I-29 “Moo-University”
Raising Your Best Calf Ever Workshops
Educating & Ag-Vocating for the Future
10th *Annual I-29 Dairy Outreach Consortium Educational Events*
January 5th – Orange City, IA
January 6th – Brookings, SD
January 7th – Fergus Falls, MN
January 8th – Mandan, ND

Program Agenda…

9:45 am – Registration & Visit with Vendors
10:00 am – Opening Remarks

10:10 am - Automatic Calf Feeders – Pro’s and con’s when utilizing: Jim Paulson or Jim Salfer, University of Minnesota
10:50 am - Ventilation-“When tube ventilation works and doesn’t work – Kevin Janni, University of Minnesota
12:00 pm – Lunch and Visit with Vendors

12:30 pm - Milk Replacers: Accelerated growth vs. non-accelerated feeding – Hugh Chester Jones – University of Minnesota
1:15 pm - Heifer Diets and considerations when feeding DDGS – Jill Anderson, South Dakota State University

2:00 pm – Break and Visit with Vendors

2:10 pm - Calf Health- Dealing with respiratory and scours problems, and considerations for raising a healthy calf. Also a 15 minutes brief FYI on the Veterinary Feed Directive update – Russ Daly, DVM, South Dakota State University

2:55 pm – Hands-on Evaluation

3:00 pm – Adjourn, visit with Vendors & Presenters

Thank You For Attending!

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Moo University

Raising Your Best Calf Ever

– a one-day workshop for heifer growers

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Milk replacers: Accelerated vs. Non-Accelerated Growth Feeding – a research perspective from University of Minnesota Southern Research and Outreach Center (SROC), Waseca

H. Chester-Jones[1], D.M. Ziegler[1], D. Schimek[2], B. Ziegler[2] G. Golombeski[2], M. Raeth-Knight[3], D. Cook[4], and N. Broadwater[5]

Raising Your Best Calf Ever

I-29 Dairy Outreach Consortium
January 5 to 8
Workshops -Orange City, IA, Brookings, SD, Fergus Falls, MN, Mandan, SD

[1]SROC, University of Minnesota, Waseca, MN; [2]Hubbard Feeds, Inc., Mankato, MN, [3]Department of Animal Science, University of Minnesota, St. Paul, MN; [4]Milk Products, Chilton, WI; [5]University of Minnesota Dairy Extension Emeritus, Rochester, MN.

Discussion today will include:

- SROC Calf and Heifer Facilities and Management Brief Overview.
- Calf profiles from 2-5 days up to 6 months of age across the 3 commercial dairies
- Nursery review – key highlights
- Post weaning transition and group housing program overview
- Examples of completed feeding strategies
- Discussion of strategies in the field

Do you know calf raising costs and document growth pre- and postweaning?

- Total cost associated with raising dairy replacements is 15 to 25% of the total cost to operate a dairy.
- 2014 U of WI update (Hoards Dairyman, September) for 40 calf raising operations av. cost of $5.31/day from birth to 61 days and custom raisers av. $3.16/day (weaned at 45 days of age).
- Av cost post weaning in WI to pre-fresh was $1,323 or $2.04/day (648.5 days). Dairy operations averaged 24 months for first freshening. Custom raised heifers freshened at 23 months.
- Knowing true costs of raising heifers is critical.

DCHA Gold Standards

	Mortality	Morbidity
24 hr-60 days	<5%	<25% (S)
		<10% (R)
61 – 120 d	<2%	<2% (S)
		<15% (R)
121-180 d	<1%	<1% (S)
		<2% (R)

DCHA Gold Standards

	Growth Rate
24 hr-60 days	At least x2 Birth BW
61 – 120 d	2.2 lbs/day gain
121-180 d	2 lbs/day gain

DCHA Gold Standards

Housing

24 hr-60 days Clean,dry draft free, good air quality, adequate space

61 – 120 d Same as above min 34 sq ft/calf; plenty of feeding space

121-180 d Same as above; 40 sq ft/calf resting area or 1 stall/calf in a free stall;

More information see www.calfandheifer.org (DCHA standards are being updated)

Calf and Facility Management
SROC

SROC Calf Project:

Partners since 2004 - University of Minnesota, Allied Industry and 3 dairy farms –

Minnesota Project dairy farms: Wolf Creek Dairy, Dundas (400+ cows); Bombay Dairy, Kenyon (700+ cows); Clay View Dairy, Gooodhue (recently expanded from 600+ to 1,000+ cows using genomics).

Contract with each dairy reviewed annually.

Raw mean profiles of heifer calves assigned to nursery studies from 3 dairy farms from 2-5 days up to 6 months of age through 2013

Item	Farm A	Farm B	Farm C
No. study heifers	1,156	1,805	1,797
Initial BW, lb	88.3	88.0	86.0
Initial SP, g/dl	5.6	5.5	5.4
Final BW, lb	474	448	452
Final Hip Height, in	45.6	45.1	45
ADG, lb	1.91	1.88	1.89

- ✓Over 9,500 calves have been brought into SROC to date – mortality about 2%
- ✓Performance of calves through 6 months has been relatively consistent across farms

Calf and Heifer
Research and Extension Facility

- Two 30 ft x 200 ft calf barns
- 40 calves/room all-in/all-out
- 160 individual pens (birth to 10 weeks of-age)

Colostrum basics* (Fetrow, 2009)

- **Quality - > 50 g/L IgG;**
- **Quantity – 4 quarts (10% BW);**
- **Quickness - < 6 hrs;**
- **Cleanliness - < 100,000 cfu/ml; feed < 1-2 hr or refrigerate < 48 hr; to help absorption;**

- **Pasteurized colostrum? – batch pasteurizer 140^{o} F for 30 (PSU) to 60 min (U of MN); PSU heat treated colostrum > IgG absorption;**
- **Colostrum replacers – min 100 g IgG/dose ($25-$30/dose) – feed 150-200 g IgG;**

- ***Remember dry cow management & nutrition**

Photo courtesy of Ruth

Stressors causing variance in performance of SROC calves:

- Dehorning – after 30 days in the nursery.
- Vaccinations – pre- and post weaning.
- Tail docking – after 30 days in the nursery (1 herd only)
- Socialization/grouping –
- Feed changes
- Environmental changes Cold vs Heat; flies

Biosecurity !!

Adapted from Hayes, SROC workshop 2006

Calves picked up each Monday and Thursday up to 30/week.

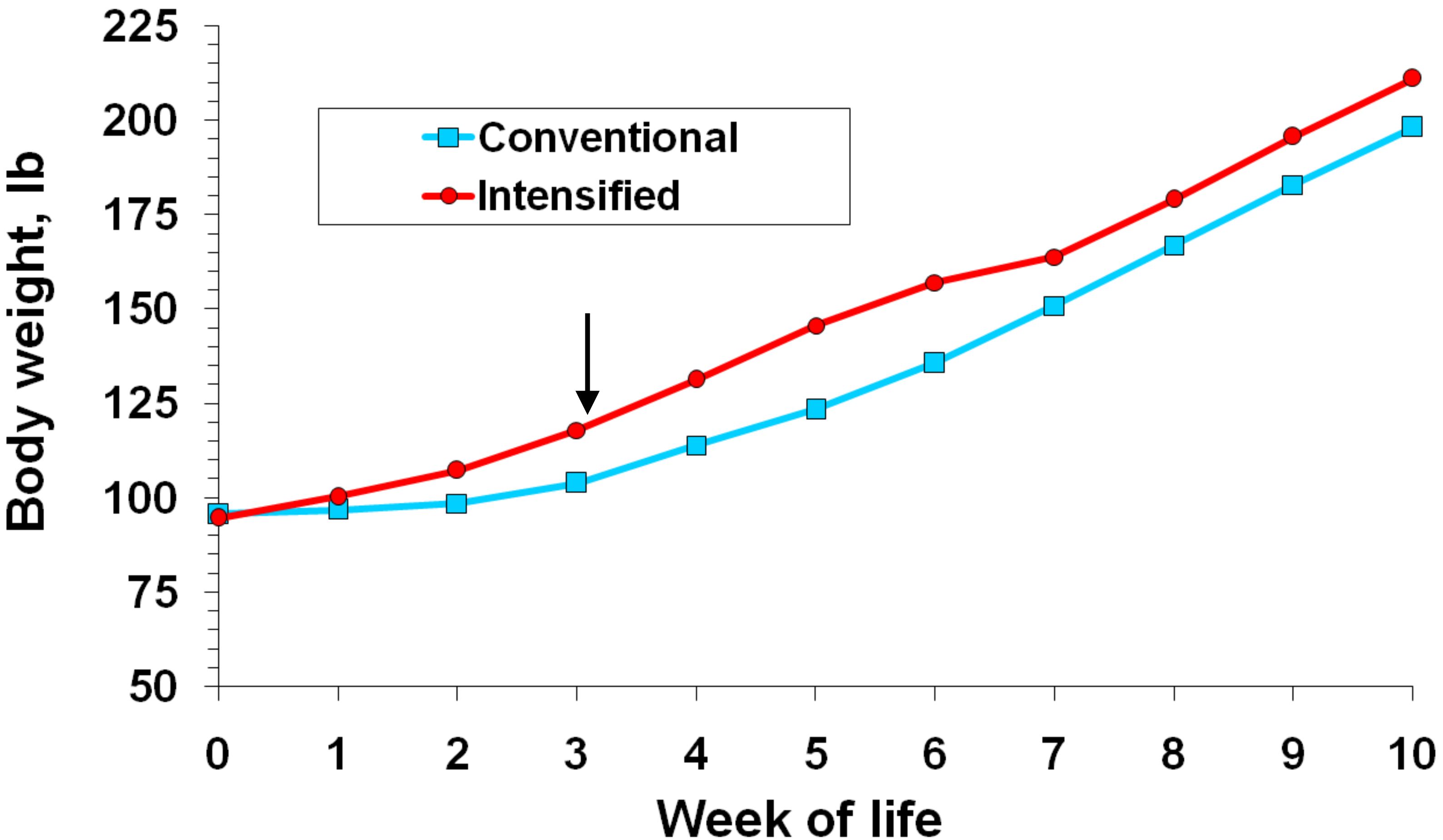

544


HOT DAWG
CALF BEGINNER
CALF
MILK
REPLACER
ALL-MILK PROTEIN

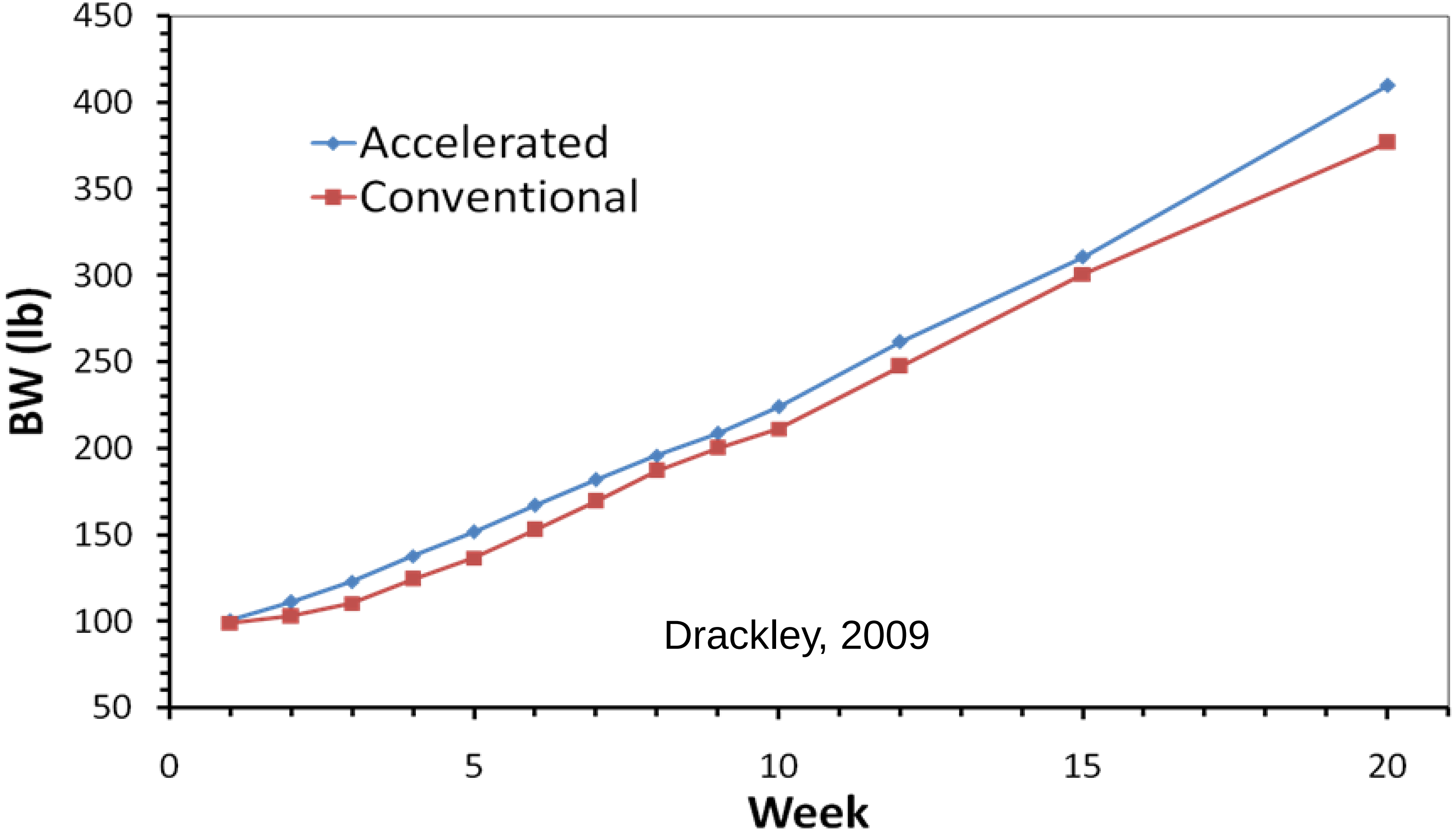

SROC option – grouping calves
prior to moving to grower heifer pens

SROC Urban computer milk and grain feeders placed in a renovated calf room in 2011 – design by U of MN David Ziegler; ventilation help from Kevin Janni

Full potential nutrition results in greater early growth of calves



Drackley, 2009



450
400
350
300
250
200
150
100
50
BW (lb)
Accelerated
Conventional
Drackley, 2009
0
5
10
15
20
Week

What have we found at SROC?


10-9-07
5570

- ✓**Production goals for SROC nursery calves – double birth weight by 2 months of age with 4 inches of frame height.**

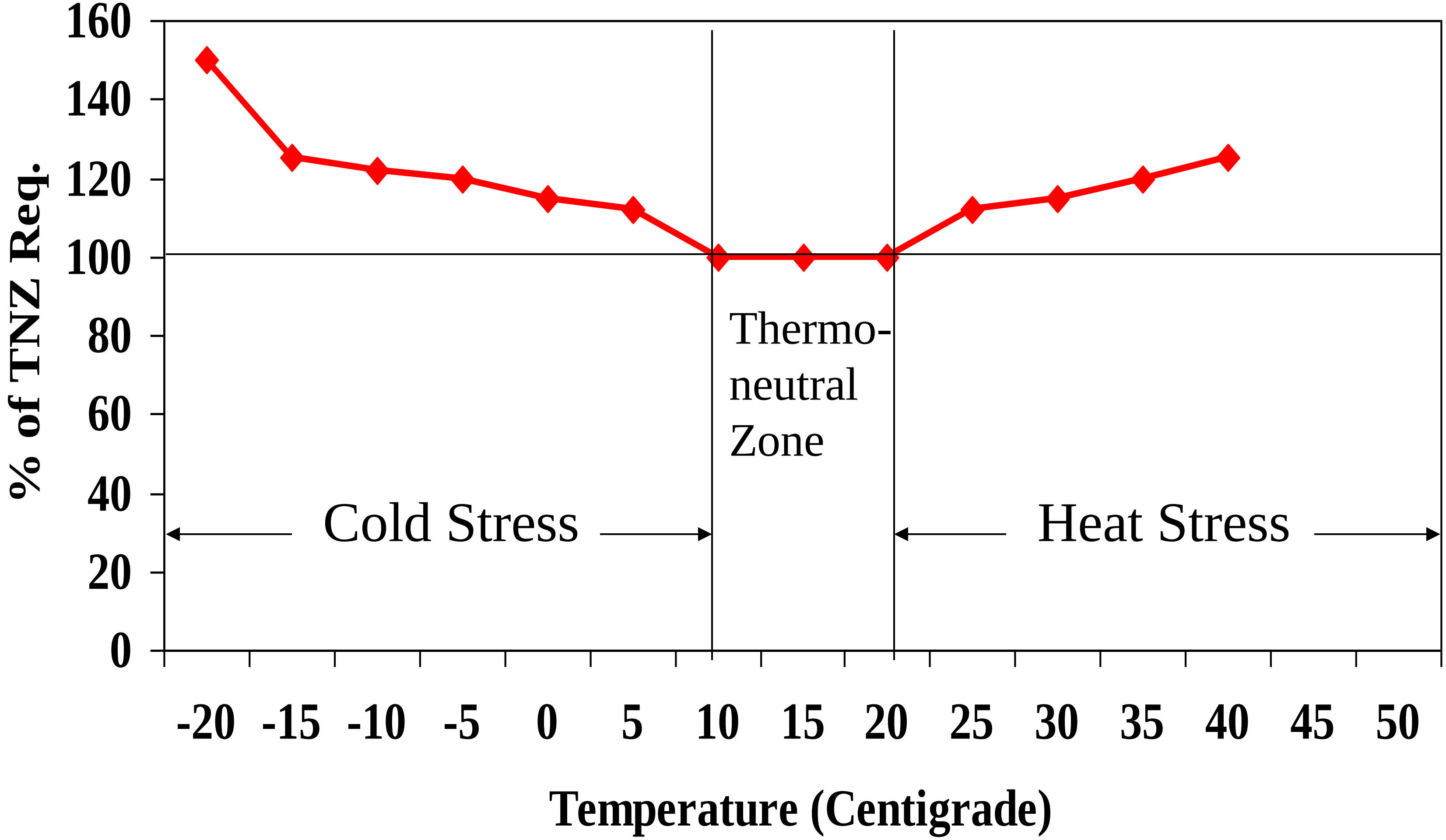
- ✓A recent goal in Holsteins includes at least 1 lb/day gain prior to 14 days old for good health (ADSA 2008 calf discover conference)

- ✓20% of variation in milk production is related to growth rate prior to weaning; (Van Amburgh, 2009)

SROC Standard Feeding Protocol

- ✓ Starts with a strong healthy calf.
- ✓ Standard control program to February 2010 -- a 20:20 medicated (2:1 NT)all-milk protein milk replacer (MR) fed at 1.25 lbs/day for 35 days and 0.625 lbs/day from day 36 to weaning at 42 days (12.5% solids).
- ✓ After February 2010 used 1:1 NT (1600 g/ton)

Effect of Ambient Temperature on Calf Maintenance Requirements (Tyler, 2007)




Summer Housing

SROC example of Conventional vs Modified Intensive or Intensive Feeding Programs

Initiated in 2004

Performance of heifer calves fed varying milk replacer and starter programs (proceedings Table 2 for all MR treatments)

Parameter	20:20 Non-Acidified	28:16	28:16
Feed rate lbs/day MR	1.25	1.5	2.25
Solids %	13.88%	16.67%	16.67%
Calf starter (CS), CP %	18%	22%	22%
Init. BW, lb	**90.64**	**89.54**	**88.66**
Init. HH, in	31.80	31.78	31.81
SP, g/dl	5.00	4.90	4.98
Final BW, lb	**169.84**	**179.08**	**188.76**
BW change vs Initial	**187%**	**200%**	**213%**
Final HH, in	**35.91**	**35.91 (-2%)**	**36.65**

Performance of heifer calves fed varying milk replacer and starter programs

Parameter	20:20 Non-Acidified	28:16	28:16
Milk DM, lb	46.86	55.44	82.72
CS DM 56 d, lb	103.40 (+19.8%)	108.46 (+23.6%)	82.94 ---
Total DM, lb	150.26	163.90	165.66
ADG 1-56 d, lb	1.4	1.61 (+12.4%)	1.76 (+19.9%)
Cost of gain vs 20:20 in 2004	---	+23.6%	+57.3%

Post weaning from 9 to 25 weeks

✓ **20:20 MR calves fed 16% grain mix (6 lb/d) and 28:16 calves fed 18% CP grain mix with free choice hay –no differences in heifer performance.**

Post weaning from 9 to 25 weeks

First calving age and lactation production (taken from Spreadsheets by farm in 2006-2007)

✓Reduced first calving age for intensive (23.5 mth) but not modified intensive (24 mth) vs 20:20 control (24.4 mth) ; Indications of no significant milk production differences.

✓305 STD ME - 28,386 lbs, (all 20:20); 28, 870 lb (1.5 lb 28:16); 30,096 lb (2.25 lb 28:16)

What is happening elsewhere on accelerated programs?

- Overview of data from Cornell, Soberon et al 2012 – every 1 lbs adg pre-weaning (especially 42-56 days) > maintenance = 850 lbs + milk; (genetic progress = 200-250 lbs milk). Van Amburgh, 2013 looked 12 studies (including U of MN data) and found high milk/MR levels av. +1,582 lbs milk; Cornell model shows + effects through 3 lactations;

- Van de Haar and Weber Nielson (2013) – conventional at 1.2% BW (1.1 lb MR) vs. accelerated at 2% BW (1.8 lb MR); 3% more milk and calved 2 weeks earlier;

- Suggested option to recover extra costs of MR with good milk prices, low calf mortality and lower calving age. Comments related to other information was that calves that grow faster pre-weaning without being affected by seasonal effects, health status and better genetics will produce > milk.

- Heinrichs and Jones (2011) summarized all available published information and found no effects of accelerated on milk production

What is happening elsewhere on accelerated programs?

- Overall milk yield response 3 to 6% vs conventional – similar to U of MN reduced calving age in some studies; variability due to management, environment, genetics;

- Hill et al. (2013) asked how to feed more milk or MR to maintain > BW as calves transition to starter suggested to limit milk feeding to 1.5 lb DM/day (12 lbs as-fed) or gradually reduce liquid diet over 14 days to increase starter intake.

- Feeding larger amounts of ME and protein pre-weaning to calves may improve calf health (Quigley Calf Note #177) can increase calf performance but review of literature suggests little effect on immunity as long as calf is fed at or above maintenance.

- Refinement of MR formulations such as balancing amino acids, balancing fatty acids (short chain C4:0 butryric; medium chain C12 and C14:0, long chain C18:2 and C18:3) effects GI tract, adds antimicrobial properties and improves immune function;

Recent strategies at SROC (Brittney et al., 2014)

Strategy 1

- Feeding rate affected intake more than CP level when comparing a 20:20 vs. 24:20 (no difference at 1.5lb/d)
- DMI was similar across all treatments

Strategy 2

- Feeding calves a 24:20 at 1.25 and 1.5 lbs/day maintains CS intake to enhance protein and energy intake of calves.
- Feeding a 24:20 MR at rates higher than 1.5 lbs/day/inhibits CS intake without improving growth rates.
- Further research needs to determine if 20% fat is the optimum for a modified accelerated MR and comparing it to an accelerated MR would be recommended to determine if calf performance and health can be enhanced.

Strategy 3

Evaluate the growth performance and health of calves fed a modified accelerated 24% CP and 20% fat MR at higher FR compared to calves fed a MR having similar or higher CP and lower fat concentrations."

(Strayer et al., 2014)

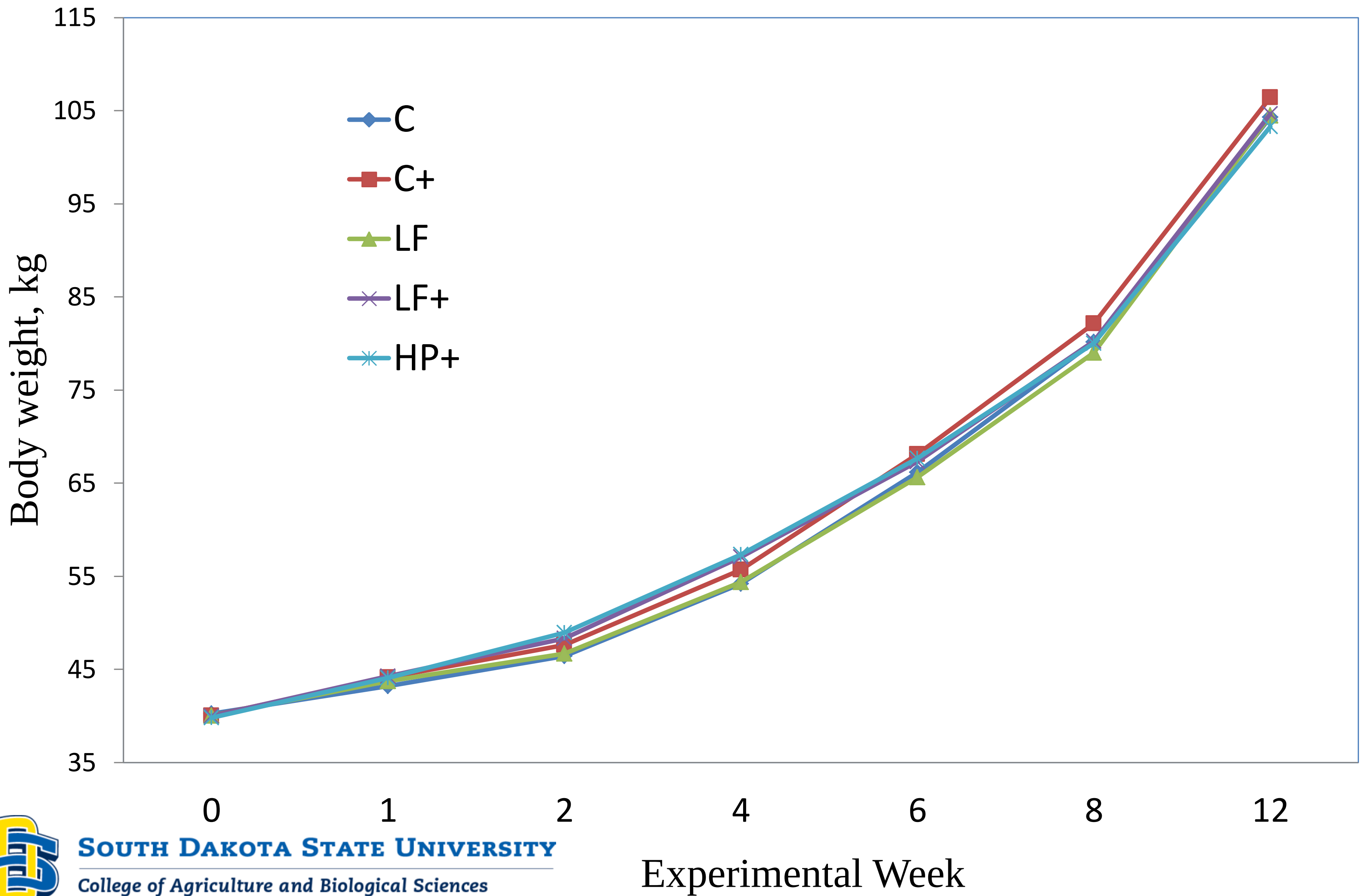
Material & Methods

126 Calves randomly assigned to:

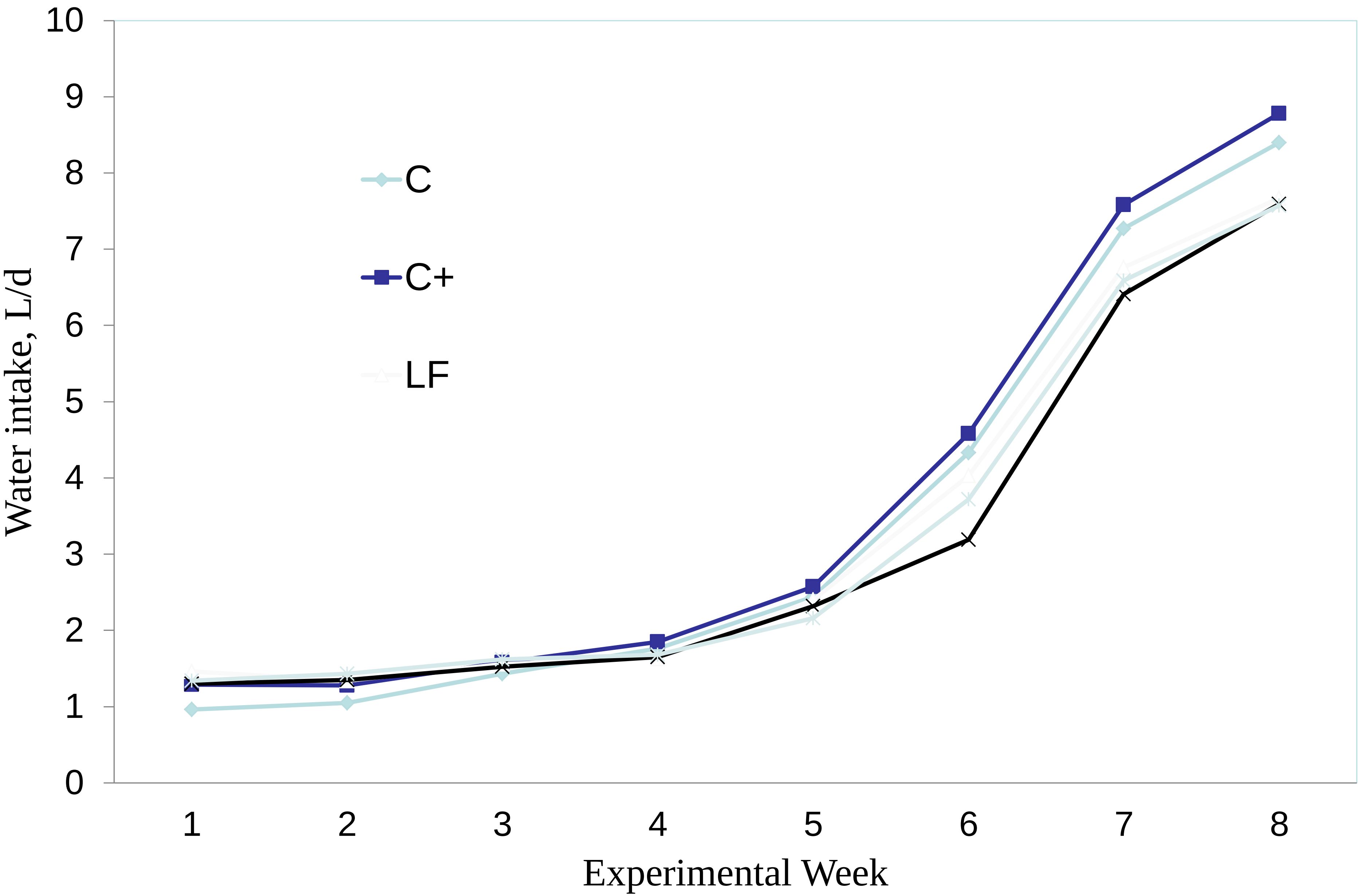
- **Control: 24:20 MR at 1.25 lbs/day**
- **Control +: 24:20 MR at 1.50 lbs/day**
- **LF lower fat: 24:16 MR at 1.50 lbs/day**
- **LF+ lower fat higher rate: 24:16 MR at 1.87 lbs/day**
- **HP+ higher protein: 26:16 MR at 1.87 lbs/day/d**

- LF+ and HP+ were feed at 1.50 lbs/day for the first 7 days of the trial as a way to step them up to 0.85 kg/d.

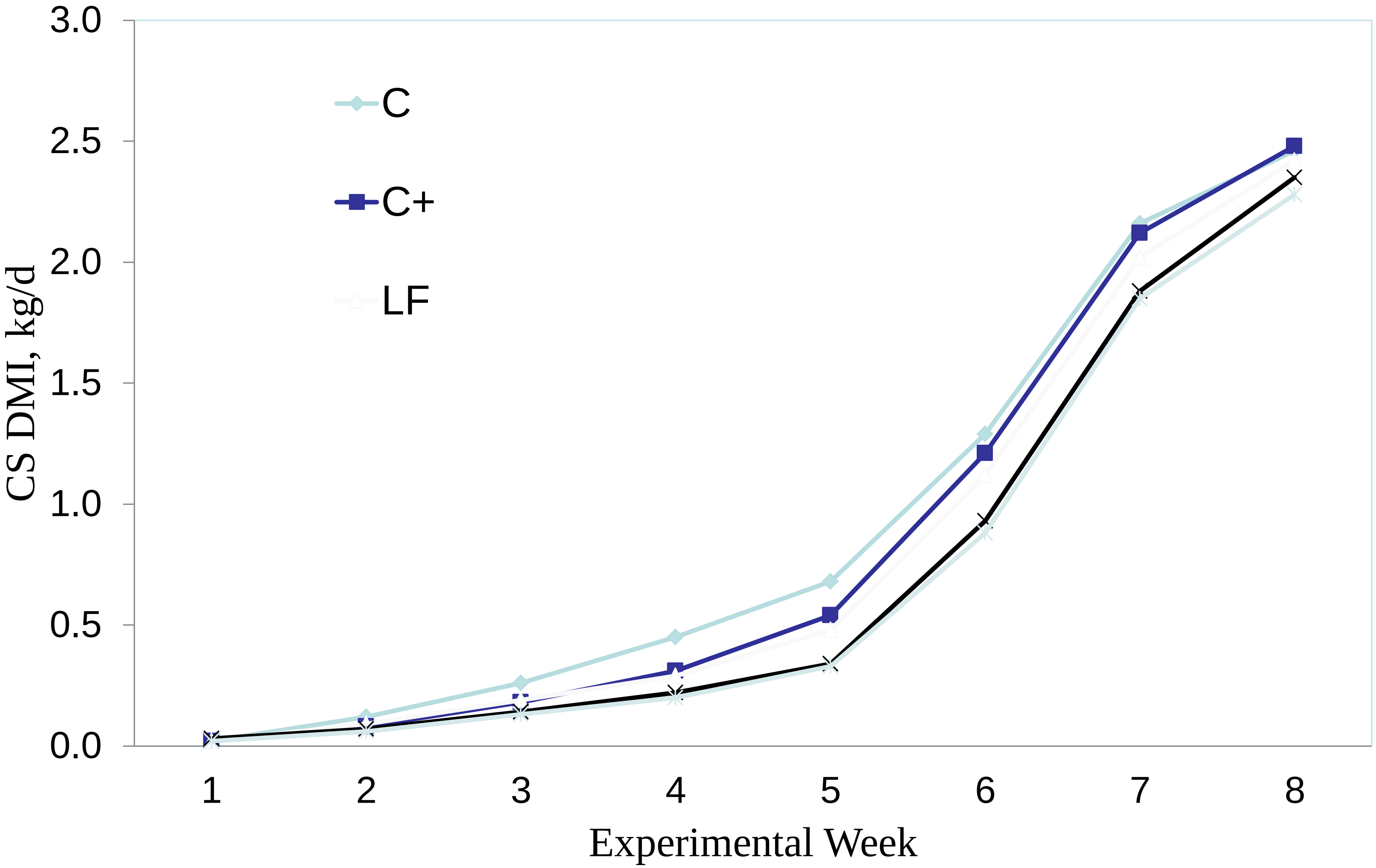
Body Weight by Week



Water Intake by Week



Calf Starter Intake by Week



Conclusions

- ✓ Feeding calves a 24:20 MR at 1.5 lbs /day maintains CS intake, which resulted in improved ADGs, feed efficiency, and gained more width and height at the hips than calves fed a 24:16 or a 26:16 MR

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- ✓ Feeding a 24:16 and a 26:16 MR fed at 1.72 lbs/day inhibits CS intake which could not maintain early growth advantages through the post-weaning period.
- ✓ CP:ME ratio range from 59 to 64 g/Mcal ME

Recent autofeeder program demonstration example July-September, 2014 – 22 calves/pen

✓MR 20:20 1.25 lbs/day 3 feedings vs. MR 28:18 up to 2.2 lbs/day 5 feedings
✓1-42 Gain 1.53 vs. 1.58 lbs/day
✓1-56 Gain 1.82 vs. 1.88 lbs/day
✓More than doubled initial BW and over 5 inches HH gain.
✓Calf health very good in this group – this is the most variable aspect of the system
✓Calf Starter (CS) x2 for conventionally fed calves.

Table Examples of calf performance using conventional programs

Parameters	20:20 all milk	22:20 all milk	20:20 all milk	20:20 50% alt wheat & plasma
Months of study	Oct-Jan, 2005	Oct-Dec, 2013	Jan-April, 2013	Jan-April, 2013
ADG 1 to 42, lbs	1.54	1.65	1.42	1.33
ADG 1 to 56, lbs	1.72	1.93	1.69	1.63
HH gain, in	4.6	4.95	4.26	4.43
BW gain, %	208	227	208	205
CS 1 to 42, lbs	57.2	60.9	53.3	46.8
CS 1 to 56, lbs	126.1	142.5	128.3	120.6
MR 1 to 42, lbs	48.2	45.9	47.0	47.0
G/F 1 to 56, lbs	0.56	0.58	0.55	0.56
SP, g/dl	5.0	5.50	5.87	6.12
Scouring d, 1 to 42	3.3	1.9	1.8	1.2
Cost 1 to 56, $	1.27	1.26	1.06	1.08

Calf Starter Programs

Commercial textured starter

Calf Starter Programs – key to SROC calf growth

✓Studies have found that replacing steam flaked corn with whole corn, air or flame roasted corn in completer calf starters resulted in as good if not better calf performance during a 56 day nursery period. There were indications of starter differences in calf health parameters and treatment costs.

✓ Calf starter studies have allowed for an improved 18% CP CS with digestible fiber levels that enhanced DMI (increased NDF and ADF)

Other focus areas for Liquid and Calf Starter Programs (details in the proceedings)

- ✓ Alternative Proteins
- ✓ Energy sources
- ✓ Ionophores and coccidiostats
- ✓ Heat abatement
- ✓ Use of glycerin
- ✓ Nutritional supplements

Weaning Criteria

Calendar or Feed intake? Calendar at SROC

- Large breeds:
  Starter consumption > 1.5 lbs/day for 2-3 consecutive days
- Jersey's:
  Starter consumption > 1 lb/day for 2-3 consecutive days
- Half feeding rates of milk replacer encourage starter consumption starter, increases rapidly after weaning

Calf and Facility Management

Post Weaning Transition and Group Housing

Post weaning group housing
Transition management control

- 65 ft x 150 ft grower barn -- 9 to 27 weeks of age
- 120 head in 20 pens

Transition Calf management

- Calves fed same calf starter for 7 days then transitioned to limit-fed 16% grain mix and free choice hay program (alfalfa/grass); different options have been assessed;

- DMI by heifers in our system will be close to 3% of BW from 9 to 25 weeks of age.

- Ionophore feeding rate of monensin 90-100 mg at 9 weeks to 150 mg at 6 months with a max 200 mg (lasalocid similar range).

Feeding pasteurized waste milk

Litherland, 2010

Proper pasteurization helps control pathogens; goal of bacterial counts < 20,000 CFU/ml; make sure waste milk is cooled in storage before pasteurizing

Comments from, a producer panel at the 2014 annual DCHA conference in Green Bay to raise the best calves.

J. Hall at Hall's Calf Ranch Kewaunee, WI

- ✓ Since 1995 have grown to raising 25,000 calves/year from 26 farms 6,800 calves housed in 4,000 hutches and barns at any one time 90% heifers.
- ✓ Each calf is tested for BVD PI and serum protein –
- ✓ Pasteurized milk and MR when supply is low; Calves fed milk 7 weeks 1 gallon x2 daily; 18% CP starter and water;
- ✓ Calves in hutches for 2 weeks after weaning then moved to groups of 10 at 9 weeks. Calves fed a TMR (HMC, haylage, corn silage, dry hay) up to 5 months then leave the ranch.
- ✓ Main challenge is good quality calves fed good quality colostrum. Train employees for health care. 2% death loss. Use IV to treat sick calves rather than tubing. Employees walk by the calves x2 daily. Good sanitation is critical. Trying implanting boluses to monitor calf temperatures wirelessly

Example of raw means profile of heifers by farm showing relationships of initial serum protein to growth by 6 months of age at SROC and by complete lactations on their home dairies

Initial SP, g/dl	4 or <	4.1-4.5	4.6 -4.9	5-5.4	5.5 or >
Farm A (1,322)					
% of heifers	2.0	5.1	8.3	32.9	51.7
Final BW, lb	476	465	466	471	473
Final Hip Height, in	45.8	45.2	45.3	45.5	45.5
ADG, lb	1.93	1.90	1.90	1.91	1.93
First calving age	712	718	713	706	703
Final Std ME, lb	27,076	28,997	29,387	29,186	29,270

Take Home Message

✓Complete pre- and post-weaning nutrition and management options for commercial dairy heifer calves have been implemented over the last 10 years at the University of Minnesota SROC.

✓Goals for calf performance in the nursery have been attained by both conventional, moderate intensive or intensive programs.

✓ Optimum calf starter intake compliments changes in liquid feeding programs to ensure calves meet their goals.

✓Good quality calves and health management have been important keys to success. Post weaning programs have maintained calf performance which has exceeded initial expectations

Further acknowledgements not listed in the Title

- Special thanks to the dairy partners at Wolf Creek, Dundas, Bombay, Kenyon and Clay View, Goodhue.

- Thanks to the SROC dairy staff for their excellent calf care.

- Sincere thanks to all partner collaborators who have contributed to calf research studies at SROC since 2004.

Questions

Heifer diets and DDGS feeding considerations

Jill Anderson, Ph.D.
Assistant Professor
Dairy Science Department
South Dakota State University

Introduction:

Raising heifers is a balance between minimizing the cost of inputs and optimizing heifer growth performance. A good goal is to have heifers calve by 22-24 months of age. During this two year growth period producers have a lot of investment with very little return. One of the major inputs during this time is the cost of feeding the heifers. Distillers grains (DG) offer an economically attractive alternative to traditional feeds like corn and soybean meal. The majority of research on feeding DG has been with beef cattle or mature dairy cattle, whose nutrient demands and production goals are slightly different from that of growing dairy heifers. In recent years at SDSU we have been conducting research on feeding DG specifically to dairy heifers and have shown it can be used to make effective diets for growing heifers that are fairly simple in ingredient composition. As DG comes from an industrial process it is different in nutrient composition compared to traditional feeds, and one must make some considerations when feeding it to dairy heifers. Some particular considerations are: What type of DG are you going to feed (what is the nutrient composition)? What other ingredients should you feed with it? How much can you feed to growing heifers?

What type of distillers grains?

Traditional full fat DG, which is what was mainly produced up until a few years ago, has been proven to be a very good feed for beef and dairy cattle at moderate dietary inclusion rates as highlighted in review papers by Klopfenstein et al., (2008) and Schingoethe et al., (2009). Most feeding research has been focused on traditional DG that is approximately 30% crude protein and 10-15% fat. In recent years, different processing techniques such as centrifugation or solvent extraction have been added to bio-fuel manufacturing practices, making it more critical than ever to know the type and nutrient composition of the DG you are using in your heifer diets. Different types of DG include distillers dried grains with solubles (DDGS), distillers wet grains with solubles (DWGS), modified distillers wet grains with solubles, reduced-fat distillers dried grains with solubles (RFDDGS), and fat-extracted distillers dried grains with solubles.

Wet versus Dry: Distillers grains can also be found in wet or dry form, with DWGS having a dry matter (DM) of around 30-35%, and DDGS having a DM content of approximately 90%. Some plants also produce a modified wet distillers grains with dry matter at approximately 50%. There has been very limited research directly comparing DDGS versus DWGS. Anderson et al., (2006) conducted a study on feeding lactating cows DDGS versus DWGS. Milk production was maintained among treatments, indicating that either can be fed to dairy cattle as long as moisture content is accounted for in the ration inclusion rate. One advantage of DWGS is high moisture content can improve mixing of the rations and result in decreased sorting and dustiness (Klopfenstein et al., 2008). However, per ton of DM, shipping DWGS is less cost effective compared to DDGS and long term storage of DDGS is less complicated. Ensiling DWGS is one the most effective preservation methods for long-term storage.

At SDSU some smaller projects on feeding DWGS to heifers by ensiling it with other fibrous by-products were conducted. Anderson et al., (2009) examined ensiling soybean hulls (SH) and DWGS. A large batch of 70% DWGS and 30% SH (as fed basis) was mixed and ensiled in a silo bag to be evaluated as a feed source for growing dairy replacement heifers. Twenty-four Holstein heifers (150 days old) were assigned to one of the 3 treatment diets and fed for 8 weeks. Treatments were: 1) control, 2) low inclusion (24.4%) of the blend, and 3) high inclusion (48.7%) of the blend. All treatment diets consisted of 50% brome grass hay on a DM basis. The control diet had 50% of the diet (DM basis) as a grain mix which was comprised of corn, soybean meal, and minerals. In a similar study (Anderson et al., 2010) also evaluated DWGS ensiled with corn stalks (CS). Twelve heifers (185 days old) were assigned to one of three treatments and fed for six weeks. Dietary treatments included: 1) Control diet with 69.7 % hay, and 30.3% commercial grain mix (Control), 2) 99% DWG-CS blend treated with silage additive and 1% mineral mix (Treated) and 3) 99% of the untreated blend and 1% mineral mix (Untreated). In both studies body frame measurements and body conditions scores were similar among treatments. Average daily gains were greater in heifers fed the ensiled blends compared to the control fed heifers, while dry matter intake was less. The combination of the higher average daily gains and lesser dry matter intakes led to significantly ($P < 0.05$) increased gain:feed for the blend fed heifers. These studies demonstrated that DWGS is very palatable and a viable feed for growing dairy heifers.

DDGS versus RFDDGS: High fat content limits the rate that traditional full fat DG can be included in dairy cattle diets. It is recommended to not exceed approximately 6% of the diet DM as fat for ruminants. In recent years the development of processing techniques (centrifugation or solvent extraction) to remove some or most of the fat for biodiesel production has led to DG products that are 2-9% fat on a DM basis. On one hand the decreased fat content has led to greater potential inclusion rates in heifer diets, but on the other hand this decrease fat also results in decreased energy content which needs to be considered in ration formulations. With the removal of the fat the remaining nutrients (like sulfur and protein) are also further concentrated.

A few years ago we conducted a longer study (Anderson, 2012) to determine the effect of feeding fat from DG on the growth, metabolism, puberty, and long-term performance of replacement dairy heifers. In previous research with feeding DG, it had been challenging to determine if improvements in production performance were from individual nutrients or the associative effects of several nutrients found in DDGS. With the development of fat-extracted DDGS, diets could be formulated that were similar in all other nutrients except fat. Thirty-three heifers were individually fed one of three treatments including: 1) a control heifer diet consisting of a corn-soybean meal based grain mix (C), 2) a low fat, higher starch diet containing fat extracted DDG (LFDG) and 3) a higher fat, lower starch diet containing traditional DDGS (HFDG). All diets contained approximately 40% grass hay and 25% corn silage on a DM basis. The diets were formulated to be similar in total crude protein and energy density. Intakes (DM basis) were limited to 2.45% of BW. The average daily gains were similar across diets, and closer to what is recommended (1.8 lbs/d) for dairy heifers compared to the DWGS studies. Feed efficiency (gain:feed) was similar across treatments as well. Body frame growth was also similar among treatments. Blood metabolites and metabolic hormones indicated that energy status was similar among heifers. However, plasma total cholesterol was greater ($P < 0.01$) in heifers fed HFDG compared to other diets. Cholesterol is a precursor to reproductive steroid hormones and may impact reproductive development. Based on progesterone analysis, 81.8% of heifers fed

HFDG were pubertal at < 300 kg of BW compared to 36.4 and 27.3% in C and LFDG, respectively (*P* = 0.03). However, treatment did not affect the post-trial reproductive performance of the heifers. Feeding increased dietary fat from DDGS during the pre-pubertal growth phase maintained milk production despite findings indicating differences in puberty. Results demonstrate that producers can feed dietary fat from DDGS as a replacement for starch from corn as an energy source for pre-pubertal heifers without detriment to long-term performance. Schroer et al., (2014) also fed heifers that were approximately 5 months of age a control, DDGS, or RFDDGS diet for 12 weeks and also demonstrated that RFDDGS did not negatively affect heifer growth and that RFDDGS is a viable feed source for dairy heifers.

What other ingredients should you feed with DG?

Distillers grains is a very acidic feed with a pH close to 4 because sulfuric acid is added during the manufacturing process. As such, it is recommended that it be fed in fairly high forage diets for stimulation of rumination and saliva buffering. It was unknown if particle size is important in heifer feeding as it could affect the types of fibrous feed that can be utilized. To test this speculation, a couple of summers ago we conducted a study (Lawrence et al., 2014) which evaluated dairy heifer growth performance and total tract nutrient digestion when fed diets high in DDGS with different forage particle size. Differences were achieved by utilizing alfalfa hay that was processed differently by chopping or pelleting. For 8 weeks, 22 Holstein heifers (4 months old) were fed either 15% chopped or 15% pelleted alfalfa hay on a DM basis. Both diets also contained 30% DDGS, 53.75% corn silage, and 1.25% mineral mix. Rations were precision-fed for a dry matter intake (DMI) of 2.3% of body weight. Heifers fed diets containing 30% DDGS with 15% chopped or pelleted alfalfa hay had similar total tract nutrient digestion and growth performance, with some very minor differences in frame growth and feed to gain. Overall, this study demonstrated that feeding dairy heifers diets with different forage particle sizes does not affect utilization of DDGS. Suarez-Mena et al., 2013 also did a study on diet particle size when feeding DG. However their study was in one year old heifers with only 19 day feeding periods. Inclusion rates of DG were also less at 0, 7, 14, or 21% of the diet DM. They found limited impact of DG inclusion rate on ruminal fermentation, although chewing/rumination time did increase with increased DG in the diet.

For the ensiling projects corn stalks or soybean hulls were chosen because they are complementary to DWGS as they are low in fat, crude protein, and minerals, such as phosphorus and sulfur, which are often found in high amounts in DWGS (NRC, 2001). In general, most of our research diets pair DG with high fiber, low energy feeds. This is in recognition that in addition to providing protein, DG is also providing energy to the diet. Pairing it with high energy feeds in free choice diets could quickly lead to over conditioned heifers. Additionally, high starch feeds may not pair as well with DG as they contribute to the acid load of the rumen, and DG is already fairly acidic – although this theory still needs further testing. Overall, we have observed that DG works best with fibrous feeds such as grass hay and corn stalks, in diets with limited corn silage.

How much DG can you feed?

In most research on feeding DG to heifers inclusion rates of 20 or 30% of diet DM have been tested and found to be safe and effective. However, in the Anderson et al., 2009 and

Anderson et al., 2010 studies average daily gains were higher than the recommend 1.8 lbs/d (Zanton and Heinrichs, 2005). In both of these studies we thought that the high forage content would limit intakes, which did not work. However, for the longer study on HFDG versus LFDG (Anderson, 2012) we implemented a precision-feeding strategy and average daily gains were closer to those recommended by Zanton and Heinrichs (2005). As DG appears to be highly palatable it may be best to precision-feed it to avoid over consumption and over conditioning. To test optimum inclusion amounts in precision-fed diets we are currently working on a study (Manthey et al. *unpublished*) evaluating dairy heifer growth performance for heifers fed RFDDGS in replacement of forage in precision-fed diets. Forty-eight Holstein heifers (199 days old) were fed one of three treatments. Treatments diets were: 1) 30% RFDDGS with 68.5% grass hay (30DG); 2) 40% RFDDGS with 58.5% grass hay (40DG) and 3) 50% RFDDGS with 48.5% grass hay (50DG) on a DM basis. All diets also contained 1.5% mineral mix. Rations were offered at 2.65, 2.50, and 2.35% of BW on a DM basis for 30DG, 40DG and 50DG, respectively. This allowed for similar intakes of crude protein and energy across treatments. Body weights and average daily gains were similar ($P>0.05$) among treatments. Precision-feeding diets with higher inclusion rates of RFDDGS resulted in improved gain:feed without increased body condition. Overall, this study demonstrated that replacing forage with RFDDGS in precision-fed diets does not negatively affect heifer growth performance. During the feeding study blood, fecal, rumen, and feed samples were collected. Analysis of these samples is still being conducted and data is also being collected on post-trial reproductive and lactation (first 90d) performance.

Conclusion:

There are still some unanswered questions on feeding DG to dairy heifers. For example is there an optimum forage type to combine with DG? Are there negative interactions with starch and sulfur content? Will inclusion rates and utilization of DG change as more fat is extracted? Also, it should be mentioned that most of our research has been conducted with heifers from 3.5 to 11 months of age. More research with older heifers is needed. Suarez-Mena et al., (2011) conducted a series of studies with feeding calves DDGS and found that is not good to include it at more than 20% of the calf starter. It is speculated that feeding DG to animals with functioning rumens may allow for better utilization of the feedstuff. Research studies at SDSU have demonstrated that feeding high inclusion rates of DG in replacement of all or most of the corn or soybean meal in high forage diets, maintains the growth performance of growing dairy replacement heifers. Feed efficiency is either maintained or improved when heifers are fed DG compared to traditional concentrate ingredients. Feeding fat from DG may impact puberty onset without negatively effecting later performance. When feeding RFDDGS the difference in energy should be accounted for in the diet formulation. Overall, DG is a quality feedstuff for growing heifers and producers should have confidence that growth performance can be maintained with incorporation at moderate inclusion rates in the heifer diets.

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Ventilation Tubes - What they do and how[1]

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Well designed, constructed and managed ventilation tubes are an effective way to distribute fresh outdoor air uniformly in calf barns without creating drafts. Poorly designed and constructed or poorly managed tube systems are a waste of money and can create drafty non-uniform conditions in a calf barn.

Tube systems are used to bring in and distribute fresh outdoor air to calves in either individual or group pens in a calf barn. They can be used in naturally and mechanically ventilated calf barns. Figure 1 shows a tube system that is part of a mechanical ventilated barn.

For these proceedings a tube system is defined as a plastic tube with a fan blowing fresh clean outdoor air from either outside or a well-ventilated attic into the tube. The tube has one, two or three rows of holes uniformly distributed along the length of the tube. They are also called positive pressure tubes because the fan blowing into the tube creates a positive pressure inside the tube.

Tube systems are not new. They are used in greenhouses to recirculate air, provide air mixing and airflow past the plants to maintain more uniform conditions when the air exchange rate is small in cold weather.

Recirculating tube systems were tried years ago in livestock barns but discontinued because the tubes got dirty, they could not be adequately cleaned and they often spread airborne disease organisms to subsequent animal groups.

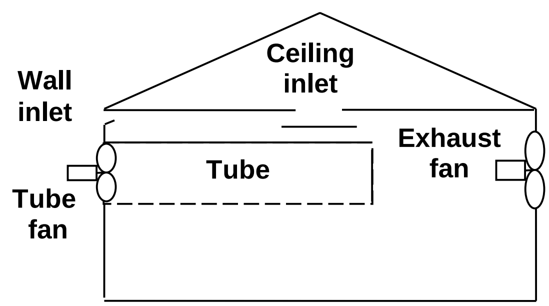

Figure 1. Schematic of a mechanically ventilated barn with a tube system

The tube systems recommended for use in calf barns today use fresh outdoor or clean attic air to supply a tube in a calf barn. DO NOT USE RECIRCULATING TUBE SYSTEMS IN ANIMAL FACILITIES.

Tube systems have become popular because:

1. Calf barns need very little fresh outdoor ventilation air in cold weather (i.e. 15 cubic feet per minute per calf (MWPS-7, 2013))
2. Well designed, constructed and managed tube systems distribute fresh outdoor air uniformly
3. They can direct fresh outdoor air into individual calf pens
4. They can enhance room air mixing and break up stagnant areas with ammonia or airborne bacteria concentrations that lead to respiratory disease in calves.

Researchers at the University of Wisconsin-Madison assessed the respiratory health of 225 calves during visits to 13 naturally ventilated calf barns in Wisconsin between January 15 and March 15, 2004 (Lago et al., 2006). They also measured pen size, ammonia and airborne bacterial concentrations, temperature and relative humidity in the barns and assessed the bedding. They observed microenvironments of poor air hygiene within barns due to solid front

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and rear panels and hovers (covers above calf pens). They reported that high airborne bacterial concentrations were associated with increased respiratory disease. They concluded that supplying dry, deep long-straw bedding that allowed calves to nest appeared to be a good strategy to help calves deal with drafts and cold temperatures. And larger pens, greater than 32 ft^2 per calf, had lower airborne bacterial concentrations (Lago et al., 2006).

Nordlund (2007) identified solid calf pen panels, deep straw bedding that allows nesting, and low airborne bacterial concentrations in calf pens as key calf housing factors. He recommended making pens larger, reducing the number of paneled sides, eliminating hovers and using tube systems to direct small amounts of fresh air into calf pens. This suggests that well designed, constructed and managed tube systems would be expected to improve calf respiratory health if the tubes effectively distribute fresh air and break up microenvironments with higher ammonia and airborne bacteria concentrations.

Calf Barn Ventilation

Calf barns can be naturally ventilated; relying on wind and buoyancy differences (warm and moist air rises) to drive air exchange. Mechanical ventilation uses exhaust fans and fresh air inlets and tube systems to drive air exchange. Tube systems can be used in both naturally and mechanically ventilated barns to distribute clean fresh outdoor air throughout the barn. If a tube system is used in a naturally ventilated barn there must be planned openings to allow the air blown into the barn by the tube system to leave the barn.

In mechanically ventilated barns with tube systems an exhaust fan must run continuously to match the tube fan to maintain a negative pressure in the barn to avoid pushing moisture into the walls (Figure 1). The exhaust fan typically is the same make and model as the inlet fan attached to the tube. Mechanically ventilated barns with tube systems also require additional wall or ceiling inlets to provide adequate inlet openings as ventilating rates increase as the weather becomes mild, warm or hot and additional exhaust fans turn on and run.

The amount of ventilating air to provide in a calf barn depends on the number of calves, age and ambient temperatures. Table 1 lists recommended minimum ventilating rates for calves. The cold ventilating rate is also called the minimum ventilating rate that must be provided even in extremely cold weather. Tube systems are designed to provide the cold weather ventilating rate or higher.

Ventilating rates for selecting fans and sizing tubes are based on the maximum number of calves to be housed in the barn. This maximum number should consider variations in calving rates. Providing excess ventilation in cold calf barns is better than under ventilating the barn.

Table 1. Calf ventilating rates for two age categories, CFM per calf. (Gooch, 2007; MWPS-7, 2013)

	Calf Age	
Weather	0 to 2 months	3 to 13 months
Cold	15	20
Mild	30	40
Warm	65	85
Hot	100	130

CFM = cubic feet per minute

Designing Tube Systems

Well designed, constructed and managed tube systems are expected to:

1. Supply the required minimum cold weather ventilating rate
2. Provide relatively uniform airflow along the duct length
3. Provide air mixing at calf level without creating a draft

Tube diameter and length, mounting height, number of rows of holes, holes per row, hole-size and spacing are important design factors. Airflow through tubes is a complex process. The airflow out of a hole depends on hole-size, air density, duct and barn pressures, and a discharge coefficient. Faculty members at the University of Wisconsin – Madison have developed a spreadsheet to help design tube systems and provide training for its use (PPTC, 2014). Proper tube design is important to provide good fresh air distribution without creating drafts in cold weather. Multiple tubes, each with their own inlet fan, can be installed to provide the minimum airflow rate needed in larger barns with many calves and older calves.

Airflow in, through and out of tubes is complex. Part of this complexity is due to the fact that the amount of airflow along the tube keeps decreasing as air leaves through the holes and the axial momentum decreases (Chen and Sparrow (2009). Because of the complex tube airflow, assumptions made and practical considerations, tube systems may not create the ideal fresh air distribution desired. For example with uniform hole spacing and size, the amount and velocity of air discharged from holes near the closed end is more than that from holes near the fan. Figure 2 shows that a theoretical tube designed to provide 100 CFM to a tube with four holes would be expected to have between 22 and almost 27 CFM coming out to the holes.

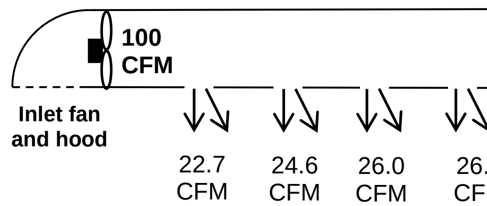

Figure 2.Example tube system air distribution

Under some undesirable conditions holes near the closed end can discharge twice that from holes near the fan (Duncan et al., 1997). Also the direction of the airflow is not exactly perpendicular to the duct because of the air velocity in the tube (Duncan et al., 1997; Chen and Sparrow, 2009). Poorly designed tubes can be unstable near the entrance and suck air in through the tubes (Saunders and Albright 1984). So proper tube design, construction and management is necessary for acceptable airflow uniformity from all of the holes.

Example Calf Barn Ventilating Tube System

This calf barn example is fictional and designed to illustrate ventilating concepts and problems with poorly designed, constructed or managed tubes.

For this example assume that there are maximum of 40 pre-weaned calves in two pens (20 calves per pen) in a barn that is 40 ft x 35 ft with 12 ft tall sidewalls with an automatic calf feeder. The total ventilating rates for cold, mild, warm and hot weather for the barn are listed in Table 2. The barn will be a cold barn, within a few degrees of outside temperature and not heated. Long straw bedding that allows nesting will be used in cold weather.

The tube system will be designed to supply the minimum cold weather ventilating rate or a slightly higher rate; 15 to 20 CFM per calf. The fan for the tube needs to be able to move 600 to 800 CFM at a static pressure of 0.18 inches of water (in H_2O). The 0.18 in H_2O static pressure is the static pressure assumed to be provided in the University of Wisconsin Positive Pressure Tube Calculator (PPTC, 2014).

It is important to use rated fans; fans capable of providing the required airflow rate between 0.15 and 0.20 in H_2O. The BESS Lab (2014) has two rated fans that move less than 1000 CFM. One fan moves less than 600 CFM

Table 2. Ventilating Example Data (CFM)

Weather	Recommended CFM per calf*	Total CFM for 40 calves
Cold	15	600
Mild	30	1,200
Warm	65	2,600
Hot	100	4,000

CFM = cubic feet per minute
* Gooch, 2007; MWPS-7, 2013

at 0.18 in H_2O static pressure. The second fan moves about 860 CFM at 0.18 in H_2O static pressure. The second fan was used for the example to make sure the tube supplies more than 600 CFM.

Using the 860 CFM ventilating rate at a static pressure of 0.18 in H_2O for the tube produces the tube design results in Table 3. Tube lengths are commonly one foot shorter than the barn length. The tube is assumed to be hung near the ceiling above the fence separating the two pens so two rows of holes positioned at the 4 o'clock and 8 o'clock positions were selected. There are 66 holes in each row and they are 7 inches apart along the tube length.

The PPTC (2014) calculates the aperture ratio, discharge coefficient and static pressure. These calculated values are used by the tube designer to assess alternative designs. The values in Table 3 meet all of the design recommendations in the PPTC (2014).

The aperture ratio is defined as the total hole area divided by the tube cross-sectional area. Chen and Sparrow (2009) found that an aperture ratio of 0.14 will have an outflow uniformity ±2%. Aperture ratios of 0.35 and 0.54 have mass outflow uniformities of ±5 and ±10% respectively. Calf barn tube system aperture ratios are recommended to be between 0.8 and 1.2 and uniformities will have more variation. The 0.9 value for this tube is within the recommended range (PPTC, 2014).

The discharge coefficient describes a characteristic of the air flow leaving one of the tube holes. The acceptable range is 0.6 to 0.75 (PPTC, 2014).

The static pressure indicates that relative pressure that the fan must overcome. The acceptable range is 0.15 to 0.22 in H_2O (PPTC, 2014).

Table 3. Positive Pressure Tube Calculator Results

Tube length	39 ft
Height of tube (bottom of tube)	11 ft
Tube diameter	12 inch
Rows of holes	2
Hole diameter	1.0 inch
Hole interval (distance between holes)	7 inch
Total number of holes	132
Aperture ratio	0.9
Discharge coefficient	0.64
Static pressure	0.18 inches of water
Hole positions	4 o'clock 8 o'clock
Air jet throw	7.0 ft
Height at which air jet is 60 fpm (fpm = feet per minute)	7.5 ft

Air Jet Throw

Air jet throw describes the distance from the tube outlet hole where the air jet velocity is 60 fpm (Figure 3). Sixty feet per minute is considered to be an air velocity that does not feel drafty. It is difficult to measure and feel air velocities of 60 fpm or less.

The air that shoots out of the tube holes is commonly called an air jet. The average air jet velocity is related to the static pressure, 0.18 in H_2O, and is typically 1,200 fpm. The velocity in the center of the jet is higher and for this design is around 1,700 fpm. For the example the throw is the distance for the air jet centerline velocity to drop from 1,700 fpm to 60 fpm. In this example the throw is 7 ft. With the bottom of the tube at 11 ft and holes at the 4 o'clock and 8 o'clock positions the air jet will be at 60 fpm at about 7.5 ft above the floor.

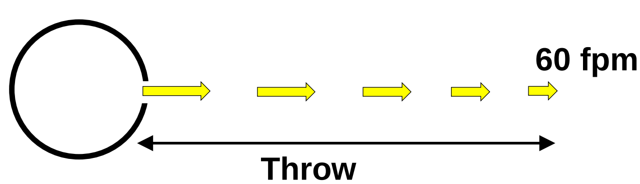

Figure 3. Throw is distance from tube outlet to where air jet velocity drops to 60 fpm. Air velocity at hole is between 1,200 and 1,700 fpm.

Airflow Uniformity

The PPTC (2014) does not assess the airflow uniformity. A different unpublished spreadsheet based on static regain (Saunders and Albright, 1994; Wells and Amos, 1994) was used to assess airflow uniformity using the same tube design characteristics and fan performance data.

The results indicate that the tube fan will operate at 0.19 in H_2O static pressure and have a total airflow rate around 837 CFM. The airflow out of the first set of holes will be approximately 11.4 CFM or 85% of the flow out the last hole at the closed end, 13.3 CFM. This is similar to the airflow variation shown in Figure 2.

Hole Size and Hole Interval

Duct hole diameters and hole intervals are related to each other to keep the aperture ratio between 0.8 and 1.2. As hole size increases the interval between holes increases. For the example in Table 3 a total of 132 holes are needed, 66 holes in two rows. The 1 in holes are separated by 7 in. If the hole diameter is increased to 1.5 in the total number of holes drops to 58 and the spacing interval is increased to 16 in (PPTC, 2014). With the larger holes the air jet throw increases to about 10 ft and the airflow uniformity ratio drops to around 0.58. This means that there is more potential for drafts at calf level and the flow along the tube length varies more.

If the hole diameter is decreased to 0.5 in the total number of holes increases to 526 holes and the hole spacing decreased to 1.7 in (PPTC, 2014). With smaller holes the air jet throw decreases to around 3.5 ft and the airflow uniformity ratio is approximately 0.85. This means that more and smaller holes have more uniform airflow from the tube and less potential for creating drafts. More and smaller holes are expected to produce more uniform airflow in individual calf pens.

Hole Rows and Positions

Most tube systems have one or two rows of holes. One row is used commonly when the tube is mounted near the room wall. Two rows are common when the tube is mounted in the center of the room. The holes can be located at different positions based on analog clock positions (i.e. 3 o’clock through 9 o’clock as shown in Figure 4). Holes located between 5 o’clock and 7 o’clock direct the fresh air towards the floor and the calves and could create drafty conditions if the air jet throw is long enough to reach the floor. Holes at 3 o’clock and 9 o’clock direct air horizontally and probably will not create drafts.

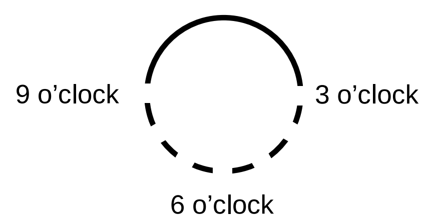

Figure 4. Holes at 3 o’clock through 9 o’clock positions.

Tube Mounting Height

Tube mounting heights measured from the bottom of the tube typically vary from 7 ft to 13 ft. Barns with 8 ft high ceiling and one ft diameter tube the tube height is roughly 7 ft. In some naturally ventilated barns tubes are mounted above the bottom chord of the truss so the height can be 13 ft or higher. Tube height can be an issue when considering manure removal with a skid loader. Leave enough space for the skid loader to pass under the tube.

Tube height, hole position and air jet throw impact the potential for creating drafts at calf level. Short tube heights with long air jet throws coming out holes between 5 and 7 o’clock positions have greater potential for creating drafts. Excess tube height can also reduce the air mixing at calf level.

Wrong Duct Diameter

If the wrong duct diameter is installed, say a 10 inch diameter duct, with the same fan and same holes sizes and number as listed in Table 3 the aperture ratio increases to 1.3, which is above the recommended range. The discharge coefficient becomes 1.05 and the expected fan pressure drop becomes 0.14 in H_2O. The airflow uniformity ratio drops to 0.27 which indicates very little outflow from the duct near the fan compared to the far closed duct end.

If the duct installed had a 14 inch diameter, with the same fan and hole information in Table 3, the aperture ratio decreases to 0.7, which is below the recommended range. The discharge coefficient becomes 0.43 and the expected static pressure is 0.21 in H_2O. The airflow uniformity ratio increases to 0.96 which indicates very uniform airflow along the duct.

These results are counter intuitive but they correspond to comments by Duncan et al. (1997), Saunders and Albright (1984) and Chen and Sparrow (2009). With a large aperture ratio the holes in the tube do not restrict flow enough to create very much static pressure within the tube and airflow uniformity is poorer. With a low aperture ratio the holes restrict airflow, increase tube pressure and airflow uniformity.

Variable Speed or Two Speed Fans

Some producers want to use two speed or variable speed fans in tube systems so that they can adjust the ventilating rate. As long as the airflow changes are not too great and the fan can generate enough static pressure at low speeds the impact on tube performance is not very great. For example if the airflow rate is reduced to 660 CFM for the case in Table 3 the aperture ratio and discharge coefficient remain the same but the static pressure drops to 0.11 in H_2O. The airflow uniformity ratio increases slightly. If the airflow rate is increased for the case in Table 3 to 1090 CFM the aperture ratio and discharge coefficient remain the same but the static pressure increases to 0.29 in H_2O. The airflow uniformity ratio decreases slightly.

Duct fan hood and screen

It is recommended that a hood be attached to the exterior of the barn to reduce the amount of dirt and precipitation that the tube system fan sucks into the tube (Figure 2). It is also recommended that tube system inlet have a either a ½ x ½ inch or ¾ x ¾ inch screen to keep out birds, leaves and other airborne matter. Do not use window screen with the hood to keep dirt out of the tube system. Window screen will plug with dust and dirt and restrict the tube system's airflow. Screens should be checked for plugging in early fall every year.

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Automated Calf Feeders: Keys to Success

JIM PAULSON
U OF MN EXTENSION
ROCHESTER, MN

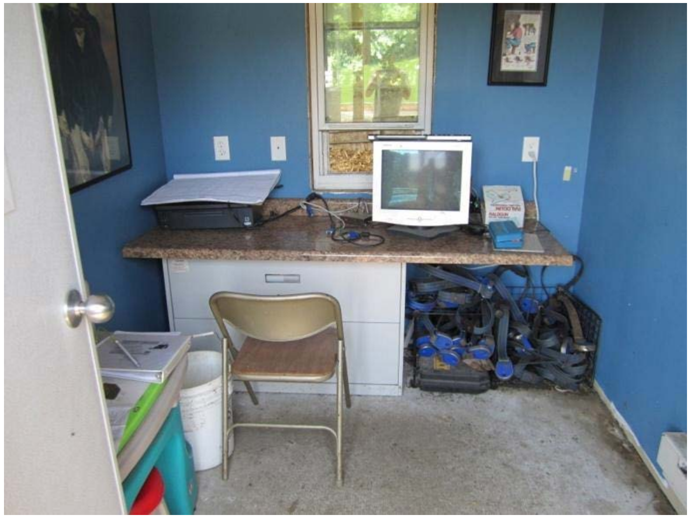
C1+C2+C3+C4+C5= CALF RAISING SUCCESS

- C1 = Colostrum
  - Critical with all management systems
- C2 = Calories
  - Automated feeding allows the feeding of more calories
- C3 = Cleanliness
- C4 = Comfort
- C5 = Consistency
  - Milk is delivered at the same temperature and concentration every time

Why consider an automated calf feeding system?

AUTOMATED CALF FEEDING- ADVANTAGES

- Consistency of feeding
  - Water- Powder- Temperature
  - Mixing- Measuring
  - Data Collection
- Sick Calf Identification
- **Easy to manage an accelerated feeding program**
- Labor Saving



MOB FEEDERS

LOW COST MODEL

- Small batch size
- Fewer settings
- Less information
- More manual cleaning required

HIGHER LEVELS OF AUTOMATION

Forster Technik

HIGHER LEVELS OF AUTOMATION

OTHER BRANDS

Other Models

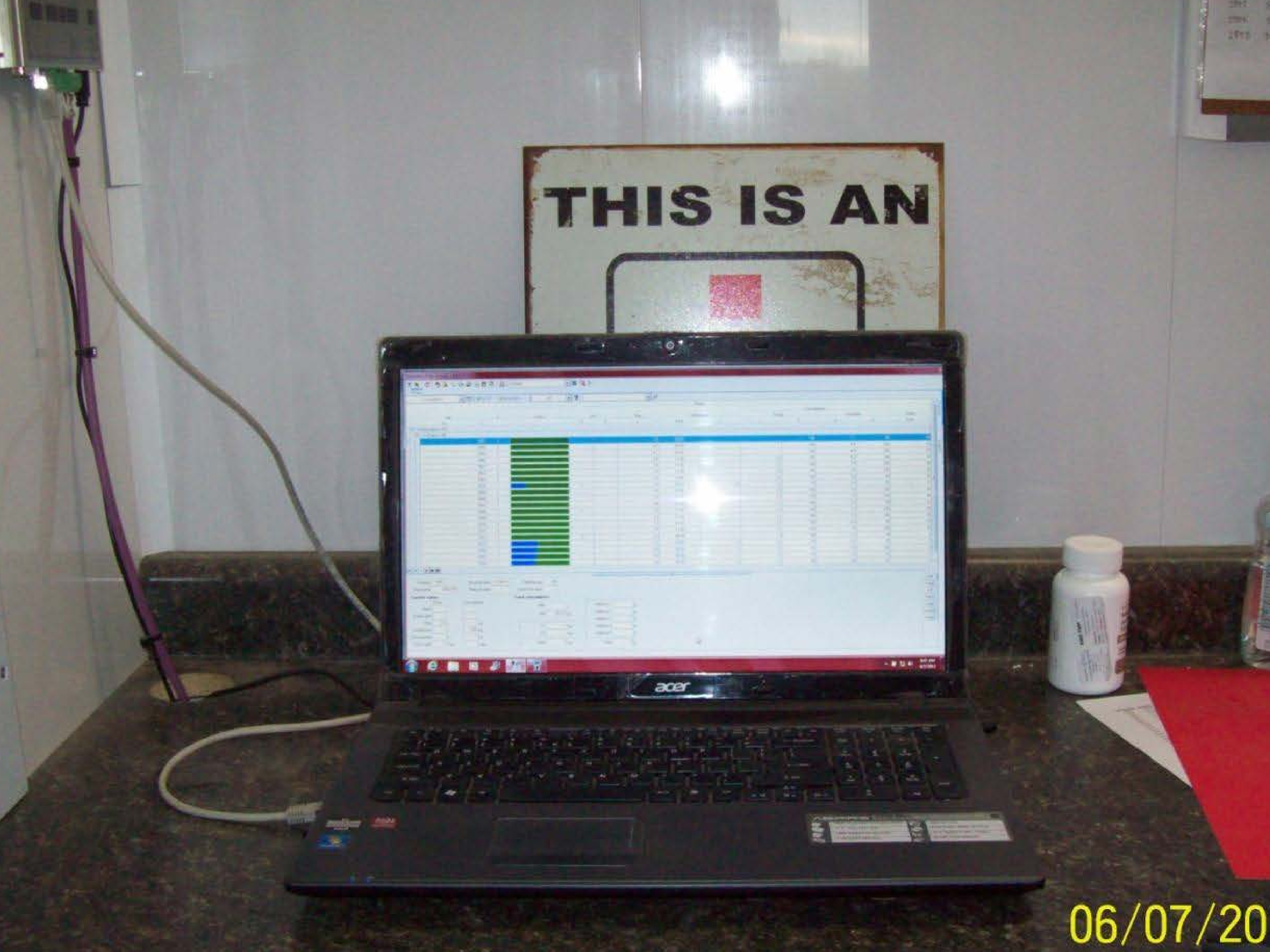
COMPONENTS OF AN AUTOMATED CALF FEEDER

- Mixing unit
- Nipple feeders
- Computer and program

Milk Replacer Mixing Bowl


DeLaval
CF1000
06/27/2008

PANEL READERS AND NIPPLE OPTIONS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MILK REPLACER VS PASTEURIZED MILK

Milk Replacer

- Lower labor
- Lower equipment cost

Pasteurized Milk

- Use for waste milk
- Lower overall cost??

MILK REPLACER FEEDING

PASTEURIZED MILK

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CHALLENGES?

- Misconception of the feeder
- Ventilation
- Colostrum management
- Failure to clean machine
- Vaccination program
- Communication with your Veterinarian

KEYS TO SUCCESS

- Colostrum management
- Starting calves on milk and starter
- Number of calves per nipple
- Ventilation
- Cleanliness
  – Calf housing area
  – Feeder
- Calf observation & Records

STARTING CALVES ON FEEDERS

- Start right on feeder if:
  - Age spread is very narrow
  - Keep animal numbers low
  - Close observation
  - Assist with drinking
- Start at 2-4 days if:
  - They are aggressively eating
- Start 10 – 14 days:
  - minimizes health issues in groups
  - Need more individual pens

START ON FEEDER OR INDIVIDUALLY


6037


4632

CALVES PER NIPPLE

- Time-lapse video studies
- Calf numbers/pen ie. 12 or 24
- Can feed 4-8 feedings/day, calves choose 5-6
- Unrewarded visits indicate calf health and satiety M.B. Jensen, Danish researcher

Farmer observations

- 18-20 calves per nipple – calves do great
- 20-22 calves per nipple – calves do OK
- >25 calves per nipples – some calves struggle

HOUSING

- 30 to 35 sq. feet per calf is ideal.
- What about air quality? How do we manage this?
- A.I.R. = Adequate, Incoming and Removal. Small calves do not generate a lot of body heat which limits convection air currents.

VENTILATION

- Most barns have positive pressure air tubes
- 4 exchanges in the winter months
- 40 exchanges in the summer months
- How do hutch calves compare?
- Do we struggle with issues in hutches?

SCHAEFER
AUTOMATIC VARIABLE SPEED FAN CONTROL
AUTOMATIC SHUT-OFF SET
Degrees °F below Temp Set
di = Differential
oS = Automatic Shut-Off
°F = Degrees Fahrenheit
id = Idle Speed
Click to reset display alarms
(hold) Room Temp Set
IDLE SPEED SET
MAX. SPEED
ROOM TEMPERATURE SET
LO
HI
OFF
LR61791
MODEL #AVS550
115/230 VAC 60 HZ 10 FLA
27

CLEANLINESS

- LOTS of bedding
- Clean bedding often
- Clean hoses and nipple regularly

BEDDING SOURCE

- Wet bedding is another source of bacterial contamination. Around the feeder is generally very wet. Keep it dry also.
- Ammonia at the bedding surface, which is also the calf level. Combination of urine, manure and wet bedding leads to release of ammonia.
- What goes in does come out…..more powder = more water intake. Greater gains!


6104


23
21

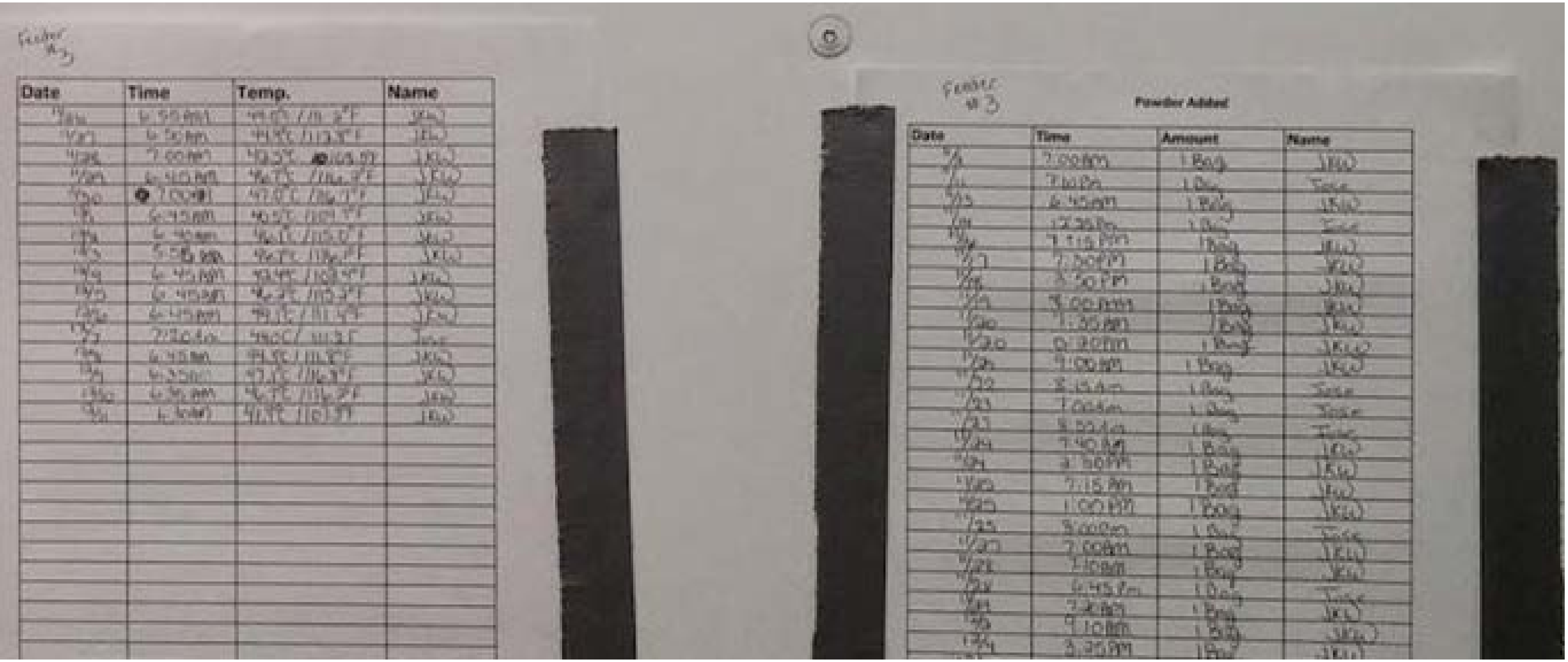

LELY

CHECKLIST FOR CLEANING FEEDER

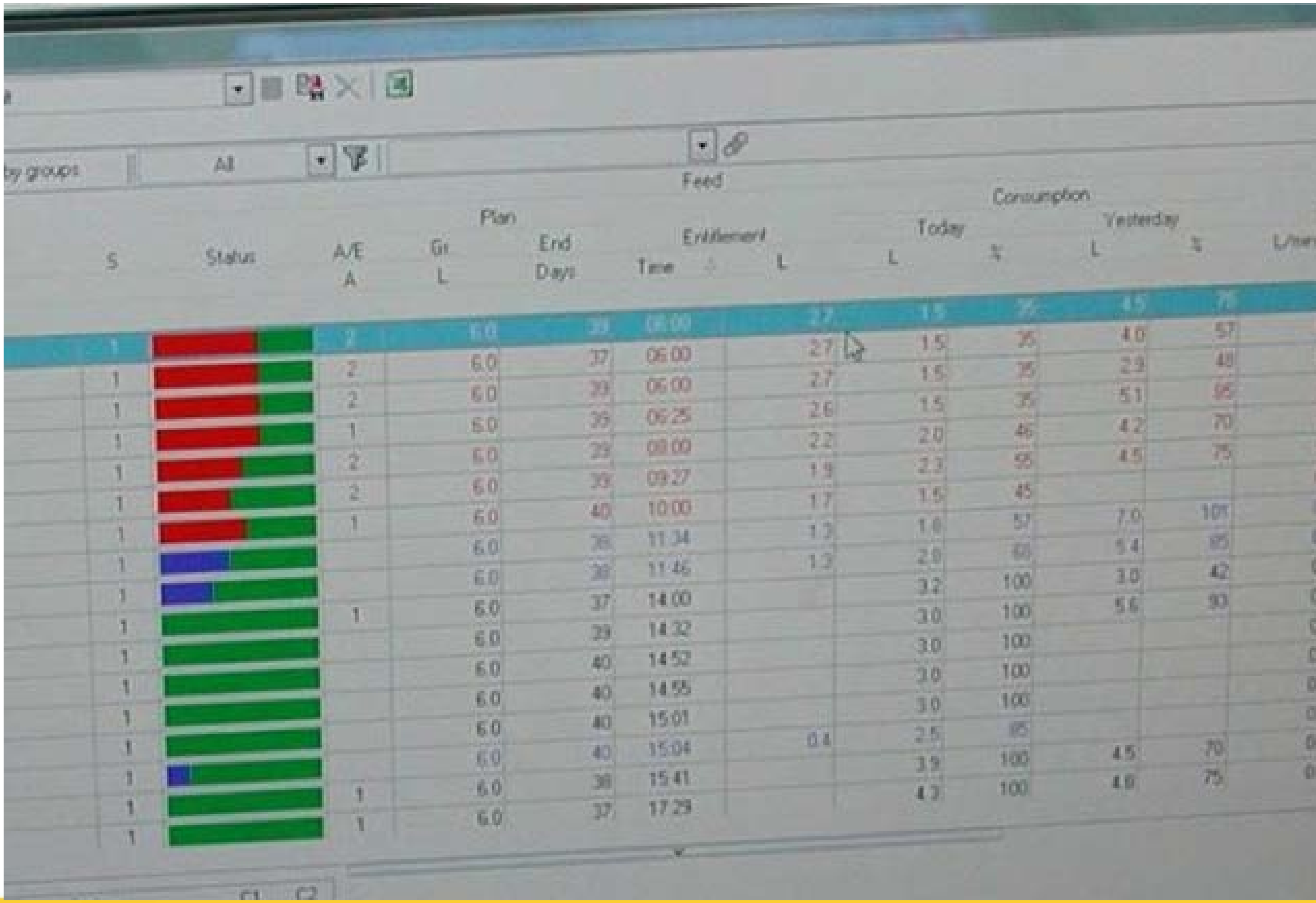
- Switch nipples daily
- Clean hoses, discard once a week
- Periodically clean mixing unit itself
- Replace hose from mixing unit to feeder hose every 6 months


2984

KEEP GOOD RECORDS



CALVES NEEDING ATTENTION




DeLaval
CF1000
DairyTech
INCORPORATED


OFF
CLEAN THIS CABINET AND MILK TANK WITH NORMAL DISHWASHING SOAP HOT WATER AND A
MILDLY ABRASIVE CLEANING PAD. TO AVOID SEVERE DAMAGE TO THE CABINET AND TANK
COMPONENTS, DO NOT USE DAIRY ACIDS FOR CLEANING

AUTOMATED CALF FEEDING - CHALLENGES

- Group Housing = greater potential for disease exposure
  - Respiratory disease exposure can increase due to “shared” air
  - Scour disease exposure can increase due to “shared” nipple
- Cleaning


23
21

What have we learned?

Calves need >30 sq. ft. each

Plenty of bedding

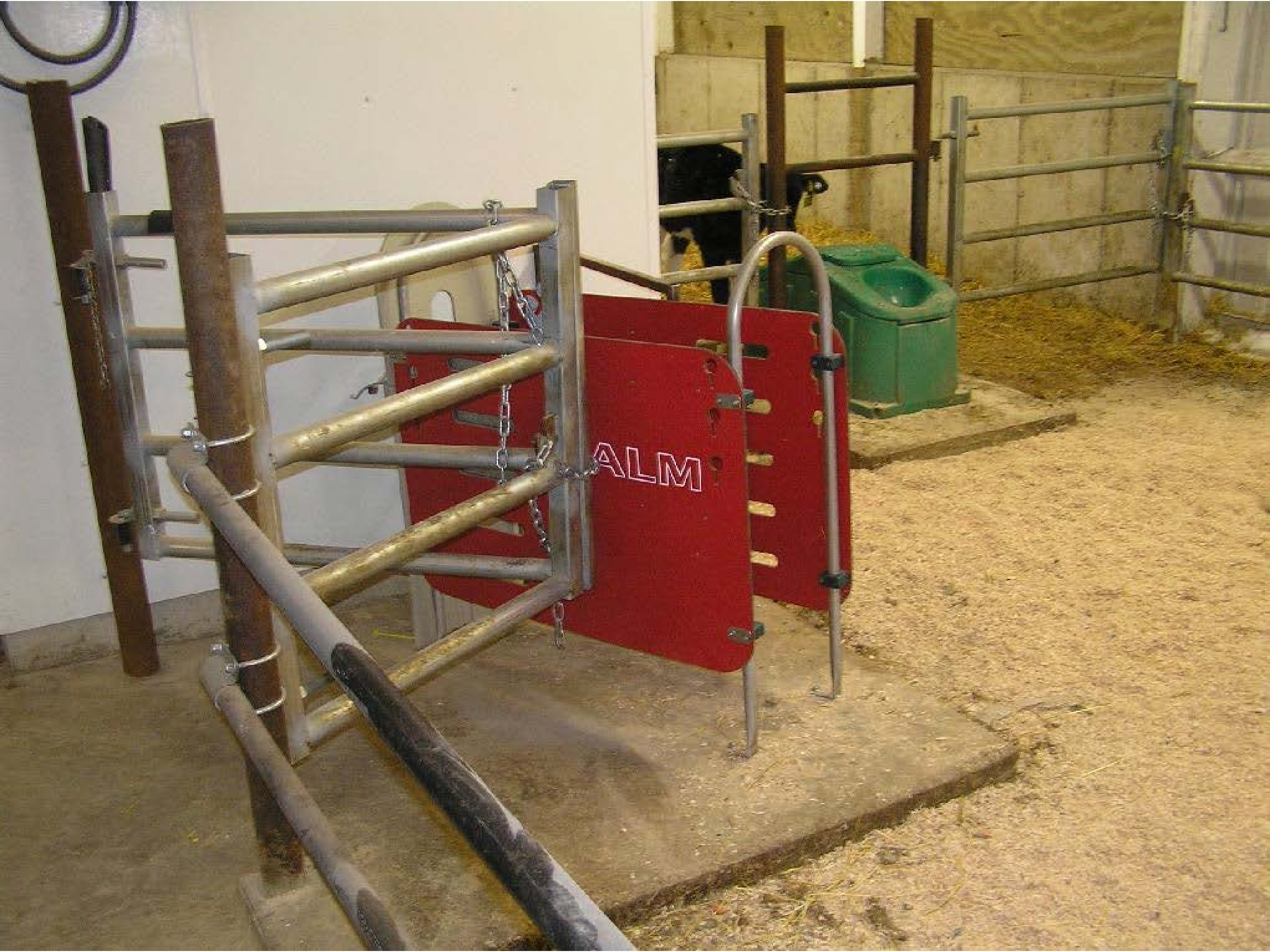
Respiratory problems are common

Calves need 30 – 50 minutes/day nipple station time

Starter feeder limits intake if overstocked, ie. Need more feeders


LELY
CAL


CALM
Auto
Esc
Enter
C
FÖRSTER TECHNIK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ECONOMICS

Mixing control unit -	$20,000
Computer	$ 4,000
Nipple feeders	$ 2,000
Calf starter units	$ 5,000

ANNUAL PARTIAL BUDGET ANALYSIS

Economics of Automatic Calf Feeding Systems — Annual Partial Budget Analysis

Jenn Bentley, Dairy Specialist, and Kristen Schulte, Farm Management Specialist, Iowa State University Extension

ISU Extension DAIRY TEAM

Positive Impacts

Increased Incomes	
Total Increased Incomes	$0
Decreased Expenses	
Reduced Calf Treatment	$0
Reduced Feeding Labor	$14,408
Reduced Calf Management Labor	$2,483
Reduced Labor Management	$2,920
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Annual Value to Quality of Life =	$2,000
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Net Financial Impact	-$3,297
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with QoL, Software, and Milk Gain	$17,693

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Increased Expenses	
Capital Recovery Cost of Feeder (Dep & Int)	$13,460
Increased Insurance Costs	$150
Increased Milk Replacer Intake	$5,453
Increased Pasturized Milk Intake	$0
Increased Calf Starter Intake	$570
Increased Calf Treatment	$30
Increased Utilities and Supplies	$525
Increased Records Management	$2,920
Total Increased Expenses	$23,108
Decreased Incomes Expected	
Total Decreased Incomes	$0
Total Negative Impacts	**$23,108**

Estimated Payback Period, Years	n/a
Estimated Payback Period, Calves	n/a

Available at: http://www.extension.iastate.edu/dairyteam/calves-heifers

How much time do you spend feeding calves?

- 40 calves bucket fed a day
  - 5-10 are < 10 days old
  - 35 10 – 50 days old
  - In hutches or calf facility?
  - What part of your time will be replaced?

- 40 calves on automatic feeder at 1 minute a day
  - .67 hours per day
  - 21 hours a month
  - At $10.00 an hour
- Labor Savings

How do we make this pay?

More free time for other things

More timely feeding

Feed out bull calves

CHECKLIST FOR CALF FEEDER

- Make sure enough milk replacer is in hopper!
- Once every 6 months clean hopper.
- Calibrate machine at least every month. Replacers need to be calibrated every ton batch.
- Make sure electrodes are mineral deposit free.
- Manually clean machine periodically.
- Set up a maintenance plan with your dealer. Every 6 months is a good target.

SUCCESSFUL MANAGEMENT

- 1. Colostrum management
- 2. Isolating the calves at birth
- 3. Adequate housing
- 4. Ventilation
- 5.Ration management
- 6. Hygiene
- 7. Care for the calves

TAKE HOME MESSAGE

- The Calf Feeder does exactly what it is meant for…feeding calves.
- Human error?
- Human Management?
- Successful management is dependent on achieving high performance of many variables.
- Q & A

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CHECKLIST FOR AUTOMATIC CALF-FEEDER

Swap nipples daily

Discard nipples after each group

Be confident in your ventilation and climate control

Automated Calf Feeders: Keys to Success

JIM SALFER
U OF MN EXTENSION
ST. CLOUD, MN

ADVICE FOR THE DAY…..

If you can’t afford to visit the doctor for a checkup, go to an airport. You’ll get a free x-ray and breast exam, and if you mutter something about Al Qaeda you may get a free colonoscopy.

C1+C2+C3+C4+C5= CALF RAISING SUCCESS

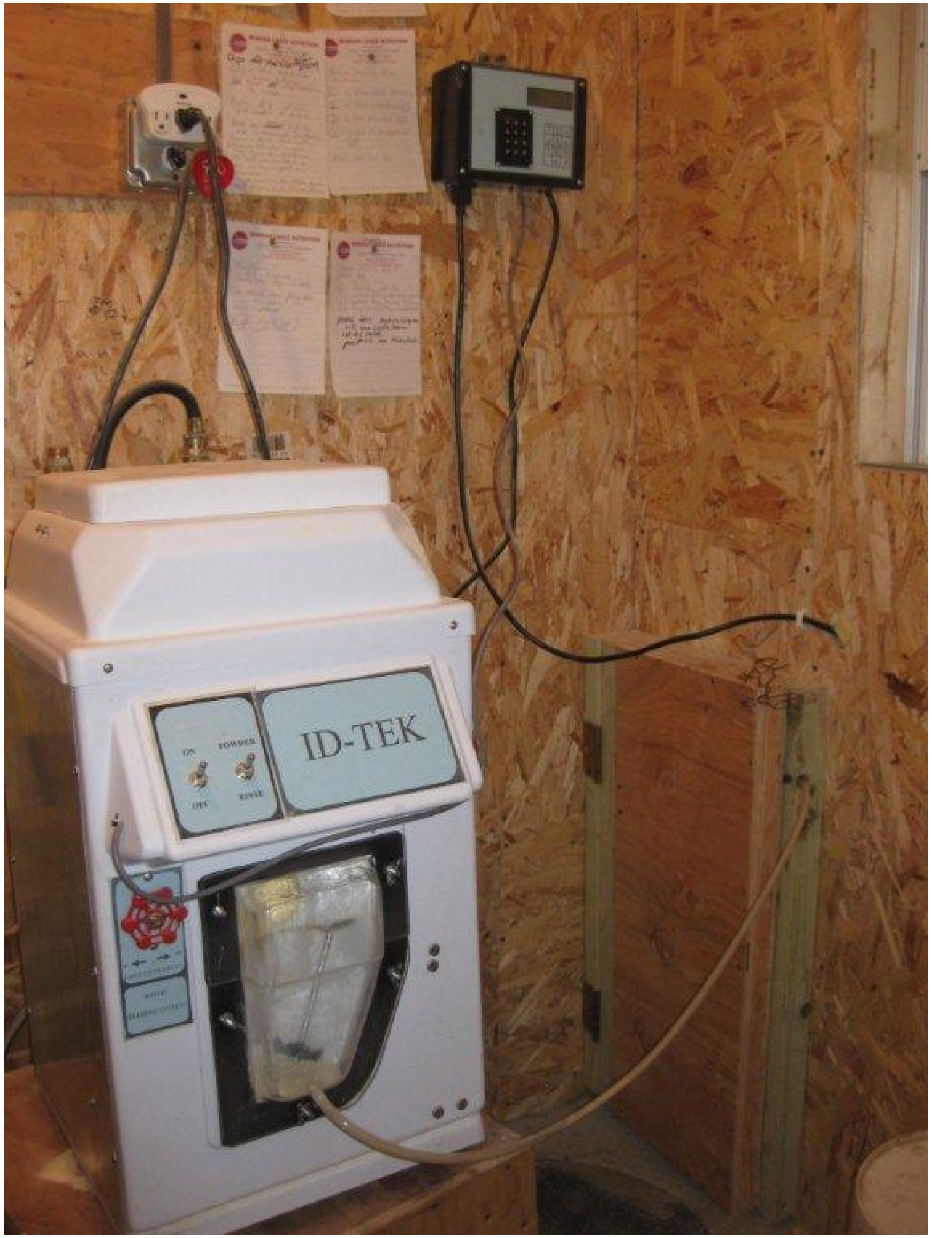
- C1 = Colostrum
  - Critical with all management systems
- C2 = Calories
  - Automated feeding allows the feeding of more calories
- C3 = Cleanliness
- C4 = Comfort
- C5 = Consistency
  - Milk delivered at the same temperature and concentration every time

AUTOMATED CALF FEEDING- ADVANTAGES

- Consistency of feeding
  - Solids content
  - Temperature
  - Mixing- Measuring
  - Feeding times
- Data Collection
- Sick Calf Identification
- Easy to manage an accelerated feeding program
- Feed each calf individually
- Labor Saving

LOW COST MODEL

- Small batch size
  - 1 pint
- Fewer settings
- Less information
- More manual cleaning required



HIGHER LEVELS OF AUTOMATION

Forster Technik

HIGHER LEVELS OF AUTOMATION

Urban
Holm & Laue

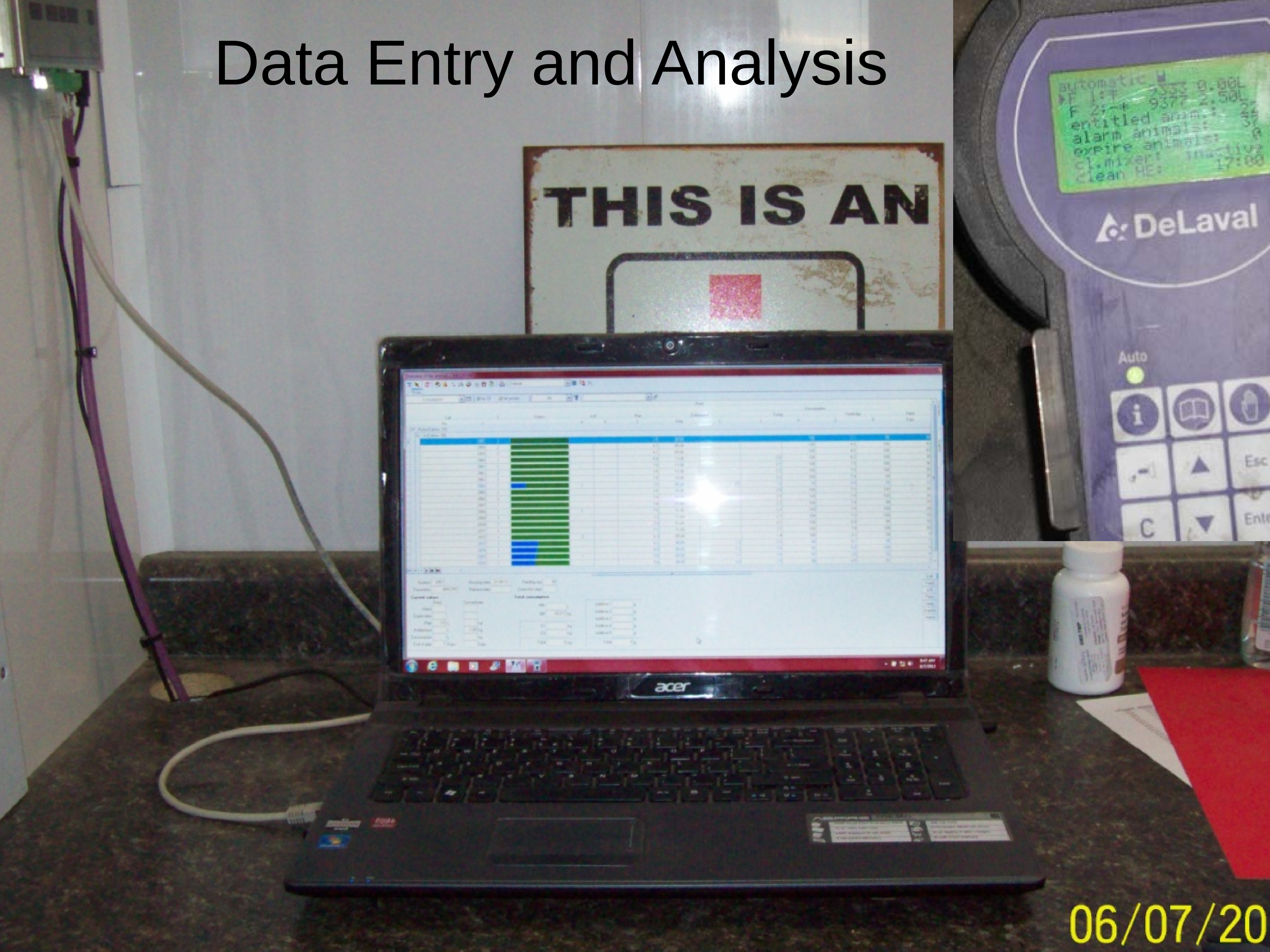
COMPONENTS OF AN AUTOMATED CALF FEEDER

- Mixing unit
- Nipple feeders
- Computer and program

MIXING BOWL

PANEL READERS AND NIPPLE OPTIONS

Data Entry and Analysis



MILK REPLACER VS PASTEURIZED MILK

Milk Replacer

- Lower labor
- Lower equipment cost
- Needs calibration on a regular basis (or automatic calibration)

Pasteurized Milk

- Use for waste milk
- Lower overall cost??
- More equipment to clean

MILK REPLACER SYSTEM

PASTEURIZER SYSTEM

DELIVERY SYSTEM

UNIVERSITY OF MINN

KEYS TO SUCCESS

Colostrum management

Milk and starter management

- Starting on milk
- Milk allowance
- Weaning
- Starter feeding
- Number of calves per nipple

STARTING CALVES ON FEEDERS

Start right on feeder if:

- Age spread is very narrow
- Calves per nipple are low
- Very close observation
- Assist with drinking

Start at 2-4 days if:

- They are aggressively eating

Start 10 – 14 days:

- Minimizes health issues in groups
- Need more individual pens

STARTING CALVES ON MILK

INTRODUCTION TO A LARGE GROUP

Introduced at day 6 compared to day 14

- more restless the first day after introduction

Rasmussen et al., 2006 AABS 100: 153-163

- needed more guidance to the feeder during the first week

Jensen, 2007 AABS 107: 22-31

Introduction delayed by one week

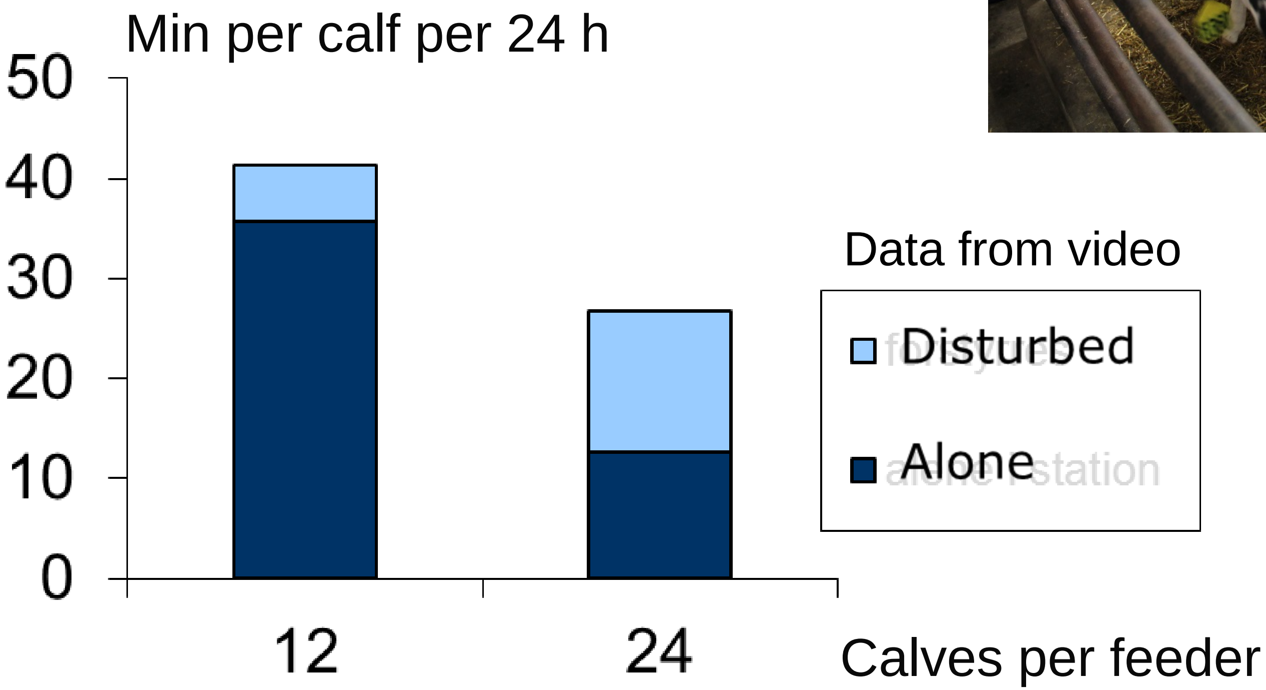
50% lower risk of respiratory disease

Svensson & Liberg, 2006, Prev Vet Med 73: 43-53

NUMBER OF CALVES/NIPPLE

Young Calves	No.
Average	16.4
Minimum	7
Maximum	32

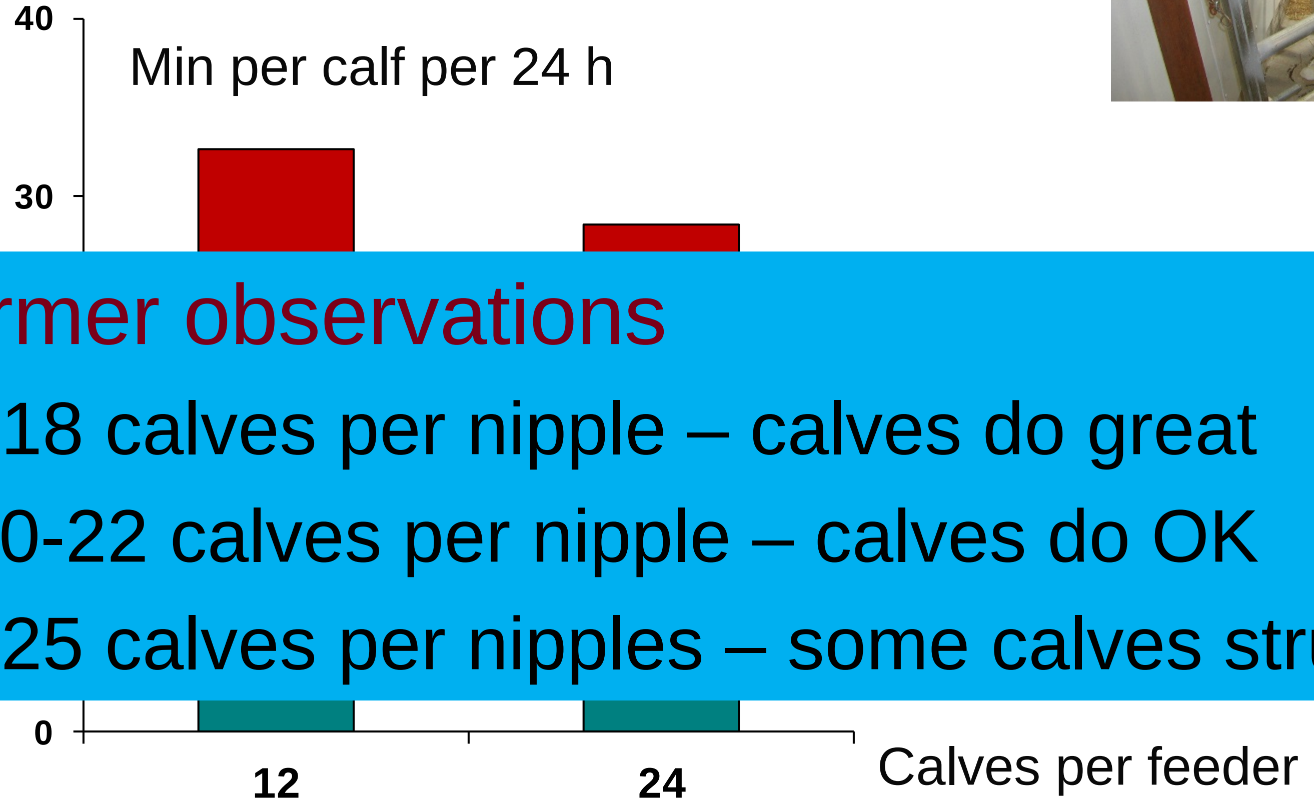
CALVES PER FEEDER



↑ Number of calves per feeder→ ↑competition for access

Jensen, 2004 JDS 87: 3428-3438

CALVES PER FEEDER



Farmer observations

- <18 calves per nipple – calves do great
- 20-22 calves per nipple – calves do OK
- >25 calves per nipples – some calves struggle

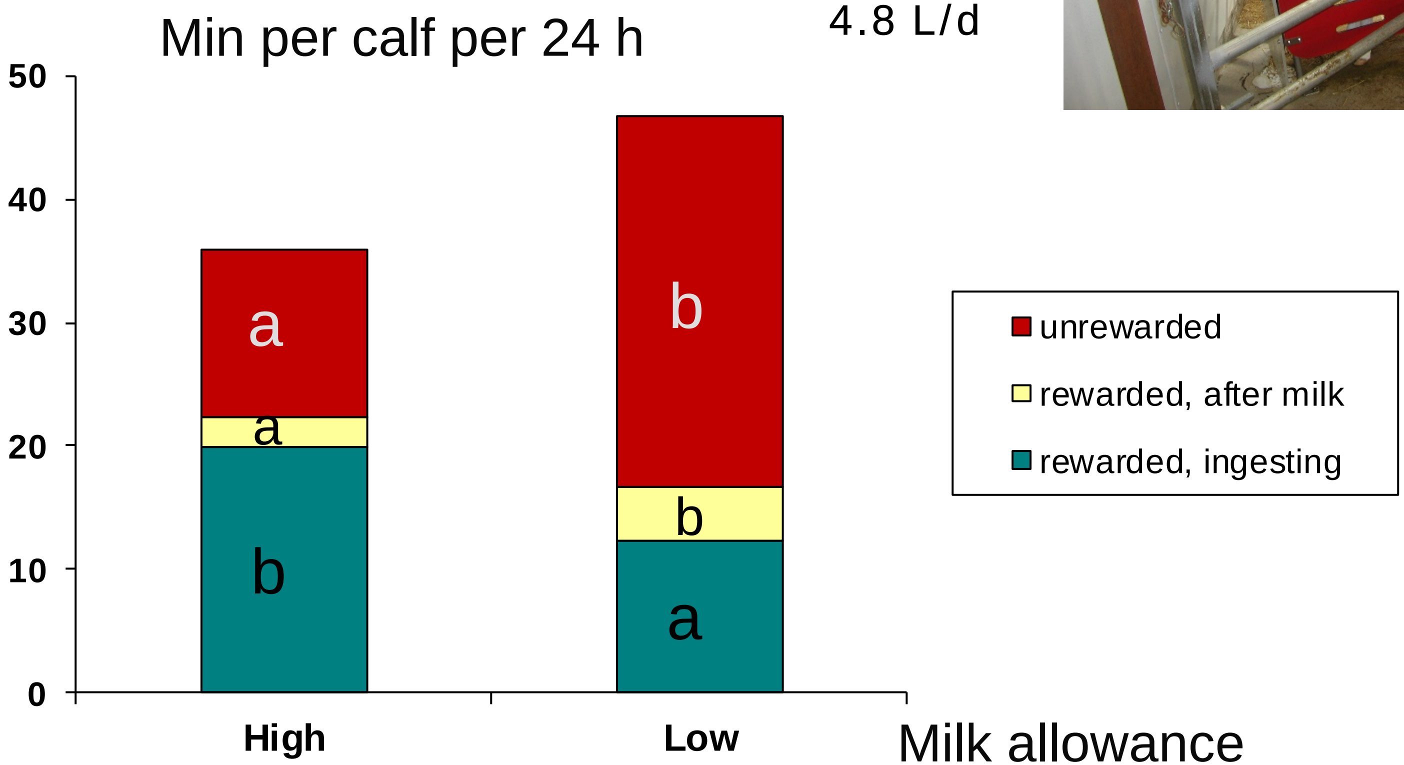
↑ number of calves per feeder → ↑ rate of milk intake

↑ competition

Jensen, 2004 JDS 87: 3428-3438

MILK ALLOWANCE

High milk
8.0 L/d
Low milk
4.8 L/d



↓ Milk allowance → ↑ more time in milk feeder

Unrewarded visits are related to hunger

Jensen, 2006 JDS 89: 201-206

STARTING MILK FED/CALF

	L/d
Average	4.9
Minimum	3
Maximum	9.6

HEALTH EFFECTS OF GROUP SIZE

Calves in groups of 3-8 had a higher daily gain than both individually housed calves <u>and</u> calves in groups of up to 30 with automatic milk feeders

Lundborg et al, 2003 Prev Vet Med 58: 179-197

Calves with automatic milk feeders in groups of 6-9 vs. 12-18

- 40% lower incidence of respiratory disease
- 40g higher daily gain

Svensson & Liberg, 2006, Prev Vet Med 73: 43-53

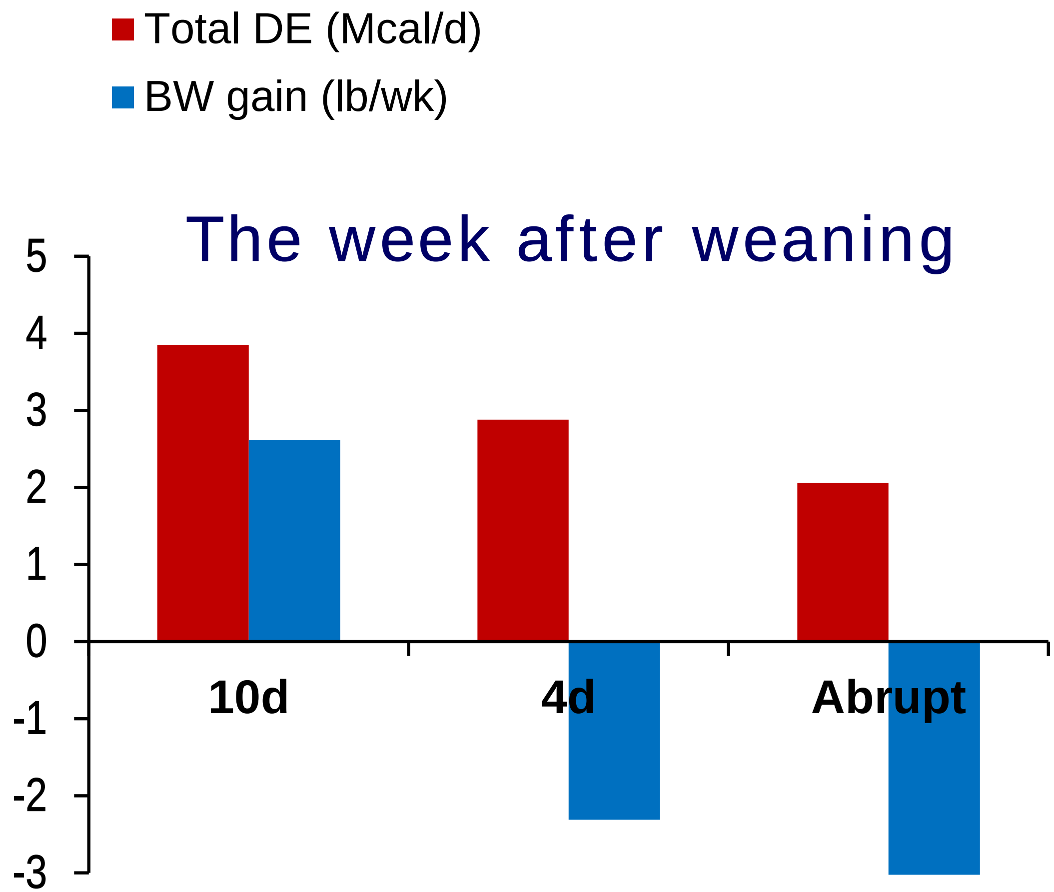
HEALTH AND GROUP MANAGEMENT

- Keep groups small
- Keep groups stable - all in all out
- Enlarge group size by combining existing groups

WEANING CALVES OFF HIGH MILK

Calves fed up to 12 L/d until gradually weaned

Gradual weaning over 10d lead to higher energy intake and higher BW gain than abrupt weaning



Sweeney et al., 2010 JDS 93: 148-152

STARTING CALVES ON STARTER

KEYS TO SUCCESS

Housing and Ventilation (Kevin Janni will cover)

Cleanliness

- Calf housing area
- Feeder

Calf observation & records

HOUSING AND VENTILATION

- 30 to 35 sq. feet per calf is ideal
- Most barns have positive pressure air tubes
- 4 exchanges in the winter months
- 40 exchanges in the summer months
- How do hutch calves compare?
- Do we struggle with issues in hutches?

CLEANLINESS

- Bedding
- Feeder
- Hoses and Nipples

BEDDING SOURCE

- Lots of clean dry bedding
- Drains around nipples
- Ammonia at the bedding surface
- Higher feeding rates = more liquid intake = greater urine output

Drains around nipple and feeding areas

Design barns for easy cleaning

Design barns for easy cleaning

FEEDER CLEANLINESS

- Use the correct soaps
  - Water temp not as hot as pipeline
- Elbow grease is good

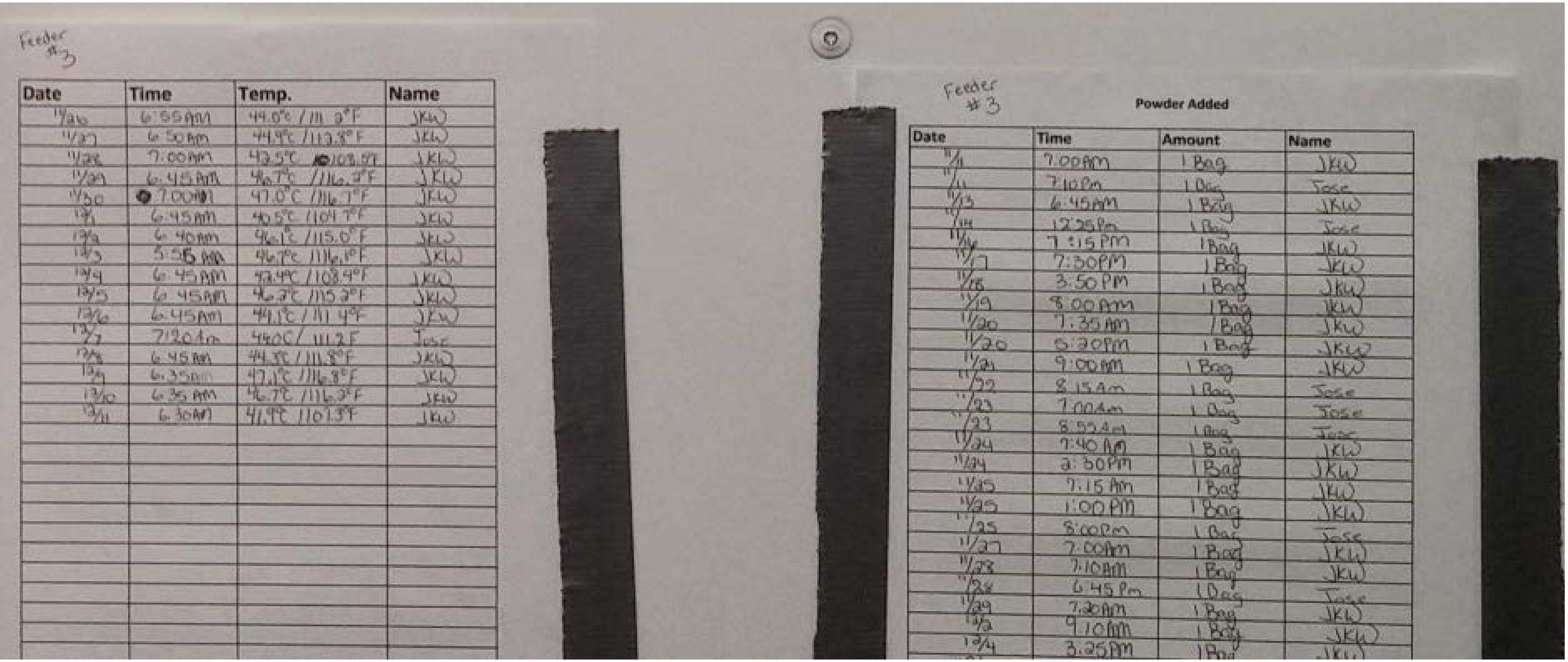
CHECKLIST FOR CLEANING FEEDER

- Switch nipples daily
- Clean hoses, discard once a week
- Periodically clean mixing unit itself
- Replace hose from mixing unit to feeder hose every 6 months

MILK/MILK REPLACER ANALYSIS

Standard Plate Count	Cells/ml
Newer hose	16,035,508
Older hose	3,320,336
Mixer	1,592,391

KEEP GOOD RECORDS


Feeder #3

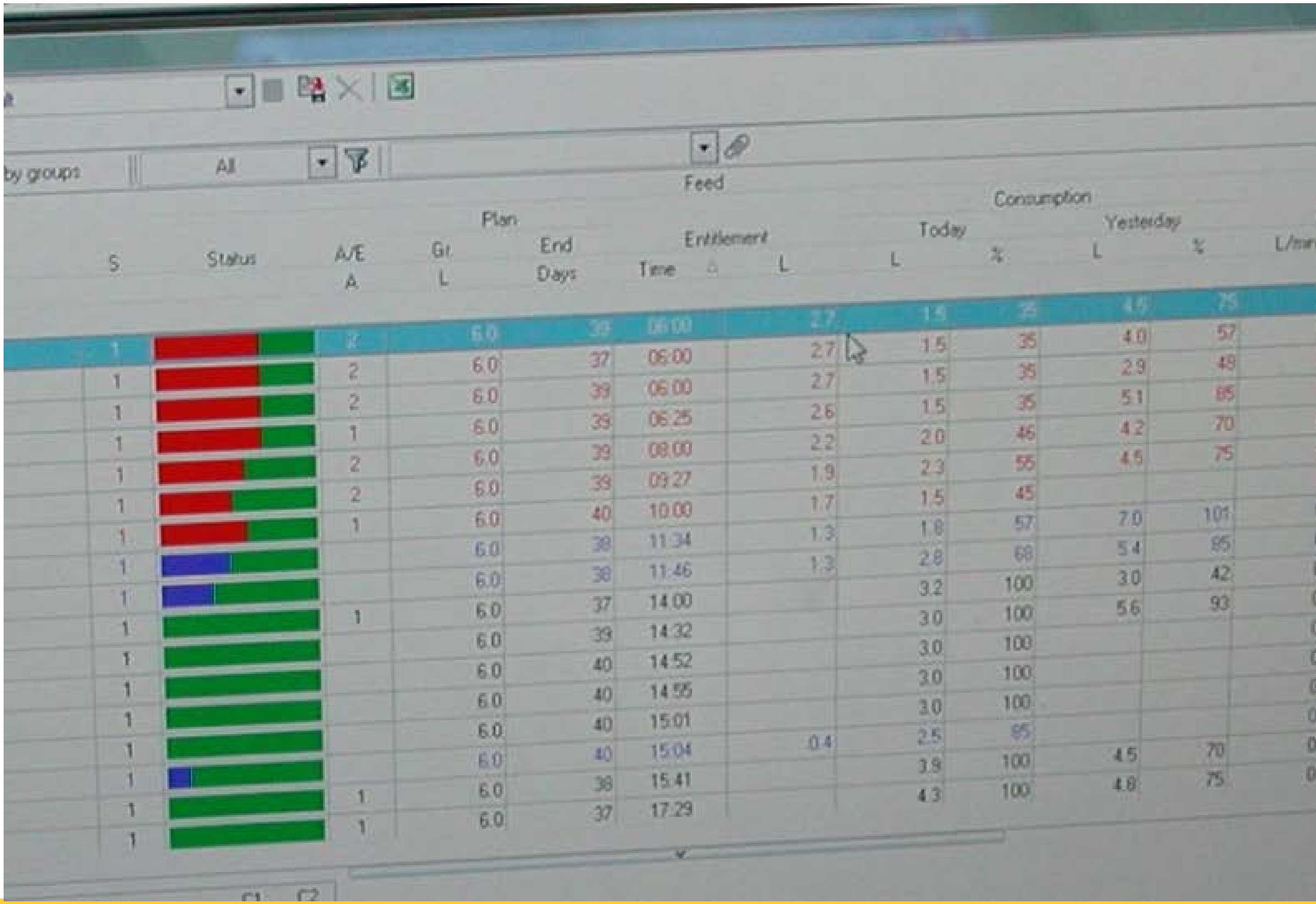
Date	Time	Temp.	Name
11/26	6:55AM	44.0°C / 111.2°F	JKW
11/27	6:50AM	44.9°C / 112.8°F	JKW
11/28	7:00AM	42.5°C / 108.5°F	JKW
11/29	6:45AM	46.7°C / 116.2°F	JKW
11/30	7:00AM	47.0°C / 116.7°F	JKW
12/1	6:45AM	40.5°C / 104.7°F	JKW
12/2	6:40AM	46.1°C / 115.0°F	JKW
12/3	5:56AM	46.7°C / 116.1°F	JKW
12/4	6:45AM	42.4°C / 108.4°F	JKW
12/5	6:45AM	46.2°C / 115.2°F	JKW
12/6	6:45AM	44.1°C / 111.4°F	JKW
12/7	7:20Am	44.0°C / 111.2°F	Jose
12/8	6:45AM	44.3°C / 111.8°F	JKW
12/9	6:35AM	47.1°C / 116.8°F	JKW
12/10	6:35AM	46.7°C / 116.2°F	JKW
12/11	6:30AM	41.9°C / 107.3°F	JKW

Feeder #3

Powder Added

Date	Time	Amount	Name
11/1	7:00AM	1 Bag	JKW
11/1	7:10Pm	1 Bag	Jose
11/3	6:45AM	1 Bag	JKW
11/4	12:25Pm	1 Bag	Jose
11/6	7:15PM	1 Bag	JKW
11/7	7:30PM	1 Bag	JKW
11/8	3:50PM	1 Bag	JKW
11/9	8:00AM	1 Bag	JKW
11/20	7:35AM	1 Bag	JKW
11/20	5:20PM	1 Bag	JKW
11/21	9:00AM	1 Bag	JKW
11/22	8:15Am	1 Bag	Jose
11/23	7:00Am	1 Bag	Jose
11/23	8:55Am	1 Bag	Jose
11/24	7:40AM	1 Bag	JKW
11/24	2:30PM	1 Bag	JKW
11/25	7:15Am	1 Bag	JKW
11/25	1:00PM	1 Bag	JKW
11/25	8:00Pm	1 Bag	Jose
11/27	7:00Am	1 Bag	JKW
11/28	7:10AM	1 Bag	JKW
11/28	6:45Pm	1 Bag	Jose
11/29	7:20AM	1 Bag	JKW
12/2	9:10AM	1 Bag	JKW
12/4	3:25PM	1 Bag	JKW

CALVES NEEDING ATTENTION



ECONOMICS

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ISU Extension DAIRY TEAM

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Estimated Payback Period, Years	**n/a**
Estimated Payback Period, Calves	**n/a**

Available at: http://www.extension.iastate.edu/dairyteam/calves-heifers

TAKE HOME MESSAGE

The Calf Feeder does exactly what it is meant for…feeding calves

Keys to success:

- starting calves on milk
- grouping strategies
- ventilation
- bedding management
- feeder cleanliness

Excellent calf observation

Using software for maximum benefit

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Driven to Discover℠

Understanding and Avoiding Respiratory and Scours Problems in Dairy Calves

"Raising the Best Calf Ever" Workshops

January 5-8, 2015

Russ Daly, DVM, MS, DACVPM
Extension Veterinarian
South Dakota State University

Introduction

- Digestive ailments (25.3% of heifers) and respiratory diseases (18.1% of heifers) are by far the most prevalent causes of illness in pre-weaned heifers.
    - Respiratory illness caused the death of 2.3% of all pre-weaned heifers, while digestive diseases killed 1.4% of all pre-weaned heifers in 2010.
- In weaned heifers, respiratory diseases are the most prevalent causes of illness, affecting 11.2% and killing 1.3% of heifers after weaning (NAHMS, 2011).
- In addition, these ailments contribute to the overall use of antibiotics in dairy heifer raising operations. During 2010, 18.2% of all calves were treated with antibiotics for digestive problems, and 16.4% of all calves were treated with antibiotics for respiratory illnesses.
    - For weaned heifers, 11.0% were treated with antibiotics for respiratory disease.

The Neonatal Immune System

- At birth, a calf has a fully developed but immature immune system. Young calves exhibit:
    - decreased function of phagocytic cells (which engulf foreign viruses and bacteria) – until 4 months of age,
    - decreased levels of "complement" (serum components which destroy foreign germs) – until 6 months of age, and
    - lower numbers of T cells (important in destroying virally-infected cells and in aiding antibody production) – until 8 months of age.
- It's possible for young calves to respond to infections (or vaccines), but the response is weaker, slower, and easier to overcome.

Colostrum

- Since ruminant animals cannot absorb antibodies from their mothers prior to birth, colostrum is the single most important factor in providing a young calf a healthy start to life.
    - Calves that do not ingest adequate colostrum (i.e., experience "failure of passive transfer") are at a higher risk of illness within the first weeks of life and shed higher levels of pathogens into their environment, even if they appear healthy.
- During the calf's first 24 hours of life, the cells lining her intestine have a unique ability to absorb large protein molecules, most importantly immunoglobulins (antibodies).

- This absorptive ability begins to decline right after birth and becomes less efficient with each passing hour. After 12 hours, the efficiency of absorption has significantly declined. Therefore, timing of colostrum feeding is of utmost importance.

- For adequate antibody transfer, a calf needs to absorb 40 grams of immunoglobulin from colostrum. Absorption of immunoglobulins is not 100% efficient, however, so a calf may need to ingest 150-200 grams of immunoglobulins to achieve this level.
    - This translates to approximately 3-4 quarts of good-quality colostrum.
- Guidelines for colostrum feeding:
    - Colostrum should be fed within the first 6 hours of life, and must be fed within the first 12 hours of life.
    - Bottle-fed calves may have slightly better immunoglobulin absorption compared to tube-fed calves but the difference is insignificant.
    - The total amount (3 quarts for Jerseys and Guernseys, 4 quarts for Holsteins and Brown Swiss) can be given in 1 or 2 feedings but should be complete by 12 hours of life.
- Checking for adequate passive transfer:
    - The only way to assess the adequacy of colostrum absorption is to test serum from calves. Serum protein is typically the test of choice.
    - Calves from 6 hours to 1 week of age may be tested. Check at least 12 calves in a cohort.
    - Serum protein level of 5.5 g/dl is considered the cutoff for adequate passive transfer. If 3 of 12 calves are below this level, contributing factors should be investigated.
    - An on-farm test kit can also be used (Quick Test Calf IgG Kit® from Midlands Bio-Products). It uses whole blood and may be handier than using serum protein.
- Powdered colostrum supplements and replacers are marketed and may be useful when colostrum is not available in the desired amounts.
    - True colostrum replacers (Acquire®, Secure®, Land o Lakes Colostrum Replacement®) supply more than 100 grams of immunoglobulin per dose.
    - Colostrum supplements (Colostrx®, LifeLine®) provide less than a full requirement of immunoglobulin, typically 30-50 grams. They should only be used as an adjunct to other sources of colostrum if quantities are inadequate.

Respiratory Disease

- Respiratory disease in dairy calves is typically associated with bacteria such as *Pasteurella multocida*, *Mycoplasma bovis*, *Mannheimia hemolytica*, and *Histophilus somni*.
- However, these same bacteria are common inhabitants of calves' upper respiratory tracts. In healthy animals, their innate and active immune systems keep the bacteria in check, preventing rapid bacterial growth, colonization, and invasion of the deeper lung tissue.
- When the normal defenses of the upper respiratory tract are hampered, the result is respiratory disease in the form of fever, cough, nasal discharge, and difficult breathing.
    - These sick calves also shed greater numbers of bacteria, which contribute to the increased colonization of non-affected calves.
    - Common ways the respiratory tract defenses are disrupted include:

        - Viral infections. Several respiratory viruses can damage the upper respiratory tract, as well as tissue deeper in the lungs. This damage enables bacteria to gain a foothold into these deeper tissues, where severe inflammation results.
            - These viruses include IBR (infectious bovine rhinotracheitis virus, or "red nose"), BRSV, (bovine respiratory syncytial virus), BVDV (bovine viral diarrhea virus), and PI-3 (parainfluenza 3 virus). Bovine coronavirus has been increasingly identified in respiratory cases, however its role is still being studied.
            - With the possible exception of BRSV, these viral infections do not induce fatal pneumonia cases all by themselves.
        - High bacterial counts in the airspace. High numbers of airborne bacteria, even non-pathogenic strains, are associated with respiratory disease in calves. They increase the workload of the respiratory defenses.
            - High ambient temperatures and solid individual pen dividers are associated with high bacterial counts. High ammonia levels and humidity are not consistently associated with high bacterial counts, but are indicators of air quality.
- Older calves are more likely to be sources of higher levels of pathogenic bacteria than are younger calves. Therefore, segregation of calf groups by age cohort and use of smaller calf groups (7-10 calves/group) can decrease the levels of respiratory disease.
- Intervening when respiratory disease hits:
    - Individual sick calves are best segregated from group arrangements into an individual pen or hutch.
    - Appropriate antibiotic and anti-inflammatory treatments should be administered upon consultation with the herd veterinarian. Nutritional support via milk is essential.
    - All calves that die should be examined via post-mortem. Most respiratory disease cases will respond to similar interventions (improving air quality, decreasing group sizes, etc.) regardless of which pathogen is involved, but some cases warrant special consideration:
        - Aspiration pneumonia causes a different pattern of lung damage compared to pathogenic bacteria. Fluid entering the airways causes lung damage primarily in the dorsal (upper lung near the backbones) mid-section of both lungs adjacent to the large bronchi, while pathogenic bacteria have a cranio-ventral (lower lung lobes nearer the sternum) orientation.
        - Mycoplasma pneumonia causes a different type of lesion compared to other bacterial causes. Sources of mycoplasma include waste milk in addition to colonization from other animals and disruption of the upper airway defenses.
- Vaccination to prevent respiratory disease. As previously mentioned, young calves have a reduced ability to respond to vaccines due to their immature immune system, but also because of interference by maternal antibodies they received through colostrum.
    - Vaccination programs for young dairy calves tend to be very extensive, oftentimes with questionable rationale regarding vaccine type and timing.

  - Intranasal vaccines tend to be better at stimulating immunity against respiratory viruses in young calves, and are appropriate to administer at a young age (1-2 weeks). An example is Inforce 3® (IBR, BRSV, and PI3).
  - Intramuscular or subcutaneous modified live vaccines should not be given to calves younger than 4-5 weeks of age. Undue immunosuppression, especially from the BVDV portion of the vaccine, may result.
  - Calves should be boostered with the viral vaccine (intranasal for younger animals, possibly MLV IM or SQ vaccine for older calves) 2 weeks prior to weaning.
  - There is little unbiased evidence regarding the use of bacterial respiratory vaccines such as Mannheimia or Pasteurella in pre-weaned dairy calves. If used, they should be administered based on timing prior to historically observed outbreaks of respiratory disease (such as post-weaning, post-transportation, or following pen changes).
- Metaphylaxis to prevent respiratory disease. This involves the injection of a full dose of an appropriate respiratory antibiotic to all calves within a group in anticipation that respiratory disease will occur. This practice is designed to treat calves with low-level respiratory disease and may change the bacterial pathogen dynamics within a group such as to decrease bacterial transmission between calves. Producers who depend on metaphylaxis to avert respiratory disease in calves should look closely at other risk factors that contribute to the occurrence of disease such as ventilation, housing, sanitation, and group sizes and age structure.

Scours Disease

- Diarrhea in young calves results from disruptions in the intestinal tract that interfere with absorption of fluid from the intestine, or create conditions in which excessive fluid is transferred from body tissues into the gut.
- Many different pathogens can be implicated in calf diarrheal disease. In outbreak situations, multiple pathogens are much more commonly found compared to pure infections of one germ only.
  - Viruses. Rotavirus and coronavirus attack the absorptive cells that line the gut. When these cells are destroyed, fluid absorption is diminished, resulting in diarrhea. Calves from 5-14 days of age are the most susceptible to viral diarrhea.
  - Protozoa.
    - *Cryptosporidium parvum* is a protozoa that is extremely common in dairy calf environments. It affects calves from 7-28 days of age. Most calves are exposed to cryptosporidia, but not all succumb to illness. Factors such as passive immunity and sanitation affect the calf's susceptibility to clinical diarrhea caused by crypto. When uncomplicated by other digestive pathogens, cryptosporidiosis results in a pudding-like stool with mucus and small amounts of blood. Cryptosporidiosis is a potentially zoonotic disease, and those taking care of young calves should practice good cleanliness to prevent potentially debilitating illness from affecting themselves.

        - Coccidia are protozoal organisms that can wreak significant damage to the cells that line the intestine. Bloody diarrhea is the common result of infection with coccidia. Since the organism takes a significant length of time to damage the gut, coccidiosis is only very rarely diagnosed in a calf less than 28 days of age.
    - Bacteria. Calves are exposed to billions of bacteria in their housing environments every day, but only some of these bacteria are capable of causing diarrheal disease in calves.
        - Pathogenic (or "enterotoxigenic") strains of *E. coli* can cause diarrhea and sudden death only in very young calves (0-5 days), as older calves no longer have the specific "receptor" spots on their intestinal cells for the bacteria to attach. These bacteria do not damage the intestine per se, but they secrete factors that promote the secretion of copious amounts of fluid from the body tissues into the gut.
        - *Clostridium perfringens* bacteria are typed according to the toxins they secrete. *C. perfringens* Type C has been implicated as a cause of bloody diarrhea and sudden death in very young calves (0-5 days of age). *C. perfringens* type A is thought by some to contribute to mild diarrhea and abomasal bloat in older (2-6 week old) calves.
        - Certain strains of *Salmonella* (*S. dublin*, *S. newport*, *S. typhimurium*, among others) can cause severe illness and death in groups of calves, usually in calves 2 weeks of age of older.   An outbreak of salmonellosis can quickly result in significant mortality, and should be immediately addressed with proper treatments, supportive care, and a heightened commitment to sanitation of housing and equipment.
- Intervention. Any calf with diarrhea (defined as fecal consistency more watery than pancake batter) can benefit from treatment. Treatment of scours is based on correcting the major problems that go along with diarrhea:
    - Dehydration due to fluid loss (intervention: replace water)
    - Metabolic acidosis (intervention: replace the buffers lost in diarrhea)
        - Acidosis is a common problem with scouring calves. Signs of acidosis include depressed brain function, decreased suckle reflex, weakness, and incoordination.
        - Metabolic acidosis is not always well-correlated with dehydration. A calf can be very sick due to acidosis and be well-hydrated.
    - Electrolyte abnormalities (intervention: replace the electrolytes)
    - Lack of nutrition due to malabsorption (intervention: supply energy source)
- Oral fluid solutions are the first line of treatment for scouring calves. They should be chosen based on their ability to:
    - Supply enough sodium to combat the loss of body fluid
    - Provide substances that promote sodium and water absorption from the gut
    - Provide buffers to reverse metabolic acidosis
        - Most calf electrolyte products contain alkalinizing agents such as bicarbonate, acetate, and proprionate. Acetate and proprionate are preferred for many

    different reasons including: better stimulation of water absorption; better ability to maintain an acidic abomasum (which cuts down on bacterial growth); better inhibition of Salmonella growth; and better energy.
    - Bicarbonate is a common component of electrolyte products sold in the US. One product containing acetate is available in the US, Hydro-lyte®.
  - Provide an energy source
- Calves undergoing treatment for scours should be isolated from other calves and removed from group housing while they are sick.
- Calves that are severely dehydrated and/or acidotic to the point where they are no longer able to rise without assistance will need intravenous therapy – oral fluids will be too little, too late in these animals.
- Additional treatments for scouring calves:
  - Antibiotics. Research has shown that up to 30-40% of scouring calves develop high levels of bacteria in their bloodstream that can subsequently cause systemic problems, regardless of the cause of diarrhea. Therefore, injectable antibiotic treatments directed against systemic coliform bacteria (ampicillin, ceftiofur) are indicated in scouring calves, even those suffering from viral diarrhea.
  - Oral antibiotics should be used with caution in sick as well as healthy calves. Many pills currently available do little to prevent coliform bacteria from entering the bloodstream. Overuse of oral antibiotics may contribute to problems with the normal intestinal flora.
  - Other medications that are commonly used to treat calf diarrhea have very little research behind their use. Some, such as "pepto-bismol"-type products, intestinal motility modifiers ("Immodium"®), and probiotics, have been associated with an increase in severity of diarrhea and should not be used.
- Prevention
  - Scours problems are invariably due to an overwhelming exposure of very young calves to excessive numbers of pathogens in their first hours of life (calving areas, temporary housing, transportation, etc.) or failure of passive transfer. These risk factors should be the first addressed when investigating the causes of scours problems. Ongoing contamination from bedding or milk feeding equipment should also be investigated.

Abomasal bloat

- Bloating, or distention, of the abomasum is a frequently-identified problem in young calves, especially in the 2-6 weeks age range.
- While many have implicated Clostridial organisms in cases of abomasal bloat, many other risk factors have been identified, and should be addressed first:
  - Use of "accelerated growth" milk replacers.
  - Other intestinal conditions or medications that cause indigestion or decreased gut motility.
  - Use of poor-quality (soy-based) milk replacers.
  - Sudden changes in milk replacer feeding:

        - Amounts
        - Types/brands/formulations of milk replacers
    - Milk fed too cold or too hot (should be fed at body temperature [102 F])
    - Erratic feeding schedules
    - Improper milk replacer mixing
        - Chunks of powder present in fed product
        - Too much powder, not enough powder mixed with milk
    - Not offering water to calves
    - Failure of passive transfer (colostrum)

NOTE: Product trade names are used for purposes of illustration only and do not constitute an endorsement of those products.

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Using Feed-Grade Antibiotics for Livestock: Changes are coming

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Recently, livestock producers and veterinarians have been made aware of changes coming in the way antibiotics are used in food animals. One year ago, the Food and Drug Administration (FDA) published a final "guidance for industry" that starts the clock running on some of these changes. Initially, it's the animal health companies that will be adjusting their practices -- adjustments that will eventually make their way down to the people who prescribe and use the drugs: veterinarians and livestock producers.

The role of livestock antibiotics in contributing to resistant bacterial infections in humans is complex and has been long-debated. Producer associations have seen the writing on the wall for a couple of years now that these changes were coming. But what do they actually mean for producers?

What will change:

The labeled uses of "medically important" antibiotics for growth promotion and improvements in feed efficiency will go away. The FDA has asked drug manufacturers to voluntarily take these uses off their products' labels. Because extra-label use of feed grade antibiotics is illegal, these uses will no longer be legal as well. All companies manufacturing feed-grade antibiotics have told the FDA they will do this. Over the next two years, the companies will be gradually making those changes to their labels, so livestock producers currently using antibiotics for growth promotion will have time to adjust, depending on how quickly the companies switch over.

The list of what FDA considers "medically important" antibiotics is pretty long. It contains older drugs like tetracyclines and penicillin along with classes of drugs that are more critical to human medicine, such as cephalosporins and fluoroquinolones. When it comes to growth-promoting antibiotics that fall into this category, it's drugs like tetracyclines, tylosin, and neomycin that will be affected.

These "medically important" products will shift from over-the-counter to "Veterinary Feed Directive" (VFD) classification – possibly with new label indications for treatment, control, or prevention. The VFD is not a new classification; it's currently being used for newer feed-grade drugs like Pulmotil® in pigs and cattle and Nuflor® in pigs and fish.

This means that before a producer can obtain (for example) CTC (chlortetracycline) crumbles for his calves or pigs, he will have to obtain a VFD form filled out by his veterinarian. The form will specify the farm and animals to be treated, the duration of treatment, and which drug is to be used. The feed mill or distributor would need to have a properly completed VFD before they could supply the feed.

These VFD regulations apply as well to medicated milk replacers, since they are feed-grade medications. A milk replacer labeled for “control of respiratory disease” and containing chlortetracycline, for example, will now require a VFD form from a veterinarian in order for a producer to purchase and use the product.

The VFD won’t be able to come from just any veterinarian. A veterinarian would only be able to issue a VFD for use in animals “under his or her supervision or oversight in the course of his or her professional practice, and in compliance with all applicable veterinary licensing and practice requirements.” Right now VFD’s have to be issued in the midst of a valid veterinary-client-patient relationship (VCPR) that’s spelled out by federal regulation. The new changes add some flexibility in that this relationship will be deemed appropriate by state and professional entities, such as the Board of Veterinary Examiners in South Dakota. This flexibility means that far-flung cattle enterprises may not need to be treated the same as an intensely managed hog operation, in regards to veterinary oversight. But it still means that a veterinarian needs to be involved – one that knows the operation and its needs well.

The VFD forms will be easier to manage. Everyone’s recordkeeping requirement will be cut from 2 years to 1 year. The forms will be able to be transmitted and stored electronically. And thankfully for this veterinarian, they will no longer have to include an estimate of how much of the medication the animals will consume in the given time frame (this was hard to accurately guess a lot of times). The form will need to simply specify the inclusion rate of the drug, the number of animals to be fed, and the duration of the feeding.

What won’t change:

The ability to use feed-grade antibiotics to treat, control, or prevent bacterial diseases. The term “prevention” is used in the situation where there is a very high risk of illness if you don’t administer the antibiotic. However, producers will need to obtain a VFD for these products as explained above.

How one uses and obtains non-“medically important” feed grade products. Examples of these include ionophores like Rumensin®, Bovatec®, most coccidiosis medications, and certain growth-promoting medications like bacitracin (BMD®). Since they’re not used very often if at all in human medicine, there will be no changes in their use.

Uses of injectable antibiotics. However, this proposal would also move over-the-counter medically-important water medications to “prescription” status like many injectable antibiotics.

Extra label uses of feed-grade medications. Any use of feed grade medications not in accordance with their label is illegal now, and it will remain so.

The ability of current distributors and feed mills to supply these products. Yes, there will be more paperwork related to more VFD forms, but these new proposals do not limit these businesses in what they can carry or manufacture.

The need for veterinarians to be involved in decisions about feed-grade antibiotics. There is no better source of information about the proper uses of these products in livestock populations than the herd veterinarian. A close relationship with a veterinarian means that producers may avoid wasting time and money on ineffective uses of these products. Better yet, it may result in practical advice on how to prevent illnesses that would necessitate the uses of these products.

Antibiotic resistance is a complex and sometimes contentious topic among animal and human health professionals. The complexity of the issue means that a “silver bullet” solution is not going to present itself any time soon. All of us involved in using these products—in animals and people alike—play a role in ensuring that they continue to work for the sake of our animals and our family members. Understanding these proposed changes and proactively deciding how they will work into your operation is a great first step that we can all take.

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