

Dietary Grouping Strategies to Improve Profitability on Dairy Farms

V.E. Cabrera & A. Kalantari

University of Wisconsin-Madison Dairy Science

XIX Congreso ANEMBE Oviedo, 25-27 June 2014, Oviedo, Spain

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

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

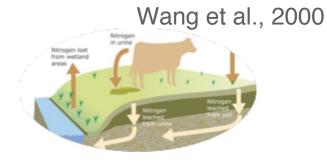


Less overfed animals

Decreased over conditioned cows

Less nutrient excretion

Decreased environmental concerns



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

A. BASIC DAIRY FARM INFORMATION	8. FEIDING & RATIONS FOR LACTATING COWS
A.I. Somber of dary cutte you typically have on your fam: A.I.F. No of Taching dary over (norm milling) A.I.S. No of replacement laddes (if dar of gar to dars of first cabing): A.I.A. No of the first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first first first annual series (if dars of gar to dars of first cabing): A.I.A. No of the first fir	8.1. Describe your facility gravess for lasticing cress (sheat, all that apply) Our or nore real mixed resistory: (TAR, all fixed approximates for a press ratios are mixed into our max and different or row; SAR — an equation in A. Partial most atoms (fricages and remonstrate mass, <u>the abilities of previded</u>): C. Abilitanci constitutions fortic sequence bedoes
A.1. Milk predening in your farm: A.2.1. What is the resident for everyor (2004) for your herd?: A.2.1. What is the report daily bulk such as much shapped for your herd?: Brown per day	Additional convertees full in their soliting prime Additional convertees full in thicking prime Additional convertees trap-densed in its real transform milling from Additional frequently foly plote dense for their former and the solition of the solitity of the solition of the solitity of the solition of the solition
A3. Decoler for galaxy, manager of the date spectrum. A3.1. Genetic Mote. — Demois A3.2. Age	Other Prope and concentrate each <u>definented separateite</u> (no mining): Concentrate of a computer fielders, Concentrate of a lossiching parter, C
graduand college with B6 or higher A. The performs for min of matchined for the days operation (thest, all, that apply) Venerative are other formits matchers	B.2. Do you fand different rations (dott) to larging (milling) cover ¹ ○ 155, How many different rations ¹ ○ NO <u>1557</u> ◆ to question B.6.
Nivate consulting metrification	B.3. <u>Ecolog. Grage. of Lacheling Cores.</u> Indicate your level of agreement with the following statements regarding grouping lacturing over the fielding purpose. In each new, circle a number:
4.5. Do you consider your farm to be managed predominantly as gasture-haused system during the gracing secure?	I find different rations based on: Breach Despen Name Ages Second
C YES, C NO	Fresh vs. all other lasturing cows 1 2 3 4 5
A. Is your form cartified arganic (or in the partification process)?	Stage of lactation for non-dresh covers 1 2 3 4 5
C YES C NO	Parity (actation number) 1 2 3 4 5
	Mik production 1 2 3 4 5
4.7. Describe your primary housing facility for lactating comy	Body condition Body weight 1 2 3 4 5
A.7.4. Preventage (%) of onvs housed individually in tie-stall or standards bars: D 100%: SKIP + to exercise A.8. C Other % [] D None	Health related issues 1 2 3 4 5
□ 100% SKP ◆ to question A.8. □ Other % □ None A.7.6. Coves housed in groups:	Reproductive status (pregnant vs. open) 1 2 3 4 5 Life per believe more than one fort is panded 1 3 3 4 5
A.1.5. Cove bound in groups, A.1.5.3. No. of groups, peak, or strings	I do ant believe soore than one dett is sended 1 2 3 4 5 1 cannot do it
A.7.5.2. Type of group housing (theck all that apple)	Ober 1 2 1 4 5
C Free still have C Shale structure. C Open dry list	Vor 1 2 3 4 3
Bolded park prove under reed. Composit bredded prov under sort. Other	B.4. <u>Constraints as Feeding Groups of Leasting Cores</u> , Indicate your level of agreement with the following statements repeding the constraints to having more fielding groups for your leasting overs. In such core, could a samely effect of the second effect of the second effect.
regarding your management related oriteria for grouping lattering cover. In each row, circle a number	Economic I do not find more rations (dats) hough Despect Name Ages Second Ages
I group Instating cores hand on: Neuron Neuron Neuron Agen Access	Carrent farm facilities de sant exposit it 1 2 3 4 5
Randomity as needed to knot permitted	Net enough labor or personnel to handle it 1 2 3 4 5
Finds one group 1 2 3 4 5	Desire to keep it simple 1 2 3 4 5
Desin mik 1 2 3 4 5	Milk dops when cows are moved to different groups 1 2 3 4 5
1º Latation helle group 1 2 3 4 5	Conflicts with grouping for reproductive purposes 1 2 3 4 5
Mik production 1 2 3 4 5	Natritionin does not want to 1 2 3 4 5
Body condition Body weight 1 2 3 4 5	I do not believe more than one finding group is sended 1 2 3 4 5
Health (i.e. mantitis, SCC, sirds, etc.) 1 2 3 4 5	Other 1 2 3 4 5
Reproduction (i.e. boreding, prognant, DNB, etc.) 1 2 3 4 5	8.5. Would you consider becoming a descentration farm for implementation of ideas? C 125. C 302
Like not believe sublighe groups are worth the effect 1 2 3 4 5 Other	B.5. Vouid you consider becoming a demonstration form for implementation of ideas? ⊂ YES. ⊂ NO Thank you very much for completing the surver! Your input is valuable and important?
Ver 1 1 1 1 1 1 1	come into only more on configural gas much: you what a carrant we what man
	1

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

EnergyProtein (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

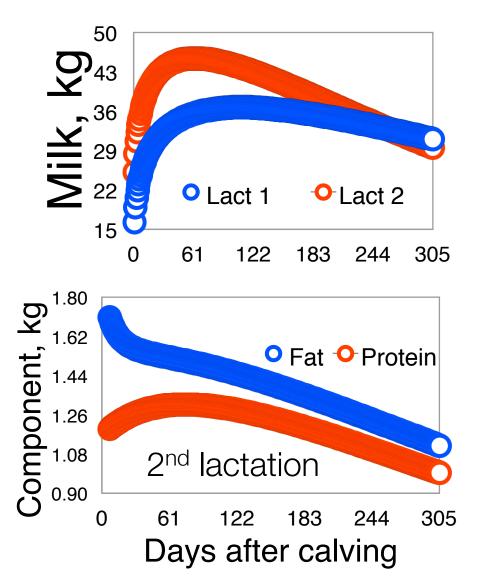
Stochasticity

Base function

•Woods

Adjusted Woods

De Vries, 2001



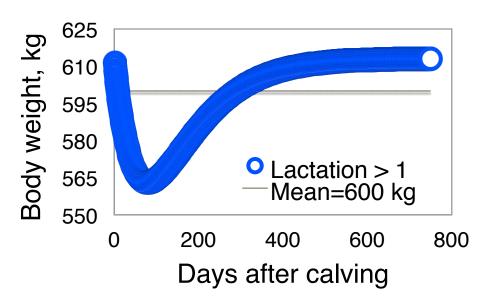
Initial individual cow BW



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

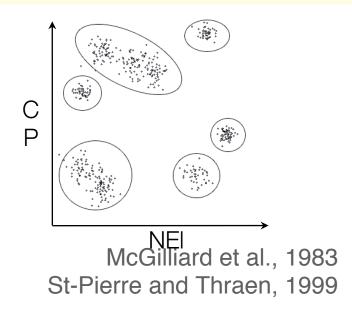
Based on level of production measured as F(P)CM

Dairy merit

Function of both F(P)CM and BW

Cluster

Seems to be MOST efficient criterion



Nutritional grouping

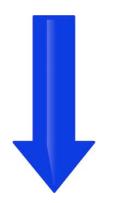
Two main types of groups

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	d to assess cow's milk class. PPA preferred if

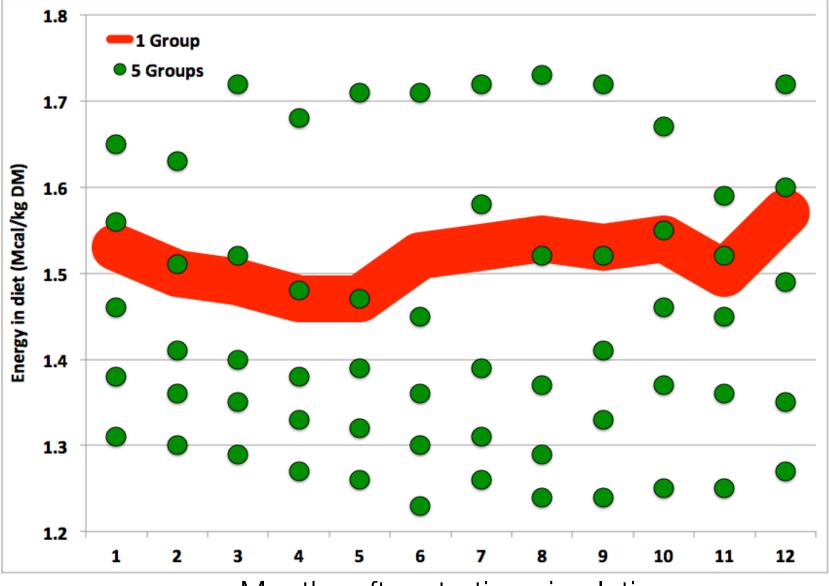
*Either PPA or ME305 used to assess cow's milk class. PPA preferred available

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 st 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	×	×	\checkmark	\checkmark	×

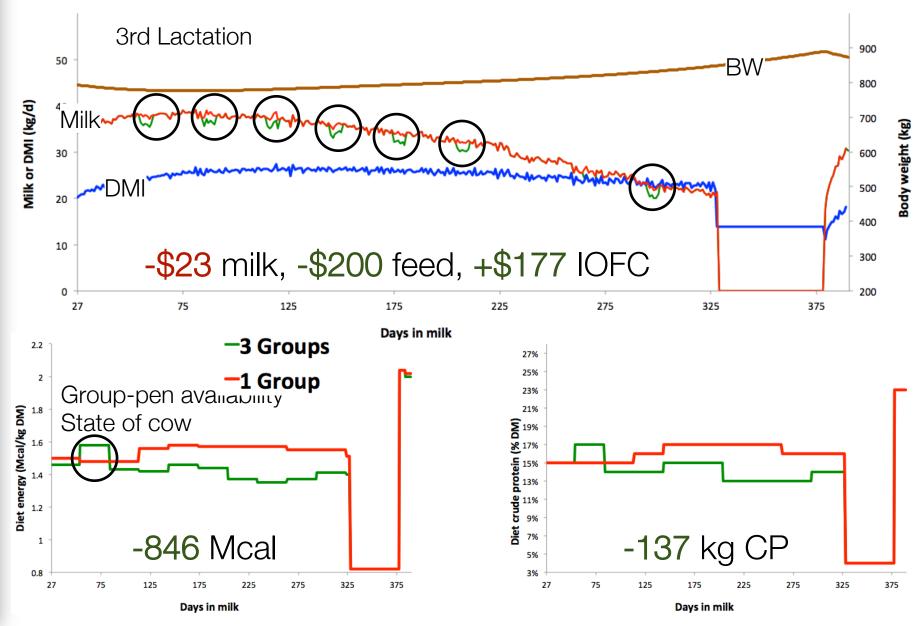


Herd 787, nutritional diets

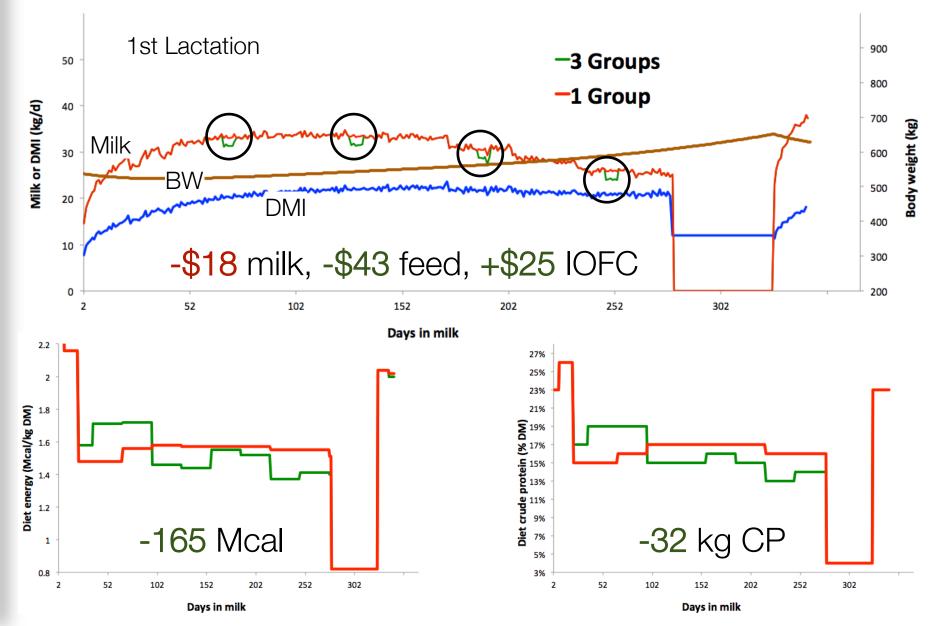


Months after starting simulation

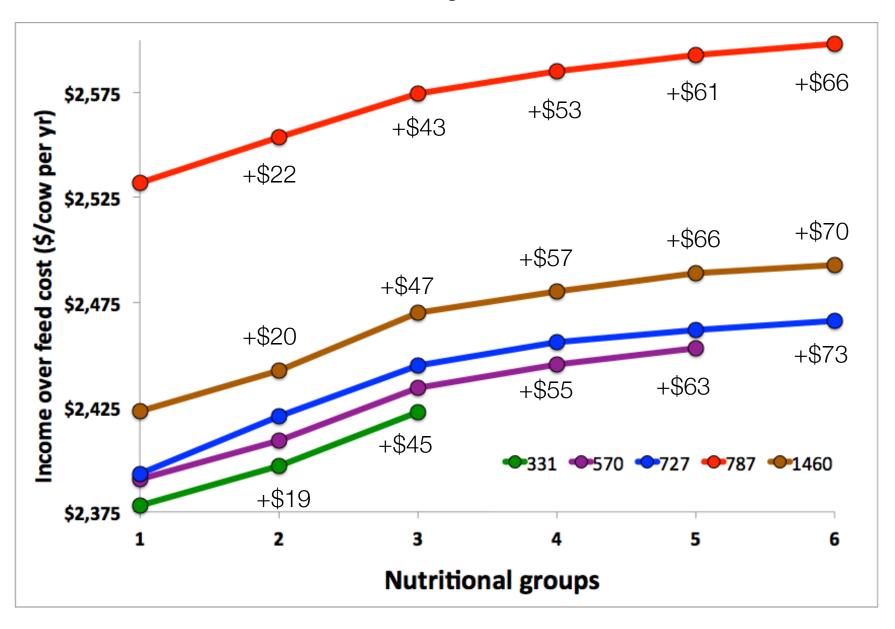
Cow 6338(727) = 78% milk, 1 yr



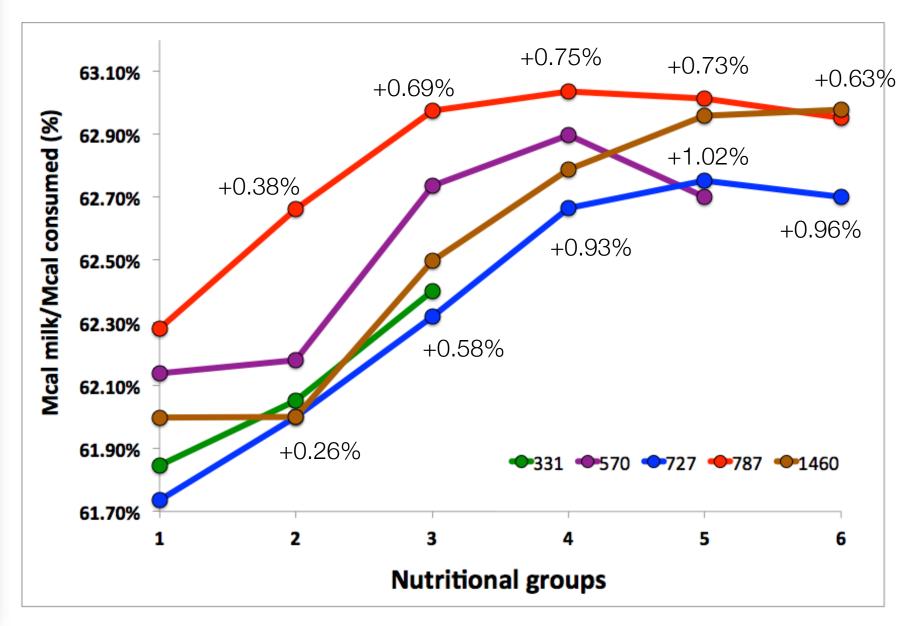
Cow10020(727) = 92% milk, 1 yr



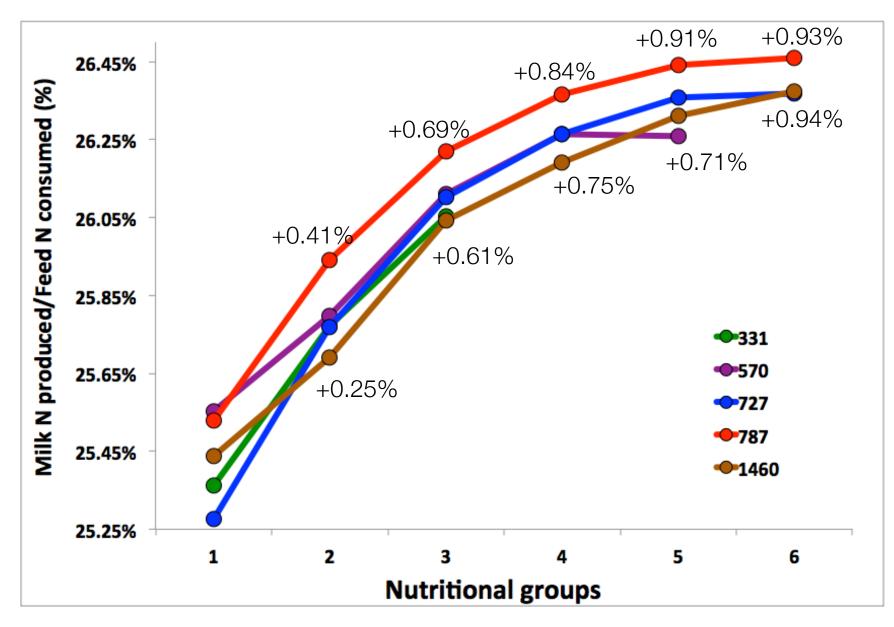
Economic efficiency



Energy efficiency

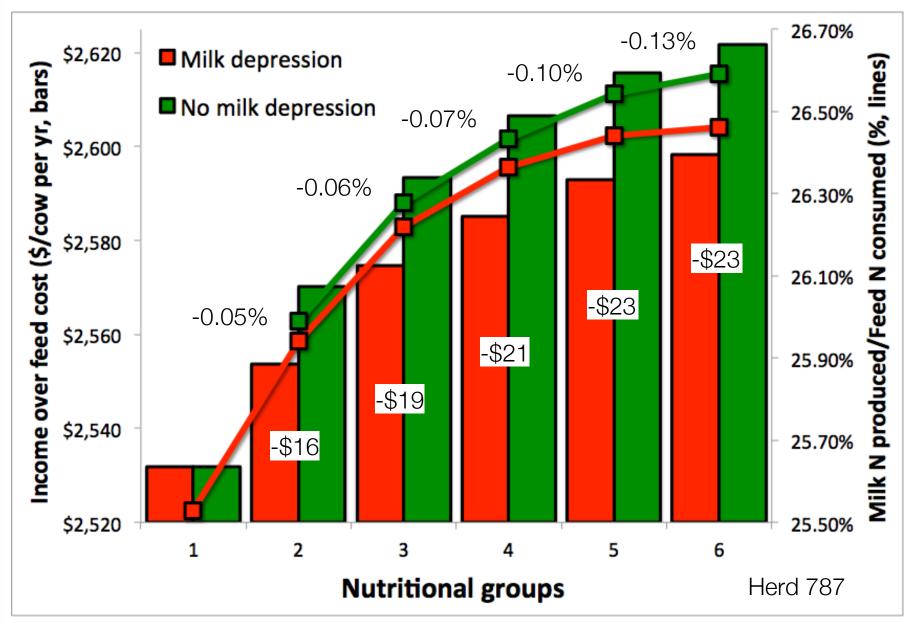


Nitrogen efficiency



Impact of milk depression







Decision support tool...



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

Tools Projects Publications Presentations LGM-Dairy Links out Contact Comments News People Opportunities Gallery Oupping Strategies for Feeding Lactating Dairy Cattle Dairy Cattle Dairy Cattle Dairy Cattle							
verview Upload Farm Details Group Cows Reap Benefits	Sample Farm	: Total	Cows	= 470			
	1,380,000						_
- Prices	1,000,000						Net Ret
CP% Nel, MCal/lb \$/(Unit)	1,310,000						
	1,010,000						
Corn 10 0.9 6.72 (\$/bu)	1,240.000						
Soybean Meal 50 0.88 350 (\$/ton)	1,240,000						
Please note that the values highlighted with this color will be used by the tool.	1,170,000						
Calculated Values	1,100,000	g CLUSTER	DIM*	FC	M* DAIRY	YMERIT	
\$/Ib CP 0.14337 Edit	No croupi	g OLOOTLIN		Group Criteria	n DAIR	THE COL	
\$/Mcal NEL 0.1174 Edit							
Milk Price: 15.89 (\$/cwt)		Group Criteria	Group Number	Number	NEL*	СР•	
					NEL* (Mcal/lb)	-	-
Milk Price: 15.89 (\$/cwt) Download Parameter Excel File (xls or xlsx version) Download Parameters File (xls) or Download Parameters File (xlsx)	_			of		CP* (%) 18.00	-
Download Parameter Excel File (xls or xlsx version) Download Parameters File (xls) or Download Parameters File (xlsx)		Criteria NO GROUPING. (No	Number	of Cows	(Mcal/lb)	(%)	-
Download Parameter Excel File (xls or xlsx version) Download Parameters File (xls) or Download Parameters File (xlsx)		Criteria NO GROUPING. (No	Number 1 Mean 1	of Cows 470 270	(Mcal/Ib) 0.82 0.82 0.71	(%) 18.00 18.00 16.05	
Download Parameter Excel File (xls or xlsx version) Download Parameters File (xls) or Download Parameters File (xlsx) - Upload Parameters as Excel File		Criteria NO GROUPING (No Optimization)	Number 1 Mean 1 2	of Cows 470	(Mcal/Ib) 0.82 0.82 0.71 0.65	(%) 18.00 18.00 16.05 14.04	1
Download Parameter Excel File (xls or xlsx version) Download Parameters File (xls) or Download Parameters File (xlsx)		Criteria NO GROUPING (No Optimization)	Number 1 Mean 1	of Cows 470 270	(Mcal/Ib) 0.82 0.82 0.71	(%) 18.00 18.00 16.05	ī
Download Parameter Excel File (xls or xlsx version) Download Parameters File (xls) or Download Parameters File (xlsx) - Upload Parameters as Excel File		Criteria NO GROUPING (No Optimization) CLUSTER	Number 1 Mean 1 2 Mean 1 2	of Cows 470 270 200	(Mcal/Ib) 0.82 0.71 0.65 0.68 0.72 0.67	(%) 18.00 16.05 14.04 15.20 16.19 14.85	ī
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		Criteria NO GROUPING (No Optimization) CLUSTER DIM	Number 1 Mean 1 2 Mean 1 2 Mean	of Cows 470 270 200 200 270	(Mcal/Ib) 0.82 0.82 0.71 0.65 0.68 0.72 0.67 0.69	(%) 18.00 18.00 16.05 14.04 15.20 16.19 14.85 15.42	ī
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		Criteria NO GROUPING (No Optimization) CLUSTER	Number 1 2 Mean 1 2 Mean 1	of Cows 470 270 200 270 270 270	(Mcal/lb) 0.82 0.82 0.71 0.65 0.68 0.72 0.67 0.69 0.71	(%) 18.00 16.05 14.04 15.20 16.19 14.85 15.42 16.03	Ī
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		Criteria NO GROUPING (No Optimization) CLUSTER DIM	Number 1 Mean 1 2 Mean 1 2 Mean	of Cows 470 270 200 200 270	(Mcal/Ib) 0.82 0.82 0.71 0.65 0.68 0.72 0.67 0.69	(%) 18.00 18.00 16.05 14.04 15.20 16.19 14.85 15.42	Ī
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		Criteria NO GROUPING (No Optimization) CLUSTER DIM	Number 1 Mean 1 2 Mean 1 2 Mean 1 2	of Cows 470 270 200 270 270 270	(Mcal/Ib) 0.82 0.82 0.71 0.65 0.68 0.72 0.67 0.69 0.71 0.66	(%) 18.00 16.05 14.04 15.20 16.19 14.85 15.42 16.03 14.37	
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		Criteria NO GROUPING. (Ne Optimization) CLUSTER DIM ECM	Number 1 Mean 1 2 Mean 1 2 Mean 1 2 Mean	of Cows 470 200 200 270 200 270 200	(Mcal/Ib) 0.82 0.82 0.71 0.65 0.68 0.72 0.67 0.69 0.71 0.66 0.69	(%) 18.00 16.05 14.04 15.20 16.19 14.85 15.42 16.03 14.37 15.33	

Home | Tools | Projects | Presentations | Publications | LGM-Dairy | Links

© 2013 Dairy Management-UW Extension

Additional costs and benefits

Impacts grouping feeding strategies

Management cost

- Additional labor
- Extra management

Avoid costs

 Additives and supplements savings

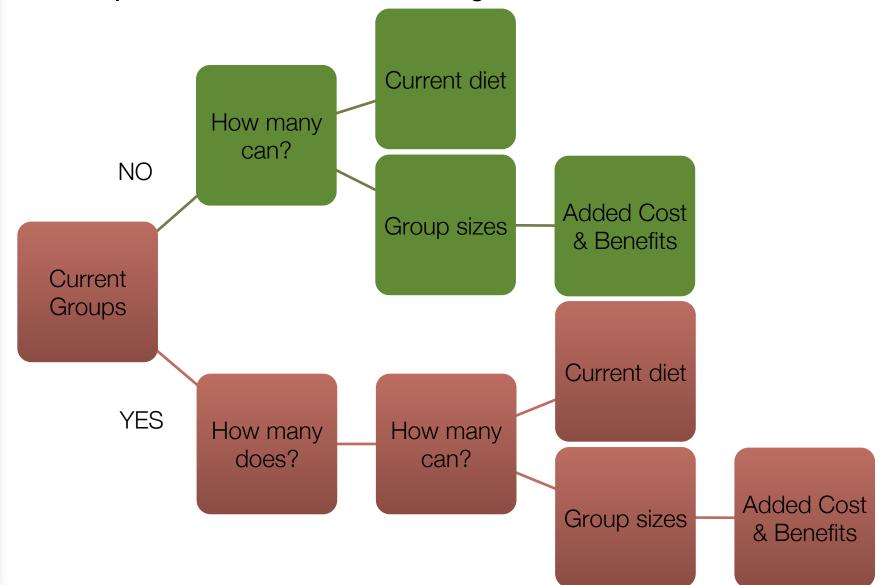
Milk depression

Cow social interactions



Grouping Strategies

Farm/herd possibilities and decision-making





Tool demonstration

Online simulator

Grouping Strategies for Feeding Lactating Dairy C	attle
Evaluates grouping strategies for feeding lactating dairy c	cattle
HTML Online Tool (Open)	
Instructions and Documentation (Download)	1,350,000
Presentation 1 (Download)	1,300,000
Presentation 2 (Download)	
Paper (Download)	Dairy Management UW-Extension University of Wisconsin-Madison
Demo (Click to View/Hide the Video)	MADINE I
	Home Tools Projects Publications Presentations LGM-Dairy Links
	About Contact Comments News People Opportunities Gallery
	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 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
	\$/Ib 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 selected Upload
	Current File/Data Status
	Using Data from Default Parameters File on Server

Anatomy of Grouping Strategies for Feeding Lactating Dairy Cattle

Overview	Upload Farr	m Details	Group Cows	Reap Benefits	Sam	ple Farm:
Prices						
	CP%	Nel, MCal/lb	\$/(Unit)			
Corn	10	0.9	6.72 (\$/bu)		
Soybean Me	al 50	0.88	350 (\$/to	n)		
Please note	that the value	es highlighted	with this color w	ill be used by the to	ool.	
	Calculated V			in be used by the t		
\$/Ib CP	0.14337	Edit				
\$/Mcal NEL	0.1174	Edit				
	F 00		()			
Milk Price: 1			/cwt)			
			xlsx version)			
Download Par	ameters File (xls) or Downloa	d Parameters File (xl	sx)		
Links of Dava		and File				
	meters as Exc			-		
Upload the l	Excel File: Ch	no f	ile selected		Jpload	
Current File						
	/Data Status-	Devenetore Fi				
Using Data f	rom Default F	arameters Fil	e on Server			

Navig	atior	tabs					No.	COW	S
	Overview	Jpload Farm Detai	ls Gro	up Cows	Reap Benefit	ts	Sample	Farm:	
	Prices								
		CP% Nel, M	Cal/lb \$/(Unit)					
	Corn	10 0.9	6.7						
Nutrient	Soybean Mea	0.88	350	0(\$/ton)					
·······································		hat the values highlig	hted with	this <mark>color</mark> will	be used by th	e tool.			
price	C	Calculated Values							
price	\$/Ib CP	0.14337	Edit						
	\$/Mcal NEL	0.1174	Euit						/iik
	Milk Price: 15	.89	(\$/cwt)						
	Download Par	ameter Excel File (x	ls or xlsx v	version)					rice
	Download Parar	meters File (xls) Or Do	ownload Para	meters File (xlsx)					
	- Upload Param	eters as Excel File-							
		cel File: Choose File	no file se	lected		Upload			
	Current File/D	Data Status					_		
	Using Data fro	om Default Paramete	ers File on	Server	_				
		Herd	For	mΓ	ata				
		IICIU	ı a						
	1						T		
Identification	Lactatic	on Days ir	milk	Milk b	utterfat	Milk	protein	Body	weight
	1			1					_

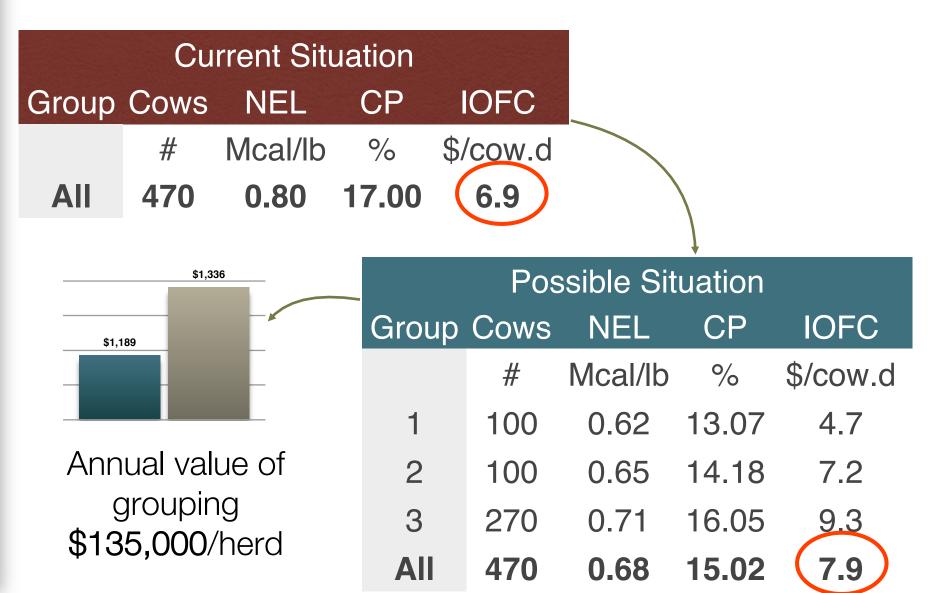
Grouping Illustration

Economic impact of nutritional grouping

Current S	Situation		
Lactating Cows	470		
Current		Poss	ible Situation
Groups	None	Groups	3
NEL Mcal/lb	0.80	Group Sizes	100, 100, 27
CP, %	17	Milk Ioss	2.27 kg/d x 4
		Added Costs	\$1,000/mont
		Saved costs	None

Decision Support System Illustration

Cluster grouping criteria



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 NEI

Projected body weight

- 500 kg primiparous
- 600 kg multiparous

Analysis from dairy farm records

	Lactating cows (n=30)	No grouping	3 Groups	Gain
		Income	e Over Feed \$/cow.yr	Cost
Minimum	<200	697	1,059	161
Mean	788	2,311	2,707	396
Maximum	>1,000	2,967	3,285	580
	e of IOFC per year)	•Mea	veen 7 and n = \$396 ge = \$161 t	

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

