Integration of Routine Computerized Monitoring Solutions for Milk Meter Performance into the Services offered by Milk Recording Organizations as a Tool for Improved Dairy Producer Satisfaction

February 10, 2018

Bruce Dokkebakken
General Manager Minnesota DHIA
Minnesota DHIA 2017

- 295,342 cows tested from 1,430 herds (average of 209 cows)
- 72,508 cows checked for Pregnancy using milk
- 34,085 cows tested for Johne’s Disease using milk
- 44,220 eartags sold (RFID and management)
- On average herd reports were mailed or e-mailed **2.14 days** after sample date
Minnesota DHIA 2017

- Average of 11 sample days per herd
- 2,000 portable Tru Test meters in the hands of 64 field techs
Minnesota DHIA 2017

- 511 herds have software from DHIA (36%)
- 63% of herds are downloaded by a consultant who has permission to access data to help dairy
- Data from Minnesota DHIA members is processed at all 4 U. S. Dairy Records Processing Centers at the option of the producer (10 years)
Minnesota DHIA 2017

- Average production in 2017 was 25,136 pounds of milk per cow, with 957 pounds of butterfat and 789 pounds of protein or 11,311 kg of milk, 431 kg of butterfat, and 355 kg of protein.
- SCC average was 238,000.
- 2017 Milk Price paid to farmers was $17.74 per hundredweight – 36% lower than 2014.
Data handling for 8 milk labs
Herds on DHI Programs

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Average Test Day Milk Yield of DHI Herds

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35.1 kilos per day
Changing Dynamics of Herd Recording

Traditional herd recording programs rely on

- Portable meters owned by herd recording organization
- Control of meter maintenance, calibration and operation
- Investment in equipment carried by recording organization

The new construct of herd testing

- Smaller number of herds coupled with increased herd size
- Desire for immediate access to data and results
- Investment in integrated milking systems/software by dairy
- Desire for increased labor and data handling efficiency
- Use of multi-day milk yield averages in recording programs
## Changing Dynamics of Herd Recording in the USA

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With the Customer in mind

• For electronic meters, we try to provide a service that shows benefits, rather than showing up with a “you must calibrate or else” attitude
Key Concept with Statistical Monitoring of Daily Milk Meters

The in-place milk meter is only part of a linked system that includes…

- Calibrated Milk Meter
- Functioning Milk Meter Controller
- Accurate ID System
- Software and Interfaces
- Milker (Human) Performance
Using Third-Party software

• Interface with manufacturer’s software
  – GEA Westfalia (Dairy Plan)
  – Afikim (Afimilk, Afifarm)
  – Boumatic (Provantage, Metrix)
  – DeLaval (Alpro)
  – DairyMaster
  – Universal

• Short List of Vendors
  – Dairy Comp 305 (Valley Ag Software)
  – PCDart (Dairy Records Management Systems)
  – DHI Plus (DHI-Provo) – under development
### Electronic Milk Meter Monitoring Report (EMMRR) Detail

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Electronic Milk Meter Monitoring Report (EMMRR) Detail
Percent Difference From Expected By Milking

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AV. +0.1 -0.1 +0.1 +0.2 +0.0 +0.1 -0.1 -0.2 -0.2 -0.2

Detail information for each milking for each cow stored in file t36420121. Open file with spreadsheet program.
DC 305 – Parlor Performance Report

POTTER ML 26
- Dairy Comp 305  ------------------ NORTH STAR ACRES  ------------------ Page 1 (PAGE)
- Command: PARLOR/WVMP
- Expanded: -
- NORTHSTAR  ------------------ North Star Acres  ------------------ 7/28/09

Milking report for 7/28/09 Milking 1 at 12:07 PM 3:04c 12

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Total: 16442 2406 26 629 92 6:10 4:09 10:59 5.2 5.2 0 31

Description
- % units were attached
- Milk / stall / hour
- Cows / stall / hour
- Flocrate 0 to 15 seconds
- Flocrate 15 to 20 seconds
- Flocrate 25 to 30 seconds
- Flocrate 30 to 60 seconds
- Peak Flocrate
- Milk in the first 2 minutes
- Milk in the last 2 minutes
- Percent time in low flow
- Seconds in low flow

Error Summary:
- Pen 1 2 3 4 5 6 7
- Reattach 12 1 1 1 1 1 1
- No Letdown 41 4 6 9 11 10 8
- Manual Mode 11 1 1 1 1 1 1
- Early Fall off 0 0 0 0 0 0 0
- Late Eject 8 0 0 0 0 0 0
- Manual Detach 78 4 1 1 1 1 1

Total: 99 9 13 21 23 15 4

DairyCOMP

305
“Scheduler” in on-farm DC 305 dumps cowfile backup to Bertha daily (150 herds)
• Patty is responsible for supporting herds with Dairy Comp 305 electronic meter interfaces. She also supports PC Dart.
• She is the point of contact on any issues with e-meter performance.
• This provides an opportunity to build confidence and comfort between DHIA and the customer.
Patty creates at least one parlor report per month per herd

- Eyeballs them for issues and follows up with email if needed
- If meter is “off” she checks that meter after the dairy has notified her of repair, or on the next monthly check
- Posts data into Excel every month
Causes contact from DHIA

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<td>270</td>
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<table>
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<tr>
<th>Number</th>
<th>Cow#</th>
<th>Cow Hand</th>
<th>Cow# &amp; Auto</th>
<th>Auto vs. Hand</th>
<th>Milk</th>
<th>Time</th>
<th>%Dev</th>
<th>Total Milk</th>
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</thead>
<tbody>
<tr>
<td>9</td>
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<td>7</td>
<td>7</td>
<td>0</td>
<td>57</td>
<td>36.02</td>
<td>281</td>
<td>311.07</td>
</tr>
</tbody>
</table>

Total: 4977.08
And occasionally, the contact on e-meters becomes a software support conversation because of that “touch” and that comfort.
Using DC305 to monitor meters

• Non-invasive (done remotely)
• Enables targeted feedback to producer on needed repairs or service for their benefit in utilizing the management information
Using DC305 to monitor meters

• When done right, this doesn’t look like a QC regulatory system. It looks like outstanding service.
Using DC305 to monitor meters

- The bottom line – cost effective routine monitoring of meter performance not only helps assure data quality and integrity, but results in improved communications with the dairy and a tighter connection to the Milk Recording organization.
Considerations on Meter Performance Reports

Advantages
- Low cost
- Frequency - i.e. monthly
- Easy for producer
- Easy for DHIA
- Shorter turnaround and targeted repairs compared to annual water test calibration
- Identify weaknesses in the entire linked milk recording system
- Service opportunity for herd recording organization - build value into recording program
- Ongoing assurance of data validity for use in recording programs

Disadvantages
- Does not clearly indicate whether a meter is operating within tolerances
  - Part of the process
  - Not the answer or result
- There is no meter system certification or validation without...
  - communication
  - interpretation
  - action
  - follow-up
- Does not replace installation test or routine maintenance
Who Benefits from Monitoring Meter Performance?

The benefit to milk recording database accuracy is just the frosting on the cake.
Dairy Farmers are “Time Poor”
Time $avers with DHIA

- Milk Pregnancy
- PCR DNA
- Action Lists / Chore lists
- Parlor performance data
- Summary and Benchmark data for a look at how I am doing – now I might know where to look
What Else

can we do that is economical, useful, creates good will, and keeps the customer looking to us to help them in a world where data has become overwhelming?
What else can we do

• To make better use of the data we already have?
• To learn more from the milk sample we already have?
• To help sort through all that new data?
Change

- Milk price in the U.S. has changed dairying and milk recording.
- We need to find more useful and creative ways to supply services that make a $ difference to dairies, or we will have a lot less data to worry about in our databases.
When I grow up and have my own dairy

- I want to test my fresh cows weekly looking for SCC, ketosis, NEFA, butterfat/protein relationships, and other health tests available in the milk, and more important stuff we don’t know about yet

- I want to test select pens of animals or select cows in select pens for PG/open using milk
When I grow up and have my own dairy

- I may occasionally even want to test my whole herd ..... If someone else is willing to pay for that - I will share the data with them.
- I don’t need to hire DHIA to collect data I will not be able to use (or want to use)
When I grow up and have my own dairy

• it will be large enough for milk recording to justify showing up WEEKLY to sample only the 300 cows in the fresh pen or the 200 cows I plan to dry off in the next 2 weeks
• And it will be important enough for me to justify that cost
• Do the data folks want good data from my 3,000 fresh cows /yr or not?
At times, farmers worry about which data to look at, when they should be worrying about which cow to look at.
We support our local (& happy) dairy farmers
What else can we do to help dairy producers in their endeavor to help feed a hungry world.
Much can be accomplished by cooperation
Thank you ICAR

ICAR’S BELIEFS AND VALUES
THE KEYS TO THE SUCCESS OF ICAR

1. Creating synergy
   Secure network to share with, learn from and interact with fellow members

2. Improving continuously
   Helping its members to become or remain competitive

3. Acting responsibly
   Quality based animal production systems around the world

Minnesota DHIA
The World is run by those who show up.

Thank you for showing up.

Minnesota DHIA
<table>
<thead>
<tr>
<th>Stall No.</th>
<th>No. 1</th>
<th>Milking 2</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
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<td>10</td>
<td>252</td>
<td>-1.1</td>
</tr>
<tr>
<td>102</td>
<td>10</td>
<td>246</td>
<td>+1.6</td>
</tr>
<tr>
<td>103</td>
<td>10</td>
<td>252</td>
<td>0.0</td>
</tr>
<tr>
<td>104</td>
<td>10</td>
<td>257</td>
<td>-0.1</td>
</tr>
<tr>
<td>105</td>
<td>10</td>
<td>258</td>
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<td>106</td>
<td>10</td>
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<td>260</td>
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</tr>
<tr>
<td>206</td>
<td>10</td>
<td>254</td>
<td>-2.0</td>
</tr>
</tbody>
</table>

Stall No. = Station (first char.), Side (next char.) and Stall (last 2 char.)

EMMR - Milking Report - Electronic Milk Meter Monitoring Report - Date 02-21-2011

Electronic Milk Meter Monitoring Report (EMMR) Detail
Percent Difference From Expected By Milking

| Stall No. | 02-21 02-21 02-20 02-20 02-20 02-19 02-19 02-19 02-19 |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|
| Stall No. | 1      | 2      | 3      | 1      | 2      | 3      | 1      | 2      | 3      |
| 101       | +1.1   | +2.4   | -3.5   | -2.4   | +1.0   | +7.7   | +0.4   | -1.2   | +1.1   |
| 102       | -9.2   | -0.7   | -2.7   | +1.6   | +5.8   | +1.8   | +3.3   | +2.1   | -0.5   | -4.5   |
| 103       | -1.4   | +1.2   | +1.1   | +1.0   | -1.4   | +2.1   | +0.1   | -0.6   | -1.2   |
| 104       | -2.4   | -3.1   | -0.2   | +2.0   | +4.1   | -0.3   | +1.1   | -2.6   | +0.3   | -4.2   |
| 105       | -2.2   | -1.6   | +1.4   | +4.8   | -2.5   | +0.4   | +1.6   | -0.3   | +4.2   |
| 106       | +2.3   | -5.8   | -2.3   | -3.5   | -3.7   | +1.4   | -0.9   | +0.2   | +1.4   | +2.8   |
| 201       | -4.6   | -2.5   | +2.6   | +1.3   | -0.3   | -0.6   | +3.4   | +2.6   | +1.1   | +1.1   |
| 202       | +1.9   | +3.2   | +5.7   | +2.8   | +2.4   | +4.9   | +5.9   | +2.3   | +3.7   | +4.2   |
| 203       | -0.4   | -0.5   | +2.1   | +2.0   | +0.8   | +3.3   | +0.7   | +0.6   | -2.0   | +2.1   |
| 204       | +1.4   | +1.1   | +0.5   | -2.9   | -1.2   | +2.5   | +0.7   | -0.7   | +1.8   | -0.6   |
| 205       | +0.0   | -1.3   | +0.6   | -0.1   | -2.0   | -2.4   | +0.0   | +2.3   | -1.9   |
| 206       | -3.3   | -2.5   | -2.8   | -5.3   | +0.2   | -4.1   | -0.9   | +1.7   | +2.4   | -1.2   |
DHI Cows by Herd Size During 2016

<table>
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<th>Number of Cows per Herd</th>
<th>Number of Cows on DHI</th>
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<tbody>
<tr>
<td>1-99</td>
<td>557,683</td>
</tr>
<tr>
<td>100-299</td>
<td>803,683</td>
</tr>
<tr>
<td>300-749</td>
<td>773,705</td>
</tr>
<tr>
<td>750-1999</td>
<td>1,046,183</td>
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<tr>
<td>2000+</td>
<td>1,201,811</td>
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Potential Sources of Error in Data Recording

- Calibrating the milk meter alone may not be sufficient
- Errors also exist when using portable meters for herd recording
- Need to review entire system and minimize errors

<table>
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<tr>
<th>Accuracy</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
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<tr>
<td>Milk Meter</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
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<tr>
<td>Controller</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>Animal ID</td>
<td>100%</td>
<td>97%</td>
<td>95%</td>
</tr>
<tr>
<td>Milker (Human)</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>Data Transfer</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Maximum Data Accuracy from On-Farm System</strong></td>
<td><strong>96%</strong></td>
<td><strong>93%</strong></td>
<td><strong>90%</strong></td>
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</table>
Variables Required for Meter Performance Report

- Date
- Herd name or Herd code
- Animal ID
- Stall or meter ID
- Measured milk weight
- Number of milkings represented at each stall/meter
- Deviation for each stall/meter

**Optional**
- Defined tolerance for reference
- ID errors (missing cows, duplicate reads, wrong pens)
- Reattachment and manual detach incidents
- Milking time deviations
- Milking speed
- Cross reference with milk shipped weights integrated into the report or software program
Calculation of the Daily Milk Meter’s Performance

**Expected Milk Weight (MW) this milking**

\[
\text{Yield average on the last } X \text{ milkings at } M_n \times \text{“herd factor”}
\]

\[
\left( \frac{\sum_{i=1}^{X} Y_{ni}}{X} \right) \times \frac{h_{(current\ milking)}}{\left( \frac{\sum_{i=1}^{X} h_{ni}}{X} \right)}
\]

**Deviation from Expected**

\[
\text{Cow Deviation (kg)} = \text{Measured yield (kg)} - \text{Expected yield (kg)}
\]

**Meter Deviation (%)**

\[
\frac{\text{sum of cow deviations (kg) for this milk meter}}{\text{sum of expected yields (kg) of these cows for this milk meter}} \times 100
\]
Removal of Outliers from Calculation

**Expected Milk Yield (2x), Adjusted for Herd Effect**

<table>
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<tr>
<th></th>
<th>&lt;65%</th>
<th>&lt;70%</th>
<th>&lt;75%</th>
<th>&lt;80%</th>
<th>&gt;120%</th>
<th>&gt;125%</th>
<th>&gt;130%</th>
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<td>21</td>
<td>33</td>
<td>69</td>
<td>109</td>
<td>33</td>
<td>15</td>
<td>12</td>
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<tr>
<td>Observed, %</td>
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<td>0.12</td>
<td>0.18</td>
<td>0.37</td>
<td>0.42</td>
<td>0.18</td>
<td>0.08</td>
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<td>&lt;14 DIM</td>
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<td>46</td>
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<td>10</td>
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<td>14-21 DIM</td>
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<td>7</td>
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<td>4</td>
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<td>0</td>
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<tr>
<td>&gt;35 DIM</td>
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<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>

- Exclusion of cows <30 DIM from meter performance report is justified as prediction of expected milk yield is unreliable
- May consider removal of expected milk yields deviating ±30%
Accurate ID is Important
Cow ID and Stall ID are essential to the Meter Performance Report

• Electronic ID systems
  – Manufacturer ID – transponders
  – Third Party EID tags and readers
    – *Primary Source of Error – TECHNOLOGY*

• Manual ID entry
  – Cow ID is keyed on the controller in the milking stall
  – Usually leg bands or visual cow number
    – *Primary Source of Error - HUMAN*
Verification of ID System is Needed...

23 out 24 Animals Read Correctly

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<th>Stall #</th>
<th>Elect. ID</th>
<th>Visual ID</th>
<th>Correct</th>
<th>Stall #</th>
<th>Elect. ID</th>
<th>Visual ID</th>
<th>Correct</th>
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<td>2670</td>
<td>2670</td>
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<td>3</td>
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<td>1693</td>
<td>✔️</td>
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<td>13</td>
<td>2679</td>
<td>2679</td>
<td>✔️</td>
</tr>
</tbody>
</table>
Deviating Meters on the Report

- It does not necessarily mean the meter is out of calibration…
  - But if one meter is out of tolerance on the report, the whole report is not usable

- Time to be a detective and isolate/correct errors…
  - Primary contacts
    - Dairy Manager
    - Representative(s) from Herd Recording Organization
  - Secondary contacts
    - Milker(s)
    - Representative from Equipment Manufacturer
Meter Performance Reports cannot be used with:

- Herds with incomplete identification or EID system challenges
- Herds with one or more failing/non-communicating controllers
- Herds with one or more missing or out-of-service meters
Sources of Variation – ID System

Possible cause(s)

- Inaccurate ID reads from automated system
- Incomplete herd ID
- Duplicate animal ID
- Data entry errors by milking personnel
Sources of Variation – Equipment

- Reattachment of milkers – Is the total milk weight computed?
- Treated cows – do they bypass the meter?
- Incomplete letdown by cows
- Meter out of calibration

<table>
<thead>
<tr>
<th>Stall No.</th>
<th>06-25</th>
<th>06-26</th>
<th>06-25</th>
<th>06-24</th>
<th>06-24</th>
<th>06-23</th>
<th>06-23</th>
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</thead>
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Detail information for each milking for each cow is stored in file MeterDl.csv. File is located in: C:\PCDADT 2315046L. Open file with spreadsheet program.
Sources of Variation - Equipment

- Meters installed properly?
- Meter out of calibration?
- Modifications to milking system?

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Details information for each milking for each cow stored in file METERDTL.CSV. File is located in PCDART 32200303. Open file with spreadsheet program.
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Sources of Variation – Software/Interface

- Upload/interface errors
  - ID data not transferred properly
  - Milk weights not transferred
  - Stall identification errors

- Software upgrades or modifications

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#### Electronic Milk Entry Ensuring Report (EMEER) Details

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Dairies

• Many problems are caught and fixed by the dairy, we think
We perform this service whether the herd contributes their data or not.