# Effect of partial covered housing and bedding on long-fed Angus cattle

Melissa George, Maddison Fryer, Samuel Platts, Fernando Dias Batista, Chandelle Brown, Brent Berry, Alex Smith, Keith Howe, Matthew George

MEAT & LIVESTOCK AUSTRALIA

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

RANGERS VALLEY

# CATTLE COMFORT
*IN YOUR FEEDLOT*

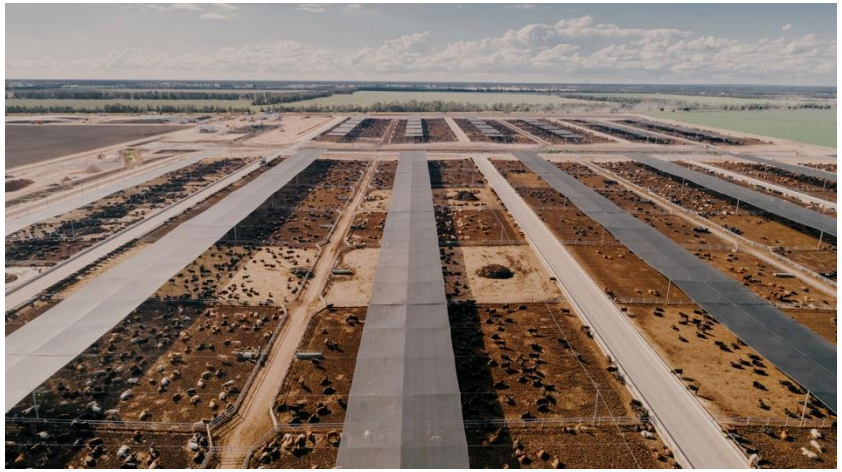

T. FOSSEY
TRUCKS


1464
397

# ALFA's Commitment

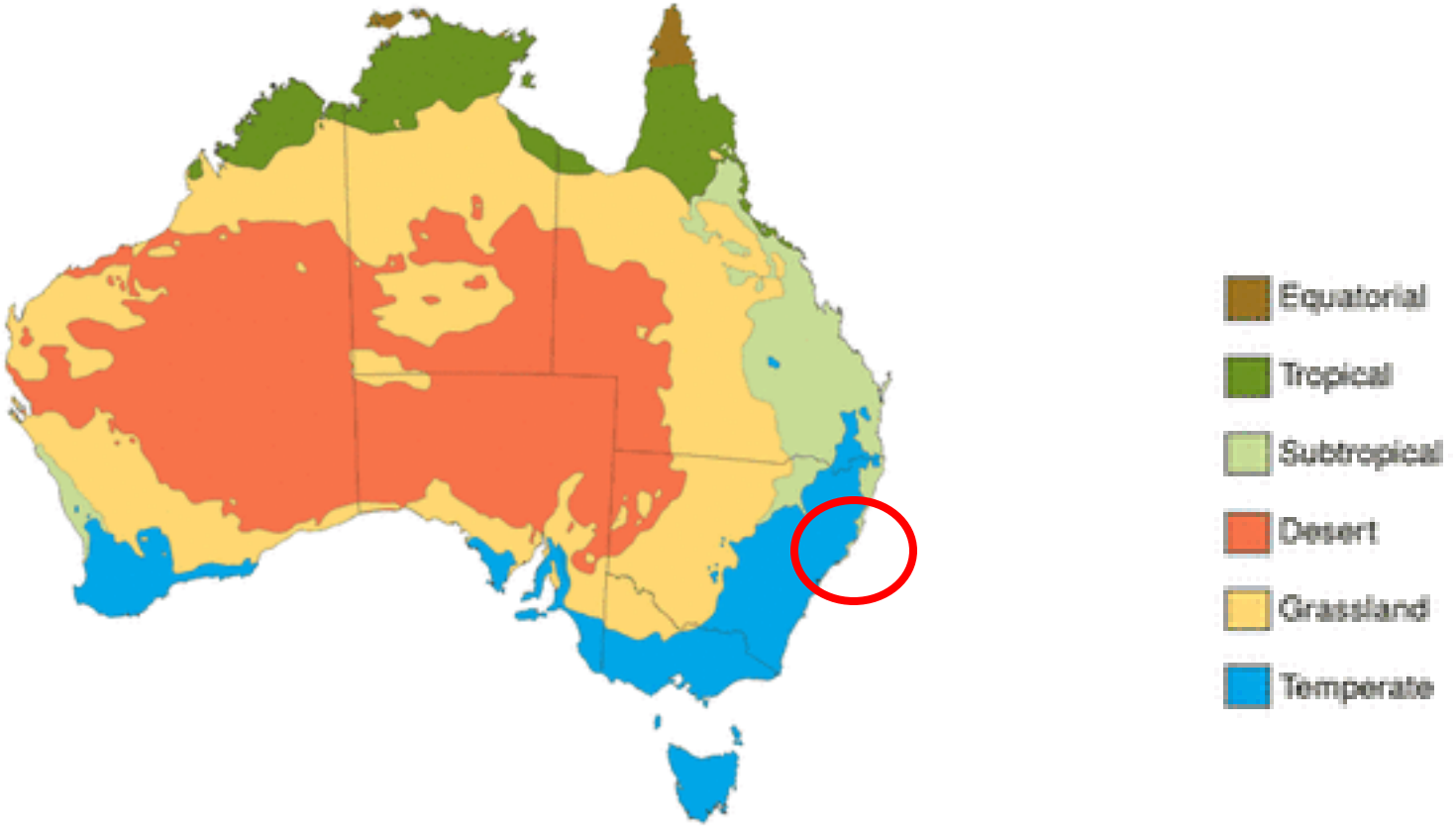
BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

- Animal Welfare
- All cattle in Australian feedlots should have access to shade by 2026
- Shade-seeking is a strong natural behaviour in cattle
- Self-regulation of temperature
- Reduces the risk of heat stress



# Australia's Diverse Climate Regions

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS



# Temperate - Glen Innes Rainfall

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

| Glen Innes Ag Long-term Averages | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann |
| Mean Max (°C) | 25.7 | 25.0 | 23.3 | 20.1 | 16.4 | 13.3 | 12.7 | 14.3 | 17.3 | 20.2 | 22.5 | 24.7 | ***19.6*** |
| Mean Min (°C) | 13.6 | 13.3 | 11.6 | 8.0 | 4.6 | 1.9 | 0.8 | 1.4 | 4.2 | 7.2 | 10.0 | 12.1 | ***7.3*** |
| Mean Rain (mm) | 105.1 | 91.6 | 73.4 | 41.8 | 54.1 | 51.9 | 55.7 | 48.2 | 53.8 | 74.7 | 90.2 | 107.5 | ***841.2*** |
| Median Rain (mm) | 91.0 | 79.0 | 58.1 | 30.3 | 35.6 | 40.3 | 49.8 | 45.6 | 50.2 | 63.9 | 78.0 | 101.1 | ***830.1*** |
| Mean Rain Days | 11.4 | 10.6 | 9.6 | 7.6 | 8.9 | 10.0 | 9.9 | 8.1 | 7.6 | 9.2 | 10.2 | 11.4 | ***113.8*** |

# ALFA's Commitment

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

- Rainfall, environment
- Cloth, Slat, Shed, Solid Structure (Covered Housing)
- Ventilation – height and design (ridge-capping) – Maximize air flow
- Orientation  (North South – shade footprint moves)

# Optimising animal welfare through choice

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

## The Voice of Choice:

### A SCOPING REVIEW OF CHOICE-BASED ANIMAL WELFARE STUDIES

#### METHODS AND COHORT

**Experimental design:**
Choice of ≥2 concurrently offered stimuli or events

**Quantitative-based welfare assessments:**
Behavioural and/or physiological outputs

**13 eligible paper articles:**
13 species identified across 7 Orders

#### FINDINGS

**9** of 13 papers studied enclosure-related choice

**3** captive settings identified: Agriculture, lab, zoo

**86%** of studies (12 papers) reported a positive welfare impact as a result of choice

**12%** (2 papers) reported a neutral or unclear welfare impact

#### CHOICES WITH INTEGRATED WELFARE BENEFITS

- Indoor & outdoor space
- Diverse food composition
- Access to thermal ranges

**Conclusion:** **Providing opportunity for concurrent choice options may improve behavioural and physiological welfare for a range of captive animal species across a variety of settings.**

However, **several papers reporting neutral or unclear quantitative outputs highlights the need for continued research to better understand choice's impact on weflare.**

APPLIED ANIMAL BEHAVIOUR SCIENCE

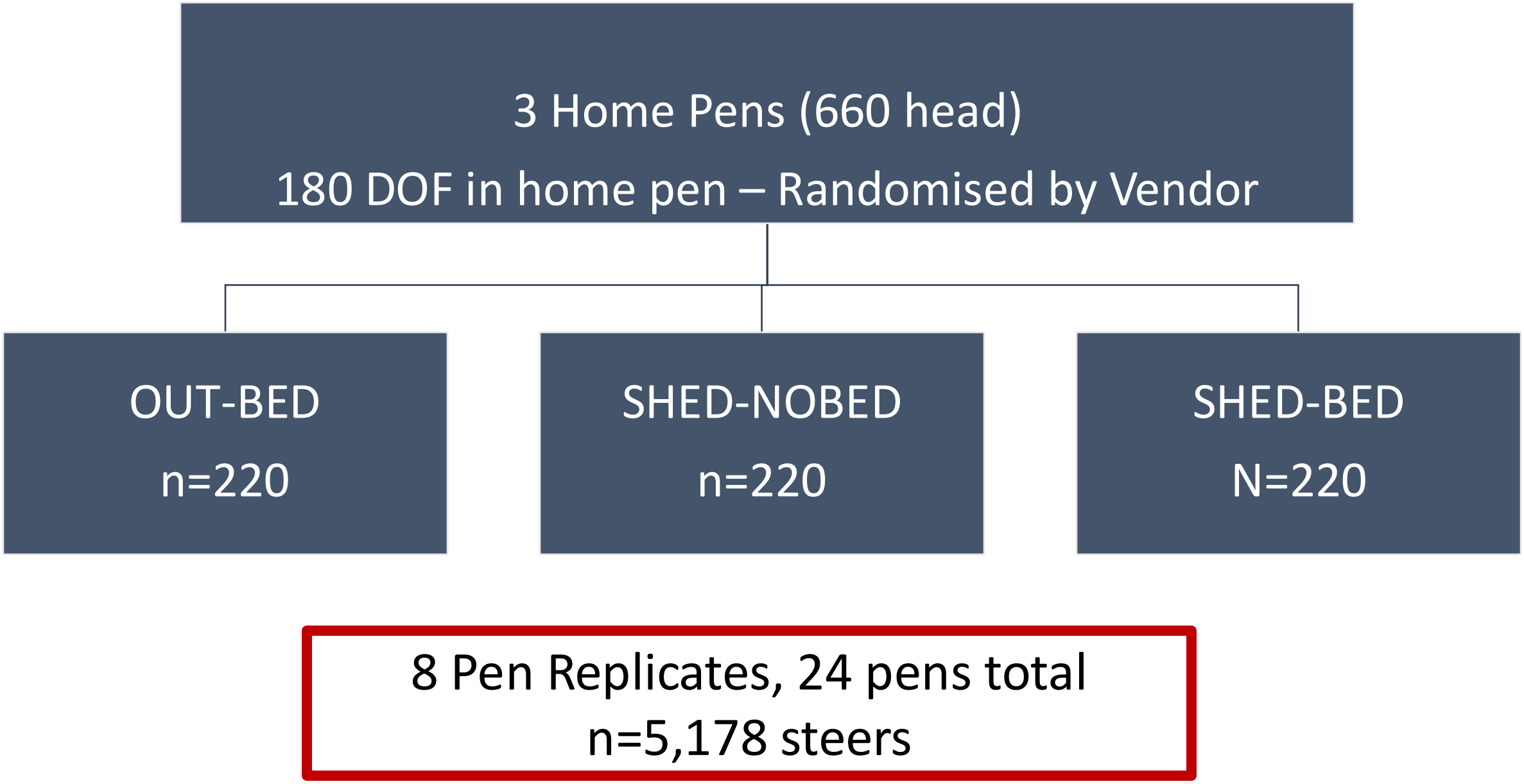
Rust, Clegg, and Fernandez (2024)

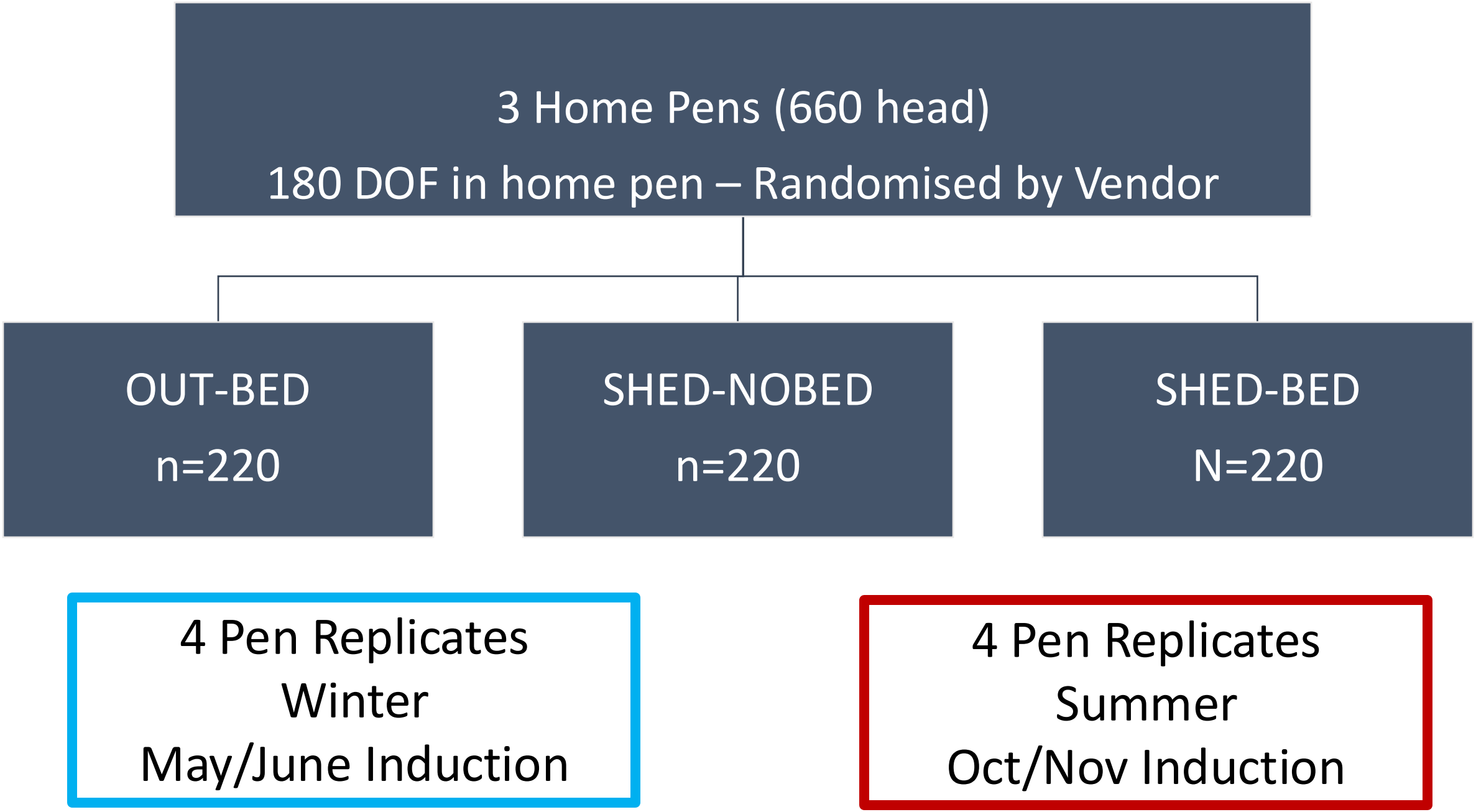
(Rust et al., 2024)

# Materials and Methods

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

- Animal Ethics: NSW DPI
  - Animal Research Establishment 80454
  - Animal Research Authority: RVF23/344
- Randomised block
- Large commercial feedlot, Location: Northern New South Wales
- Steam-flaked wheat and barley ration
- Experimental unit = pen, n= 24 pens, 8 replicates, 220 head per pen
- Pure Black Angus steers, n=5,178, HGP Free
- Days in trial= 110 days
- Statistical analysis: SAS, Proc Mixed, Proc Glimmex

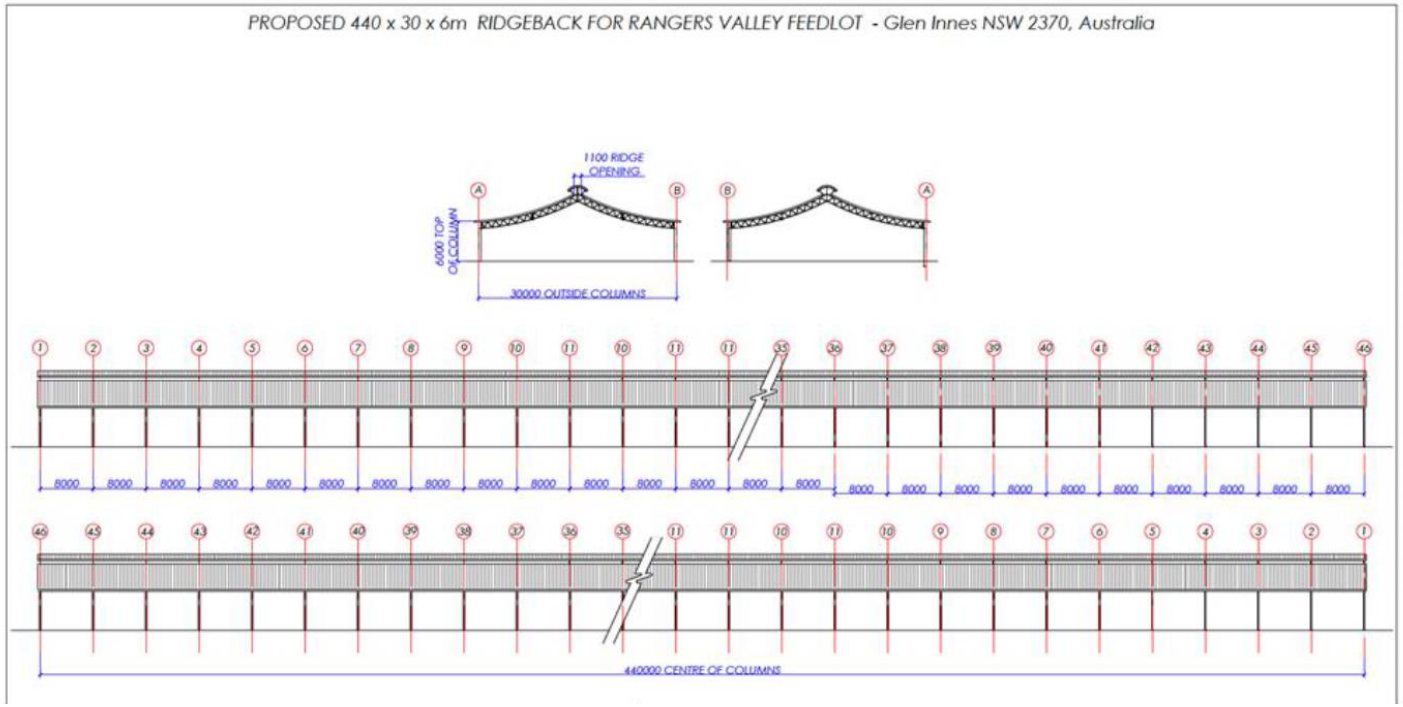

3 Home Pens (660 head)
180 DOF in home pen – Randomised by Vendor
OUT-BED
n=220
SHED-NOBED
n=220
SHED-BED
N=220
8 Pen Replicates, 24 pens total
n=5,178 steers


3 Home Pens (660 head)
180 DOF in home pen – Randomised by Vendor
OUT-BED
n=220
SHED-NOBED
n=220
SHED-BED
N=220
4 Pen Replicates
Winter
May/June Induction
4 Pen Replicates
Summer
Oct/Nov Induction

# Covered Housing

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

# Covered Housing




1) Unshaded pens E11-E18.
   Pen dimensions: 55 x 60 m
   Head in pen: 220 animals
   Outdoor Pen – Industry Standard
   Bedding: Hardwood Wood Chipped at a depth of 150 mm
   Stocking density of 15 m2 per head
   Water trough: 2900 m x 790 mm
   Bunk Space: 55m – 25 cm per head

2) Partial shelter pens E2-E9.
   Pen dimensions: 55 x 60 m
   Head in pen: 220 animals
   Covered Pen- 7.5 $m^2$ per head covered housing
   Bedding: Hard Packed Soil – No Wood Chip
   Stocking density of 15 m2 per head
   Water trough: 2900 m x 790 mm
   Bunk Space: 55 m – 25 cm per head

3) Partial shelter pens E2-E9
   Pen dimensions: 55 x 60 m
   Head in pen: 220 animals
   Covered Pen- 7.5 $m^2$ per head covered housing
   Bedding: Hardwood Wood Chipped at a depth of 150 mm
   Stocking density of 15 m2 per head
   Water trough: 2900 m x 790 mm
   Bunk Space: 55 m – 25 cm per head

# OUT-BED

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

Unshaded pens E11-E18.

Pen dimensions: 55 x 60 m

Head in pen: 220 animals

Outdoor Pen – Industry Standard

Bedding: Hardwood Wood Chipped at a depth of 150 mm

Stocking density of 15 m2 per head

Water trough: 2900 m x 790 mm

Bunk Space: 55m – 25 cm per head

# SHED-NOBED

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

Partial shelter pens E2-E9.

Pen dimensions: 55 x 60 m

Head in pen: 220 animals

Covered Pen- 7.5 $m^2$ per head covered housing

Bedding: Hard Packed Soil – No Wood Chip

Stocking density of 15 m2 per head

Water trough: 2900 m x 790 mm

Bunk Space: 55 m – 25 cm per head

# SHED-BED

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

Partial shelter pens E2-E9

Pen dimensions: 55 x 60 m

Head in pen: 220 animals

Covered Pen- 7.5 $m^2$ per head covered housing

Bedding: Hardwood Wood Chipped at a depth of 150 mm

Stocking density of 15 m2 per head

Water trough: 2900 m x 790 mm

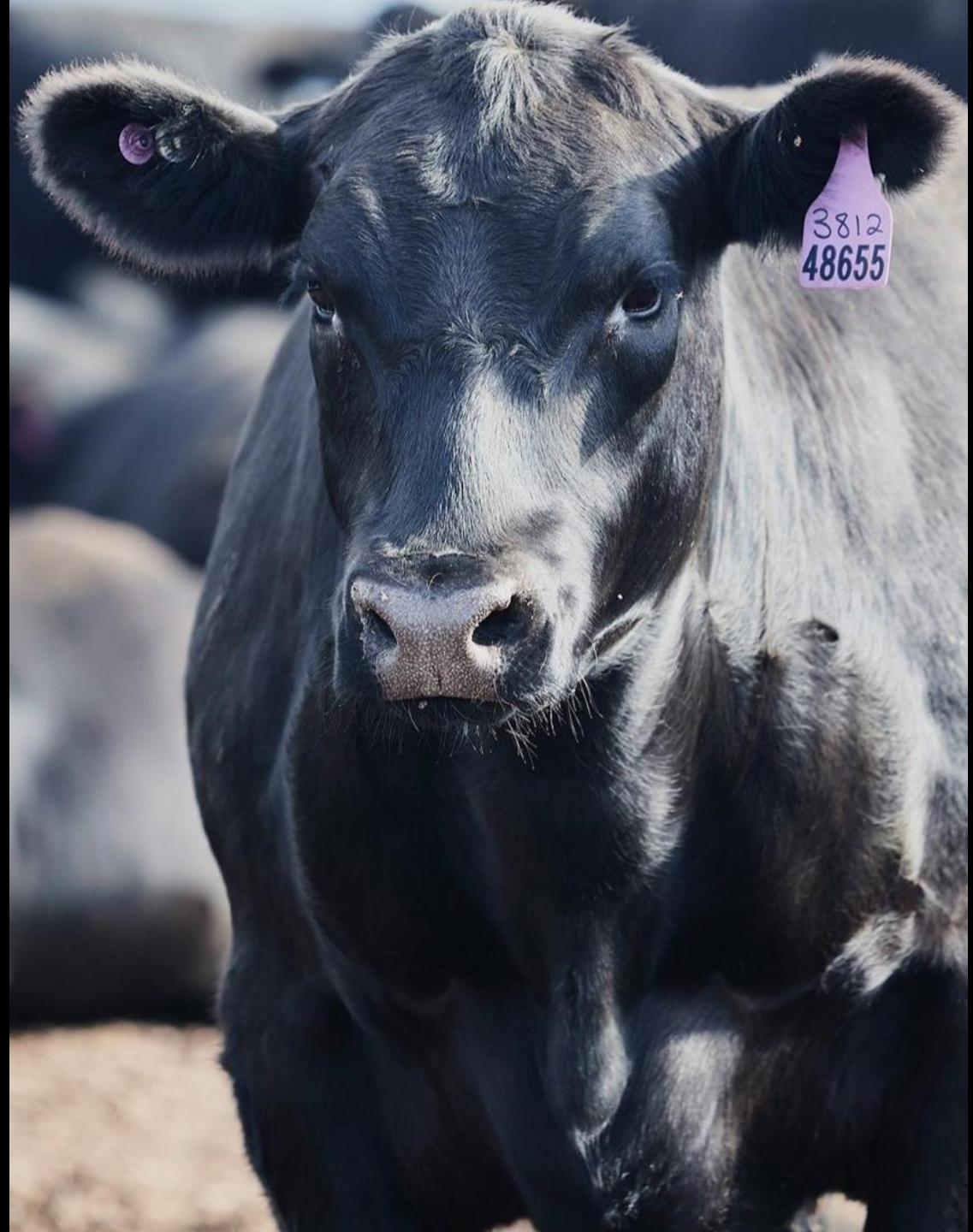
Bunk Space: 55 m – 25 cm per head

# Results

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

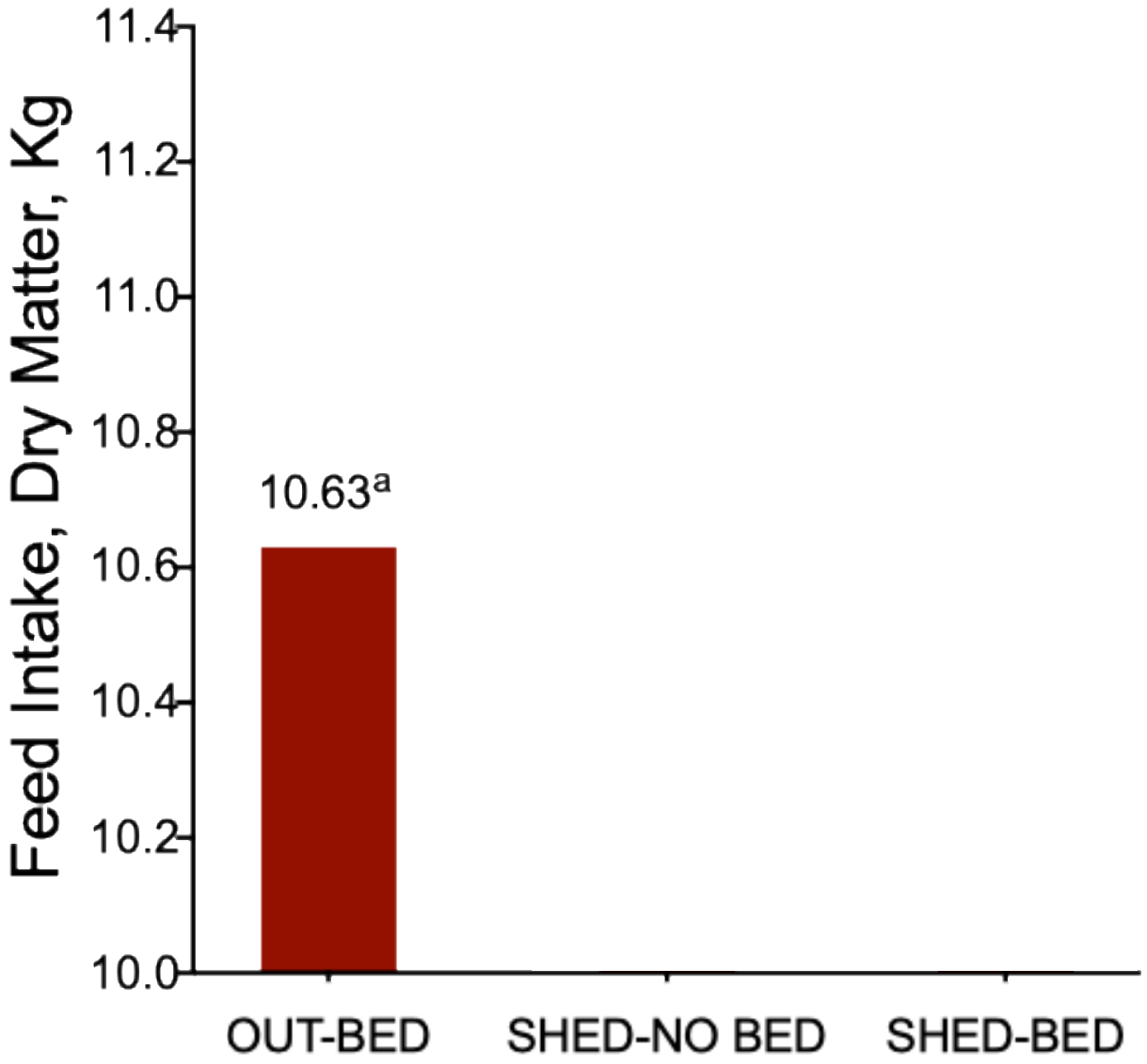
- Emphasis on performance, health, and carcase results
- Dag score
- Objective and subjective mud depth
- Water intake
- Manure Analysis
- Cost-benefit analysis

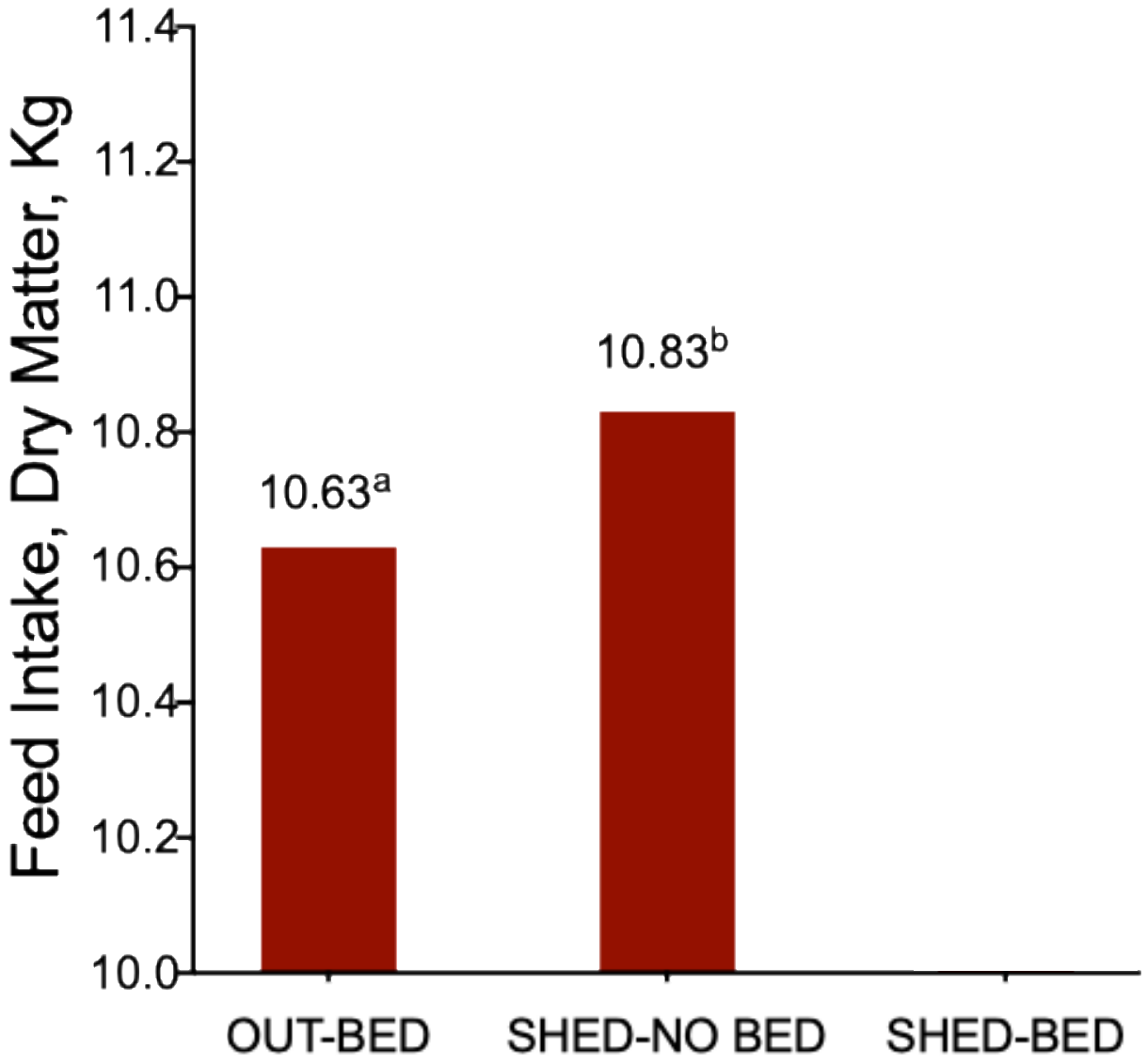
| Variable | Mean | Stdev | Minimum | Maximum |
|---|---|---|---|---|
| Trial Entry Weight, kg | 748.1 | 12.2 | 724.0 | 772.3 |
| Trial days on feed | 110.6 | 1.5 | 108.3 | 112.9 |
| Feed intake, As-Fed, kg | 14.8 | 0.5 | 14.0 | 16.4 |
| Feed intake, DM, kg | 10.8 | 0.4 | 10.2 | 12.0 |
| Average daily gain, kg/hd | 0.99 | 0.11 | 0.72 | 1.19 |
| Cattle weight at feedlot exit per hd, kg/hd | 857.4 | 14.6 | 828.2 | 888.8 |
| Hot carcase weight, kg | 486.0 | 11.1 | 468.4 | 512.3 |
| Dressing percent, % | 56.68 | 0.88 | 55.56 | 58.32 |
| Dentition at processing | 2.4 | 0.3 | 2.1 | 3.0 |
| Ossification | 149.2 | 4.8 | 142.9 | 159.3 |
| AusMeat meat colour‡ | 2.0 | 0.1 | 1.8 | 2.2 |
| MSA marbling | 594.6 | 18.1 | 568.0 | 623.8 |
| Ausmeat marbling | 3.5 | 0.2 | 3.2 | 3.8 |
| Eye muscle area, $cm^2$ | 89.3 | 2.0 | 84.6 | 94.1 |
| Rib Fat | 9.1 | 1.7 | 7.0 | 13.8 |
| P8 Fat | 25.0 | 1.2 | 22.9 | 27.7 |
| Fat colour | 0.5 | 0.5 | 0.0 | 1.4 |
| Ultimate pH | 5.48 | 0.09 | 5.23 | 5.55 |
| MSA Index | 65.66 | 0.54 | 64.69 | 66.44 |

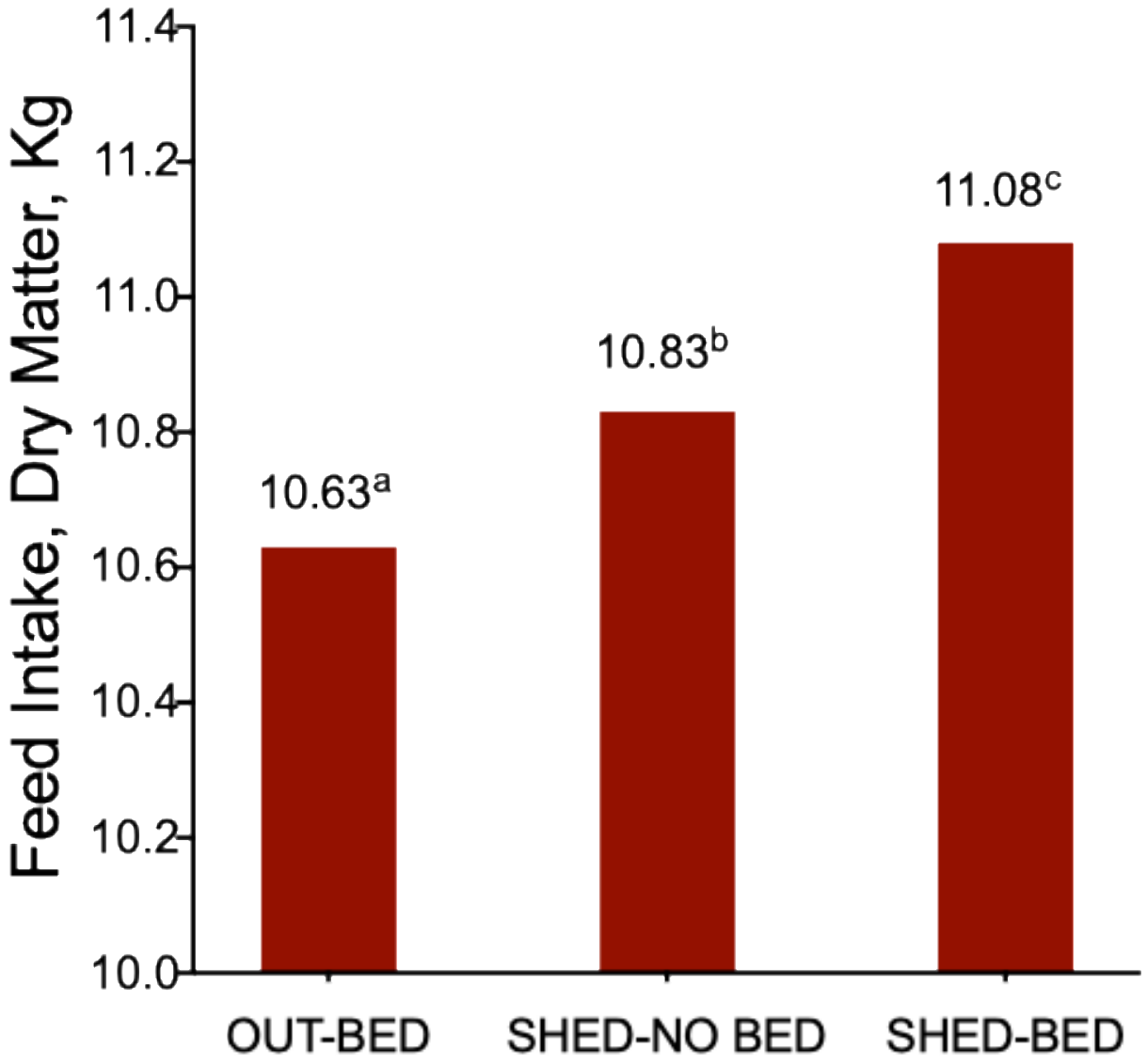

3812
48655

# Results

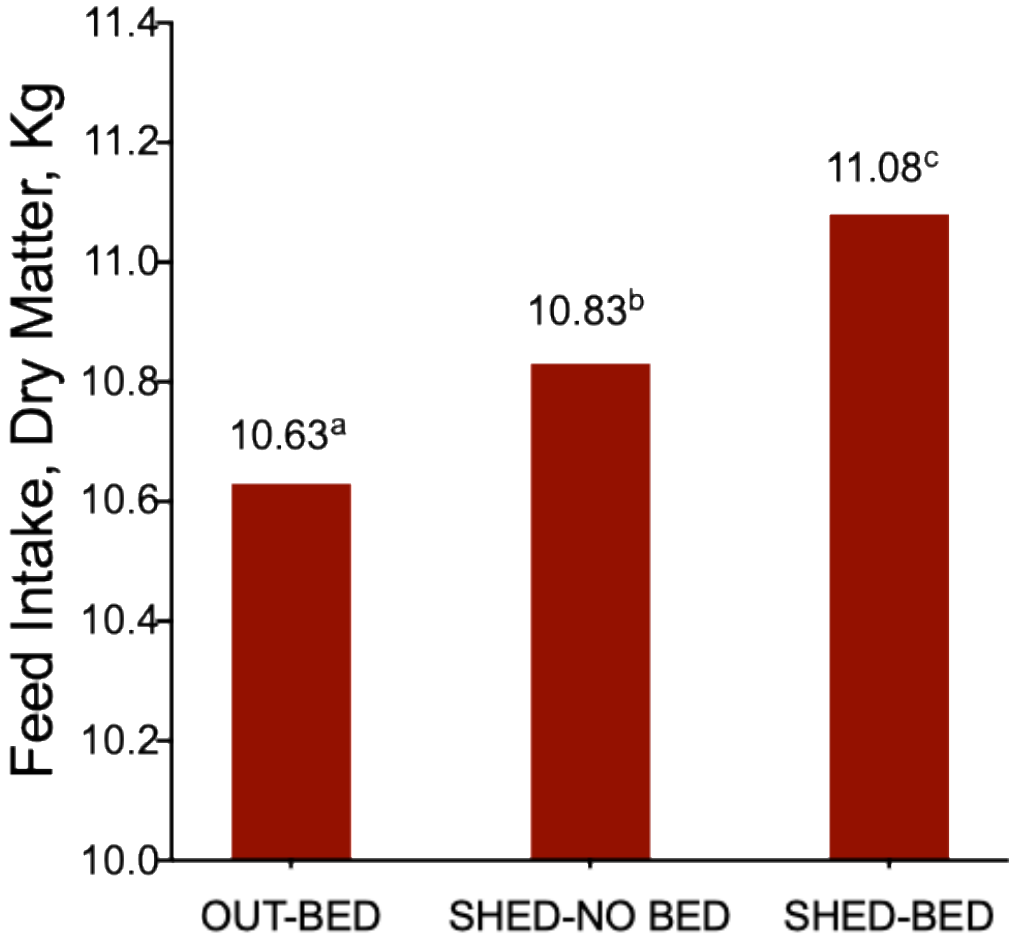
| Variable | Treatment | | | SE | P-value | | |
|---|---|---|---|---|---|---|---|
| | OUT-BED | SHED-NOBED | SHED-BED | | Treat | Season | Treat*Season |
| Individuals, n | 1694 | 1660 | 1699 | | | | |
| Trial Entry Weight, kg | 747.2 | 749.8 | 747.5 | 4.820 | 0.29 | 0.79 | 0.79 |
| Trial days on feed | 110.6 | 110.6 | 110.6 | 0.34 | 0.34 | <0.01 | 0.64 |
| Feed intake, As-Fed, kg | 14.53$^{a}$ | 14.80$^{b}$ | 15.15$^{c}$ | 0.140 | <0.01 | 0.13 | <0.01 |
| Feed intake, DM, kg | 10.63$^{a}$ | 10.83$^{b}$ | 11.08$^{c}$ | 0.103 | <0.01 | 0.13 | <0.01 |
| Average daily gain, kg/hd | 0.97$^{a}$ | 0.94$^{a}$ | 1.06$^{b}$ | 0.032 | <0.01 | 0.61 | 0.02 |
| Weight at feedlot exit | 853.8$^{a}$ | 853.5$^{a}$ | 864.9$^{b}$ | 5.165 | 0.01 | 0.87 | <0.05 |
| Gain:Feed, DM | 0.091$^{ab}$ | 0.087$^{b}$ | 0.096$^{a}$ | 0.002 | <0.01 | 0.19 | 0.08 |


Feed Intake, Dry Matter, Kg
11.4
11.2
11.0
10.8
10.6
10.4
10.2
10.0
10.63a
OUT-BED
SHED-NO BED
SHED-BED


Feed Intake, Dry Matter, Kg
11.4
11.2
11.0
10.8
10.6
10.4
10.2
10.0
10.63a
10.83b
OUT-BED
SHED-NO BED
SHED-BED


Feed Intake, Dry Matter, Kg
11.4
11.2
11.0
10.8
10.6
10.4
10.2
10.0
10.63a
10.83b
11.08c
OUT-BED
SHED-NO BED
SHED-BED

# Cattle under partial covered housing with bedding had increased dry matter intake



# Results

| Variable | Treatment | | | SE | P-value | | |
|---|---|---|---|---|---|---|---|
| | OUT-BED | SHED-NOBED | SHED-BED | | Treat | Season | Treat*Season |
| Individuals, n | 1694 | 1660 | 1699 | | | | |
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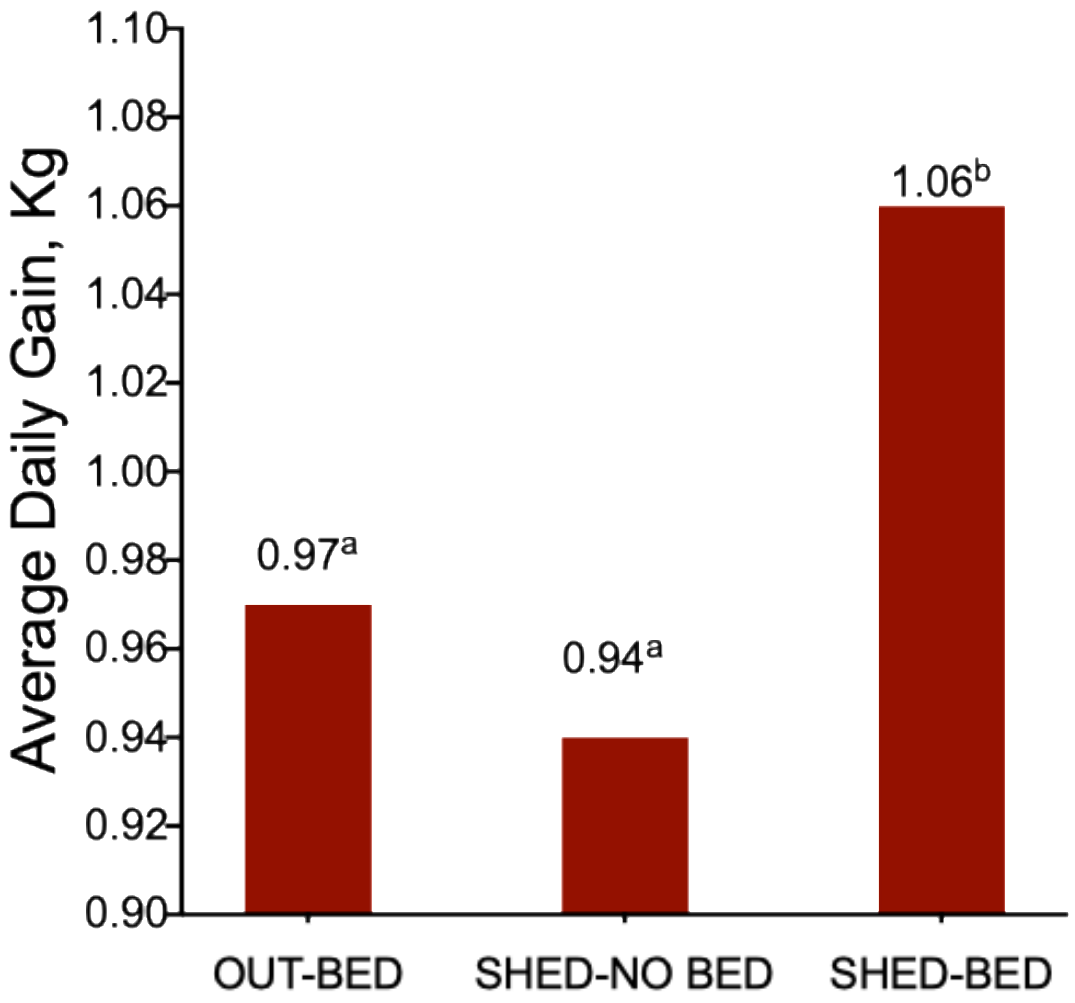
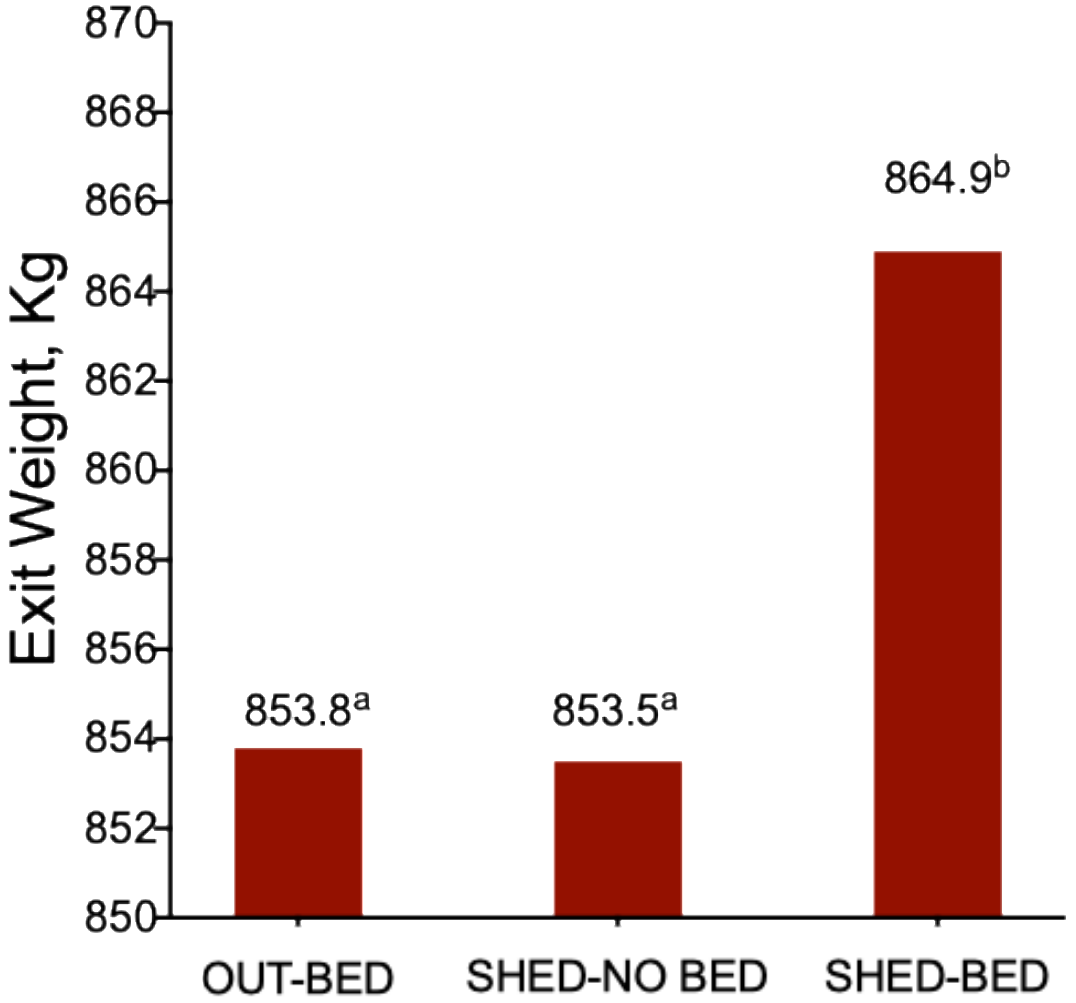
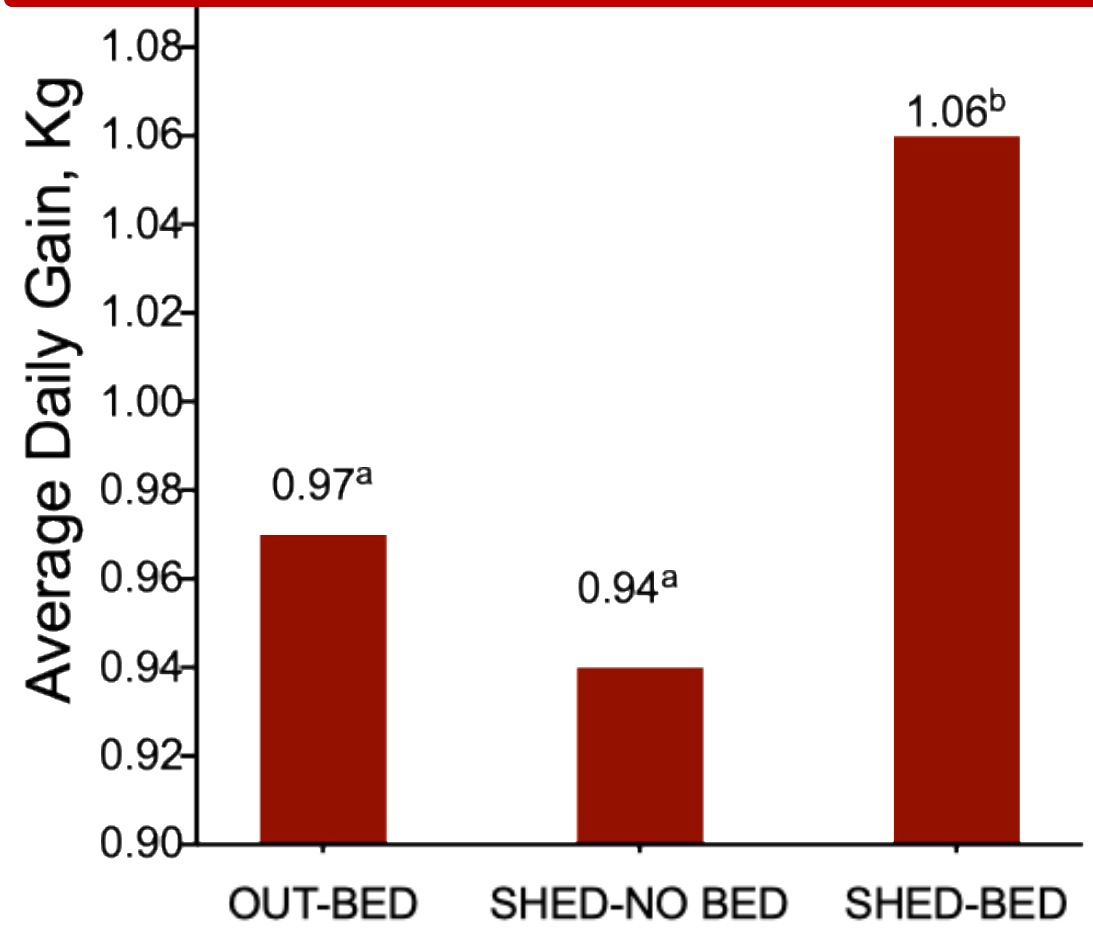
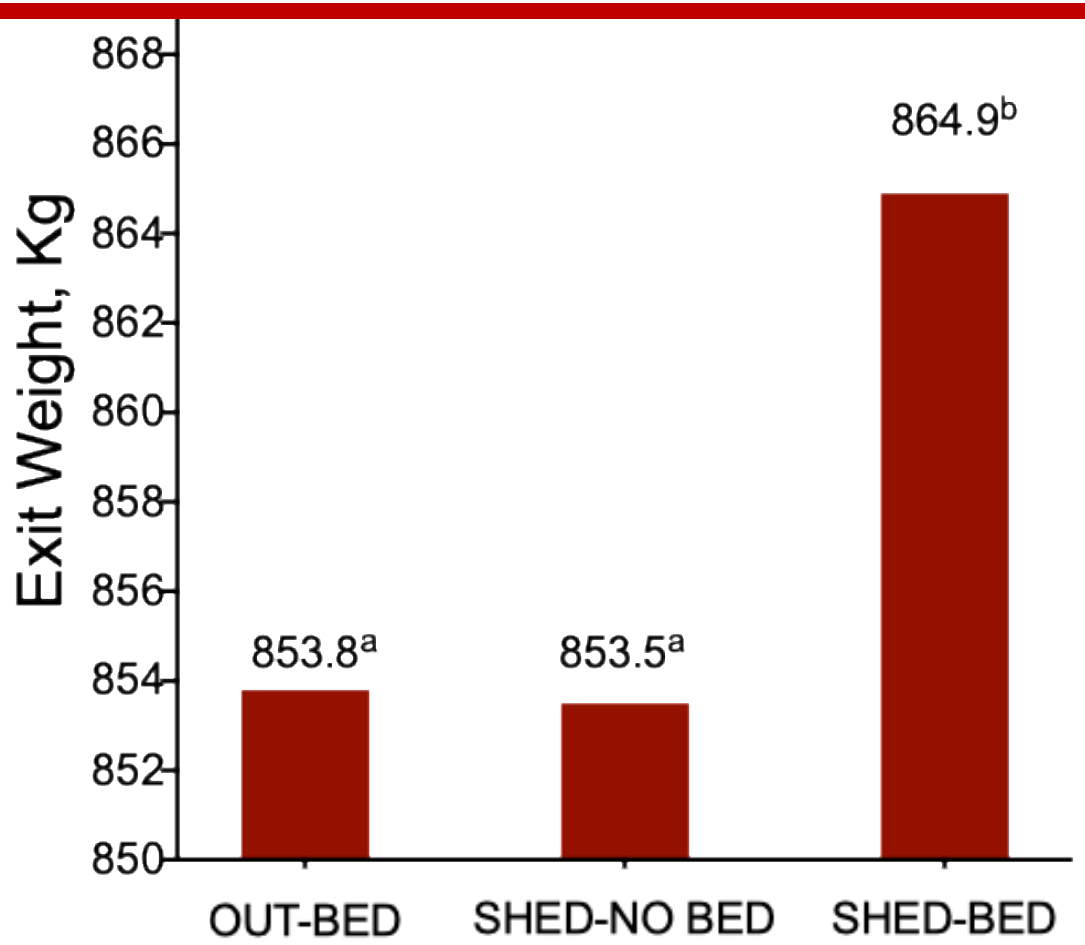

Average Daily Gain, Kg
1.10
1.08
1.06
1.04
1.02
1.00
0.98
0.96
0.94
0.92
0.90
0.97a
0.94a
1.06b
OUT-BED
SHED-NO BED
SHED-BED

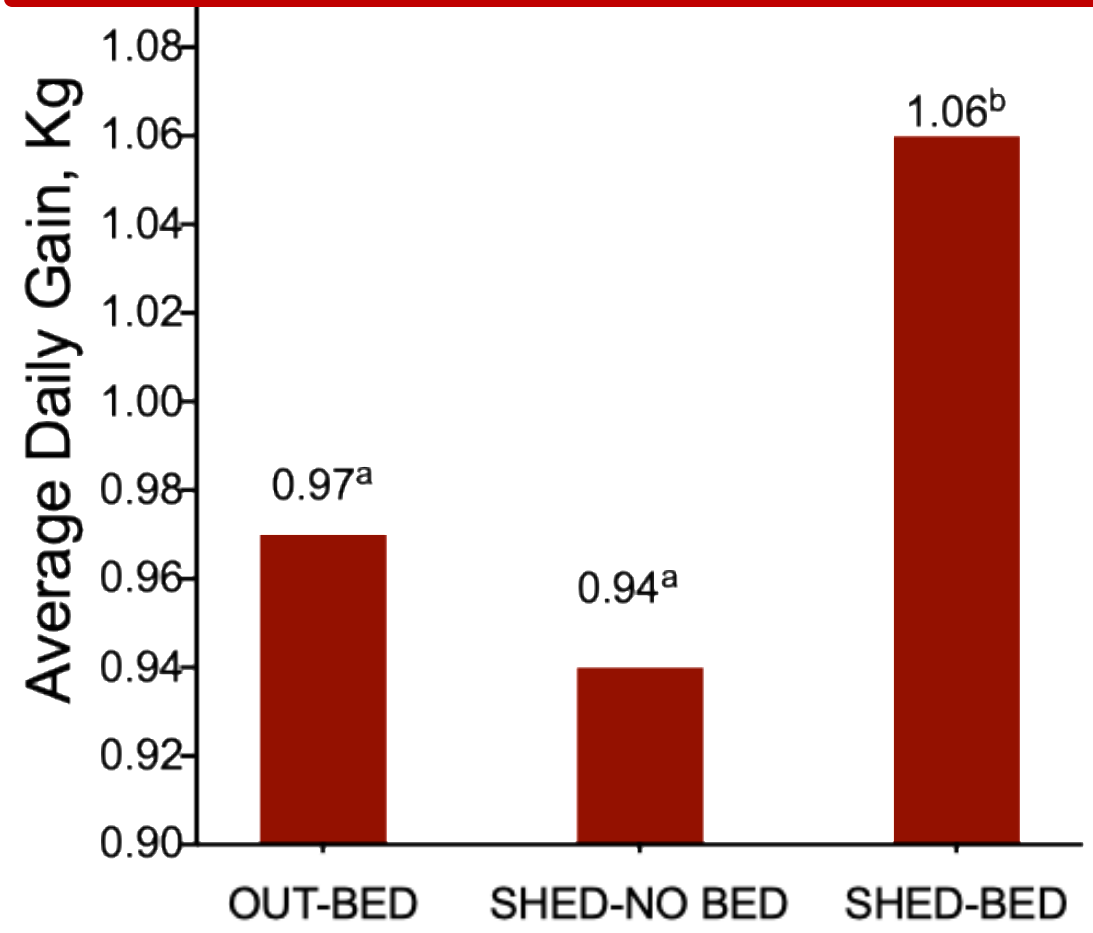

Exit Weight, Kg
870
868
866
864
862
860
858
856
854
852
850
853.8a
853.5a
864.9b
OUT-BED
SHED-NO BED
SHED-BED

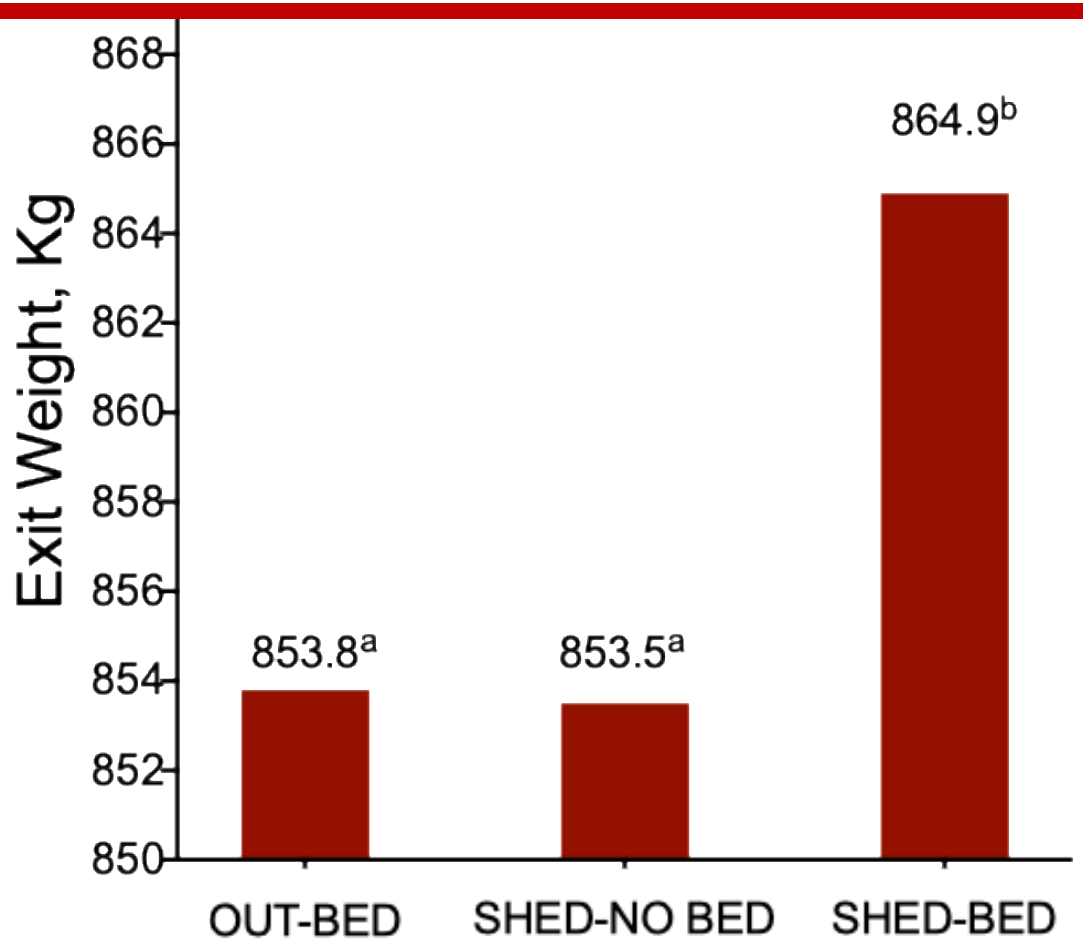
# Cattle under partial covered housing with bedding had increased average daily gain and exit weight



Even though cattle with partial covered housing and no bedding had higher feed intake, they were similar to outdoor cattle in gain

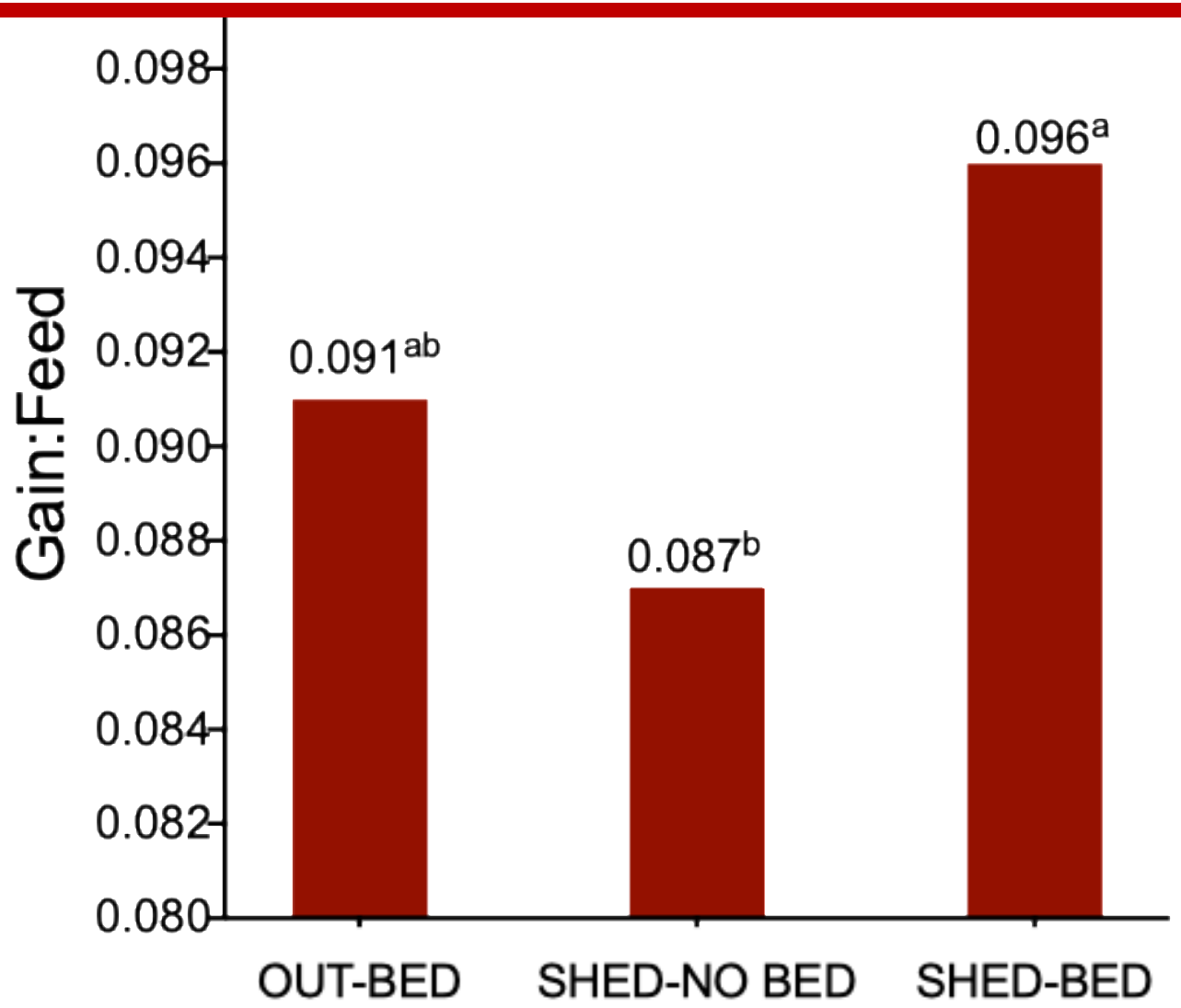


# Results

| Variable | Treatment | | | SE | P-value | | |
|---|---|---|---|---|---|---|---|
| | OUT-BED | SHED-NOBED | SHED-BED | | Treat | Season | Treat*Season |
| Individuals, n | 1694 | 1660 | 1699 | | | | |
| Trial Entry Weight, kg | 747.2 | 749.8 | 747.5 | 4.820 | 0.29 | 0.79 | 0.79 |
| Trial days on feed | 110.6 | 110.6 | 110.6 | 0.34 | 0.34 | <0.01 | 0.64 |
| Feed intake, As-Fed, kg | 14.53$^{a}$ | 14.80$^{b}$ | 15.15$^{c}$ | 0.140 | <0.01 | 0.13 | <0.01 |
| Feed intake, DM, kg | 10.63$^{a}$ | 10.83$^{b}$ | 11.08$^{c}$ | 0.103 | <0.01 | 0.13 | <0.01 |
| Average daily gain, kg/hd | 0.97$^{a}$ | 0.94$^{a}$ | 1.06$^{b}$ | 0.032 | <0.01 | 0.61 | 0.02 |
| Weight at feedlot exit | 853.8$^{a}$ | 853.5$^{a}$ | 864.9$^{b}$ | 5.165 | 0.01 | 0.87 | <0.05 |
| Gain:Feed, DM | 0.091$^{ab}$ | 0.087$^{b}$ | 0.096$^{a}$ | 0.002 | <0.01 | 0.19 | 0.08 |

# Cattle under the shed with no bedding were the least efficient




T12
T12
T12

| Variable | Treatment | | | | P-value | | |
|---|---|---|---|---|---|---|---|
| | OUT-BED | SHED-NOBED | SHED-BED | SE | Treat | Season | Treat*Season |
| Individuals, n | 1694 | 1660 | 1699 | | | | |
| Trial Entry Weight, kg | 747.2 | 749.8 | 747.5 | 4.820 | 0.29 | 0.79 | 0.79 |
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| Average daily gain, kg/hd | 0.97[a] | 0.94[a] | 1.06[b] | 0.032 | <0.01 | 0.61 | 0.02 |
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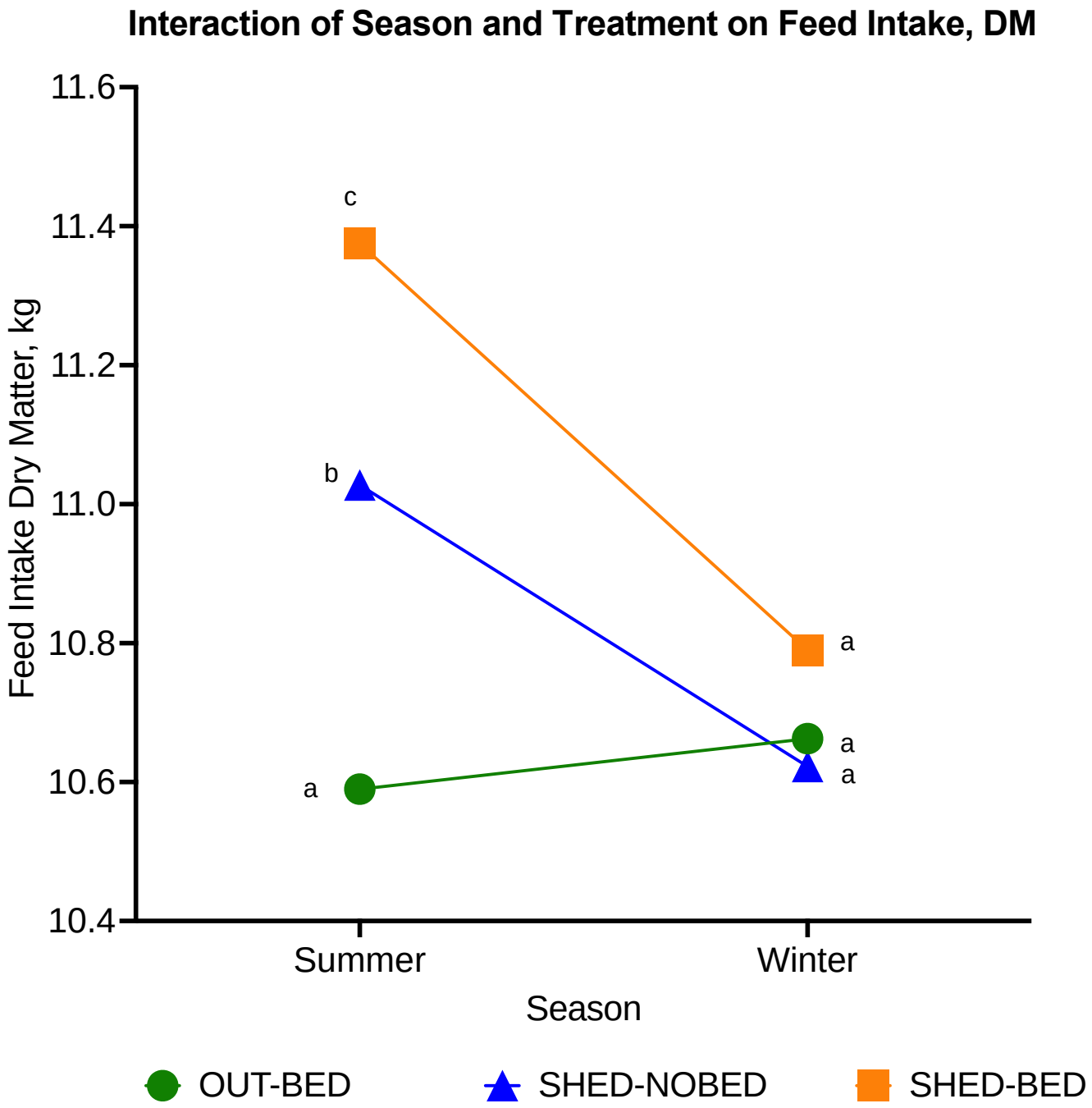
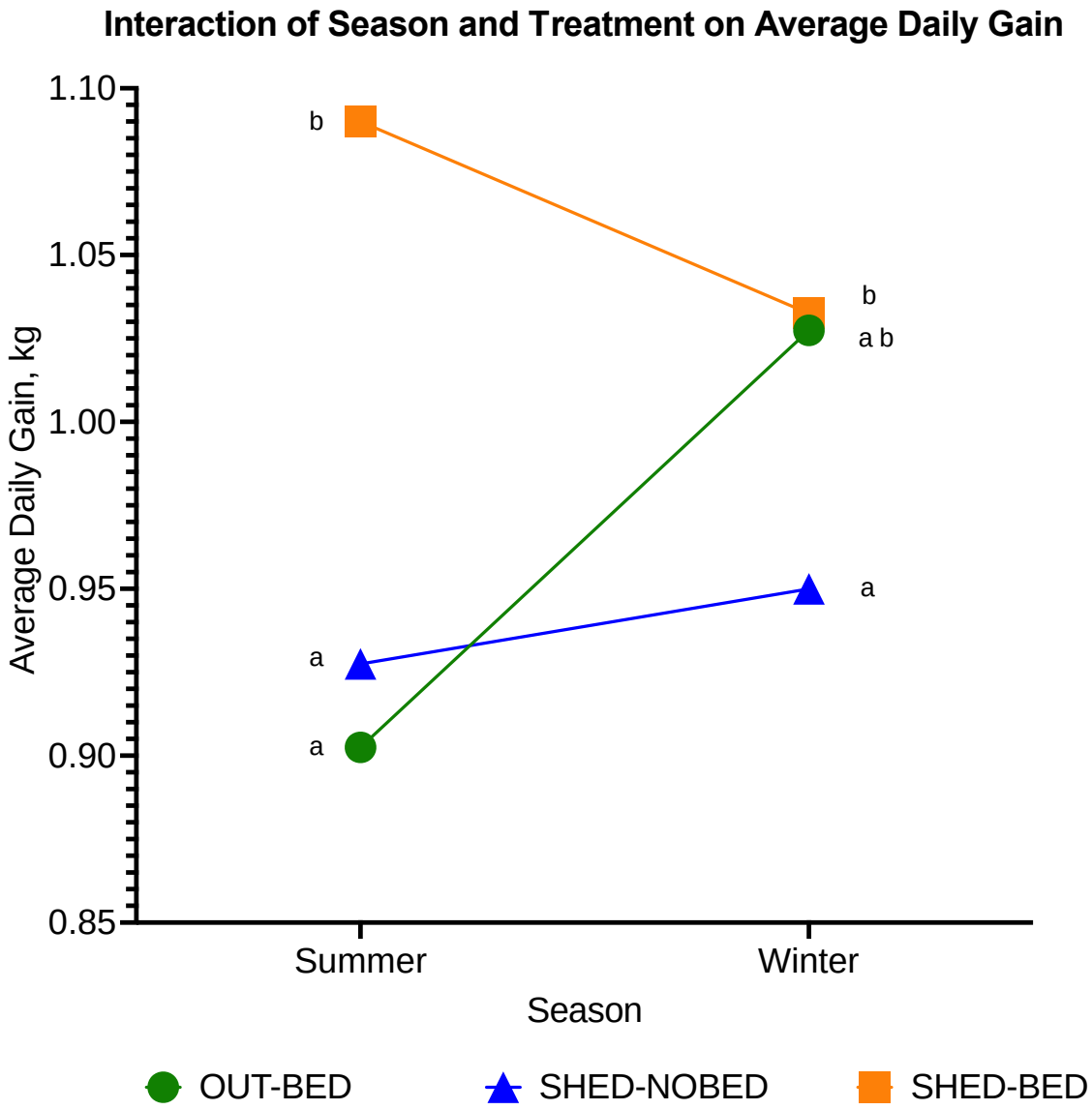
| Gain:Feed, DM | 0.091[ab] | 0.087[b] | 0.096[a] | 0.002 | <0.01 | 0.19 | 0.08 |

Cattle under partial covered housing with bedding had increased feed intake, average daily gain, exit weight, and Gain:Feed

The effect of treatment is not consistent across the two seasons.

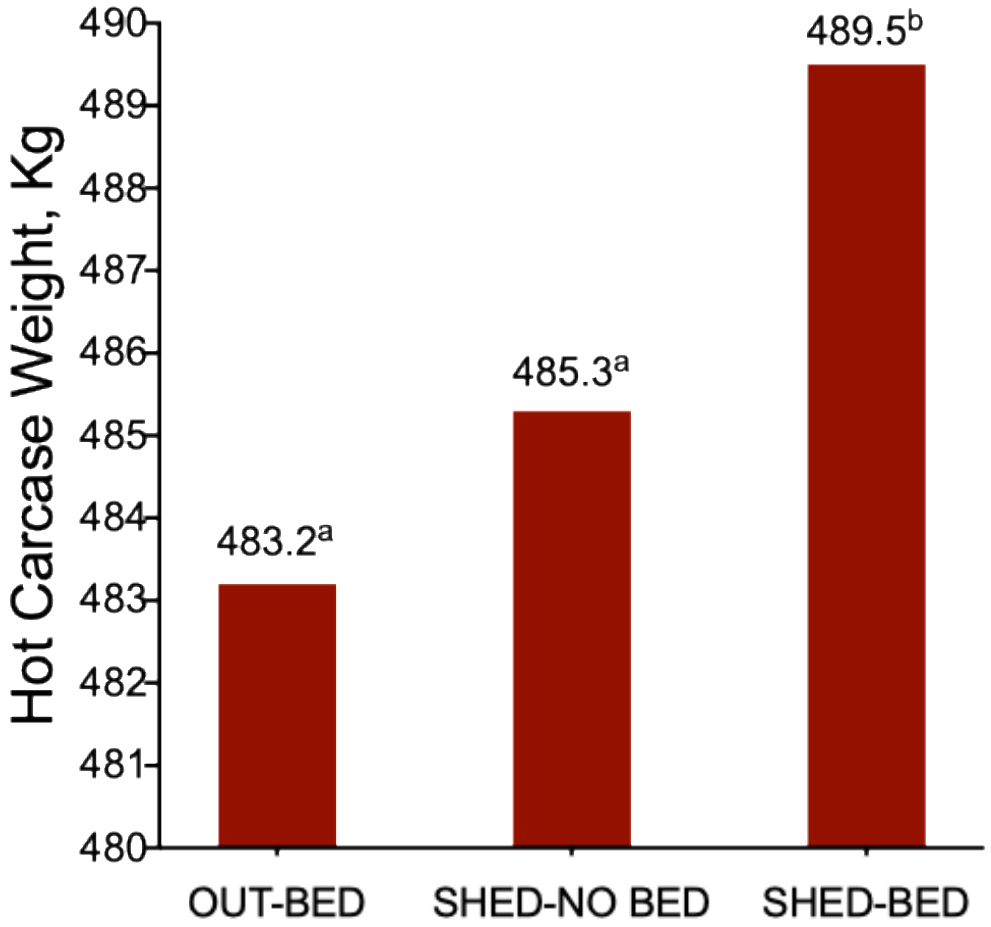

Interaction of Season and Treatment on Feed Intake, DM
11.6
11.4
11.2
11.0
10.8
10.6
10.4
Feed Intake Dry Matter, kg
c
b
a
a
a
a
Summer
Winter
Season
OUT-BED
SHED-NOBED
SHED-BED




The effect of treatment is not consistent across the two seasons. Significant response in summer. Wet, mild summer.

| | Treatment | | | | P-value | | |
|---|---|---|---|---|---|---|---|
| Variable | OUT-BED | SHED-NOBED | SHED-BED | SE | Treat | Season | Treat*Season |
| Hot carcase weight, kg | 483.2[a] | 485.3[a] | 489.5[b] | 3.026 | 0.02 | 0.03 | 0.06 |
| Dressing percent, % | 56.60 | 56.85 | 56.60 | 0.126 | 0.22 | <0.01 | 0.28 |
| Dentition at processing | 2.4 | 2.4 | 2.4 | 0.063 | 0.43 | <0.01 | 0.68 |
| Ossification | 149.1 | 149.3 | 149.2 | 1.357 | 0.94 | 0.03 | <0.01 |
| AusMeat meat colour‡ | 2.08[ac] | 2.01[b] | 2.04[bc] | 0.018 | 0.03 | 0.02 | 0.37 |
| MSA marbling | 595.8 | 592.9 | 595.0 | 3.710 | 0.80 | <0.01 | 0.27 |
| AusMeat marbling | 3.5 | 3.4 | 3.5 | 0.040 | 0.43 | <0.01 | 0.49 |
| Eye muscle area, $cm^2$ | 89.4 | 89.0 | 89.6 | 0.720 | 0.73 | 0.18 | 0.79 |
| Rib Fat, mm | 9.4 | 8.7 | 9.3 | 0.471 | 0.17 | 0.02 | 0.20 |
| P8 Fat, mm | 24.7 | 24.9 | 25.3 | 0.403 | 0.30 | 0.17 | 0.41 |
| Fat colour | 0.5 | 0.6 | 0.6 | 0.067 | 0.14 | <0.01 | 0.38 |
| Chiller assessment pH | 5.48 | 5.47 | 5.49 | 0.028 | 0.62 | 0.11 | 0.53 |
| MSA Index | 65.67 | 65.60 | 65.72 | 0.071 | 0.15 | <0.01 | 0.66 |

# Cattle under partial covered housing with bedding had increased hot carcase weight (6.3 kg versus OUT-BED, 4.2 kg versus SHED-NOBED)



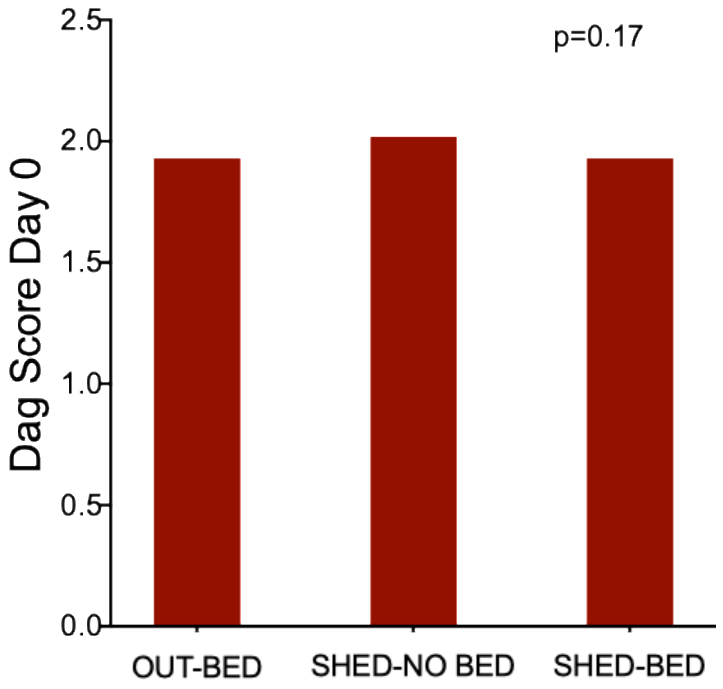
# Dag Scoring

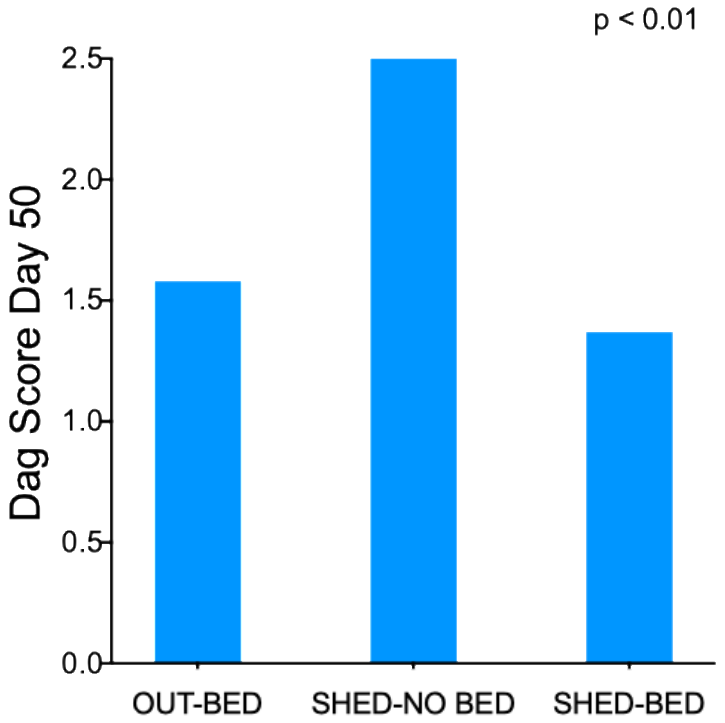
BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

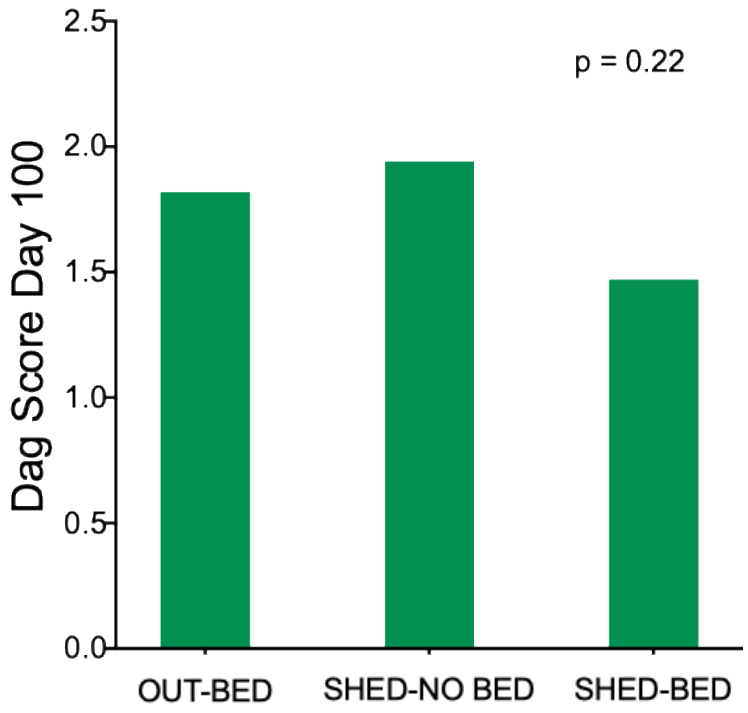
| Score | Description |
|---|---|
| 1 | No dag, clean hide |
| 2 | Small lumps of manure attached to the hide in limited areas of the legs and underbelly |
| 3 | Small and large lumps of manure attached to the hide, covering larger areas of the legs, side and underbelly |
| 4 | Small and large lumps of manure attached to the hide, in even larger areas along the hind quarter, stomach and front shoulder |
| 5 | Lumps of manure attached to the hide continuously on the underbelly and side of the animal from brisket to rear quarter |

# Dag Score Results

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

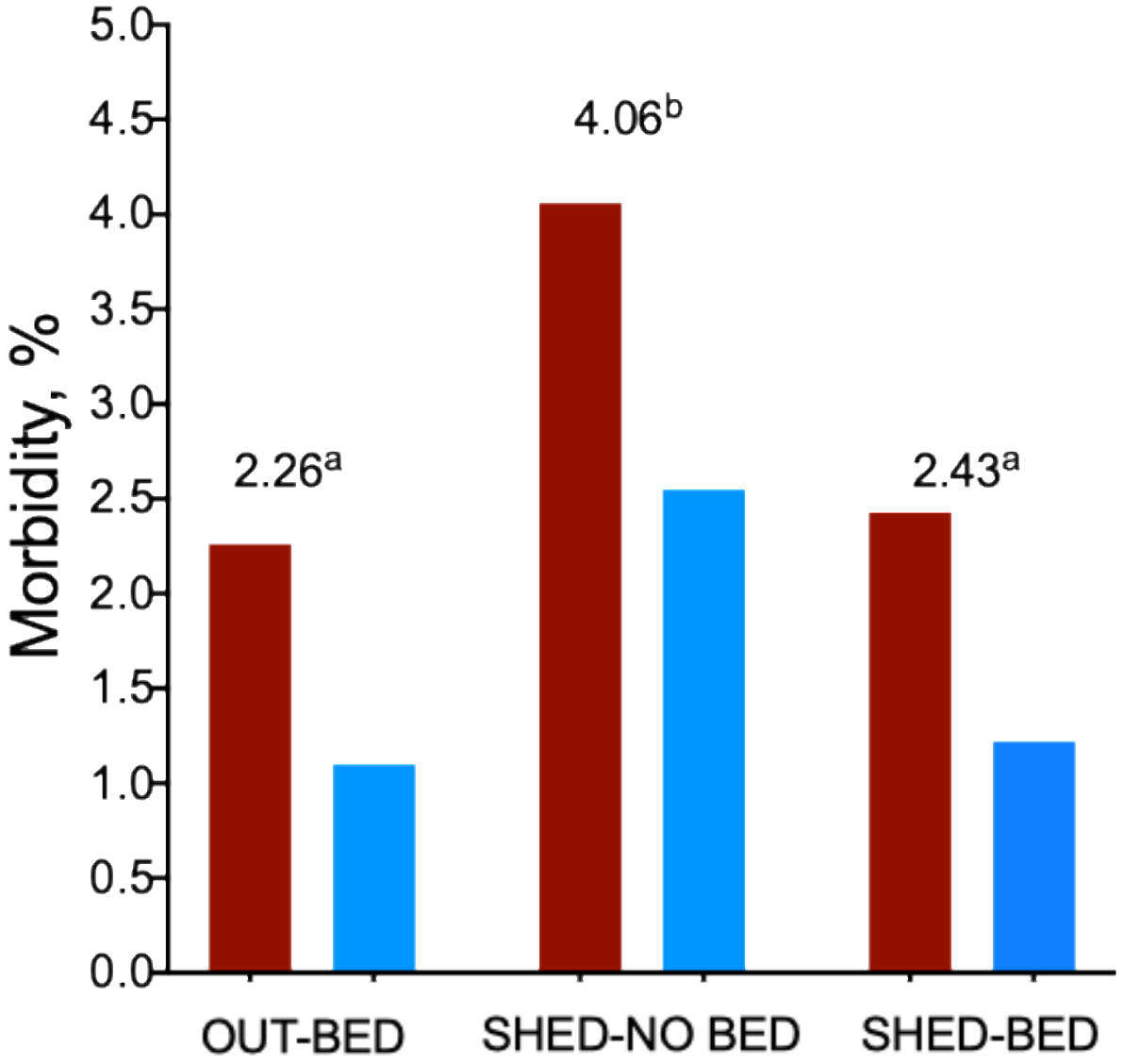


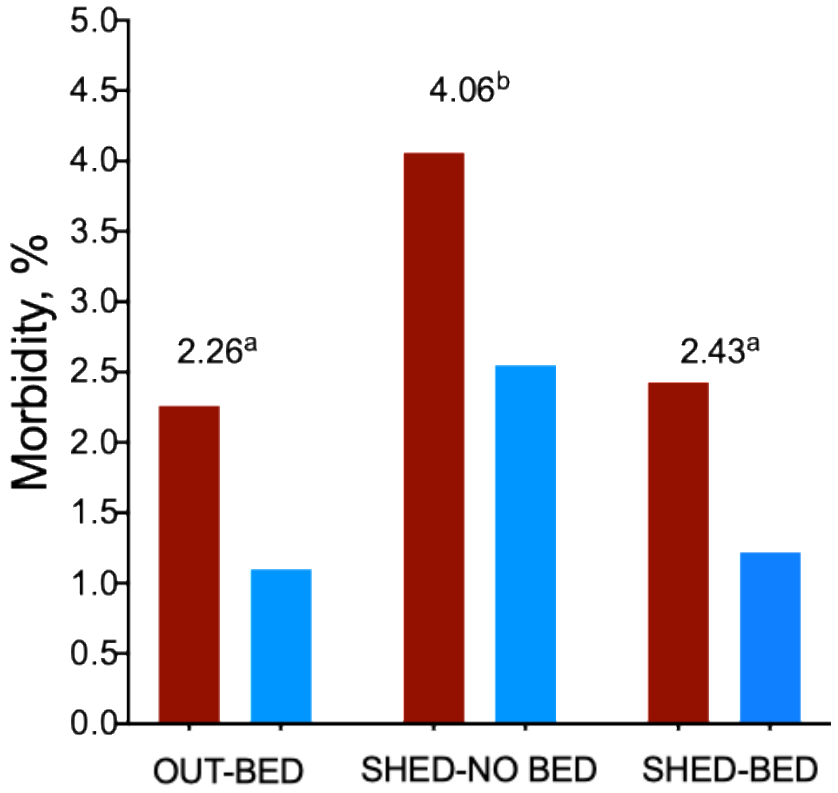



# Morbidity

| Variable | Treatment OUT-BED | SHED-NOBED | SHED-BED | P-value Treatment |
|---|---|---|---|---|
| Individuals, n | 1724 | 1725 | 1729 | |
| Morbidity | | | | |
| Total first pull, n (%) | 39 (2.26)[a] | 70 (4.06)[b] | 42 (2.43)[a] | 0.01 |
| Digestive | 15 (0.87) | 18 (1.04) | 17 (0.99) | 0.72 |
| Musculoskeletal | 19 (1.10)[a] | 44 (2.55)[b] | 21 (1.22)[a] | 0.01 |
| Respiratory | 3 (0.17) | 4 (0.23) | 2 (0.12) | 0.73 |
| Other | 2 (0.12) | 4 (0.23) | 2 (0.12) | 0.77 |


Morbidity, %
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2.26a
4.06b
2.43a
OUT-BED
SHED-NO BED
SHED-BED




Cattle under partial covered housing with no bedding had increased morbidity, particularly musculoskeletal morbidity.

Bedding is beneficial to musculoskeletal health in long-fed cattle.

| Variable | | Treatment | | | P-value |
|---|---|---|---|---|---|
| | | OUT-BED | SHED-NOBED | SHED-BED | Treatment |
| Individuals, n | | 1724 | 1725 | 1729 | |
| Mortality, n (%) | | 11 (0.64) | 20 (1.16) | 8 (0.46) | 0.07 |
| | Digestive | 2 (0.12) | 7 (0.41) | 4(0.23) | 0.96 |
| | Musculoskeletal | 6 (0.35) | 11 (0.64) | 4 (0.23) | 0.51 |
| | Respiratory | 0 (0.00) | 1 (0.06) | 0 (0.00) | 1.00 |
| | Other | 3 (0.17) | 1 (0.06) | 0 (0.00) | 1.00 |
| Removed, n (%) | | 19 (1.10)[a] | 45 (2.61)[b] | 22 (1.28)[a] | 0.01 |
| | Digestive | 1 (0.06) | 4 (0.23) | 7 (0.41) | 0.96 |
| | Musculoskeletal | 14 (0.81)[a] | 33 (1.91)[b] | 12 (0.69)[a] | 0.02 |
| | Respiratory | 2 (0.12) | 4 (0.23) | 2 (0.12) | 0.73 |
| | Other | 2 (0.12) | 4 (0.23) | 1(0.06) | 0.84 |
| Exits, n (%) | | 1694 (98.26)[a] | 1660 (96.23)[b] | 1699 (98.26)[a] | <0.01 |

Cattle under partial covered housing with no bedding had increased removals, particularly musculoskeletal removals

| Variable | | Treatment | | | P-value |
|---|---|---|---|---|---|
| | | OUT-BED | SHED-NOBED | SHED-BED | Treatment |
| Individuals, n | | 1724 | 1725 | 1729 | |
| Mortality, n (%) | | 11 (0.64) | 20 (1.16) | 8 (0.46) | 0.07 |
| | Digestive | 2 (0.12) | 7 (0.41) | 4(0.23) | 0.96 |
| | Musculoskeletal | 6 (0.35) | 11 (0.64) | 4 (0.23) | 0.51 |
| | Respiratory | 0 (0.00) | 1 (0.06) | 0 (0.00) | 1.00 |
| | Other | 3 (0.17) | 1 (0.06) | 0 (0.00) | 1.00 |
| Removed, n (%) | | 19 (1.10)[a] | 45 (2.61)[b] | 22 (1.28)[a] | 0.01 |
| | Digestive | 1 (0.06) | 4 (0.23) | 7 (0.41) | 0.96 |
| | Musculoskeletal | 14 (0.81)[a] | 33 (1.91)[b] | 12 (0.69)[a] | 0.02 |
| | Respiratory | 2 (0.12) | 4 (0.23) | 2 (0.12) | 0.73 |
| | Other | 2 (0.12) | 4 (0.23) | 1(0.06) | 0.84 |
| Exits, n (%) | | 1694 (98.26)[a] | 1660 (96.23)[b] | 1699 (98.26)[a] | <0.01 |

Cattle with bedding had higher exit rates.

# Manure Analyses

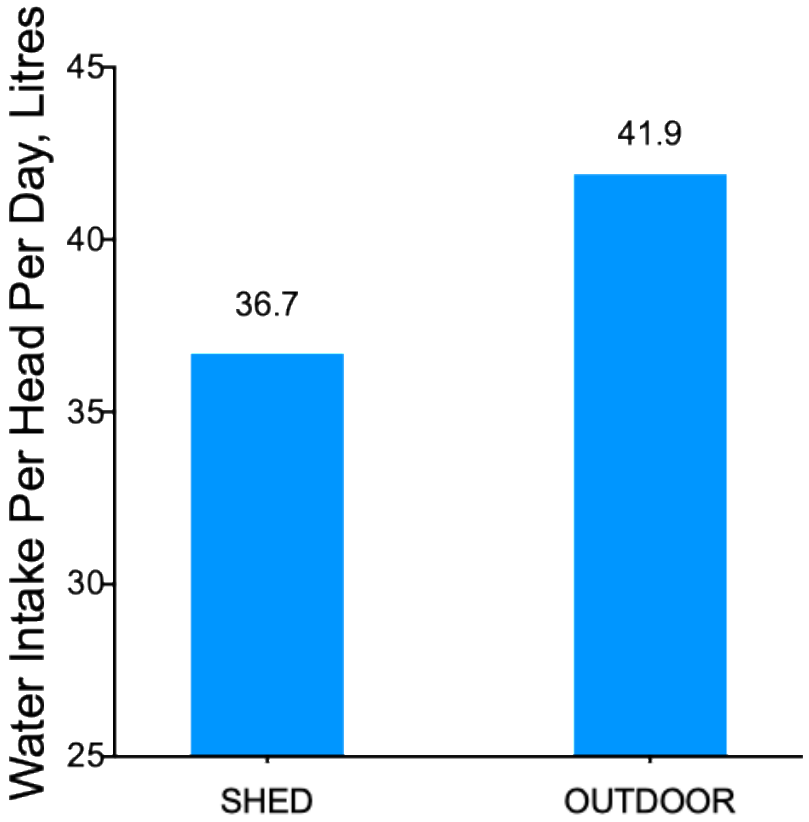
BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

- Pen contents removed from pens with bedding had
  - Increased carbon:nitrogen ratio
  - Total carbon
  - Moisture content

EAL
Environmental
Analysis
Laboratory

# Water Intake

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS



# Cost-Benefit Analysis

MEAT & LIVESTOCK AUSTRALIA

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

| Feedlot Breakeven Calculator | | | | |
|---|---|---|---|---|
| **Treatment: Shed with bedding** | | | | |
| **Inputs** | | **Outputs** | | |
| **Cattle Purchase** | | **Diet** | | |
| Date in | 5/5/23 | Ration DM Cost, $/t DM | 615.17 | |
| Trial days on feed | 110.60 | Cost, $/t Neg DM | 439.41 | |
| Head purchased | 216.00 | Feeding Cost, $/hd/d | 6.82 | |
| Trial entry weight, kg | 748.10 | Feeding Cost, $/hd | 753.86 | |
| Trial Entry Value, $/kg | 5.00 | **Cattle** | | |
| Transport to Feedlot, $/hd | 0.00 | Purchase Cost Landed, $/hd | 3740.50 | |
| Initial Payweight Dressing Percent, % | 54 | Date Out | 23/8/23 | |
| **Shed and Bedding Cost** | | Final BW, kg | 864.9 | |
| Shed Costs, $/hd | 16.31 | F:G (DM Basis) | 10.45 | |
| Bedding Costs, $/hd | 28.70 | | | |
| Bedding Labour, $/pen | 300.00 | | | |
| Cleaning and Carting Labour, $/pen | 360.00 | | | |
| Machinery Operations, $/pen | 2640.00 | | | |
| **Medical** | | No. Slaughtered | 212 | |
| Medication, $/hd | 0.41 | HCW, kg | 489.5 | |
| Death Loss, % | 0.46 | Carcass Gain, kg | 85.6 | |
| Removal Loss, % | 1.28 | | | |
| **Feeding** | | Carcass ADG, kg/d | 0.77 | |
| Avg Ration Cost, $/t As-Fed | 450.00 | Carcass F:G | 14.32 | |
| Ration DM, % | 73.15 | Carcass Revenue, $ | 7338.00 | |
| Ration NEg, Mcal/kg DM | 1.4 | Manure Revenue @ 12.5/tonne, $ | 3645.50 | |
| | | **Total Costs** | | %, Total |
| DMI, kg/d | 11.08 | Cattle Purchase, $ | 807948.00 | 81.85 |
| **Performance** | | Shed and Bedding, $ | 13022.16 | 1.32 |
| ADG, kg/d (Deads out) | 1.06 | Medication, $ | 89.10 | 0.01 |
| Dressing Percent (Full to HCW, kg) | 56.60 | Feeding, $ | 162834.65 | 16.50 |
| **Transport** | | Transport to Slaughter, $ | 3183.62 | 0.32 |
| Transport to slaughter, $/hd | 15.00 | Purchase interest, $ | 0.00 | 0.00 |
| **Finance Costs** | | Operating Interest, $ | 0.00 | 0.00 |
| %, Purchased Cost Borrowed | 0.00 | TOTAL, $ | 987077.53 | **100.00** |
| %, Operating Cost Borrowed | 0.00 | **Sales Revenue** | | |
| Interest Rate, % | 0.00 | TOTAL, $ | 1561074.57 | |
| **Sales** | | **Profit-Loss** | | |
| HCW Price, $/kg | 15.00 | Total P/L, $ | 573997.04 | |
| Grid Penalties, $/hd | 0.00 | **P/L, $/hd Purchased** | **2657.39** | |
| Commission, $/hd | 0.00 | ROI, % | 58.15 | |
| Levies, $/hd | 5.00 | Breakeven HCW, $/kg | 9.51 | |
| | | Carcass COG, $/kg | 9.86 | |
| Constructed by | | | | |
| J.P. McMeniman, M.S., Ph.D. | Edited by | | | |
| Meat & Livestock Australia | M. M. George, BVSc Hon, BS, MS, PhD | | | |
| jmcmeniman@mla.com.au | Bovine Dynamics Pty Ltd | | | |

# Cost-Benefit Analysis

- Average value per individual at the start of the trial of $3740 ($5 per kg x 748 kg)
- Initial value of the covered housing (shed) was $2,862,550. Rental rates for shed were 3.6% per annum. The rental fess was $8,600 per month to rent the shed for the project. This fee was divided by 9 pens to result in a pen rental fee of $955.56 per pen per month. This fee was divided 30 days in a month to equal a daily rental fee of $31.85 per pen per day. This rental fee was multiplied by the duration of the trial (110.6 days) to result in a price of $3,522.81 per pen per 110.6 days. This price was divided by 216 head in the pen to result in $16.31 shed cost per head for 110.6 days.

# Cost-Benefit Analysis

- Woodchip landed cost of $80 per tonne landed. (Cubic metre $22-$26). The price per tonne was multiplied by the number of tonnes used to fill a pen (155 tonnes) which equalled $12,400. This price was divided by 216 head to result in $57.41 per head. The woodchip can be used for two rounds of feeding per woodchip load and hence this price was divided by two to result in a woodchip price her head for 110.6 day of $28.70.

- Bedding labour was valued at $30 per hour. To apply woodchip to a pen, 10 labour hours were required for a total cost of $300. To clean a woodchipped feedlot pen and cart the manure and woodchip away, 12 labour hours were required resulting in a total cost of $360. To clean a non-bedded pen, 8 labour hours were required resulting in a total cost of $240. Machinery wet hourly rates were $120 per hour including carting trucks, loader, and excavator. A woodchipped pen required 22 hours of wet machinery hire for raking, cleaning, and carting for a total cost of $2,640. An unbedded pen required 8 hours of wet machinery hire for cleaning and carting for a total cost of $960.

# Cost-Benefit Analysis

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

- Dressing percent for a 748.1 kg individual at the commencement of the trial was 54.0%.
- A transport cost of $15 per individual was applied for transport from the feedlot to abattoir.
- A price of $15 per kg hot carcase weight was applied to the value of the carcases.
- A $5 levy was applied for each individual animal.

# Feedlot Breakeven Calculator

**Treatment: Shed with bedding**

| Inputs | | | Outputs | | |
|---|---|---|---|---|---|
| **Cattle Purchase** | | | **Diet** | | |
| Date in | 5/5/23 | | Ration DM Cost, $/t DM | 615.17 | |
| Trial days on feed | 110.60 | | Cost, $/t Neg DM | 439.41 | |
| Head purchased | 216.00 | | Feeding Cost, $/hd/d | 6.82 | |
| Trial entry weight, kg | 748.10 | | Feeding Cost, $/hd | 753.86 | |
| Trial Entry Value, $/kg | 5.00 | | **Cattle** | | |
| Transport to Feedlot, $/hd | 0.00 | | Purchase Cost Landed, $/hd | 3740.50 | |
| Initial Payweight Dressing Percent, % | 54 | | Date Out | 23/8/23 | |
| **Shed and Bedding Cost** | | | Final BW, kg | 864.9 | |
| Shed Costs, $/hd | 16.31 | | F:G (DM Basis) | 10.45 | |
| Bedding Costs, $/hd | 28.70 | | | | |
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| | | | **Total Costs** | | %, Total |
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| Transport to slaughter, $/hd | 15.00 | | Purchase interest, $ | 0.00 | 0.00 |
| **Finance Costs** | | | Operating Interest, $ | 0.00 | 0.00 |
| %, Purchased Cost Borrowed | 0.00 | | TOTAL, $ | 987077.53 | **100.00** |
| %, Operating Cost Borrowed | 0.00 | | **Sales Revenue** | | |
| Interest Rate, % | 0.00 | | TOTAL, $ | 1561074.57 | |
| **Sales** | | | **Profit-Loss** | | |
| HCW Price, $/kg | 15.00 | | Total P/L, $ | 573997.04 | |
| Grid Penalties, $/hd | 0.00 | | **P/L, $/hd Purchased** | **2657.39** | |
| Commission, $/hd | 0.00 | | ROI, % | 58.15 | |
| Levies, $/hd | 5.00 | | Breakeven HCW, $/kg | 9.51 | |
| | | | Carcass COG, $/kg | 9.86 | |


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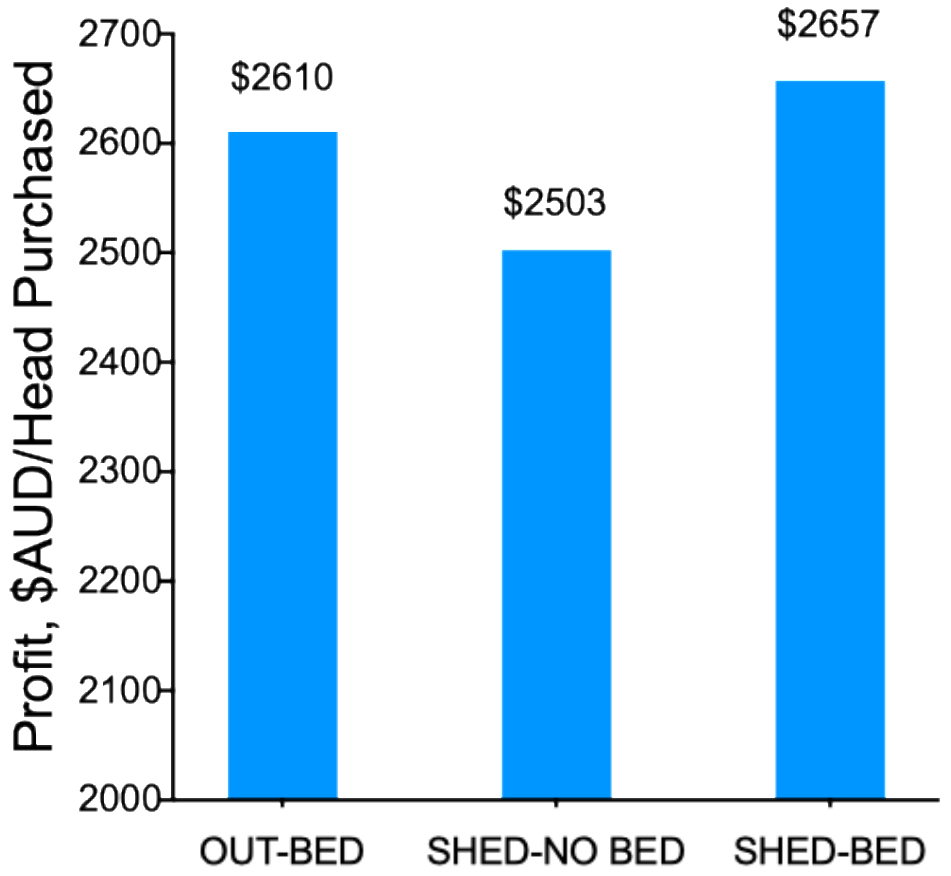
Bovine Dynamics Pty Ltd

# Cost-Benefit Analysis



# Conclusions

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

- Cattle under partial covered housing with bedding had increased feed intake (0.45 kg DM/hd/d), average daily gain (0.09 kg/d), exit weight (11.1 kg), and Gain:Feed (0.009)
- Cattle under partial covered housing with bedding had increased hot carcase weight (6.3 kg HSCW)
- Bedding has a significantly positive impact on musculoskeletal health in long-fed Angus cattle, reducing morbidity and cull rates
- Cattle with access to covered housing drank 5.2 L less water per day
- Cost-Benefit Analysis revealed an economic advantage of $47 per head for partial covered housing and $154 for bedding in the current model

# Questions

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MEAT & LIVESTOCK AUSTRALIA

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

RANGERS VALLEY

| Physical Domain | Factors | Associated positive or negative mental states: 5th Domain |
|---|---|---|
| Nutrition | Access to drink sufficient and good quality water | Quenching thirst and pleasure of drinking |
| | Restricted food intake and a poor food quality | Hunger, and malnutrition |
| Physical Environment | Space for spontaneous movement | Physical comfort |
| | Exposure to thermal extremes | Thermal discomfort |
| Health | Minimal injury | Comfort, good functional capacity |
| | Poor physical fitness | Weakness and exhaustion |
| Behavioural interactions | Varied, novel environment | Interested, occupied |
| | Limits on threat avoidance, escape or defence activity | Anxiety, fear, anger, panic |

# B.FLT.4009

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

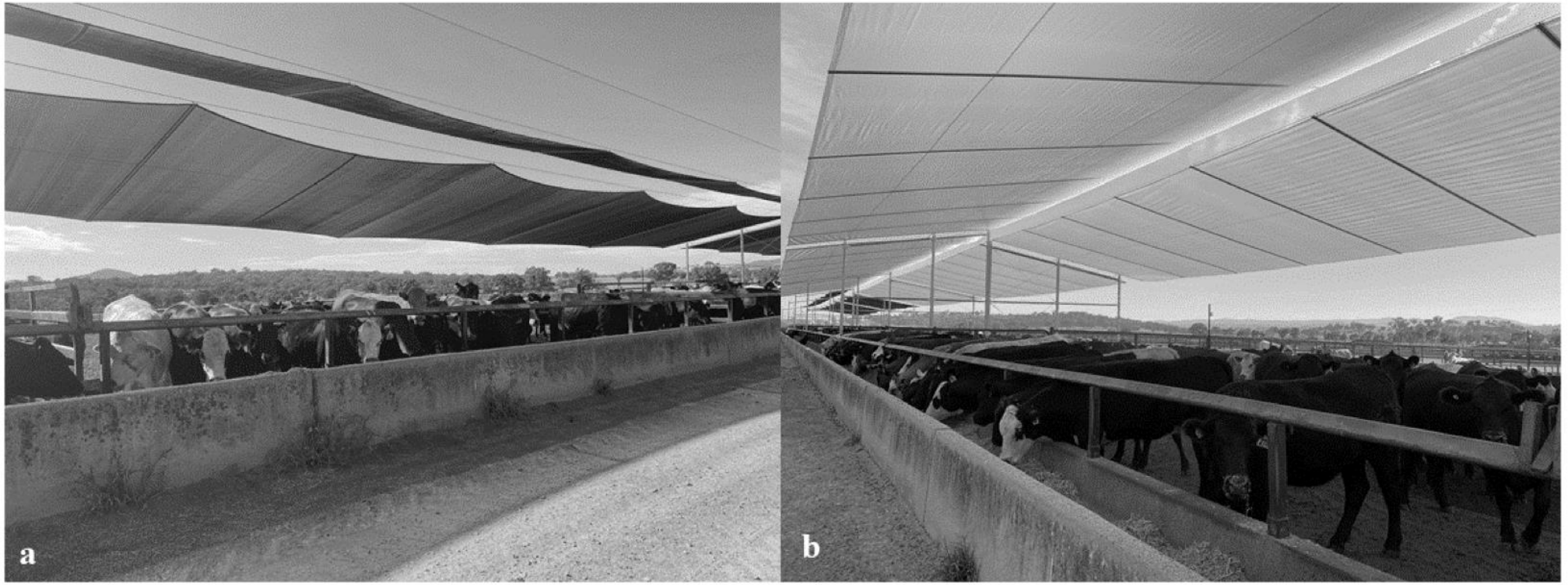


**Figure 1. A representation of the a) shade cloth and b) waterproof shade structures over the Tullimba research feedlot pens**

(Lees et al., 2022)

# Introduction – B.FLT.4009

- Summer – partial pen coverage with waterproof system – 720 heifers
  - Improved ADG 100 g/hd/d, Feed Efficiency 4%, HSCW 7 kg
  - No differences in performance in shaded and unshaded conditions
  - Mild and wet summer conditions

| Trait | Treatment | | | Significance |
|---|---|---|---|---|
| | Unshaded | Shade Cloth | Waterproof | |
| HSCW, kg | 305.32 ± 3.36 | 305.83 ± 3.36 | 312.52 ± 3.36 | ≤ 0.01 |
| Dressing percentage, % | 53.61 ± 0.23 | 53.5 ± 0.23 | 53.7 ± 0.23 | 0.49 |
| P8 fat, mm | 13.91 ± 0.45 | 14.31 ± 0.45 | 14.6 ± 0.45 | 0.15 |
| Rib fat, mm | 9.61 ± 0.37 | 10.09 ± 0.37 | 10.46 ± 0.37 | 0.03 |
| EMA, $cm^2$ | 87.9 ± 1.13 | 88.73 ± 1.13 | 89.55 ± 1.13 | 0.43 |
| MSA Marbling | 354.28 ± 5.45 | 349.75 ± 5.45 | 353.73 ± 5.45 | 0.81 |
| Ossification | 193.48 ± 4.42 | 193.56 ± 4.42 | 195.46 ± 4.42 | 0.51 |
| $pH_u$ | 5.59 ± 0.02 | 5.59 ± 0.02 | 5.60 ± 0.02 | 0.80 |
| MSA index | 54.0 ± 1.38 | 53.9 ± 1.42 | 54.0 ± 1.44 | 0.77 |
| Adrenal wt, g/100 kg HSCW | 4.19 ± 0.12 | 4.24 ± 0.12 | 4.10 ± 0.12 | 0.12 |

(Lees et al., 2022)

# Introduction – B.FLT.4009

BOVINE DYNAMICS
FEEDLOT VETERINARY & NUTRITION CONSULTANTS

- Winter – partial pen coverage with waterproof system – 480 steers
  - Improved ADG 100 g/hd/d, Feed Efficiency 5.3%, HSCW 5 kg

| Trait | Treatment | | Significance |
|---|---|---|---|
| | Unsheltered | Sheltered | |
| HSCW, kg | 356.0 ± 1.96 | 361.0 ± 1.96 | 0.08 |
| Dressing percentage, % | 54.86 ± 0.12 | 55.34 ± 0.12 | 0.004 |
| P8 fat, mm | 16.8 ± 0.36 | 16.8 ± 0.36 | 0.86 |
| Rib fat, mm | 9.69 ± 0.27 | 10.43 ± 0.27 | 0.05 |
| EMA, $cm^2$ | 89.6 ± 0.62 | 89.7 ± 0.62 | 0.85 |
| MSA Marbling | 362 ± 4.12 | 359 ± 4.12 | 0.57 |
| Ossification | 163 ± 1.27 | 164 ± 1.27 | 0.65 |
| $pH_u$ | 5.49 ± 0.004 | 5.51 ± 0.004 | 0.003 |
| MSA index | 55.82 ± 0.11 | 55.72 ± 0.11 | 0.53 |
| Adrenal wt, g/100 kg HSCW | 3.93 ± 0.05 | 3.72 ± 0.05 | 0.001 |

(Lees et al., 2022)