



Management of Calf Autofeeders: What Have We Learned?

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Objectives

- Autofeeder functions
- VT and U of MN research study
- Management observations:
 - How are producers managing autofeeders?
 - What's working/not working?



INTRODUCTION TO AUTOFEEDERS



Available Autofeeders

- Biotic: ID-TEK
 - Simplest machine
 - Low cost
 - Few feeding plan options



<http://www.biotic.com/proddetail.php?prod=idtek>



Available Autofeeders

- Sophisticated autofeeders
 - Manufacturers
 - Urban
 - Förster Technik (Lely, DeLaval, GEA)
 - Recognize calves by RFID tag or collar
 - Fed according to feeding plan controls
 - Ability to control many features



Sophisticated Autofeeders

- Urban Calf Mom



<http://www.urbanonline.de/calfmom-paula-details.html>



Sophisticated Autofeeders

- Urban Calf Mom

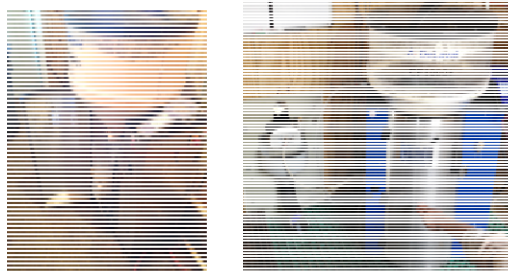


<http://www.urbanonline.de/calfmom-paula-details.html>

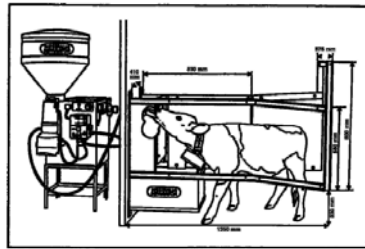


Sophisticated Autofeeders

- Förster Technik



FT Autofeeder



Adapted from Kung et al., 1997

<http://www.foerster-technik.de/website/en/home.php>

Feeding Plan Example

Period	Feed			Concentration			Min. quantity		
	Days	Start qu	Final qu	Days	Start qu	Final qu	Days	Min.	Max.
Group A									
1	3	6.0 L	6.0 L	48	150 g	150 g	3	1.5 L	2.0 L
2	10	6.0 L	8.0 L	0	0 g	0 g	10	1.5 L	2.0 L
3	25	8.0 L	10.0 L	0	0 g	0 g	25	1.5 L	2.5 L
4	10	10.0 L	2.5 L	0	0 g	0 g	10	1.5 L	2.0 L
5	0	0.0 L	0.0 L	0	0 g	0 g	0	0.0 L	0.0 L
Total	48		373 L	48		56 kg	48		

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Quantity per day:
Total allotment

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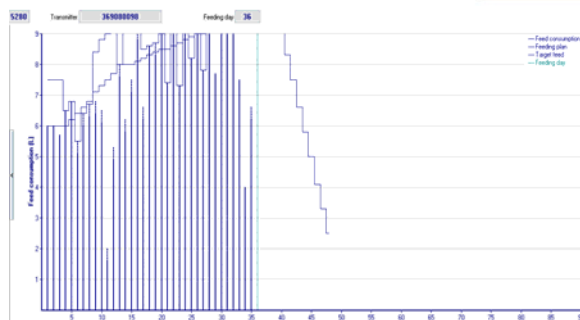
MR Concentration

Feeding Plan Example

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Total	48		373 L	48		56 kg	48		

Meal size

Feeding Plan Example



Data and Software

- Handheld device
- Connect machine to PC
- Keep track of:
 - Alarms
 - Consumption (today and over time)
 - Drinking speed
 - Visits
 - Break offs
- Input other calf records manually

Animal Overview

Calf Alarms



Feed alarm	Today	Yesterday
Feed consumption	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Drinking speed	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Break without additive	<input type="checkbox"/>	<input type="checkbox"/>
Break with additive	<input type="checkbox"/>	<input type="checkbox"/>
Robbery	<input type="checkbox"/>	<input type="checkbox"/>
Powder additive too high	<input type="checkbox"/>	<input type="checkbox"/>
Liquid additive too high	<input type="checkbox"/>	<input type="checkbox"/>
Powder additive too low	<input type="checkbox"/>	<input type="checkbox"/>



OBSERVATIONAL RESEARCH STUDY

University Study



- Observational study conducted by:
 - University of Minnesota College of Veterinary Medicine
 - Virginia Tech Department of Dairy Science
- Objectives
 - To investigate the application of feeding behavior to predict morbidity in group housed calves
 - Identify cleaning management factors associated with the level of bacteria in calf autofeeders

Farm Visits



- VA farms visited biweekly spring to fall 2014
- MN farms visited weekly winter to summer 2014
- Farms
 - VA: 6 farms, 7 FT autofeeders
 - MN: 4 farms, 7 FT autofeeders
- Over 1300 calves represented



Data Collection

- Milk/milk replacer samples
 - At each visit from each feeder
 - For 4-week period each day before and after circuit cleaning (VA farms)
- Calf weights/heights
- Blood for serum protein analysis
- Calf feeding data exported from machine
- Calf treatment records
- Various observations of facilities



FINDINGS: Machine Sanitation



Sanitation Management

- Producer has control over:
 - Cleaning agents and amount used
 - Frequency of cleanings
 - Hose type and frequency of replacement
 - Mixer and hose drainage





Autofeeder Cleaning

- Circuit cleaning – manually initiated
 - Pre-clean rinse
 - Placement of feeding hoses into mixer to form “circuit”
 - Wash cycle using detergent
 - Mixer and feeding hoses cleaned together
 - Return hoses for water rinse



Autofeeder Cleaning

- Mixer cleanings - automatically or manually initiated
 - Pre-clean rinse
 - Clean with detergent
 - Water rinse
 - Units that feed waste milk have a similar heat exchanger cleaning



Cleaning Agents

- Förster Technik recommends:
 - Ability to function at 40-50°C
 - No corrosive effect on machine materials (specifically chlorine)



Common Cleaning Agents

- Alkaline detergents – saponify fat so it can be removed with water
 - BouMatic System Shock™
 - Sodium hydroxide
 - DeLaval RTD™
 - Chlorinated alkaline detergent
 - Functions at water temp of 45°C

(Thomas and Sathian, 2014)



Common Cleaning Agents

- Acid detergents
 - Remove mineral deposits
- Chlorine bleach
 - Sanitizing agent
 - Works best at 75° - 100°F
 - Used in combination with other cleaning agents

(The Dairy Research & Information Center)



Use on Study Farms

Cleaning Agent	Number of Farms
BouMatic System Shock	3
DeLaval RTD	6
Acid detergent	3
Chlorine bleach	4



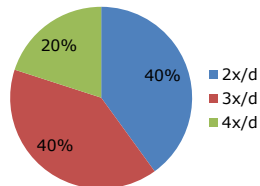
Frequency of Cleanings

- Recommendation:
 - Daily circuit clean + 2x/d mixer/HE clean
- OR
- Every other day circuit clean + 3x/d mixer/HE clean
- 4/10 study farms did not meet either recommendation

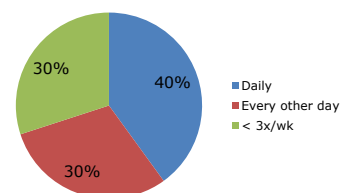


Cleaning Frequency

Mixer/HE Clean Frequency



Circuit Clean Frequency



Feeding Hoses

- Vinyl, silicon, or plastic
- Replacement frequency
 - Recommend changing every 1-2 weeks
 - Varies between farms from every 2 weeks to a few times a year
 - Costs about 30¢/ft from Lowe's



Mixer Hose

- Should be purchased through dealer
- Producers replace much less frequently



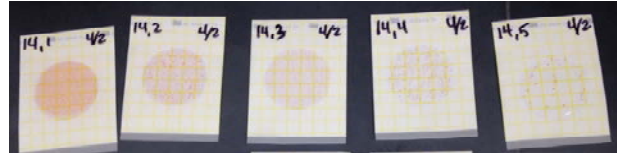


Bacteria Counts

- Plated on 3M Petrifilms
 - Aerobic Plate Count (SPC)
 - Coliform Count



Bacteria Counts

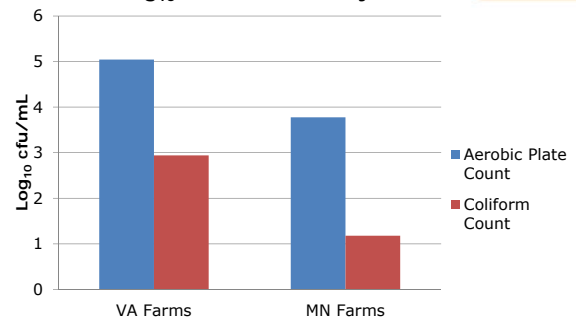


Overall Summary Table

Farm	Geometric Mean cfu/mL	
	Aerobic Plate Count	Coliform Count
VA-1	280,000	1,100
VA-2	50,000	6,500
VA-3	75,000	1,900
VA-4	18,000	<10
VA-5	259,000	1,900
VA-6	239,000	1,600
MN-1	11,000	<10
MN-2	2,000	<10
MN-3	37,000	100
MN-4	3,000	<10
Overall Mean	33,000	90
Range	160 - 13,000,000	0 - 370,000

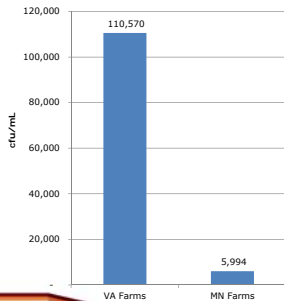


Mean Log₁₀ Bacteria Count by State

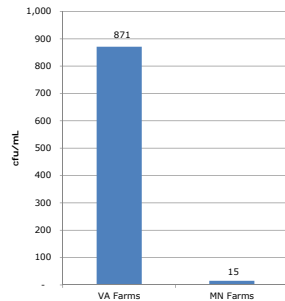




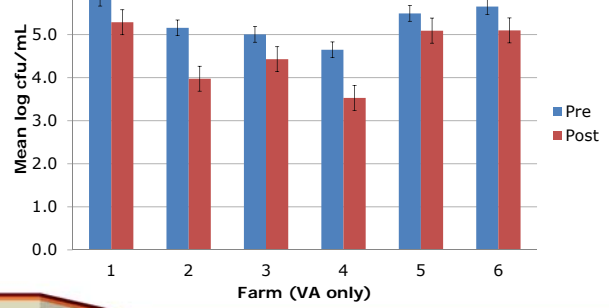
Geometric Mean Aerobic Plate Count



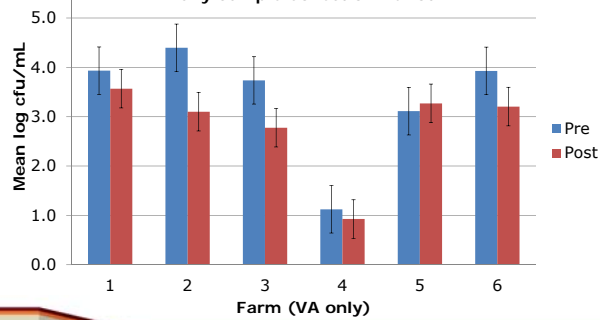
Geometric Mean Coliform Count



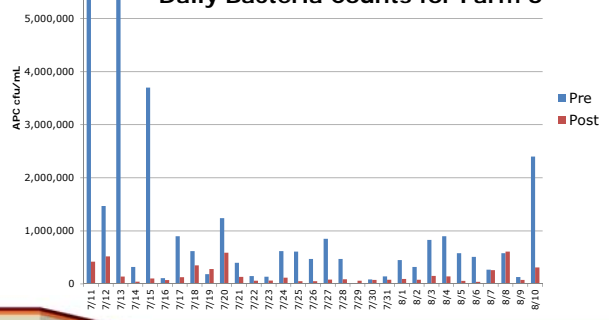
Aerobic Plate Count Pre or Post Wash Daily Sample Collection Period



Coliform Count Pre or Post Wash Daily Sample Collection Period

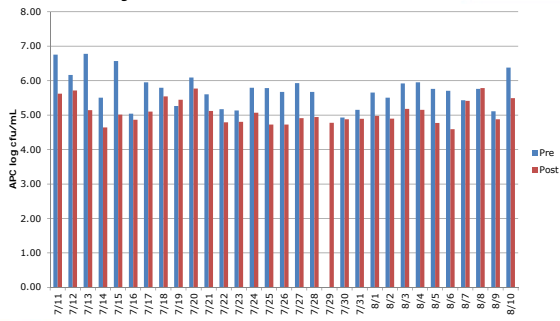


Daily Bacteria Counts for Farm 6

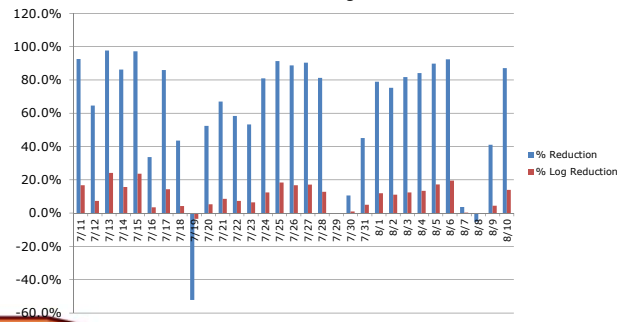




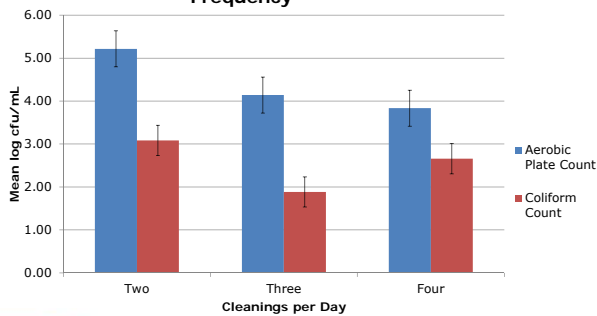
Daily Bacteria Counts from Farm 6



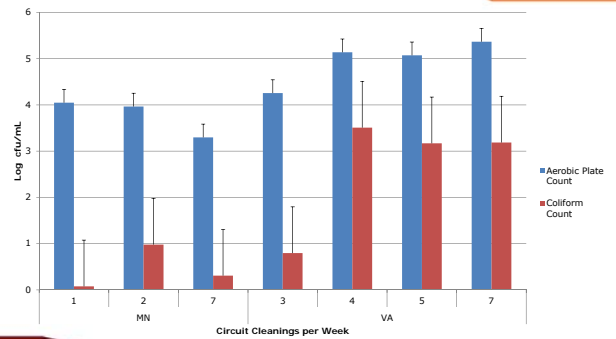
% APC Reduction by Circuit Clean



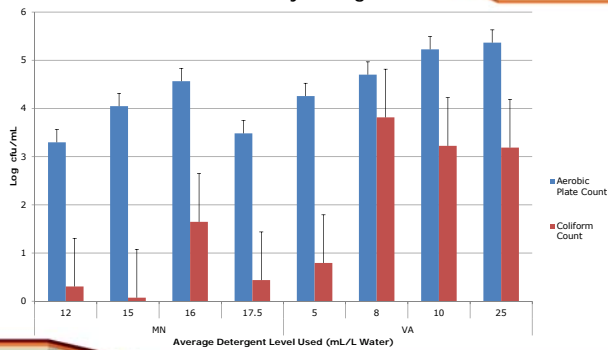
Mean Bacteria Counts by Mixer/HE Cleaning Frequency



Mean Bacteria Counts by Circuit Clean Frequency



Mean Bacteria Counts by Detergent Level



Feed Contamination

- Main concern – disease caused by ingestion of pathogens or toxins
- Means of contamination
 - Water for milk replacer
 - Processing/storage of waste milk
 - Biofilms in mixer, hoses, nipples

“Safe” bacteria levels?

- Grade A pasteurized milk cannot exceed:
 - 20,000 cfu/mL total bacteria
 - 10 cfu/mL coliforms (USPHS, 2009)
- McGuirk (2003) recommended goals:
 - < 10,000 cfu/mL total bacteria
 - 0 cfu/mL fecal coliforms
- These goals are achievable!

Discussion on Sanitation

- Circuit cleaning appears to reduce bacteria levels, but is variable in day-to-day effectiveness
- Increasing frequency of mixer/HE cleanings appears to keep bacteria levels lower



FINDINGS: Group Housing



Ventilation

- Critical for success!
- Tube ventilation highly recommended if properly installed
- At start of study, 2 VA farms had tube ventilation. By end, 3 more were in the process of installing it.



Pen Management

- Dynamic groups
 - 2 pens/machine; calves sorted by age
 - All VA farms on study use this method
- All in/all out
 - Add new calves to a pen until full
 - Calves do not leave pen until weaned
 - Appropriate for larger farms
 - May allow for easier sanitizing of pens between groups



Cross-sucking

- Not usually an issue if calves are allotted enough feed
 - Feed restriction may be related to non-nutritive sucking (Jensen, 2003)
- Less cross-sucking in calves fed via teat compared to calves fed via bucket (Jensen, 2003)



Bedding

- Same rules apply for all calves – bedding must be clean, dry, and abundant!
- Types for group-housed calves
 - Sawdust + straw appropriate for all seasons
 - Sand appropriate during warm weather



FINDINGS: Feeding Plan Management



Feeding Plan Management

- Variety of feeding plans represented in study

Calf Growth Across Study Farms (lb)

Average Daily Gain	1.66
Range	1.25 – 1.99
Standard Deviation	0.27



Effect of Feeding Plan

- Restricted feeding plans not fit for autofeeders
 - Hungry calves spend more time trying to eat, less time resting
 - High incidence of feeder occupancy





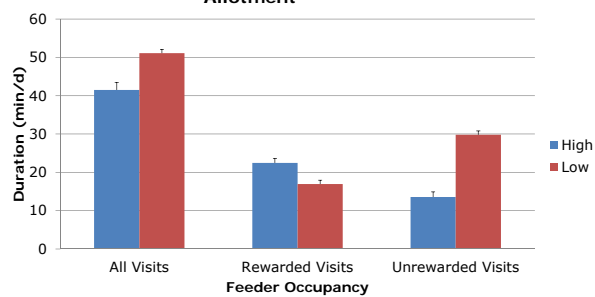
Effect of Feeding Plan

Jensen, 2006

Milk Allotment Treatments		
Breed Type	High	Low
Large Breed	8.0 L/d	4.8 L/d
Jersey	6.4 L/d	3.8 L/d



Duration of Feeder Occupancy According to Milk Allotment



All differences significant ($P < 0.001$)



Effect of Group Size

More calves = more competition

(Jensen, 2004)

- Compared behavior of calves in groups of 12 or 24
- Calves in large group:
 - Made more attempts to enter occupied feeder ($P = 0.02$)
 - More often displaced calves occupying feeder ($P = 0.03$)



Effect of Group Size

- Calves in group of 24 consumed feed faster and in fewer visits than calves in group of 12 (Jensen, 2004)
- Larger max meal size helps reduce feeder occupancy in large groups
 - Calves can consume feed in fewer visits
 - Calves will leave the feeder sooner if they're full (Jensen, 2004)



Effect of Portion Size

- As calves' natural feeding behaviors develop, they consume total allotment in fewer meals (Jensen, 2009)
- Important to have a high enough max meal size (>2.0L), especially for older calves



FINDINGS: Autofeeder Management



Autofeeder Location

- Commonly housed in separate room
 - AC units reduce humidity, flies
 - Heating can prevent frozen hoses
 - Windows let you view calves
 - Computer setup nearby



Drainage

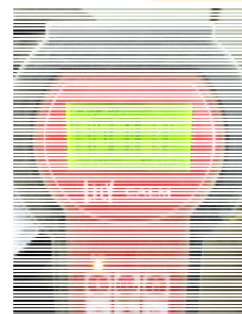
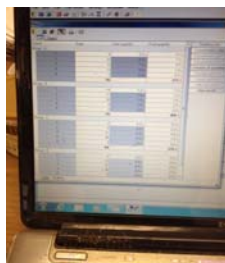
- Front of feeding stall to drain liquid from feeding
- Back of stall to drain manure
- Grate size must be large enough
- Concrete floors allow for much easier cleaning





Adding New Calves

- Most producers add calves at 3-7 d
- May skip morning feeding so calf is hungry for autofeeder
- May have to help her feed for 1-2 d, but most catch on surprisingly quick



CALF MONITORING



Design an Routine

- Autofeeders do not babysit calves!
- Managers must be extra-observant
 - Calves bawling?
 - Calves crowding feeder?
- Most managers check calves and machine at least 3x/d
- Stick with a routine cleaning schedule



Monitoring with Software

- Autofeeder handheld device
 - Control panel
 - Info on consumption, visits, drinking speed, break-offs, alarms determined by machine
- Kalb Manager software for computer
 - Better for looking at performance over time
 - Can export to Excel



Monitoring with Software

- Monitoring preference varies between managers
 - Computer disconnects are discouraging
 - Data-oriented managers prefer Kalb Manager



Monitoring with Software

- Top data utilized by managers:
 - Consumption for current day
 - Alarm calves
 - Current data compared to previous day's
 - Drinking speed



Closing Thoughts

- Machine sanitation
 - Low bacteria counts are achievable
 - Cleaning cycle effectiveness is limited
 - Recommend replacing machine hoses and parts frequently to reduce biofilms
- Calf/feeding management
 - Adequate nutrition, ventilation, bedding necessary for success
 - Research in progress on monitoring calves via software



QUESTIONS?



References

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