Animal Welfare in Modern Cattle Husbandry

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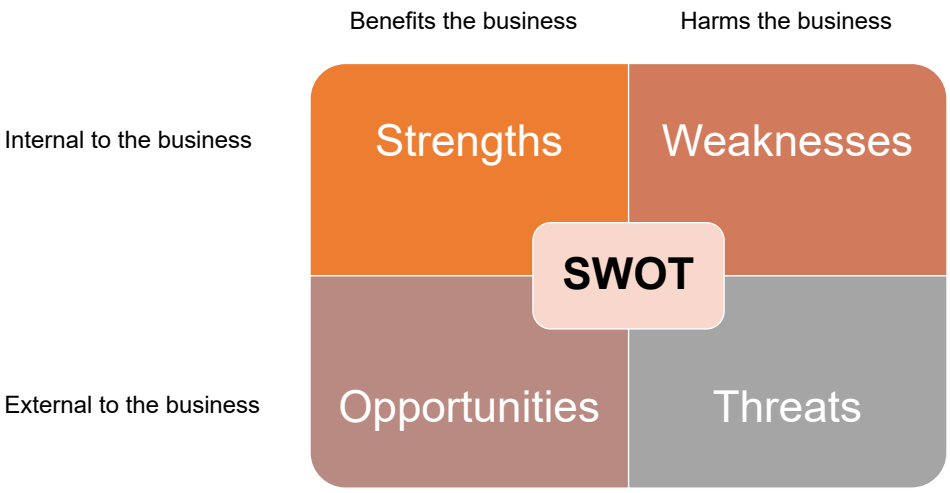
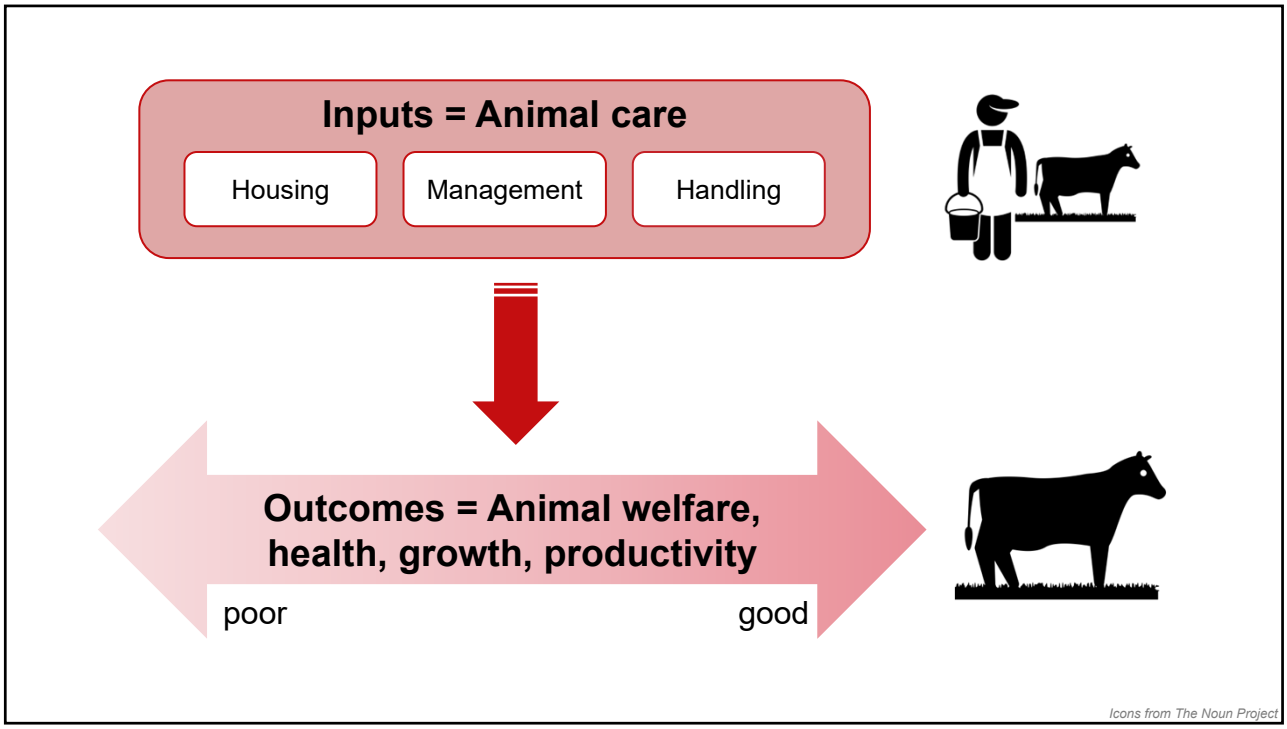
Photo by McKenzie Trinko

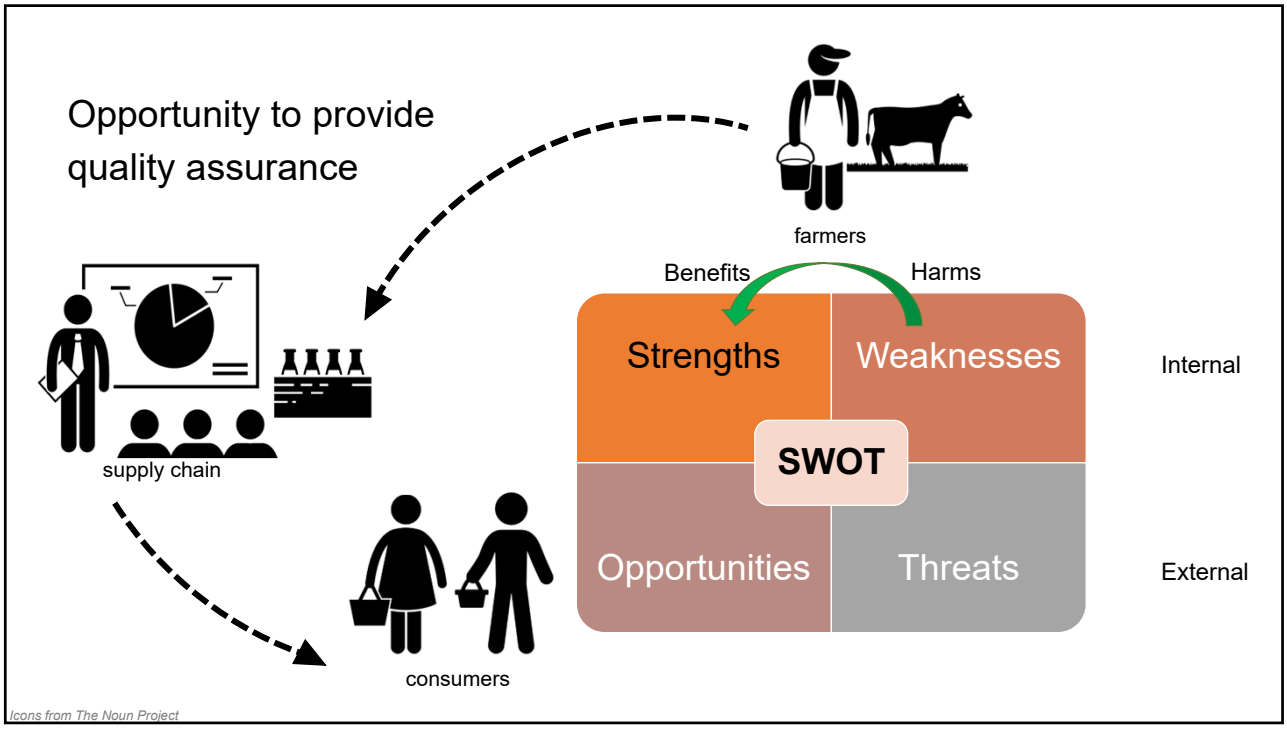
MSD Expertise Conference
Tuesday, 9 May 2023
Cattle Health

Department of Animal & Dairy Sciences
UNIVERSITY OF WISCONSIN-MADISON

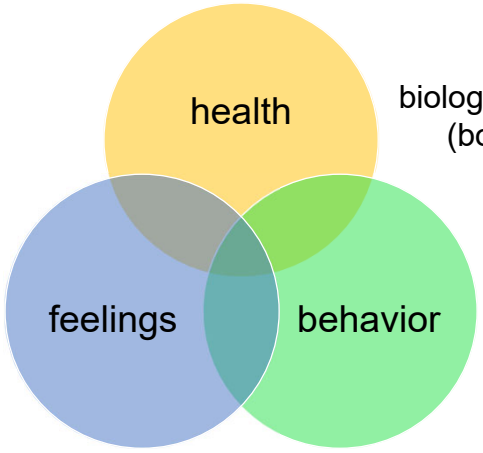
Role of animal welfare on dairy farms




Inputs = Animal care
Housing
Management
Handling
Outcomes = Animal welfare, health, growth, productivity
poor
good
Icons from The Noun Project


Opportunity to provide quality assurance
farmers
Benefits
Harms
Strengths
Weaknesses
SWOT
Opportunities
Threats
Internal
External
supply chain
consumers
Icons from The Noun Project

What is important for animal welfare?



biological functioning
(bodily health)

affective state
(+ vs – experience)

species relevance
("behavioral well-being")

Figure adapted from Fraser, et al. 1997. Animal Welfare 6:187-205

What is important for animal welfare?

biological functioning
(bodily health)

- Disease
- Injury
- Production
- Growth
- Reproduction
- Biomarkers
- etc.

https://www.nadis.org.uk/diseasae-a-z/cattle/lameness-control-in-dairy-herds/part-2-mobility-scoring-how-do-you-score/

What is important for animal welfare?

feelings

Tests:
- Judgment bias
- Aversion race
- Conditioned place preference
- etc.

affective (emotional) state
(+ vs – experience)

What is important for animal welfare?

behavior

- Time budgets
- Abnormal behavior
- Preference tests
- Motivation tests
- etc.

species relevance
("behavioral well-being")

Giving cows a voice through science

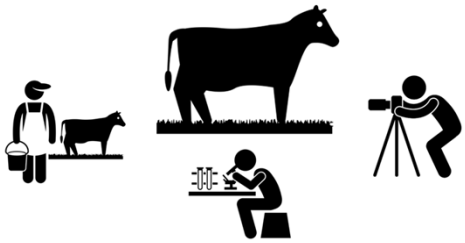
Provide opportunity for animals to express:

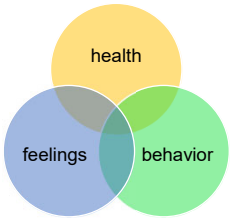
- What they prefer
- What is important to them

→ We gain insights into their needs

↓

We can improve their welfare



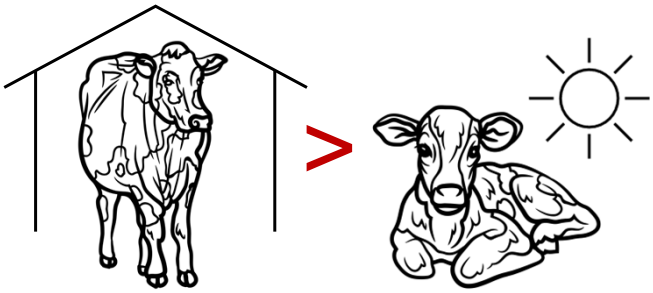


Icons from the Noun Project

Example 1: Heat stress mitigation

Cows are highly motivated for shade

- After 12 hours of forced standing, cows continued to stand, as long as they could do so in the shade
- Shelter from the hot sun is extremely important to cows



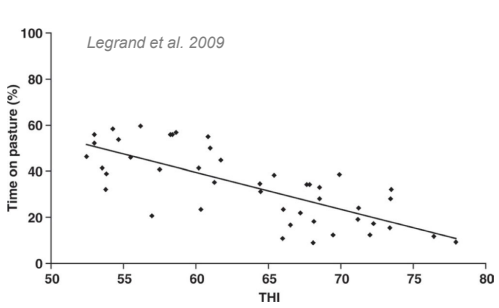
Keep standing, but in the shade

Lie down, but in the sun

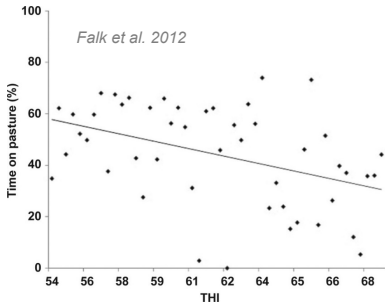
Icons by 'Hey Rabbit' from The Noun Project

Schütz et al., 2008

Preference for shelter magnified in hot weather



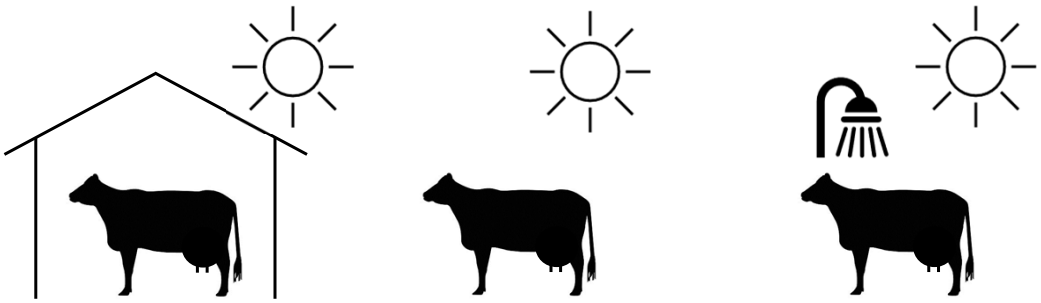
(0800 – 2200 h)



(0830 – 1500 h)

Cows chose to spend less time on pasture during the daytime and more time inside the barn as temperature-humidity index (THI) increased

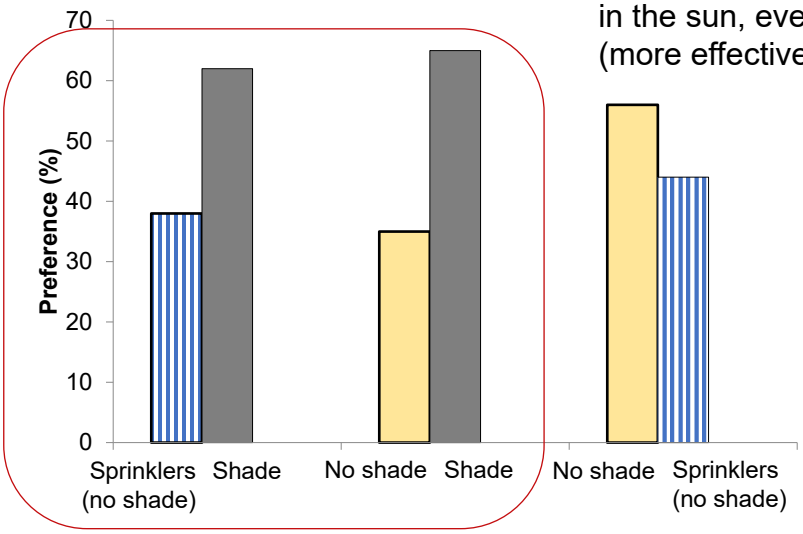
Cows prefer shade as a cooling resource



Shade | No shade | Sprinklers (no shade)

Schütz et al., 2011

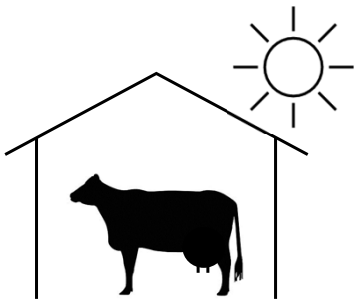
Cows prefer shade



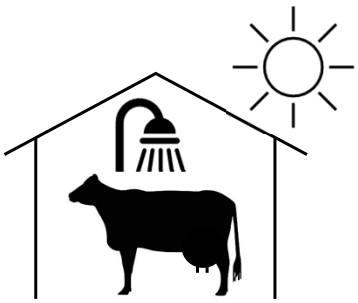
Cows prefer shade compared to being in the sun, even when cooled with (more effective) water sprinklers

Adapted from Schütz et al., 2011

Avoid tradeoffs between important resources



Shade

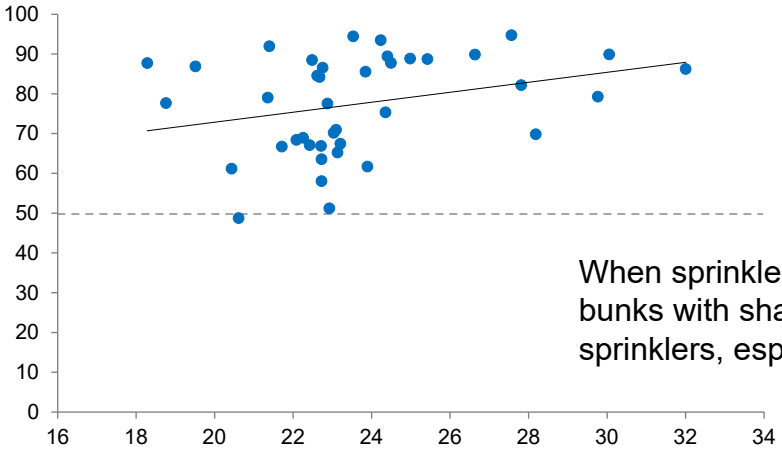


Sprinklers
with shade

Chen [Van Os] et al., 2013

Preference for combining important resources

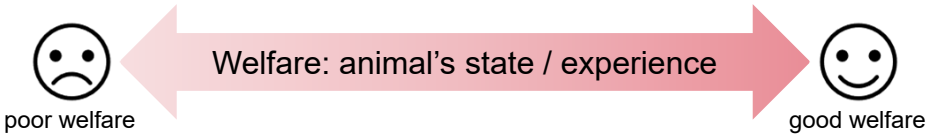
Preference (% of time) for feed bunk with sprinklers (vs. just shade)



When sprinklers are mounted over feed bunks with shade, cows do prefer sprinklers, especially in warmer weather

Chen [Van Os] et al., 2013

Cows seek cooling to relieve thermal discomfort



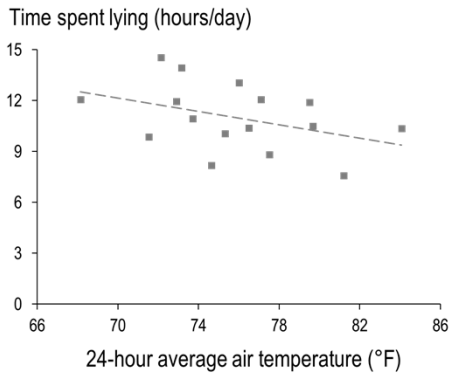
Cows experience discomfort and seek cooling in "thermoneutral" conditions and below the THI thresholds based on production losses. They:

- voluntarily use soakers overnight when it's already "cool"
- prefer soakers even on relatively milder days
- prefer soakers even in AM before daily ambient THI rises/peaks

Bianca, 1968; Spiers et al, 2004; Gaughan et al, 2008; Legrand et al, 2011; Chen (Van Os) et al, 2013, 2016

Lying time decreases with heat stress

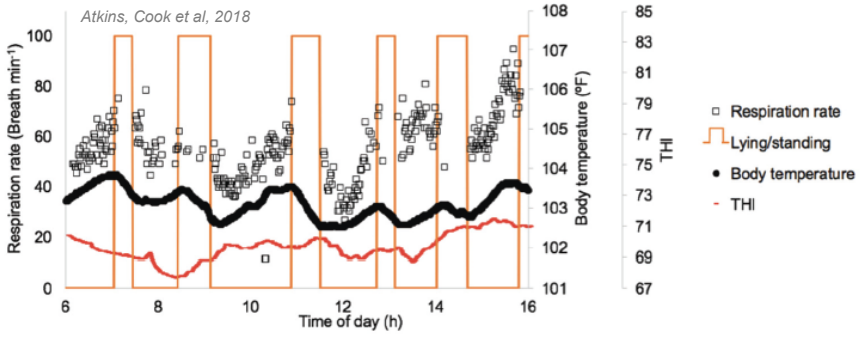
- Normally, cows are highly motivated to spend half of the day lying down
  - common indicator of cow comfort
- Lying time decreases with heat stress, regardless of soaking



Chen (Van Os) et al., 2013, 2016, Cook et al, 2007; Tucker et al, 2008; Jensen et al, 2005; Hillman et al, 2005; Ansell, 1981; Legrand et al, 2011; Overton et al. 2002

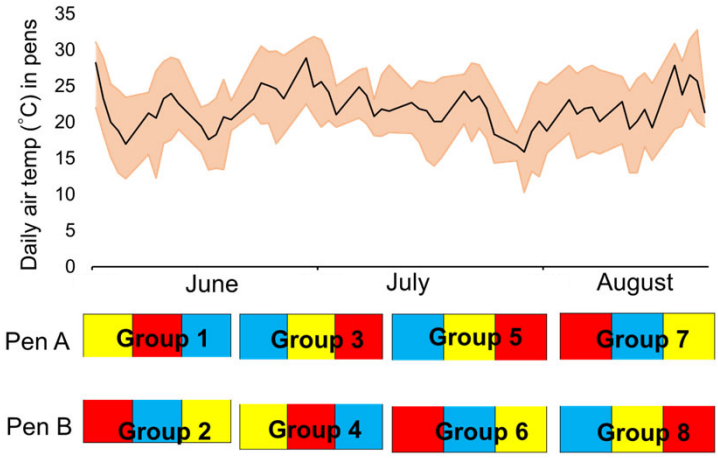
Why does this happen?

- While cows lie down, respiration rate & body temperature ↑
- While cows are standing, respiration rate & body temperature ↓
- Standing exposes more surface area for convective heat loss



Chen (Van Os) et al., 2016, Cook et al, 2007; Tucker et al, 2008; Jensen et al, 2005; Hillman et al, 2005; Ansell, 1981; Legrand et al, 2011

Replicated crossover design



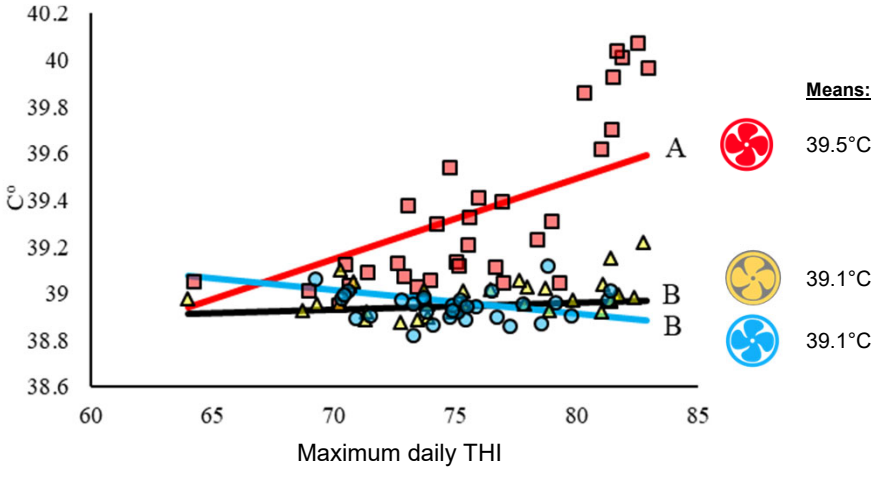
- n = 8 groups
- 16 cows/pen
- All groups received all 3 treatments
- 2 pens tested concurrently
- Each treatment: 3 days acclimation + 4 days data collection

Control (no fans; 0.4 m/s ± 0.2 m/s)
60% of max fan power (1.7 m/s ± 0.5 m/s)
100% of max fan power (2.4 m/s ± 0.8 m/s)

Reuscher, Van Os, et al. (submitted)

Fans kept body temperature normal

Maximum daily vaginal temperature



Means:

39.5°C

39.1°C

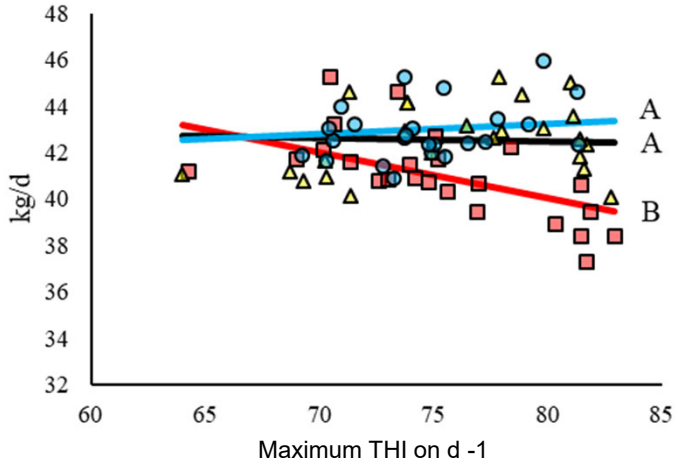
39.1°C

Fans also reduced respiration rate and skin temperature

Reuscher, Van Os, et al. (submitted)

Fans protected milk yield

Daily milk yield



Means:

43.3 kg/d

42.7 kg/d

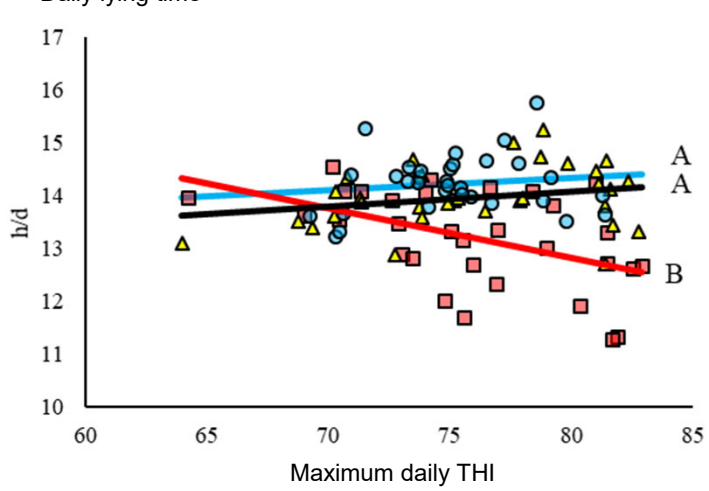
41.4 kg/d

Fans also increased dry matter intake

Reuscher, Van Os, et al. (submitted)

Critically, fans protected lying time

Daily lying time



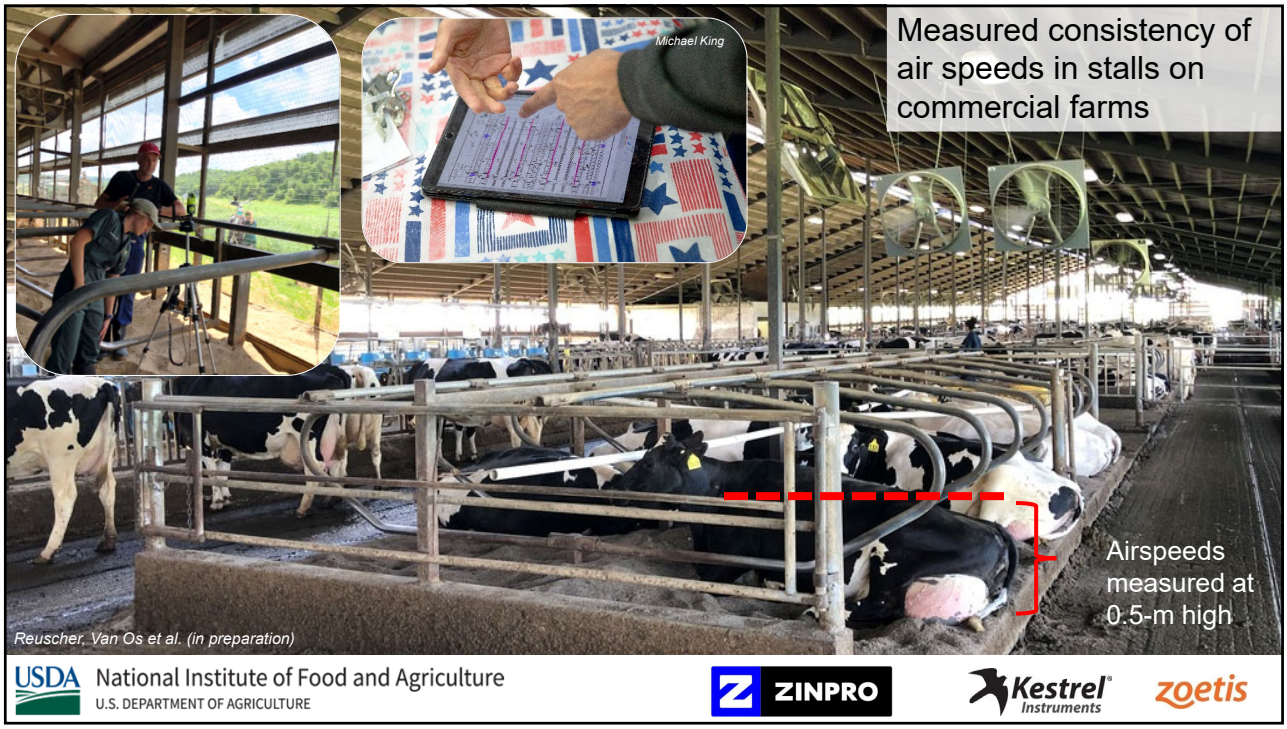
Means:

14.3 h/d

13.9 h/d

13.2 h/d

Reuscher, Van Os, et al. (submitted)



Adjust cooling strategies by observing cows

Limitations of measuring the environment:

- The weather forecast doesn't tell us how cows will respond on different farms
- Measuring a barn's microclimate doesn't tell us how individual cows will cope

Therefore:

✓ Use the forecast to decide <u>when</u> to measure

✓ Measure both the microclimate + individual cow responses

✓ Use microclimate for context to help interpret how the cows are coping

What should we observe?

If the cows are doing the following, they are telling us they are uncomfortable and could benefit from (more) cooling!

- behaviors such as lethargy, seeking shade, water, or cooling
- vasodilation (proxy: skin temperature)
- sweating (hard to measure outside of research setting)
- **panting, ⇧ respiratory rate**

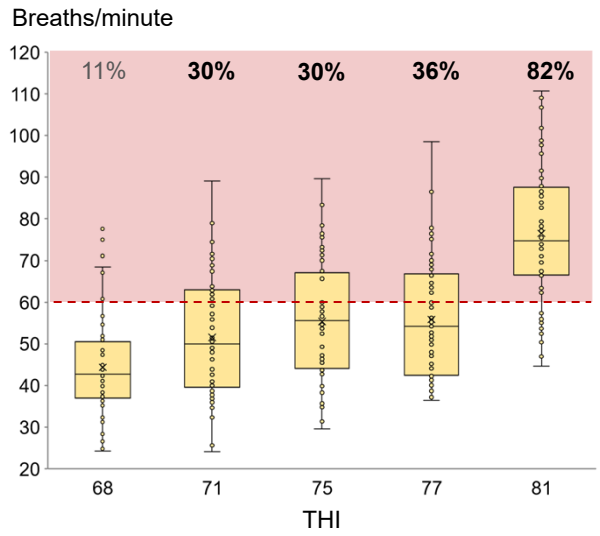
Van Os. 2019. Vet. Clin. N. Am. Food Anim. Practice 35:157-173; Bianca, 1968

Panting: conspicuous indicator of severe heat stress

Drooling	[open mouth] Panting	Tongue Out
Saliva (clear, transparent) comes out of the cow's mouth; cow is not ruminating; any quantity of visible saliva counts as drooling	Open mouth; space between the lips is visible; cow is not ruminating	Protruding tongue; tongue tip or more crosses the lower teeth and it does not touch any body parts (e.g. not grooming)

Test yourself: http://tuckerlab.ucdavis.edu/heat-stress.html

Respiratory rate: an early indicator



Target: <25% of cows (top quartile) with respiratory rate ≥ 60 breaths per minute

DAIRY INNOVATION HUB NOVUS

da Silva, Van Os, et al. (in preparation); see also Chen (Van Os) et al, 2016; Atkins et al., 2018

Example 2: Pair or group housing of calves

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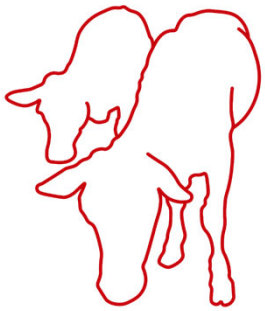
Two heads are better than one:
A starter guide to pairing dairy calves



Topics

1. Why all the fuss about pair housing?
2. Benchmarks for calf health before pair housing
3. Hygiene practices
4. Options for housing pairs or groups
5. Grouping strategies
6. Feeding practices and reducing cross sucking
7. Disbudding and dehorning considerations

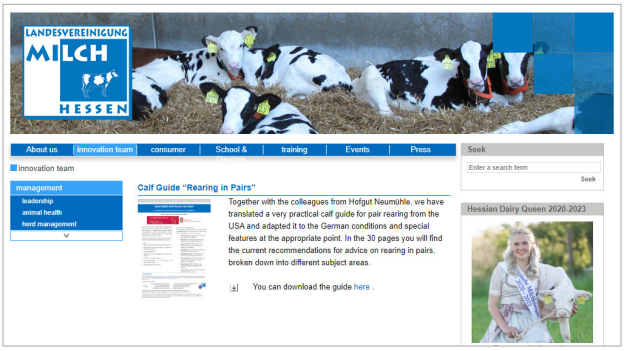
https://animalwelfare.cals.wisc.edu/calf_pairing/

Created by Jennifer Van Os with contributions from Sarah Adcock, Joao Costa, Courtney Halbach, Tina Kohlman, Emily Miller-Cushon, Theresa Ollivett, Donald Sockett, and Sandra Stuttgen

1. Einleitung | 2. Benchmarks | 3. Hygiene | 4. Haltung | 5. Gruppen | 6. Fütterung | 7. Enthornen

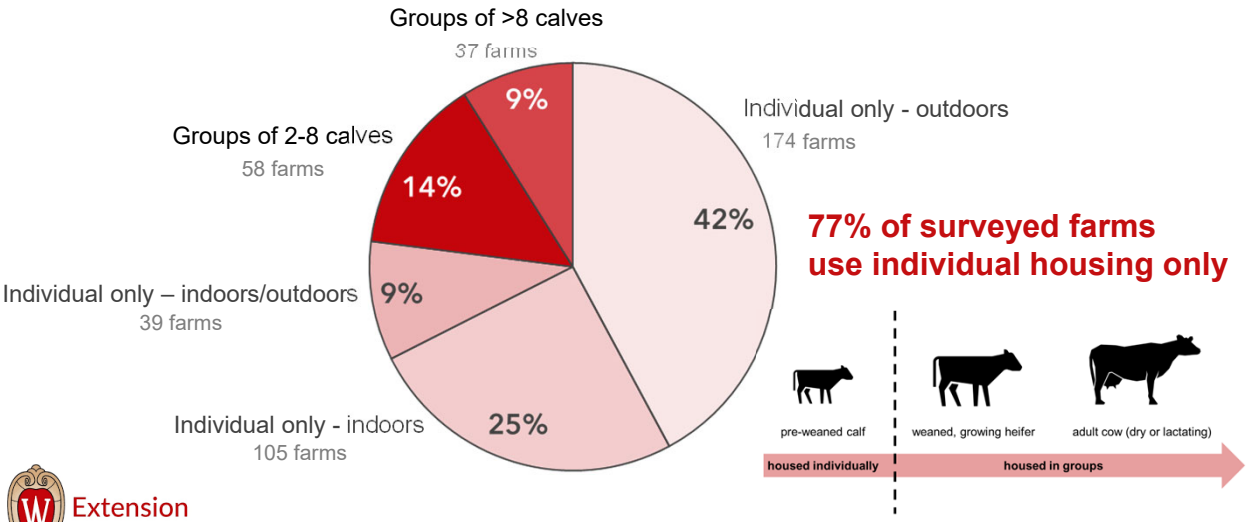
Zwei Köpfe sind besser als einer:

Ein Leitfaden für die paarweise Aufzucht von Tränkekälbern



https://www.milchhessen.de/kaelber-paarweise-aufzucht

Individual housing remains the norm in the U.S.



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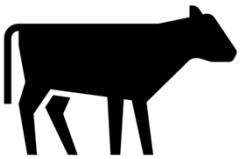
Silva, Van Os et al., in preparation; USDA, 2016 (75% of farms used individual housing)

Why is individual housing the norm?

- Allows for controlling & monitoring individual calves (feeding, health issues)
- Physical separation can reduce disease risks:
  - ⇩ calf-to-calf contact
  - ⇩ shared aerosol
  - ⇩ contamination of shared feeding equipment or bedding
- Ease of handling individual calves

Amanda Gimenez, Van Os lab

Benefits of social rearing



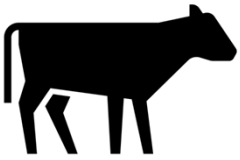
benefits for the calves

Emily Miller-Cushon

✓ Addresses calves' motivation and preference for contact
✓ Positive emotional state reflected in "optimistic" test responses

Holm et al., 2002; Faervik et al., 2006, 2007; Ede et al., 2021; Bučková et al., 2019; Lindner et al., 2022; Icon from the Noun Project

Benefits of social rearing



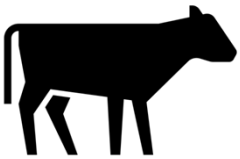
benefits for the calves

✓ Play behavior
✓ Social development

Van Os lab

Broom & Leaver, 1978; Jensen et al., 1997, 1998, 2015; Veissier et al., 1994, 1997; Holm et al., 2002; Icon from the Noun Project

Benefits of social rearing



benefits for the calves

- ✓ Resilience to stress (weaning)
- ✓ Cognitive / behavioral flexibility
- ✓ Adaptability to new things

Jensen et al., 1997; Chua et al., 2002; de Paula Vieira et al., 2010; Duve et al., 2012; Costa et al., 2014; Gaillard et al., 2014; Meagher et al., 2015; Bolt et al., 2017; Whalin et al., 2018; Icon from the Noun Project

Why does learning ability matter?

We expect cows to learn a lot of new things over their lifetimes:

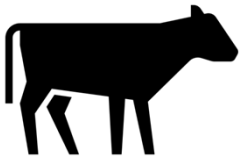
- ✓ New housing elements (e.g., hutch → bedded pack → stalls; different feeding and drinking sources)
- ✓ New diets and feed items
- ✓ New social groups
- ✓ Milking in parlors (both sides!) or AMS

Photo: http://udderside.blogspot.com/2012/05/graduating-to-milking-herd.html

Icons from the Noun Project

Benefits of social rearing

✓ Greater solid feed intake
✓ Greater weight gains, ADG



benefits for the calves

benefits for the farm business

Costa et al., 2016. Invited review in J. Dairy Sci. 99:2453-2467;
Pempek et al., 2016; Wormsbecher et al., 2017; Overvest et al., 2018; Whalin et al., 2018; Knauer et al., 2021; Zhang et al., 2021; Lindner et al., 2022

To date, no study has shown individually housed calves to outperform those housed in pairs or small groups

DMI of starter grain	11	8	0
Avg. daily gain	6	7	0
Weaning bodyweight	8	4	0

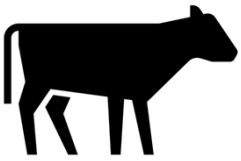
Dr. Joao Costa

Adapted from Costa et al., 2016. Invited review in J. Dairy Sci. 99:2453-2467;
Pempek et al., 2016; Wormsbecher et al., 2017; Overvest et al., 2018; Whalin et al., 2018; Knauer et al., 2021; Zhang et al., 2021; Lindner et al., 2022

Icons from the Noun Project

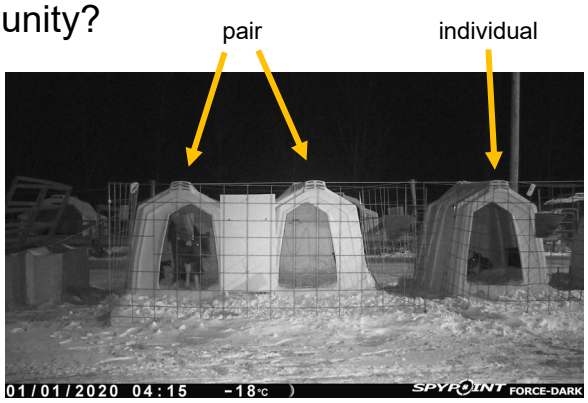
Benefits of social rearing

Protection from cold stress
→ more energy for growth and immunity?



benefits for the calves

benefits for the farm business



Reuscher, Van Os, et al. in preparation; Icons from the Noun Project

Benefits of social rearing

preferred by the public
(consumers, voters)

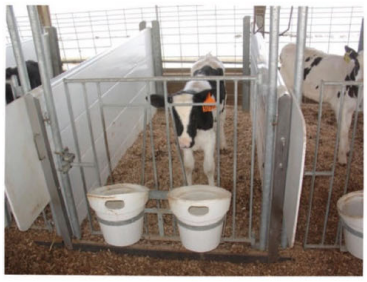
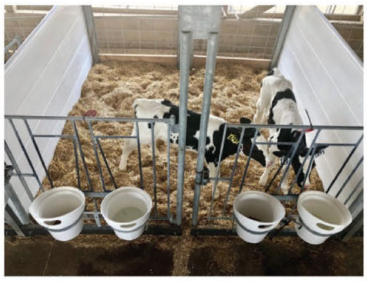
benefits for the farm business

✓ Greater public acceptance

Perttu et al., 2020. J. Dairy Sci. 103:8507-8517; Icons from The Noun Project

Perttu et al., 2020. J. Dairy Sci. 103:8507-8517; Icon from the Noun Project

n = 1,310 adults at the Minnesota State Fair

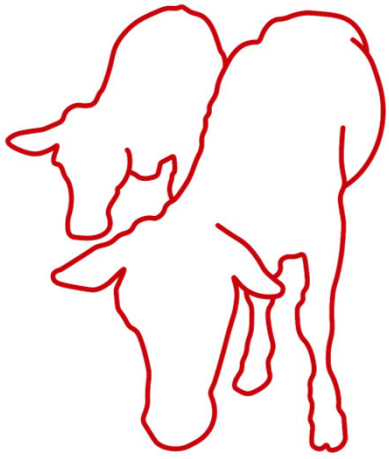




	individual	pair	group
approve	31.5%	**66.0%**	**75.8%**
neutral	21.5%	19.9%	16.8%
disapprove	**47.0%**	14.1%	7.4%

Benefits of pairing calves:

- ✓ Motivated for social contact
- ✓ Play behavior
- ✓ Social development
- ✓ Resilience to stress
- ✓ Cognitive / behavioral flexibility, adaptability to new things
- ✓ Greater solid feed intake
- ✓ Greater weight gains
- ✓ Greater public acceptance
- ✓ (Enhanced protection from cold stress?)

What about potential challenges?



Potential challenges of pair or group raising

1) How to raise healthy calves?

- Many farms successfully raise healthy calves in social groups
- We surveyed producers using pair or group housing:
  72% were satisfied with calf health
- But, some farms may need to adjust management practices
  before transitioning from individual housing

Silva, Van Os, et al. in preparation

Multiple factors contribute to calf morbidity

The same principles for good health apply
whether housing calves individually or in groups:

- ✓ preventive care and monitoring
- ✓ colostrum protocol
- ✓ nutrition
- ✓ hygiene, sanitation, biosecurity
- ✓ ventilation
- ✓ space allowance, bedding
- ✓ all-in / all-out moves

Ollivett, 2020. Vet. Clin. Food Anim. 36:385-398;
Costa et al., 2016. J. Dairy Sci. 99:2453-2467

Potential challenges of pair/group raising

2) How to manage unwanted behaviors
(e.g., cross sucking)

In our survey, at least "occasional" cross sucking reported by:

- 85% of producers using pair or group housing
- 70% of producers using individual housing with fence-line contact

Extension
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Silva, Van Os et al., in preparation

cross sucking on the ear

Feeding strategies to reduce cross sucking

1. Reduce hunger by feeding a generous milk volume
2. Provide enough opportunity to suckle appropriately

Braden® bottle

Slow-flow teat bucket
(Milk Bar®)

Hammel et al., 1998; de Passillé, 2001, 2010; Jung & Lidfors, 2001; Keil & Langhans, 2001; Loberg & Lidfors, 2001; Lidfors & Isberg, 2003; Veissier et al., 2002; Jensen & Budde, 2006; Salter, Reuscher, Van Os (2021)

Take-home messages

- Animal welfare is a key outcome of on-farm practices
- Scientific research provides insights into animals' needs
- Examples of giving cows and calves a voice through science:
  - Cows tell us when and what heat abatement they need
  - Pair or group housing → benefits for calf development, growth, welfare

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