



Strategies to Improve Economic Efficiency of the Dairy

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32nd Annual Western Canadian Dairy Seminar. Strategies to Optimize Performance. 11-14 March 2014. Sheraton Red Dee, Red Deer, Alberta, Canada

Considering nutritional grouping Take home messages

Opportunity to improve economic efficiency

Considering additional nutritional groups

Diets closer to requirements

Saves feed costs and increases income over feed costs

Improved profitability

IOFC gains far exceed additional expenses or losses

Additional benefits

- ↓ environmental concerns
- 1 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



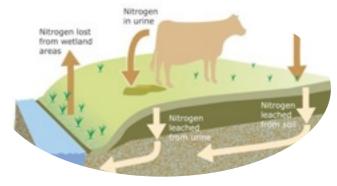
Less overfed animals

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

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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

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 ME305Cow PPA or ME305Stochasticity

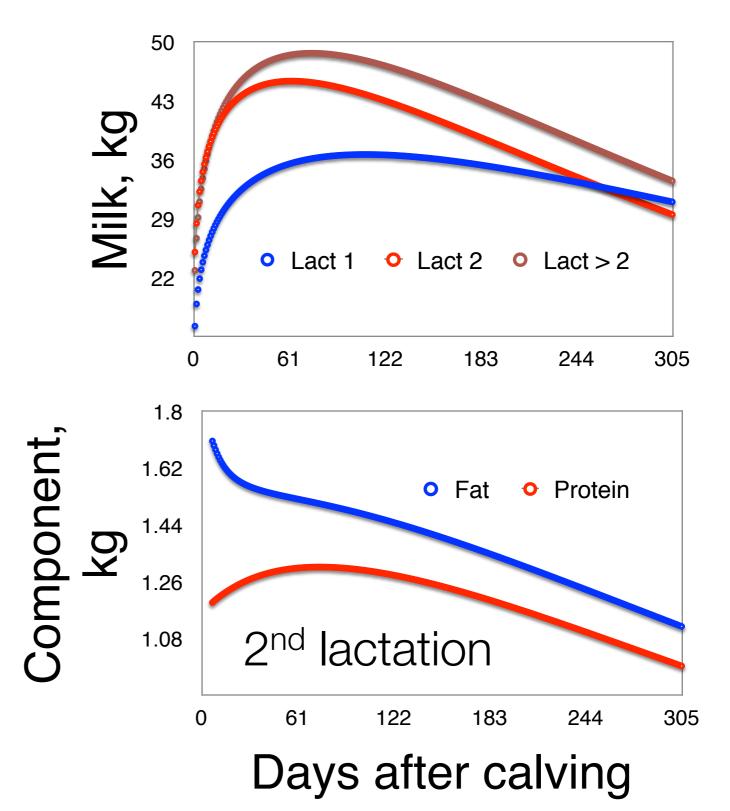
Components

- •Herd
- Stochasticity

Base function

- •Woods
- Adjusted Woods

De Vries, 2001



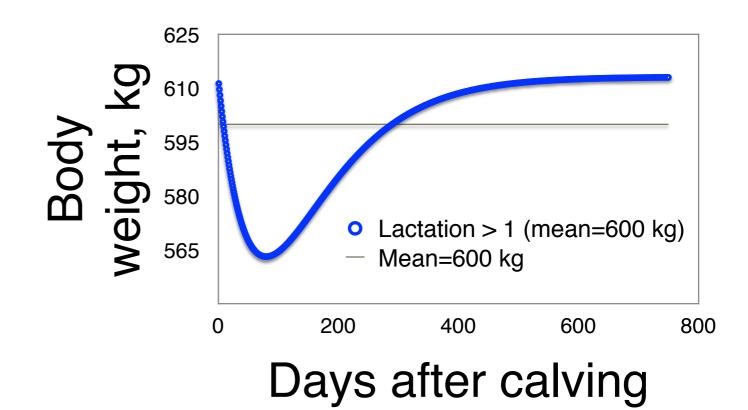
Initial individual cow BW Cow-specific BW



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

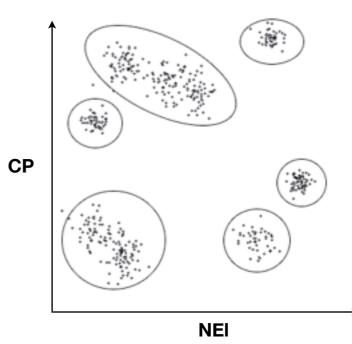


Fat (protein) corrected milk

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

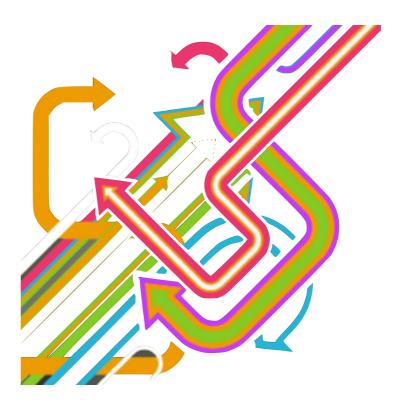
Nutritional grouping Two main types of groups

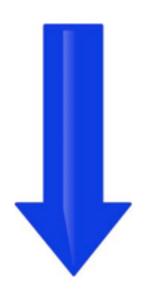
Obligated groups

- 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

Immediate replacement

•After a cow leaves the herd

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

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

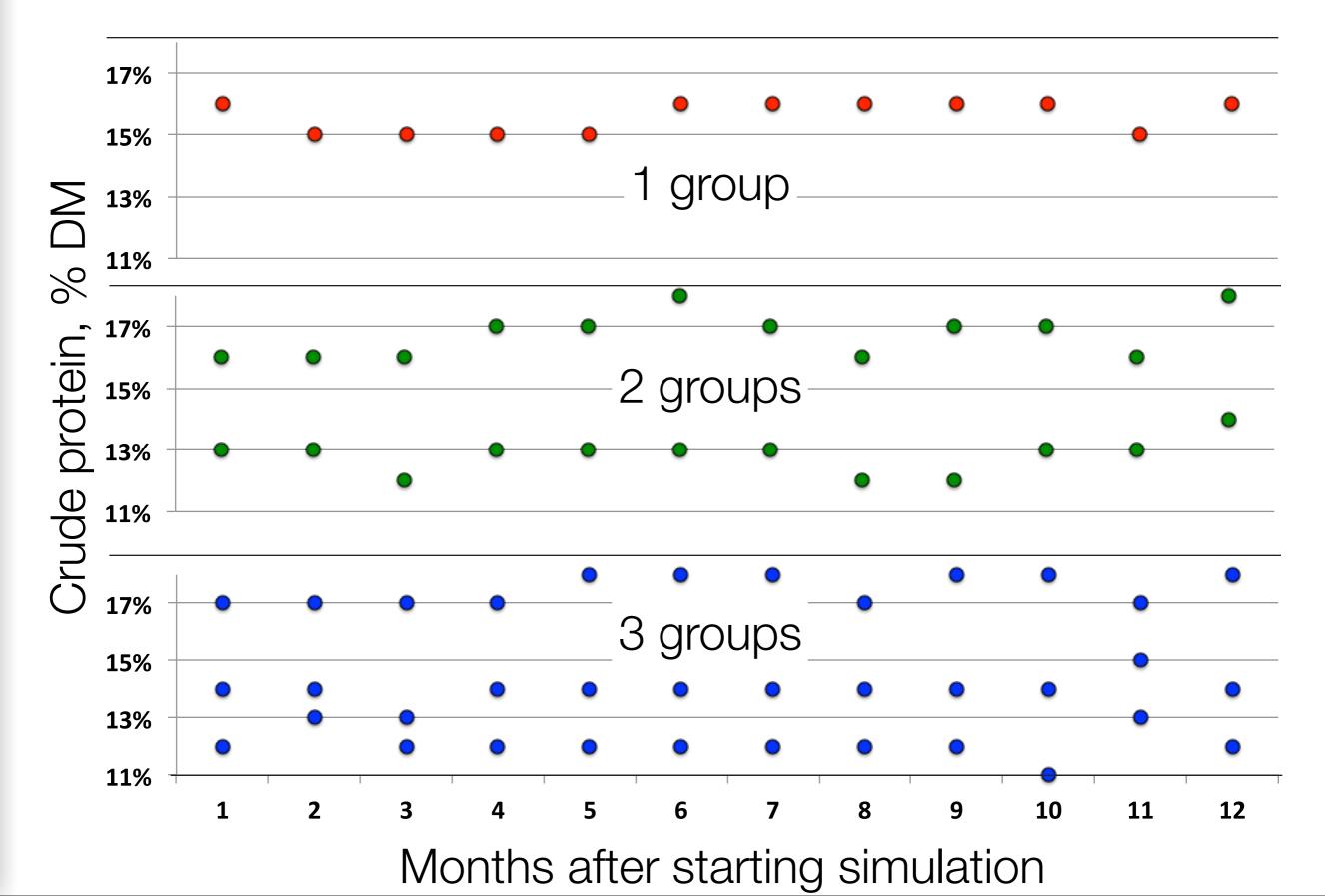
Studied herds

All data collected at the cow-level

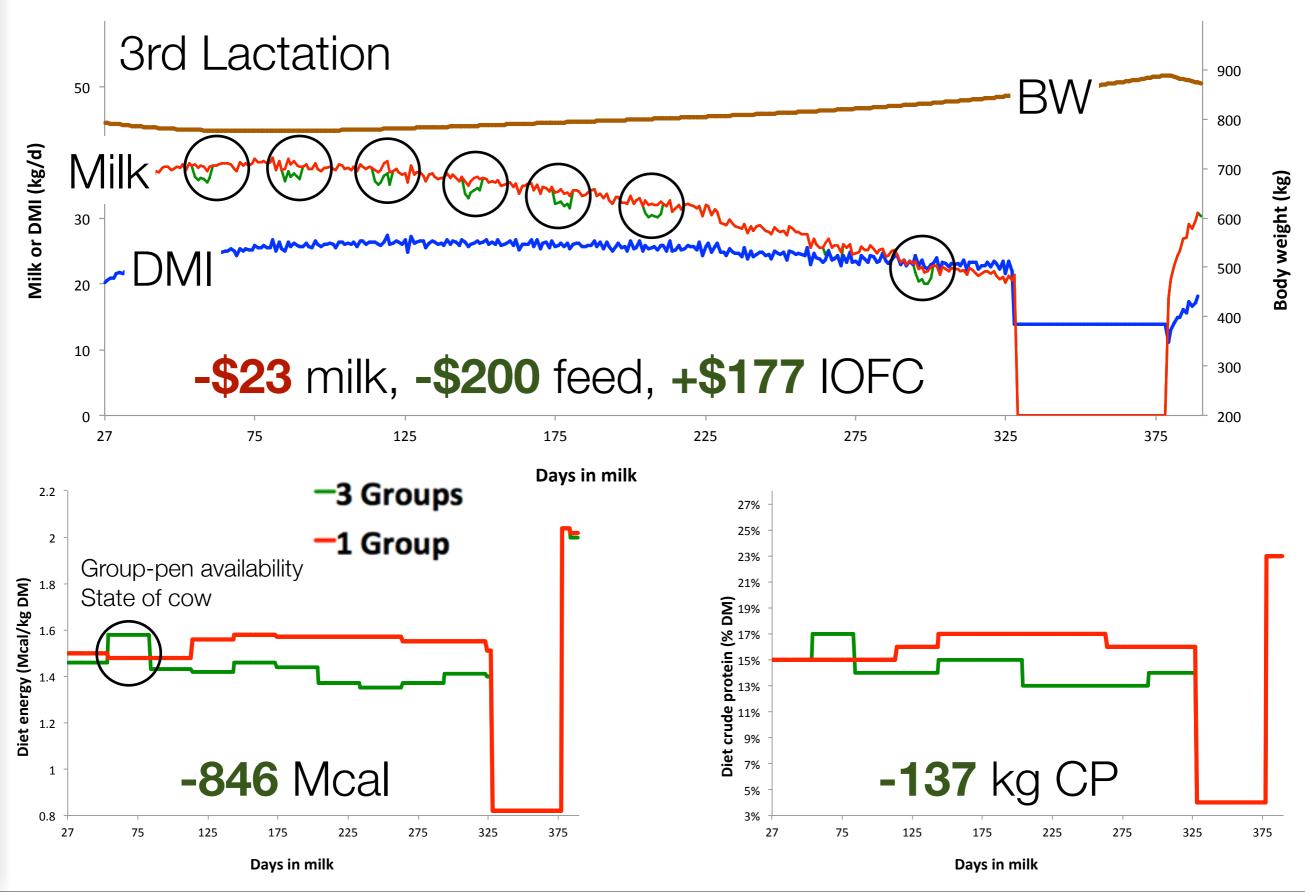
Herd (size)	570	787	727	331	1460
Herd ME 305, kg	16,140	12,884	13,897	13,348	14,188
1	43	39	39	38	45
Average DIM	187	178	201	208	189
21-d PR, %	18	19	19	17	18
Culling risk, %	32	37	36	35	40
Abortion, %	7	11	11	16	7
BW available	X	X	\checkmark	\checkmark	×

...And we are finding

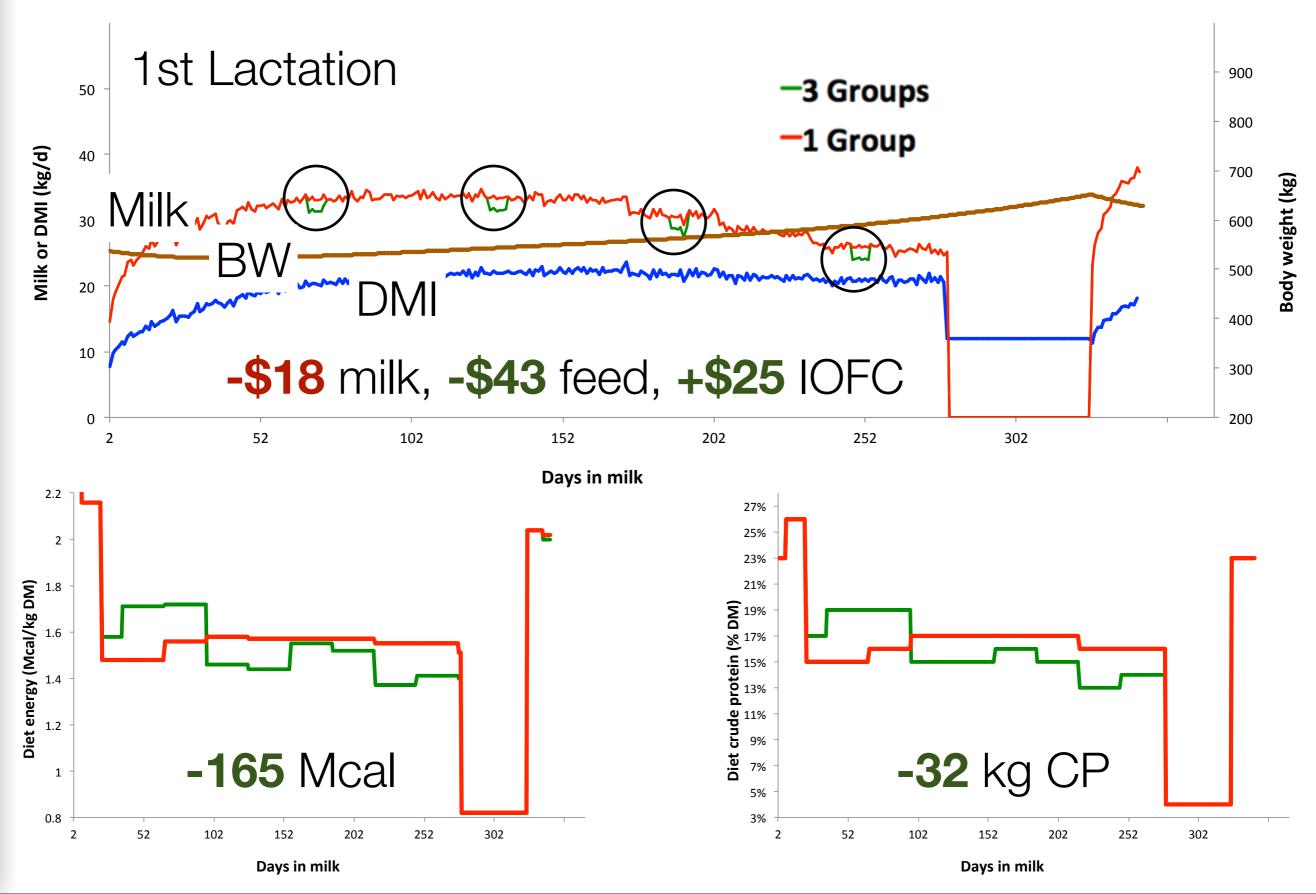
Herd 331, nutritional diets



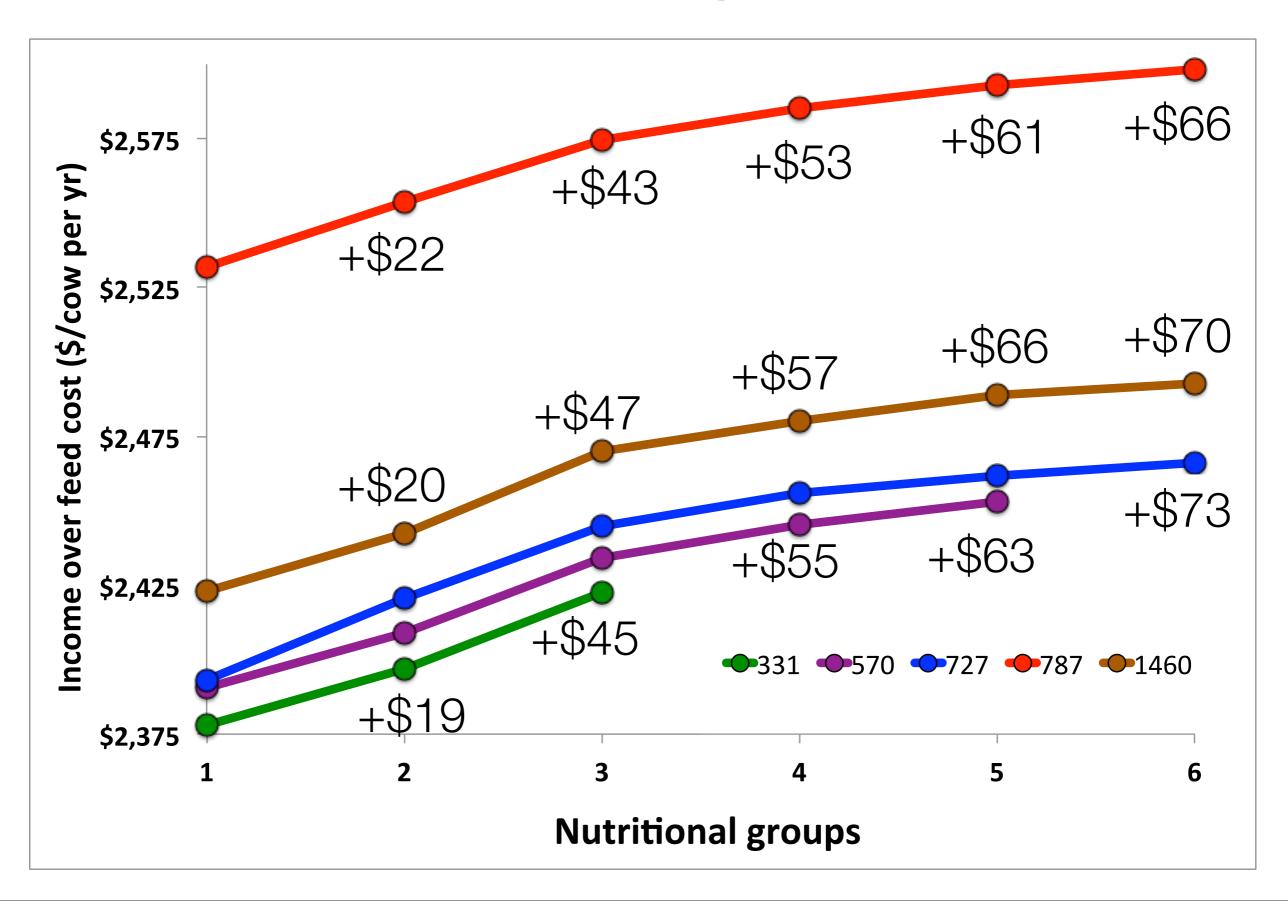
Cow 6338(727) = 78% milk, 1 yr



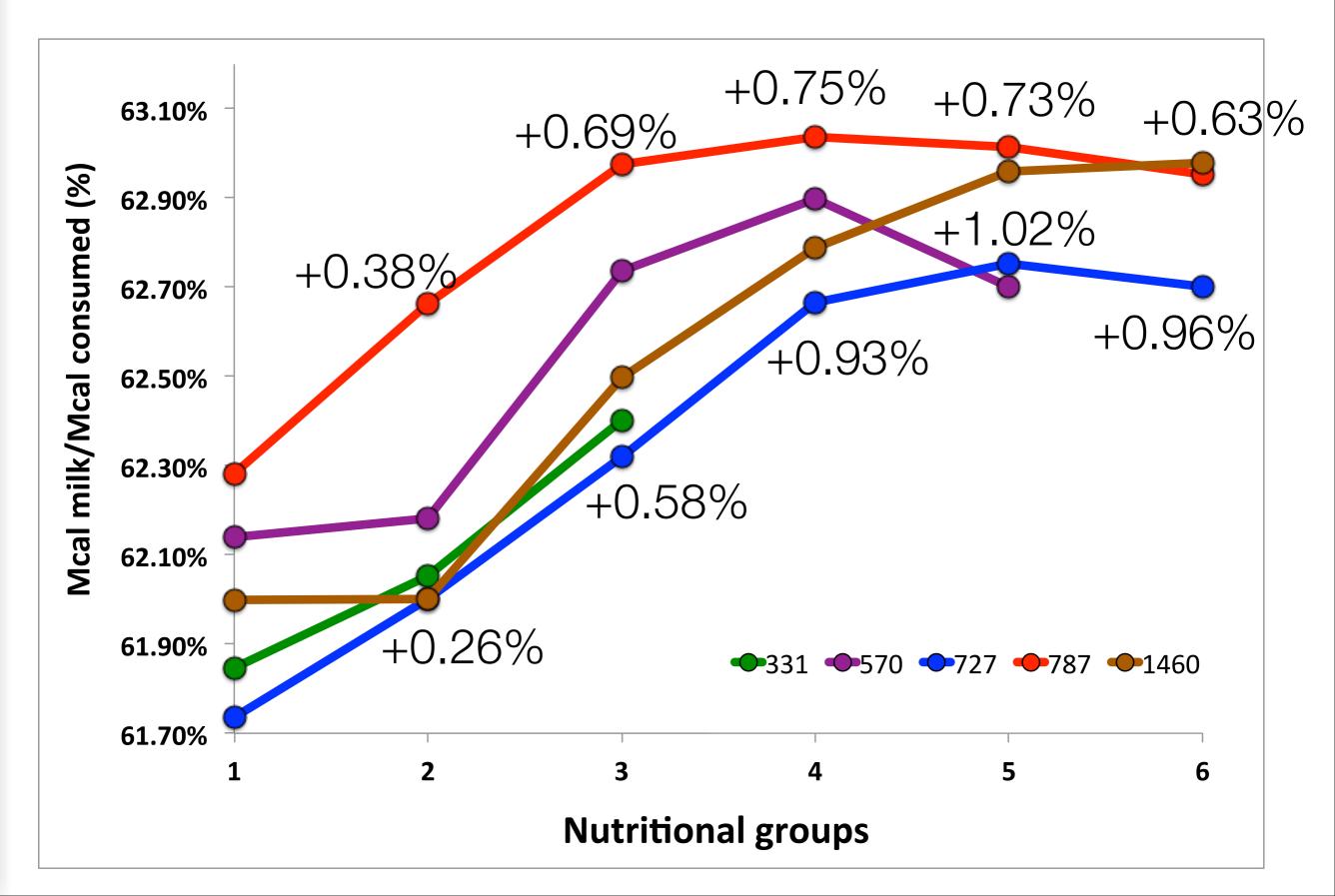
Cow10020(727) = 92% milk, 1 yr



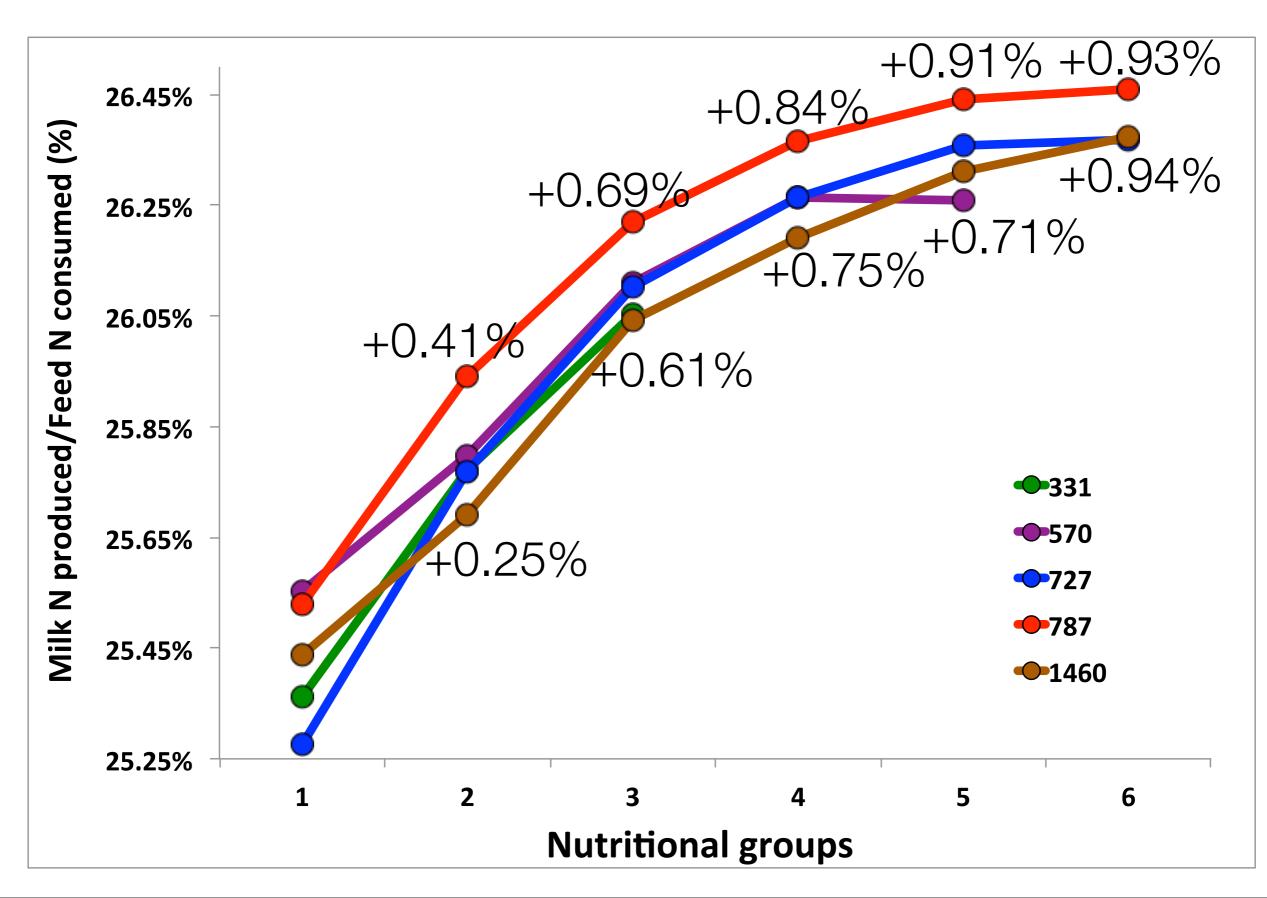
Economic efficiency



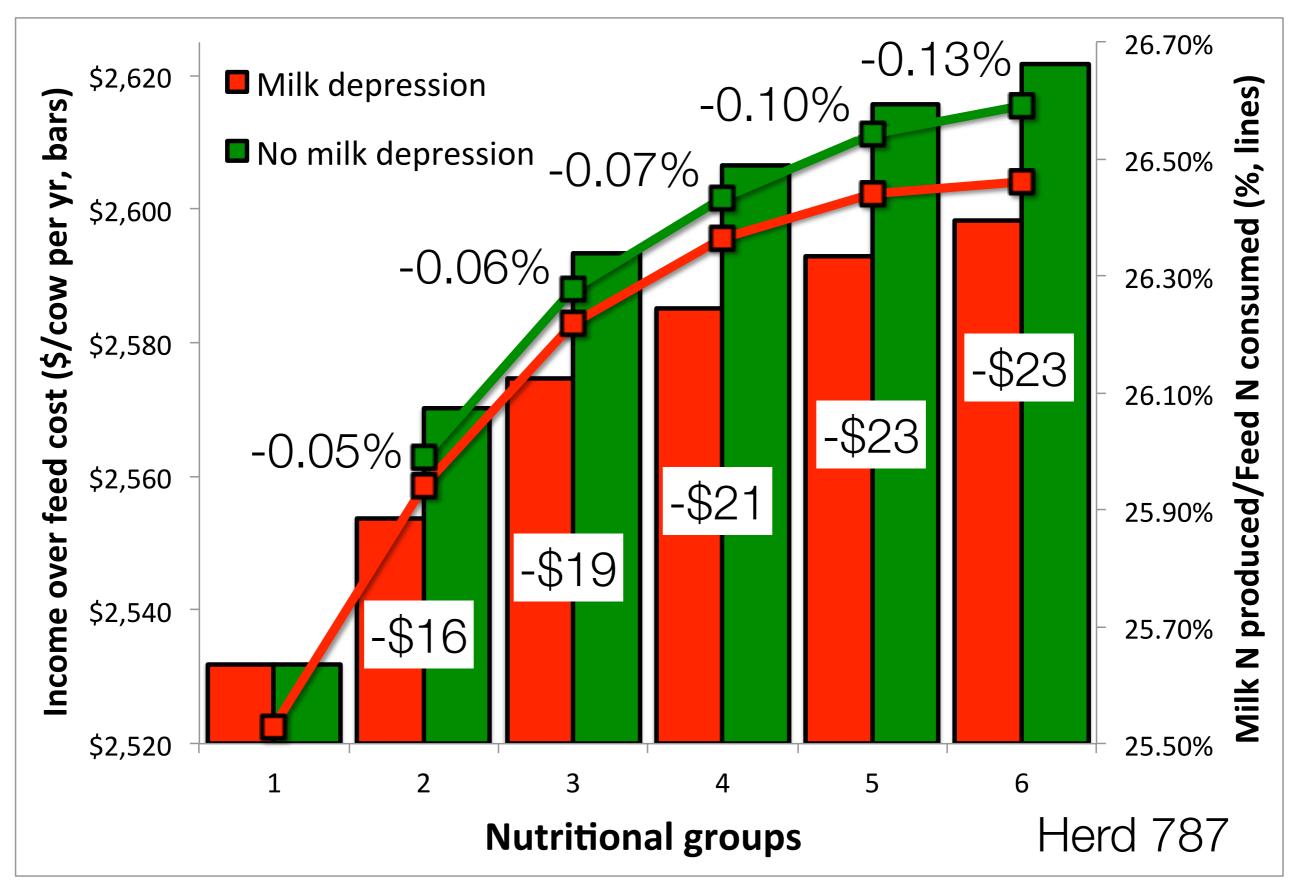
Energy efficiency



Nitrogen efficiency



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





Decision support tool...



A simplified online tool Herd-specific assessments (DairyMGT.info)

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Additional costs and benefits Impacts grouping feeding strategies

Management cost

- Additional labor
- Extra management

Avoid costs

 Additives and supplements savings

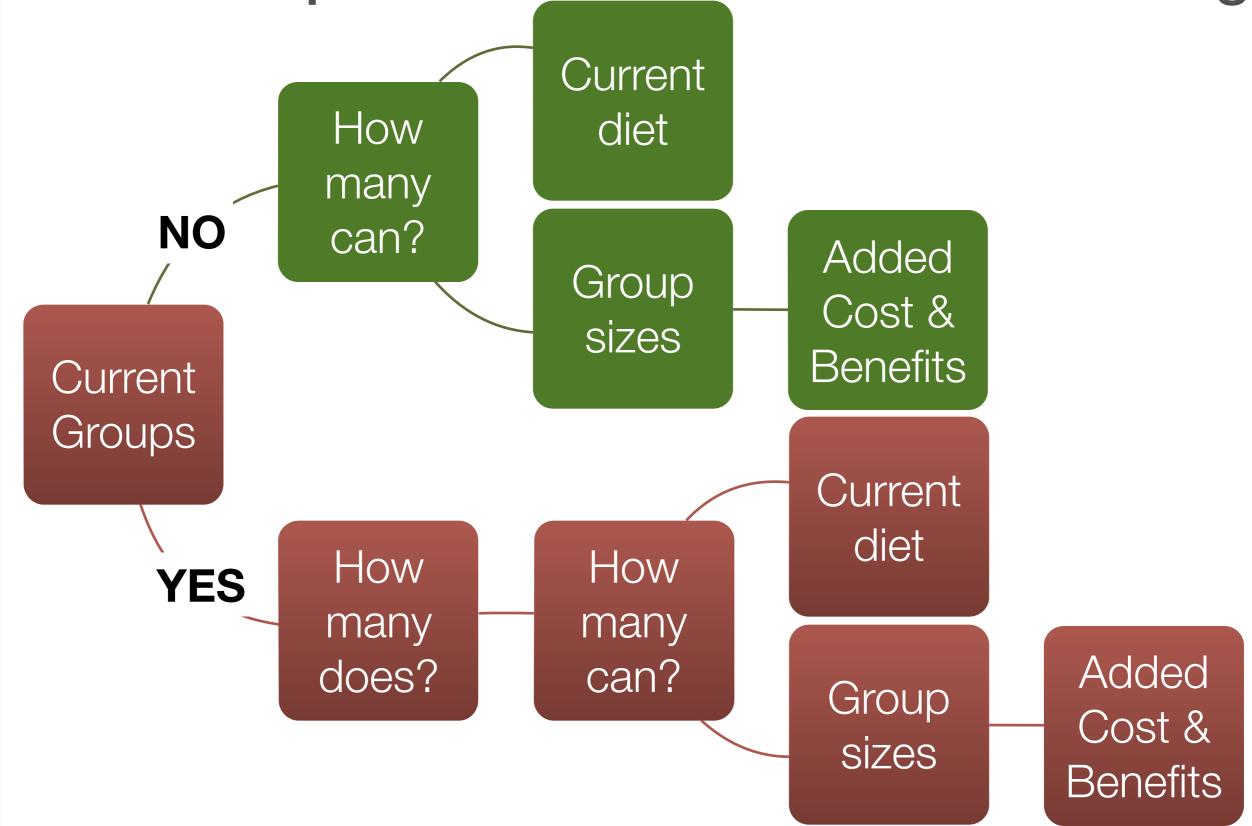
Milk depression

Cow social interactions



Grouping Strategies

Farm/herd possibilities and decision-making

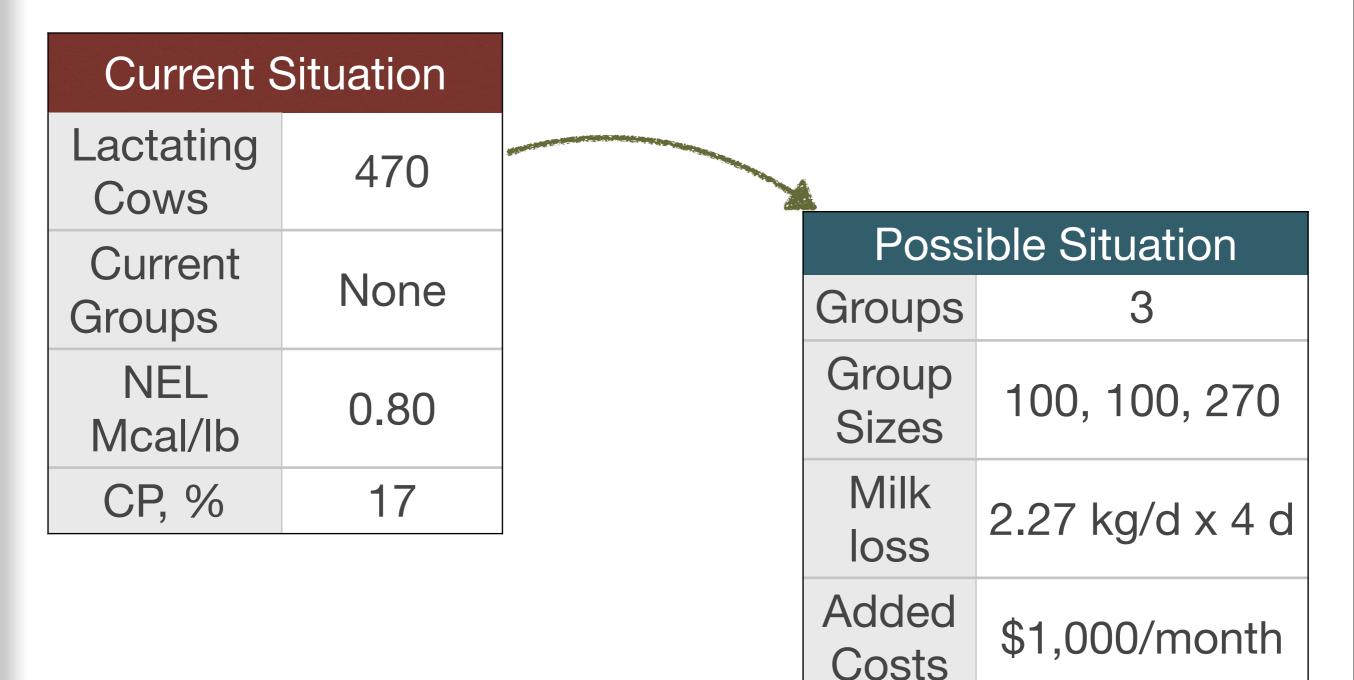




Tool demonstration

Grouping Illustration

Economic impact of nutritional grouping



Saved

costs

None

Decision Support System Illustration

Cluster grouping criteria



\$1,336 \$1,189

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 criterionCluster



Same prices for all

- •\$0.35/kg milk
- •\$0.315/kg CP
- •\$0.1174/Mcal NEI

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 Fee \$/cow.yr	d Cost
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



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