Strategies to Improve Economic Efficiency of the Dairy

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Considering nutritional grouping

Take home messages

Opportunity to improve economic efficiency

Considering additional nutritional groups

Improved profitability

IOFC gains far exceed additional expenses or losses

Diets closer to requirements

Saves feed costs and increases income over feed costs

Additional benefits

- ↓ environmental concerns
- ↑ health conditions

Feeding all lactating cows equally

A larger number of cows are overfed

Same ration (TMR) to all cows (groups)

All lactating cows receive same nutrient density diet

Preferred “high” rations

Low producing animals receive more nutrients than required

One diet for all

Would never optimize production and efficiency

VandeHaar, 2011

Improve feed efficiency

+ feeding groups

Improved nutrient use efficiency

Diet closer to cow requirements

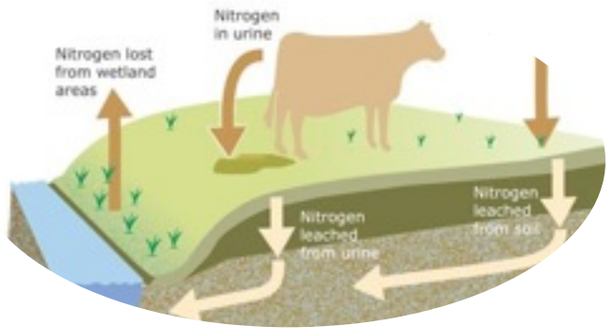
Less overfed animals

Decreased over conditioned cows

Less nutrient excretion

Decreased environmental concerns

Wang et al., 2000



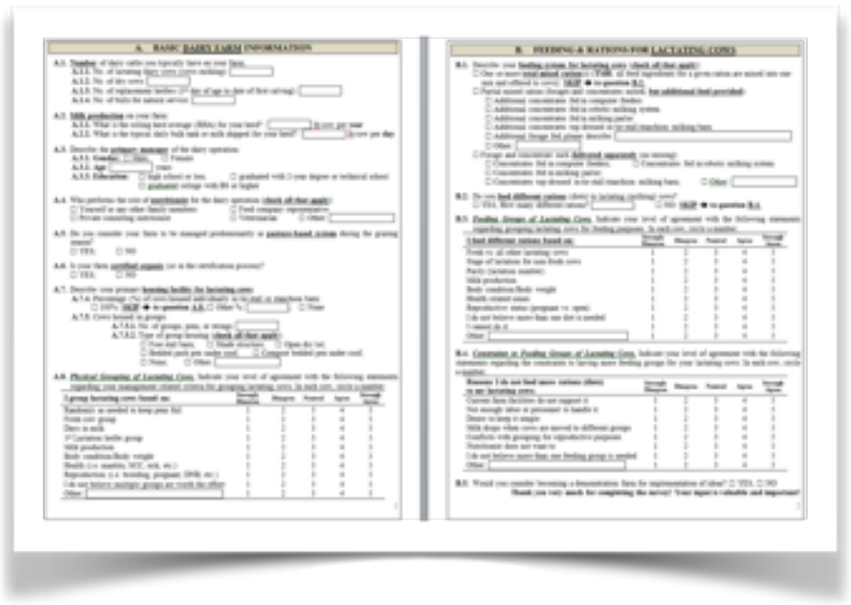
Lower feeding costs

Higher milk income over feed cost

Why farmers do not group more?

Trying to find most important constraints

2-page mailed survey



Results (responses)

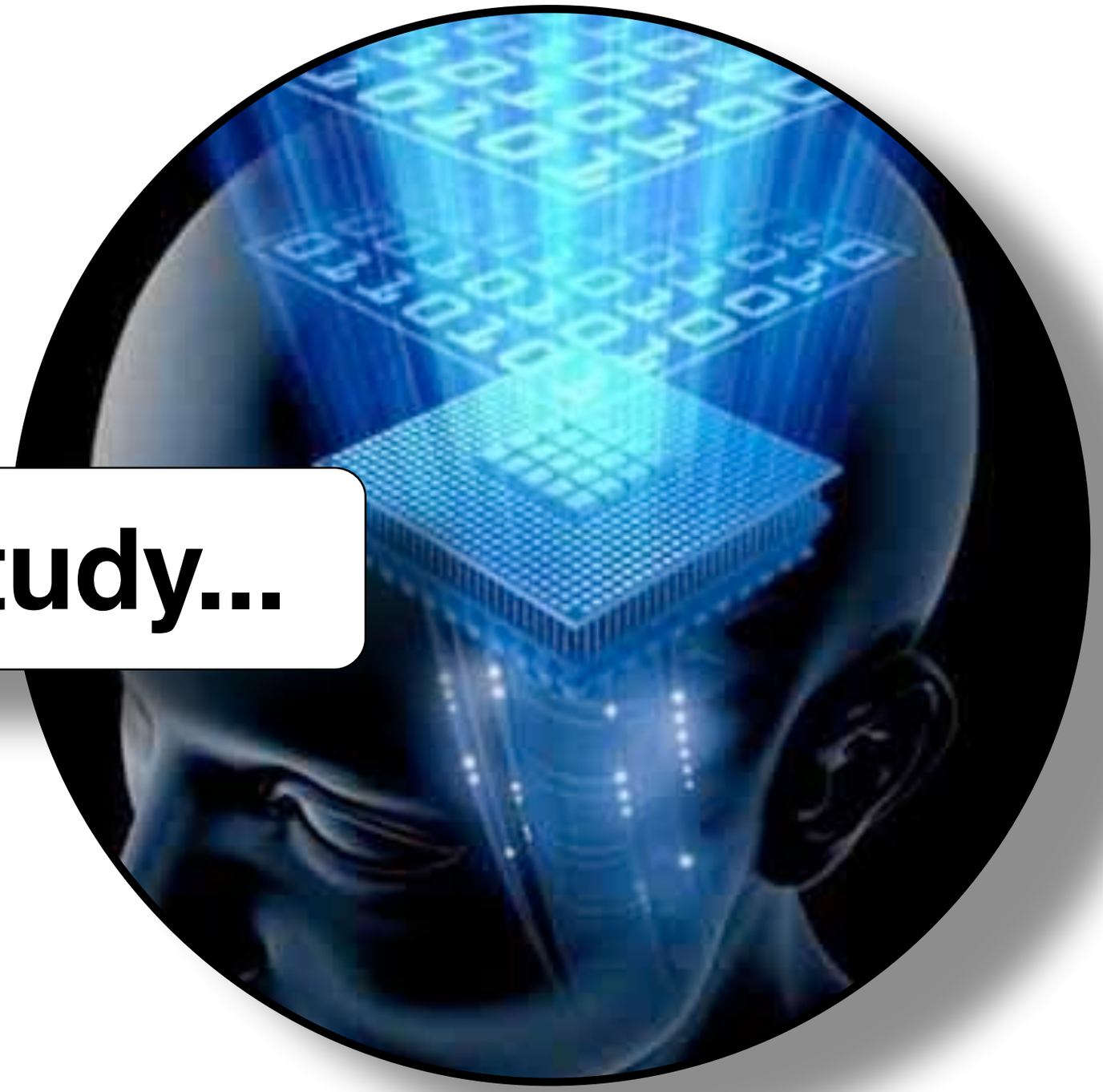
- 196 WI farms
- 211 MI farms

Constraints to feeding more ration groups

1. Milk drops when cows are moved
2. Desire to keep management simple
3. Conflicts with grouping for reproduction
4. Farm facilities do not allow it
5. Not enough labor or personnel to handle it

Contreras-Govea et al., 2013

A simulation study...



Strategies for grouping cows

Depend on farm and herd characteristics

Individual cow nutrient requirements

- Energy
- Protein (RUP, RDP, MP)

Number of lactating cows on the herd

States

Farm characteristics

Capacity to handle lactating feeding groups

Adapted from McGilliard et al., 1983;
St-Pierre and Thraen, 1999

Milk (and components)

Cow-specific lactation curves

Milk based on

- Herd ME305
- Cow PPA or ME305
- Stochasticity

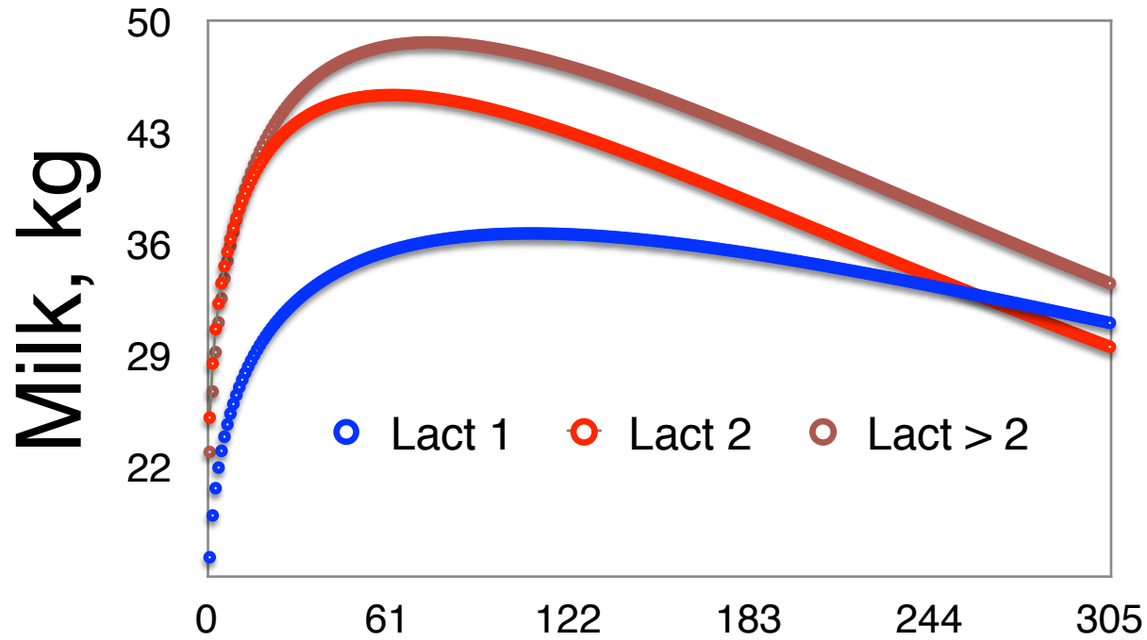
Components

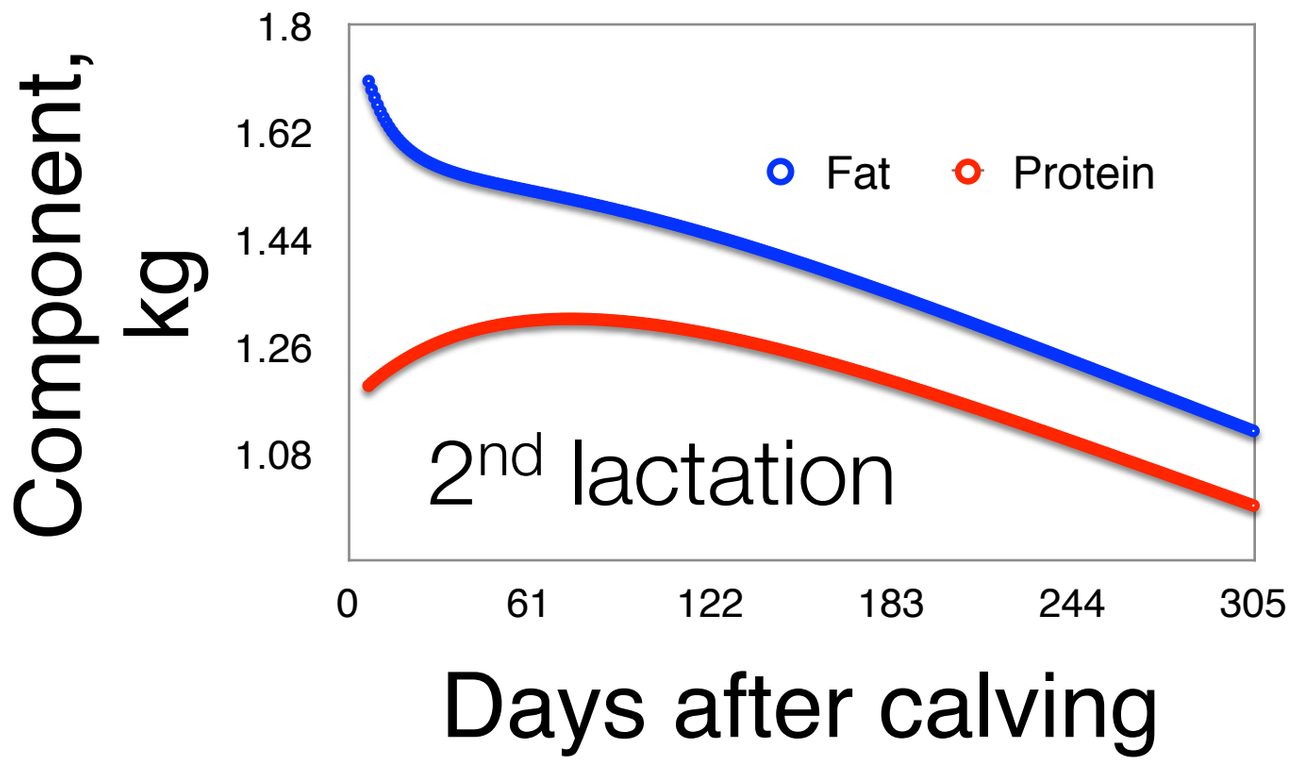
- Herd
- Stochasticity

Base function

- Woods
- Adjusted Woods

De Vries, 2001





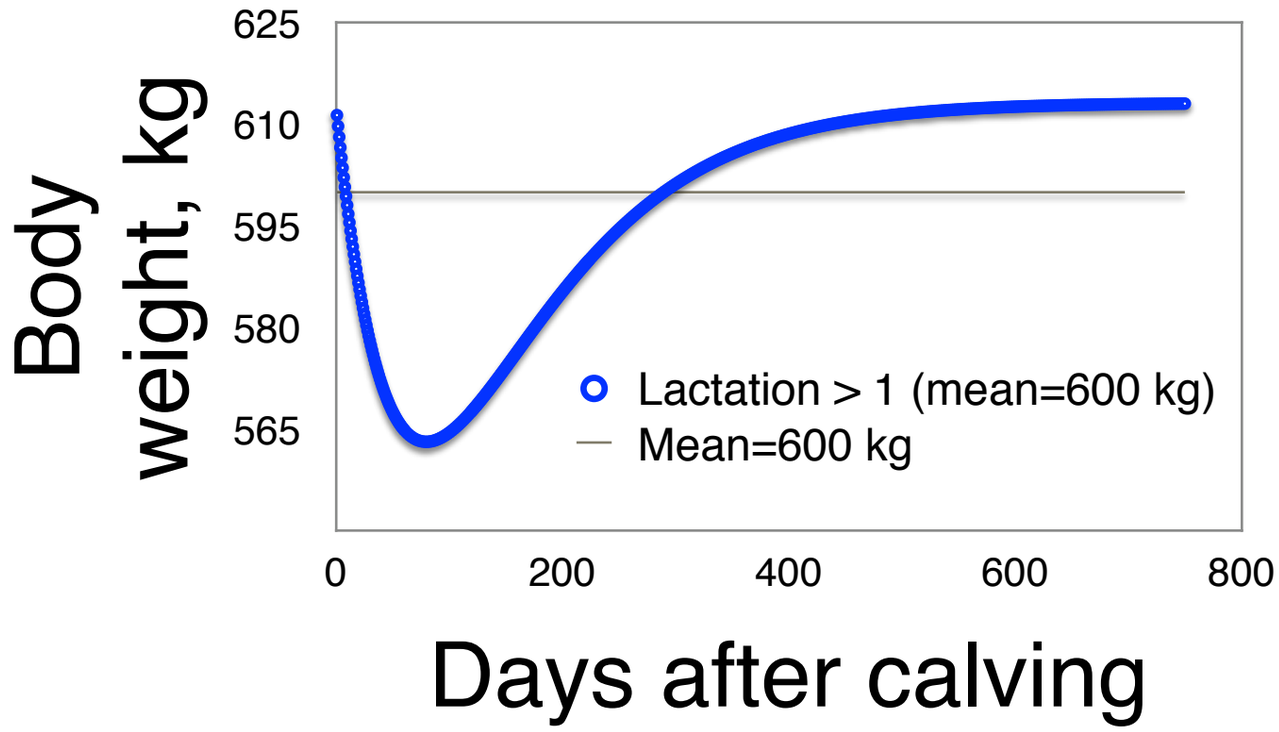
Initial individual cow BW

Cow-specific BW

1. **Available from farm records, or**
2. **Stochastic distribution**

Daily BW and BCS change according to:

- Lactation
- DIM
- Stochasticity



Criteria for nutritional grouping

Several criteria exist

Days after calving (DIM)

Based on stage of lactation

Fat (protein) corrected milk

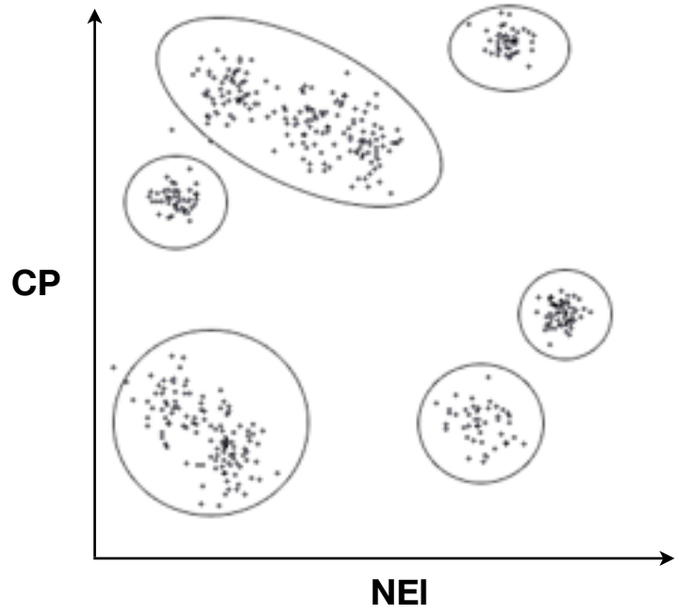
Based on level of production measured as F(P)CM

Dairy merit

Function of both F(P)CM and BW

Cluster

Seems to be MOST efficient criterion



McGilliard et al., 1983
St-Pierre and Thraen, 1999

Nutritional grouping

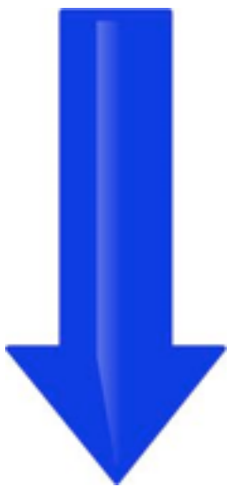
Two main types of groups

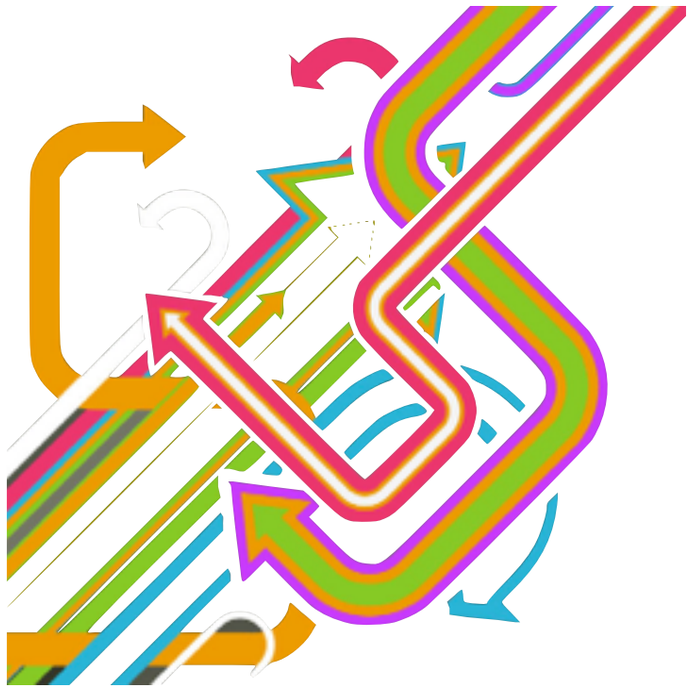
Obligated groups

- Fresh (< 22 DIM)
- Dry (~> 220 DCC)
- Daily assigned

Optional groups

- Actual additional groups
- Daily assigned
- Monthly re-grouped





Cow and herd simulation

Monte Carlo approach

Next event scheduling

- Pregnancy
- Abortion
- Dry-off
- Parturition
- Involuntary culling
- Death

Two-step

- 1. Binary outcome of event:
  - Happens or not
  - E.g., uniform distribution
- 2. DIM of the occurrence
  - When it happens
  - E.g., Weibull distribution

Immediate replacement

- After a cow leaves the herd

Replicates

- 1,000 replicates for each cow within specific herd

Cow simulation

Follows actual COW card

Variable	Unit	Description
Cow ID	#	Cow identification
Parity	#	Lactation
DIM	d	Days in milk, days after calving
DCC	d	Days in pregnancy (DIP)
Fat	%	Fat component on milk
Protein	%	Protein component on milk (%)
PPA*	%	Predicted producing ability
ME 305*	kg/305 d	Mature equivalent milk production
BW	kg	Live body weight

*Either PPA or ME305 used to assess cow's milk class. PPA preferred if available

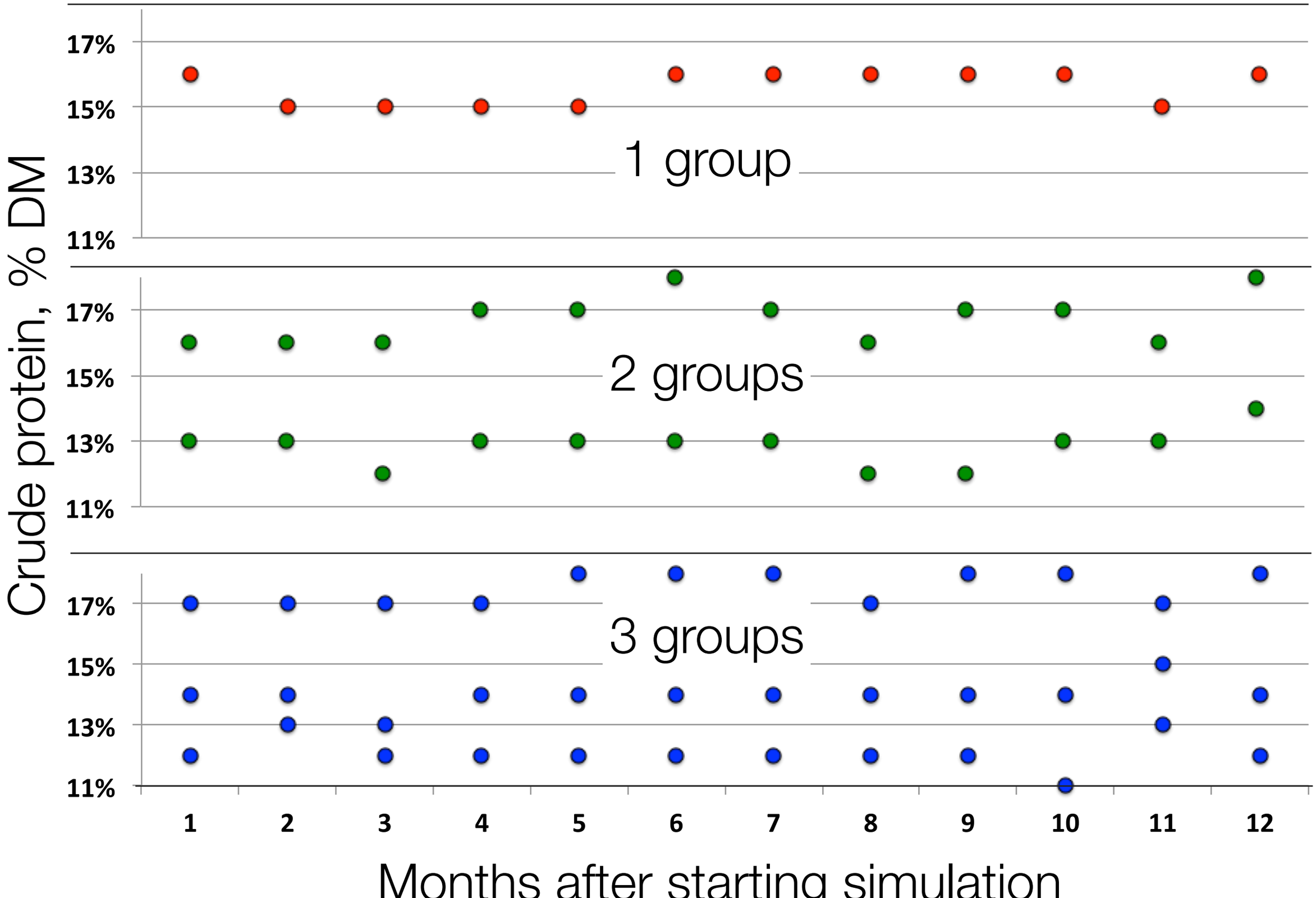
Studied herds

All data collected at the **cow-level**

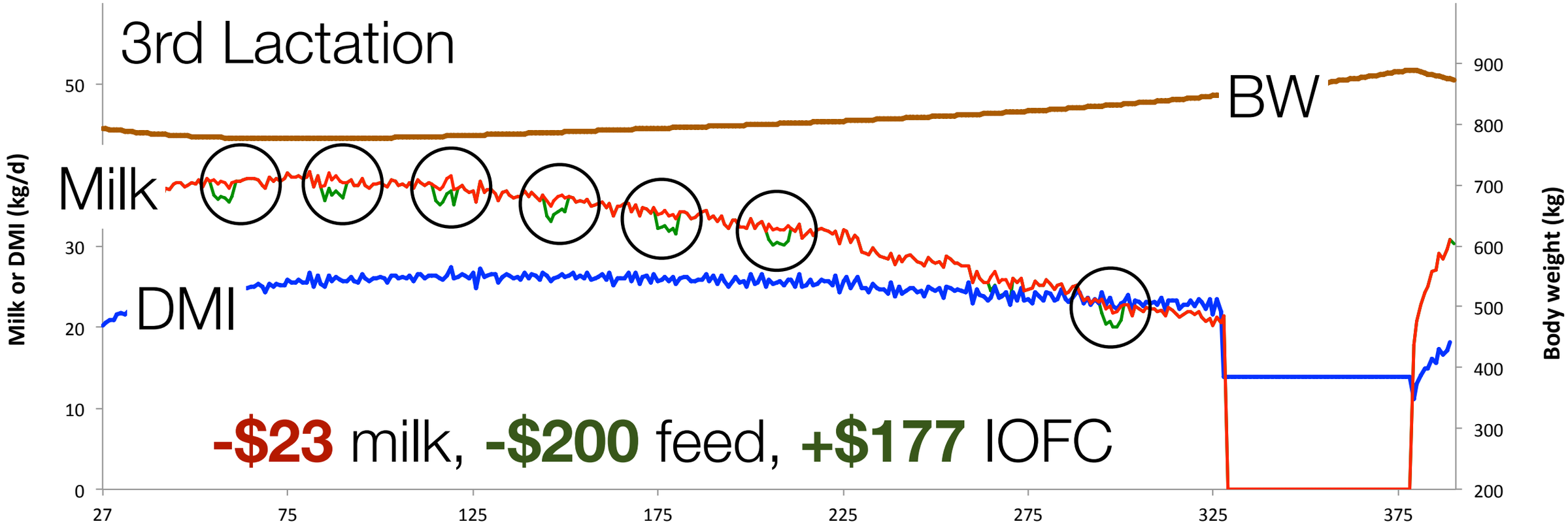
Herd (size)	570	787	727	331	1460
Herd ME 305, kg	16,140	12,884	13,897	13,348	14,188
1	43	39	39	38	45
Average DIM	187	178	201	208	189
21-d PR, %	18	19	19	17	18
Culling risk, %	32	37	36	35	40
Abortion, %	7	11	11	16	7
BW available	✗	✗	✓	✓	✗

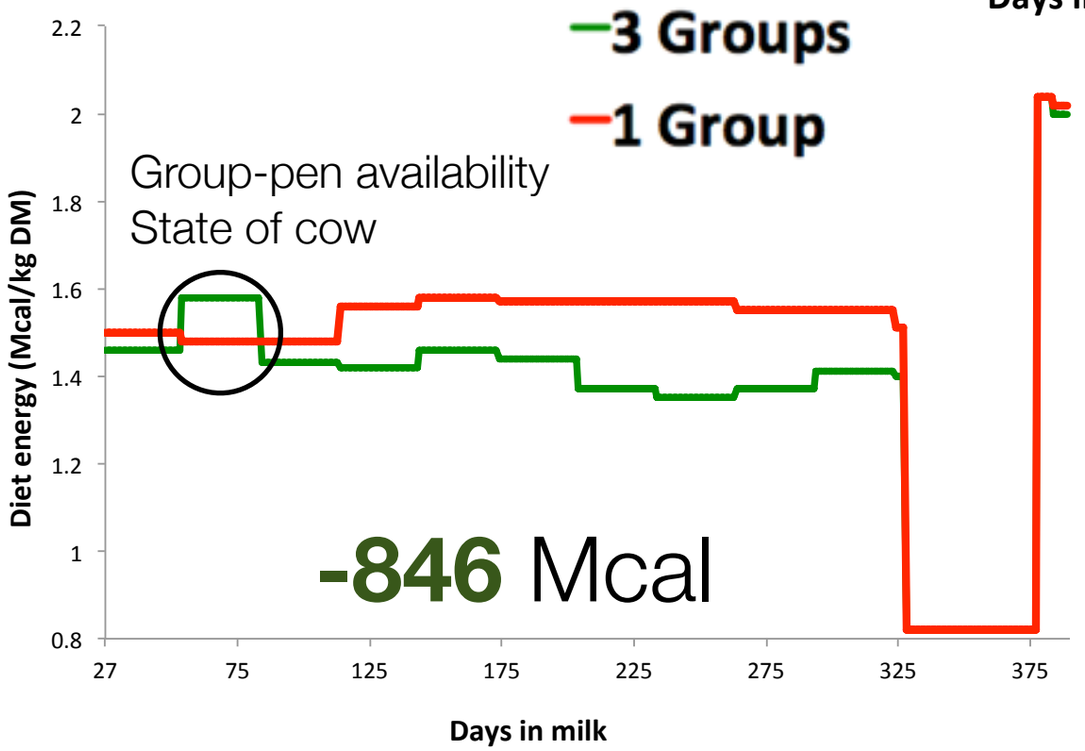
...And we are finding

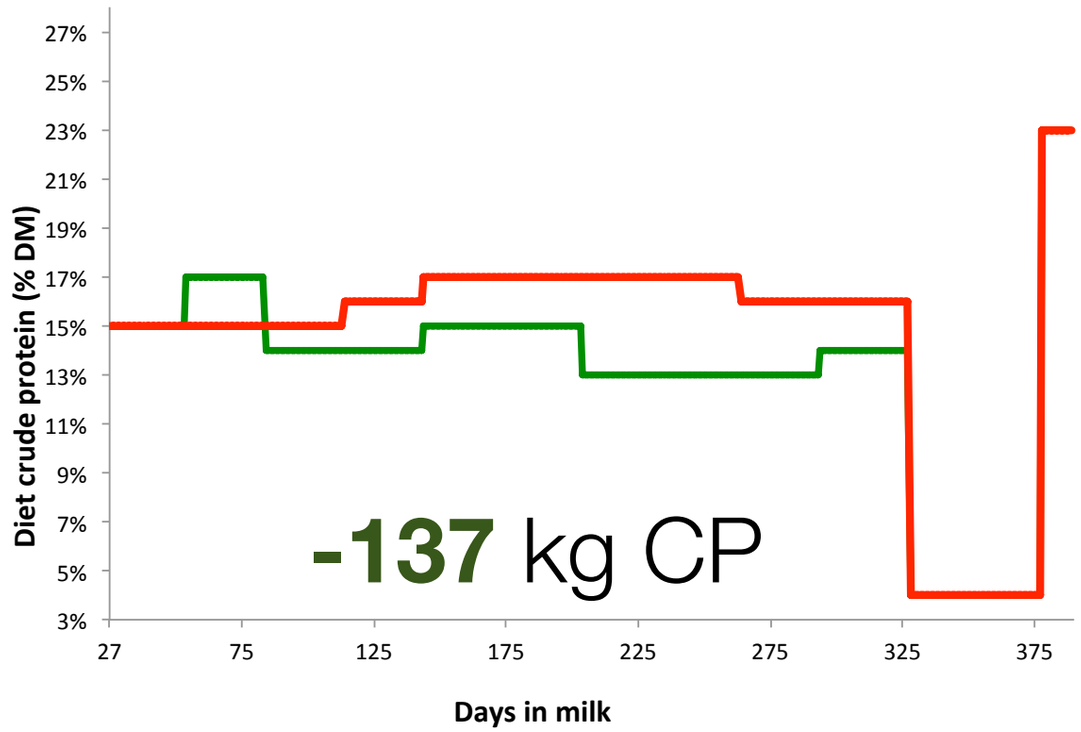
Herd 331, nutritional diets



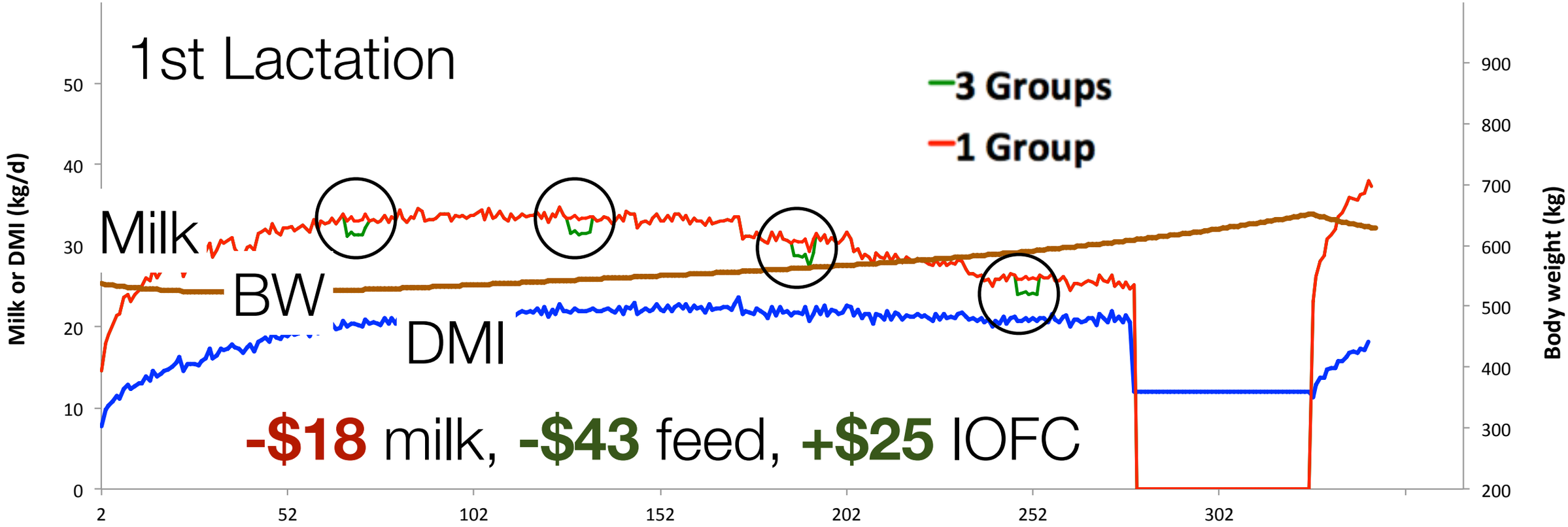
Cow 6338(727) = 78% milk, 1 yr

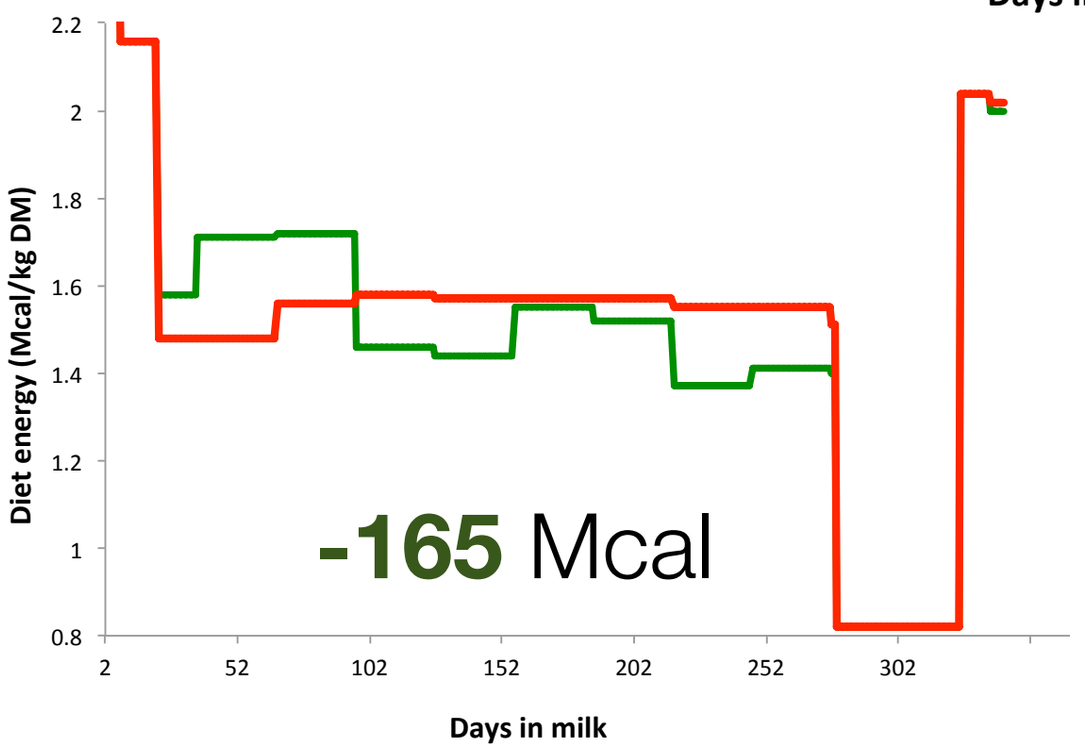


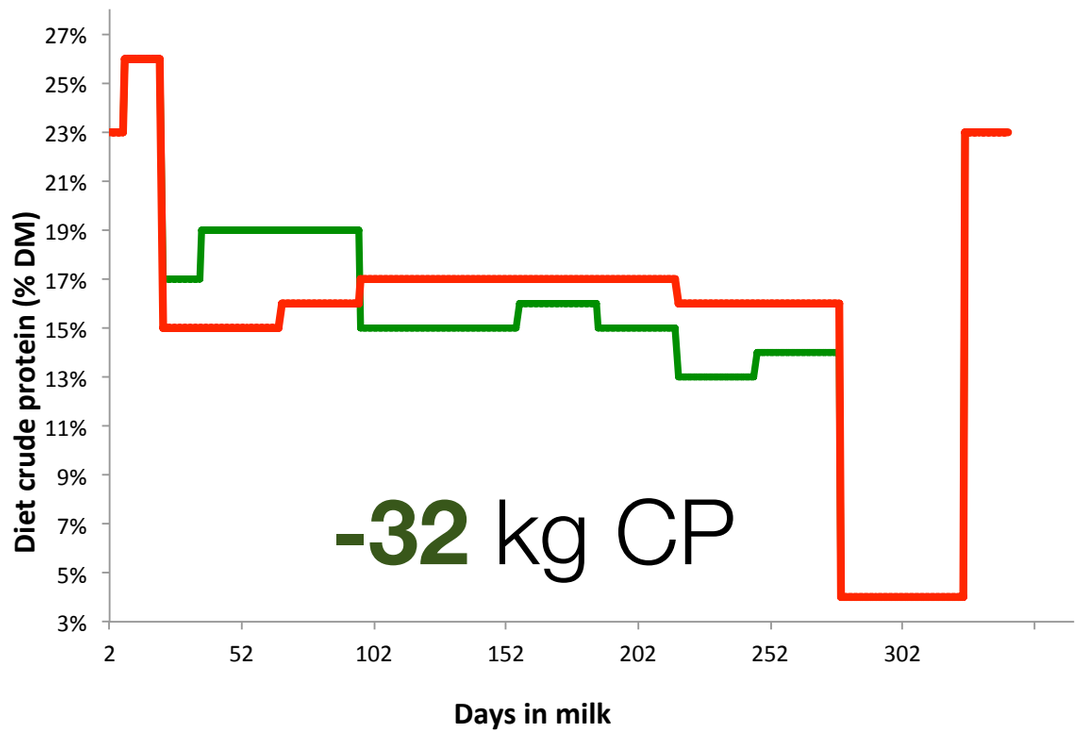




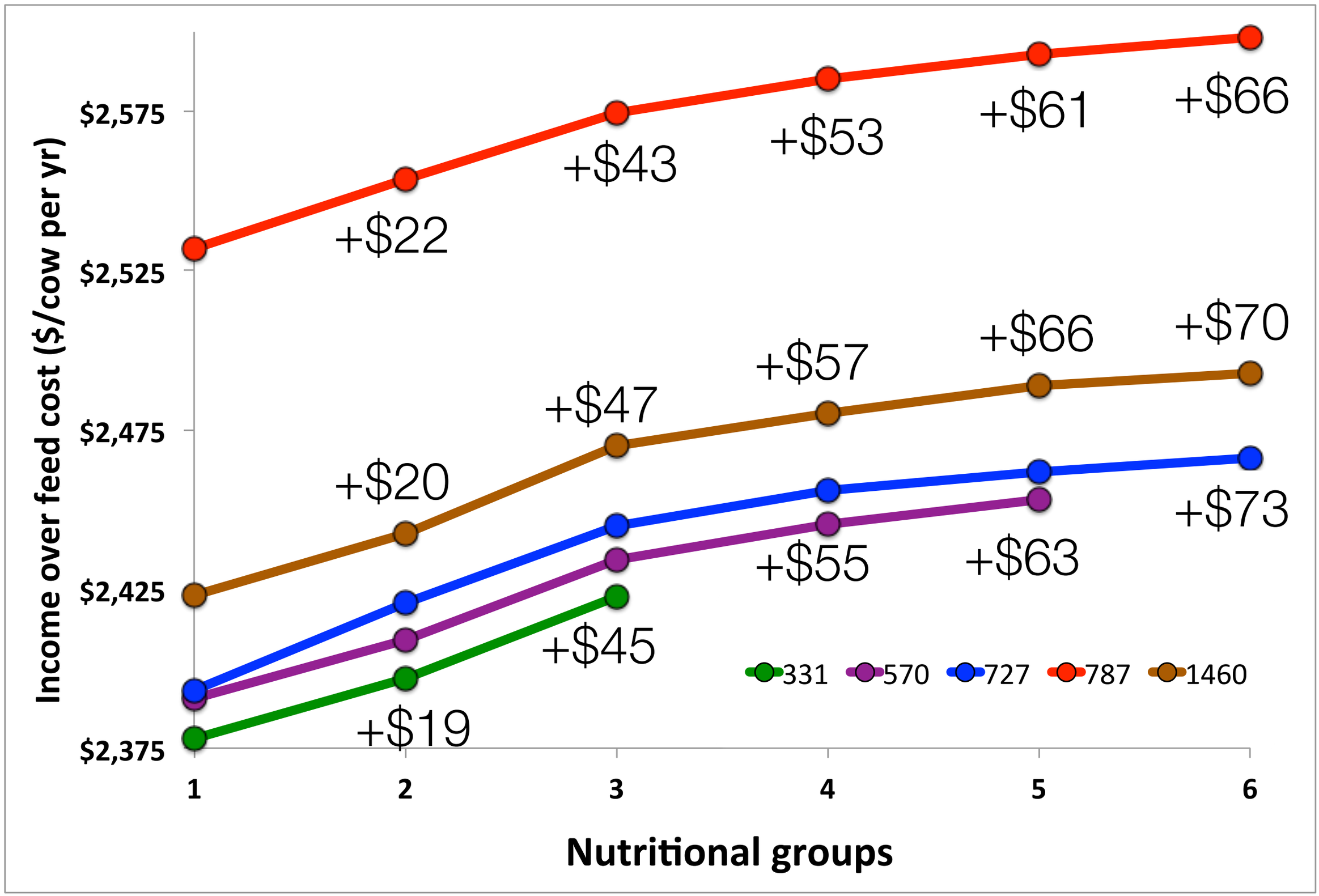
Cow10020(727) = 92% milk, 1 yr



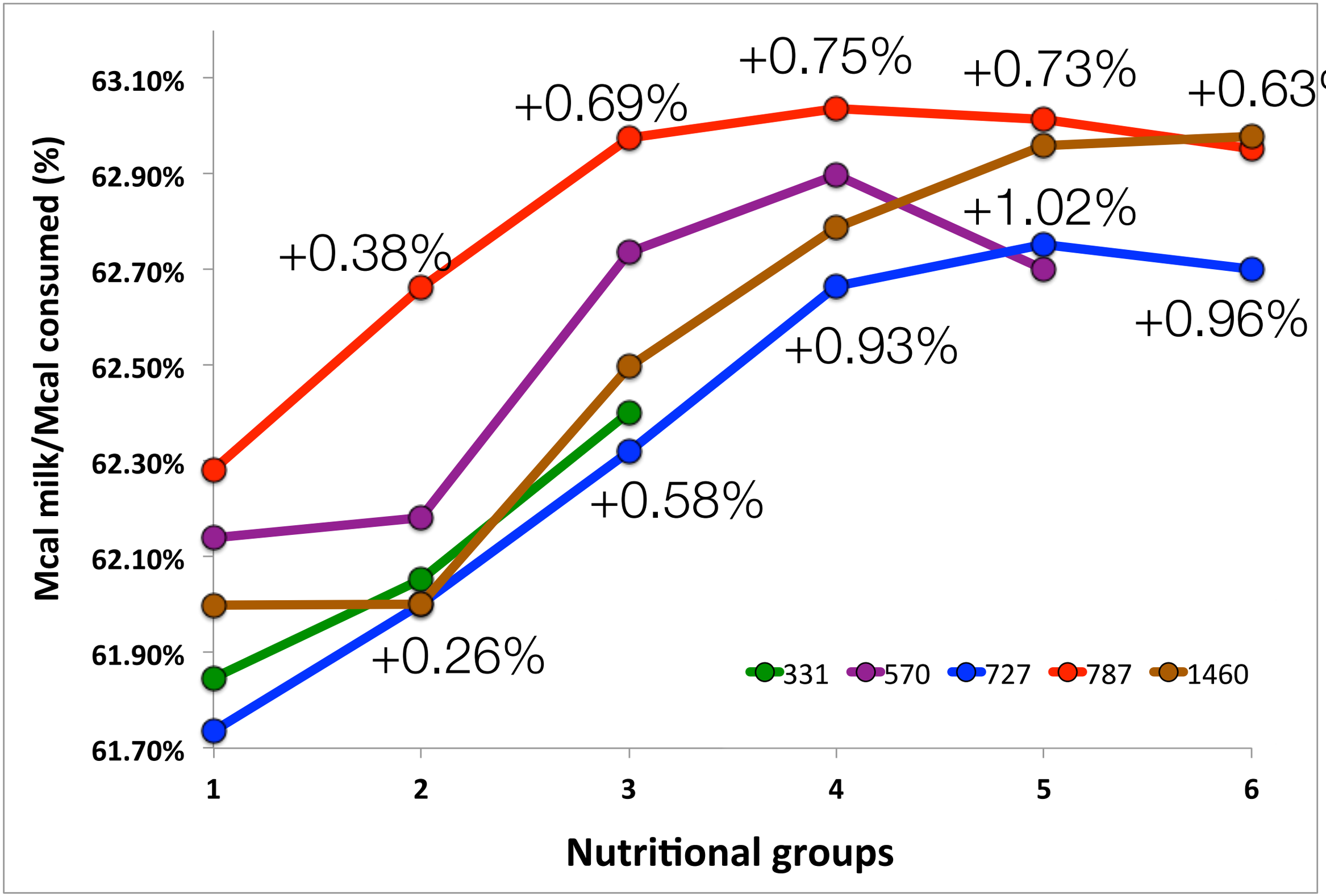




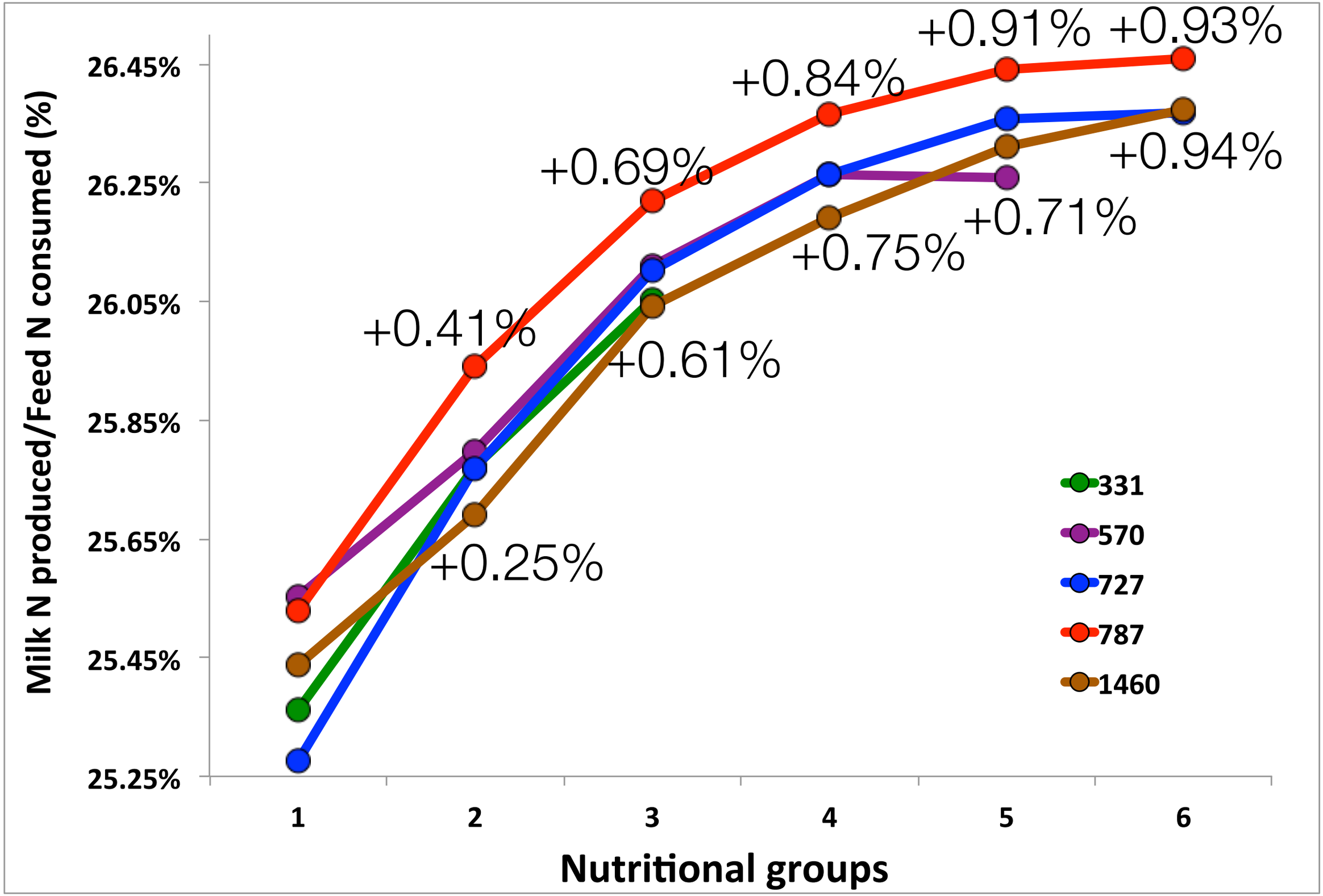
Economic efficiency



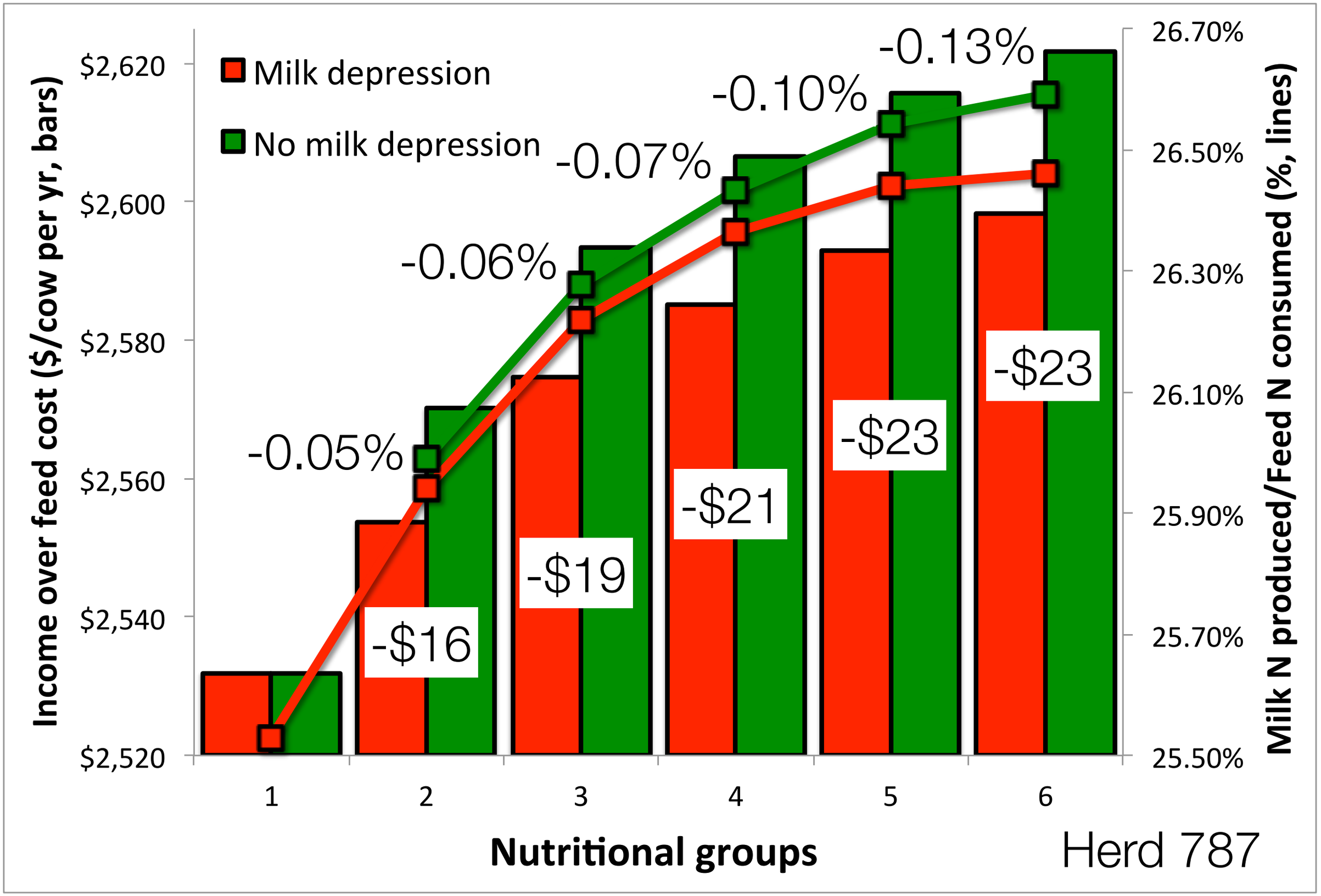
Energy efficiency



Nitrogen efficiency



Impact of milk depression $\frac{9.1\ kg}{\Delta group}$



Decision support tool…

http://DairyMGT.info

A simplified online tool

Herd-specific assessments (DairyMGT.info)

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Grouping Strategies for Feeding Lactating Dairy Cattle

Overview | Upload Farm Details | Group Cows | Reap Benefits

Prices

	CP%	Nel, MCal/lb	$/(Unit)	
Corn	10	0.9	6.72	($/bu)
Soybean Meal	50	0.88	350	($/ton)

Please note that the values highlighted with this color will be used by the tool.

Calculated Values		
$/lb CP	0.14337	Edit
$/Mcal NEL	0.1174	Edit

Milk Price: 15.89 ($/cwt)

Download Parameter Excel File (xls or xlsx version)

Download Parameters File (xls) or Download Parameters File (xlsx)

Upload Parameters as Excel File

Upload the Excel File: Choose File No file chosen Upload

Current File/Data Status

Using Data from Default Parameters File on Server

Sample Farm: Total Cows = 470

Group Criteria	Group Number	Number of Cows	NEL* (Mcal/lb)	CP* (%)
NO GROUPING (No Optimization)	1	470	0.82	18.00
	Mean		0.82	18.00
CLUSTER	1	270	0.71	16.05
	2	200	0.65	14.04
	Mean		0.68	15.20
DIM	1	200	0.72	16.19
	2	270	0.67	14.85
	Mean		0.69	15.42
FCM	1	270	0.71	16.03
	2	200	0.66	14.37
	Mean		0.69	15.33
DAIRYMERIT	1	270	0.71	16.05
	2	200	0.65	14.09
	Mean		0.68	15.22

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Additional costs and benefits

Impacts grouping feeding strategies

Management cost

- Additional labor
- Extra management

Avoid costs

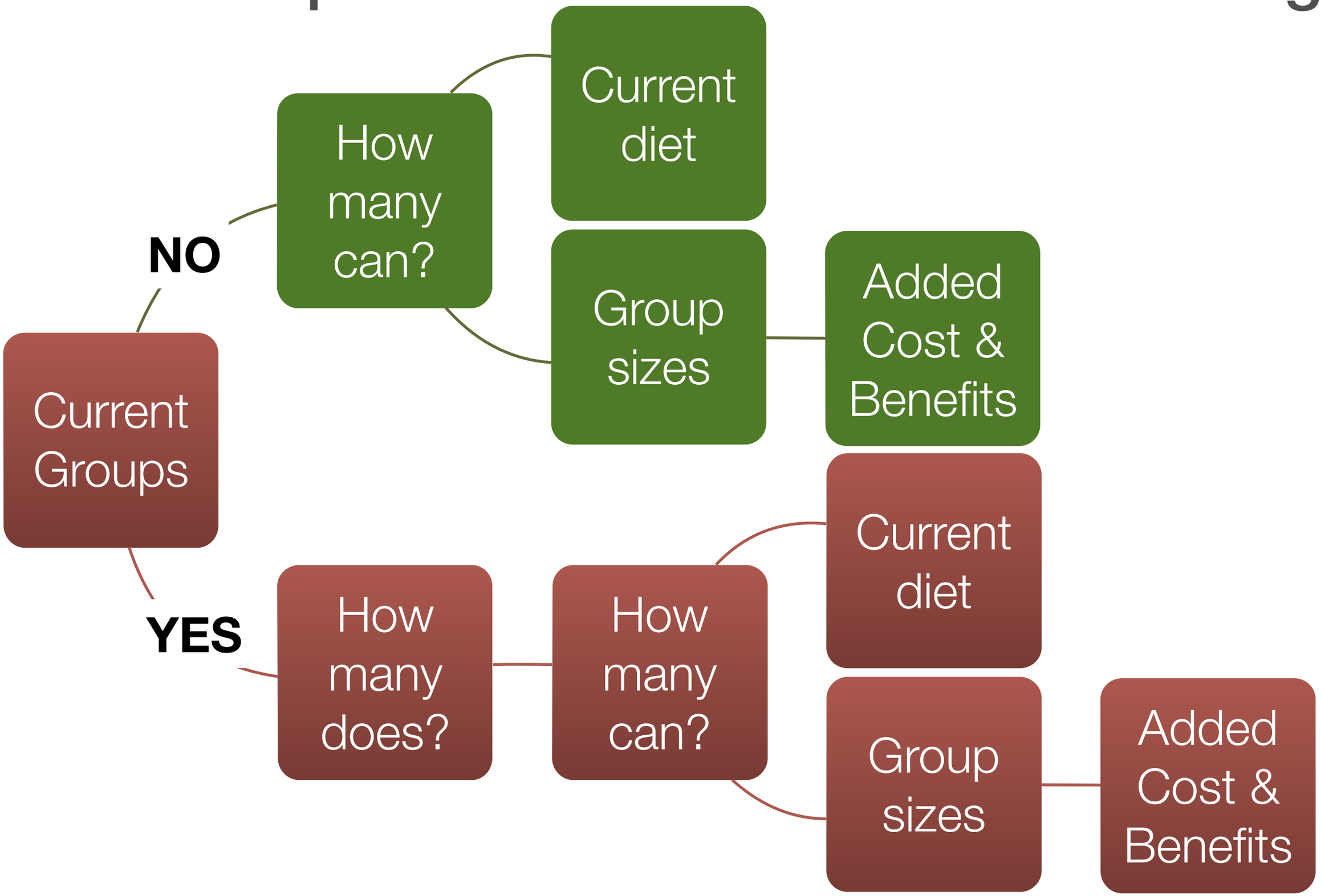
- Additives and supplements savings

Milk depression

- Cow social interactions

Grouping Strategies

Farm/herd possibilities and decision-making



Tool demonstration

Grouping Illustration

Economic impact of nutritional grouping

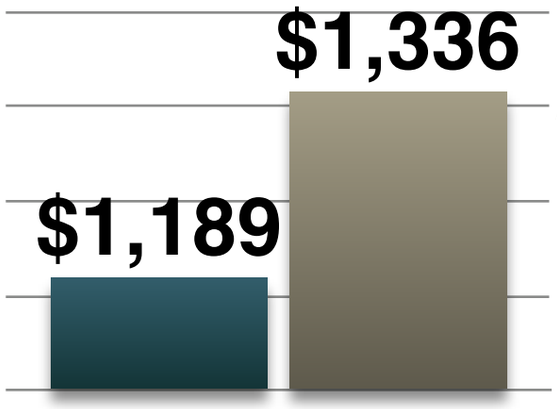
Current Situation	
Lactating Cows	470
Current Groups	None
NEL Mcal/lb	0.80
CP, %	17

Possible Situation	
Groups	3
Group Sizes	100, 100, 270
Milk loss	2.27 kg/d x 4 d
Added Costs	$1,000/month
Saved costs	None

Decision Support System Illustration

Cluster grouping criteria

Current Situation				
Group	Cows	NEL	CP	IOFC
	#	Mcal/lb	%	$/cow.d
All	**470**	**0.80**	**17.00**	**6.9**



Annual value of grouping **$135,000**/herd

Possible Situation				
Group	Cows	NEL	CP	IOFC
	#	Mcal/lb	%	$/cow.d
1	100	0.62	13.07	4.7
2	100	0.65	14.18	7.2
3	270	0.71	16.05	9.3
All	**470**	**0.68**	**15.02**	**7.9**

Wisconsin herds analysis

Analysis from dairy farm records

30 Wisconsin dairy farms

No grouping vs. 3 groups

- Same size groups

Grouping criterion

- Cluster

Same prices for all

- $0.35/kg milk
- $0.315/kg CP
- $0.1174/Mcal NEl

Projected body weight

- 500 kg primiparous
- 600 kg multiparous

Analysis from dairy farm records

30 Wisconsin dairy farms

	Lactating cows (n=30)	No grouping	3 Groups	Gain
		Income Over Feed Cost $/cow.yr		
Minimum	<200	697	1,059	161
Mean	788	2,311	**2,707**	**396**
Maximum	>1,000	2,967	3,285	580

Increase of IOFC ($/cow per year)

- Between 7 and 52%
- Mean = $396
- Range = $161 to $580

Acknowledgements

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United States Department of Agriculture
National Institute of Food and Agriculture

Thanks