

Lowering Cost of Production with Feed Efficiency and Cow Comfort

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Modern Day Embodiment of William Miner's Vision

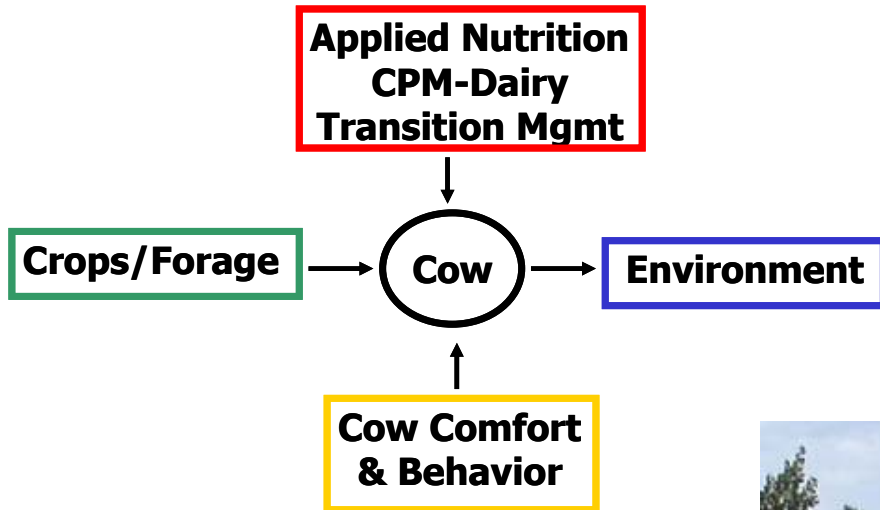
"It goes without saying that agriculture is *the fundamental occupation . . .* No other occupation is as important to the human race, nor requires such a wide range of practical and technical knowledge as farming . . .



It has to do with our very existence – *the production of food and conservation of the soil.*"

1915 Heart's Delight Farm Yearbook

Miner Institute Programs

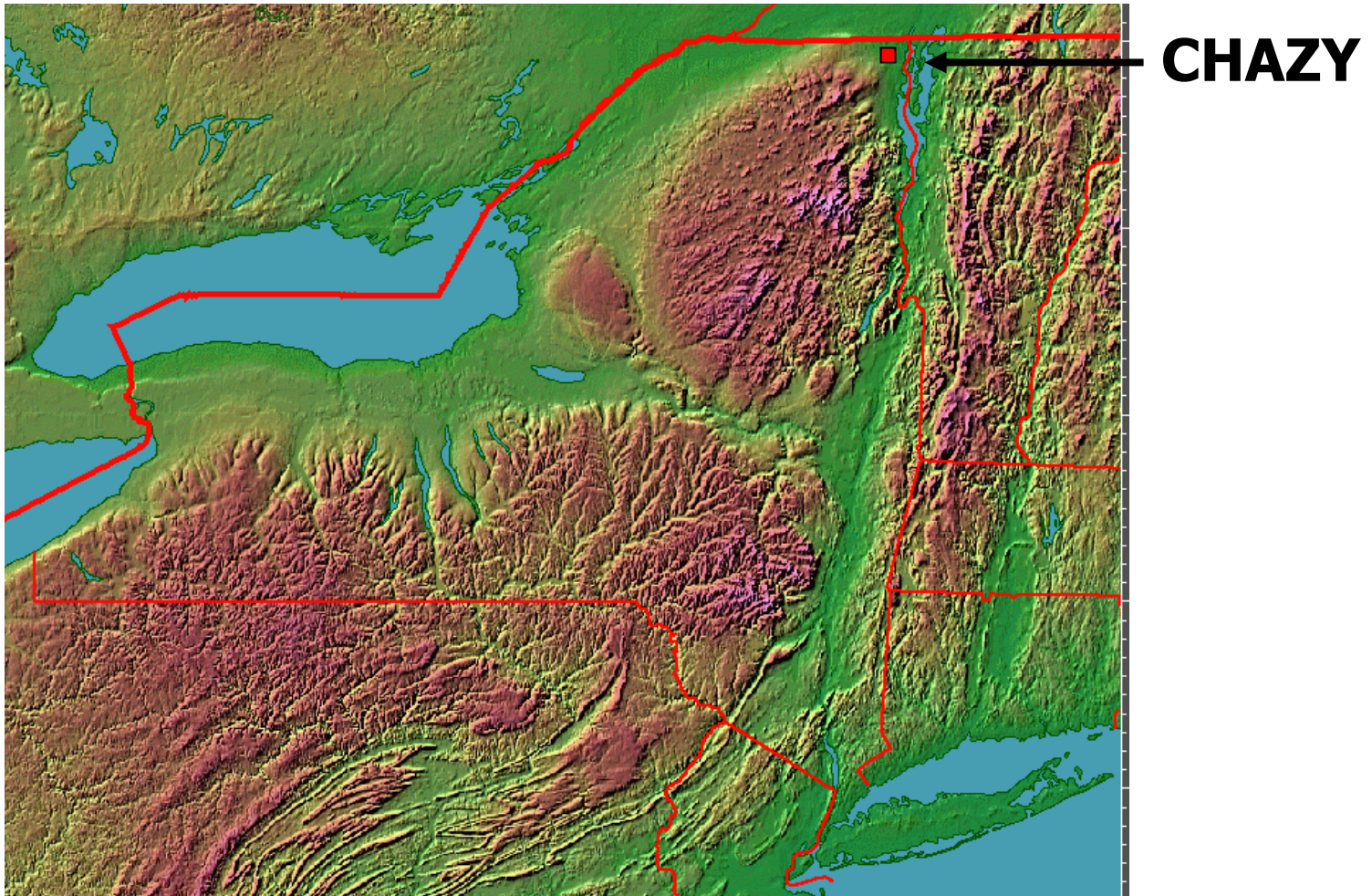


Miner Institute Dairy Herd

- **300-cow Holstein herd: teaching & research**
- **~31,500-lb RHA, 3x, rbST**
- **Productive, healthy herd underpins education and research programs**



Where is Miner Institute?



Reducing Your Cost of Production

- You can focus on many areas, but two big ones are:
 - Feed (~40-50% of total COP)
 - Vet & health costs (~10% of OC)

Forage Quality

- ✓ Fiber digestibility
- ✓ Starch digestibility
- ✓ Higher forage diets

+

Cow Comfort

- ✓ Resting
- ✓ Eating
- ✓ Ruminating

=

Profitability

- ✓ Greater SCM/DMI
- ✓ Better health
- ✓ Lower COP



High Quality Forage & Dairy Cow Performance

- **As nutritive value of forage increases:**
 - **DMI increases**
 - **Milk yield increases**
 - **Greater microbial protein production and milk protein output**
 - **Peak milk & persistency increase**
 - **Efficiency (SCM/DMI) increases**
 - **Less body weight loss in early lactation**
 - **Better body condition**



How do you get the most out of your high quality forage?

- **High efficiency of feed use:**
 - **Greater digestibility of forage means more feed nutrients go toward milk/body condition and not into the manure!**
 - **Improving efficiency of nutrient use is more cost-effective than trying to remove feed ingredients.**
 - **Herd target: 1.4 to 1.7**
 - **Each 0.1 unit change is worth ~\$0.24/cow/day (Hutjens, 2010)**

What Can Reduce Cow's Efficiency Response to Highly Digestible Forage?



- **Poor silage fermentation**
- **Palatability, intake problems**
- **Improper ration formulation**
- **Feed mixing, consistency, delivery, sequencing**
- **Feeding environment**
 - **Poor rumen health**
 - **Cow comfort!**

And there's more ...

Responses to Forage NDF Digestibility

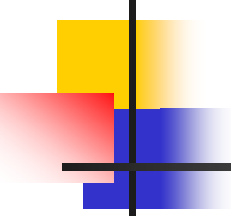
Response	High (62.9%)	Low (54.8%)
DMI, lb/d	51.0	47.9
4% FCM, lb/d	63.5	58.9
Milk fat, %	3.43	3.35
Milk pro, %	2.93	2.90
BW change	0.81	0.31

(Oba and Allen, 1999)



Forage Digestible NDF and Performance

- **For every 1 percentage-unit increase in NDF digestibility:**
 - **+0.40 lb DMI**
 - **+0.51 lb milk**
 - **+0.55 lb 4%FCM**
 - **+0.06 lb BW**
- **You can feed a higher forage diet without sacrificing milk yield**



**You cannot replace
poorly digestible forage
NDF with purchased
starch and expect equal
milk yield (and it's more
expensive)!**

Alfalfa quality and dairy cow performance

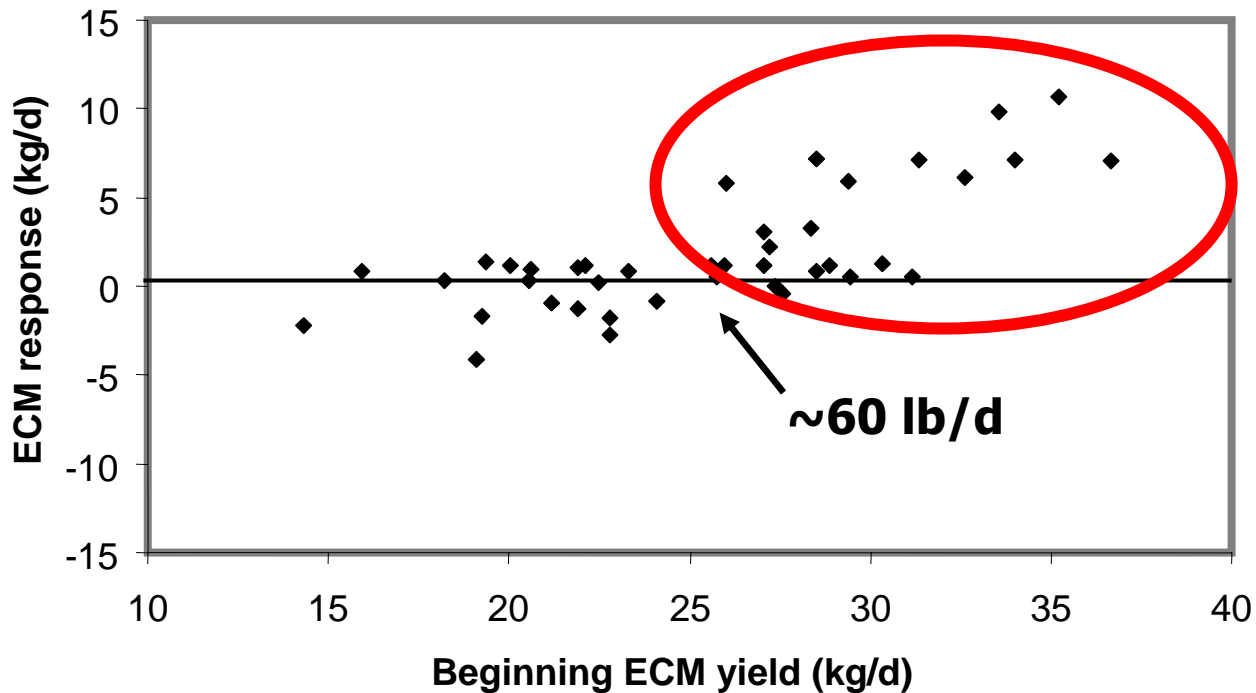
	4% fat-corrected milk (lb/d)			
		% Grain		
Forage NDF, %	71	54	37	20
40	86.0	87.1	83.2	79.6
42	77.2	77.2	69.1	67.9
52	64.7	66.2	62.5	57.2
60	69.5	64.7	55.4	52.1

(Kawas et al., 1991)



**Response to forage
digestibility varies by
milk production level:
So, target its use!**

Response to High-NDFd Corn Silage by Milk Production Level



- Allocate high NDFd forages to highest producing cows and fresh cows



Targeted allocation of forages & multiple groups/diets

- **Cows varying in milk yield vary greatly in response to diet; practice “precision feeding”**
 - **Early lactation, higher producers respond positively to highly digestible diets; later lactation cows don’t**
- **Multiple diets allow you to target appropriate forages and grains to specific groups of cows**
- **Allows management of BCS while maximizing milk yield**
 - **Diets that minimize over-conditioned late lactation cows DO NOT allow cows to attain genetic potential for milk yield**
- **Proper grouping & allocation of feed improve efficiency, lower COP**

**Must get the most out of
our corn silage and higher-
priced corn grain!**





Optimizing corn starch digestion (Hoffman, 2008)

Factor	Correlation with starch availability
Particle size	-0.70
Moisture	-0.53
Endosperm type	-0.46

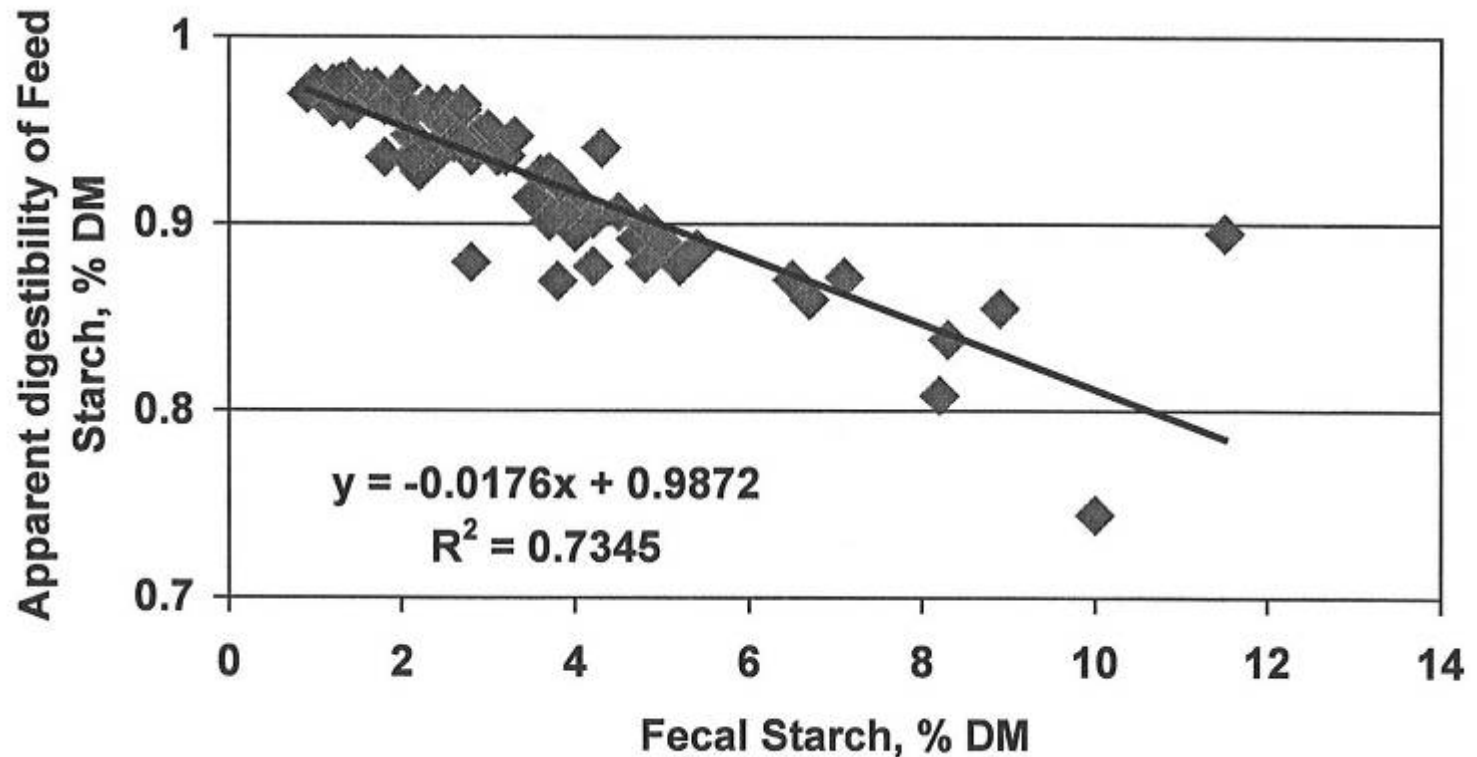
Grain particle size > Grain/silage moisture > Endosperm type

Optimizing Corn Silage Starch Digestion

- 3/4-in TLC, 2-3 mm roller clearance
- All kernels crushed, especially silage >33% DM
- Penn State Particle Separator
 - 10-15% top screen
 - 50+% second screen
 - <35% pan
- **Corn Silage Processing Score**
 - % starch passing through 4.75-mm screen
 - Target ~70%



Fecal starch and digestibility



- **4.5% fecal starch ~ 90% starch digestibility**
- **1%-unit decrease in fecal starch ~ 1 pound more milk**
- **Range in starch: 2.3 – 22.4%**



Forage quality and milk production; Nebraska Field Study (20 herds; tie & free stall)

	Improved Forage Quality	No Improvement in FQ
Milk, % increase	9.8%	6.7%
Feed costs, \$/cow/year	-20%	-10%
Total benefits, \$/cow/year	\$269	\$176

Making the Most of Highly Digestible Forages

- High quality forage **DOES NOT ASSURE** high milk production and low COP
- But low quality forage **GUARANTEES** low milk production and high COP



Cow Comfort and Cost of Production



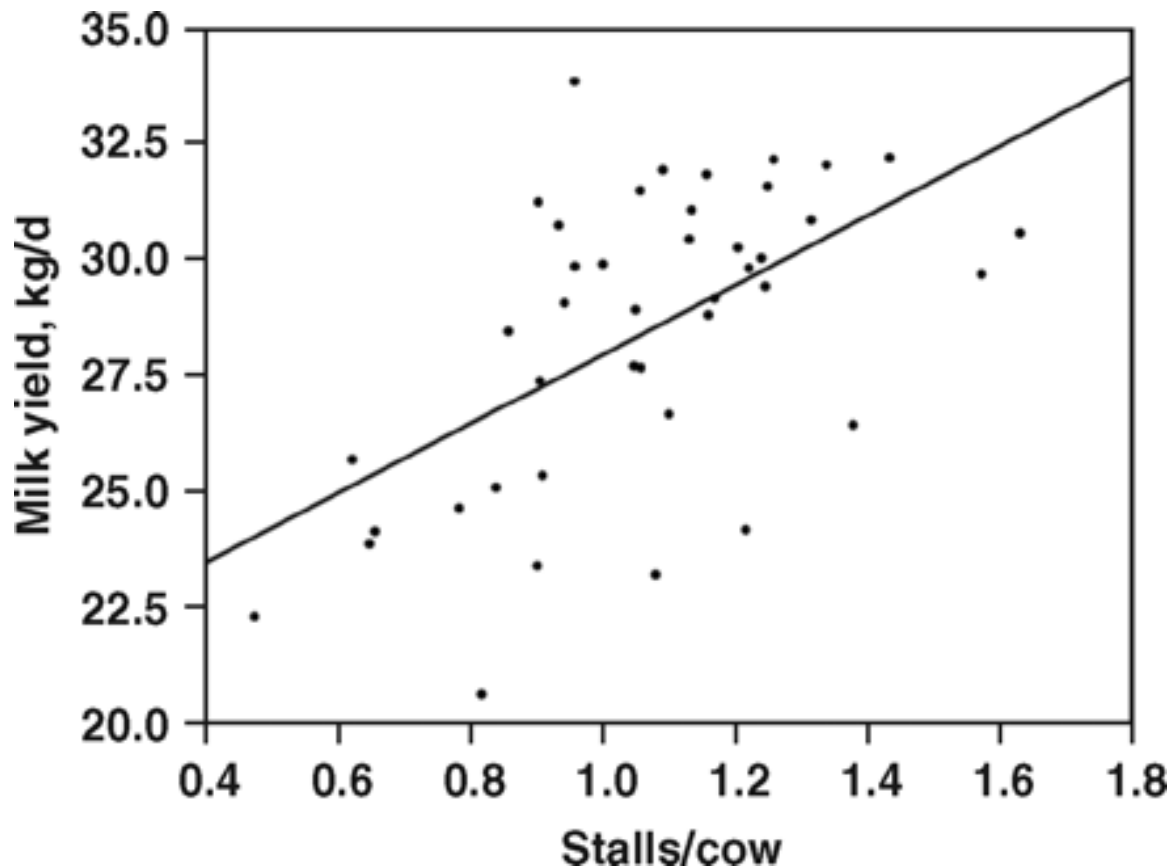
- **Is there a relationship between comfortable cows and lower cost of production?**
 - **Positive relationship between components of cow comfort and milk, SCM/DMI, growth, health, and reproduction**
 - **Quote to ponder: “There is an easy way to make 30,000 pounds and a hard way.”**
 - **Easy way: comfortable cows fed high quality forage**



Role of management and herd performance (Bach et al., 2008)

- **47 herds with similar genetics were fed same TMR**
- **Milk yield varied by ± 29 lb/d**
 - **Mean milk yield=65 lb/d**
- **Non-dietary factors accounted for 56% of variation in milk yield**
 - **Age at first calving**
 - **Feeding for refusals (64.1 vs 60.6 lb/d)**
 - **Feed push-ups (63.7 vs 55 lb/d)**
 - **Stalls:cow, stocking density**

Stalls per cow and milk production in 47 herds fed same TMR (Bach et al., 2008)



**Milk yield = 20.4 +
7.5 x stall/cow**

$R^2=0.32$

Three Major Behaviors

- **Eating**
 - 3-5 h/d

- **Resting**
 - 12 h/d
 - CCI > 85%

- **Rumination**
 - 7-9 h/d
 - 1/2 of resting cows



- **Requirements for all three must be met for optimal efficiency, health, and COP!**

Cows have strong behavioral need to rest ...

- Cows sacrifice feeding to make up lost resting
- Cows spend more time waiting in alleys to lie down than eating when overstocked
- **Negative effects of short periods of deprivation are cumulative**



**Resting: 12-14 h/d
"Vitamin R"**



Lying deprivation, cow welfare, and cost of production

- **Increased cortisol, stress response**
- **Reduced growth hormone & milk yield**
- **Unnatural feeding behavior, reduced rumination, compromised rumen health**
- **Increased standing**
 - **Predisposes cows to sole hemorrhages, lameness**



Common ways to reduce cow well-being on the farm ...

- Excessive time outside pen (>3.5 h/d)
- Mixing of primi- and multiparous cows
- >1 h/d in headlocks, esp. fresh cows
- Short pen stays during transition – social turmoil
- Lack of exercise
- Uncomfortable stalls – tie or free stalls
- Inadequate feed availability
- Overcrowding, excessive competition
- Inadequate heat stress abatement

Time away from pen and cow response: Do time budgets matter?



- **3 h/d versus 6 h/d outside pen**
 - Adjusted pen size versus parlor capacity
 - Mixed primi- and multiparous cows
 - 100% stocking density
 - **Comparing 3 versus 6 h/d:**
 - Cows gained 2.6 h/d rest, 5.0 lb/d milk
 - First-calf heifers gained 4.1 h/d rest, 7.9 lb/d milk

(Matzke, 2003)

➤ **Effect on COP?**



Effect of competition with older cows on first-calf heifers . . .

- **At ~100% stocking density:**
 - **DMI reduced by 10%**
 - **Resting reduced by 20%**
 - **Milk reduced by 9% (Kongaard and Krohn, 1980)**
 - **Greater loss of BW by 30 DIM**
 - **Reduced FCM/DMI by 30 DIM (Bach et al., 2006)**
 - **Less drinking, rumination, and milk fat % (Bach et al., 2007)**

➤ **Effect on COP?**

Transition Cow Environment: Behavior and Health Responses

- **Overcrowding bunk (>80-90%) in close-up pen**
 - reduces feed intake
 - increases DA incidence
 - reduces milk yield of 1st-calf heifers
- **>2 pen moves during transition doubles DA rate; “social turmoil”**
- **Overcrowding bunk in fresh pen increases feeding rate**



➤ **Effect on COP?**



Cost of overcrowding: summary of cow responses

- **Changes in these behaviors:**

- Greater aggression & displacements at feed bunk
- Greater feeding rate
- Reduced resting time
- Increased idle standing in alleys
- Decreased rumination
- Subordinate (i.e. primiparous and lame cows) most affected

- **May result in these economic losses:**

- Less milk yield
- Lower milk fat
- Greater SCC
- More health disorders
- Increased lameness
- Fewer cows pregnant

➤ **Effect on
COP?**



Are the stalls comfortable?

Stall Softness and 305-d Milk Production (lb/yr; Ruud et al., 2010)

Parity	Concrete (1)	Rubber (2)	Soft Mat (3)	Multi-layer mat (4)	Mattress (5)
1	13,338 ^a	13,369 ^a	13,572 ^b	14,106 ^d	13,746 ^c
2	15,255 ^b	15,048 ^a	15,649 ^c	16,139 ^e	15,893 ^d
3	16,086 ^a	15,997 ^a	16,498 ^b	16,744 ^c	16,788 ^c
>3	15,767 ^a	15,811 ^a	16,221 ^b	15,943 ^a	16,500 ^d
Mean	14,799 ^b	14,749 ^a	15,149 ^c	15,464 ^e	15,382 ^d

➤ Survey of 1,923 farms in Norway; related to greater lying times

Make smart bedding

decisions (Tucker et al., 2009)

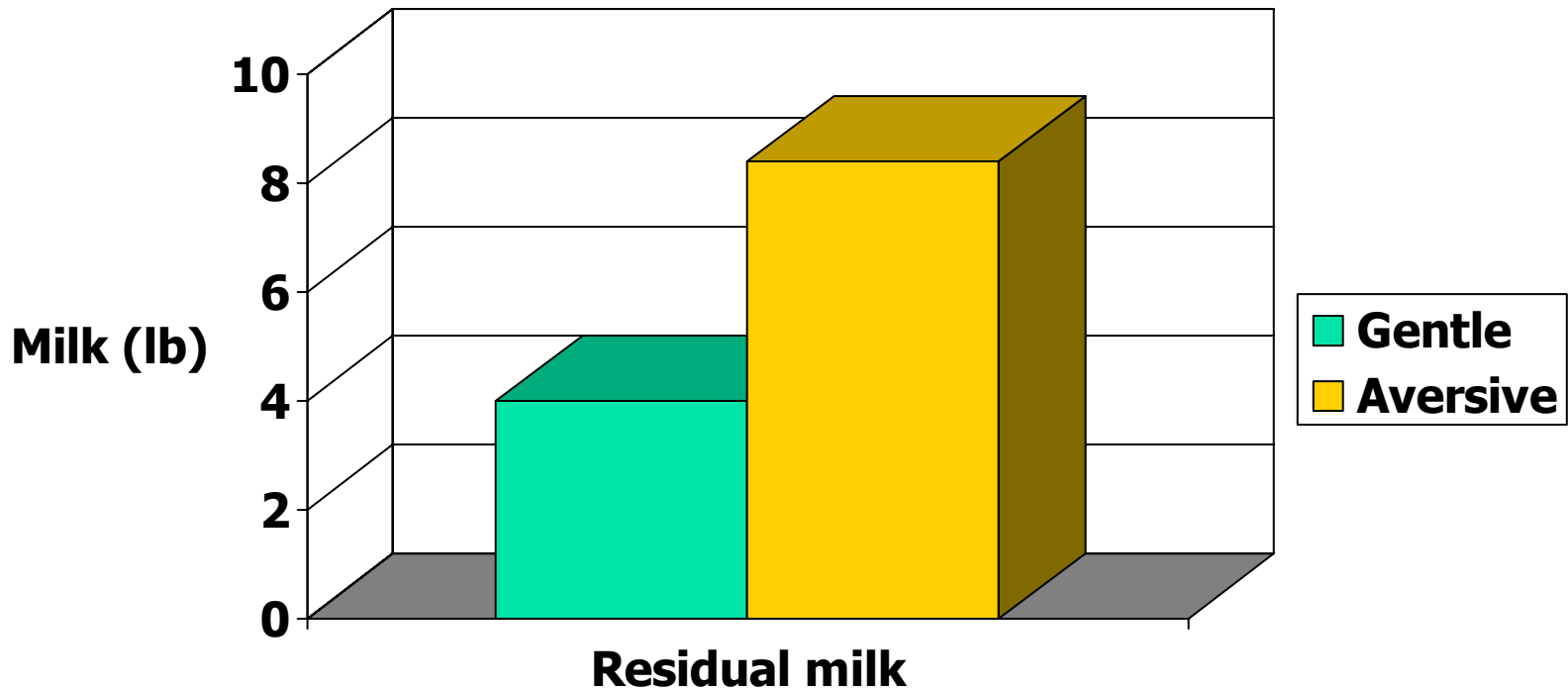
- Cows prefer more compressible (softer) lying surface
- +3 min/d lying time for each additional 2 lb sawdust shavings
 - 6 to 52 lb/stall: +1.1 h/d lying
- +12 min/d lying time for each additional 2 lb straw
 - 2 to 15 lb/stall: +1.2 h/d lying
- +12 min/d lying time for each additional 1/2 inch of sand



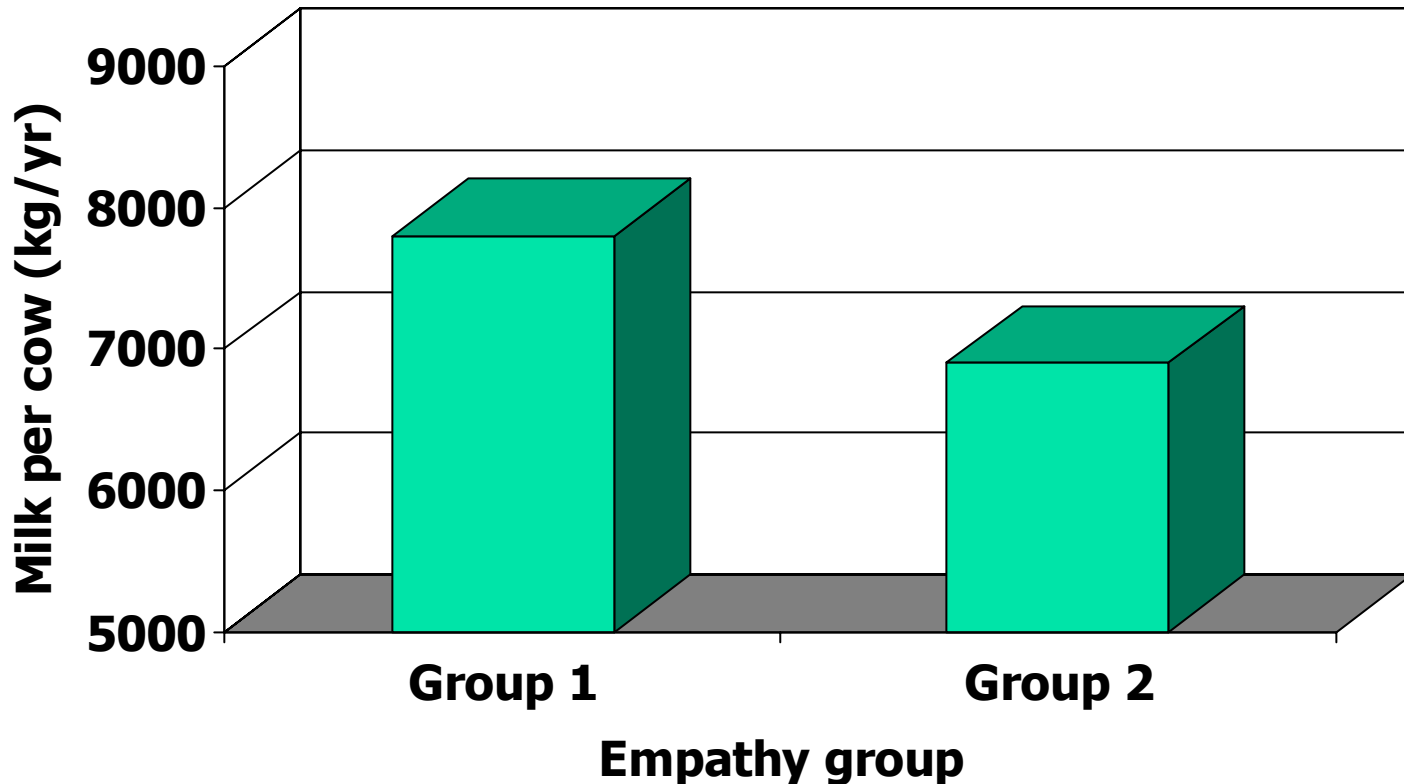
Adjust your attitude!

**Are you a source of
comfort or stress for
your cows?**

Effect of fear on residual milk (dePassille and Rushen, 1999)



Empathy with cattle pain and milk production (Kielland et al., 2010)



➤ **Group 1=4.9; Group 2=6.7 on 1 to 10 scale (lower score=greater empathy with cattle pain)**



Effect of milker behavior on milk production

- **Seabrook (1984)**
 - **13% more milk with gentle vs aversive handling**
- **Hanna et al. (2006)**
 - **3.6% more milk with milking team that had greater positive vocal and physical contact with cow**
- **Doesn't cost a dime.**



Five Things to Do Today to Lower Long-Term Cost of Production

- 1. Feed high quality forage**
High NDF digestibility = more milk per pound of feed & higher forage diets
- 2. Monitor CSPS to ensure optimal starch digestion and minimize need for purchased grain**
- 3. Monitor feed efficiency rather than cutting out diet ingredients**
- 4. Group cows and strive toward “precision feeding” for forages and concentrates**
- 5. Assess resting time and stall comfort**
Adjust bedding, stall design

Bottom Line

- Herds with similar genetics fed the same diet differ in milk by ± 29 lb/day
- You need high quality forage, properly processed, in a well-formulated diet fed in an optimal environment.



"I'm never contented anymore."

Listen to your cows



Thank you

