Improving lactation persistency in dairy cows.


1-Scientia Ltd, Innovation Park, Ruakura, Hamilton, New Zealand. adrian.molenaar@agresearch.co.nz

Methods and results

Background

- Lactation persistency is the degree that early milk yield persists through the lactation season1,2.
- Lactation persistency in New Zealand (NZ) dairy cattle is heritable, with Friesians at 0.22 and Jersey cows at 0.163. A large QTL for lactation persistency has been identified in some NZ cows on bovine chromosome 3 at approximately 67 CM2.
- With the seasonal nature of pasture-based dairying in NZ, milk production peaks in spring then declines by about 10% per month4. Hence the industry must have enough processing capacity to cope with the volume of milk at the peak, leaving processing plants under-utilised at other times.
- Cows with high lactation persistency are better for total milk production and efficiency.

Objective

- To select groups of cows with high and low lactation persistency with good overall production, based on their performance in several past lactations, and study production and mammary characteristics in cows that differ in lactation persistency.

Research design

Animal Trial

- Persistency data, defined as a ratio of late lactation to early lactation within season, from 1592 cows with suitable herd test or daily records from three farms, was analysed across lactations with a repeated-animal REML model. Fifteen cows, matched as well as possible for age, year of record, breed and days in milk, and with at least average milk production, were selected for each high and low persistency group.
- Selected cows were relocated to a research farm, were managed together with the main research farm herd, and their lactations through the next season were closely monitored.
- Daily milk yields were recorded, fortnightly samples were taken for milk composition analysis, monthly milk and blood samples were taken for ELISA measurement of milk and blood IGF-1 and prolactin levels. Body condition scores and weights were assessed at the same time.
- Mammary biopsies, penetrating about 10 cm into the mid udder, were taken near peak and again at late lactation. The deepest portion was processed for histological analysis and the rest frozen for subsequent molecular analysis.
- Udder capacity was determined by measuring udder circumference, udder depth and milk yield before and after oxytocin injection at mid and at late lactation.
- Daily milk yield data were thoroughly scrutinised, aberrant data points removed, adjusted to days in milk and statistical analysis performed on the variation between groups and on all other measurements.

Results

Milk yield summary: High group vs. Low group *10% more milk

<table>
<thead>
<tr>
<th>All cows</th>
<th>Selected cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistency</td>
<td>MY</td>
</tr>
<tr>
<td>Sum of data</td>
<td>40 43 44</td>
</tr>
<tr>
<td>Avg high</td>
<td>0.51</td>
</tr>
<tr>
<td>Avg low</td>
<td>0.40</td>
</tr>
<tr>
<td>% P value</td>
<td>0.002</td>
</tr>
<tr>
<td>% H-L</td>
<td>27.7</td>
</tr>
</tbody>
</table>

Milk yield by days in milk, all cows.

Udder capacity and volumes

- Body weight, the prior week’s average milk yield, udder volume index (UVI) (tape method) and residual milk (after oxytocin) at 0 and 40h, functional udder capacity (UC= 40h MY with oxytocin, kg), or divided by average 24h secretion rate preceding test, and efficiency (UC in kg/UVI-40h*1000) were recorded in December and April.
- December measurements showed no significant differences between the high and low groups and just a trend for increased UC (p=0.3).
- April measurements showed significant differences between the groups for; prior weeks MY (p=0.001), in residual milk at 0hr (milking out then oxytocin) (p=0.012); residual milk trend at 0hr (p=0.1); UC kg (p=0.045); efficiency (p=0.02). Other measurements were ns.

Future plans

- Refined tools (one for herd test data and another for daily milk yield) for identifying cows with higher and lower lactation persistency based on past milking performance has been produced that can be used by farmers in their culling decisions.
- Potential $50,000 return per average NZ farm.
- Needs implementation over time (top 1-2 % selected).
- Note selection from “1600 cows with records. Now ~4.4M NZ dairy cows.

Impact on the dairy industry

- Both groups on average produced more milk than the NZ average.
- Predicted that the high group would be 27% more persistant than the low group.
- From MY data at 43-73 (early) and 210-240 (late) DIM, the high persistency group had a ratio that was ~28% superior to that of the low persistency group.
- An approximately 85% between-farm accuracy of prediction (in these cows).
- There was a 9% difference in total milk yields to day 250 of lactation between the two groups.
- Five cows from the high and one from the low group did not get pregnant in the next season. Implication that persistent cows may have negative selection pressure.
- Removing these (& 3 other cows) dropped the persistency to 22% while the difference in the total milk yield to day 250 between the two groups increased to 9.7%.

Summary

- Both body condition; low persistency cows had slightly better condition than highs – P value not significant (ns)
- Body Weight - ns
- Effect of cow age on persistency - ns
- Fat, protein, lactose, solids - ns
- SCC - rarely significant
- Prolactin, insulin very similar - both plasma and milk - ns
- Breed - possible slight effect, the low group had 3/16 more Jersey and the high group had 3/16 more Friesian (p=0.047)