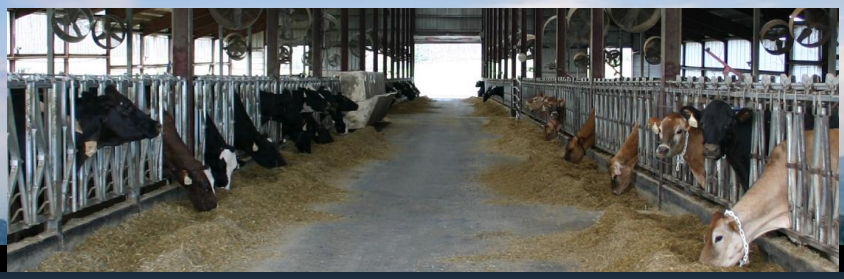

VTDairy–Home of the Dairy Extension Program at Virginia Tech

Early Youngstock Rearing
Beef vs. Dairy

Bob James

VirginiaTech Invent the Future | Virginia Cooperative Extension | VSU Virginia State

Traditional Objectives of Dairy Calf Feeding – 1950 - ????

- Individual housing
  - Prevent spread of disease
  - Calf hutches, Indoor stalls or elevated crates
- Colostrum management / nurse the dam or hand fed – immediate removal from dam
- Nutrition
  - Limit feed – one lb of milk or MR solids
  - Encourage early starter intake and early weaning.

Motivation for these practices?

- Isolation for disease control
- Encourage early starter intake by limiting milk or MR intake
- Reduce cost
  - Less milk or MR which is $$$$
    - Milk = $.20 / lb. = $1.60/lb. of DM
    - Calf starter grain = ~ $.15 - $.20/lb. of DM
  - Less labor for weaned vs. milk fed calves
  - Less disease in weaned calves???

Challenges to dairy calf rearing due to traditional management systems

- Dry cow management
- Calving difficulty for Holstein's
- Calving location
- Colostrum management
- Young calf nutrition
- Housing
- Weaning

Dry cow management

- Body condition of dry cow - 3.25 – 3.5.
  - Impact on calf
  - Body fat content of the calf and body condition of dam
- Qualitative nutrient content of dry cow diets

Nutrient density of dry cow diet

Nutrient	Nutrient density conventional - % DM Basis	Nutrient Density Anionic - % DM Basis*
Crude protein	13 – 14	13 – 14
Ne_l Mcal/lb.	.6 - .64	.6 - .68
Acid Detergent Fiber	>28	>28
Neutral Detergent Fiber	36	36
Forage NDF	>27	>27
Ca	.45 - .55	1.4 – 1.6
P	.3 - .35	.35 - .4
Mg	.2	.28 - .32
K	.8 – 1.0	.8 – 1.0
S	.2	.35 - .40
Salt	.25	.25

Nutrient density of dry cow diets

Nutrient	Nutrient density – conventional - % of DM	Nutrient density – anionic - % of DM
Manganese	44	44
Zinc	70 – 80	70 – 80
Selenium (added)	.3 ppm	.3 ppm
Co	20 ppm	20 ppm
Iodine	.5 ppm	.5 ppm
Vitamin A	1,000 IU/lb of DM	1,000 IU/lb. of DM
Vitamin E	35 – 35 IU/lb. of DM	35 – 35/lb of DM
DMI	1.8 – 2.2% of BW	<2.0% of BW*

* Estimate DMI of dry cows!!!!!

Calving difficulty

Breed	Cows	Heifers
Holstein	13.7%	22.6%
Swedish Red	1.9%	3.9%
Norwegian Red	1.1%	2.7%
Jersey	<1%	<2%

Source: J.Mee – WCDS, 2012
National All Jersey.

Colostrum management

Not colostrum again!

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Composition of Colostrum

- 1ml >10^6 maternal immune cells
  - IgG (immunogobulin G)
  - T and B Lymphocytes
  - Neutrophils and Macrophages
- Nutritional value
  - 23.9% solids
  - 6.7% fat
  - 14% protein

Colostrum composition by milking

		Milking		
Item	**1**	**2**	**3**	**Milk**
Specific Gravity	1.06	1.04	1.04	1.03
Solids, %	23.90	17.90	14.10	12.90
Protein, %	14.00	8.40	5.10	3.10
Casein, %	4.80	4.30	3.80	2.50
IgG, g/l	48.00	25.00	15.00	0.60
Fat, %	6.70	5.40	3.90	3.70
Lactose, %	2.70	3.90	4.40	5.00

Source: Foley and Otterby

Calf body weight	40	kg
Plasma volume (9% of BW)	3.6	liters
Minimum Plasma concentration	10	g/L
Apparent efficiency of absorption	35	%
Required IgG intake (3.6 × 10 / 0.35)	103	grams
Colostral concentration	50	g/L
Required amount to feed	2.1	L

Figure 1. Estimated colostrum required by a 40 kg calf to achieve minimum plasma IgG concentration of 10 g/L at 24 hours of age.

Colostrum

- Minimum of 100g in 1st 6 hours
- If conditions are ideal!!!!
- Holstein colostrum - 48 g IgG/L
- Jersey colostrum – 66 g IgG/L

Quality

- >85% of 1st milking colostrum over 50 g/liter
- Using colostrometer
  - room temperature – 22°C
  - Adjust readings for temperature
  - Body temperature =+14
  - Refrigerated = - 14

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Quality

- >85% of 1st milking colostrum over 50 g/liter
- Using Brix Refractometer
  - Not temperature sensitive
  - More durable than colostrometer
  - Readings > 21indicate good quality colostrum
  - RID values > 50mg IgG/mL

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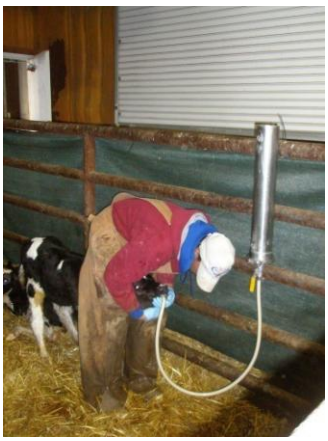
Quantity

- 4 liters in 1st 6 - 12 hours
- Bottle feed?
- Tube fed?



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Esophageal feeder 101

- Sanitation of esophageal feeder???
- Recent sample
  - >2,500 cfu/in^2
  - Overgrowth with E. coli
- Cuts in the ball

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Feeding colostrum with esophageal feeder –. Benefits vs risks

- Benefits – they got it
- Routinely tubing calves with one gallon?
- Consumption of second feeding.

First one there is the winner!

It's a race between bacteria in the environment or the initial feeding and the antibodies in colostrum.

One reason why it's important

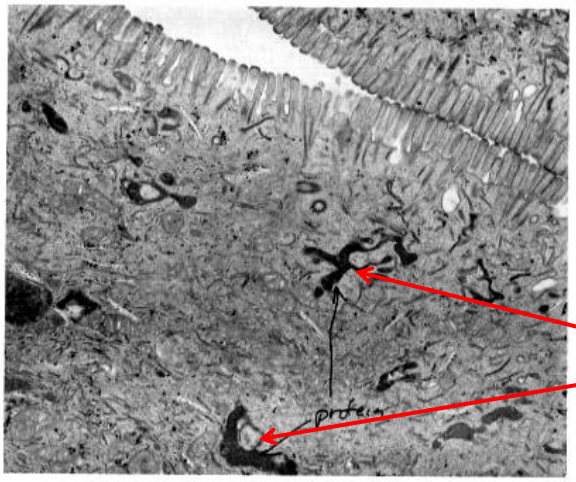


FIG. 4. Ileal epithelial cells from a calf which had received colostrum prior to *E. coli* were unaltered cytologically. Dark aggregations of colostral proteins were in the apical tubular system of the cells (approximately 14,000×).

Early consumption of colostrum before exposure to ???

Colostrum protein

One reason why it's important!

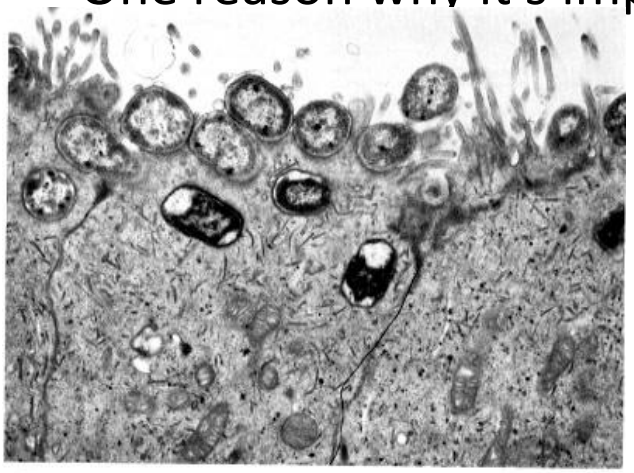


FIG. 2. Apical ends of several ileal epithelial cells from an *E. coli* exposed calf which had received no colostrum. The microvilli were largely absent at the sites of *E. coli* attachment. *E. coli* were also within the apical cytoplasm (approximately 16,000×).

Early exposure to E. coli without colostrum intake

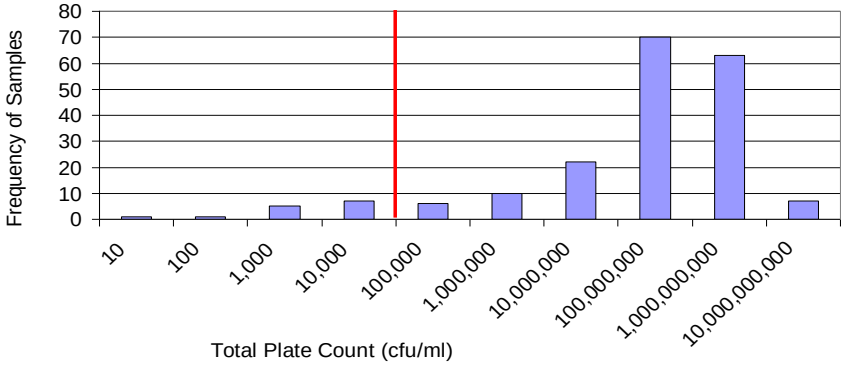
Total Bacteria Counts in Minnesota Colostrum

(Swan et al. 2007. JDSci. 90)

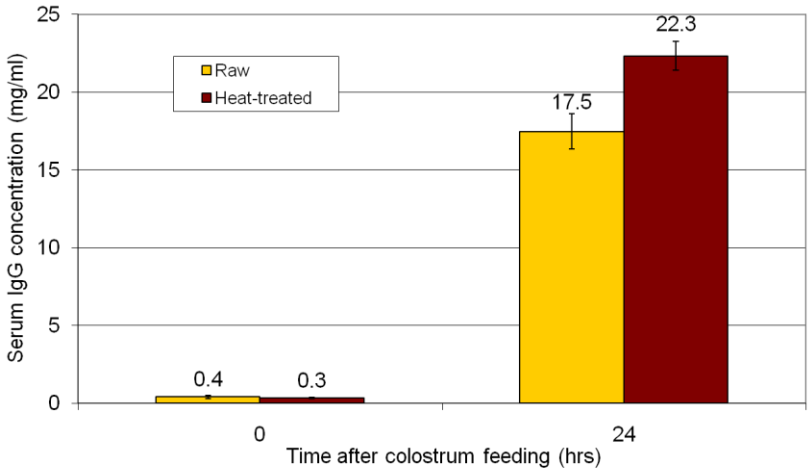
Median TPC = 615 million cfu/ml (73 to 104 billion)

93% of samples > 100,000 cfu/ml TPC

"*We are feeding 'fat-laden' manure*" Rob Trembley, 2006



Serum IgG levels were significantly higher in calves fed heat-treated colostrum



Godden et. al. 2006

Recent UMN Field Study

M. Donahue, S. Godden

- 1,000 calves / 6 herds
  - ½ fed raw and ½ fed heat-treated colostrum
- Colostrum total plate count and serum IgG – **negative effect**
- Colostrum IgG concentration – **positive effect**
- Heat treatment – **positive** – independent of Total plate count

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Heat treated colostrum

Godden et al. 2012

Measure	Heat Treated Colostrum	Fresh Colostrum
Standard plate count, cfu/ml	2,000	515,000
Coliform count, cfu/ml	90	51,500
Serum IgG – ml/ml	18.0	15.4
Incidence of scours (%)	16.5	20.7

All calves fed 3.8 Liters within 60 minutes of birth

Colostrum management – three Q's

- Quantity – 4 liters
- Quality – 50g IgG/liter
- Quickness – As soon as possible

Plasma IgG – 10g/liter

Cleanliness - <50,000 - 100,000 cfu/ml**

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Colostrum management – critical points

- Location
  - Calving area
  - Fresh cow milking
  - Calf housing
- People – who is responsible?
  - Fresh cow milking?
  - Colostrum handling?
  - Calf feeding

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Disconnect cont'd

- Quality
  - Colostrum handling –
    - Feed immediately or cool as soon as possible
    - Rapid cooling – frozen Coke bottles in bucket.
      - 6 hours at room temp = 6,000,000 cfu/ml
    - Clean containers
      - Luke warm water rinse
      - Hot soapy water
      - Sanitizer
      - SPC / sq. in. < 1,000

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Two recent herd visits

- Dairy 1
  - >25,000,000 /ml SPC, >15,000 coliform /ml, E. coli - TNTC
  - 8 calves < 7 days - serum protein – 3.9 – 4.6 g/dl.
- Dairy 2
  - >25,000,000/ml, >15,000 coliform, E. coli TNTC -
  - 9 calves < 7 days – serum protein 3.9 – 5.2 g/dl

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Dairy calf nutrition

- How much milk does a beef cow give?
  - 1st week?
- How much milk does a beef calf consume?

Conventional Calf Feeding Program

- 1 lb. / day or one gallon/day
- 20% protein: 20% fat milk replacer
- Calf Starter - 16 – 20% CP.

A more methodical approach to calf nutrition

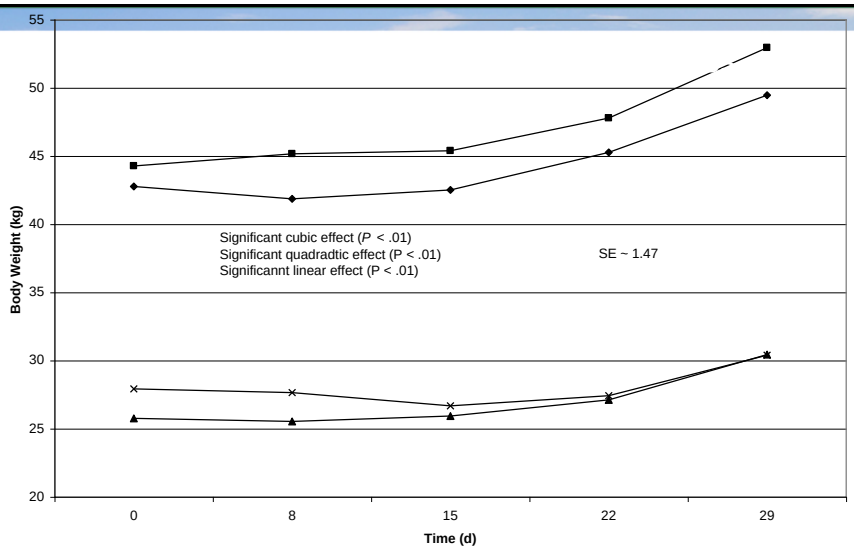
- What should milk replacers contain?
- Nutrient requirements should be based upon studies which measure growth.
- Define growth
  - Weight
  - Stature
  - Reproductive maturity
- Based upon composition of growth – fat, protein, ash - slaughter studies.

What is nutrient content of whole milk ?

Milk	DM%	Fat%	Prot%	Lactose	Ash%
Holstein	12.3	3.6	3.0	5.0	.7
Jersey	14.5	5.0	3.8	5.0	.7

Compare whole milk on a powder basis?

Liquid feed	DM %	Fat%	Protein %
Holstein	100	28.8	24
Jersey	100	34.5	26.2



BW (kg) on d 1 to d 29 of Holstein females (♦), Holstein males (■), Jersey females (▲), and Jersey males (×). Significant breed by time interaction; differences detected on all d. (Mowrey, 2001).

Feeding more 20:20?

- 115 lb. Calf – 60°F
- Feed 2 lb/day of powder instead of 1 lb.
- 15% solids

- Milk DMI = 2.0 LB.
- Energy allowable gain = 1.74 lb. / day
- Diet ME – 2.15 Mcal
- Diet CP = 20%
- Diet dig. CP = 18.5%
- ADP allowable gain = 1.29 lb. / day
- Crude protein balance = -52g/day

Amount of Milk or Milk Replacer Needed to Meet *Maintenance* Requirements – gaining NO weight!

Temp. °F	59[a]	32	5
Body weight, lb	Lb milk or milk replacer/d		
110 (MR)	1.00	1.35	1.77
110 (milk)	0.91 (7.3)	1.20 (9.6)	1.51 (12.1)

[a]Lower critical temp. calves less than 21 d age.

Cornell research

- >2,000 calves fed at Cornell
- Range in body weight gains pre-weaning - .5 – 2.5 lb. / day
- Reared together after weaning
- Followed through 1st and 2nd lactations.
- Statistically account for source of variation in lactation yield
- 25% of variation in yield due to gains during milk feeding period!

3X vs. 2X daily Feeding – Same Total Amount Daily.

Item	2x Feeding	3x Feeding	P value
BW Gain (1–42 days), kg	25.1	29.8	0.0001
Hip height gain (1–42 days), cm	8.6	10.3	0.0027
Feed efficiency Gain/DM intake, 1–42 days	0.52	0.61	0.0001
Number weaned	32	34	0.3070
Number lactating	28	34	0.0250
Age first calving, days	734	718	0.2278
ME305, milk production, kg	13053	13568	0.2217

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Calf management 101

- Feed enough solids – 750 – 1000 g
- 20% - 25 % protein – quality
- 10 – 20% fat – depends on season
- Calf environment
  - DRY!!!!
  - VENTILATION
- Calf starter - 20 – 23% protein / palatable

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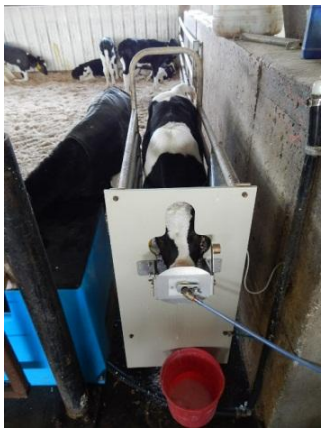
Automatic calf feeders



General recommendations for group housing calves.

- Colostrum status and vigor of calves depend on when they are best introduced to the system.
  - Colostrum monitoring – Brix >23
  - Calf Ig status with refractometer - >85% with serum protein >5.5g/dl
- Place on the feeder – 3? – 14days of age.
  - Less risk of respiratory disease when placed on feeder @10-14 days vs. 6 days (Svennson and Liberg (2006) and Jensen (2008)

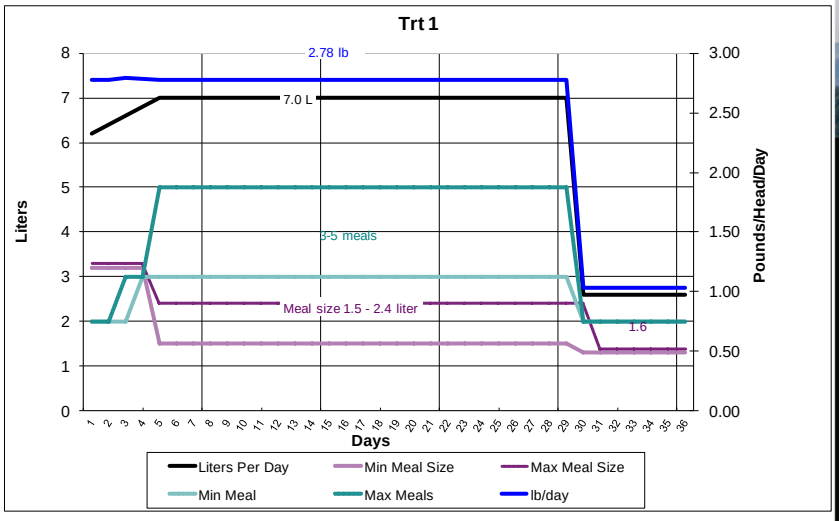
- Training to the feeder
  - Skip morning feeder, place in autofeeder pen an and lead to nipple.
- Stocking rate < 25 per feeder?
- Milk Allowance
  - 1.5 – 2.5 lb of milk solids / day = 1.4 – 2.3 gallons/day
- Meal size - 1 pint to 1 quart (.14 - .28 lb. solids)

- Meals per day
  - Size of mixing bowl – 1 pt?
  - Example 2.2 lb. of solids / day = 16 meals of one pint.
  - Ability to mix multiple batches if calf is allowed
    - Minimum and maximum amount per meal.
  - Sophisticated systems – 3 – 5 meals per day

Example Feeding program

(Backgrounded 12 days)

Figure – courtesy of T. J. Earleywine



Can we learn something from beef cattle?

- Calving environment
- Nutrition
  - More liberal feeding of calves – 2 – 2.75 lb. milk solids
  - More frequent feeding of calves.
  - Group housing of calves.
- What's the payback
  - Morbidity
  - Social stress
  - Lactation yield.