An integrated Approach to Improving Dairy Cow Fertility

“To improve reproductive efficiency of lactating dairy cows using an interdisciplinary extension and research team that will identify and remove barriers to reproductive success and link outcomes of basic and applied research with an innovative extension delivery program.”

Materials and Methods


Results and Conclusions

Breeding only a selected group of 59% primiparous cows in 1st service, those that are predicted to have better reproductive performance, accrue a gain of $4.12/cow.

Specific Aim 1

Prediction of Pregnancy Using Machine Learning Algorithms

Objectives

1. Find the machine learning algorithm that better predicts pregnancy status in dairy cattle.
2. Find breeding optimal decisions through cost/benefit evaluation according to pregnancy values, breeding costs, and days open costs.

Materials and Methods


Specific Aim 2

Determine the impact of specific milk components on reproductive performance of lactating dairy cows.

Experiment 1 - Objective: Analyze milk fat/protein ratio (FPR) from the first 5 DHIA milk test results to measure health consequences and to predict conception at first postpartum AI (CR1).

Materials and Methods

Dataset consisted of 207,506 1st postpartum services performed in 648 herds (July 2009 to July 2010). Cows scored based on the number of days that deviated from the ideal FPR range of 1 to 1.4.

Results and Conclusions

Average FPR throughout the 1st 5 postpartum milk tests

- A dramatic amount of cows had an FPR outside the ideal range.
- Cows deviating from ideal FPR range in 2 out of the 5 initial milk tests still had a good fertility in CR1.
- FPR had a greater impact when AI was performed in summer months (not shown).

Specific Aim 3

Treatment Outcomes for Clinical Mastitis Caused by E. coli in a Wisconsin Dairy Herd

Materials and Methods

Cows (n = 94) enrolled between May 2011 and January 2012 had either a mild or moderate (abnormal milk and/or udder) clinical mastitis (CM) case and single quarter intramammary infection. Cases were allocated as Treated (IMM cellfree) or Control.

Results

- Additional analyses: Continued data collection is currently being used to analyze the integrated impact of clinical mastitis and its association with treatment, DIM, previous milk yield, and other herd and cow specific factors to explain reproductive performance in lactating dairy cattle.

Specific Aim 4

Evaluate the economic impact of different reproductive management strategies on overall farm profitability under a variety of management scenarios.

Objective

Determine the effect of reproductive performance on herd value

Materials and Methods

Develop a daily dynamic programming model (DP) to calculate retention pay off (RPO)

Results and Conclusions

- Herd values ($/cow per year) for 5 reproductive programs (RP) across 5 relative milk yields (MC) (%) for each RP:

<table>
<thead>
<tr>
<th>Reproductive Program (RP)</th>
<th>RP1 (%)</th>
<th>RP2 (%)</th>
<th>RP3 (%)</th>
<th>RP4 (%)</th>
<th>RP5 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC1 (66%)</td>
<td>76%</td>
<td>88%</td>
<td>100%</td>
<td>112%</td>
<td>124%</td>
</tr>
<tr>
<td>MC2 (56%)</td>
<td>76%</td>
<td>88%</td>
<td>100%</td>
<td>112%</td>
<td>124%</td>
</tr>
<tr>
<td>MC3 (46%)</td>
<td>76%</td>
<td>88%</td>
<td>100%</td>
<td>112%</td>
<td>124%</td>
</tr>
<tr>
<td>MC4 (36%)</td>
<td>76%</td>
<td>88%</td>
<td>100%</td>
<td>112%</td>
<td>124%</td>
</tr>
<tr>
<td>MC5 (26%)</td>
<td>76%</td>
<td>88%</td>
<td>100%</td>
<td>112%</td>
<td>124%</td>
</tr>
</tbody>
</table>

- RPI: 100% TAI Management; RP: Combination of timed AI and estrous detection. MCC: Lowest milk production; MCC: Highest milk production.

- The most extreme herd value difference ($/cow per year) between two RP was $77 for MCC3 (RP5 – RP2); $13 for MCC1 (RP5 – RP1); and $160 for MCC5 (RP5 – RP2).

- There is a strong positive relationship between 21-d PR and herd value.

- There is an opportunity to perform individual cow daily reproductive decisions for improved herd value.