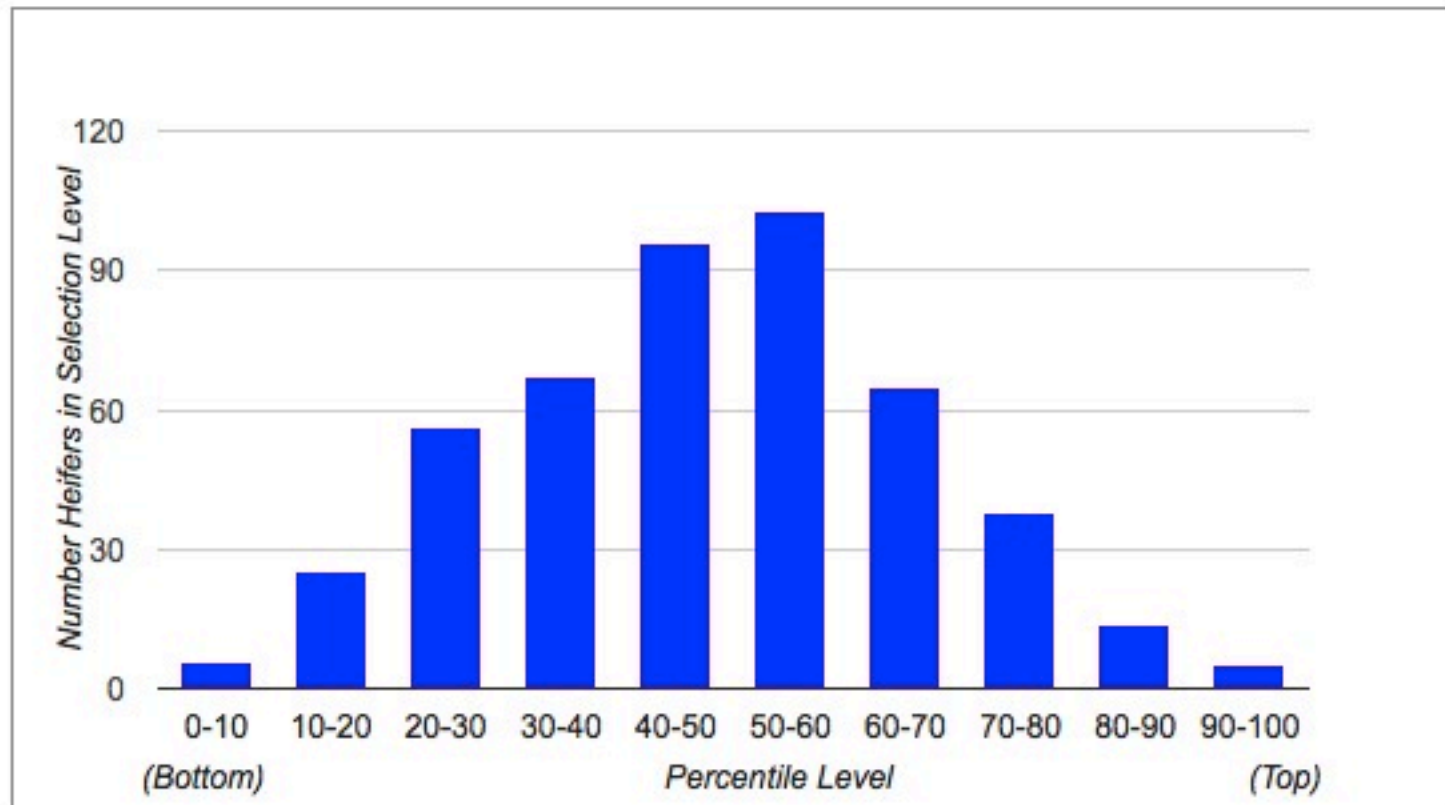
[Download Data Entry File](#)

Upload Data Entry as Excel File

Select Spreadsheet:

no file selected

Please generate data first.



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

Calculate

Step 3: Find the Best Policy Investment

Required Calves to Maintain Herd Size, %	72.03
Cost Per Test, \$	40
Total Investment, \$	5000

Calculate

Generating Results...This may take 1 minute...



Prototype

Decision support tool

Customized Selection that Should Be Genetically Tested (Genomics)

Customized Selection:

0 to 50

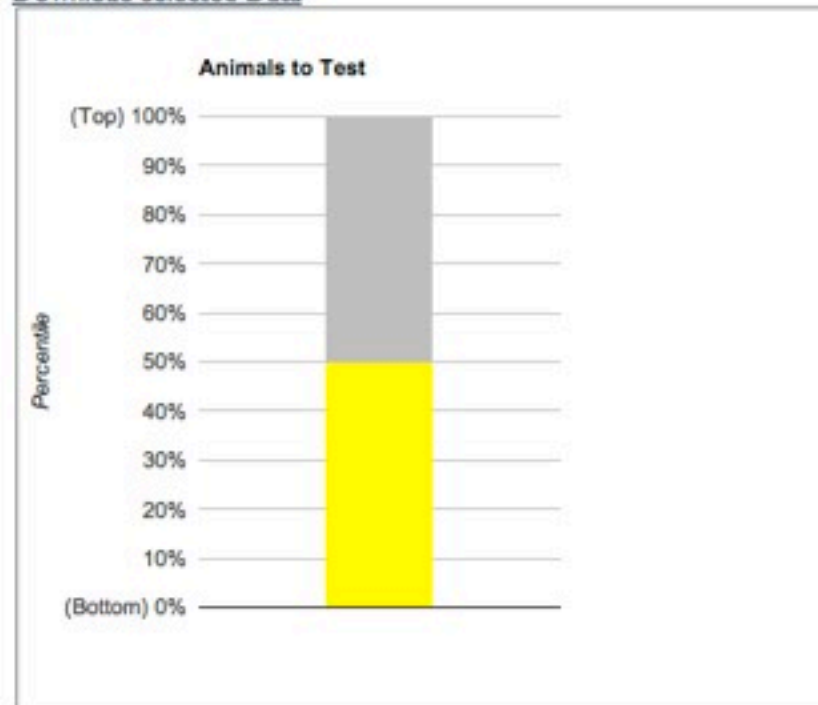
Calculate Cost

	Gen	Trad
Value (\$)	655.19	653.75
Test Cost	16.83	0.00
Value Cost	638.36	653.75

Difference (\$): -15.38

Total Expenses (\$): 9600

[Download Selected Data](#)



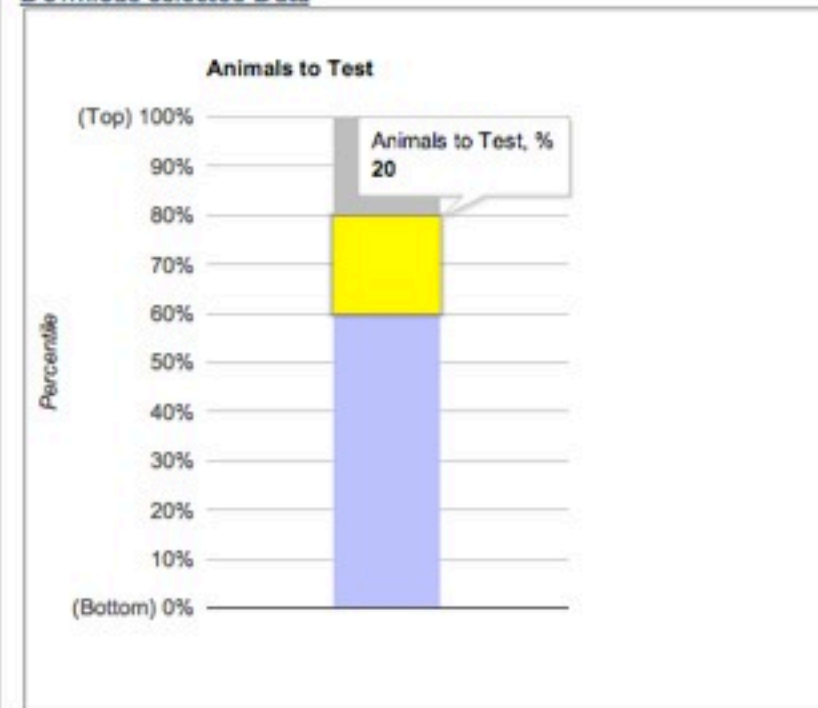
Suggested Calves That Should Be Genetically Tested (Genomics)

	Gen	Trad
Value (\$)	667.47	653.75
Test Cost	6.73	0.00
Value Cost	660.74	653.75

Difference (\$): 6.99

Total Expenses (\$): 3840

[Download Selected Data](#)



Acknowledgement

Funding support

This project is being supported by the American Jersey Cattle Association, National All-Jersey-Inc.

