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)

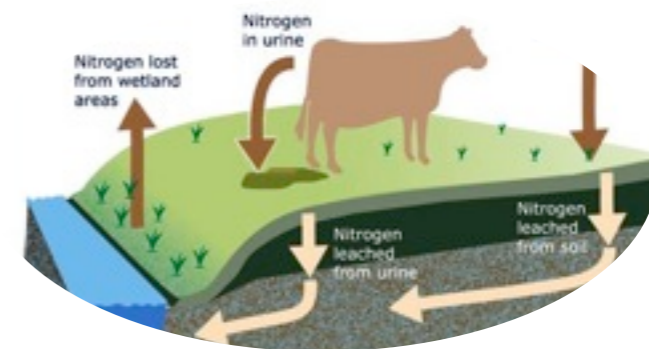**Improved nutrient use efficiency**
Diet closer to cow requirements

Less nutrient excretion
Decreased environmental concerns

Wang et al., 2000

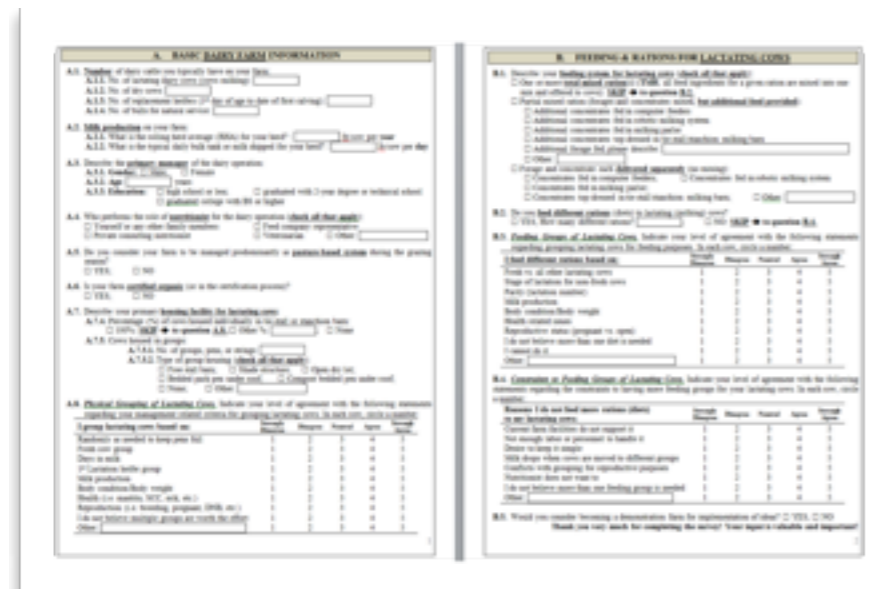**Less overfed animals**
Decreased overweighted cows

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)

~200 WI

~59 MI

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

Contreras-Govea et al., 2013

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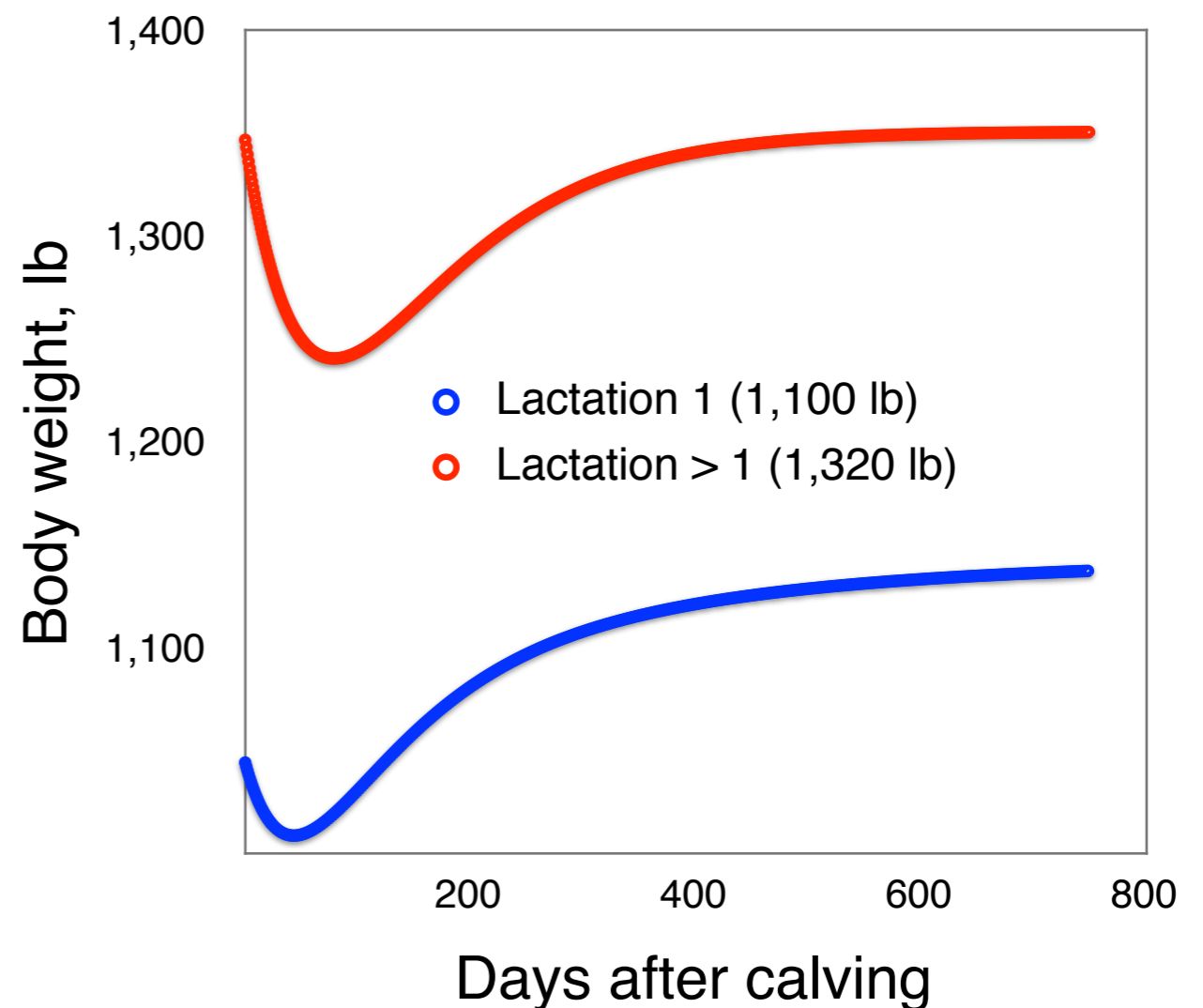- NEL (NRC, 2001)
- CP (McGilliard et al., 1983)

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

Legend:
- Lactation 1 (1,100 lb)
- Lactation > 1 (1,320 lb)

Y-axis: Body weight, lb (1,100 – 1,400)
X-axis: Days after calving (200 – 800)

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

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

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

Criteria for nutritional grouping

Several criteria exist

Days after calving (DIM)
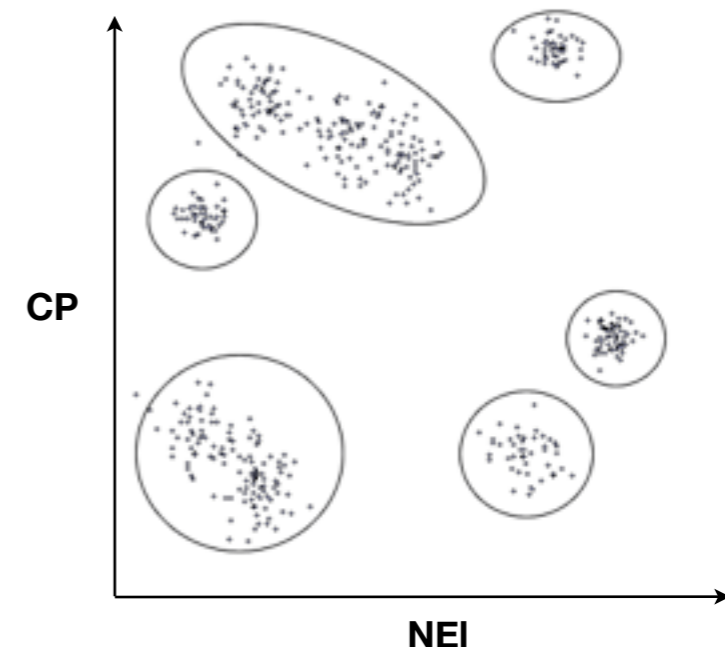Based on stage of lactation

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

CP

NEI

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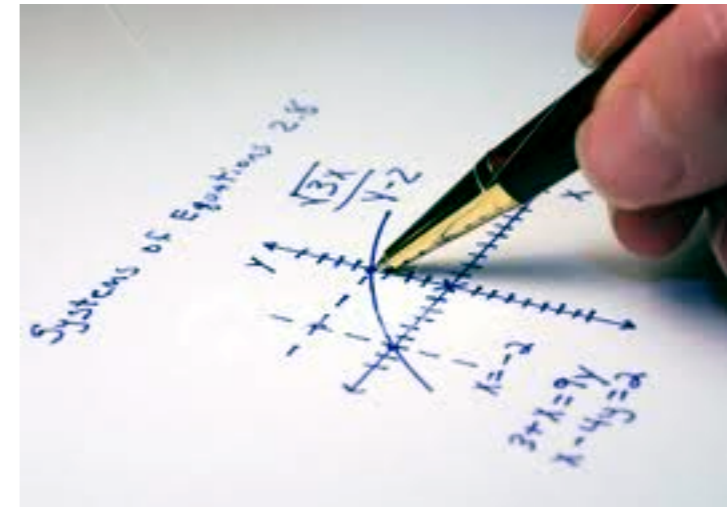
Corn: 9% CP + 2 Mcal/kg   = $0.267/kg

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

Price NE and CP
NE ($/Mcal) = 0.116
CP ($/kg)   = 0.748

http://dairymgt.info/tools/feedval_12/index.php

Price of milk
$0.42/kg

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

Optimize cows to a feeding group
Maximize the income over feed cost

Non-linear optimization
- Iterative process (all permutations)
- Search for global maxima IOFC
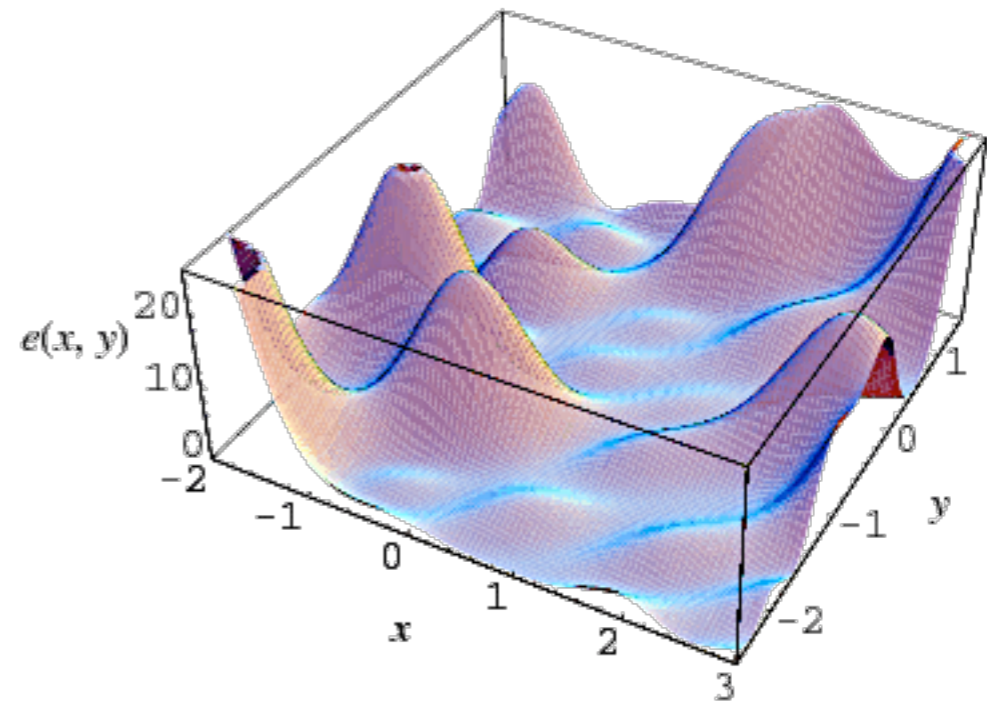
$$Max(IOFC) = SUM(IOFC_{group})$$

$$IOFC_{group} = Milk\ Value - Feed\ Cost$$

Cabrera, 2012

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
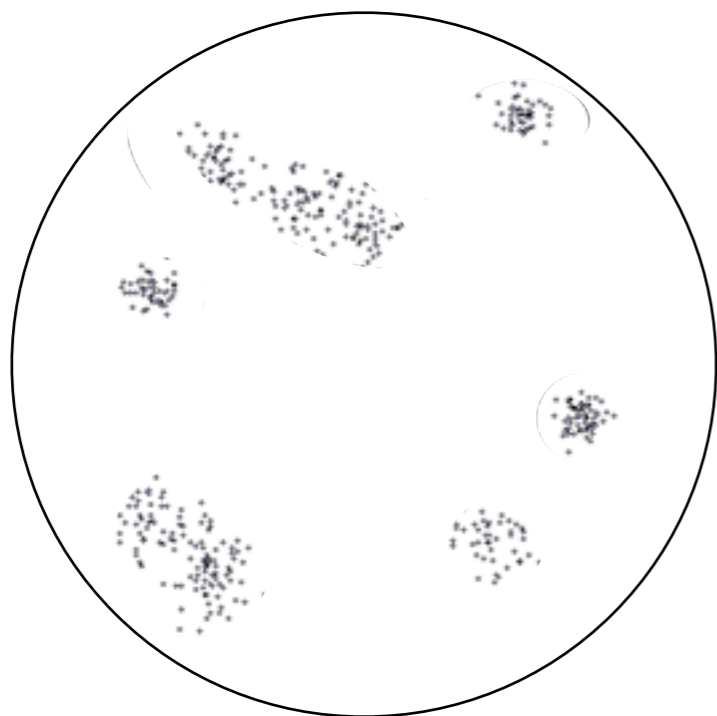
vs.
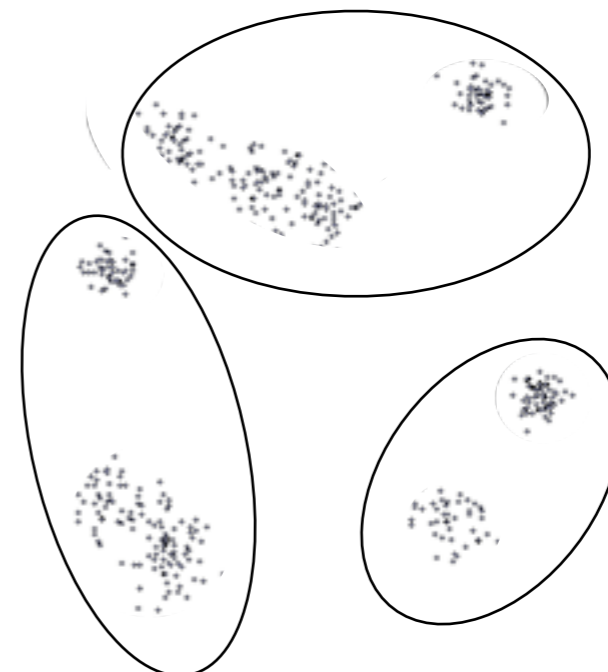
Grouping strategies for feeding
Online user-friendly decision support tool

Video demonstration
Available at DairyMGT.info

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
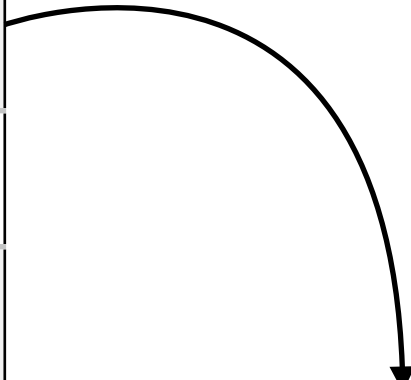
Grouping strategies for feeding
Decision process
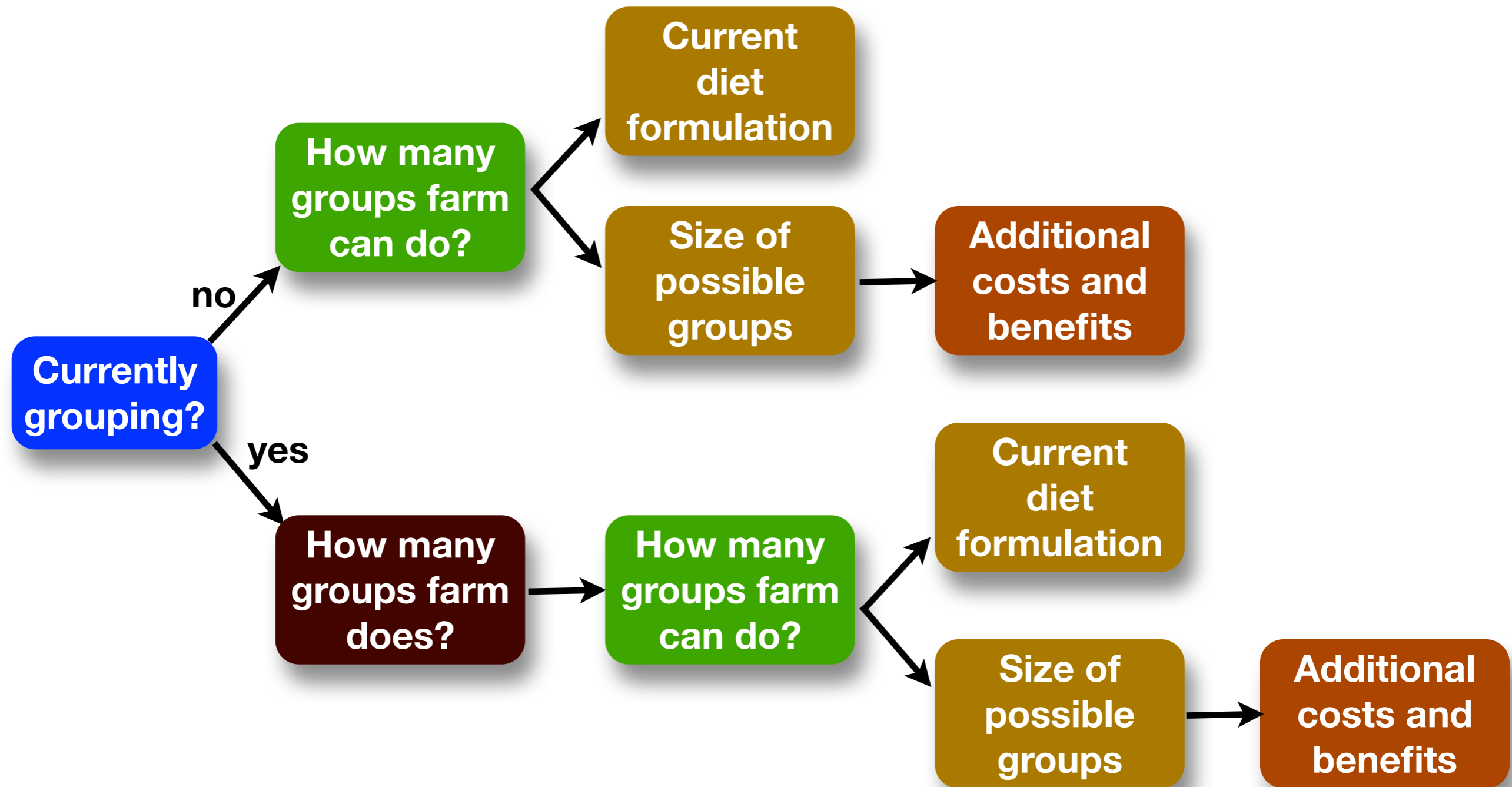
Tool application
Wisconsin farm with 470 lactating cows

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

$1,336

$1,189

3 groups

no groups

x1,000

Annual value of grouping
$147,000/470 cows

Cabrera et al., 2012
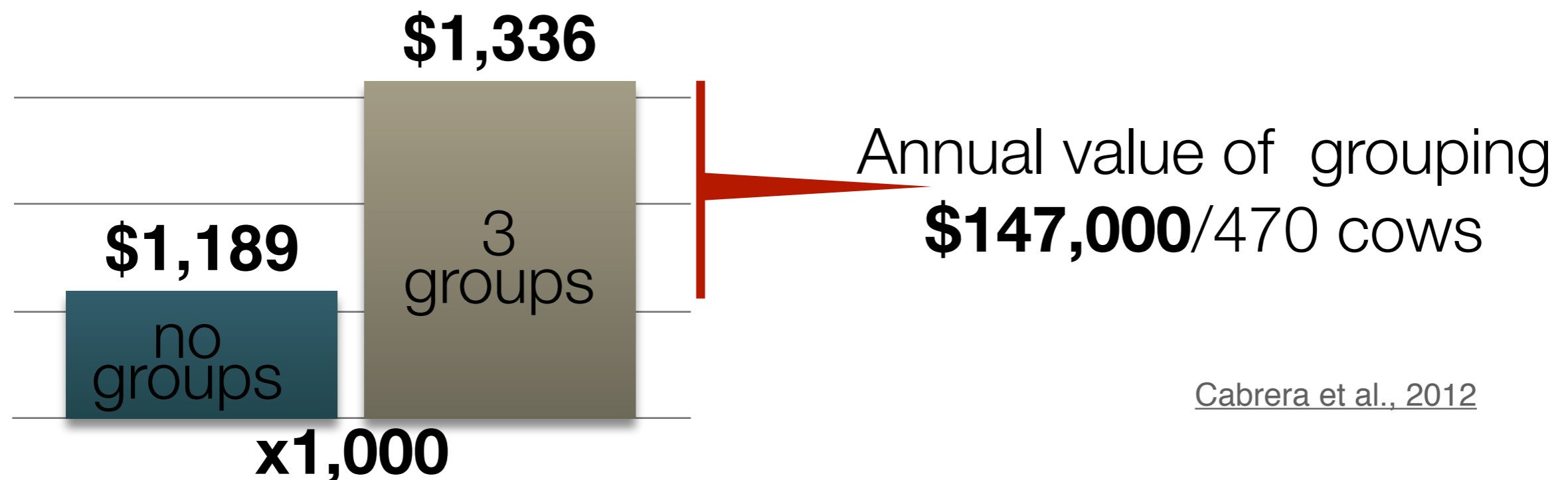
Tool application
30 Wisconsin dairy farms

No grouping vs. 3 groups
- Same size groups

Same prices for all
- $15.89/cwt milk
- $0.14337/lb CP
- $0.1174/Mcal NEl

Cluster grouping
- 83rd percentile CP and NEl

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	**$2,707**
Minimum	< 200	$697	**$1,059**
Maximum	> 1,000	$2,967	**$3,285**

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