Group Housing Systems for Calves: Facilities, Equipment, Protocols and Personnel

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Down Home Heifer Solutions
Calf feeding management since 19??

• Limit feed calves
  • 2 quarts / feeding
  • Twice daily feeding
    • Interval between feeding?

• Why?
  • Convenience for labor?
  • Limit feed to encourage weaning – lower cost / day.

• House calves individually – disease prevention
Why should it change?

• Biology! Optimize cost/unit of gain and not cost/day.
• Labor management?
• Consumer perceptions?
Biology of the calf

Use the same logic for ration formulation and delivery as for the lactating herd??
Do we adjust feeding programs for:

- Requirements for maintenance
  - Environmental temperature
  - Environment – moisture, wind, hair coat?

- Requirements for growth?
  - How much should a calf gain?
    - Week 1, 2, ...........
  - What is growth?  Body composition?
Requirements for maintenance
How much should calves gain?

• Double birth weight at 56 days
  • Holstein - 90 lb/56 days = 1.6 lb.
  • Jersey – 65 lb. / 56 days = 1.16 lb.

• BUT – What gains – week 1, 2, 3.?
• Body composition of gain - fill, fat, lean tissue?
Take home message

We need to feed calves more milk solids (1.5 – 2.5 lb. of milk or milk replacer solids) for better growth during the first 4 weeks of life!
Challenges of feeding more milk or milk replacer per day

• Feeding times? AM and PM
• Limited “stomach” capacity!
  • Consume one feeding and not other
• Poor response to some CMR with 2X feeding
• Why not feed 3X / day?
Labor management

• Labor - comfort and efficiency of labor
• Special skills of calf labor?
  • They should be more than bucket and bottle washers!
  • Disease detection and prevention
• OSHA???
  • Repetitive motions on calf operations
• Source of labor?
  • Immigrant labor – How long have our politicians “dodged” this issue?
Animal welfare

• Who defines “welfare”?
• Consumer perceptions
• Research
Welfare

• Calf comfort
• Minimize environmental impact on maintenance expense
• Social development of calves?
• Achieving desired nutritional management
Prerequisites for group housing calf feeding systems!

• Effective colostrum management - monitor serum proteins
• Excellent calving environment
• Accommodations to manage calves individually - < 14? days of age
• Accommodations for “sick” calf management
A facility designed by an engineer for effective ventilation and drainage

• Retrofit “older” facilities?
• Construction expenses
• Operating expenses – electric
• Disposal of liquid and solid waste
• Capture labor efficiencies.
Group housing systems
Why group housing systems?

• **Opportunity** for higher daily liquid feeding rates with smaller meal sizes.

• Labor efficiency

• Working conditions for calf feeders.

• Social development of calves – welfare.

• Each system has advantages and limitations!
Prerequisites

- Group housing facility
  - Excellent ventilation
  - Sufficient sq. ft. / calf – 35+
  - Well drained and bedded
  - Sanitation

- People
  - Sensitive to calf health symptoms
  - Aggressive and early response to disease
“Mob” feeders

- Labor efficiency + / - , Large herds?
- Knowledge of intake?
- Sanitation ?
- Cross sucking at lower feeding rates
Free choice acidified milk


Dangerous compound at 85% level – care in handling

**Formic acid is illegal in the U.S.**

Higher intake – 8 – 12 quarts / calf / day
Acidified Free Choice

• Premixed acidified milk replacer
  • blend of organic acids
• Uniform nutrient and acid content
• Commitment to sanitation and consistency
• High rate of intake
  • 8 to 12 quarts per day is not unusual
• Weaning
Automatic calf feeders
Foerster Technik (Delaval, GEA, Lely) Urban, Holm-Laue, Biotic...

Positive attributes
• Controlled feeding plans
• Feeding behavior information – consumed, drinking speed, breaks......
• Consistency of temperature and solids level

Concerns
• Technical support?
• Operator skills – observation, equipment?
• Cost?
Achieving success with calves in autofeeder systems

• Facility design
• Machine
  • Feeding plans
  • Diet ingredients
  • Sanitation
• People
• Service
• Others – Management!!!!!!
Facility design
Facility

• Central “kitchen(s)”
  • Air conditioned
    • Reduce humidity for milk replacer
  • Large sink
  • Hot water supply
  • Refrigerator
  • Internet connection
  • Drainage
  • Elevations – same as feeding station
What height for nipple?
Facility design

• Bedding
  • Availability of and amount of bedding
  • Frequency of bedding
  • Dust
  • Drainage

• Feeding area –
  • Platform
  • Flat floor – heated?

• 35 – 45 sq ft/calf
Bedding!!!!!!!
Ventilation

- 4 turns / hour
- 750 ft³/calf
Preconditioning calves

• 0 – 14 days ~ 5 – 6 days
  • Strong appetite.
• Location of preconditioned calves
  • Inside or outside?
• Feed with nipple bottles!
• Same diet as on feeder
• Training calves
  • Move in evening after feeding
  • First day training in the morning and a second time? in the afternoon or evening
  • Second day only in the morning, if there was no feed intake
  • Careful and slow
  • Don’t overtrain
  • Good experience for them.
# Feeding plan

- How fast to increase feeding?
- Concentration - grams of solids added to 1,000 ml!
  - 150g/1150 = 13.04%

## Table: Feed Concentration and Min/Max Meal

<table>
<thead>
<tr>
<th>Period</th>
<th>Days Start</th>
<th>Days Final</th>
<th>Days Start</th>
<th>Days Final</th>
<th>Days Min</th>
<th>Days Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>56</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
<td>8</td>
<td>8</td>
<td>36</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>8</td>
<td>2</td>
<td>10</td>
<td>1.5</td>
<td>2.0</td>
</tr>
</tbody>
</table>

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**Keep it simple**
• Minimum meal size >1 L
  • 8L daily allocation and 20 h day? = .4 L
    “earned”/h – must wait ~ 2.5 h to be able to receive milk

• Maximum meal size – 2.5 – 3.5 L
  • If wait longer then can consume more/meal
  • Calves tend to consume more milk/meal and fewer meals with >age.

• How soon to reach maximum intake?
  • Let the calf determine this.
    • Limit maximum meal size every 2 hours - ~2.5L
<table>
<thead>
<tr>
<th>Days</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 5 Days</td>
<td>8.0 to 9.0 liters</td>
</tr>
<tr>
<td>Next 5 Days</td>
<td>9.0 to 10.0 liters</td>
</tr>
<tr>
<td>Next 32 Days</td>
<td>10.0 to 10.0 liters</td>
</tr>
<tr>
<td>Next 14 Days</td>
<td>10.0 to 2.0 liters</td>
</tr>
<tr>
<td>Weaned at 56 Days</td>
<td></td>
</tr>
</tbody>
</table>

**Feeding limits:**
- 5 day’s 1.0 min 2.0 max
- 15 day’s 1.5 min 2.5 max
- 36 day’s 1.5 min 3.0 max
**Holstein Ad lib Feeding plan**

<table>
<thead>
<tr>
<th>Days</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 28 Days</td>
<td>8.0 to 8.0 liters F</td>
</tr>
<tr>
<td>P2 04 Days</td>
<td>12.0 to 9.0 liters R</td>
</tr>
<tr>
<td>P3 10 Days</td>
<td>9.0 to 9.0 liters R</td>
</tr>
<tr>
<td>P4 14 Days</td>
<td>9.0 to 2.0 liters R</td>
</tr>
<tr>
<td>Weaned 56 days</td>
<td></td>
</tr>
</tbody>
</table>

F is for ad lib feeding - establish 2.0 – 2.5L/2h
8.0 L is alarm setting.
28 days transition to max of 8.0 L/days
   Begin weaning 42 days
   Wean at 56 days
• When to place calves on autofeeder?
  • <14 days?
  • As soon as possible?

• Number of calves / nipple?
  • Calves drink 0.6L/min – If 8L intake = 13 min/day to consume allocation.
  • Recommendation is ~ 20 – 25. Best managers feed up to 30/feeder?
Quattro system - SynchroFeed

• Liquid Feed can be dispensed to up to four stations simultaneously allowing one machine to feed up to 120 calves.
• Also used to pump milk longer distances from feeder.
Effects of two feeding systems on the development of dairy calves
- 40FIT vs. Restricted Feeding –

Masterthesis Nina Jurkewitz

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

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

Average daily gain per day

What is gain vs. fill?
Unrewarded visits

- Restricted: ~ 13 visits
- 40FIT: ~ 1.5 visits
Comparison of restricted to 40 FIT program

Concentrate intake (N. Jurkewitz, 2012)
Guidelines for milk replacer

• High quality - ???, easy mix at “low temp”. <120F
• Flow through the hopper
• Meet the nutrient requirements for growth at higher intake – 25% protein
• Fat levels according to season? Fat composition?
• 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

M. C. Scott, M.S. Thesis
Sanitation Management

• Cleaning cycles
  • Circuit cleaning
  • Mixer/heat exchanger cleaning – 3x/day

• Cleaning agents – chlorinated alkaline (new machines acid rinse)
  • Follow directions
  • Freshness of cleaners
  • Temperature

• Material replacement
Sanitation - Bacteria Goals

• Not well-established or tested

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>SPC$^1$</th>
<th>Coliform$^1$</th>
<th>Environmental Strep$^2$</th>
<th>CNS$^2$</th>
<th>Noncoliform$^2$</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>

$^1$Pasteurized Milk Ordinance, 2011; $^2$McGuirk, 2003
General Sanitation Practices – scrub brush/ foamers......
How accurately do they mix milk replacer?

- Temperature? - need to check and calibrate
- Solids – depends on MR delivery mechanism.
- FT autocalibrates - Warning periodically – 500 g weight provided.
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></th>
<th>Treated (%)</th>
<th>Died (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Feeder</td>
<td>63.0% (663/1052)</td>
<td>1.1% (12/1052)</td>
</tr>
</tbody>
</table>

*On feeder = 9d to 60d of age*
Feed intake
## Results: Feeding Behavior and Morbidity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Disease Status</th>
<th>Calf Days</th>
<th>Mean ± SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking Speed</td>
<td>Healthy</td>
<td>40377</td>
<td>$896 ± 337_a$</td>
<td>0 – 2307</td>
</tr>
<tr>
<td>(ml/min)</td>
<td>Sick</td>
<td>3230</td>
<td>$644 ± 345_b$</td>
<td>0 – 2234</td>
</tr>
<tr>
<td>Consumption</td>
<td>Healthy</td>
<td>40377</td>
<td>6.6 ± 2.2_a</td>
<td>0 – 16</td>
</tr>
<tr>
<td>(L/day)</td>
<td>Sick</td>
<td>3230</td>
<td>6.2 ± 2.5_b</td>
<td>0 – 16</td>
</tr>
<tr>
<td>Rewarded Visits</td>
<td>Healthy</td>
<td>40377</td>
<td>4.3 ± 3.0_a</td>
<td>0 – 68</td>
</tr>
<tr>
<td>(Count)</td>
<td>Sick</td>
<td>3230</td>
<td>4.8 ± 3.1_b</td>
<td>0 – 76</td>
</tr>
<tr>
<td>Unrewarded Visits</td>
<td>Healthy</td>
<td>40377</td>
<td>7.4 ± 7.7_a</td>
<td>0 – 93</td>
</tr>
<tr>
<td>(Count)</td>
<td>Sick</td>
<td>3230</td>
<td>4.2 ± 6.1_b</td>
<td>0 – 56</td>
</tr>
</tbody>
</table>

* Different letter subscripts denote variables that are significantly different from one another. Significance determined at $p<0.05$. 
Results: Drinking Speed by Disease

Respiratory Disease (n=53 pairs)

Diarrheal Disease (n=97 pairs)

\* = p < 0.05

Knauer et al., 2016
The daily routine

• A.M. - Machine operating normally – winter time?
• Walk the pens and look at calves
• Return to machine and review data.
  • Drinking speed declines –
    • “normal is .5L to 1L/min
• Allocation
• Breaks
• Conduct circuit cleaning and clean nipples.
People

• Observational skills
  • Observe calves first
  • Dehydration, nose, eyes, attitude

• Data oriented
  • Alarms
    • Drinking speed
    • Allocation

• Details oriented
  • Sanitation, daily routine.

• Repurposing labor!
Service

• Autofeeders are not high dollar item for most milking equipment dealers
• Dealer volume with autofeeders – parts, service experience
• Tech Service from company
• Extremely important!!!!!!
What is the future?

• Labor for feeding calves?
• Capturing genetic potential?
• Animal welfare – social development of calves
Smart Calf System

Activity Box

Smart Neckband

Smart Water Station
Early Disease Identification

- Milk consumption
- Moving activity
- Drinking speed
- Drinking activity

Changes
Strategic calf management

• Key calf management focus
  • Colostrum
    • Facilities and People
  • Feeding to biological potential for growth
    • Commitment for feeding higher quantity solids – Waste milk or milk replacer
    • Commitment for higher quality solids – Waste milk or milk replacer
    • Managing environment – moisture, ventilation
    • Positioning the right people and protocols.
  • Adopting new technologies for better calf and labor management.
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