

'Towards' using grazing markers to determine grazing intake

Ron Lewis

Department of Animal and Poultry Sciences

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Cow efficiency

An efficient cow herd has:

- high reproductive rates
- early sexual maturity
- longevity
- minimum maintenance requirements
- ability to convert available energy from forage into calf weaning weight

(Dickerson, 1970)



Maintenance costs

- ~ 65% total beef production costs due to feed
- ~ 70% total energy consumed by cow-calf sector
- ~ 75% cow's total annual energy requirement for maintenance
 - varies appreciably

(Ferrell and Jenkins, 1985)

Challenge



Today's talk

- Plant-wax markers
 - Measurement
 - Prediction
- Our process
 - Validation
 - Additional markers
 - Extension to pasture
- Summing up



Plant cuticular wax

- Wax on external surface of plants
 - Complex mixture with chemical composition that differs appreciably among plant species
- *n*-alkanes (hydrocarbons)
 - Over 90% have odd-numbers of carbons (C_{29} , C_{31} and C_{33} predominant)
 - Relatively inert and 'easy' to assess

(Dove and Mayes, 2005)

Measurement

- Plant
 - Assess *n*-alkane profiles of plants
- Animal (fecal sample)
 - **Diet composition**
 - Assess *n*-alkane profile of fecal sample
 - **Feed intake** (and whole-diet digestibility)
 - In addition, dose with even-chain *n*-alkane (C₃₂)

Prediction

○ Diet composition

- Match n -alkane concentrations in feces with combinations of plant profiles

○ Feed intake (I)

$$I = \frac{\text{Dose rate}_j}{\left(\frac{F_j}{F_i}\right) \times (H_i - \text{herbage content}_j)}$$

i – odd-chain n -alkane

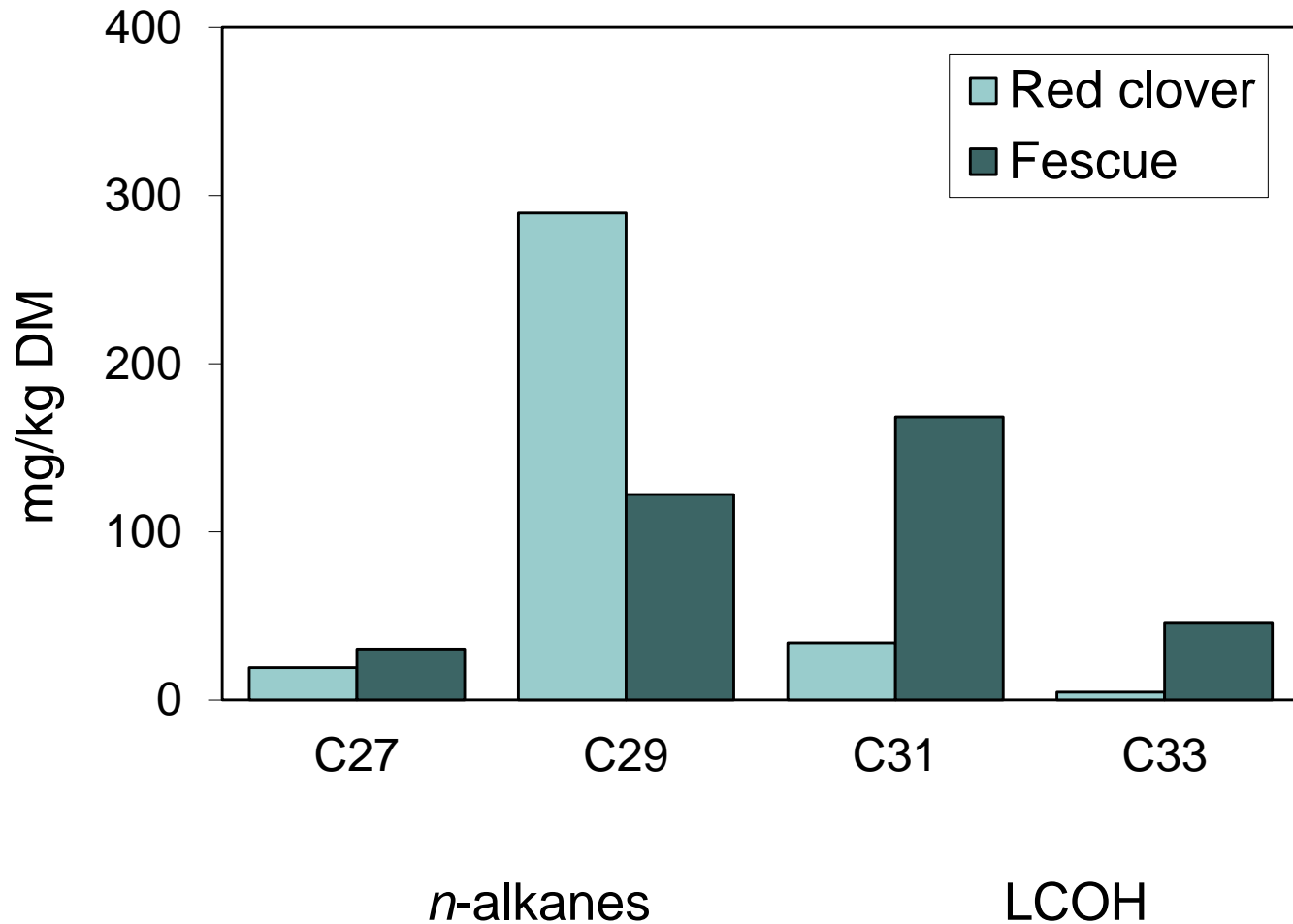
j – odd-chain n -alkane

Our process

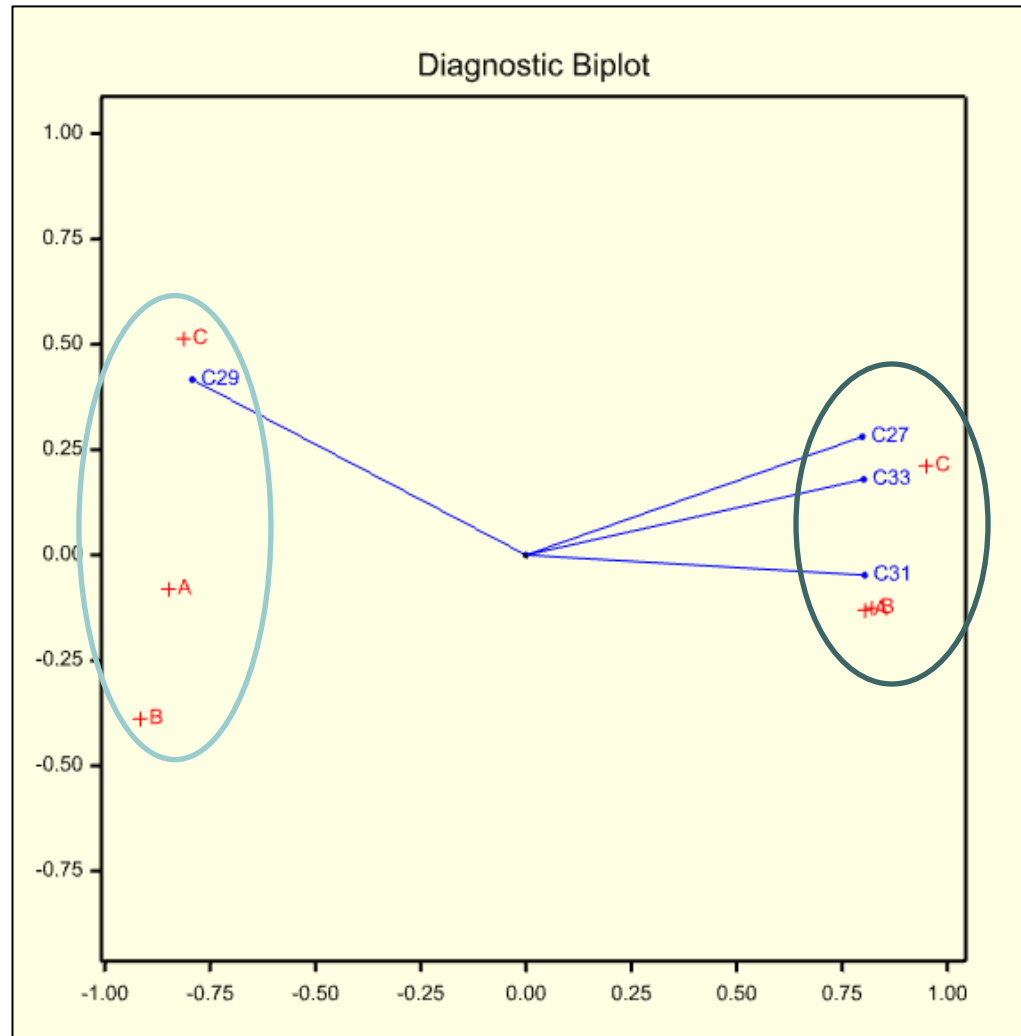
- Validation (*n*-alkanes)
 - Characterize plants
 - Predict diet composition
- Additional markers
- Extension to pasture
 - Fecal sampling
 - Dosing



Characterize plants (simple mixture)

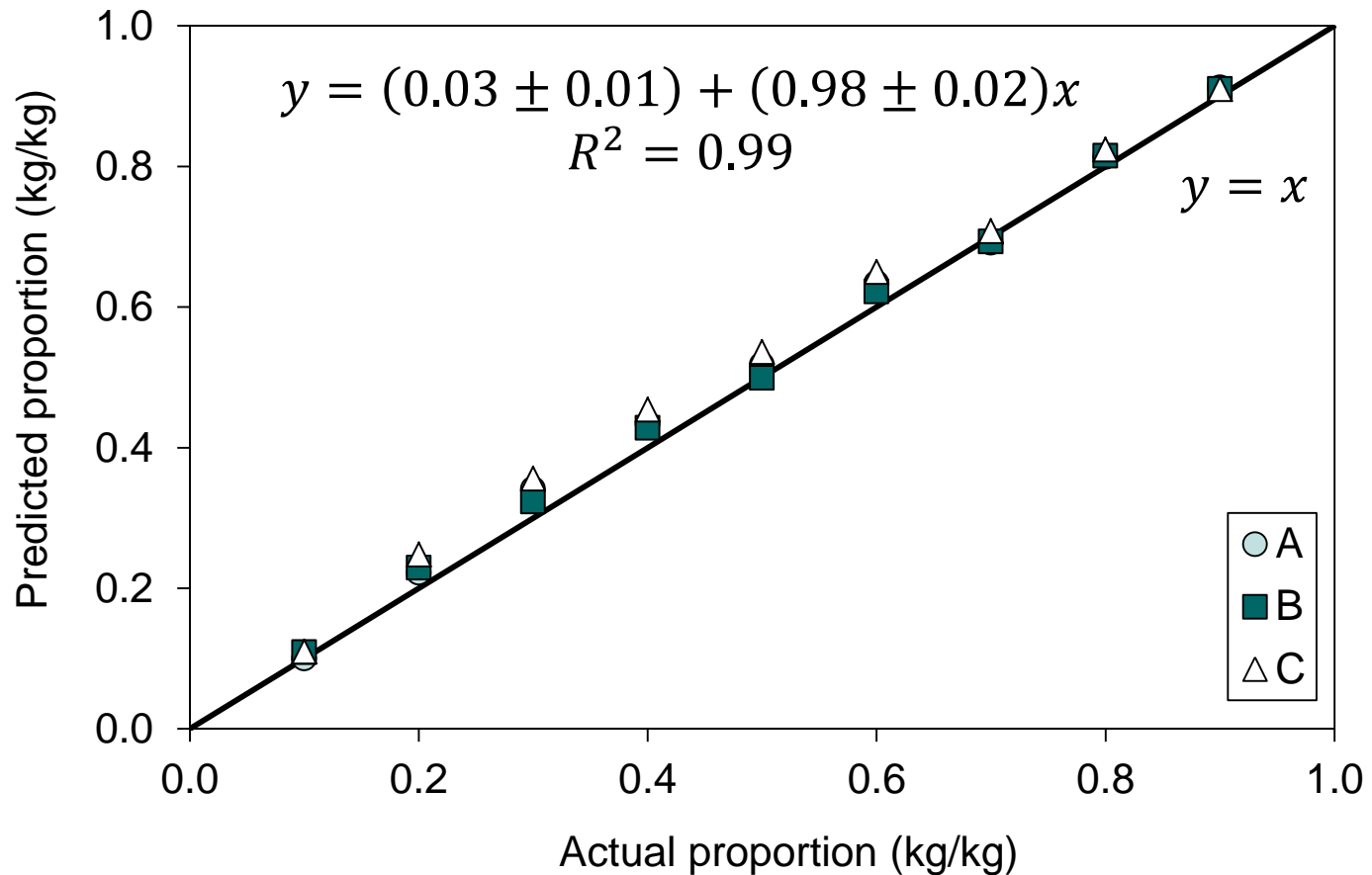


Characterize plants (simple mixture)

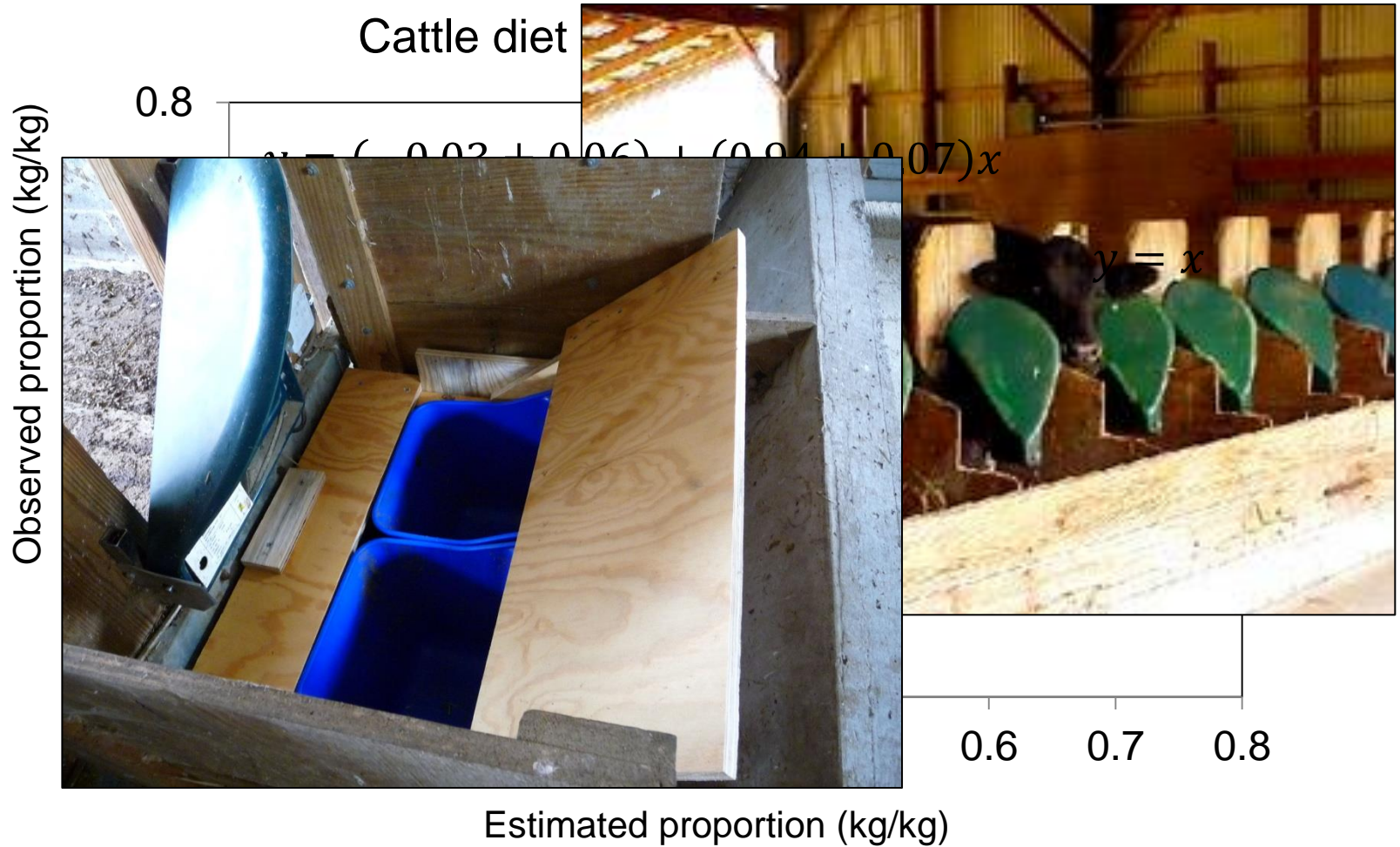


Characterize plants (simple mixture)

Test diet composition: fescue proportion



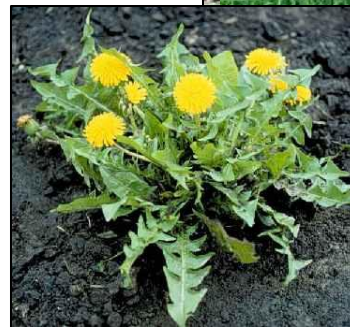
Predictions (simple mixture)



Characterize plants (complex mixture)

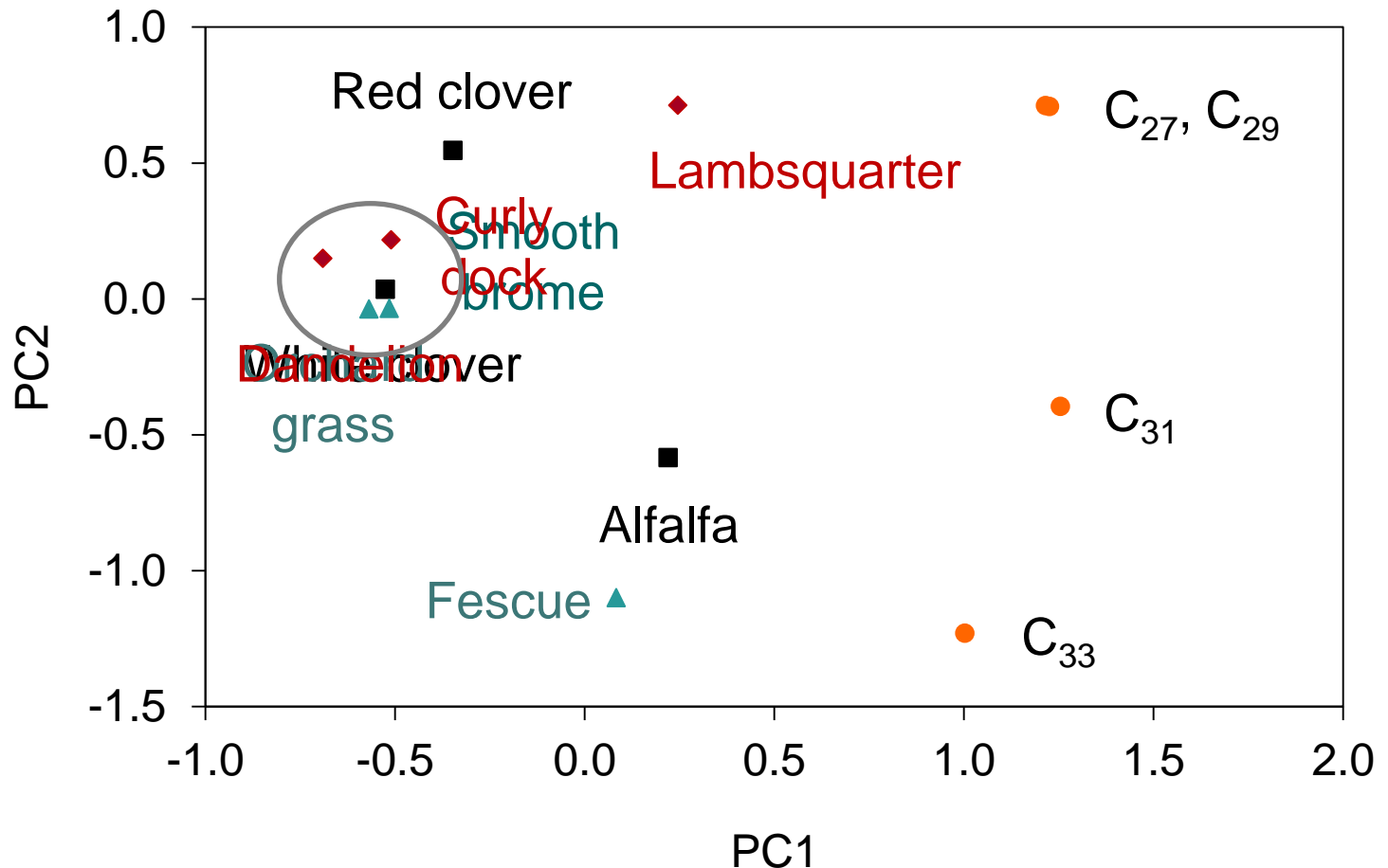
Forage

- Alfalfa
- Clover
 - Red
 - White
- Fescue
- Orchard grass
- Smooth brome



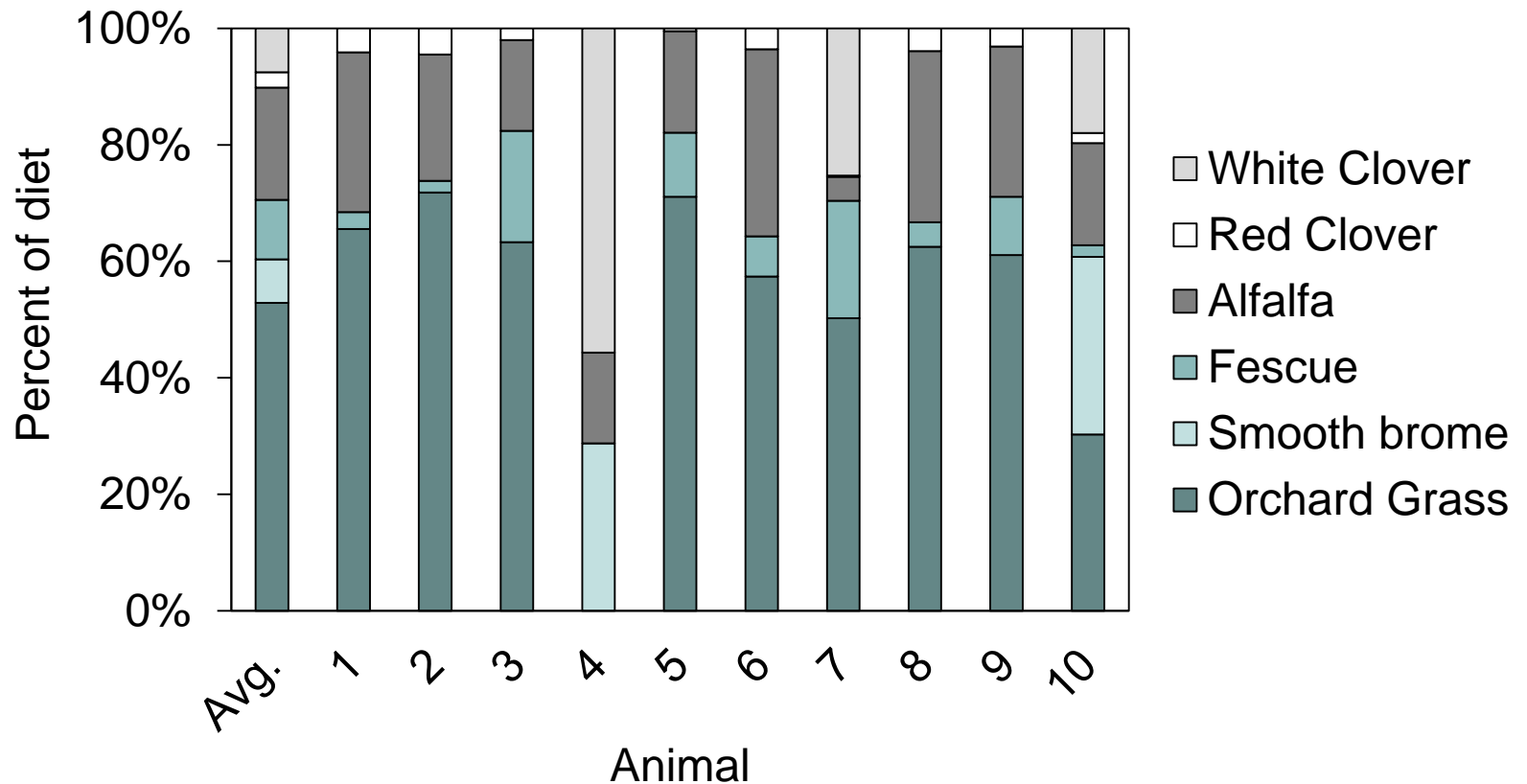
○ Dandelion
○ Smooth brome

Characterize plants (complex mixture)



Prediction (complex mixture)

Cattle diet composition: mixed plants

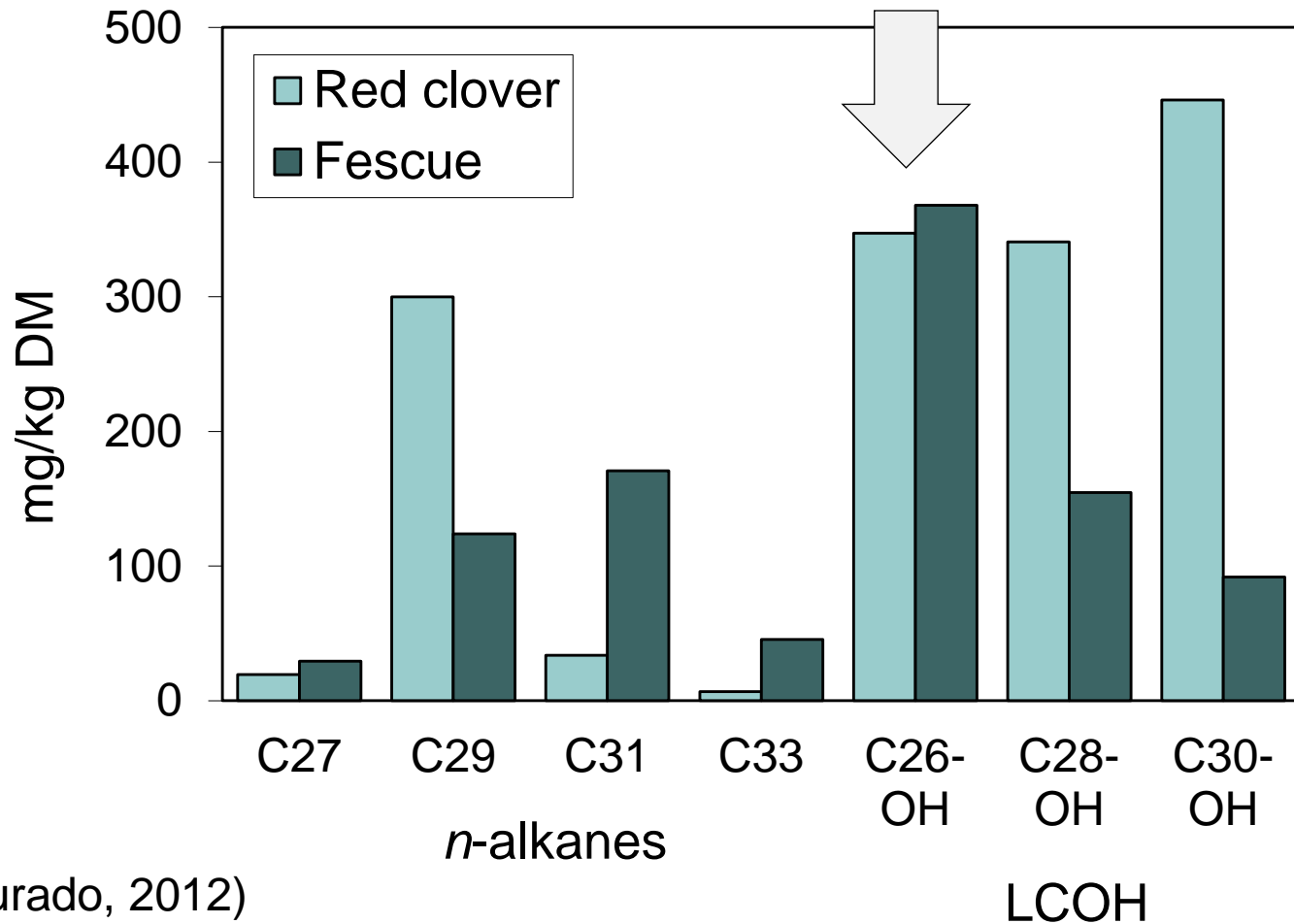


Additional markers

- Long-chain fatty acids
 - Even-numbers of carbons
 - C₂₀ – C₃₂ exclusive to plants with high fecal recoveries
- Long-chain alcohols (LCOH)
 - Primarily even-number of carbons with high fecal recoveries
 - Wide variation in patterns across plants

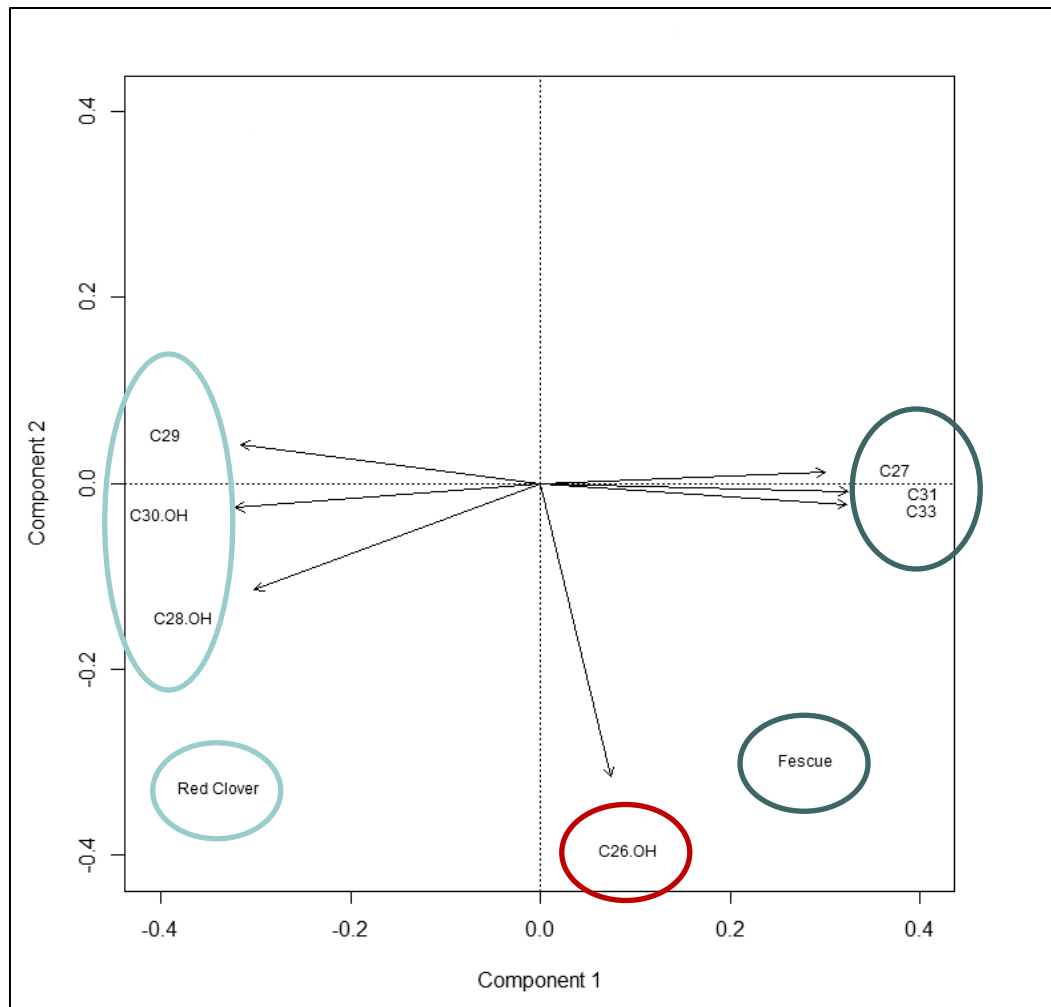
(Dove and Mayes, 2005)

Characterize plants (simple mixture)



(Vargas Jurado, 2012)

Characterize plants (simple mixture)

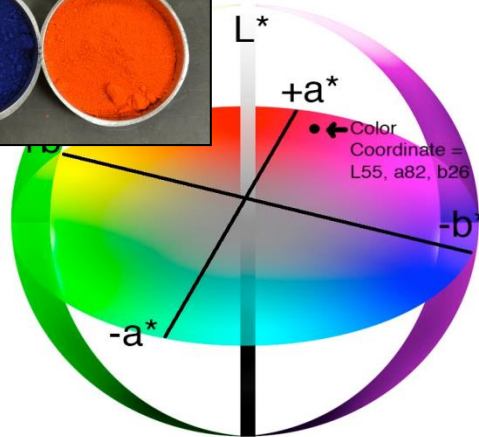


Extension to pasture: dosing



Extension to pasture: sampling

- Need to link fecal sample to an animal



Day 2



Day 3

Extension to pasture: sampling



Summing up

- Understanding cow efficiency would benefit from measures of diet composition and intake at pasture
- Plant-wax markers, with refinements, offers opportunities to achieve that aim

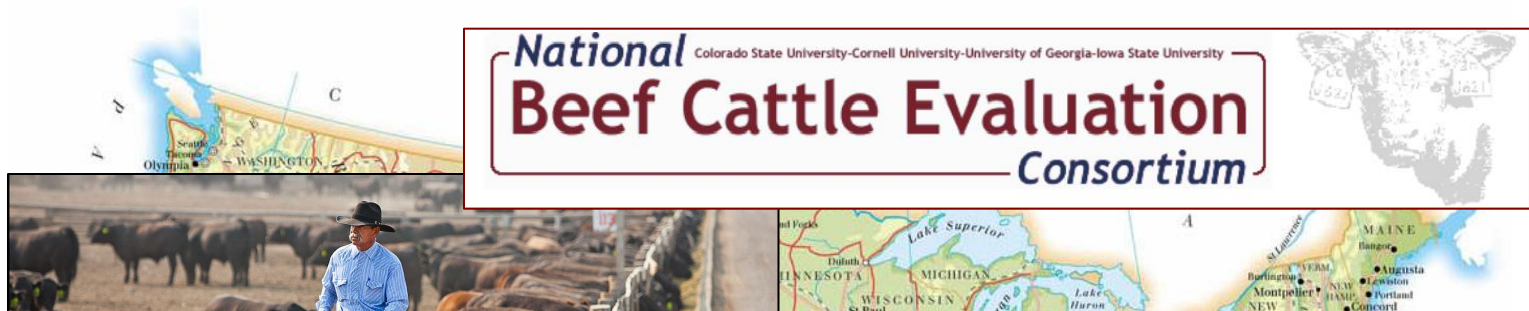


Summing up

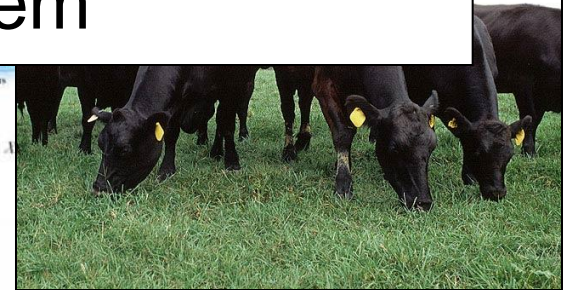
- If scalable, such information may contribute to
 - pasture management systems
 - animal selection decisions



Summing up



- National sire (bull) testing program
 - Progeny tests within feedlot and pasture-based systems
- Evaluate 'sensitivities' in feed efficiency relative to production system



Thanks for listening

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Faculty/Staff

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Graduate student

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Patricia Helsel

Annie Laib

Jaime Rutter

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USMARC

Harvey Freetly

Heidi Hillhouse

John Keele

Larry Kuehn

Sam Nejezchleb

