

ACCELERATED CALF FEEDING AND SUBSEQUENT PRODUCTION

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COLOSTRUM

- Colostrum
 - essential for first day of life
 - rich in nutrients

- Total solids 23.9%
- Fat 6.7%
- Protein 4.8%
- Calcium 0.26%
- Vitamin A 295
- Vitamin E 84
- IgG 48mg/ml
- Immunological active cells
- Lactoferrin



WHOLE MILK

- Whole milk
 - Nature's food for calves
 - Pasteurizer
- Bulk Tank---29.9-32.7% Fat, 24.2-27.8% Protein (DM)
- Waste Milk---11.5-55.5% Fat, 20.6%-34.9% Protein (DM)



MILK REPLACER

- Calf milk replacer
 - Usually consistent quality
 - 20-28% Protein
 - 15-25% Fat
 - 0.15% Crude Fiber



WHY INVESTIGATE?

- Intensified feeding of calves for accelerated growth is a hot topic in calf management (10 years).
- These programs involve feeding more milk replacer than in conventional programs, such that calves 1.5-3X the dry milk replacer solids.
- Calves will grow faster (lean muscle and skeletal growth) and attain breeding size earlier, and may even produce slightly more milk.
- Dairy Calf and Heifer Association (DCHA) Gold Standard is to double the weight of the calf from birth to 60 days of age
- Holsteins ~ 1.5# per day
- Jerseys ~ 1# per day



WHY INVESTIGATE?

- 1) Maintenance (Metabolizable Energy) is not small
- 2) For calves to grow fast they need to consume more (milk or starter)
- 3) Calf protein (amino acid) needs are low for maintenance but increase rapidly for growth
- 4) Protein needs for growth plateau around 28%, in regard to milk or milk replacers
- 5) Simply feeding more 20/20 will not provide enough protein and will have relative excess energy, which can lead to fat accumulation.





Report Components

- Calf Requirements
- Mineral Requirements

90# calf
 1.25# of milk replacer
 per day
 75 degrees F

0.86 #/day

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DIET A

Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

Calf Body Weight : 90 (lbs)	Diet ME : 2.10 (Mcal/lbs)
Temperature : 75.0 deg F	Diet NEM : 1.81 (Mcal/lbs)
	Diet NEg : 1.45 (Mcal/lbs)

Calculation of Young Calf Requirements

Allowable Gain

Energy Allowable ADG : ADP Allowable Gain :

Maintenance Requirement Calculations

Total Milk Dry Matter Intake : 1.25 (lbs/day)
 Total Starter Dry Matter Intake : 0.00 (lbs/day)

Net Energy Basal Maintenance Requirement : 0.086 (Mcal/day/BW^{0.75})
 Temperature Multiplier : 1.00
 Net Energy Required for Maintenance : 1.39 (Mcal/day)
 Dry Matter Intake Required for Maintenance : 0.77 (lbs/day)

Efficiency of use of ME for NEM : 0.86
 Metabolizable Energy Required for Maintenance : 1.62 (Mcal/day)

Apparently Digested Protein Required for Maintenance : 27 (g/day)
 Crude Protein Required for Maintenance : 29 (g/day)

Growth Requirement Calculations

Intake Available for Growth : 0.48 (lbs/day)
 Net Energy Available for Growth : 0.70 (Mcal/day)
 Efficiency of use of ME for NEg : 0.69





Report Components

- Calf Requirements
 - Mineral Requirements
- 90 # calf
 1.25 # of milk replacer
 per day
 32 degrees F
- 0.16 #/day**

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Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

Calf Body Weight : 90 (lbs)	Diet ME : 2.10 (Mcal/lbs)
Temperature : 32.0 deg. F	Diet NEM : 1.81 (Mcal/lbs)
	Diet NEG : 1.45 (Mcal/lbs)

Calculation of Young Calf Requirements

Allowable Gain

Energy Allowable ADG ADP Allowable Gain :

Maintenance Requirement Calculations

Total Milk Dry Matter Intake : 1.25 (lbs/day)
 Total Starter Dry Matter Intake : 0.00 (lbs/day)

Net Energy Basal Maintenance Requirement : 0.086 (Mcal/day/BW^{0.75})
 Temperature Multiplier : 1.54
 Net Energy Required for Maintenance : 2.14 (Mcal/day)
 Dry Matter Intake Required for Maintenance : 1.18 (lbs/day)

Efficiency of use of ME for NEM : 0.86
 Metabolizable Energy Required for Maintenance : 2.49 (Mcal/day)

Apparently Digested Protein Required for Maintenance : 27 (g/day)
 Crude Protein Required for Maintenance : 29 (g/day)

Growth Requirement Calculations

Intake Available for Growth : 0.07 (lbs/day)
 Net Energy Available for Growth : 0.09 (Mcal/day)
 Efficiency of use of ME for NEG : 0.69





Accelerated Milk Replacer

Report Components

- Calf Requirements
 - Mineral Requirements
- 90 # calf**
1.88 # of milk replacer
per day
- 1.74 #/day**
- 32 Degrees F**
1.18 #/day

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Calf Requirements

Major Inputs Used to Compute Young Calf Requirements

Calf Body Weight : 90 (lbs)	Diet ME : 2.10 (Mcal/lbs)
Temperature : 72.0 deg. F	Diet NEM : 1.81 (Mcal/lbs)
	Diet NEg : 1.45 (Mcal/lbs)

Calculation of Young Calf Requirements

Allowable Gain

Energy Allowable ADG	ADP Allowable Gain
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Maintenance Requirement Calculations

Total Milk DryMatter Intake : 1.89 (lbs/day)
 Total Starter DryMatter Intake : 0.00 (lbs/day)

Net Energy Basal Maintenance Requirement : 0.086 (Mcal/day/BW^{0.75})
 Temperature Multiplier : 1.00
 Net Energy Required for Maintenance : 1.39 (Mcal/day)
 DryMatter Intake Required for Maintenance : 0.77 (lbs/day)

Efficiency of use of ME for NEM : 0.86
 Metabolizable Energy Required for Maintenance : 1.62 (Mcal/day)

Apparently Digested Protein Required for Maintenance : 28 (g/day)
 Crude Protein Required for Maintenance : 30 (g/day)

Growth Requirement Calculations

Intake Available for Growth : 1.12 (lbs/day)
 Net Energy Available for Growth : 1.62 (Mcal/day)



THERMONEUTRAL ZONE FOR CALVES

- < 3 weeks of age
- 59-77 degrees F
- > 3 weeks of age
- 41-77 degrees F



WHAT'S THE DIFFERENCE?

Conventional

- Protein – 20-22%
- Fat – 15-**20**%
- Feed 1-1.25#/day or 8-10 ounce per feeding
- 2 quarts volume
- Free choice water and grain (20-22% protein)

- Maximize starter intake

Accelerated

- Protein – 26-28%
- Fat – **15**-20% (Jersey 25%)
- Feed 1.88-2.5#/day or 15-20 ounces per feeding
- 3-4 quarts volume
- Free choice water and grain (20-22% protein)
- Varying amount of milk replacer depending on age
- Maximize milk/milk replacer



HOW DO YOU IMPLEMENT?

- As you increase solids, you must be **increased fluid**
- Use only high protein milk replacers
- Mix one batch of liquid for all calves (no individual bottles) to avoid errors in weighing and allow for more thorough mixing.
- For large breed heifers, feed 2 to 2 ½ quarts per feeding (twice a day) for week one.
- Feed 3 to 4 quarts per feeding twice a day from week two to 1-2 weeks before weaning.
- Decrease the amount fed the last 1-2 weeks of feeding milk or milk replacer.
- Water and starter feed should be available free choice at all times starting at day two.



IMPACTING RUMEN DEVELOPMENT: GRAIN EFFECT

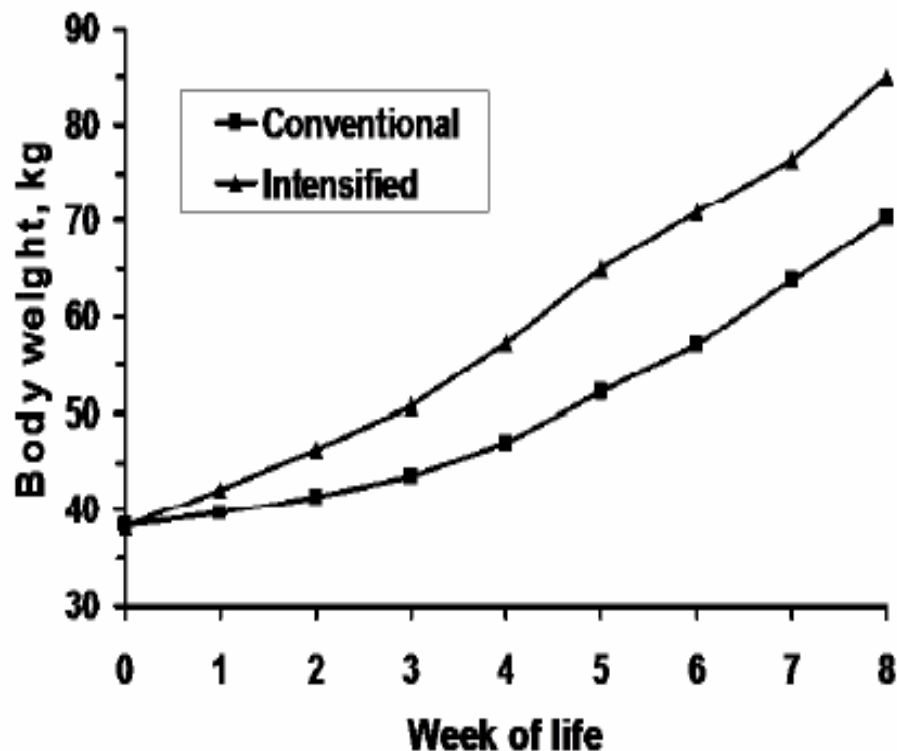


A.J. Heinrichs, The Pennsylvania State University





WHAT HAVE RESULTS BEEN WITH HOLSTEINS ON CONFINEMENT DAIRY FARMS?



The major difference in growth rate is in the first 2-3 wk of life, and after that growth rates generally are parallel.



WHAT HAVE RESULTS BEEN WITH HOLSTEINS ON CONFINEMENT DAIRY FARMS?

■ **Reproduction**

- reach puberty at a younger age
- age at conception lower
- age at calving (14-27.5 days)



WHAT HAVE RESULTS BEEN WITH HOLSTEINS ON CONFINEMENT DAIRY FARMS?

■ Health

- University of Minnesota (whole milk)
 - decreased death loss during winter (2.8% vs 21%)
- Cornell University (Milk replacer)
 - Cryptosporidia
 - maintained hydration better, less days of diarrhea, grew faster, and feed efficiency was better
- Other studies
 - some show increased immune system



WHAT HAVE RESULTS BEEN WITH HOLSTEINS ON CONFINEMENT DAIRY FARMS?

■ **Milk Production (1st lactation)**

- 1000-2000# of increased milk in first lactation
- Parent adjusted milk was greater
- Most studies showed an advantage with over $\frac{1}{2}$ statistical or a trend



WHY INVESTIGATE FOR PASTURE-BASED SYSTEMS?

- Determine if intensified milk feeding in smaller framed dairy heifers will result in:
 - Younger weaned calves at similar weights as traditionally fed calves
 - Decreased breeding and calving age
 - Increase milk production in first lactation



WHAT DID WE DO?





Active Drug Ingredient

Neomycin Sulfate	1300 grams/ton
Oxytetracycline (from oxytetracycline dihydrate base)	1300 grams/ton

Guaranteed Analysis

Crude Protein, min	28.50%
Crude Fat, min	15.00%
Crude Fiber, max	0.15%
Calcium, min	0.75%
Calcium, max	1.25%
Phosphorus, min	0.60%
Vitamin A, min	7500 IU/lb
Vitamin D ₃ , min	2500 IU/lb
Vitamin E, min	50 IU/lb

Active Drug Ingredient

Neomycin Sulfate	1600 grams/ton
Oxytetracycline (from oxytetracycline dihydrate base)	1600 grams/ton

Guaranteed Analysis

Crude Protein, min	20.0%
Crude Fat, min	20.0%
Crude Fiber, max	0.15%
Calcium (Ca), min	0.75%
Calcium (Ca), max	1.25%
Phosphorus (P), min	0.7%
Vitamin A, min	30,000 IU/lb
Vitamin D ₃ , min	10,000 IU/lb
Vitamin E, min	150 IU/lb



PARAMETERS

- 32 Holstein, Jersey or Crossbred heifers assigned to Milk Formula 1 as the traditional milk replacer program
- 43 Holstein, Jersey or Crossbred heifers assigned to Velocity as the accelerated feeding program
- Calves were assigned as groups of 8 and “mob-fed” using 10 nipple feeders
- Birth weight:
 - MF1 = 70.6 #
 - Velocity = 69.0 #
- Average age of start of treatment
 - MF1 = 9.7 days
 - Velocity = 7.0 days

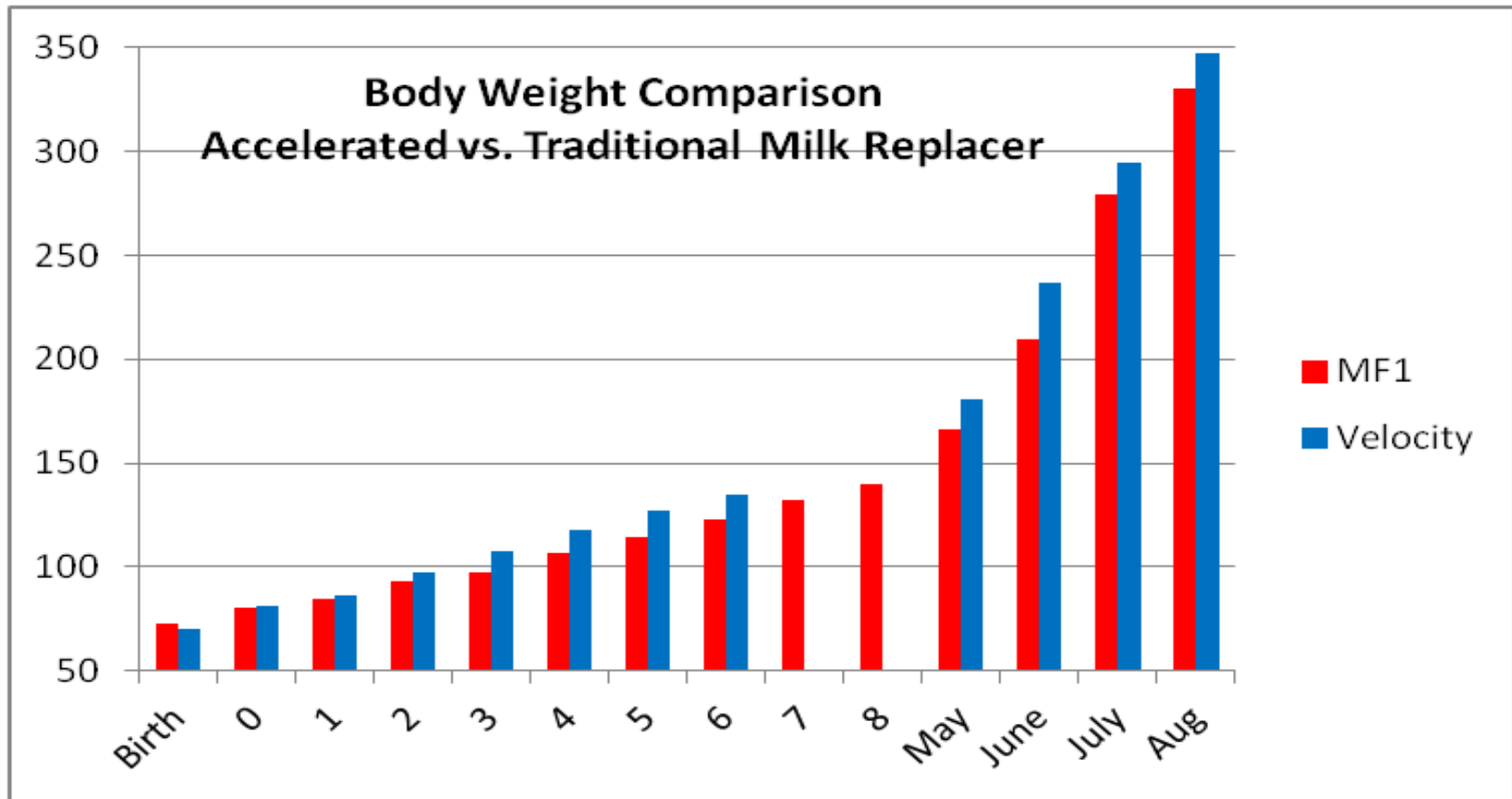


PROTOCOL FOR FEEDING TRADITIONAL VS. ACCELERATED MILK REPLACERS

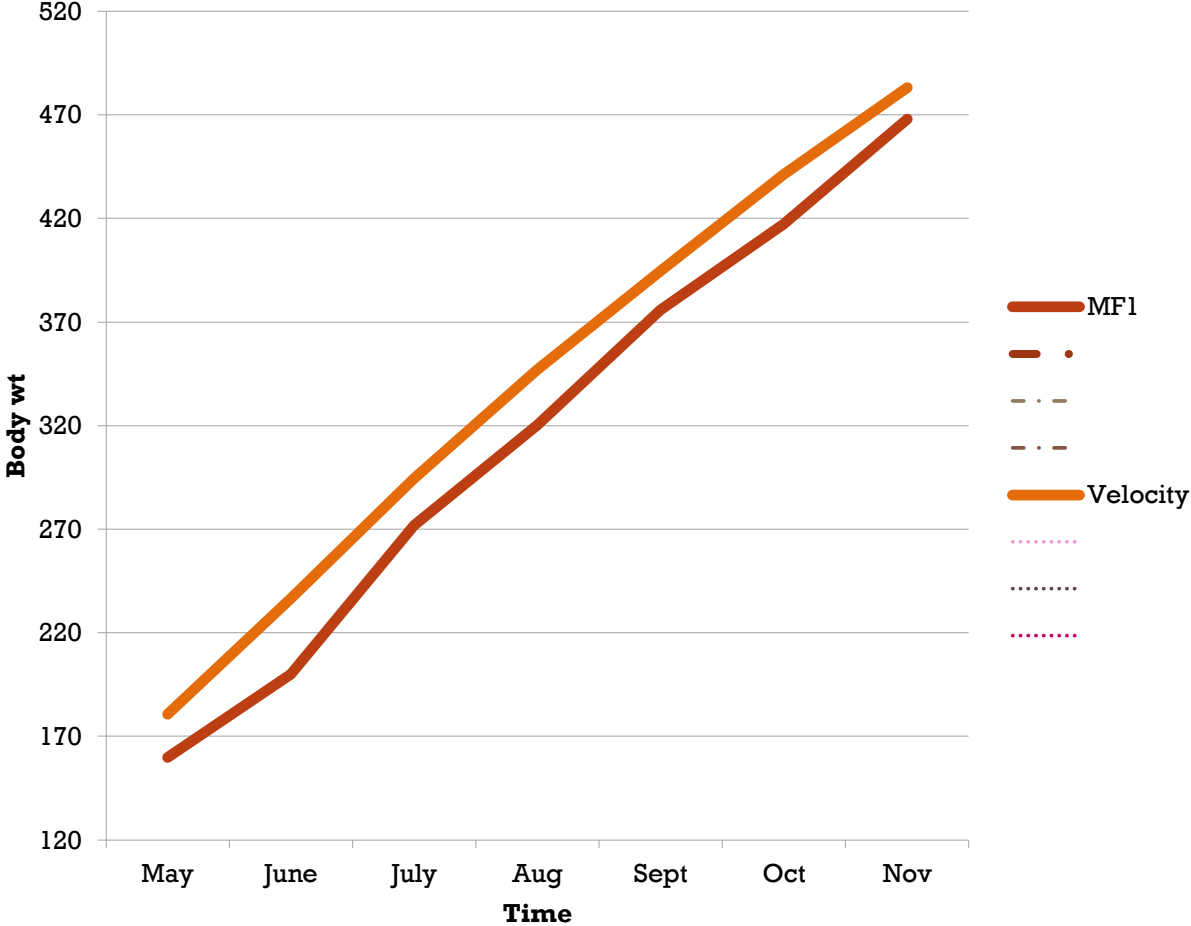
Milk Formula 1-traditional MR								
	week 1	week 2	week 3	week 4	week 5	week 6	week 7	week 8
Oz powder/feeding	7.5	10	10	10	10	10	10	10
warm water (Pints)/feeding	3	4	4	4	4	4	4	4
Milk Formula 1-traditional milk replacer – 68#								
Velocity-accelerated MR								
Oz powder/feeding	7.5	12.5	15	15	15	10		
warm water (pints)/feeding	3	5	6	6	6	4		
Velocity-accelerated milk replacer – 66#								



SOUTHWEST CENTER 2012 BORN CALVES



BODY WEIGHT DIFFERENCES AFTER WEANING BETWEEN HEIFERS FED ACCELERATED OR TRADITIONAL MILK REPLACER: 2012 BORN CALVES



WHAT WERE THE RESULTS AT THE SOUTHWEST CENTER?

■ Growth

- Same advantage as with the confinement Holsteins for preweaning
- Variable at breeding and calving (depending on year)



WHAT WERE THE RESULTS AT THE SOUTHWEST CENTER?

- **Reproduction** (year of breeding)

	2013 and 2014 combined			
	MF1		Velocity	
	32 heifers		43 heifers	
First Service	21	65.6%	32	74.4%
Second Service	5	15.6%	7	16.3%
Third Service	6	18.8%	4	9.3%
Cull	6	18.8%	5	11.6%



WHAT WERE THE RESULTS AT THE SOUTHWEST CENTER?

■ **Reproduction**

Cows in 2014

MF1

Velocity

12 Cows (16)

19 Cows (21)

Preg

%

Preg

%

	# Preg	%	# Preg	%
First service	5	41.7%	11	57.9%
Second Service	6	50.0%	5	26.3%



WHAT WERE THE RESULTS AT THE SOUTHWEST CENTER?

■ **Health**

- No advantage
- Historically, calf health was excellent when dairy personnel raised the calves.



WHAT WERE THE RESULTS AT THE SOUTHWEST CENTER?

■ Milk Production (1st lactation)

Year of Birth	Treatment	ME305 FCM
2012	Milk Formula 1	14,400
2012	Velocity	14,877
2013	Milk Formula 1	15,766
2013	Velocity	16,760
Total	Milk Formula 1	15,110
Total	Velocity	15,871



WHY INVESTIGATE FOR PASTURE-BASED SYSTEMS?

- Determine if intensified milk feeding in smaller framed dairy heifers will result in:
 - Younger weaned calves at similar weights as traditionally fed calves
 - **YES!**
 - Decreased breeding and calving age
 - **Yes, appears to be better reproduction**
 - Increase milk production in first lactation
 - **Yes, appears to be better production**





WHAT ARE DISADVANTAGES / NEGATIVES?

■ Health

- Feces
- “milk scours”



WHAT ARE DISADVANTAGES/NEGATIVES?

■ Clostridial disease

- Clostridium perfringens C & D (maybe B)
- Antitoxin (10 cc subQ shortly after birth)
- Colorado Serum
 - Clostridium perfringens types C&D antitoxin
- Boehringer Ingelheim
 - C & D Antitoxin
- Novartis (Elanco)
 - Clostratox BCD Antitoxin



APPROXIMATE COST OF EACH PROGRAM

- Intensified feeding programs will cost about \$35 to \$55 more in milk replacer and starter than traditional programs.

	Velocity (Accelerated)			MF1			Difference	Period Fed
	Cost/Unit	Total Cost		Cost/Unit	Total Cost			
Milk	66	\$1.90	\$125.40	68	\$1.43	\$97.24	\$28.16	to weaning
Starter	315	\$0.28	\$88.20	292.5	\$0.28	\$81.90	\$6.30	3 days to April 30
Grower	450	\$0.27	\$121.05	450	\$0.27	\$121.05		May 1-July 31
Developer	675	\$0.25	\$167.40	675	\$0.25	\$167.40		Aug 1 to end of December
Total Per Calf			\$502.05			\$467.59	\$34.46	



WHAT ARE DISADVANTAGES/NEGATIVES?

- Intensive management required for program success
- Increased costs during the milk feeding period (\$30- \$50 per calf)
- Delayed rumen development and poor transition at weaning
- Jerseys need more fat than Holsteins



SUMMARY OF POSITIVES

- **Increased lean growth in pre-weaning stage**
- **Potential health benefits**
- **Earlier age at first calving**
- **More potential production in first lactation**

