



# Nutritional Grouping Strategies for Dairy Lactating Cows

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# Rationale

Opportunity to fine-tune nutrient use

## **Same ration (TMR) to all cows (groups)**

All lactating cows receive same density diet



## **Preferred “high” rations**

Low producing animals receive more nutrients than required

## **One diet for all**

Would never optimize production and efficiency

# Improve feed efficiency

+ feeding groups (precision feeding)

## Improved nutrient use efficiency

Diet closer to cow requirements



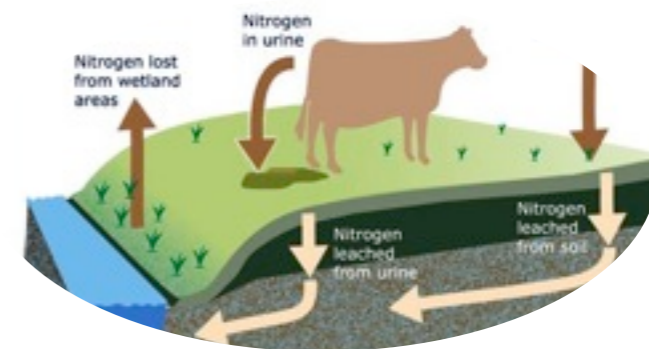
## Less overfed animals

Decreased overweighted COWS

## Less nutrient excretion

Decreased environmental concerns

Wang et al., 2000



## Lower feeding costs

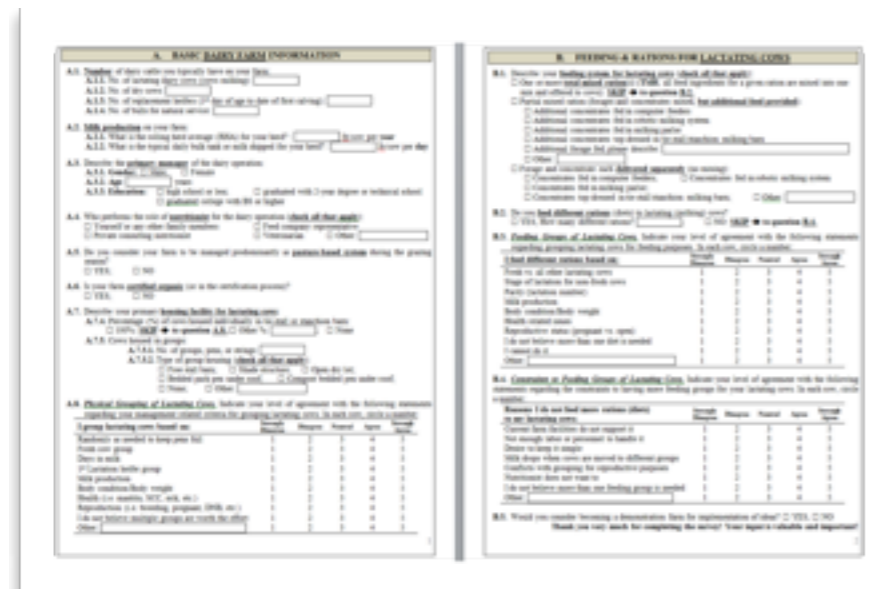
Higher milk income over feed cost



# Why farmers do not group more?

Trying to find most important constraints

2-page mailed survey



25% feeding same ration to all lactating

	Reported constraint
1	Perception of milk drops
2	Keep mgt. simple
3	Conflicts w/repro group
4	Facilities do not allow
5	Don't believe are needed
6	Nutritionist don't want
7	Labor or personnel

## Results (responses)

~200 WI

~59 MI



# Strategies for grouping cows

Depend on farm and herd characteristics

## Individual cow nutrient requirements

- Energy
- Protein

## Number of lactating cows on the herd



## Farm characteristics

Capacity to handle lactating feeding groups



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

# Cow-level estimates

Internally performed

## Nutrient requirement

- NEL (NRC, 2001)
- CP (McGilliard et al., 1983)

## Feed requirement

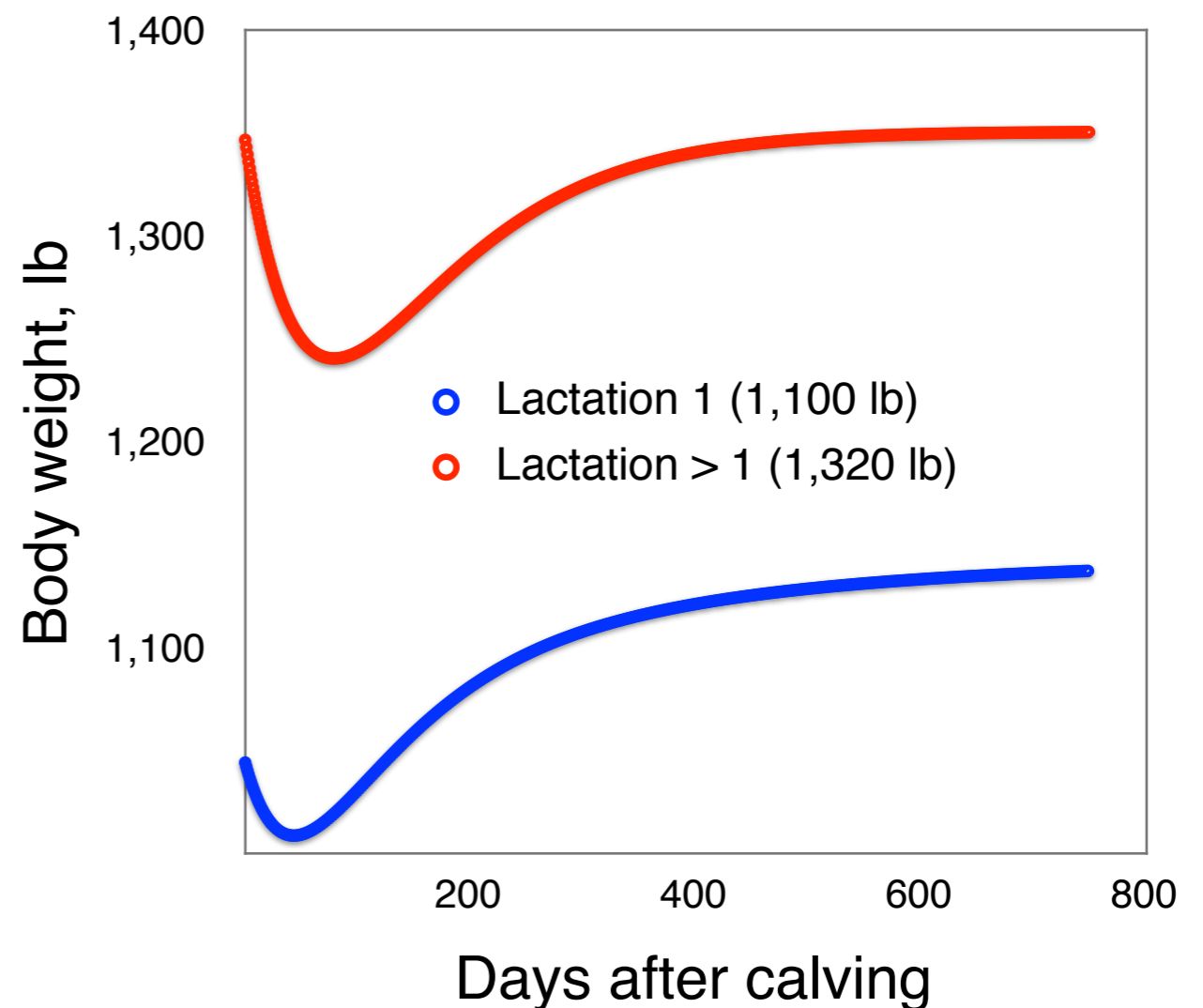
- DMI (NRC, 2011)

## Live body weight

- Farm records (if available)
- Calculated (Korver et al., 1985)

## Nutrient per unit DM

- NEL/DMI
- CP/DMI



# Nutrient requirement for a group

Energy and protein

## Lead factor

Multiplicative factor to adjust nutrient requirements of a group

Stallings and McGilliard, 1984  
St-Pierre and Thraen, 1999



$$NE_{group} (Mcal) = 83^{rd} \text{ Percentile of } (NE_{group\_cows})$$

$$CP_{group} (\%) = 83^{rd} \text{ Percentile } (CP_{group\_cows})$$

# Criteria for nutritional grouping

Several criteria exist

## Days after calving (DIM)

Based on stage of lactation



## Fat corrected milk

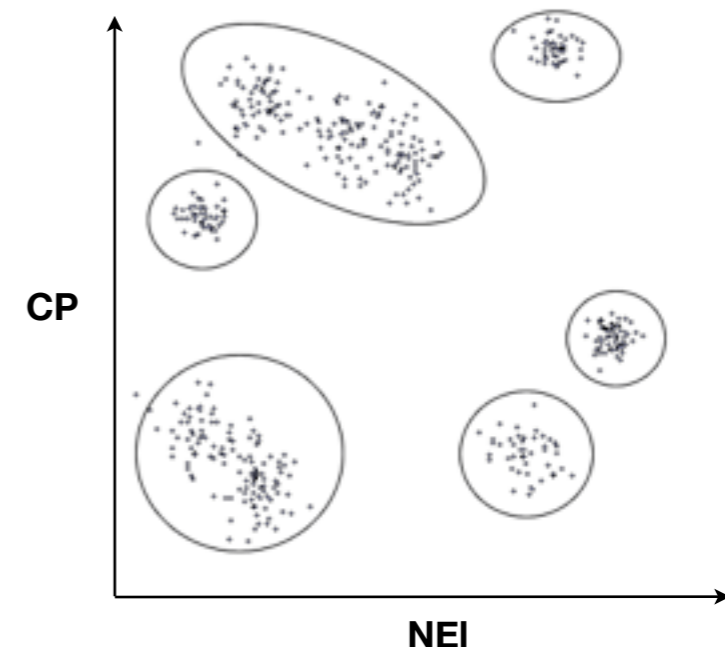
Based on level of production measured as FCM

## Dairy merit

Function of both FCM and BW

## Cluster

Seems to be MOST efficient criterion



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



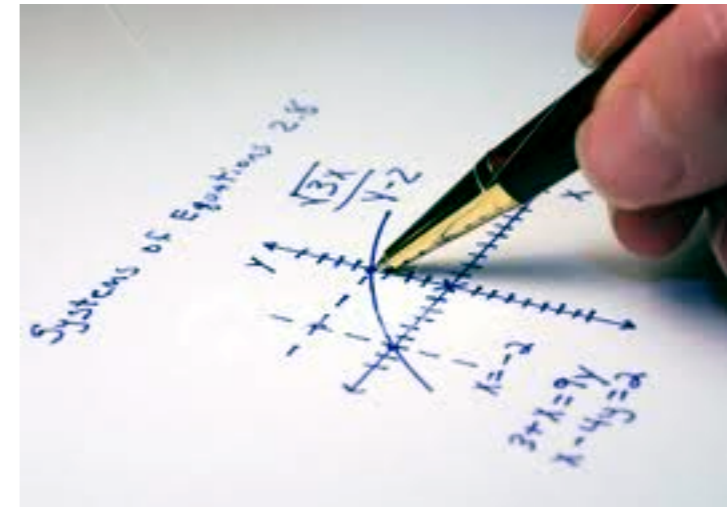
# Value of NE, CP, and milk

Determine diets' cost (August 2013)

## Using referee feeds

Petersen method

St-Pierre and Giamocic, 2000



***Corn: 9% CP + 2 Mcal/kg = \$0.267/kg***

***SBM: 54% CP + 2.2 Mcal/kg = \$0.587/kg***

## Price NE and CP

NE (\$/Mcal) = 0.116

CP (\$/kg) = 0.748

## Price of milk

\$0.42/kg

<http://future.aae.wisc.edu/>

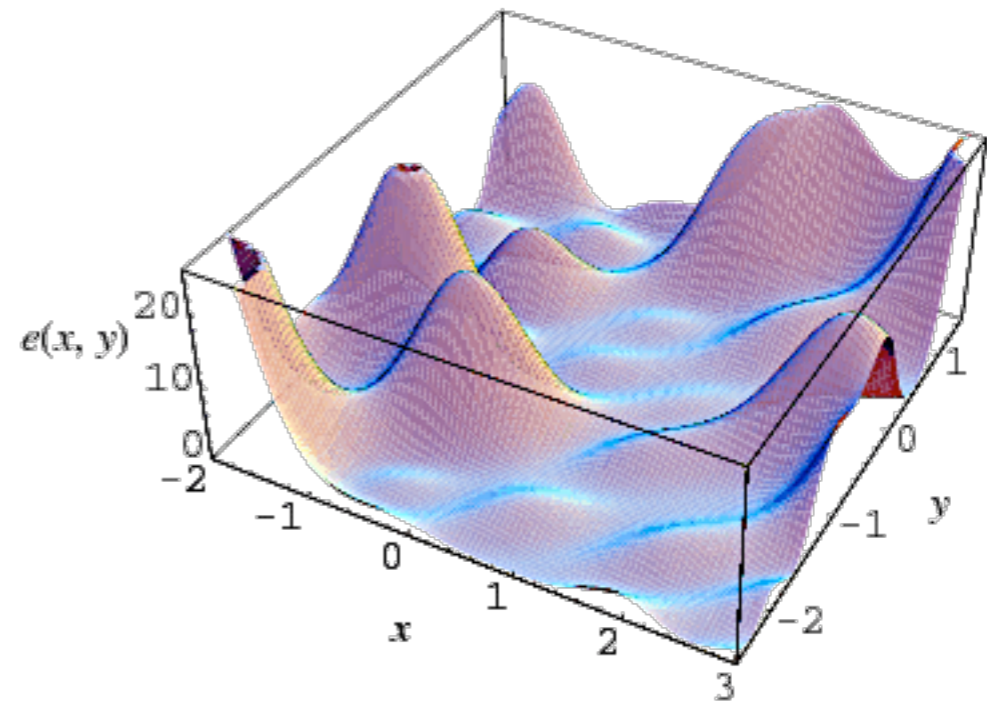
[http://dairymgt.info/tools/feedval\\_12/index.php](http://dairymgt.info/tools/feedval_12/index.php)

# Optimize cows to a feeding group

Maximize the income over feed cost

## Non-linear optimization

- Iterative process (all permutations)
- Search for global maxima IOFC



$$\mathbf{Max}(IOFC) = \mathbf{SUM}(IOFC_{group})$$

$$\mathbf{IOFC}_{group} = \mathbf{Milk\ Value} - \mathbf{Feed\ Cost}$$

# 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
- Diet changes

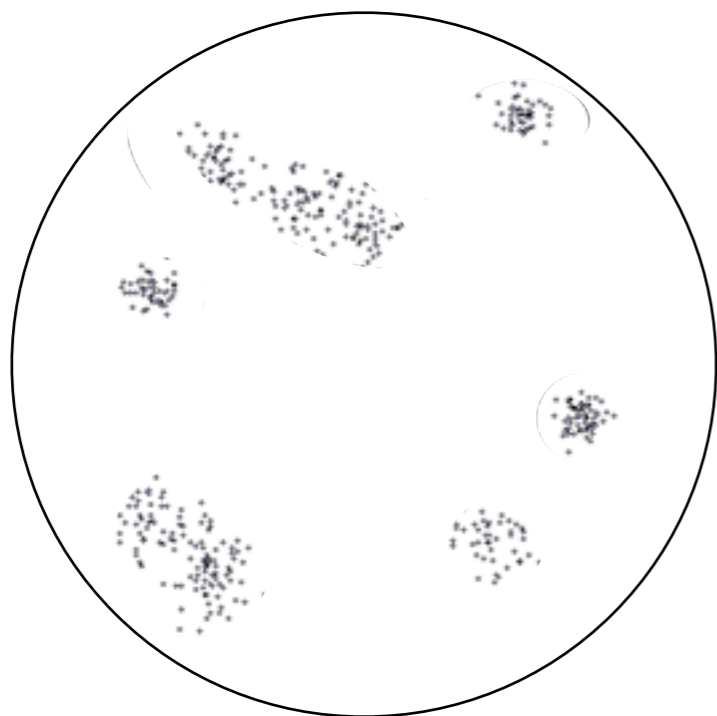


# Overall net return

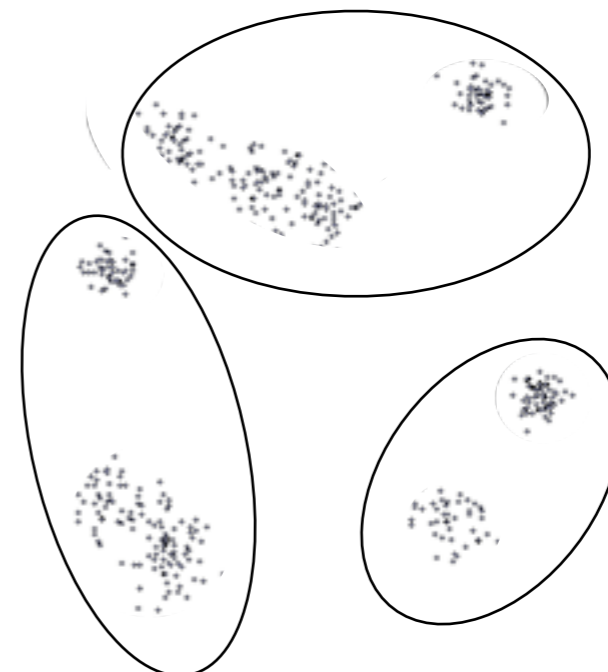
## Bottom line grouping strategies

### Net return

- + Max (IOFC)
- Extra management
- Milk depression
- + Savings



vs.





# Grouping strategies for feeding

## Online user-friendly decision support tool

The screenshot displays the web interface for the 'Grouping Strategies for Feeding Lactating Dairy Cattle' tool. The header includes the University of Wisconsin-Madison and UW Extension logos. A navigation menu contains links for Home, Tools, Projects, Publications, Presentations, LGM-Dairy, Links, About, Contact, Comments, News, People, Opportunities, and Gallery. The main title is 'Grouping Strategies for Feeding Lactating Dairy Cattle'. Below the title, there are tabs for Overview, Upload Farm Details, Group Cows, and Reap Benefits, along with a status indicator 'Sample Farm: Total Cows = 470'. The 'Prices' section contains a table with input fields for CP%, Nel, and \$/(Unit) for Corn and Soybean Meal. Below this is a note about highlighted values and a 'Calculated Values' table showing \$/lb CP and \$/Mcal NEL. There are also input fields for Milk Price, a 'Download Parameter Excel File' button, an 'Upload Parameters as Excel File' section with a file upload button, and a 'Current File/Data Status' section indicating the tool is using default parameters.

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### Grouping Strategies for Feeding Lactating Dairy Cattle

Overview Upload Farm Details Group Cows Reap Benefits **Sample Farm: Total Cows = 470**

Prices

	CP%	Nel, MCal/lb	\$(Unit)
Corn	<input type="text" value="0.1"/>	<input type="text" value="0.9"/>	<input type="text" value="6.72"/> (\$/bu)
Soybean Meal	<input type="text" value="0.5"/>	<input type="text" value="0.88"/>	<input type="text" value="350"/> (\$/ton)

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

Calculated Values	
\$/lb CP	<input type="text" value="0.14337"/> <input type="button" value="Edit"/>
\$/Mcal NEL	<input type="text" value="0.1174"/> <input type="button" value="Edit"/>

Milk Price:  (\$/cwt)

Download Parameter Excel File

Upload Parameters as Excel File  
Upload the Excel File:  No file chosen

Current File/Data Status  
Using Data from Default Parameters File on Server



# Video demonstration

Available at [DairyMGT.info](http://DairyMGT.info)

## Grouping Strategies for Feeding Lactating Dairy Cattle



# Get the farm data

## Farm time specific dataset

### NE and CP value

- Farm known value
- Calculated from corn and soybean meal

### Milk price

- Farm known value

### Grouping strategies

- Farm current situation
- Possible situations

### Cow information

Table of specific data

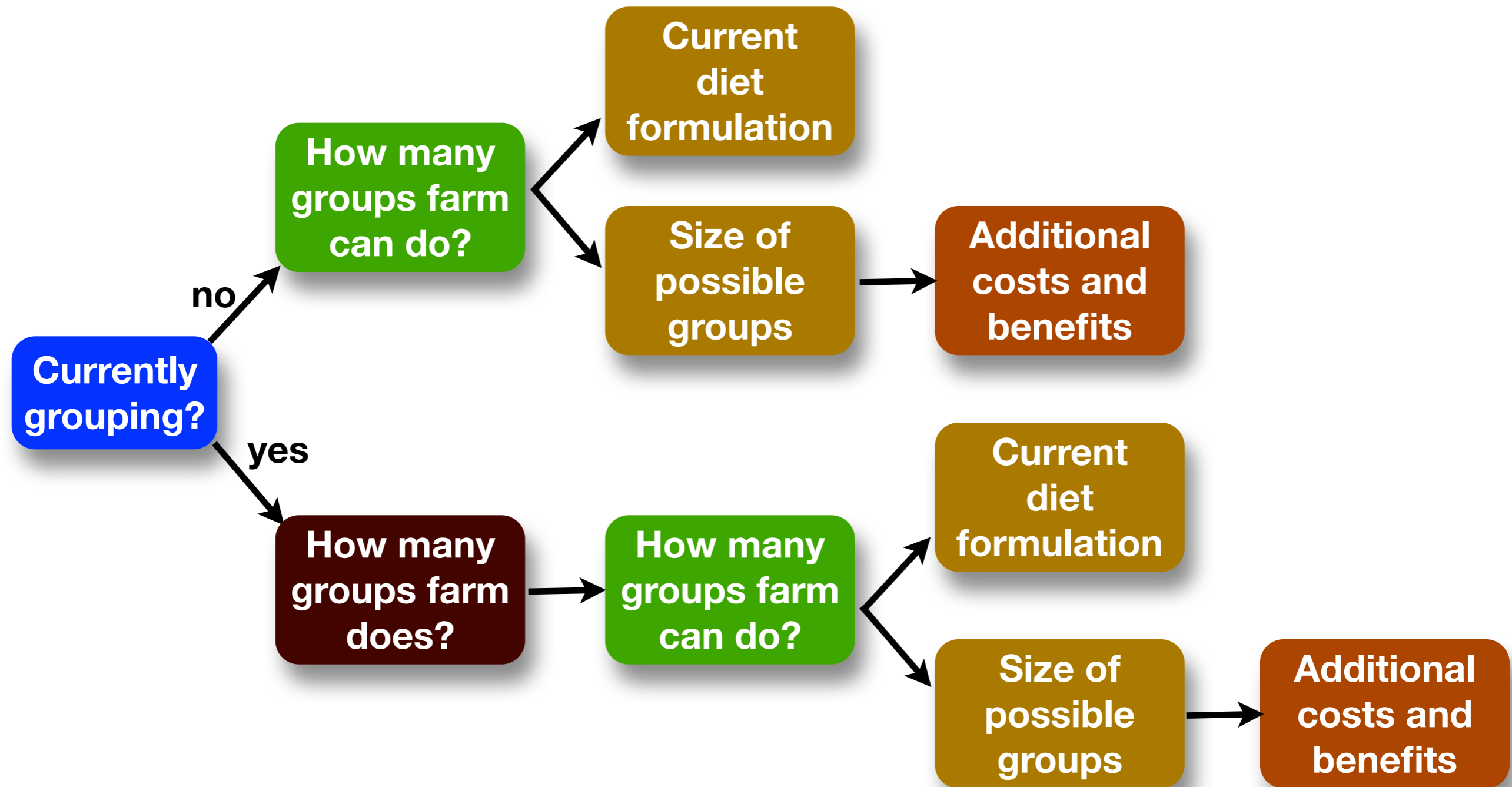
Cow ID	Parity	DIM	Milk, lb/d	Milk fat, %
6234	1	84	62	4.1
132	7	118	73	3.8
6196	1	198	85	3.4
6149	4	199	114	3.6
5045	2	280	81	4.3

### Additional information

- Cow's BW, or
- Parity's average BW

# Grouping strategies for feeding

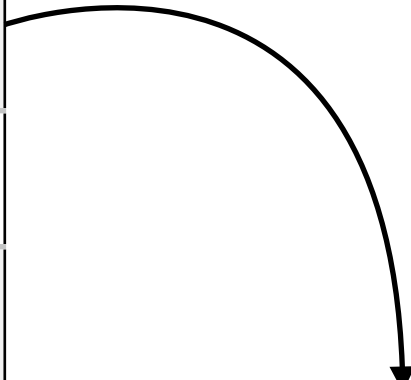
## Decision process



# Tool application

Wisconsin farm with 470 lactating cows

Current situation	
Lactating cows	470
Number groups	None
NE, Mcal/lb	0.80
CP, %	17%

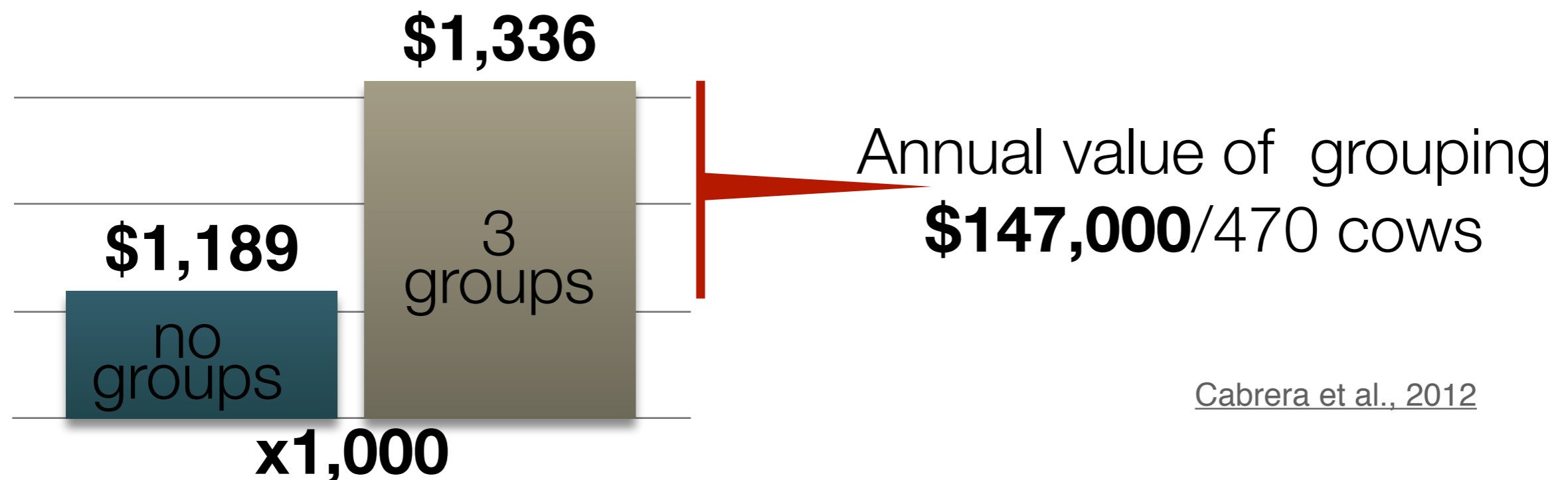


Possible situation	
Number groups	3
Group sizes	100, 100, 270
Added cost, \$	\$1,000/month
Milk loss	5 lb/cow
Milk loss time	4 days
Saved cost, \$	\$0

# Decision support system

## Cluster grouping criteria

	Possible situation			
	Cow numbers	NE, Mcal/lb	CP, %	IOFC, \$/cow/day
Group 1	270	0.71	16.05	9.3
Group 2	100	0.65	14.18	7.2
Group 3	100	0.62	13.07	4.7





# Tool application

30 Wisconsin dairy farms

## No grouping vs. 3 groups

- Same size groups

## Same prices for all

- \$15.89/cwt milk
- \$0.14337/lb CP
- \$0.1174/Mcal NEI

## Cluster grouping

- 83<sup>rd</sup> percentile CP and NEI



## Projected body weight

- 1,100 lb primiparous
- 1,300 lb multiparous

# Analysis from dairy farm records

30 Wisconsin dairy farms

	Number of lactating cows (n=30)	Income over Feed Cost (no grouping)	Income over Feed Cost (3 groups)
		\$/cow per year	
Mean	788	\$2,311	<b>\$2,707</b>
Minimum	< 200	\$697	<b>\$1,059</b>
Maximum	> 1,000	\$2,967	<b>\$3,285</b>

## Increase of IOFC (\$/cow per year)

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

## After reasonable extra costs

- Still increased net margin of between 5 and 47%





**Thanks**