Practical aspects of automated calf feeding and health related issues with automated feeding.

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Why consider group housing and feeding?

- Labor
  - Efficiency – Repurposing labor
  - Work environment?
- Opportunity to feed more milk or milk replacer solids.
- Animal welfare - group interactions

Group housing feeding alternatives

Mob feeders
- Simple
- Low cost
- Control intake, knowledge of intake?
- Sanitation?

Acidified free choice
- Simple
- Palatability for young calf?
- High level of intake $$$
- Weaning
- Successful weaning

Automatic calf feeders
- Foerster Technik, Urban, Holm-Laue, Biotic,……..
- Controlled feeding plans
- Feeding behavior information – consumed, drinking speed, breaks……
- Opportunity for consistency of temperature and solids level
- Technical support?
- Operator skills – observation, equipment?
- Cost?

Achieving success with calves in autofeeder systems
- Colostrum management
- Facility design
- Machine
  - Feeding plans
  - Diet ingredients
  - Sanitation
- People
- Service

Colostrum Management
- Poor calf performance?
  - Autofeeder, group housing, milk replacer is blamed
  - Measure serum proteins on calves <5 days of age. 85% > 5.5 g/dl.
Most colostrum problems are facility and/or people problems!

- Facilities – Location of close up cows, calving environment, newborn housing
  - Interval between calving and fresh cow milking?
  - Colostrum harvest – clean milking equipment, containers

People

Who is responsible for:
- Milking fresh cows?
- Handling colostrum?
- Feeding newborn calves?

Monitors????

Autofeeder Facility Design

- 38 Midwestern dairies with autofeeders
- 61% retrofitted older facilities
- 53% naturally ventilated
- 84% supplemented with positive pressure tubes.

Jorgensen et al., 2015
Key facility components

- Space
- Ventilation
- Drainage

Facility

- Central “kitchen(s)”
- Air conditioned
  - Reduce humidity for milk replacer
- Heated for Alberta!
- Large sink
- Hot water supply
- Refrigerator
- Internet connection
- Drainage

Feeding station

- Nipple
- Height relative to mixer
- Drainage

Facility design

- Bedding
  - Amount of bedding
  - Frequency of bedding
  - Drainage
  - Dust
- Feeding area —
  - Platform
  - Flat floor — heated?

Preconditioning calves

- 0 – 14 days ~ 5 – 6 days
  - Strong appetite.
- Location of preconditioned calves
  - Inside or outside?
- Feed with nipple bottles or calf rail!
- Same diet as the autofeeder

Training calves

- Move in evening after hand feeding.
- Train to feeder in A.M.
- Careful and slow
- New technology for starting calves.
Calves per feeder

Min. / calf / 24 h

More calves per feeder = more competition and disturbance
Jensen (2004)

Milk allowance per calf

Min. / calf / 24 h

Lower milk allowance = more time in feeder
More unrewarded visits. (Jensen, 2004)

6.7 vs. 5.5 qt/day

Feeding plan

• How fast to increase feeding?
• Concentration - grams of solids added to 1,000 ml!
  • 150g/1150 = 13.04%
• Minimum and Maximums
  • 6 liters in 20 hours = .3 L/hour = 5 hours to "earn" minimum meal of 1.5L
  • Most important – minimum = 1 to 1.5 L
  • Max = 2.5 – 3.0 L

Midwestern states survey

(Jorgensen et al. 2015)

– Time from introduction to peak – 18 days?
  • Maximum was 44 days – WHY??
– Milk allocation at entry 5.4 L
  • 3 was minimum
– Peak allocation 8.4L
  • 15 L was maximum
    – Range from 3 – 15 L
  • 18 days (0-44 days)

How fast to peak and how much?

Comparison of restricted to 40 FIT program

40FIT – up to 2.5 L every 2 hours to 35 days and then reduce to wean at 50days
Restricted – 6 L to abrupt wean at 50 days – 3 meals / day

Effects of two feeding systems on the development of dairy calves – 40FIT vs. Restricted Feeding –

German dairy farm - 940 cows
1st 13 days bucket feeding – 4 calves / pen
13 days – autofeeder in group pen – 16 calves / pen
Comparison of restricted to 40 FIT program

**Average daily gain per day**

- **Restricted**
- **40FIT**

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Restricted</th>
<th>40FIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15 days</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>16-27 days</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>28-49 days</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>50-84 days</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>85+ days</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

**Unrewarded visits**
- Restricted: ~13 visits
- 40FIT: ~1.5 visits

**Comparison of restricted to 40 FIT program**

**Concentrate intake** *(N. Jurkewitz, 2012)*

- Jorgensen study
  - 68% fed milk replacer
  - 24% waste milk plus balancer
  - 8% waste milk
- VA / MN study
  - 6 Virginia herds - 20:20 - 27:10
  - 4 Minnesota herds - 2 waste milk, 2 milk replacer

**Guidelines for milk replacer**

- High quality - ???, easy mix at "low temp".
- Flow through the hopper
- Meet the nutrient requirements for growth at higher intake – 26% protein –
- Fat levels according to season?
- Intake of solids is more important than %

**Challenges of using whole milk**

- Managing whole(waste)milk
  - Pasteurizer?
  - Two tanks – raw milk and pasteurized milk
  - Conveyance from storage tank to autofeeder
  - Account for:
    - Varying supply of waste milk
    - Varying solids level of waste milk
    - Foerster Technik will blend waste milk with milk replacer to create desired solids level
Feeding waste milk in an autofeeder

Managing variation in waste milk supply

Sanitation Management

- Cleaning cycles
  - Circuit cleaning
  - Mixer/heat exchanger cleaning
- Cleaning agents – chlorinated alkaline
  - Follow directions
  - Freshness of cleaners
  - Temperature
- Material replacement

Bacteria Goals

- Not well-established or tested

<table>
<thead>
<tr>
<th></th>
<th>SPC&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Coliform&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Environmental Strep&lt;sup&gt;2&lt;/sup&gt;</th>
<th>CNS&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Noncoliform&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal (cfu/ml)</td>
<td>&lt; 20,000</td>
<td>&lt; 100</td>
<td>&lt; 5,000</td>
<td>&lt; 5,000</td>
<td>&lt; 5,000</td>
</tr>
</tbody>
</table>

SPC<sup>1</sup> and Noncoliform<sup>2</sup> recommendations not specified. Pasteurized Milk Ordinance, 2011; McGuirk, 2003

Autofeeder Cleaning

- Circuit cleaning
  - Manually initiated
  - Pre-clean, placement of feeding hoses into mixer, circuit clean with detergent, return hoses for rinse
- Mixer or heat exchanger cleanings
  - Automatically or manually initiated
  - May or may not use detergent
  - Pre-clean, clean with detergent, rinse
Cleaning Frequency

- Mixer/HE Clean Frequency
  - 2x/d: 40%
  - 3x/d: 30%
  - 4x/d: 20%

- Circuit Clean Frequency
  - Every day: 40%
  - Daily: 30%
  - <3x/wk: 20%

LSM bacteria counts by state from biweekly farm visits

- Aerobic plate count
  - Minnesota: 6,310
  - Virginia: 38

- Coliform count
  - Minnesota: 1,023
  - Virginia: 1

Sanitation

- For each additional circuit clean/wk, total plate and coliform count increased.
- For each additional mixer cleaning/d, plate count and coliform count decreased.
- For each h since last mixer clean the plate count and coliform count increased.

What does this mean?

- Circuit cleaning not as effective as mixer cleaning.
- Do circuit clean once a day when working calves – remove nipple, hand clean, rotate.
- Schedule at least 3 mixer cleanings / day before heavy calf feeding times.

How accurately do they mix milk replacer?

- Temperature? - need to check and calibrate
- Solids – depends on MR delivery mechanism.
- FT autocalibrates - Warning periodically – standardization weight provided.

Total Solids of MR

- Mean derived from optical refractometer
- Target

*P < 0.01
Refractometer Reading vs. Total Solids

\[ y = 0.0133x - 0.0162 \]
\[ R^2 = 0.9918 \]

Correlation between optical and digital - >.9

General Management

- Study Population: 1052 Pre-weaned Dairy Calves

<table>
<thead>
<tr>
<th>Variable</th>
<th>Count</th>
<th>Mean± SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at Pen Entry</td>
<td>n=1052</td>
<td>9.1 ± 5</td>
<td>1 – 36</td>
</tr>
<tr>
<td>Age at Pen Exit</td>
<td>n=736</td>
<td>60 ± 17</td>
<td>7 – 130</td>
</tr>
<tr>
<td>Days in Pen</td>
<td>n=1052</td>
<td>52 ± 20</td>
<td>7 – 117</td>
</tr>
<tr>
<td>Group Size</td>
<td>n=1052</td>
<td>17 ± 5</td>
<td>4 – 25</td>
</tr>
</tbody>
</table>

Preliminary Results: Calf Disease

- Treatment and death events were producer recorded

<table>
<thead>
<tr>
<th>Treated (%)</th>
<th>Died (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Feeder</td>
<td>63.0% (663/1052)</td>
</tr>
</tbody>
</table>

*On feeder = 9d to 60d of age

Preliminary Results: Calf Disease

- Average Days On The Feeder at First Treatment
  \[ 9.3 ± 8.5 (1 – 53) \]

- Average Days Treated for First Disease
  \[ 3.8 ± 3.9 (1 – 41) \]

*663 calves with first treatment events

Kalbmanager

Wealth of information

Feed intake
Conclusions on autofeeder management

- Management
  - Variety of protocols in practice – most are too conservative in increasing milk allotments.
  - Peak allotment - >8 L
  - Meal size 1.5 – 3.0 L. Older calves eat fewer larger meals
  - 20 calves per nipple?
  - 3.25 – 4 M²/calf
  - Tube ventilation is mandatory

- Sanitation
  - Circuit cleaning not as effective – new procedures - higher temperature, alkaline wash followed by acid rinse in newer machines.
  - 4x/d mixer/heat exchanger cleanings is easily-implemented method of reducing bacteria, schedule prior to heavy milk feeding time.

- Monitor temperature and solids level. Calibrate when advised and in each new shipment of milk replacer.

- More timely detection of disease!
  - 63% of calves had first treatment - better observation?

- Only 1.1% mortality -
- Predictors of disease?
  - Drinking speed or change in drinking speed
  - Unrewarded visits

- People
  - Repurpose labor from tedious tasks.
  - Observational skills
    - Observe calves first
    - Dehydration, nose, eyes, attitude
  - Data oriented
    - Alarms
    - Drinking speed
    - Allocation
  - Details oriented
    - Sanitation, daily routine.
  - Consultants - Nutritionist – DVM – Autofeeder expert!
Service

- Autofeeders are not high dollar item for most milking equipment dealers
- Dealer volume with autofeeders – parts, service experience
- Tech Service from company

Behavior of calves when managed in groups

- Calves not “conditioned” to feeding time.
  - Influenced by # milk intake and availability of milk.
- Early life social adaptation
  - Calves raised in pairs less post weaning “slump” problems – Chua et al (2001)

Individual vs. group housing – welfare impact?

Challenges observed in the field

- Feeding plans – increase too slowly
- Not using the data to evaluate calves.
- Cleaning protocols
- Calibration
  - Autocalibration monitors

Autofeeders …..

- Water quality – Mineral and bacterial
- Pay for professional facility design

- Opportunity to feed more solids in smaller more frequent meals
- Improved socialization of calves
- Long term impact?
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