Dairy Management

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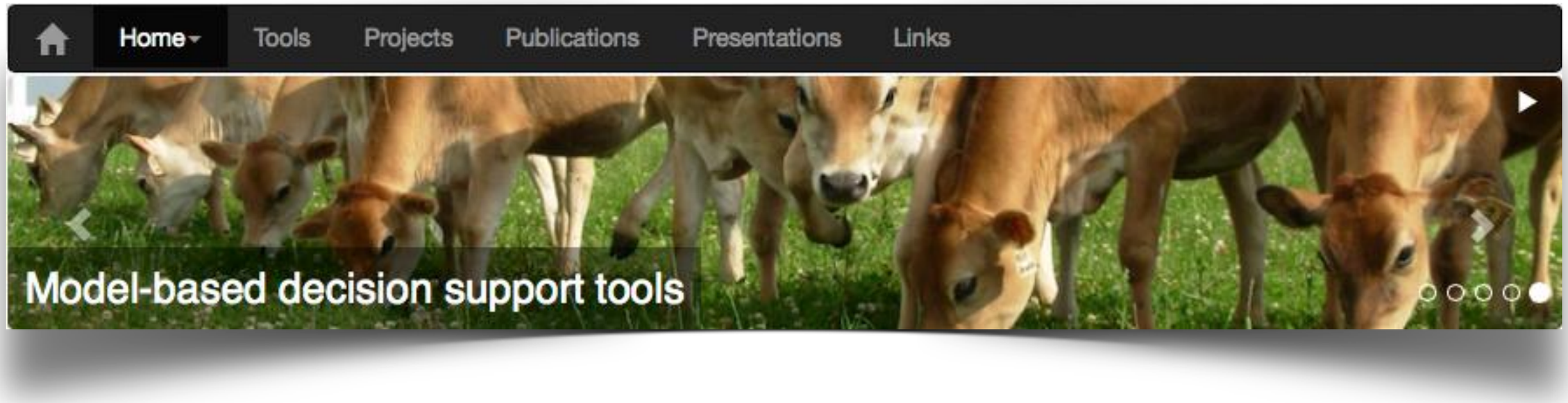

Management Tools to Increase Dairy Cow Feed Efficiency

V.E. Cabrera and A. Kalantari
University of Wisconsin-Madison Dairy Science

Wisconsin Feed Efficiency Workshop 2015

Dairy Management

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This site is designed to support dairy farming decision-making focusing on model-based scientific research. The ultimate goal is to provide user-friendly computerized decision support tools to help dairy farmers improve their economic performance along with environmental stewardship.

UW-Dairy Management Decision Support TOOLS

University of Wisconsin

- University of Wisconsin - Madison
- UW - Cooperative Extension
- UW - Dairy Science
- Dairy Cattle Reproduction
- Dairy Cattle Nutrition
- Milk Quality
- UW Dairy Nutrient
- Understanding Dairy Markets
- UW Center for Dairy Profitability

Latest Projects

- Improving Dairy Farm Sustainability
- Genomic Selection and Herd Management
- Dairy Reproduction Decision Support Tools
- Strategies of Pasture Supplementation
- Improving Dairy Cow Fertility

Contact

Associate Professor
Extension Specialist
in Dairy Management
279 Animal Sciences
1675 Observatory Dr.
Madison, WI 53706
(608) 265-8506
vcabrera@wisc.edu
More »

Victor E.Cabrera, Ph.D.

Helpful Link

Repro Money Program

Tweets Follow

UW-Madison @UWMadison 11 Apr
Drop everything, this time-lapse will make you want to shout from the mountaintops, "I love Madison!" youtu.be/_8cGpjARTvw
Retweeted by Victor E. Cabrera
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Victor E. Cabrera @vecabrera 18 Mar
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Home | Tools | Projects | Publications | Presentations | Links

Tools

A collection of the state-of-the-art and scientific-based dairy farm management decision support tools that are user-friendly, interactive, robust, visually attractive, and self-contained. These tools count with associated documentation and video demonstrations. Technical support on their application is also available upon request.

Feeding

- FeedVal 2012
- Grouping Strategies for Feeding Lactating Dairy Cattle
- Nutritional Grouping in Wisconsin and Michigan Dairy Farms
- Optigen® Evaluator

Heifers

Reproduction

Genomics

Production

Replacement

Health

Financial

+40 Decision Support Tools

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

Considering nutritional grouping

For improved feed efficiency

Opportunity to increase productivity

Cows receive more precise diets

Improved profitability

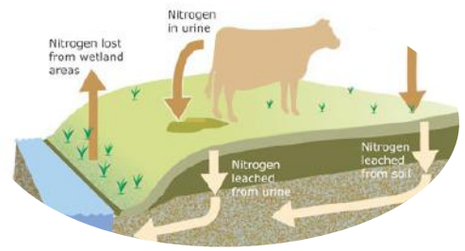
IOFC gains far exceed additional expenses or losses

Diets closer to requirements

Saves feed costs and increases income over feed costs

Additional benefits

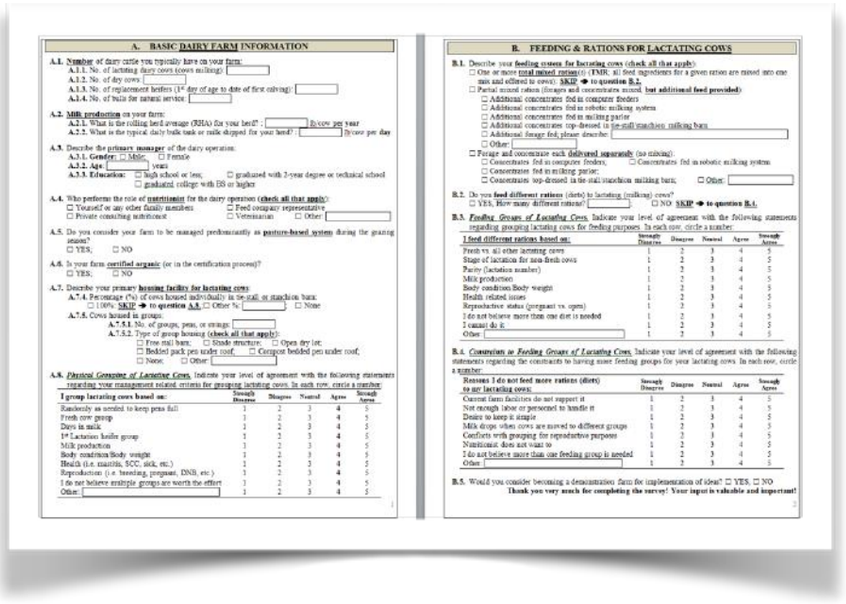
- ↓ environmental concerns Wang et al., 2000
- ↑ health conditions



Why farmers do not group more?

Trying to find most important constraints

2-page mailed survey



A. BASIC DAIRY FARM INFORMATION

A.1. Number of dairy cattle you typically have on your farm:
A.1.1. No. of lactating dairy cows (cows milking):
A.1.2. No. of dry cows:
A.1.3. No. of replacement heifers (1st day of age to date of first calving):
A.1.4. No. of bulls for natural service:

A.2. Milk production on your farm:
A.2.1. What is the rolling herd average (RHA) for you herd? : lb/cow per year
A.2.2. What is the typical daily bulk tank or milk shipped for your herd? : lb/cow per day

A.3. Describe the **primary manager** of the dairy operation:
A.3.1. **Gender:** ☐ Male; ☐ Female
A.3.2. **Age:** years
A.3.3. **Education:** ☐ high school or less; ☐ graduated with 2-year degree or technical school ☐ graduated college with BS or higher

A.4. Who performs the role of **nutritionist** for the dairy operation **(check all that apply)**:
☐ Yourself or any other family members; ☐ Feed company representative
☐ Private consulting nutritionist; ☐ Veterinarian; ☐ Other:

A.5. Do you consider your farm to be managed predominantly as **pasture-based system** during the grazing season?
☐ YES; ☐ NO

A.6. Is your farm **certified organic** (or in the certification process)?
☐ YES; ☐ NO

A.7. Describe your primary **housing facility for lactating cows**:
A.7.4. Percentage (%) of cows housed individually in tie-stall or stanchion barn:
☐ 100% **SKIP ➔ to question A.8.** ☐ Other %: ☐ None
A.7.5. Cows housed in groups:
A.7.5.1. No. of groups, pens, or strings:
A.7.5.2. Type of group housing **(check all that apply)**:
☐ Free stall barn; ☐ Shade structure; ☐ Open dry lot;
☐ Bedded pack pen under roof; ☐ Compost bedded pen under roof;
☐ None; ☐ Other:

A.8. ***Physical Grouping of Lactating Cows.*** Indicate your level of agreement with the following statements regarding your management related criteria for grouping lactating cows. In each row, circle a number:

I group lactating cows based on:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Randomly as needed to keep pens full	1	2	3	4	5
Fresh cow group	1	2	3	4	5
Days in milk	1	2	3	4	5
1st Lactation heifer group	1	2	3	4	5
Milk production	1	2	3	4	5
Body condition/Body weight	1	2	3	4	5
Health (i.e. mastitis, SCC, sick, etc.)	1	2	3	4	5
Reproduction (i.e. breeding, pregnant, DNB, etc.)	1	2	3	4	5
I do not believe multiple groups are worth the effort	1	2	3	4	5
Other:	1	2	3	4	5

B. FEEDING & RATIONS FOR LACTATING COWS

B.1. Describe your **feeding system for lactating cows (check all that apply)**:
☐ One or more **total mixed ration(s)** (TMR; all feed ingredients for a given ration are mixed into one mix and offered to cows); **SKIP ➔ to question B.2.**
☐ Partial mixed ration (forages and concentrates mixed, **but additional feed provided**)
☐ Additional concentrates fed in computer feeders
☐ Additional concentrates fed in robotic milking system
☐ Additional concentrates fed in milking parlor
☐ Additional concentrates top-dressed in tie-stall stanchion milking barn
☐ Additional forage fed; please describe:
☐ Other:
☐ Forage and concentrate each **delivered separately** (no mixing):
☐ Concentrates fed in computer feeders; ☐ Concentrates fed in robotic milking system
☐ Concentrates fed in milking parlor;
☐ Concentrates top-dressed in tie-stall stanchion milking barn; ☐ Other:

B.2. Do you **feed different rations** (diets) to lactating (milking) cows?
☐ YES, How many different rations? ; ☐ NO **SKIP ➔ to question B.4.**

B.3. ***Feeding Groups of Lactating Cows.*** Indicate your level of agreement with the following statements regarding grouping lactating cows for feeding purposes. In each row, circle a number:

I feed different rations based on:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Fresh vs. all other lactating cows	1	2	3	4	5
Stage of lactation for non-fresh cows	1	2	3	4	5
Parity (lactation number)	1	2	3	4	5
Milk production	1	2	3	4	5
Body condition/Body weight	1	2	3	4	5
Health related issues	1	2	3	4	5
Reproductive status (pregnant vs. open)	1	2	3	4	5
I do not believe more than one diet is needed	1	2	3	4	5
I cannot do it	1	2	3	4	5
Other:	1	2	3	4	5

B.4. ***Constraints to Feeding Groups of Lactating Cows.*** Indicate your level of agreement with the following statements regarding the constraints to having more feeding groups for your lactating cows. In each row, circle a number:

Reasons I do not feed more rations (diets) to my lactating cows:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Current farm facilities do not support it	1	2	3	4	5
Not enough labor or personnel to handle it	1	2	3	4	5
Desire to keep it simple	1	2	3	4	5
Milk drops when cows are moved to different groups	1	2	3	4	5
Conflicts with grouping for reproductive purposes	1	2	3	4	5
Nutritional diets not want to	1	2	3	4	5
I do not believe more than one feeding group is needed	1	2	3	4	5
Other:	1	2	3	4	5

B.5. Would you consider becoming a demonstration farm for implementation of ideas? ☐ YES, ☐ NO
Thank you very much for completing the survey! Your input is valuable and important!

Results (responses)

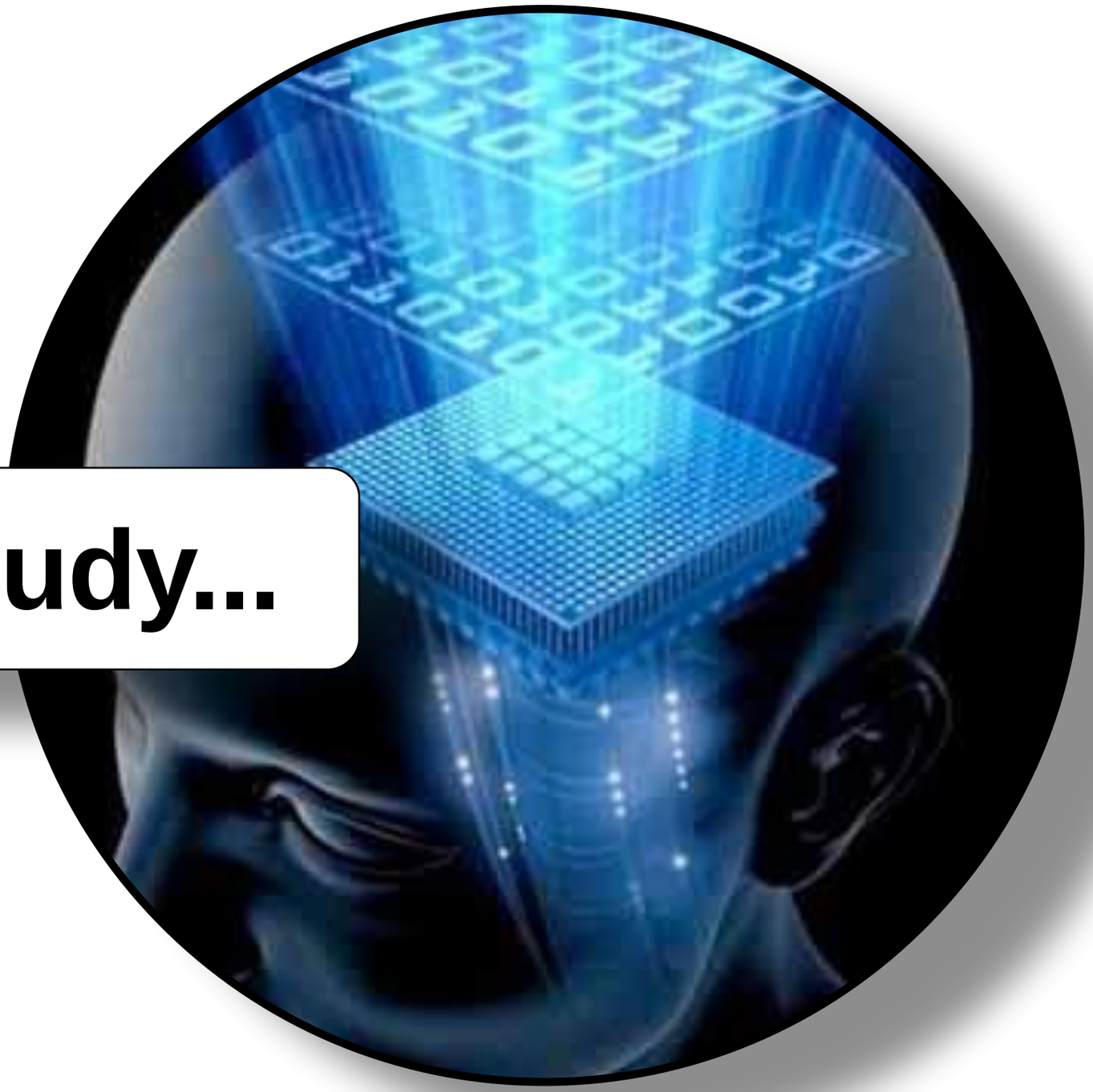
- 196 WI farms
- 211 MI farms

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., 2015 (*accepted*)

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 (i.e., current characteristics of the cow)

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

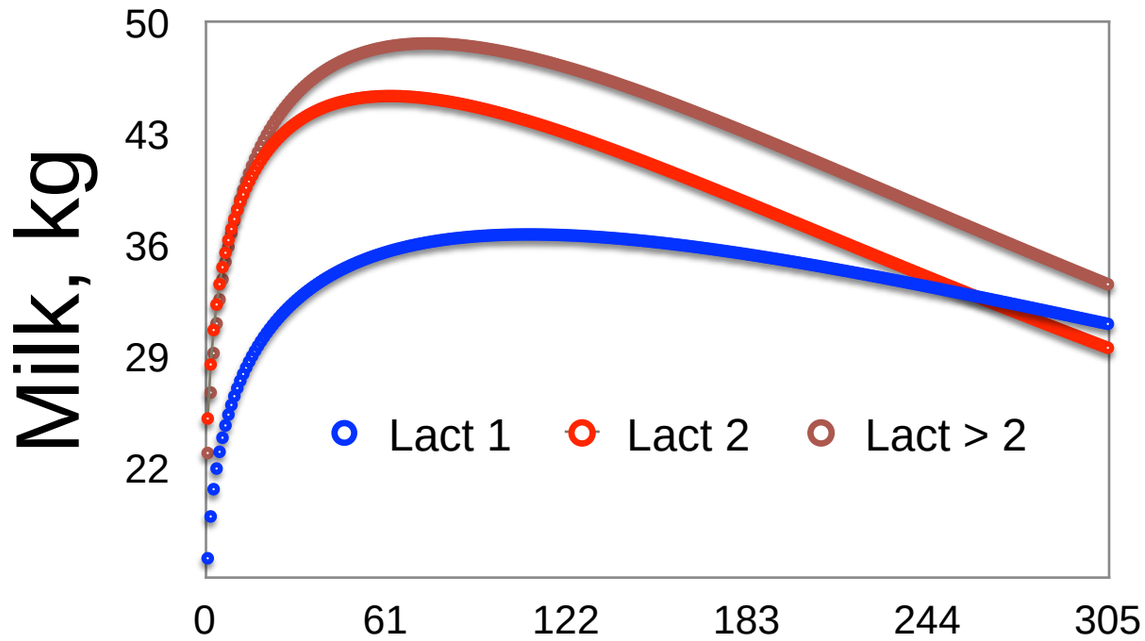
Components

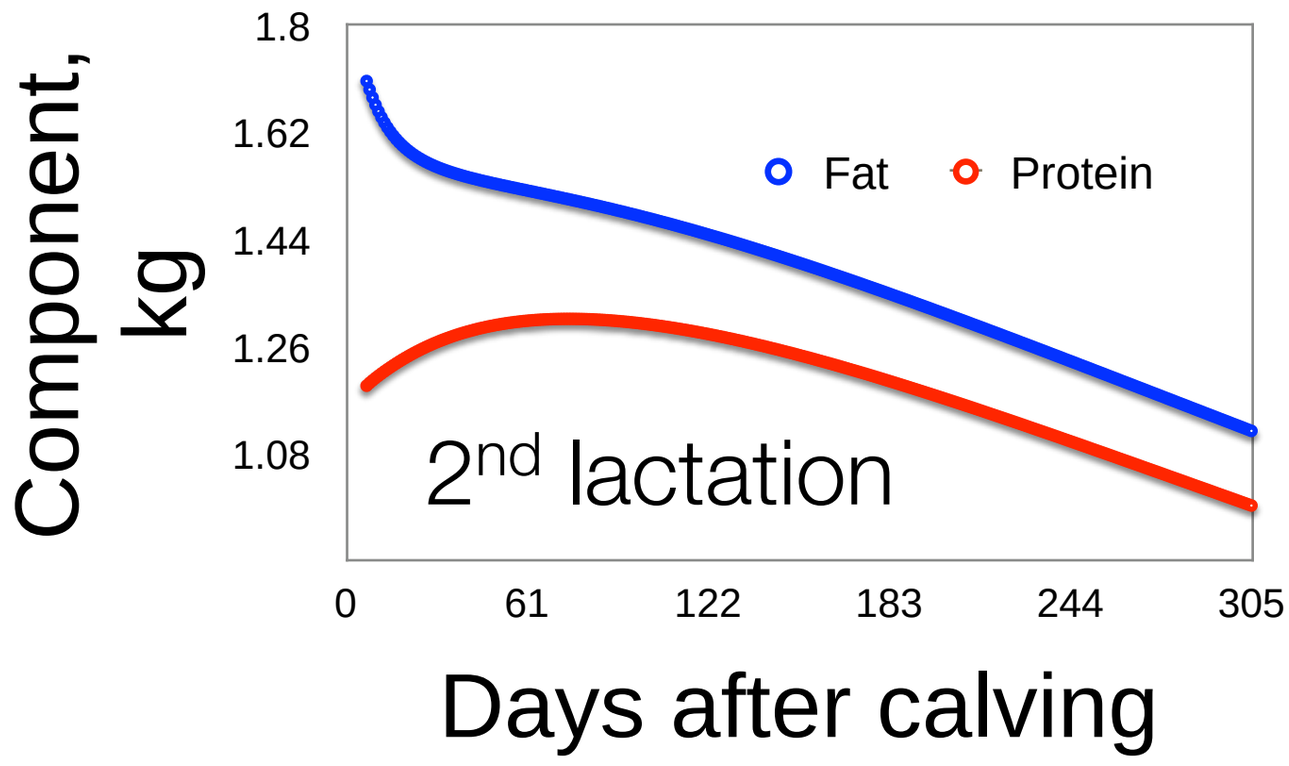
- Herd
- Stochasticity

Base function

- Woods
- Adjusted Woods

De Vries, 2001





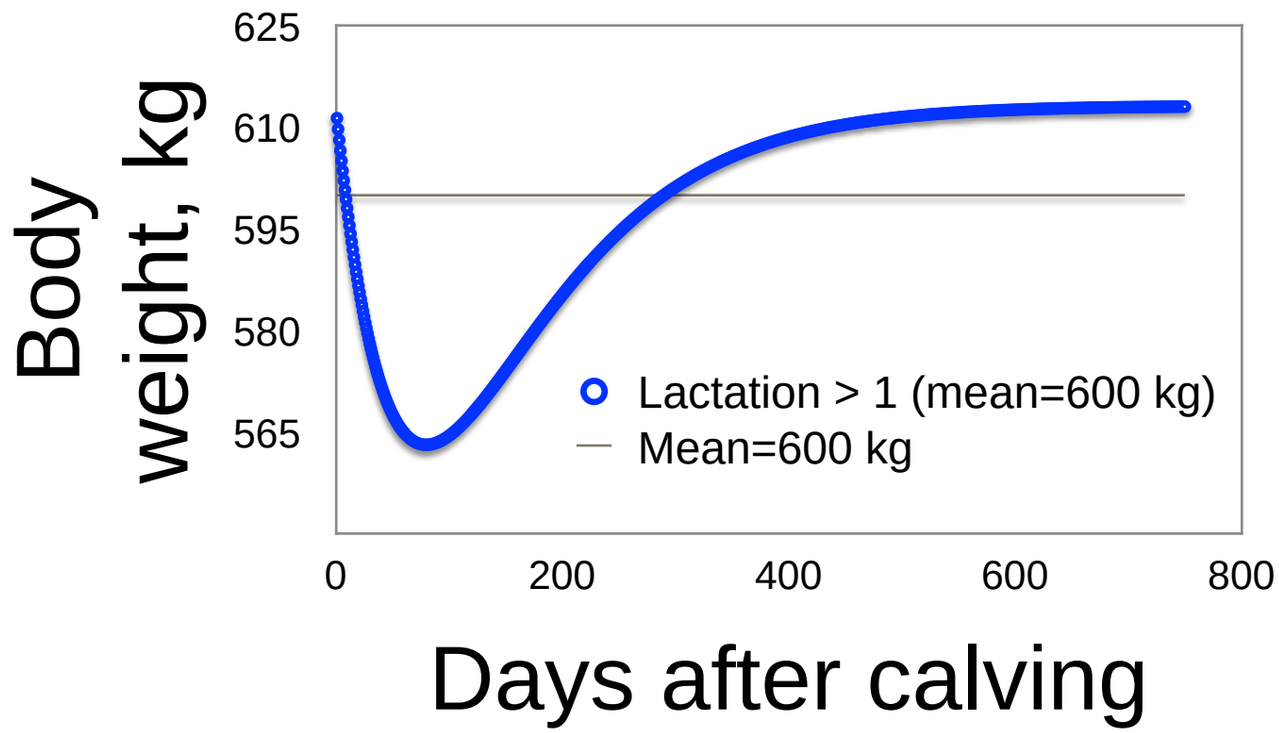
Initial individual cow BW

Cow-specific BW

Daily BW and BCS change according to:

- Lactation
- DIM
- Stochasticity

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



Criteria for nutritional grouping

Several criteria exist

Days after calving (DIM)

Based on stage of lactation

Fat (protein) corrected milk

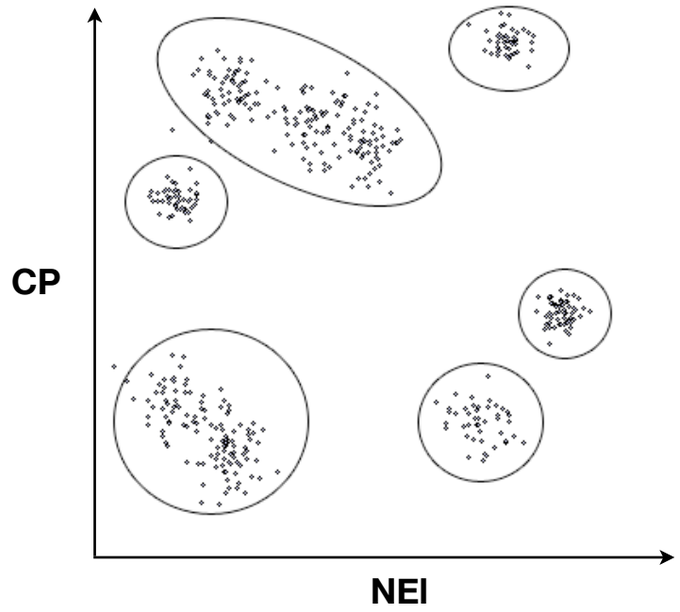
Based on level of production measured as F(P)CM

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

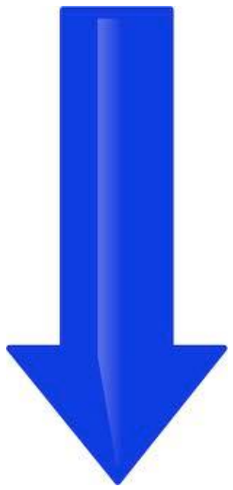
Two main types of groups

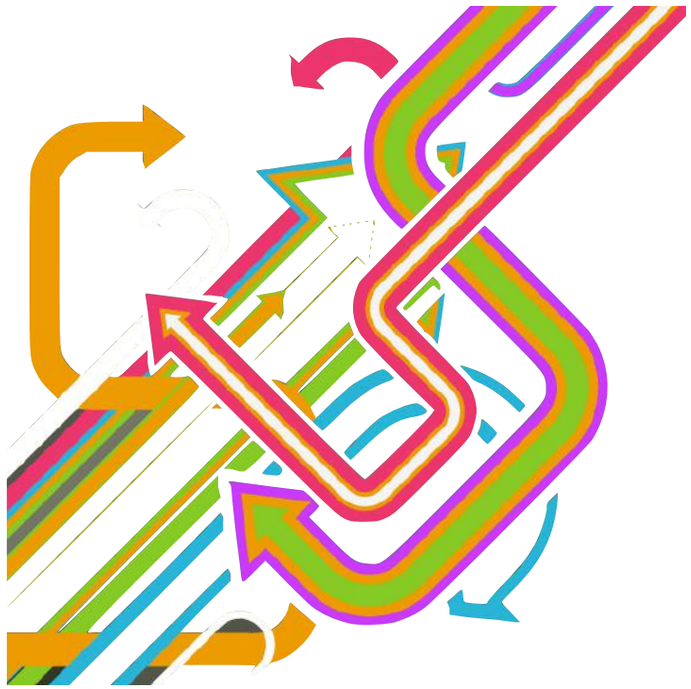
Obligated groups

- 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

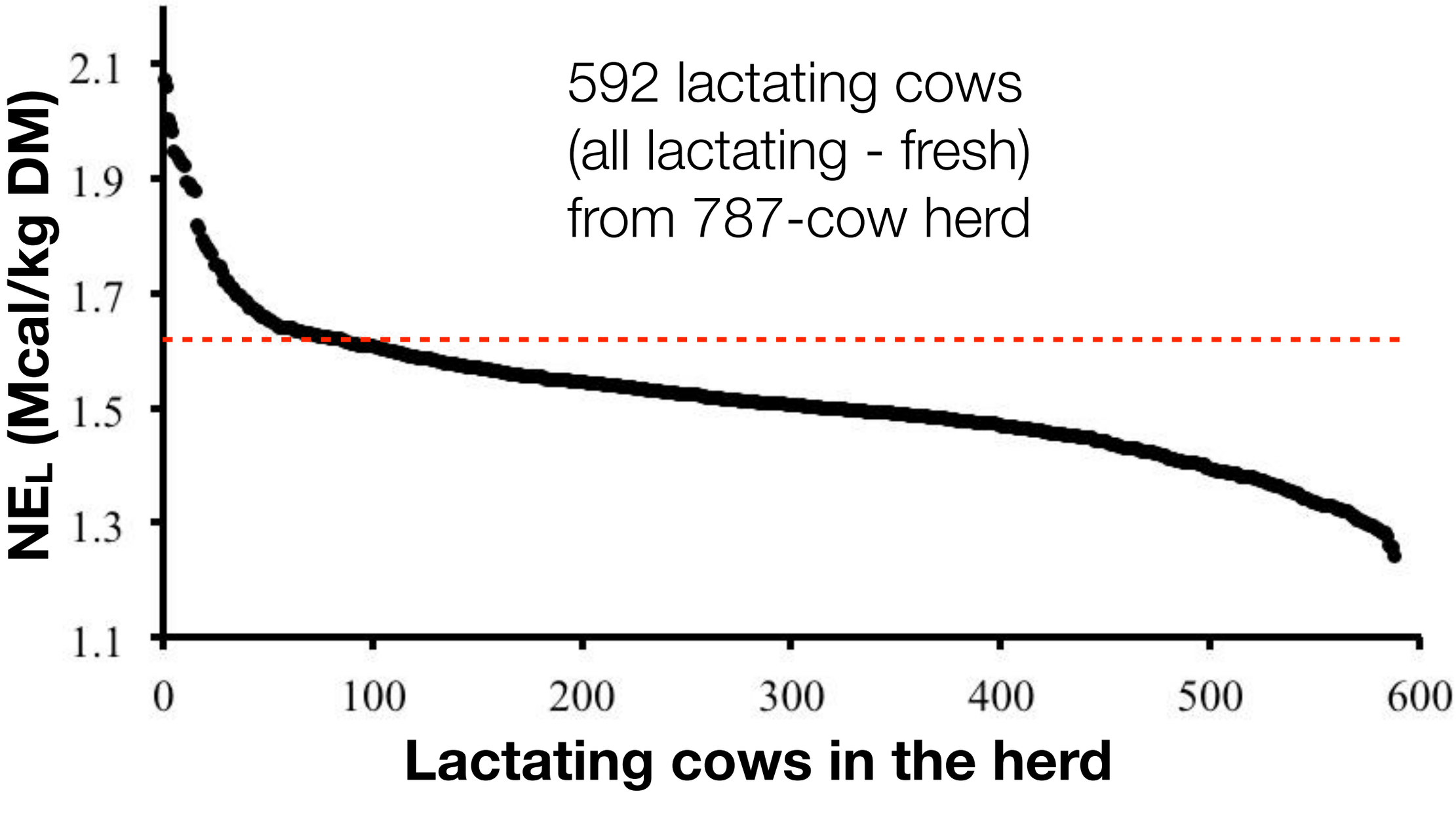
Studied herds

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
1st lactation, %	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	✗	✗	✓	✓	✗

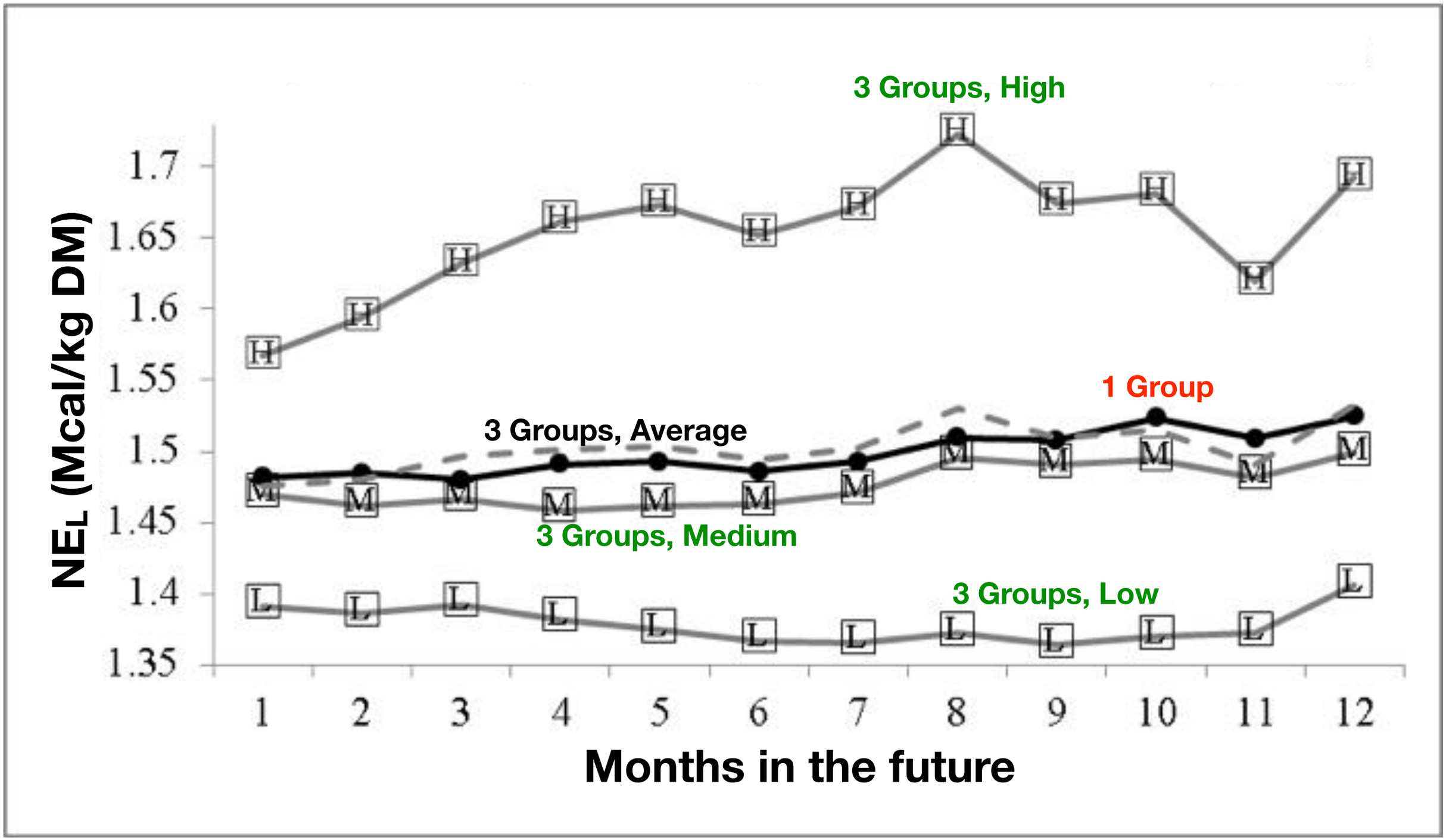
...And we are finding

Energy requirements of cows

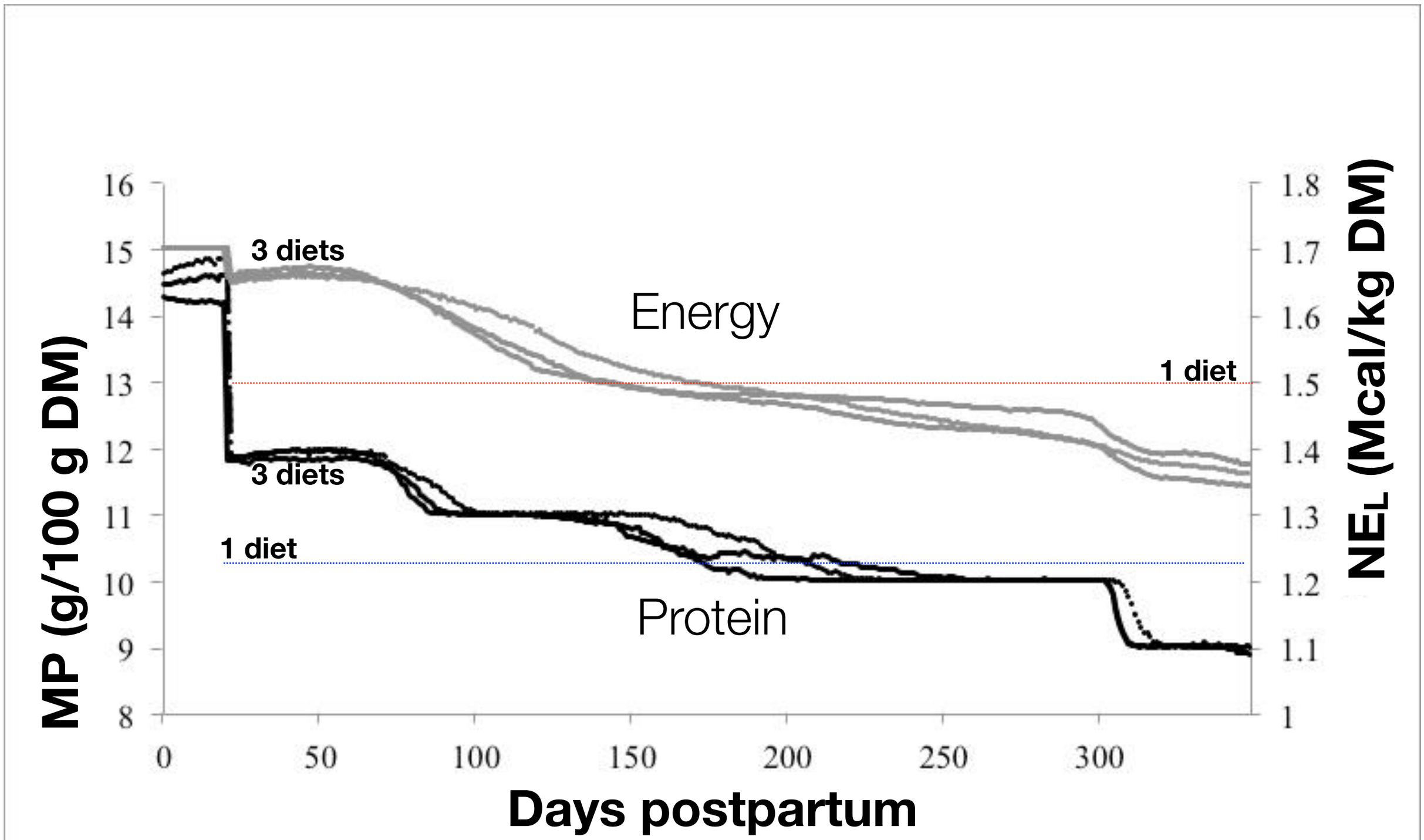


592 lactating cows
(all lactating - fresh)
from 787-cow herd

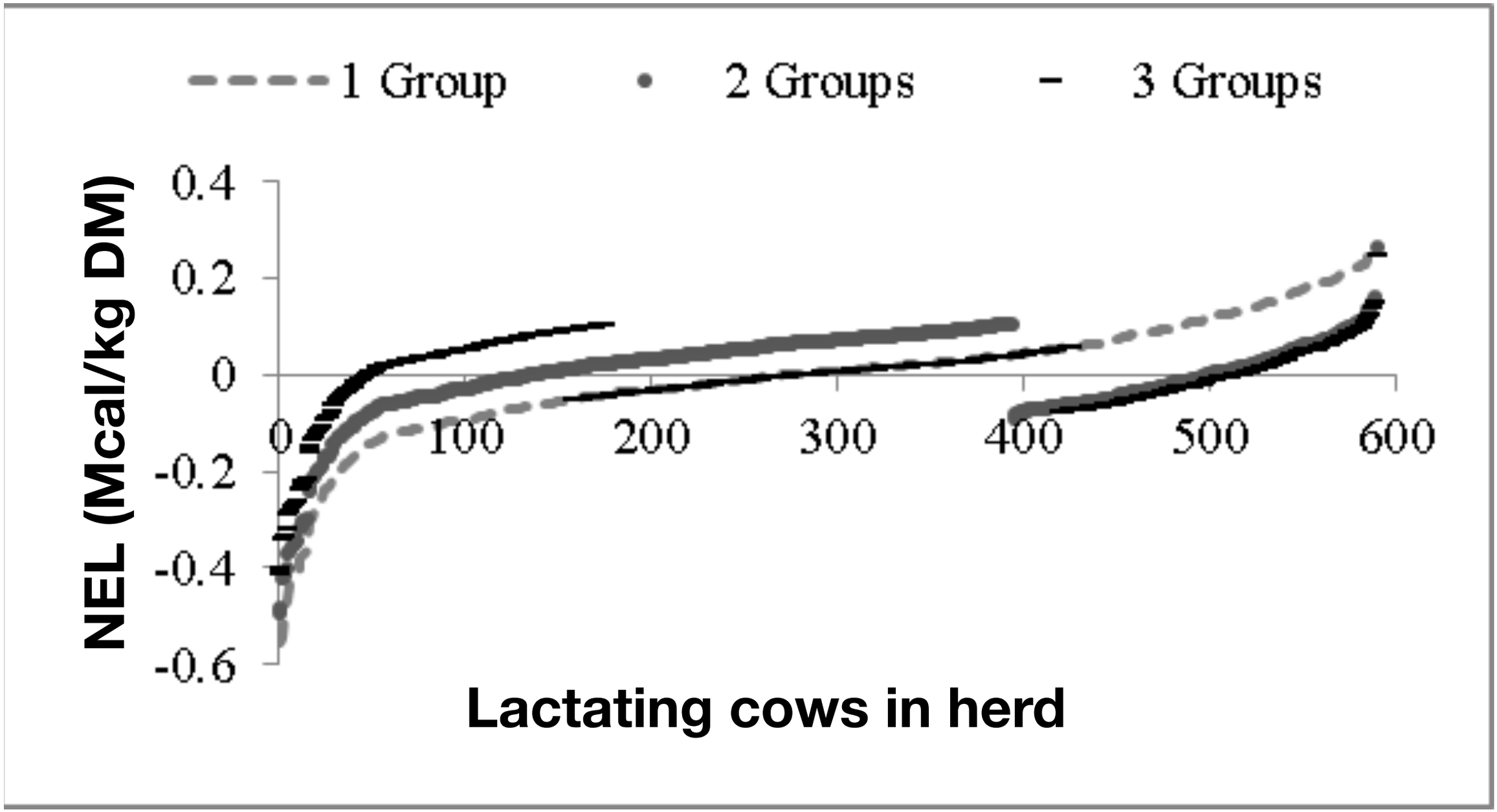
Energy provided in diets



Energy and Protein concentrations throughout Lactations (1, 2, ≥ 3)

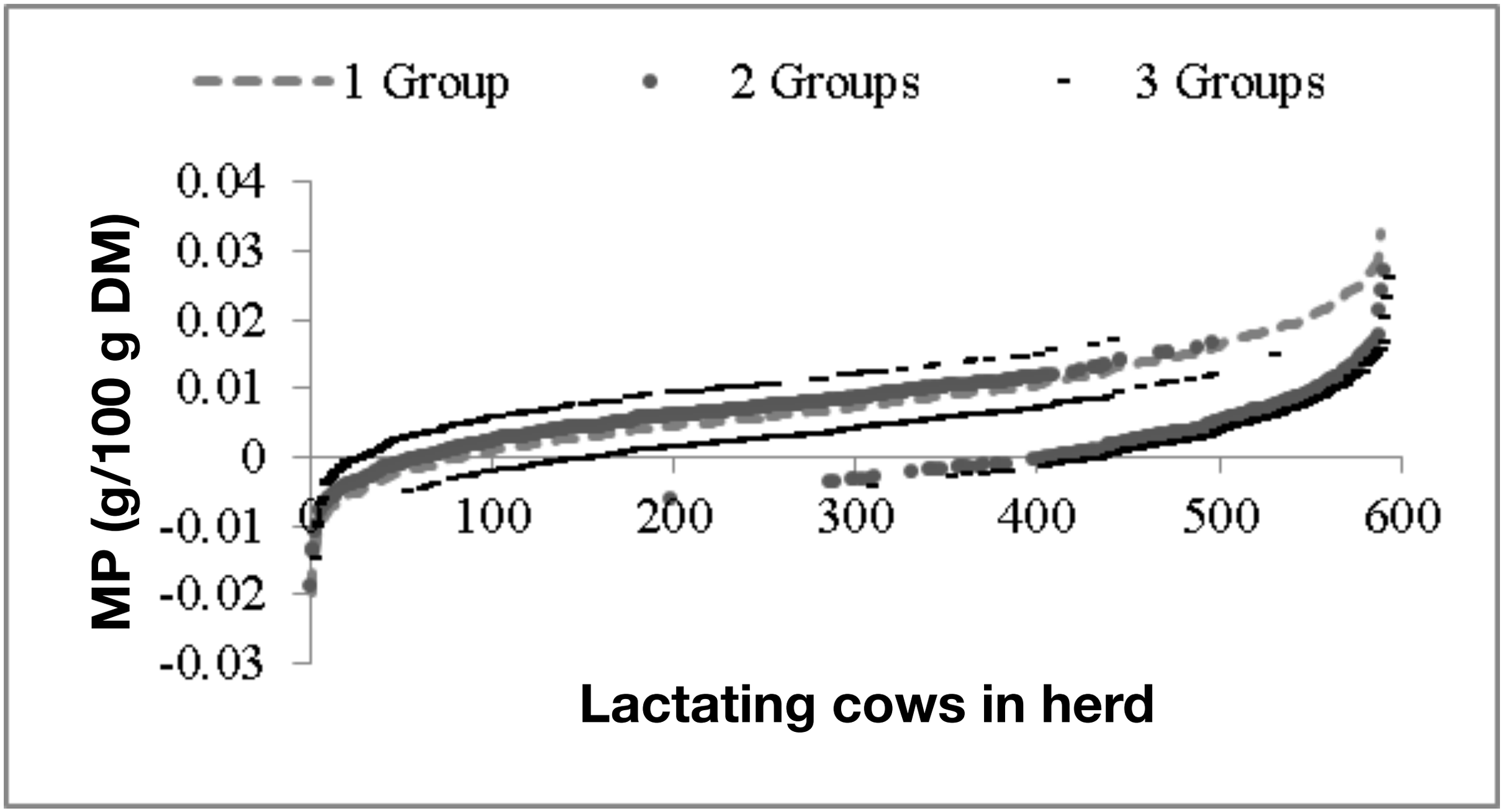


Provided - Required Energy in diet



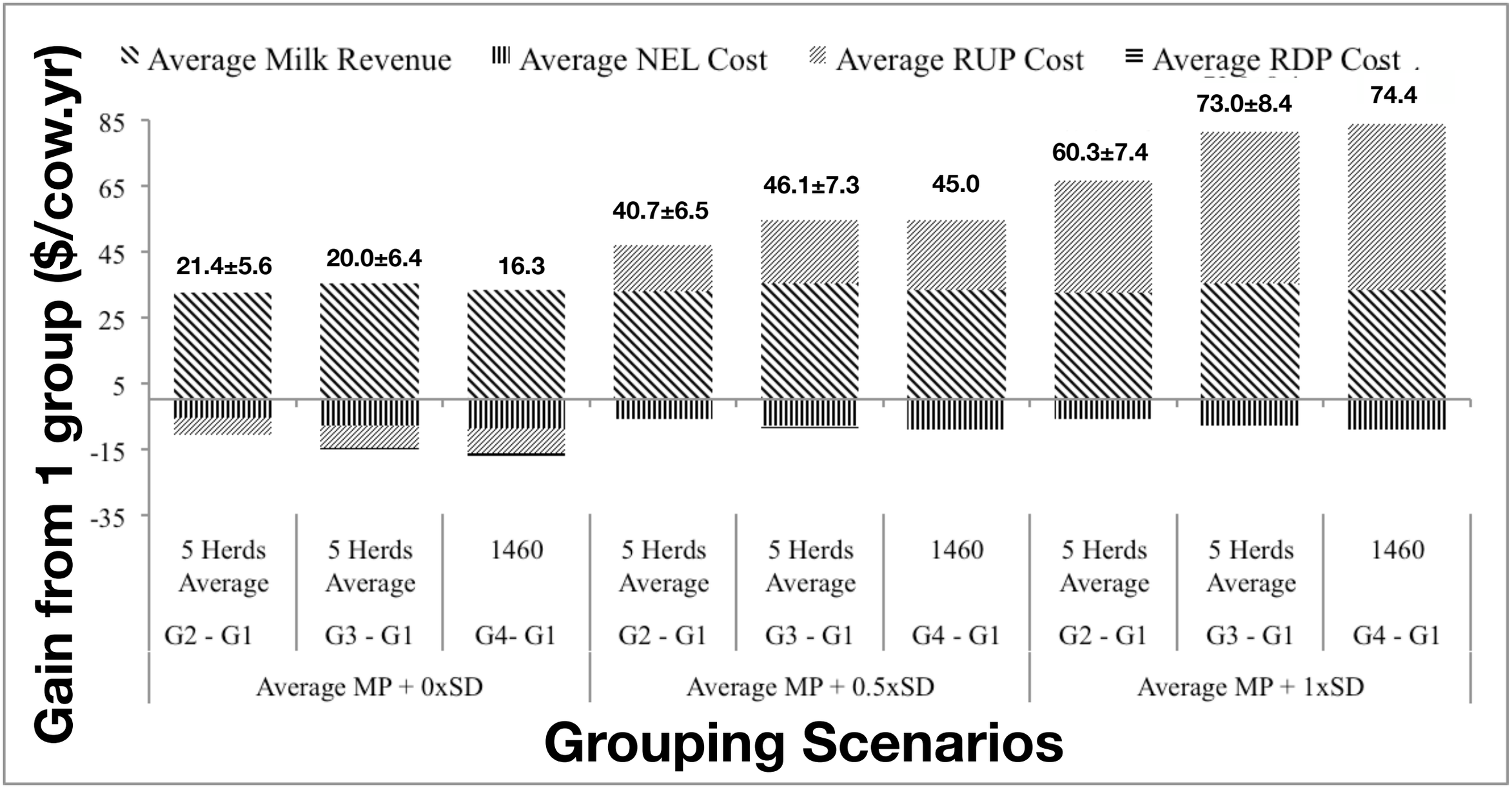
592 lactating cows (all lactating - fresh) from 787-cow herd

Provided - Required MP in diet



592 lactating cows (all lactating - fresh) from 787-cow herd

Average gain of grouping

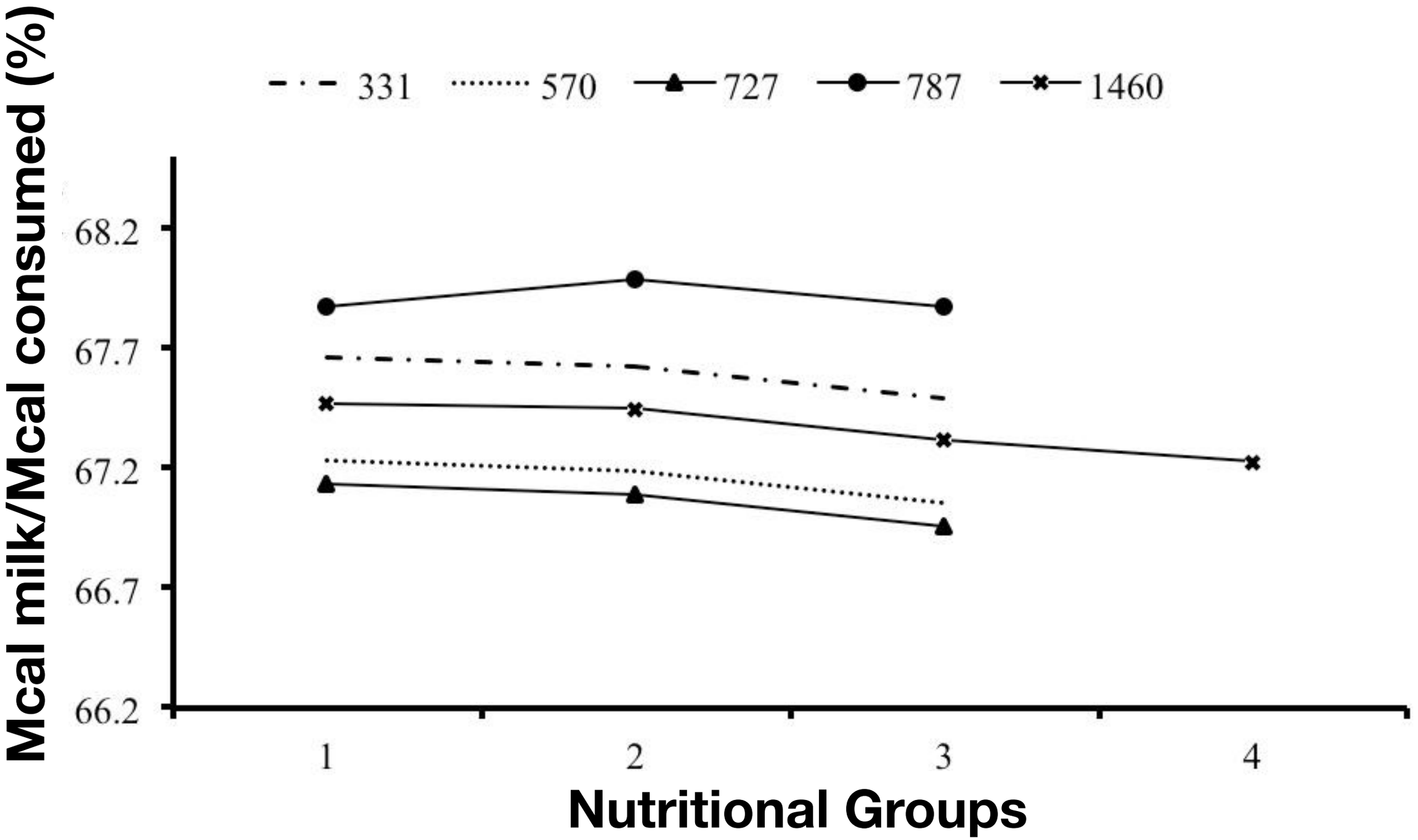


Economic Gain ($/cow.yr)

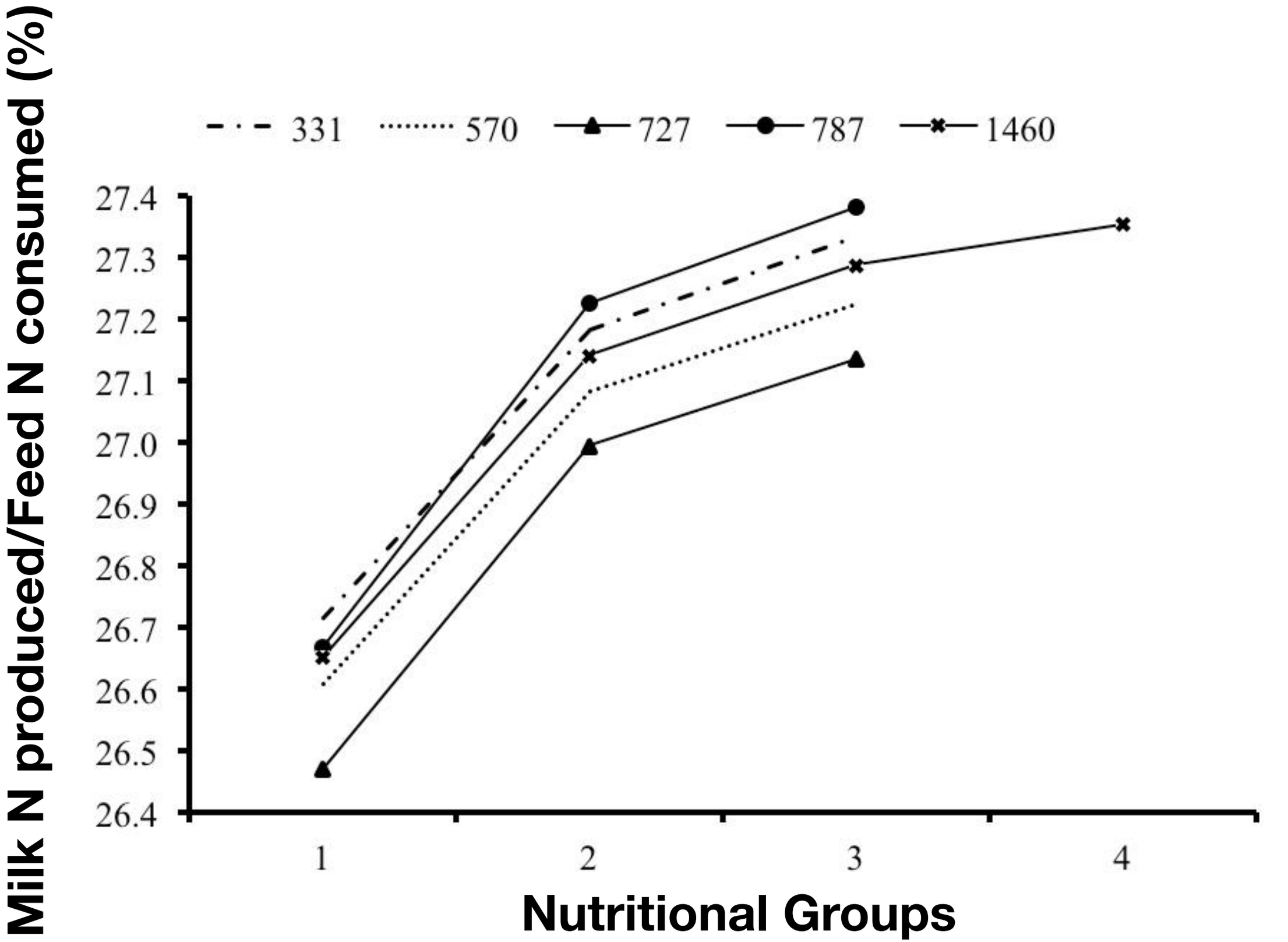
Farm and Herd Size	Scenario	Difference between Grouping and 1 Group		
		2 Groups	3 Groups	4 Groups
331	base	**53.54**	**65.91**	-
	milk loss[1]	35.75	47.59	-
	1st lactation[2]	47.66	58.29	-
570	base	**54.0**	**65.79**	-
	milk loss[1]	37.59	44.82	-
	1st lactation[2]	43.28	53.45	-
727	base	**62.72**	**74.98**	-
	milk loss[1]	49.63	54.75	-
	1st lactation[2]	49.89	59.47	-
787	base	**73.50**	**88.41**	-
	milk loss[1]	57.53	67.39	-
	1st lactation[2]	61.80	74.64	-
1,460	base	**57.57**	**69.96**	**74.45**
	milk loss[1]	43.56	49.36	50.81
	1st lactation[2]	46.90	57.19	61.45

[1]1.82kg x 5 d. [2]1st lactation fed as a separate group

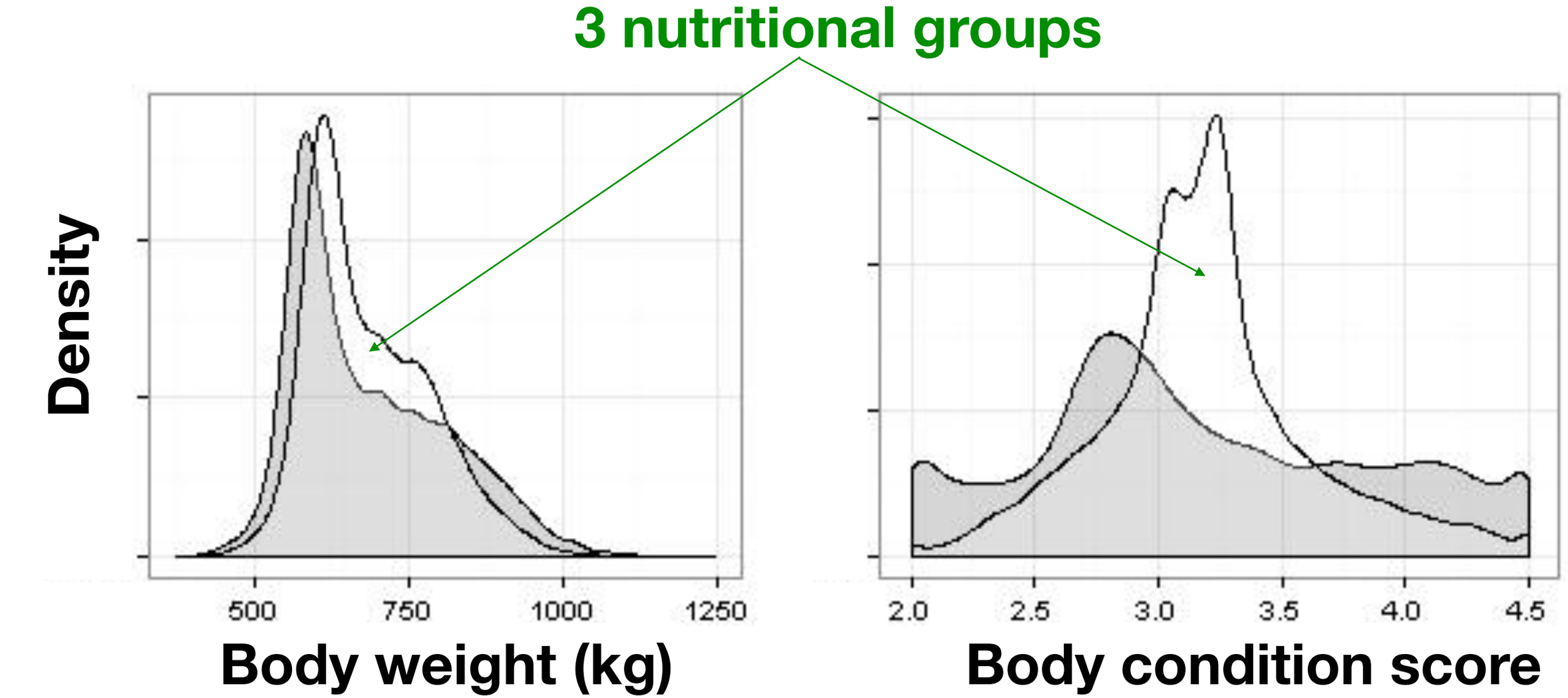
Energy captured in milk



Nitrogen captured in milk



Body weight and BCS



1,000 replicates for 787-cow herd

Total are under curves adds to 1

UW-Dairy Management
Decision Support TOOLS

Decision support tool…

http://DairyMGT.info

A simplified online tool

Herd-specific assessments (DairyMGT.info)

UW Dairy Management Tool | University of Wisconsin-Madison | UW Extension | Dairy Science | Contact

Grouping Strategies for Feeding Lactating Dairy Cattle

V.E. Cabrera, UW-Madison Dairy Science

Sample Farm: Total Cows = 470

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)

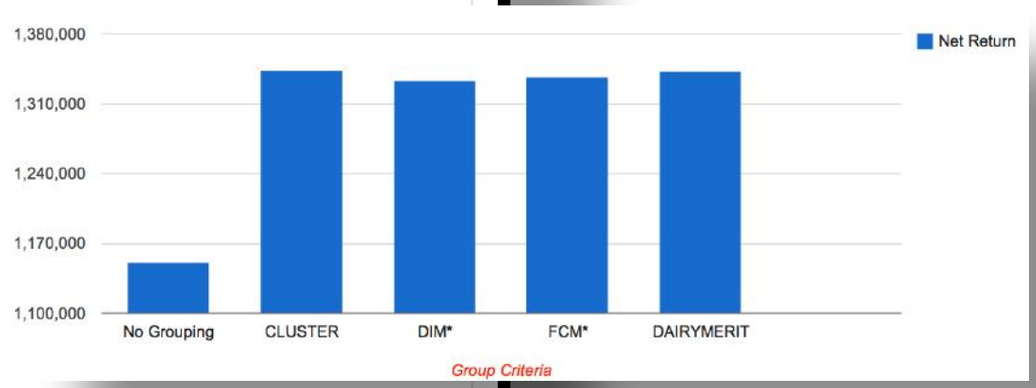
Download xls | Download xlsx

Upload Parameters as Excel File

Choose File no file selected | Upload

Current File/Data Status

Using Data from Default Parameters File on Server



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

Additional costs and benefits

Impacts grouping feeding strategies

Management cost

- Additional labor
- Extra management

Avoid costs

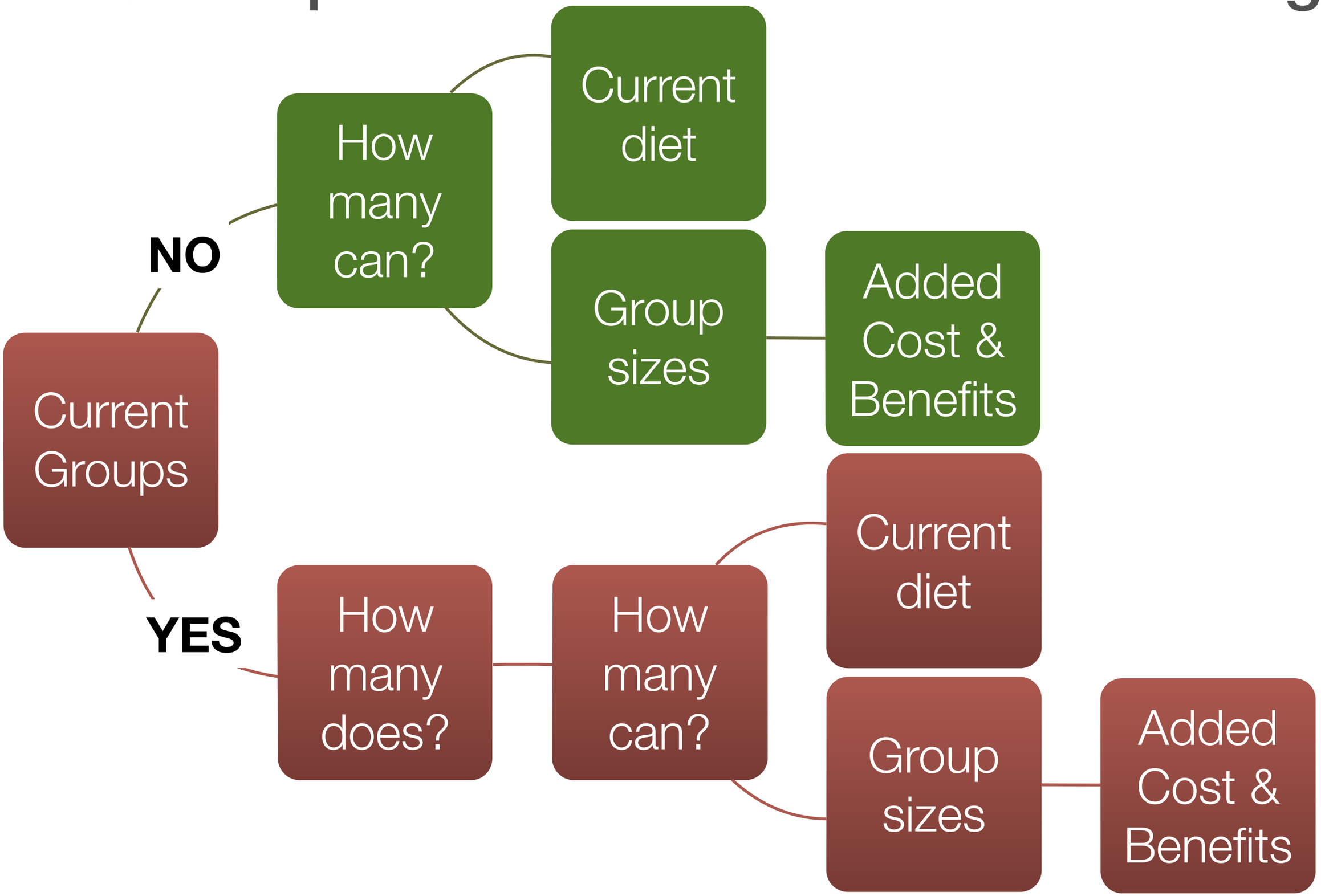
- Additives and supplements savings

Milk depression

- Cow social interactions

Grouping Strategies

Farm/herd possibilities and decision-making



Tool demonstration

Grouping Illustration

Economic impact of nutritional grouping

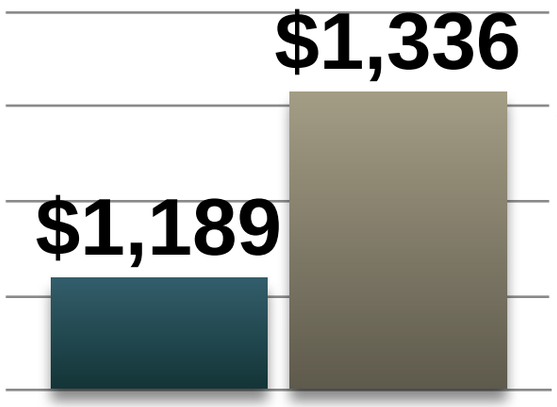
Current Situation	
Lactating Cows	470
Current Groups	None
NEL Mcal/lb	0.80
CP, %	17

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 NE_L

Projected body weight

- 500 kg primiparous
- 600 kg multiparous

Analysis from dairy farm records

30 Wisconsin dairy farms

	Lactating cows (n=30)	1 Group	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

This project is supported by Agriculture and Food Research Initiative Competitive Grant No. 2011-68004-30340 from the USDA National Institute of Food and Agriculture

United States Department of Agriculture
National Institute of Food and Agriculture

Thanks