

Sports Cars vs. Farm Trucks:

Maintaining Cows Like the Top Performers They Are



Vs.



Clem Nash, PhD

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NOVUS
Made of More™

Some Context: NOVUS C.O.W.S.™ Assessments



March 2010

2023

CA

NY/PA/VT

TX/NM

Novus C.O.W.S.

43

40

**1500+ assessments
conducted in North America**

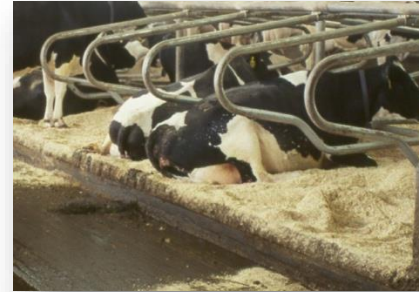
200,000+ cows scored &
1.6 Million+ cows influenced
by the C.O.W.S.™ Program

C.O.W.S.™ ASSESSMENT PROCESS



1. On-Farm Assessments

- **Management Metrics**
Feeding, hoof health, bedding, culling, etc
- **Cow Metrics**
Lameness, lying time, injuries, etc
- **Facility Metrics**
Time away from pen, stalls, flooring, cooling, etc



2. Result Delivery

- **Benchmarked**
- **Detailed**
- **Facilities action**

Novus C.O.W.S.™ Individual Farm Report
Benchmark Report(s) Any Region
USA Number of Dairies in Benchmark: 18

Any Dairy
Any Town, Any State
July 1, 2021
Pen: 7

Economics of Lameness
A dairy's lame cow costs a dairy producer \$450 per cow (Quinn, 2006). Figure 1 highlights the economic consequences of lameness through higher labor and repair costs. Lameness has been reported not only to reduce milk production from 8 to 26% annually (Chickelstein and Franz-Craig, 2017), but it's expected to be the cause of 7.6% of the revenue loss by 2025 with an average prevalence (McCombs et al., 2015). Prevention measures and timely treatment can reduce the impact of lameness on herd productivity and profitability.

Figure 1. Economic consequences of lameness

Lameness Overview for Pen 7
Lame: 24.2%
Severely Lame: 4.1%

Facility and Management Overview for Pen 7

Year	Pen	Pen 7	Pen 8	Pen 9
Lying Time (min)	120	120	120	120
Lameness	24.2%	24.2%	24.2%	24.2%
Severely Lame	4.1%	4.1%	4.1%	4.1%
Moisture	30.2%	30.2%	30.2%	30.2%
Severely Moist	13.8%	13.8%	13.8%	13.8%
Swollen Knees	1.1%	1.1%	1.1%	1.1%

Observations on Lameness
The flooring was very slippery in the feed lanes and slightly slippery in the pen which had low moisture. 50% of the feed lanes were white on areas with water being laid. Some of the water was very deep and caused separation of the white line. Continued moving equipment, a lameness prevention program that includes stall floor from your veterinarian.

Observations on Stalls
This stall in pen 7 appeared to be larger than the 4000 sq ft stall. Total stall length was measured to be 90 inches. Back rail height was 3 inches closer to the bedding surface than the cow. At 2000 lbs, a heavy cow will not stand square with cows are lying. The back rail is spaced 6 inches apart. Bedding is not being pushed and bedding particles are rubbing the hocks to increase injury. It would be best to have 3 inches to allow the cows to rise easily.

Target Stall Dimensions by Cow Size

Stall Dimensions (in.)	Low	Med	High	Very High
Stall length	100	100	100	100
Stall width	42	42	42	42
Back rail height	42	42	42	42
Distance between back of neck and back of hock	58	58	58	58
Distance between back of neck and back of hock	58	58	58	58
Distance between back of neck and back of hock	58	58	58	58
Distance between back of neck and back of hock	58	58	58	58
Distance between back of neck and back of hock	58	58	58	58
Distance between back of neck and back of hock	58	58	58	58
Distance between back of neck and back of hock	58	58	58	58

Action Plan for Any Dairy

Area of Opportunity	Notes or Action	Individual Performance	Priority	Est. Time Frame
Lying Time				
Lameness				
Moisture				
Severely Moist				
Swollen Knees				
Other				

Date of Follow-up Meeting:
Notes:

40 years of change...

1981 Car of the Year Plymouth Reliant



Performance:

Top speed: 99mph
Acceleration: 0-60 12.3s

2021 Car of the Year – Mercedes-Benz E-Class



Performance:

Top speed: 186mph
Acceleration: 0-60 4.9s

1981 Supreme Champion J-WS Monitor Racheal



Performance:

305 Milk: 6,560kg*
Milk fat: 3.4%*

2021 Supreme Champion Erbacres Snapple Shakira-ET



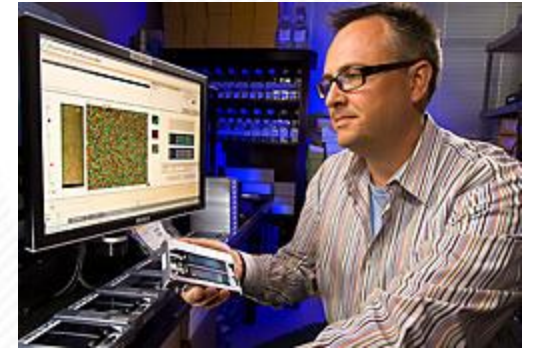
Performance:

305 Milk: 14,236kg
Milk fat: 4.8%

What supported this change?

Engineering aka Genetics

Modern selective breeding practices have impacted as much as 30% of the Holstein genome. USDS-ARS and University of Minnesota



What supported this change?

Fuel aka Nutrition

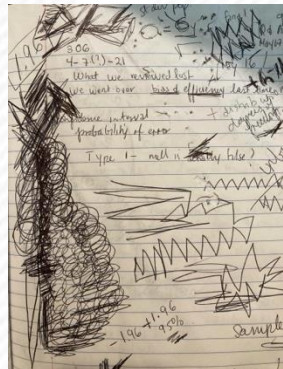
Basic Ingredient Feeding



TMR



PMR



NDS PROFESSIONAL		Feedback	
Working group		Wednesday 2017-01-24	
Com Silage Processed 30 DM 48 NDF Mo	25.2033 7.5788 12.20	Dairy in milk	1.0515
Green Silage 20 CP 48 NDF 1 LNDP	12.0000 4.2000 17.00	Milk production kg	40.00
Concentrate Meal 475 Silage	1.0000 1.0000 4.00	Milk Fat % w/w	3.70
Com Grain Grapona Fine	6.0000 5.2000 22.51	Milk Protein % w/w	3.32
Calcium Mica Silage	2.0000 2.2342 3.61	Mean FCM kg	870.0
Dist Pulp Pellets	1.0000 1.3700 5.87	ME M MJ/kg	265.15
Molasses	0.0000 0.6000 2.05	ME g/kg	-0.76
Sodium Bicarbonate IARM & HAMMER	0.2000 0.1800 0.85	ME effective ECM	2.6523
Sorbolat P-100 (BERG-SCHMIDT)	0.3000 0.2800 1.27	ME available ECM	87.0
Soy Fluke	0.8000 0.7102 3.04	ME M/kg	171.6
		Lys R	-15.6
		Total EAA w/kg	1.2273
		ME M/kg	-30.4
		NEI M/kg	97.7
		NEI M/kg	7.17
		NEI M/kg	X
		NEI M/kg	7.14



40 years of change..



**1981 Supreme Champion
J-WS Monitor Racheal**



Performance:

**305 Milk: 6,560kg*
Milk fat: 3.4%***

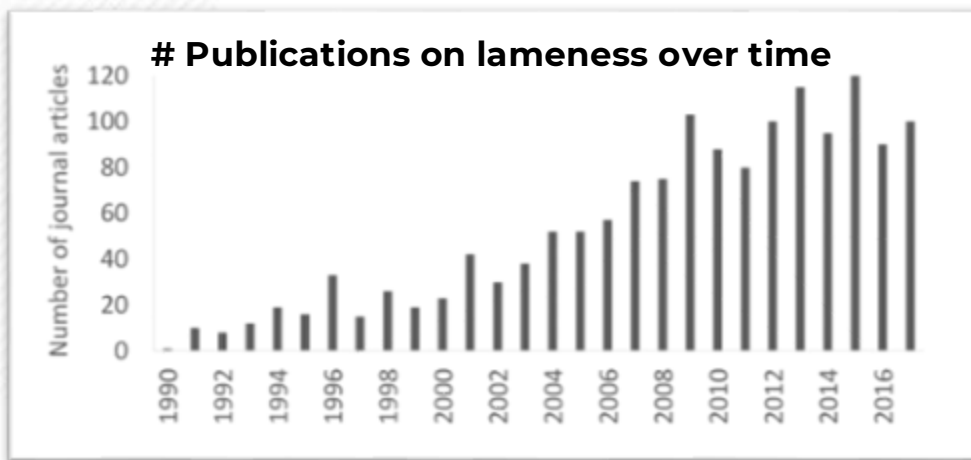
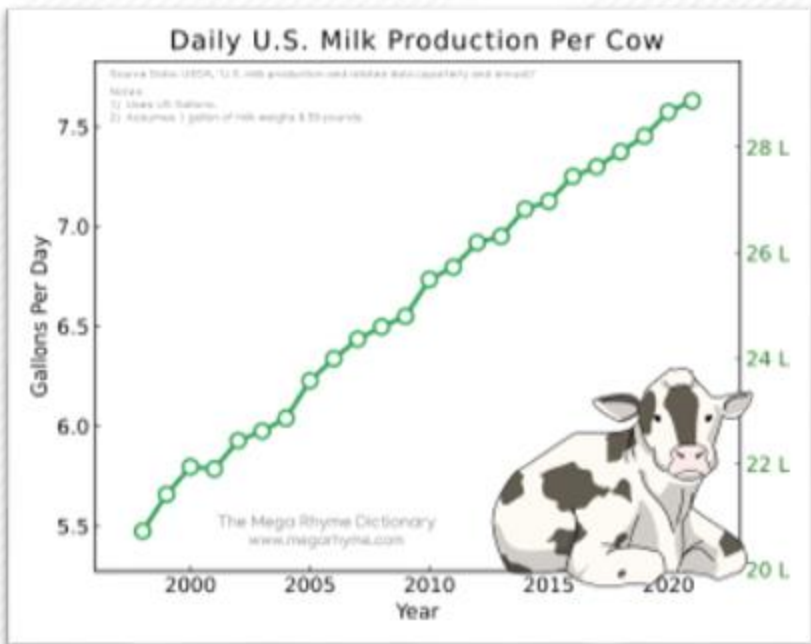
**2021 Supreme Champion
Erbacres Snapple Shakira-ET**



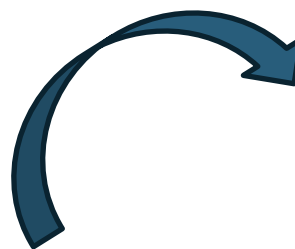
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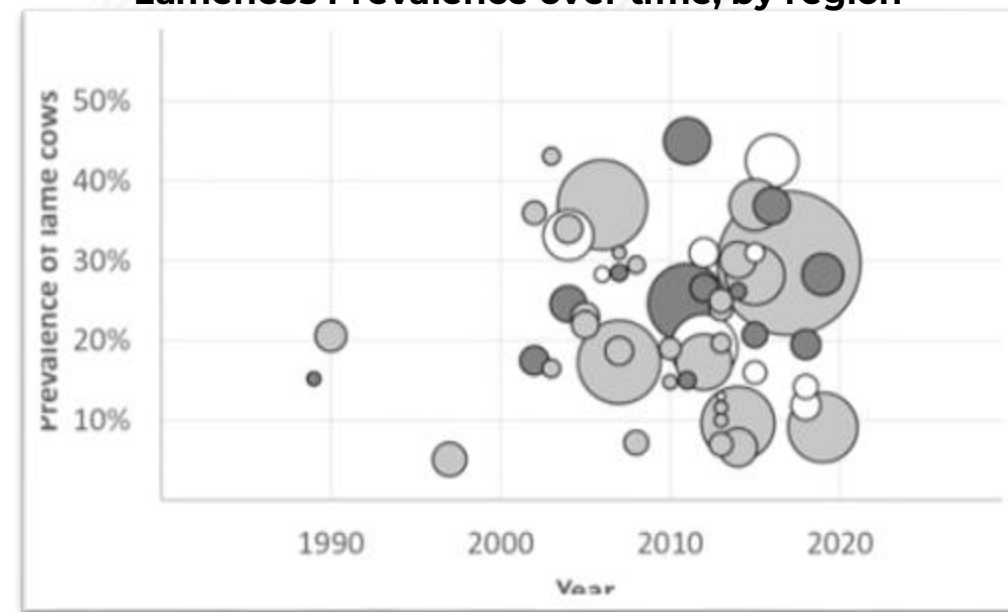
**Lower fertility
Higher Lameness
Lower longevity**



Ventura et al. 2015



Lameness Prevalence over time, by region



Houe et al., 2023

What created these challenges?

Solid engineering, high quality fuel... What about the maintenance and environment?

Mercedes-Benz E-Class



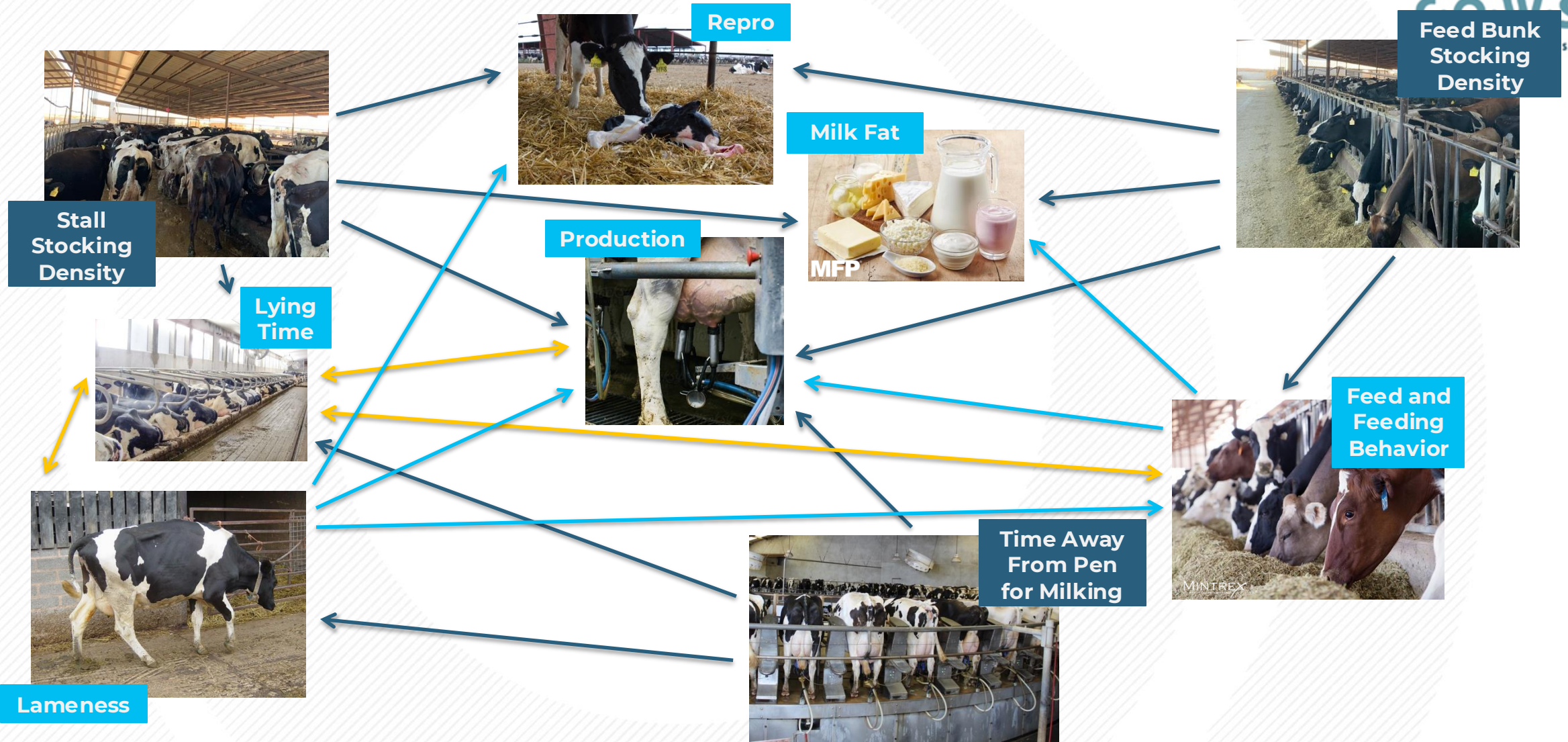
SOME RISK FACTORS FOR POOR PERFORMANCE



COW COMFORT ISSUES ARE MULTI-FACTORIAL



COWS



40 years of change...



Source: Gayla Marty. Kodacolor. May 1986



Source: <https://www.agristeelusa.com/dairy-buildings>

Though tiestalls were more common, freestalls were invented as early as the 1950s by Major Bramley:

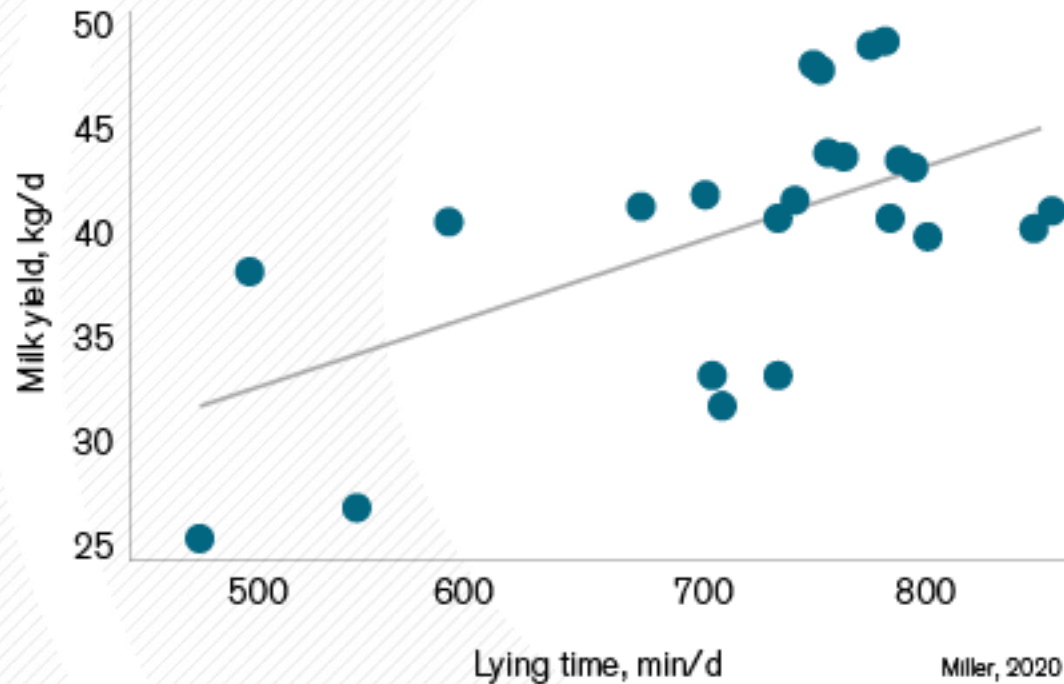
Major Bramley in 1962 said *“The size of the cubicle must be adequate to enable the animal to stand and lie down in comfort but at the same time its positioning must be reasonable accurate, and the permissible margin of movement restricted so that it cannot stand forward or move sideways sufficiently to enable it to dung and urinate on the bedding”* Eerdenburg and Ruud, 2021

The challenges...



ECONOMICS OF LYING TIME

RELATIONSHIP BETWEEN MILK YIELD AND LYING TIME



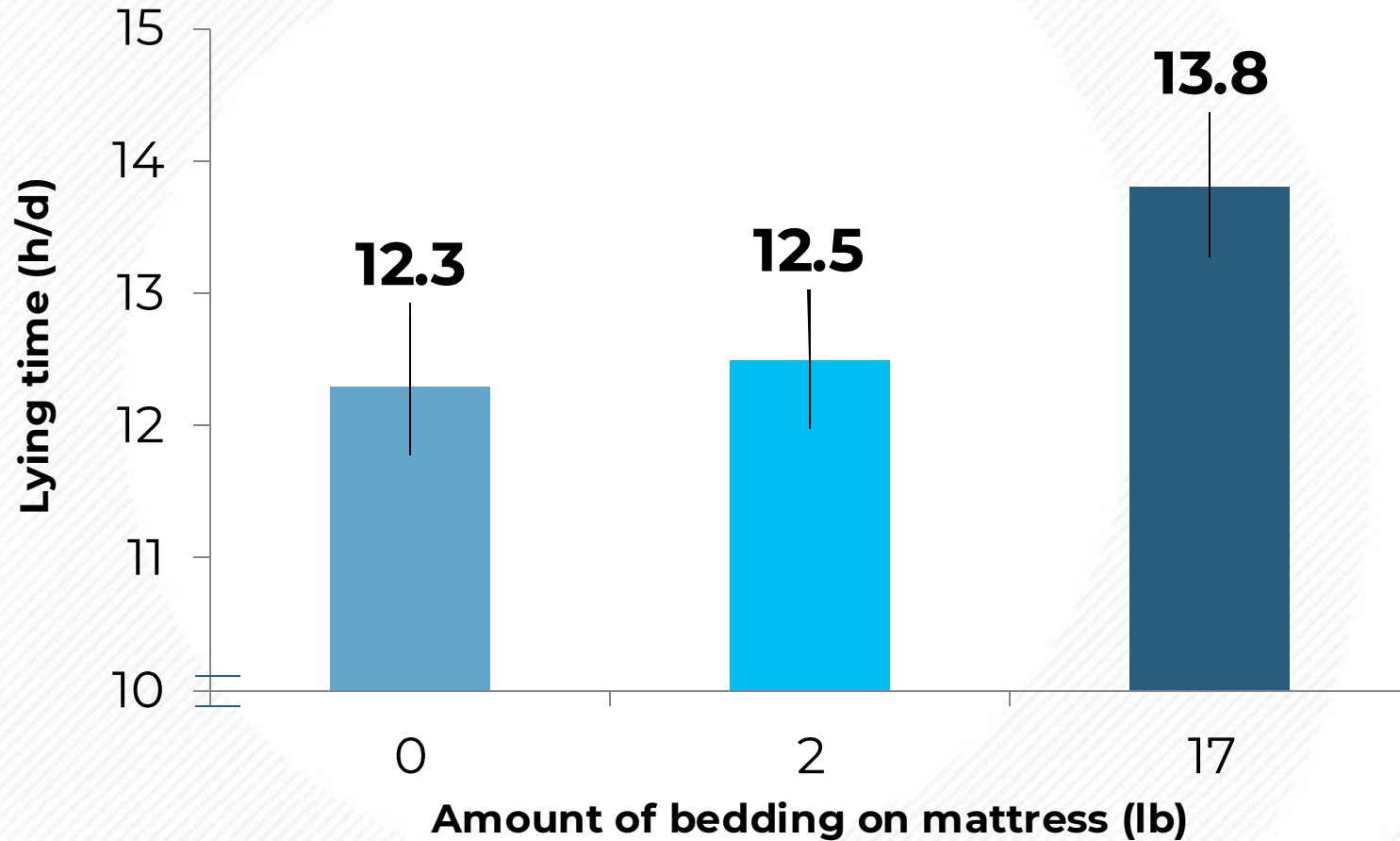
Each extra hour of lying time = **2.4 lbs/d** more milk (*Miller, 2020*)

Novus data – **2 to 4 lbs/d** more milk for each extra hour of lying

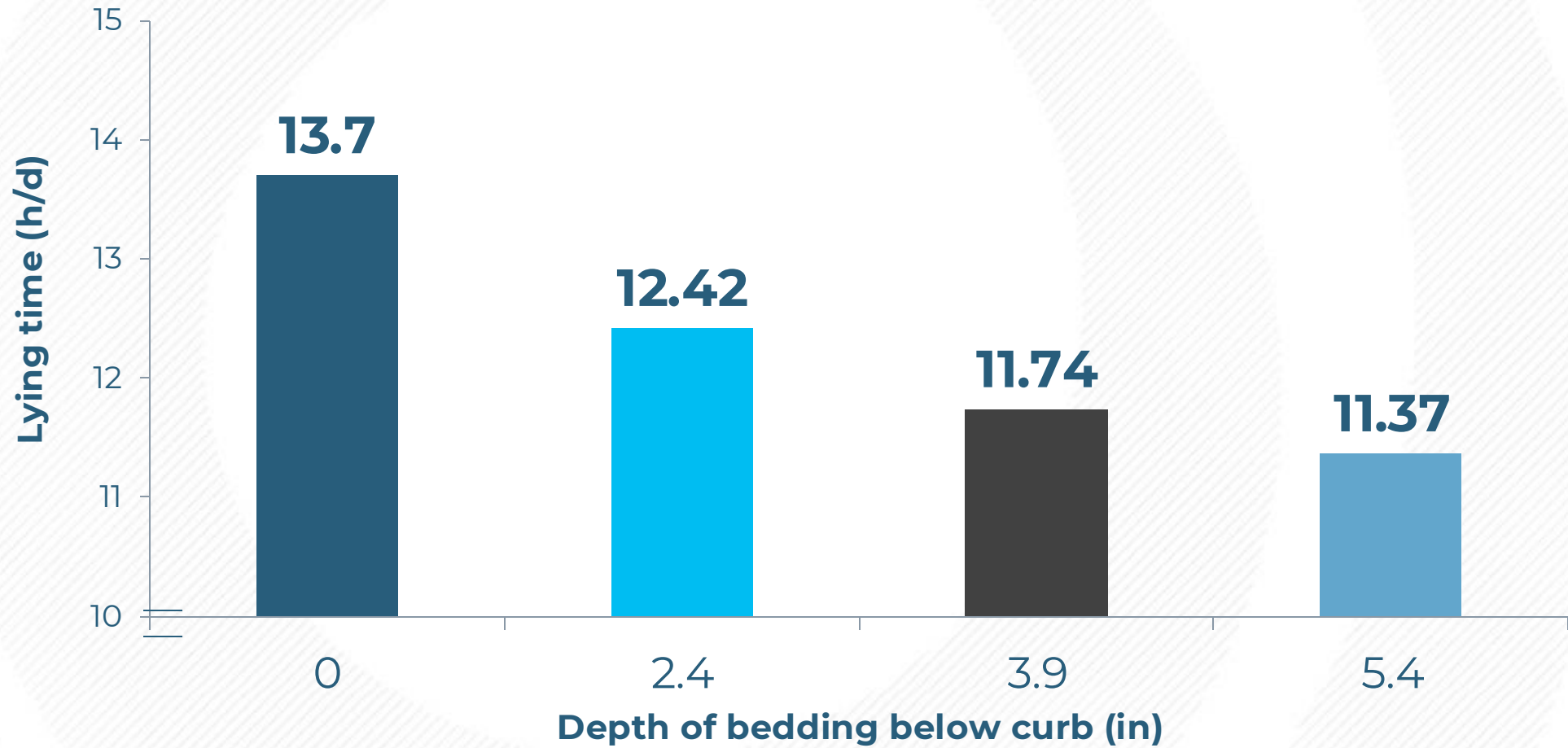
According to the USDA Mailbox Price Report, the Avg Mailbox Milk Price for the USA in 2020 was \$16.96/cwt

- \$0.34 - \$0.68 more income for each extra hour of lying time.
- For a pen with 150 cows that is \$51 to \$102 of additional income per DAY!

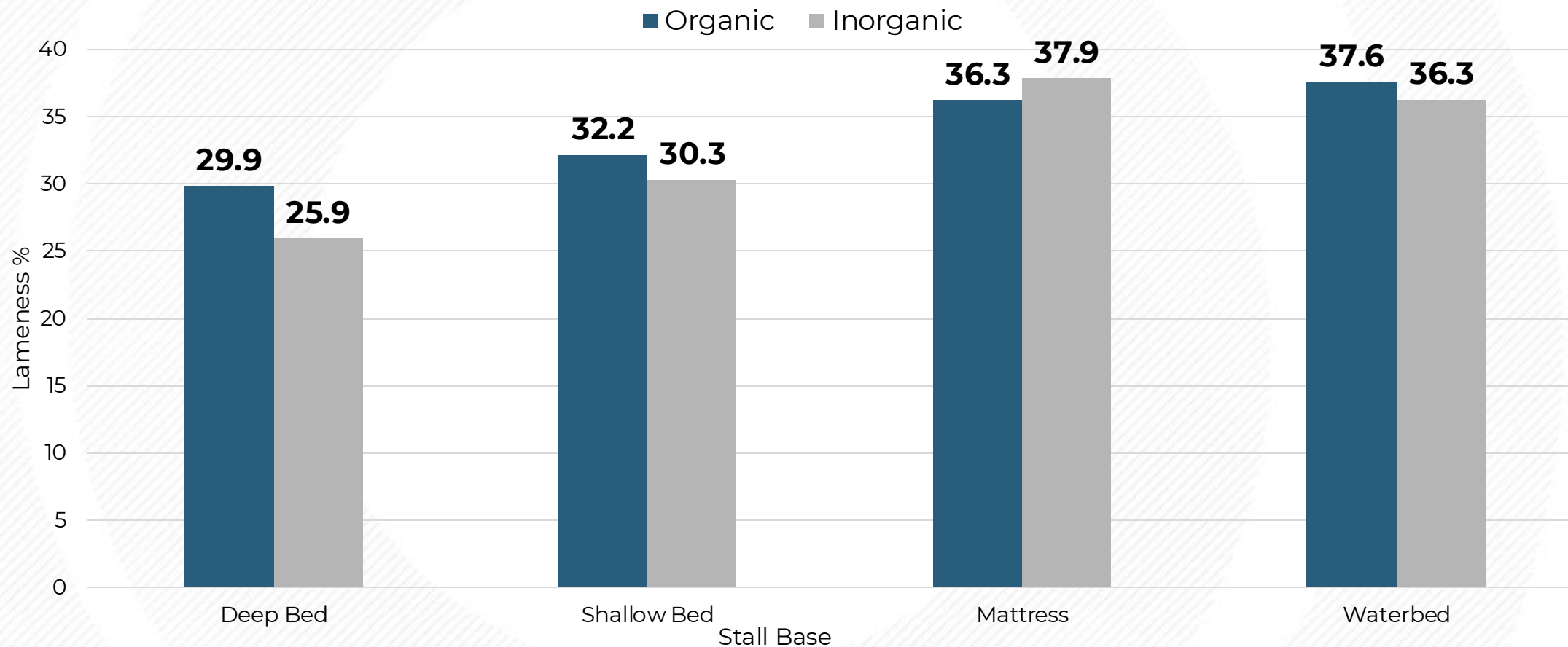
Lying Time on Mattresses Increases with More Bedding



Lying Time on Deep-Beds Decreases with Less Bedding



Average Lameness by Stall Base – Organic vs. Inorganic Bedding



What if mattresses are the only option?



"We can't do deep beds - what's the best option if we can only do mattresses?"

- Collected feedback from the industry on various brands to identify what the “best of the worst” might be
- The goal was to provide feedback on pros and cons from various mattress brands/models seen in the field without aligning with any specific brand



General Feedback



Mattress Brand	Comfort	Warranty	Durability	Ease of installation	Longevity	Good top cover	Thickness of foam	Good bedding retention	Cost effective	Recommended by producers
[Redacted]	✓	✓	✓	✓	✓				✓	✓
	✓		✓		✓	✓				✓
	✓		✓		✓		✓			✓
				✓				✓		
	✓		✓		✓					✓
Mattress Brand	Wear down	Top covers	Durability	Hock lesions	Abrasive Surface	Poor bedding retention	Bad warranty	Harden	Producers cautioned against them	
[Redacted]	✗	✗								
	✗			✗	✗	✗				
	✗	✗		✗	✗			✗		
			✗					✗		
					✗		✗		✗	
			✗						✗	

Key Takeaways on Mattresses

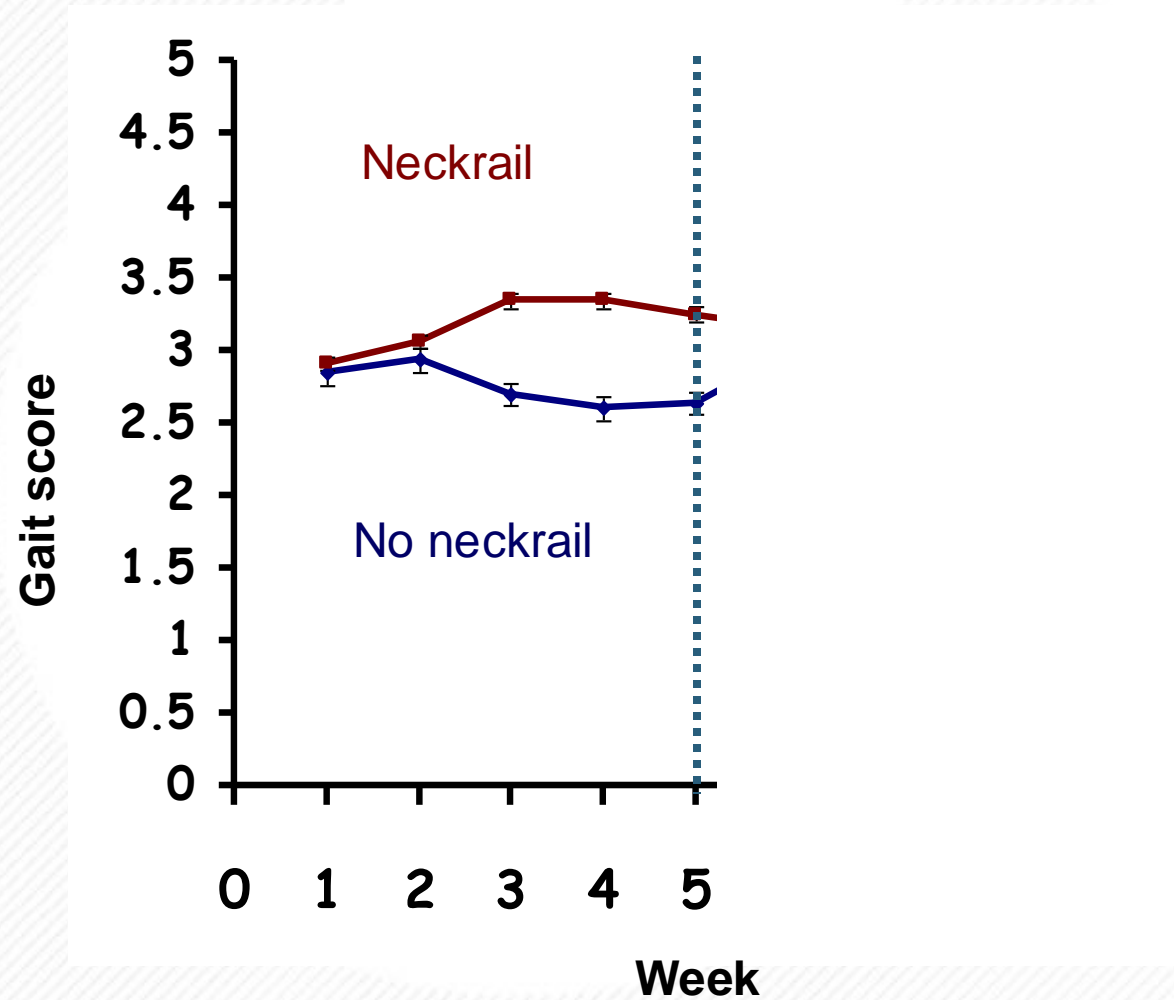
- Mattresses with foam and rubber top cover get the most positive feedback
- All mattresses tend to wear down after 7-10 years, no matter the brand
- Proper bedding management has a huge impact regardless of stall base

Neck Rail: Position Can Increase Lameness

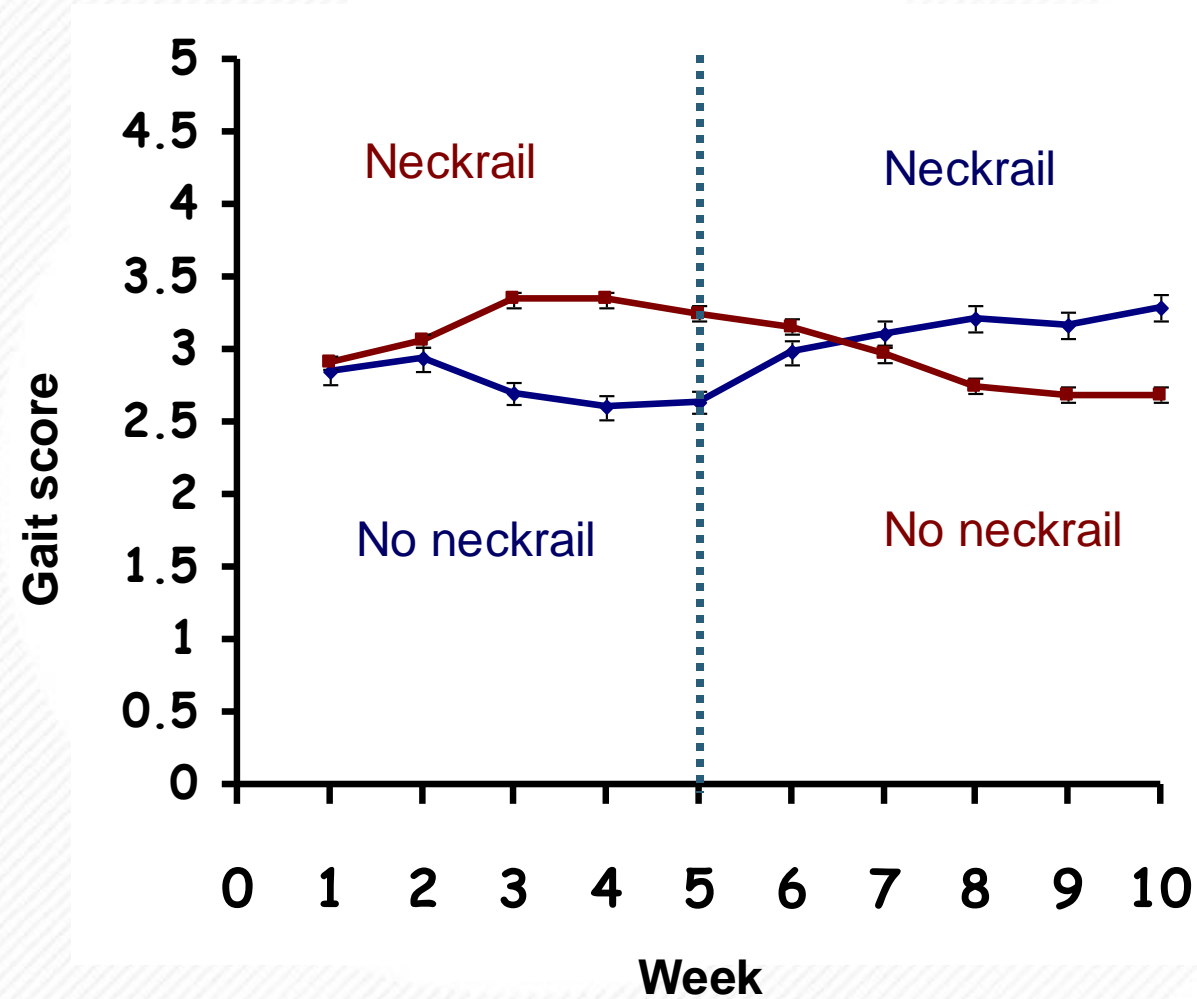


(Bernardi et al, 2009)

Neck Rail: Position Can Increase Lameness



Neck Rail: Position Can Increase Lameness

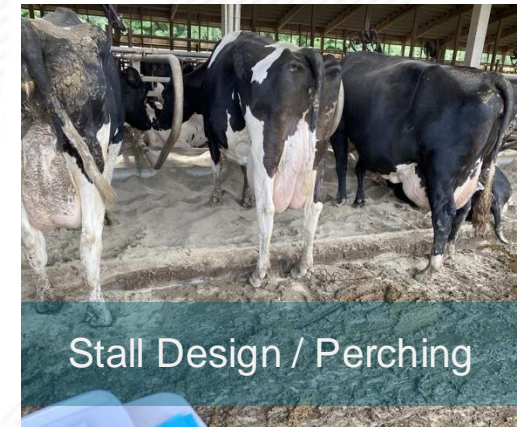
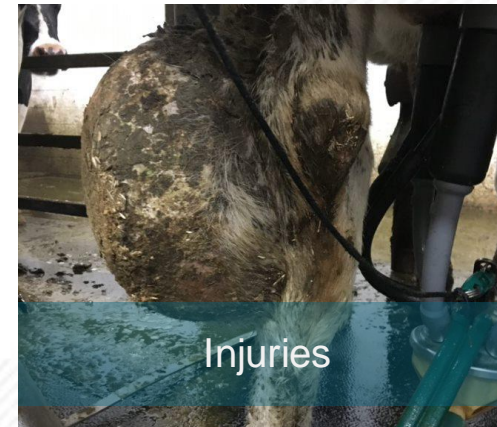
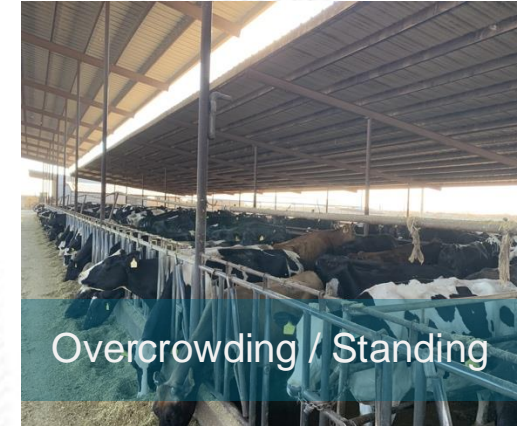


Risk Factors of Lameness – Causes of Infectious vs. Non-Infectious

Infectious



Non-Infectious



Footbath Management / Recommendations



Footbath Sizing and Use

- Minimum **10 ft (3 m)** long – each hoof **2** full steps in solution
- Minimum **4 in (10 cm)** solution depth – dewclaws submerged as pass through footbath
- Solution concentration – maintained according to manufacturer specifications
- Replacing/replenishing solution is dependent on:
 - Hoof & leg hygiene of cows
 - Product recommendations
 - Size of footbath
- Footbath pH should be maintained at **3.5 - 5.5**
 - Normal skin pH is **4 - 5.5**

Alley Management / Recommendations



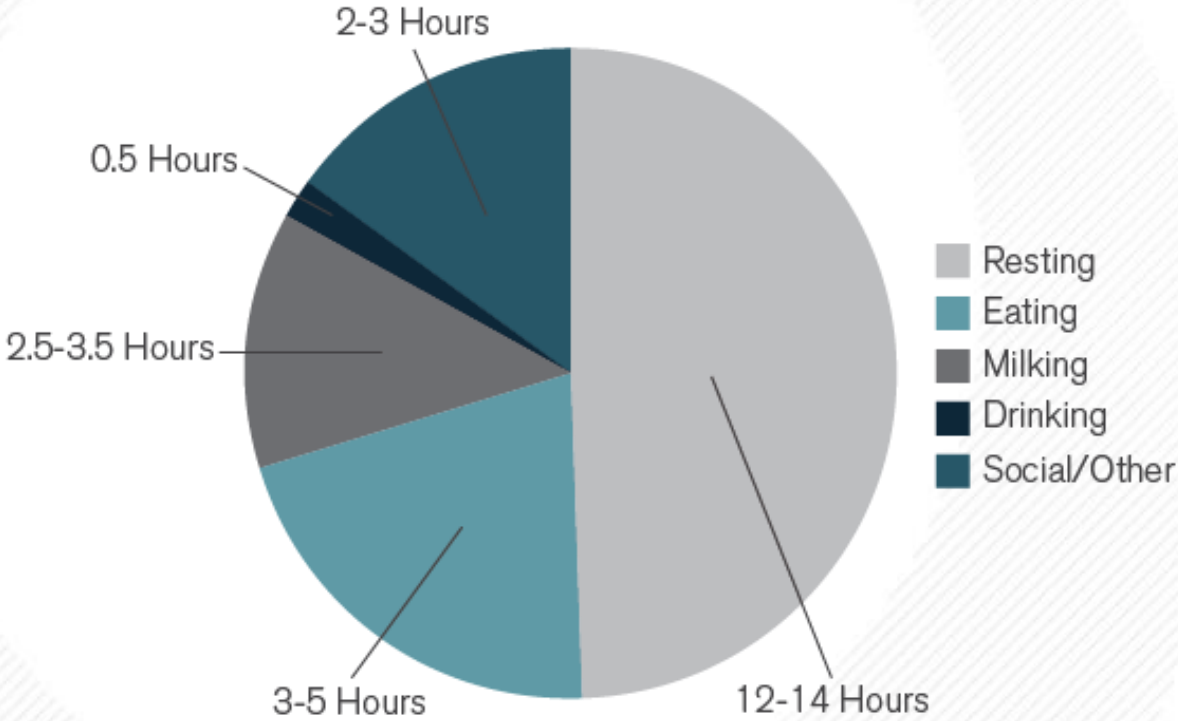
Source: Dan McFarland, Penn State

Surface Recommendations:

- Dependent on bedding type and concrete quality
- Grooves must be cut in a way that the hoof is fully supported
- Resurfacing must be done in a way that does not create too much wear on the sole and hoof walls
- **Grooving and resurfacing needs redone periodically**

Average Time Budget of a Freestall-Housed Dairy Cow

Figure 2. Average time budget of a freestall-housed dairy cow



Effects of Time Away from Pen

Higher lameness prevalence

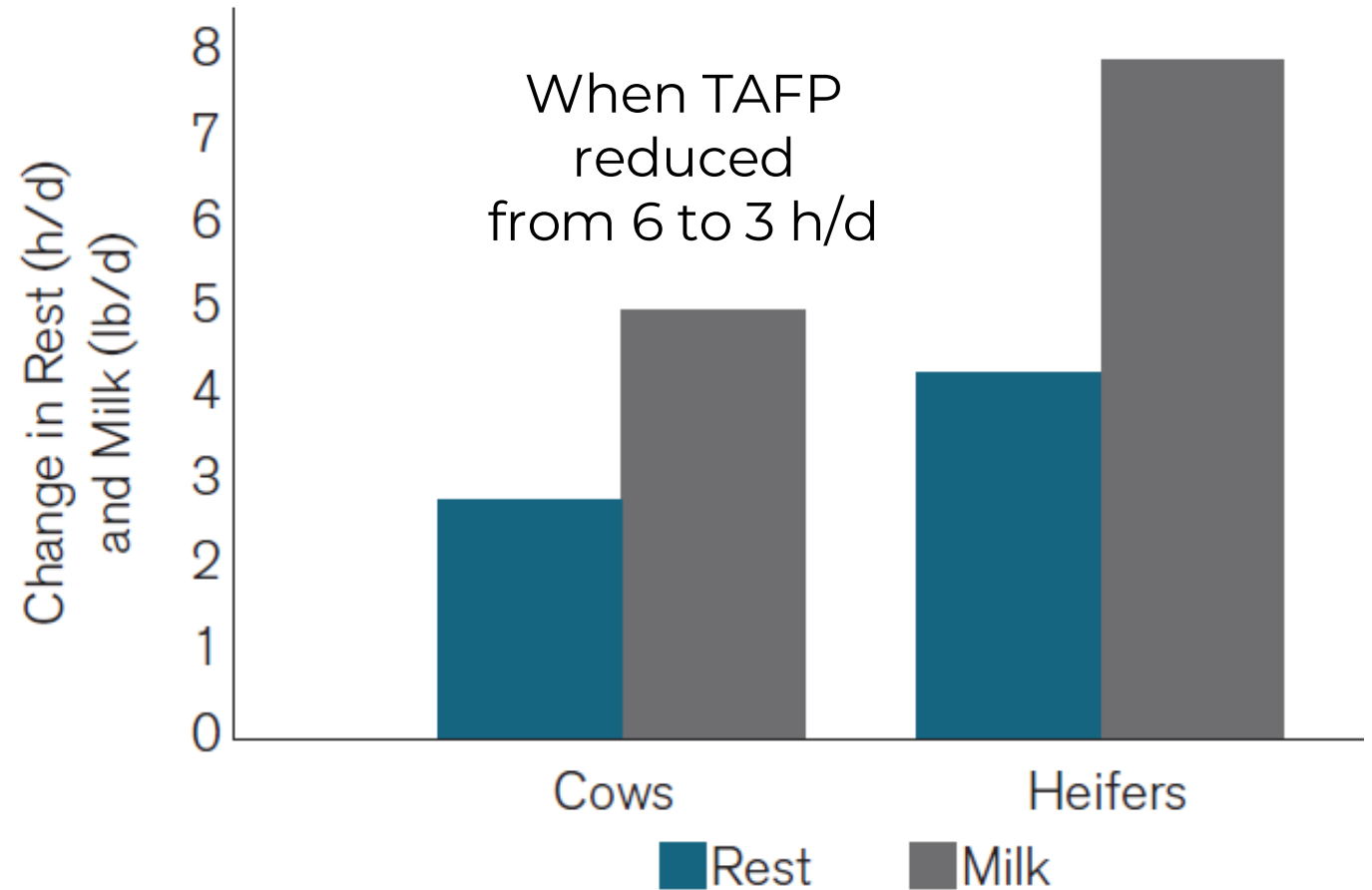
(Espejo and Endres, 2007)

Reduced lying time

(Matzke, 2003)

Reduced production

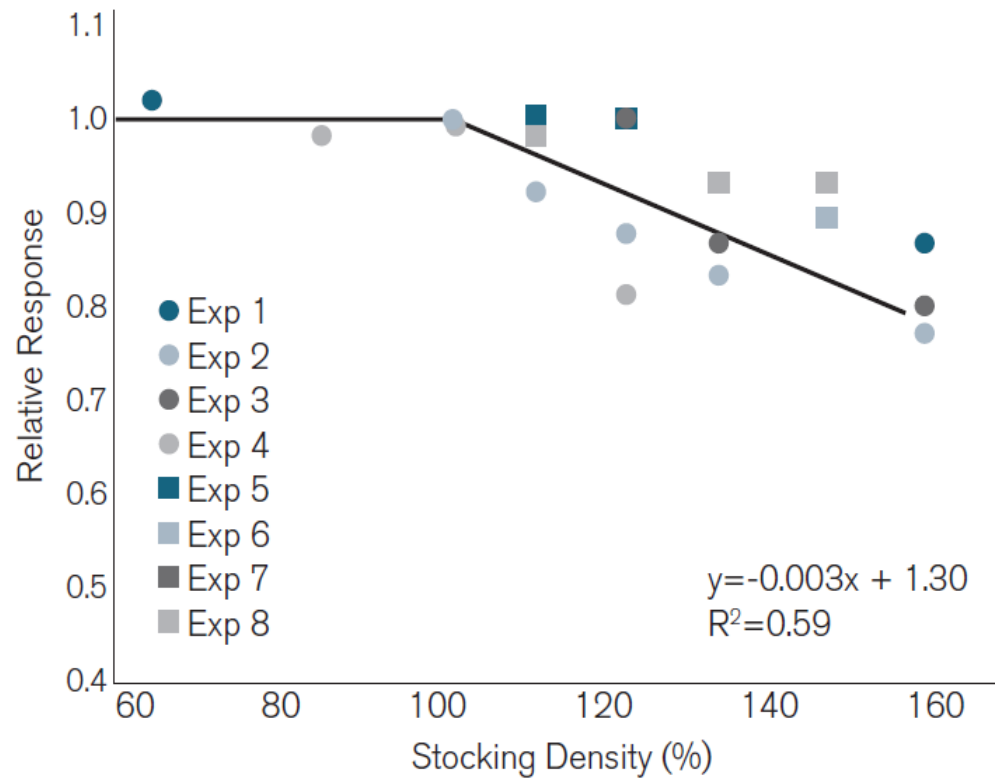
(Matzke, 2003)



Lying Time Decreases with Stall Overstocking

Summary of 8 studies:

Lying time decreases as stall stocking density increases
As low as 109%, and especially beyond 120%



Effects of Heat Stress

Milk production



↓ milk production in the following lactation \approx 5kg (11lbs)
(Tao and Dahl, 2013; Ferreira, 2016)

Reduce feed intake & Rumen acidosis



↓ rumination activity, ↓ DM digestibility of concentrate and diet *(Maia et al., 2020)*
Change in rumen microbial composition resulting in acidosis
(Russell et al., 2011)

Lameness & Laminitis



↑ in claw horn lesion development in late summer, associated with ↑ in total standing time per day
(Cook et al., 2003)

Mitigating Heat Stress



Mitigating Heat Stress – Air Ventilation



Air Speed

Avg. Air Speed

- Across the barn 3-5mph (5-8kmh)
- At resting height = 5 mph (8kmh)

Start of heat load differs between standing and lying COWS
(THI = 70 vs. 65), *Pinto et al., 2020.*

Fans

(optimize natural ventilation first)

ON

- Turn fans ON when Temp > 68° F

Spacing

- 10x diameter
- 2x for HVLS

Angle

- 20°

Maintenance

Clean

- Blades | Louvers | Cages
- Inlets
- Can reduce speed by 50% if dirty

Check

- Motors | Bearings | Belts
- Curtains | Inlets open and operational

Mitigating Heat Stress – Water Availability

IN THE PEN & Return Alleys – Soakers

Water

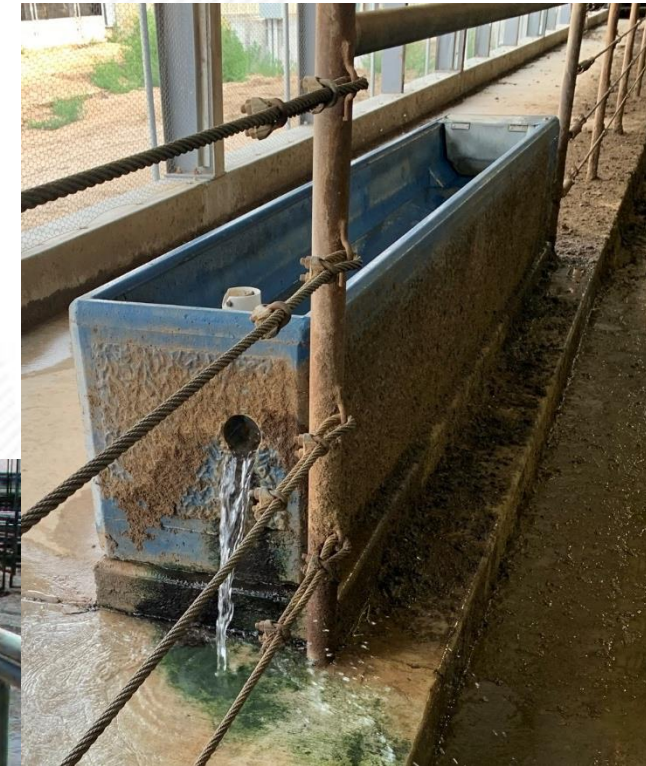
- Consumption will increase during hot season, make sure to provide enough water to all cows
- Space > 3.5 in/cow
- Depth \approx 7 in maintained when cows drinking
- Flow Rate > 4 gal/min for individual waterers

Check

- Cleanliness
- Leaks
- Cow behavior at the drinker - with increasing THI, cows drank more water, spent more time at the drinker, made more visits to the drinker, and engaged in more competitive events at the drinker (*McDonald et al., 2020*)



Picture: Jeff Keaman



Handling

Fear of humans has been correlated with lower production parameters: milk volume and components. (Breuer et al, 2000, Hemsworth et al, 2000)

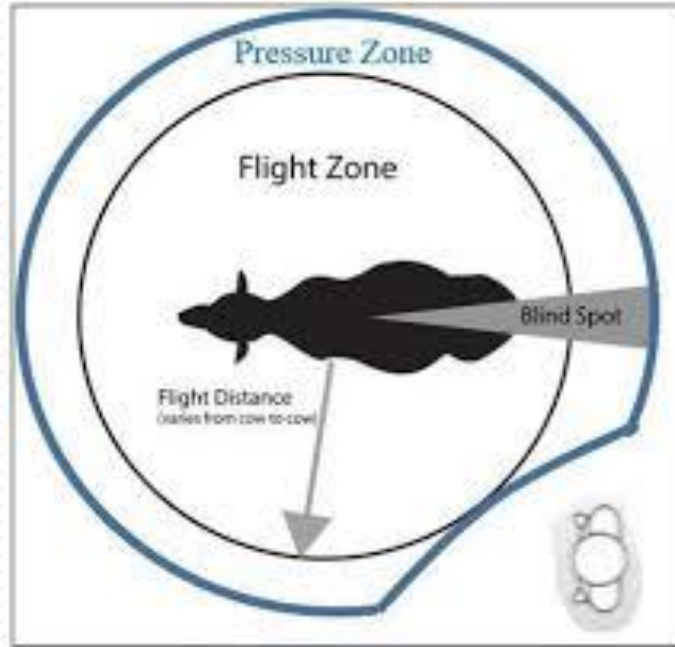
Poor handling has also been associated with greater probability of injury to both cow and human. (<https://dairy.extension.wisc.edu>)

Proper handling of these top performers allow them to perform their best.

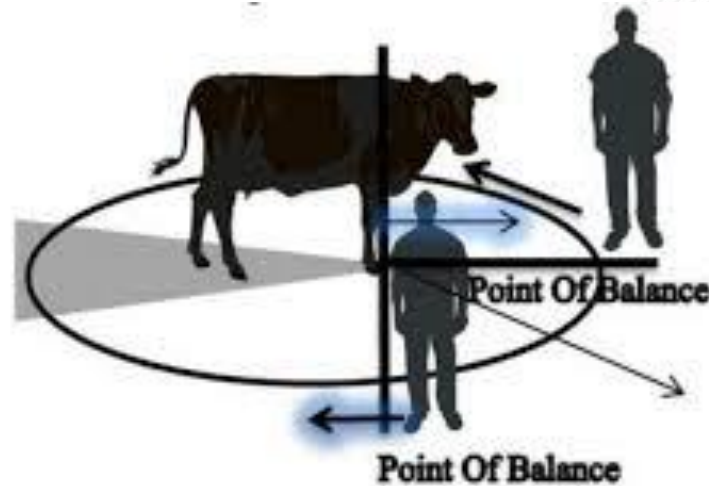


Source: <https://dairy.extension.wisc.edu/>

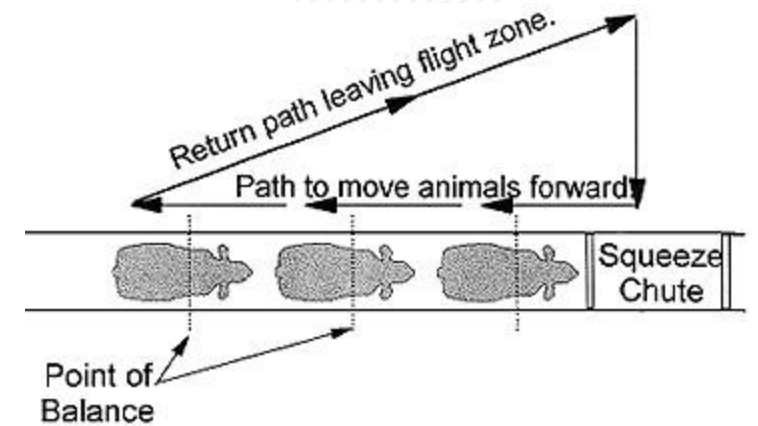
Stress-Free Handling



Source: SDS University



Source: Virginia State University



Source: Dr Temple Grandin

Cattle handlers properly trained and supervised, facilities designed for natural cattle movement, accountability and reporting system for poor handling.

Take Aways

Keep and manage cows like the high performers they are!

- **Genetics and Nutrition have shown exponential improvements**
- **Housing and Management have not kept up...**

What do we need to do? Use critical Cows-First thinking!

- ✓ **Comfortable housing – bedding, no pressure points or moisture**
- ✓ **Ideal time budgets – no excessive lock up, stocking densities or holding pen times**
- ✓ **Optimized hoof care – optimally timed high-quality trims, footbath strategy, high traction non-abrasive walkways**
- ✓ **Climate controlled – good ventilation and air exchange, heat mitigation adapted to environment**
- ✓ **Gentle, effective handling and handling systems – no rushing, aggression, yelling**

Utilize the services available to you!

The logo for NOVUS features the word "NOVUS" in a bold, dark blue, sans-serif font. The letter "O" is stylized as a target symbol, consisting of three concentric circles. A registered trademark symbol (®) is positioned to the upper right of the "S".

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Made of More[™]