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Environmental effects on feed consumption and feeding behaviour of cattle with known feed efficiency

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Contents & General Scope

- + Introduction
- + Material & Methods
- + Results & Discussions
- + Conclusions
- + Acknowledgments



Introduction: Individual variation: feed efficiency



✚ **WHY TWO ANIMALS OF...**

Same breed

Fed in the **same** way

Subject to the **same** husbandry
with **same** weight & composition

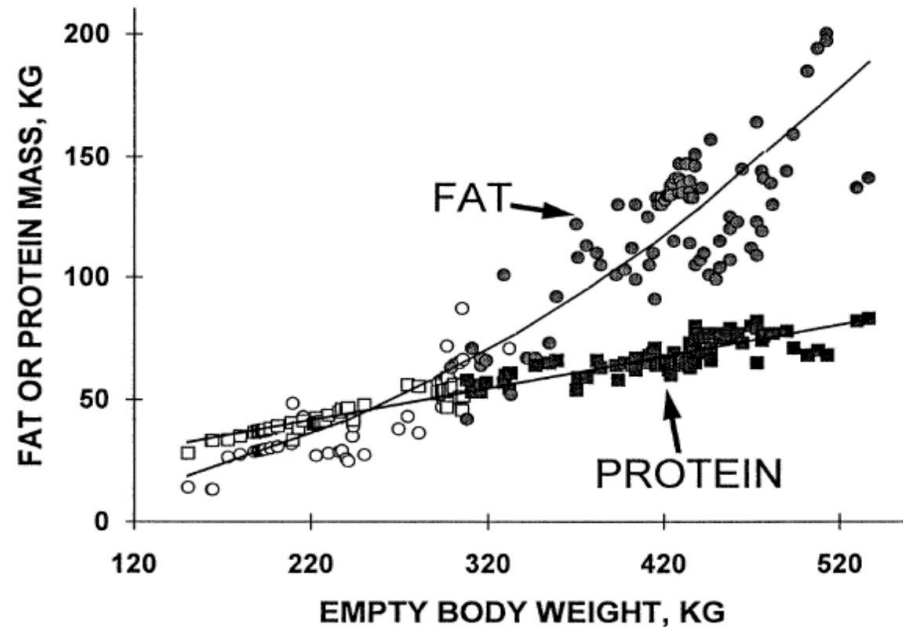
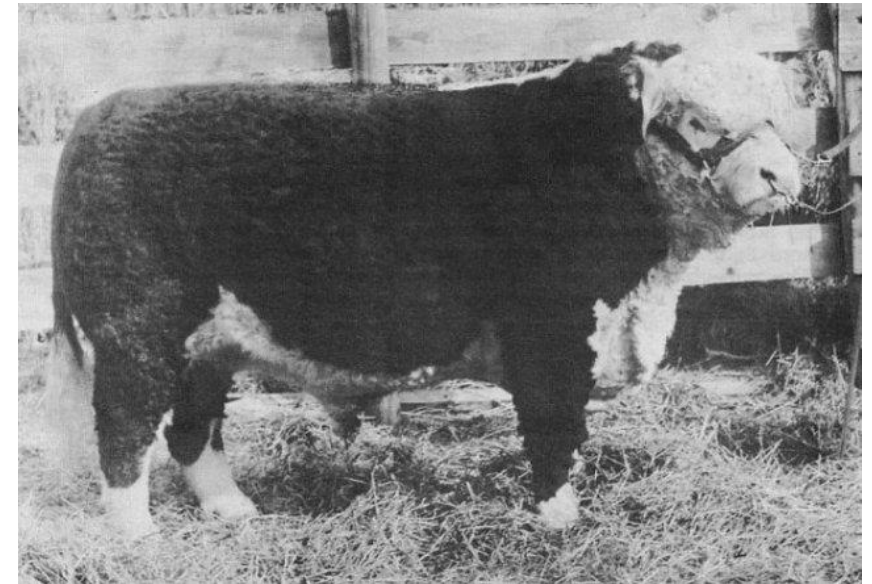
... DIFFER ON FEED EFFICIENCY?

Introduction: Feed efficiency through RFI

Titus et al 1927

Koch et al 1963

$$\text{Intake} = \text{BW} + \text{BW}_{\text{variation}} + \text{egg}_{\text{production}}$$

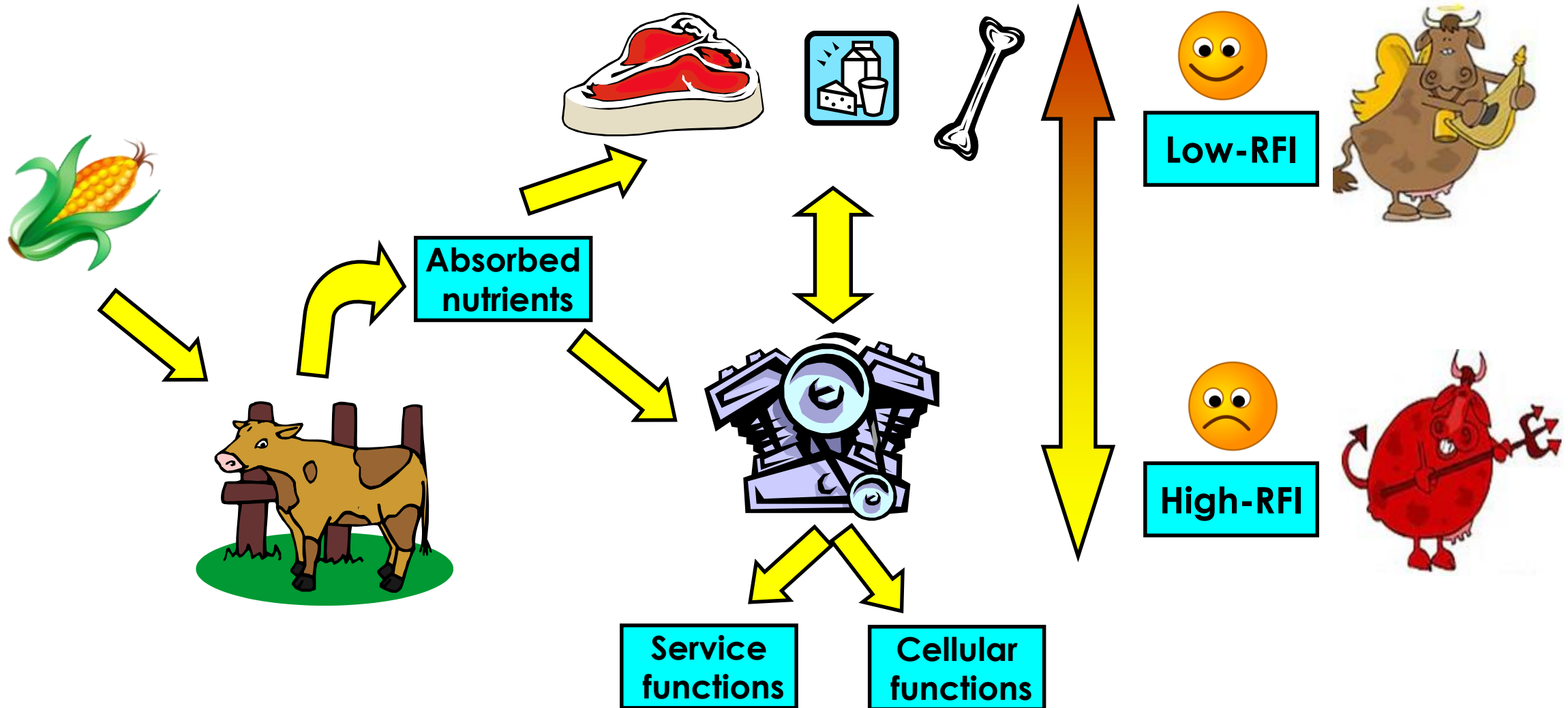


EFFICIENCY OF FEED USE IN BEEF CATTLE¹
 ROBERT M. KOCH,² L. A. SWIGER,² DOYLE CHAMBERS³ AND K. E. GREGORY^{4,5}
University of Nebraska, Oklahoma State University and United States Department of Agriculture

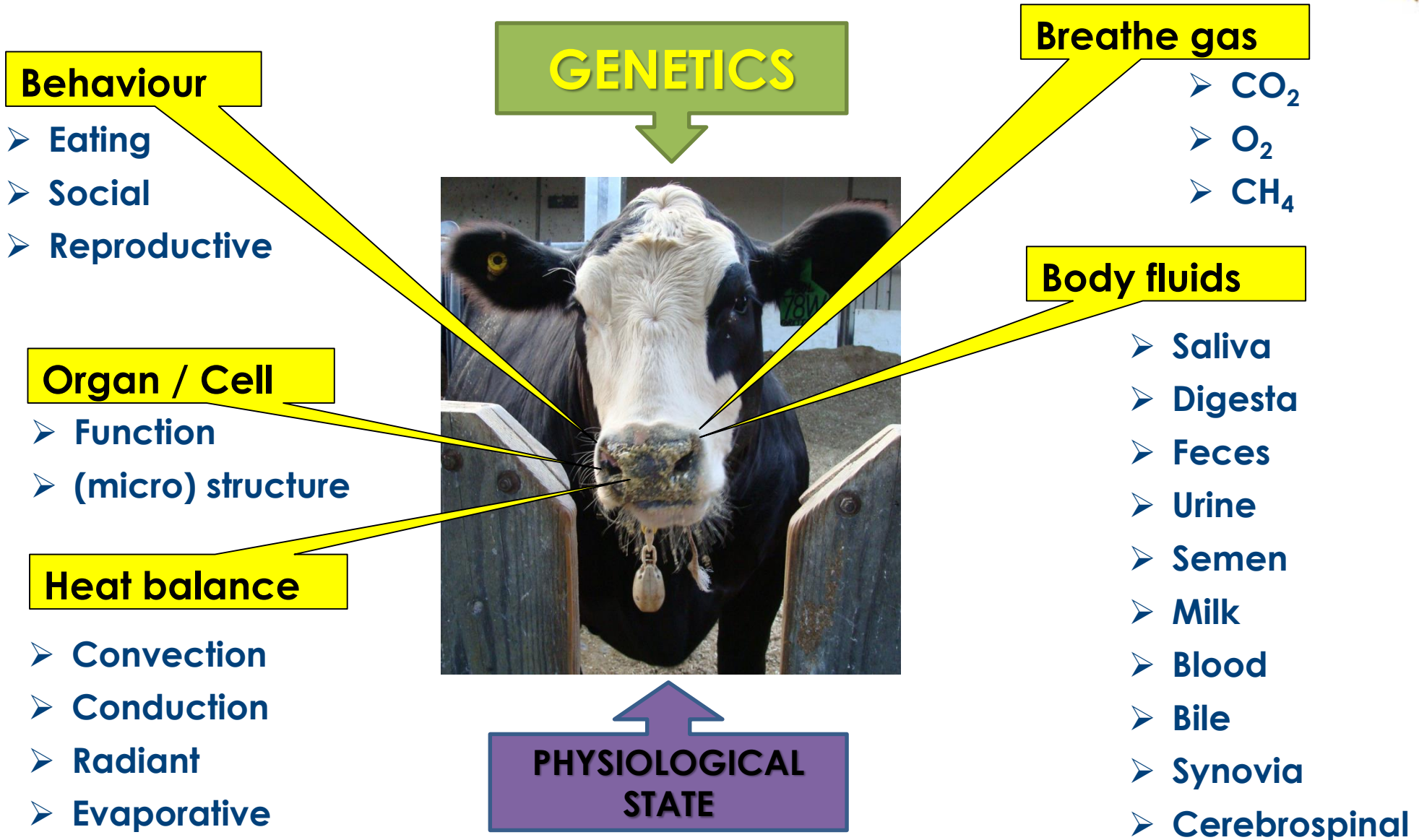
$$\text{Feed intake} = \text{BW} + \text{BW}_{\text{variation}}$$



Introduction: RFI and biological aspects



Introduction: “More than a hand full” of biomarkers



Introduction: How about the weather?

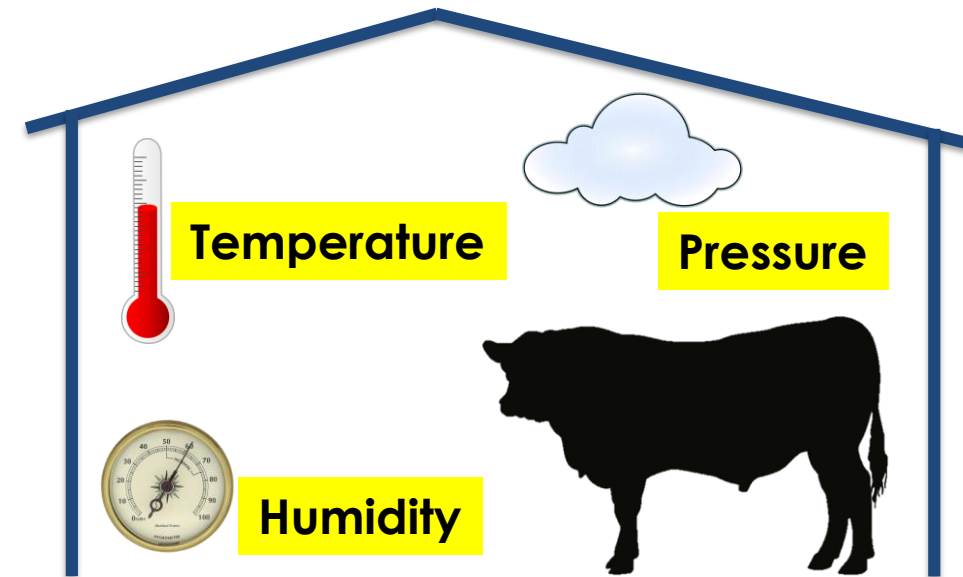


Sunshine

Precipitation

Wind speed

Solar Radiation



Introduction: Hypothesis

The weather impacts behavioral and metabolic processes. Because feed efficiency (RFI) is linked to metabolism, it is reasonable to hypothesize that:

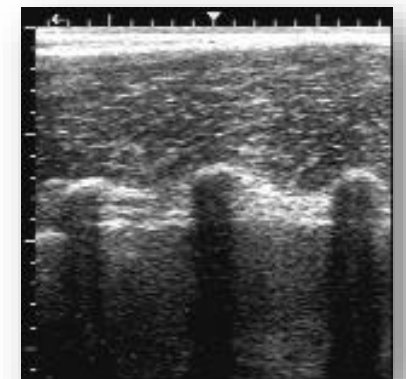
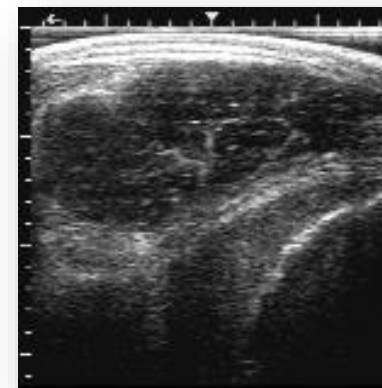
- ✚ Distinct phenotypes for feed efficiency (RFI) respond differently to weather conditions, which is reflected on feeding behaviours.



Material & Methods: Cattle & performance



- 104 steers (240 \pm 20 days old)
- 112 days performance test
- Tested over Canadian winter
- Weight every 14 d
- Body composition every 28 d



Material & Methods: Housing & feeding

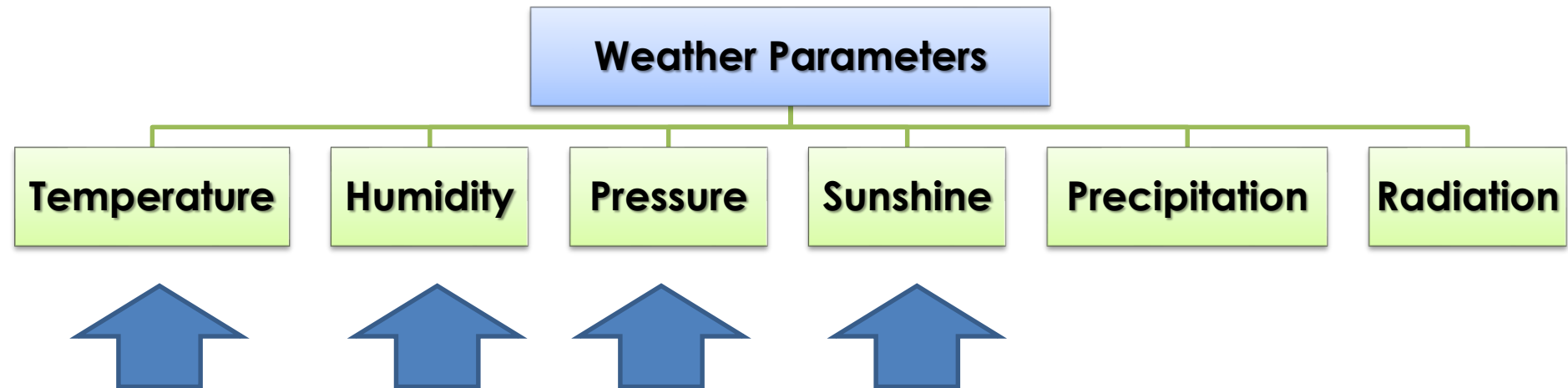
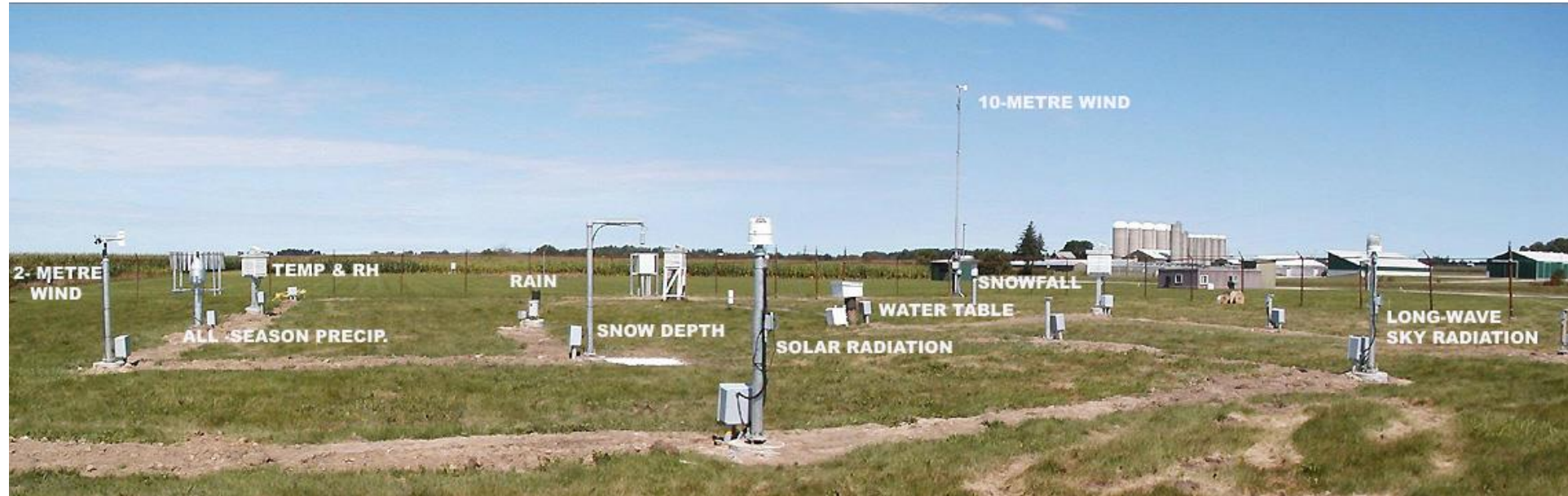


- Bedded with wood shavings
- Automated feeding system
- Feed refilled twice daily

- 52.2%: High moisture corn
- 42.4% Alfalfa silage
- 5.0% Soybean meal
- 0.11% vitamin & mineral



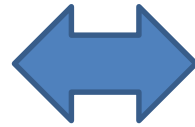
Material & Methods: Weather parameters



Material & Methods: Feed intake information

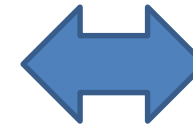
FEEDING BEHAVIOURS

- Time at feeder
- Intake per visit
- Number of visits



PERIOD OF THE DAY

- Sunrise
- Daytime
- Sunset
- Nighttime



FEEDING STATUS

- New feed
- Old feed



Material & Methods: Feed efficiency (RFI) values

Predictive Intake (kg/d) = β_0 +

$\beta_1(\text{BW}) + \beta_2(\text{ADG}) +$ } **Body size / Growth rate**

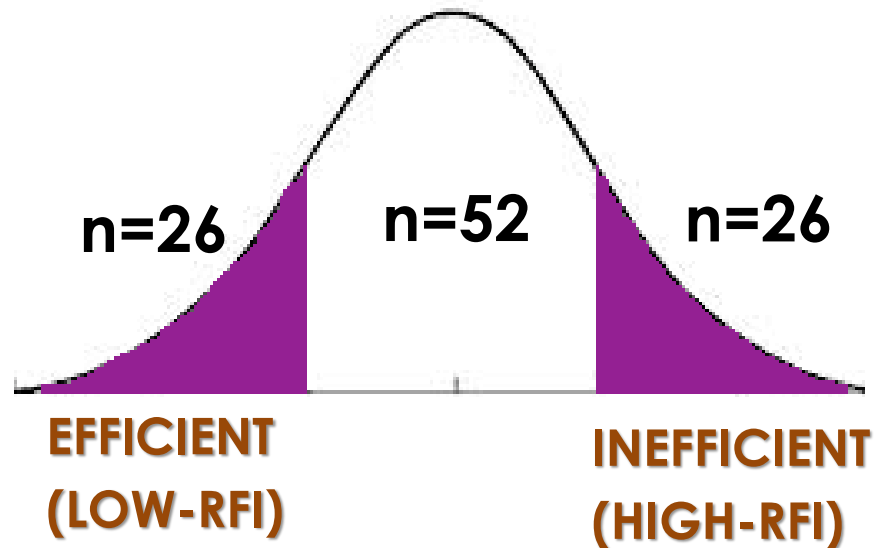
$\beta_3(\text{Back Fat}) + \beta_4(\text{Rump Fat}) + \beta_5(\text{Marbling}) +$ } **Fatness**

$\beta_6(\text{Ribeye Area}) +$ } **Leanness**

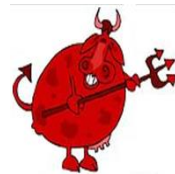
RFI } **Physiological variability**

RFI (kg/d) = Feed Intake – Predicted Intake

Material & Methods: Statistical analysis



AVERAGE



- + **Proc univariate – descriptive statistics**
- + **Proc mixed - Feeding behaviours (FB)**
- + **Model:** $FB = RFI_class + period + feed_status + pressure + temperature + humidity + interactions;$
- + **Slope:** 'slope on humidity: LOW-RFI' $humidity\ 1\ humidity * RFI_class\ 0\ 0\ 1;$
- + **Means:** $lsmeans\ RFI_class\ RFI_class * period\ feed_status / cl;$

Results & Discussions: RFI groups & weather stats



45\$

281 kg

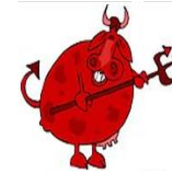
143 kg

-0.85 kg/d



138 kg

+0.82 kg/d

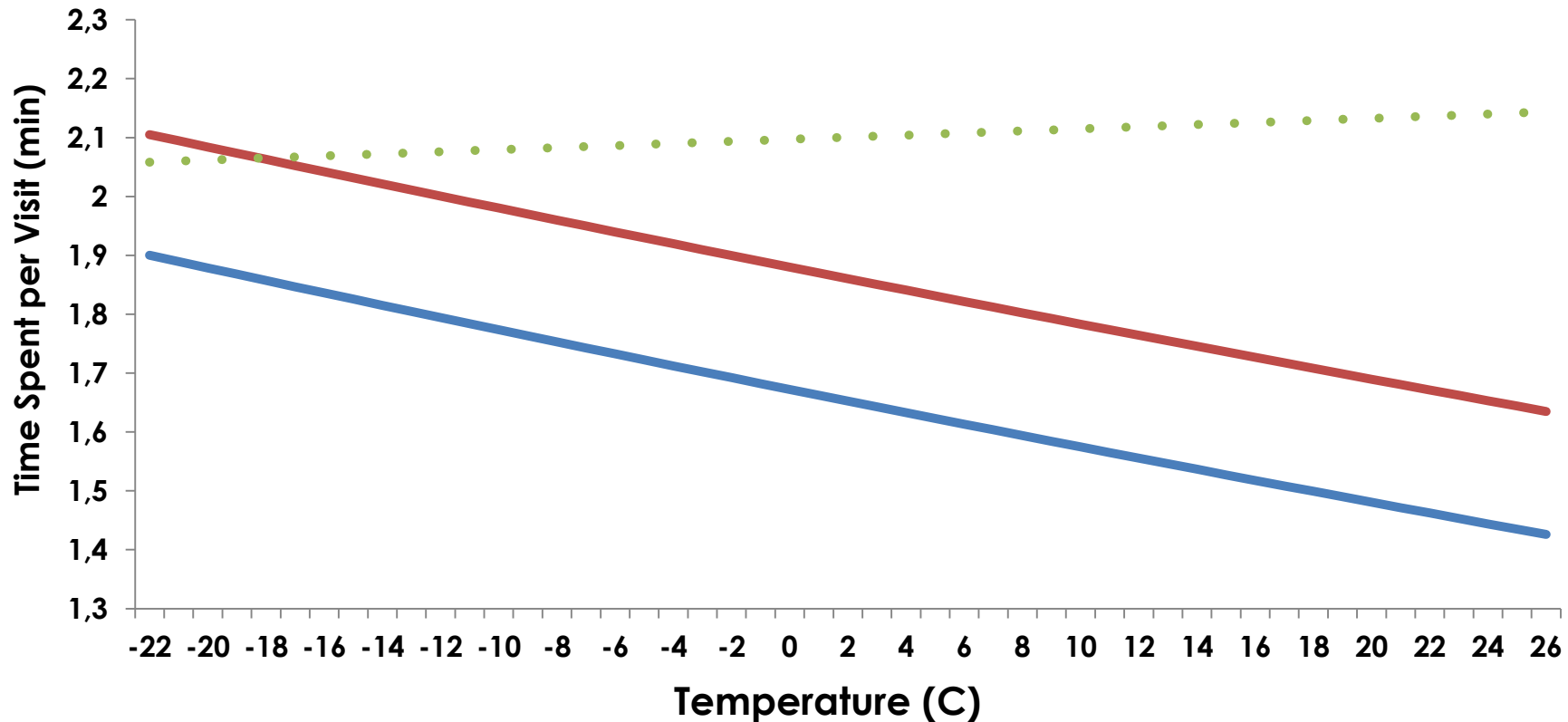
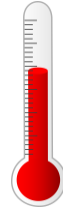


Variable	Mean	Min.	Max.
Temperature (°C)	0.76	-22.0	26.0
Humidity (%)	75.1	19.0	100
Pressure (kPa)	96.9	94.3	99.1

Results & Discussions: RFI groups & temperature



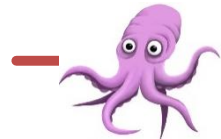
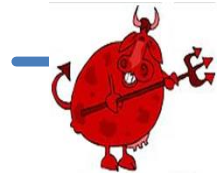
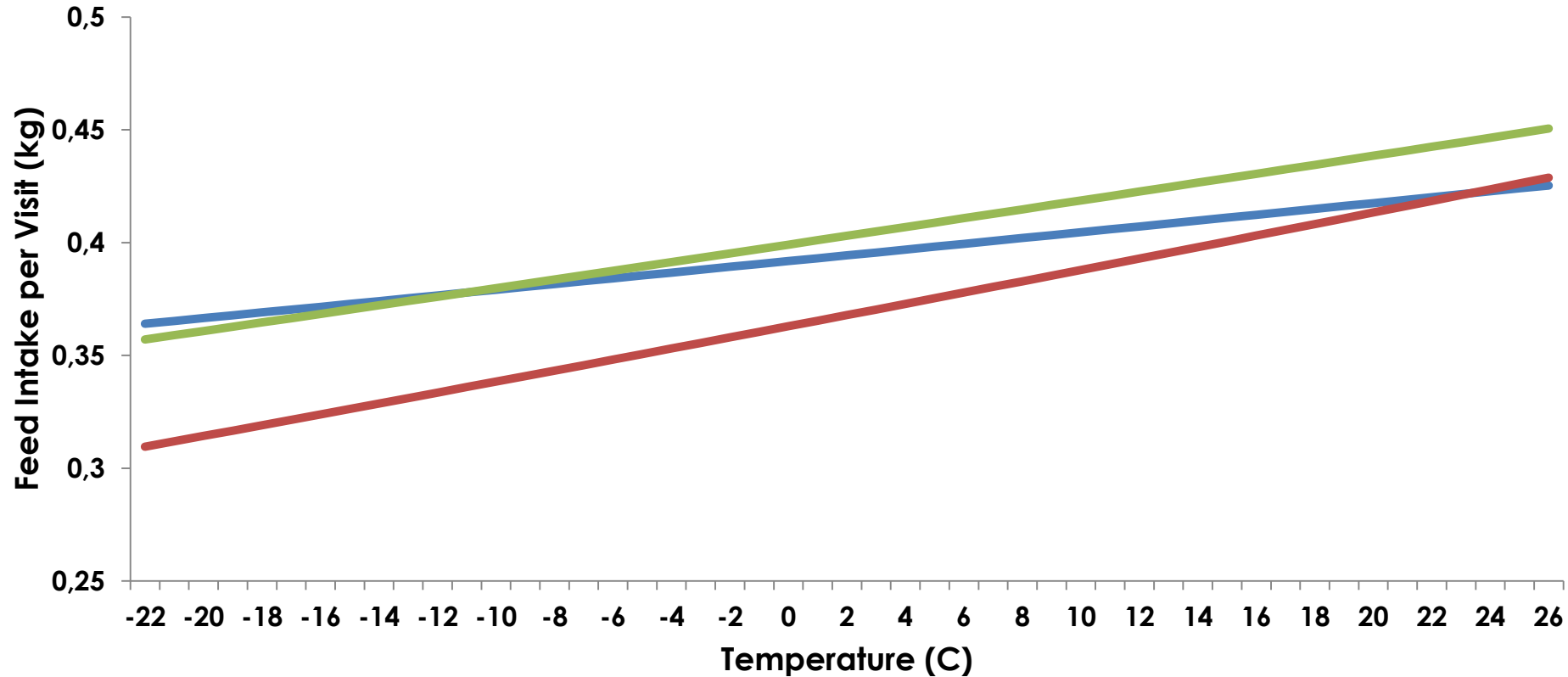
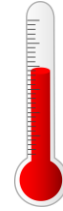
Temperature vs. time at feeder



Results & Discussions: RFI groups & temperature



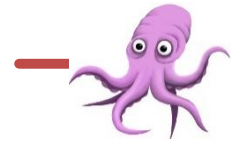
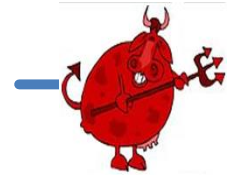
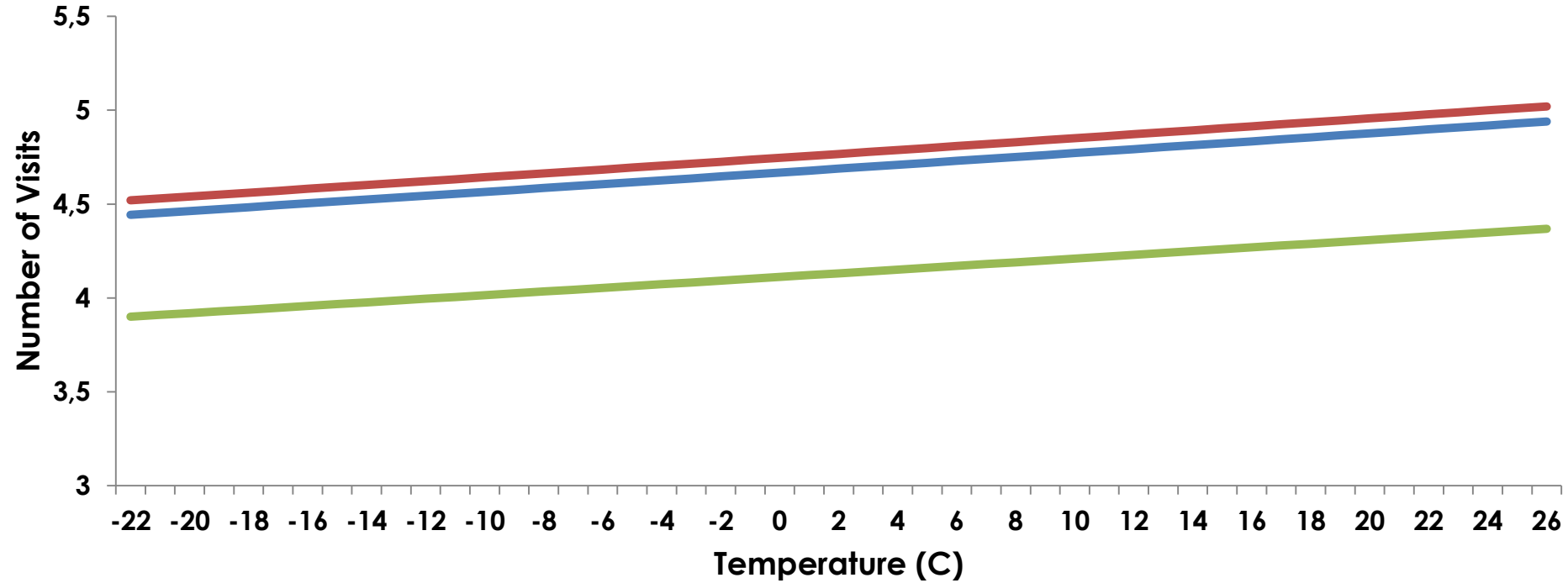
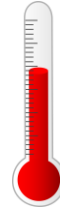
Temperature vs. intake per visit



Results & Discussions: RFI groups & temperature

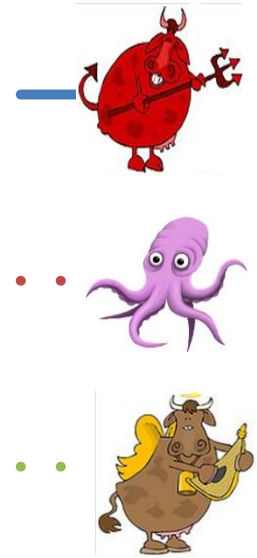
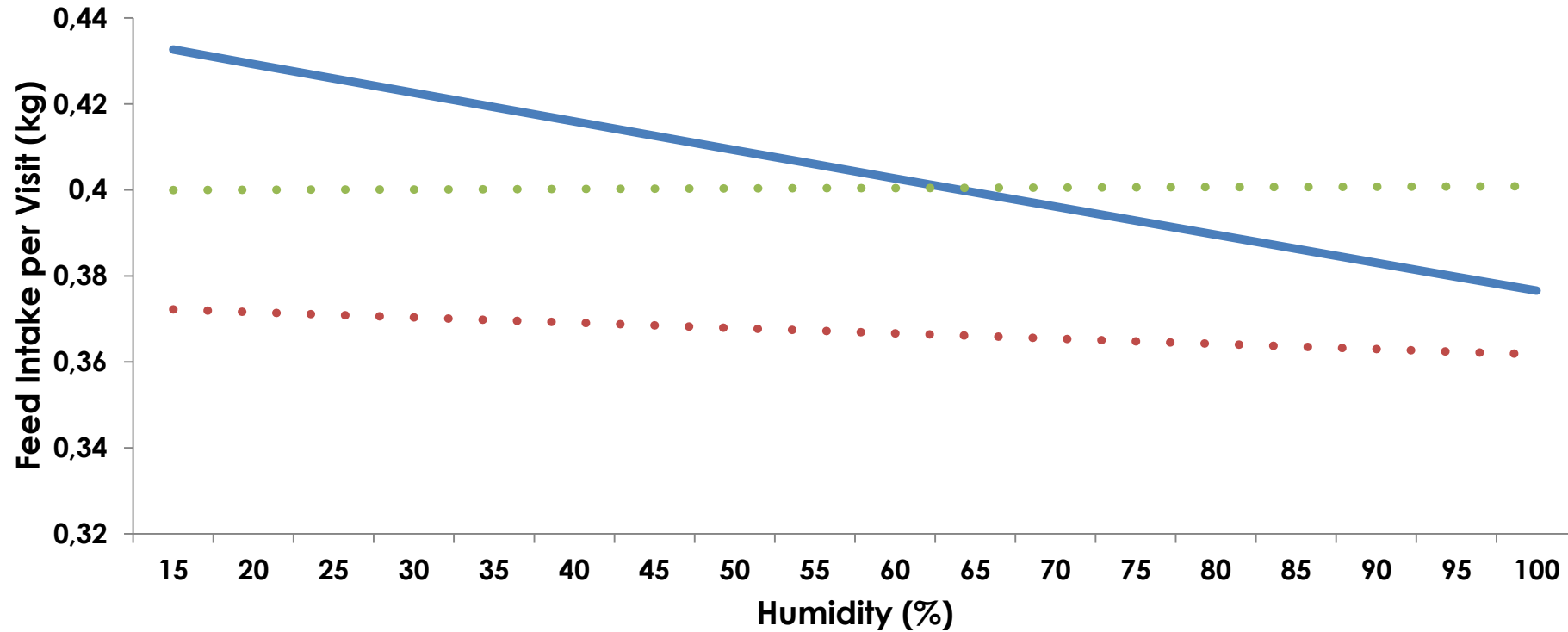


Temperature vs. number of visits



Results & Discussions: RFI groups & humidity

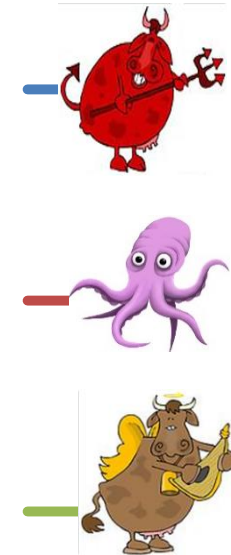
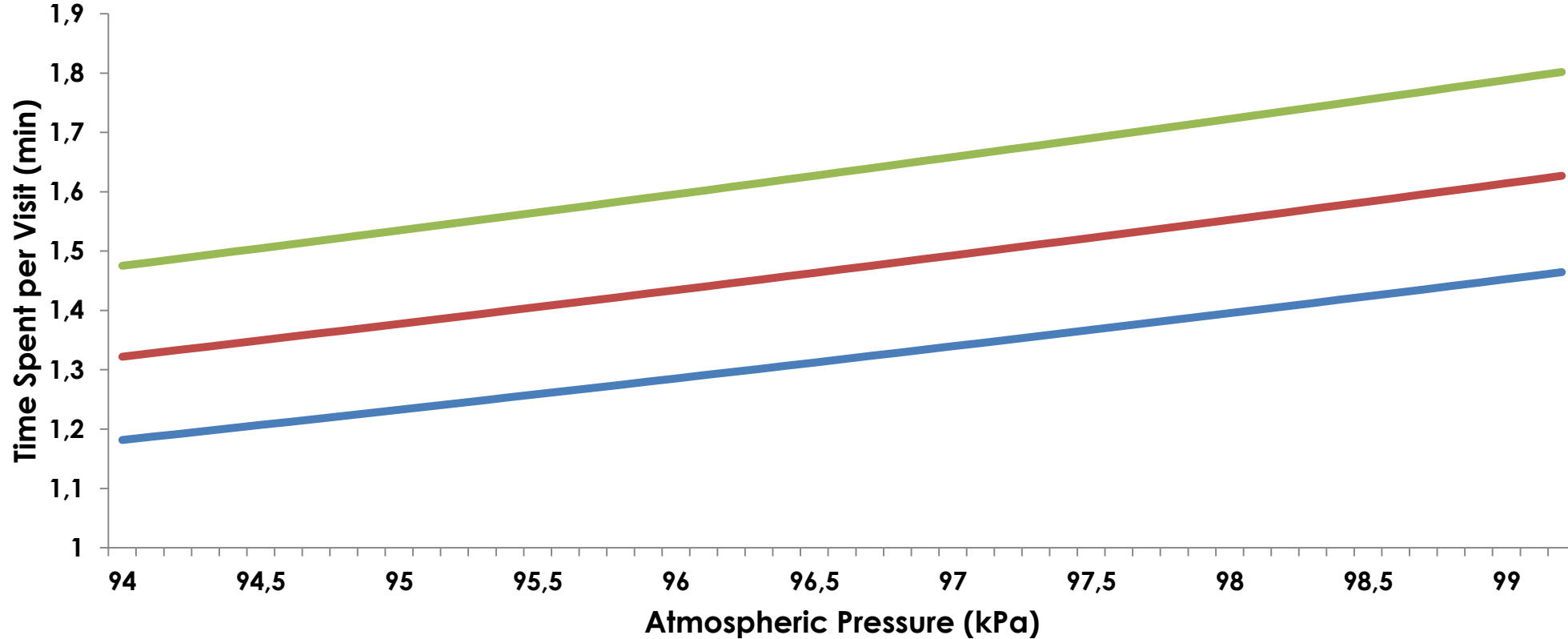
Humidity vs. intake per visit



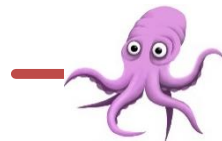
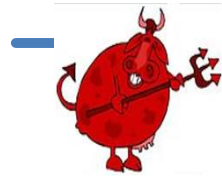
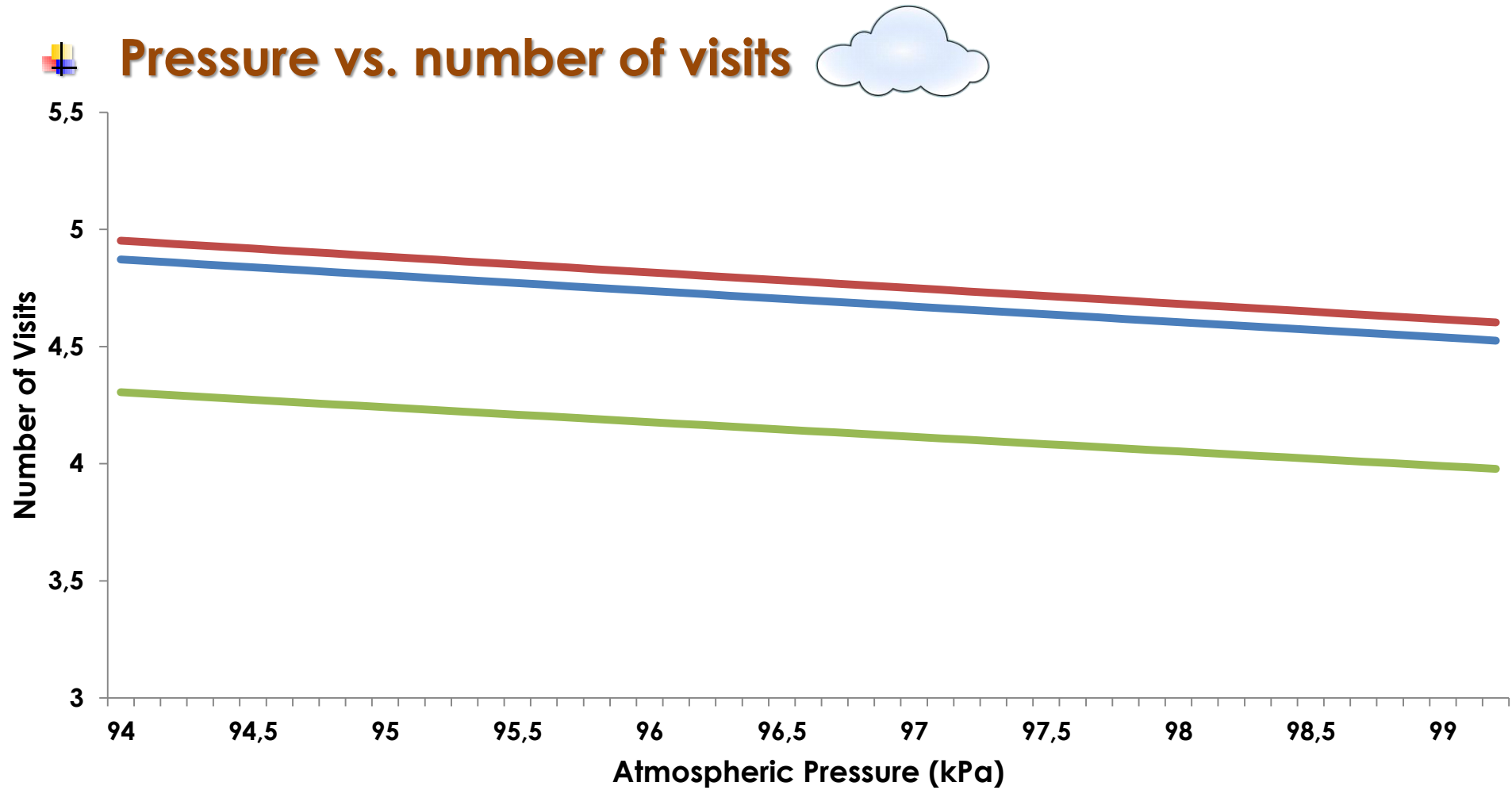
Results & Discussions: RFI groups & pressure



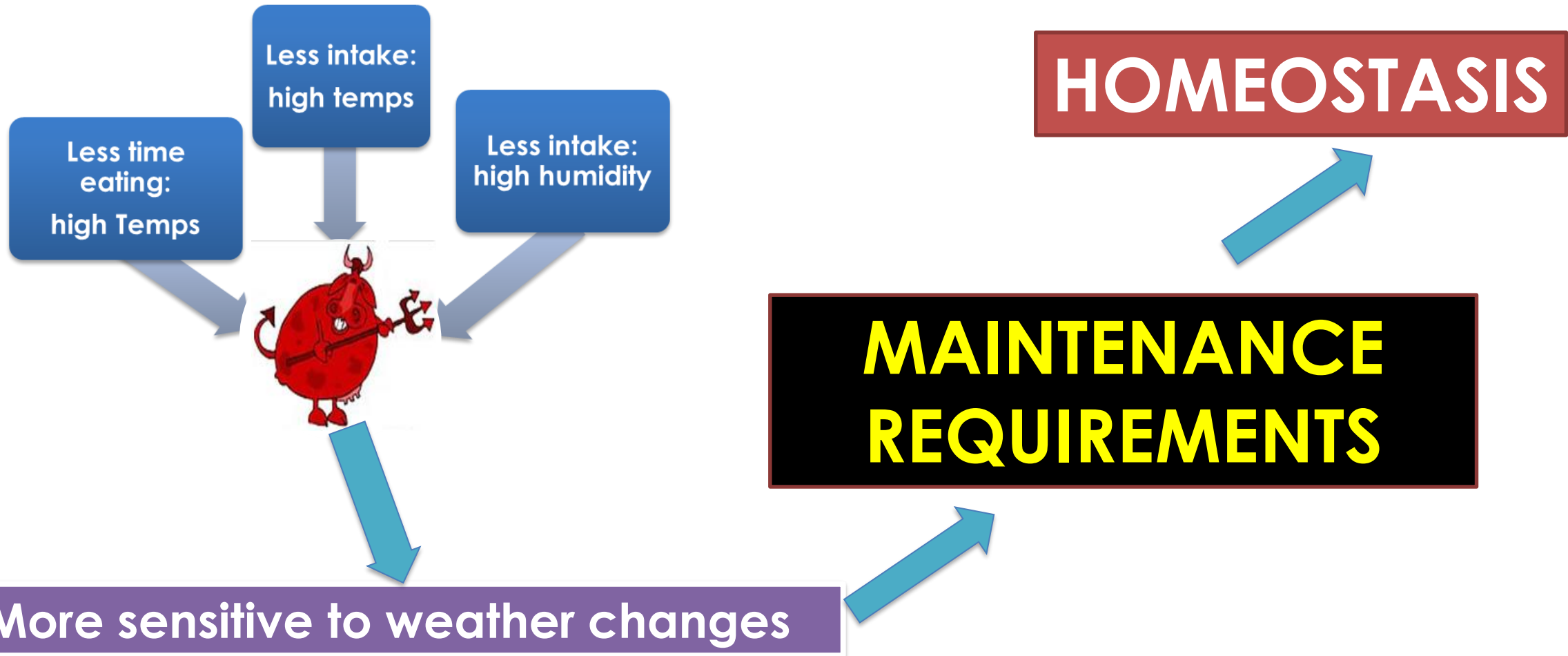
Pressure vs. time at feeder



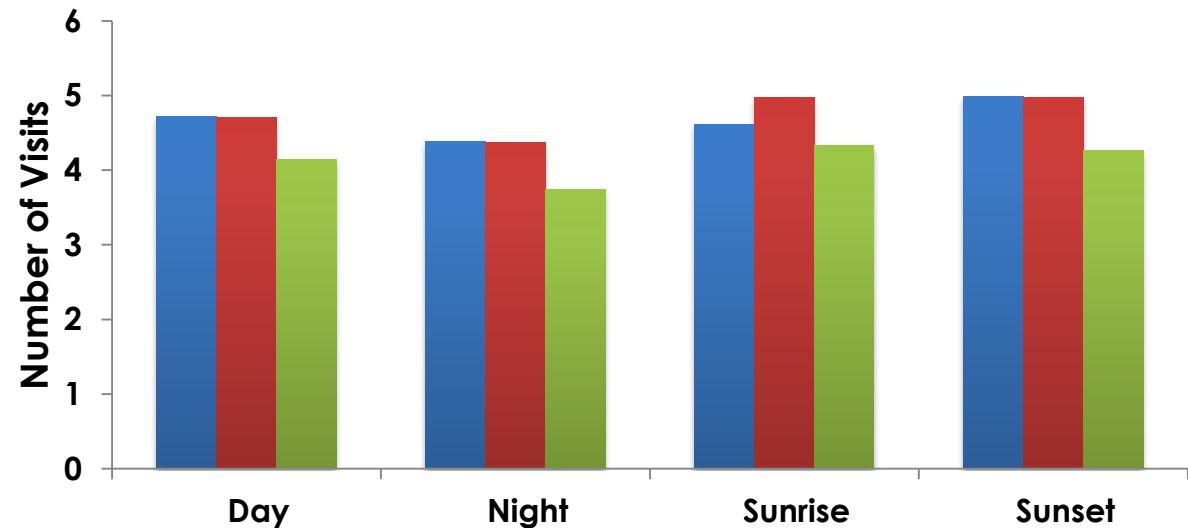
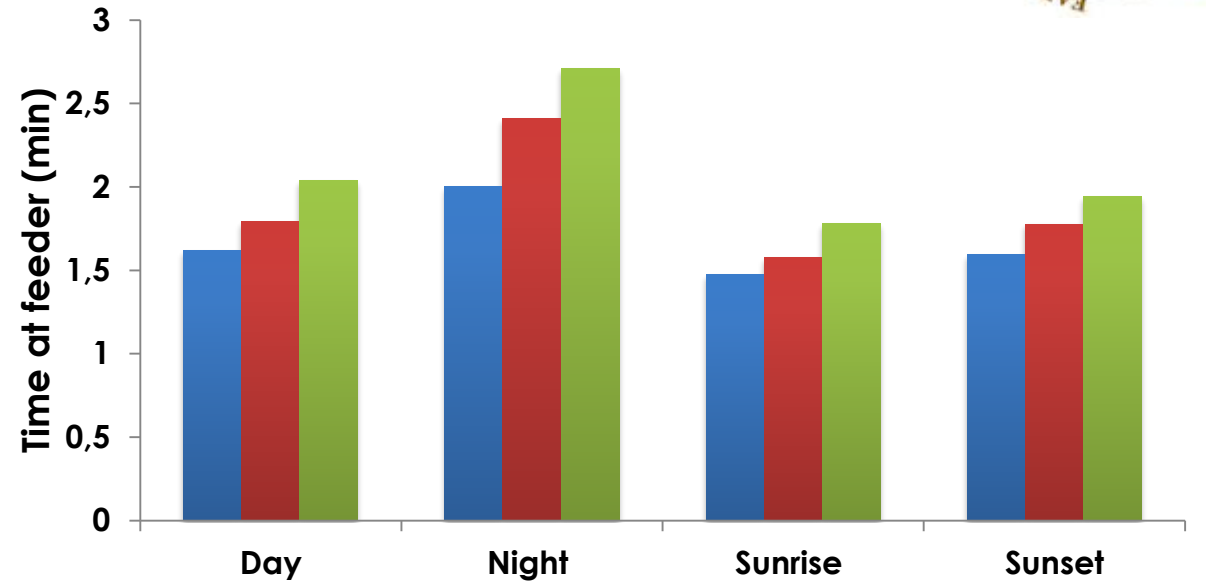
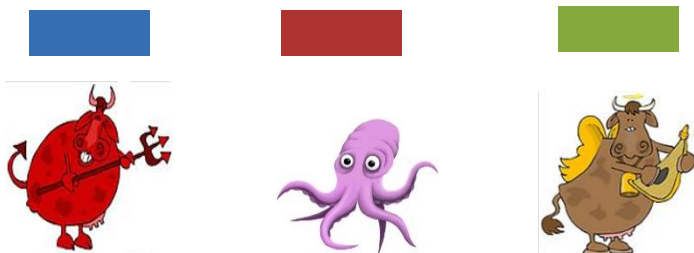
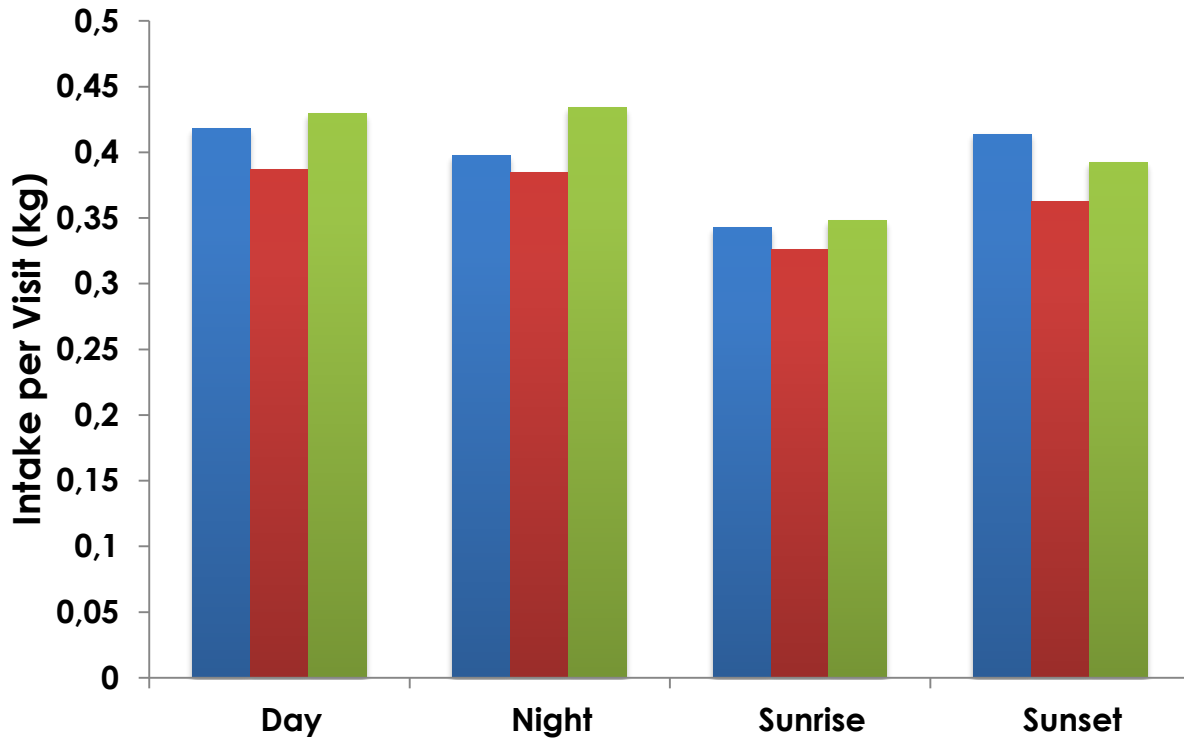
Results & Discussions: RFI groups & pressure



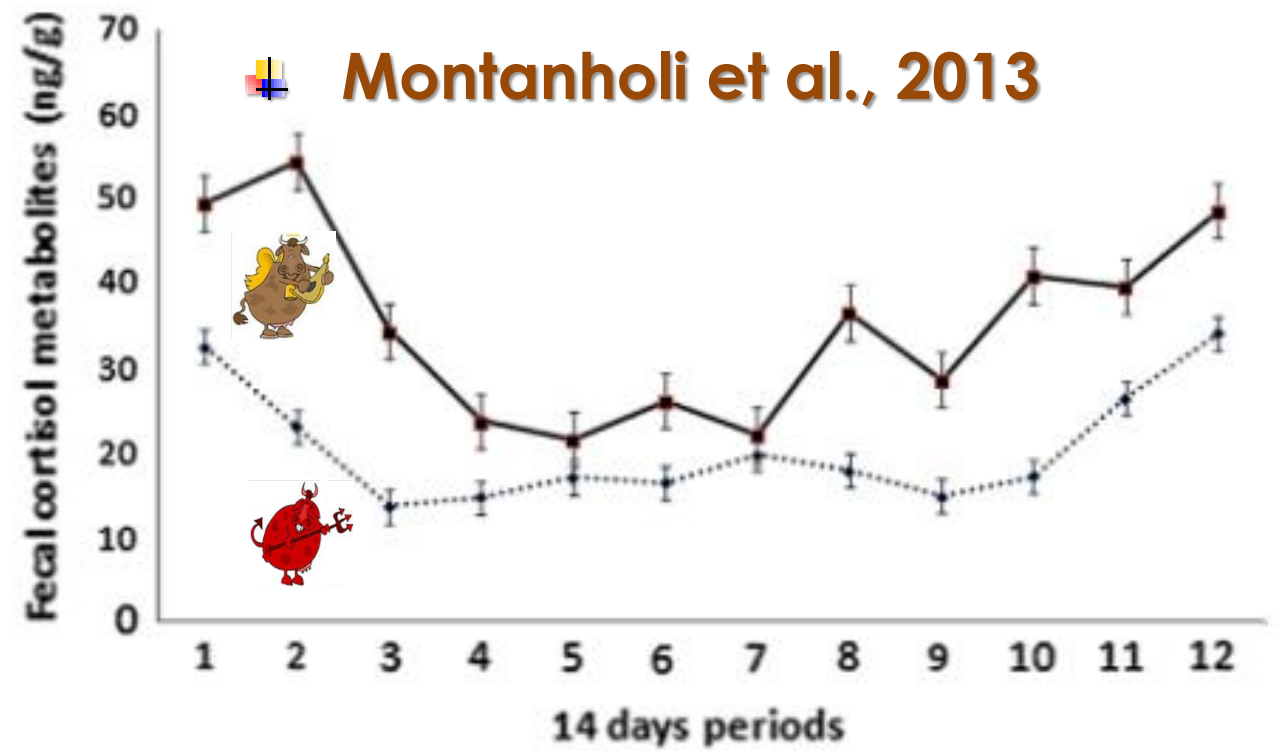
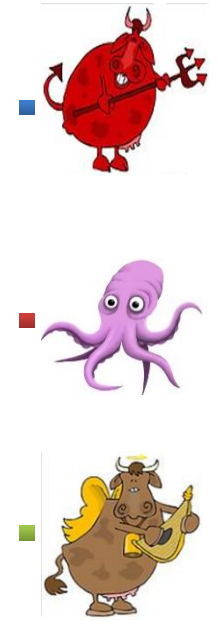
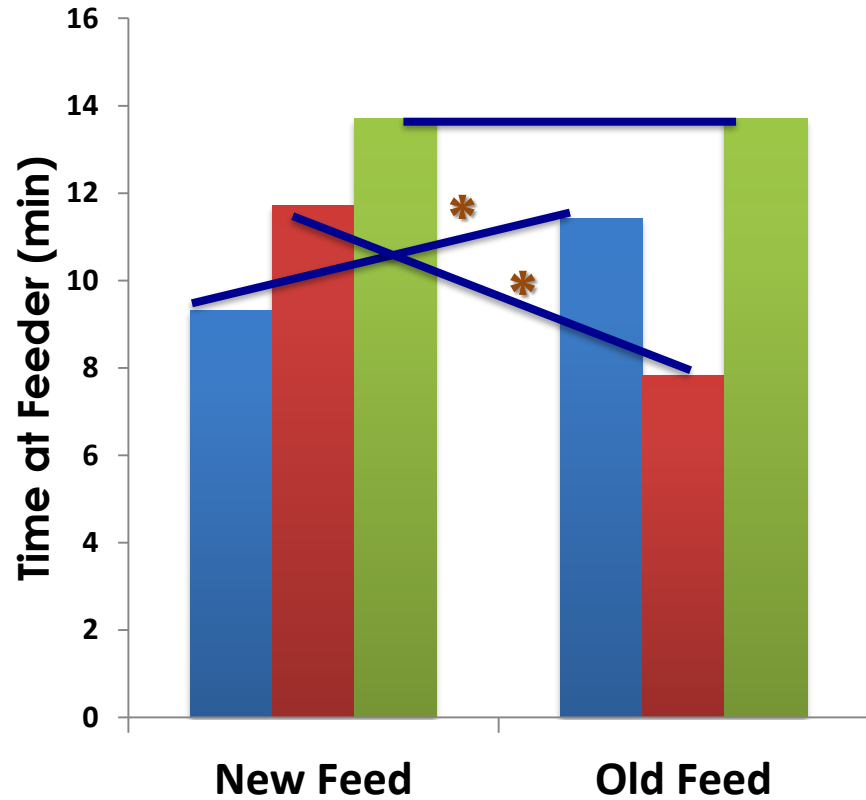
Results & Discussions: Inefficiency & weather



Results & Discussions: RFI groups & day periods



Results & Discussions: RFI groups & feeding status



Mooring et al. 2006



Conclusions:

Temperature
Humidity



Atmospheric pressure

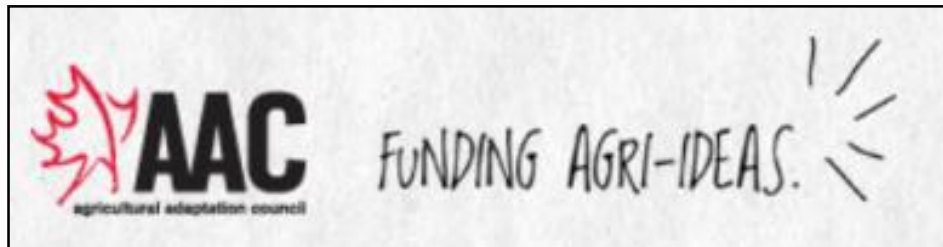
Temperature
Humidity



Feed efficiency relates to getting served at the dinner table first!

MANAGEMENT IMPLICATIONS

Acknowledgments



NDSU

Got interested?



Yuri.R.Montanholi@gmail.com



Yuri Montanholi



BosTaurus Efficiency

