The Relative Forage Quality: Animal Allocation

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Importance of Digestible Fiber

- Use of empirical equations
  - For many years we estimated forage energy content from single analyte

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Sampling of Empirical equations

- From Western Region
  - %TDN = 82.38 - (0.7515 x ADF)
- From Pennsylvania
  - %TDN = 4.898 + (89.796 x NEL)
  - NEL (Mcal/lb) = 1.044 - (0.0119 x ADF)
- From Midwest
  - %DDM = 88.9 - (0.779 x ADF)

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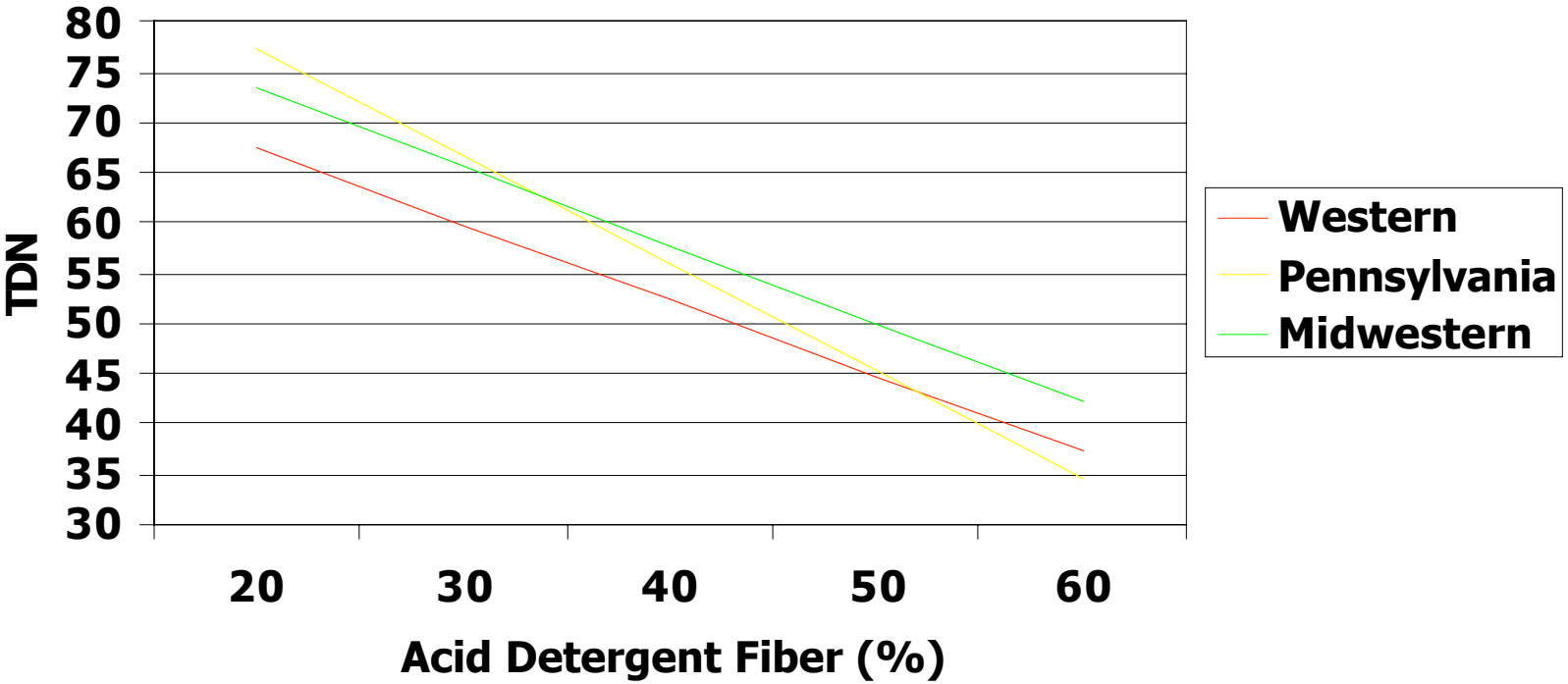
TDN Estimates from Different Empirical Equations



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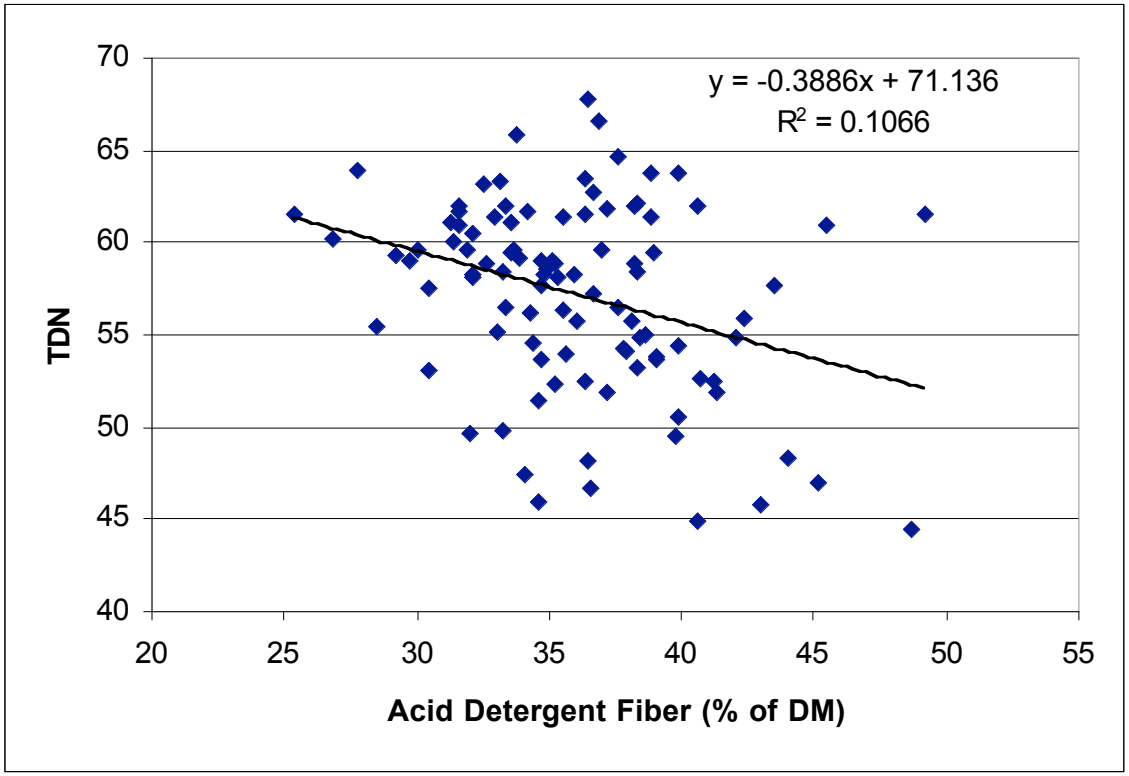
Comparison of ADF to Summative TDN



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NRC (2001) Dairy Approach to Predicting TDN of Forages

- Uniform feed fractions will have predictable digestion coefficients

$$TDN_{1-X} = tdCP + (tdFA \times 2.25) + tdNDF + tdNFC - 7$$

+ *A more accurate and robust way to estimate TDN of forages than ADF*
- *TDN values estimated by NRC(2001) are different than what we are used to.*

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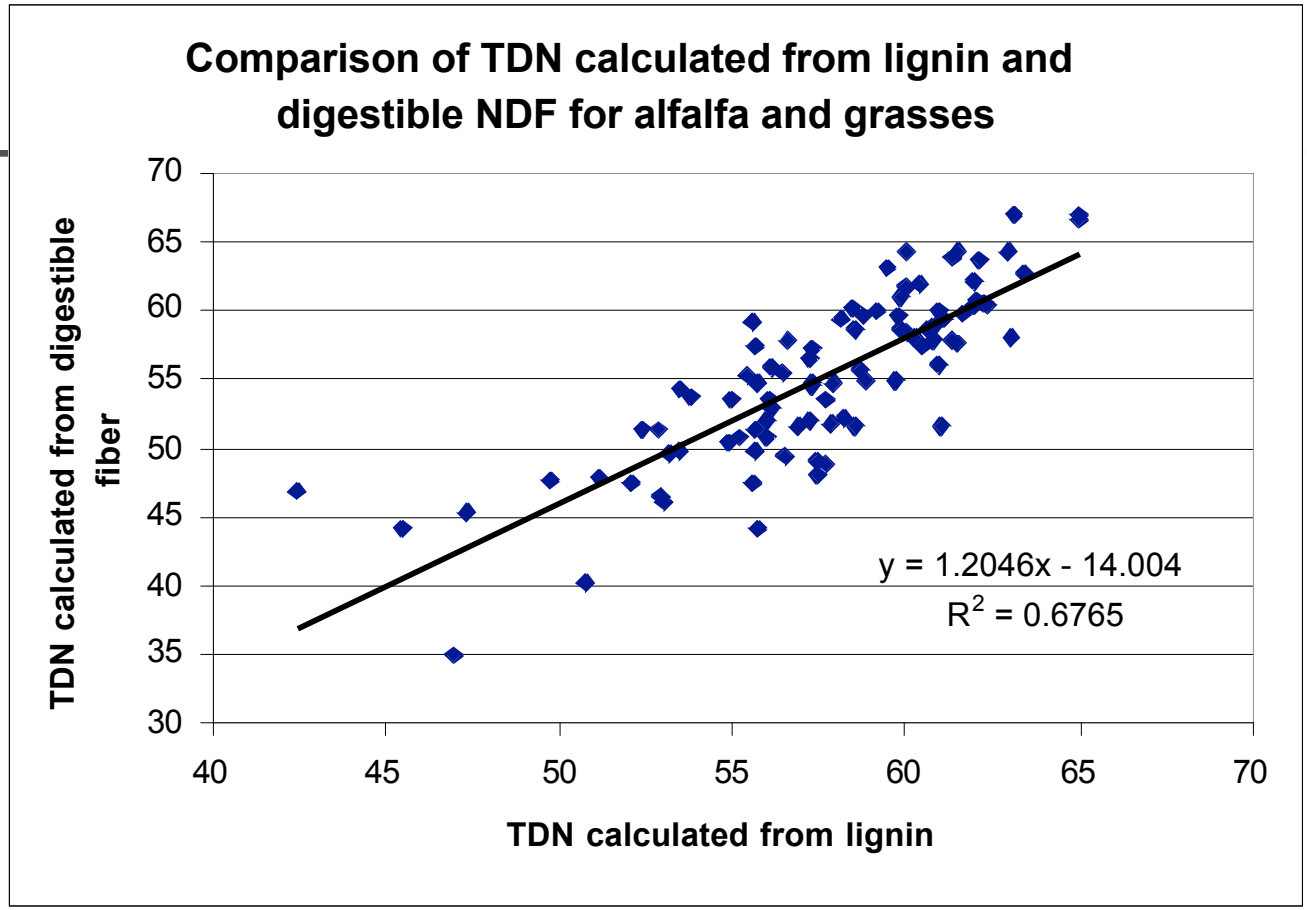

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Why use in vitro instead of empirical estimates of NDF digestibility?

- In Vitro estimates are based on direct measure of fiber degradation
- NIR calibration statistics are higher for in vitro estimates than wet chemistry NDFn and lignin

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Relative Feed Value

- Is index of forage quality
- Relative to full bloom alfalfa

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Relative Feed Value =

$$\frac{\text{(Intake Potential * Digestible DM)}}{\text{Constant}}$$

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Relative Feed Value (Current)

Intake Potential = 120/NDF

Digestible DM = 88.9 - (0.779*ADF)

Constant = 1.29

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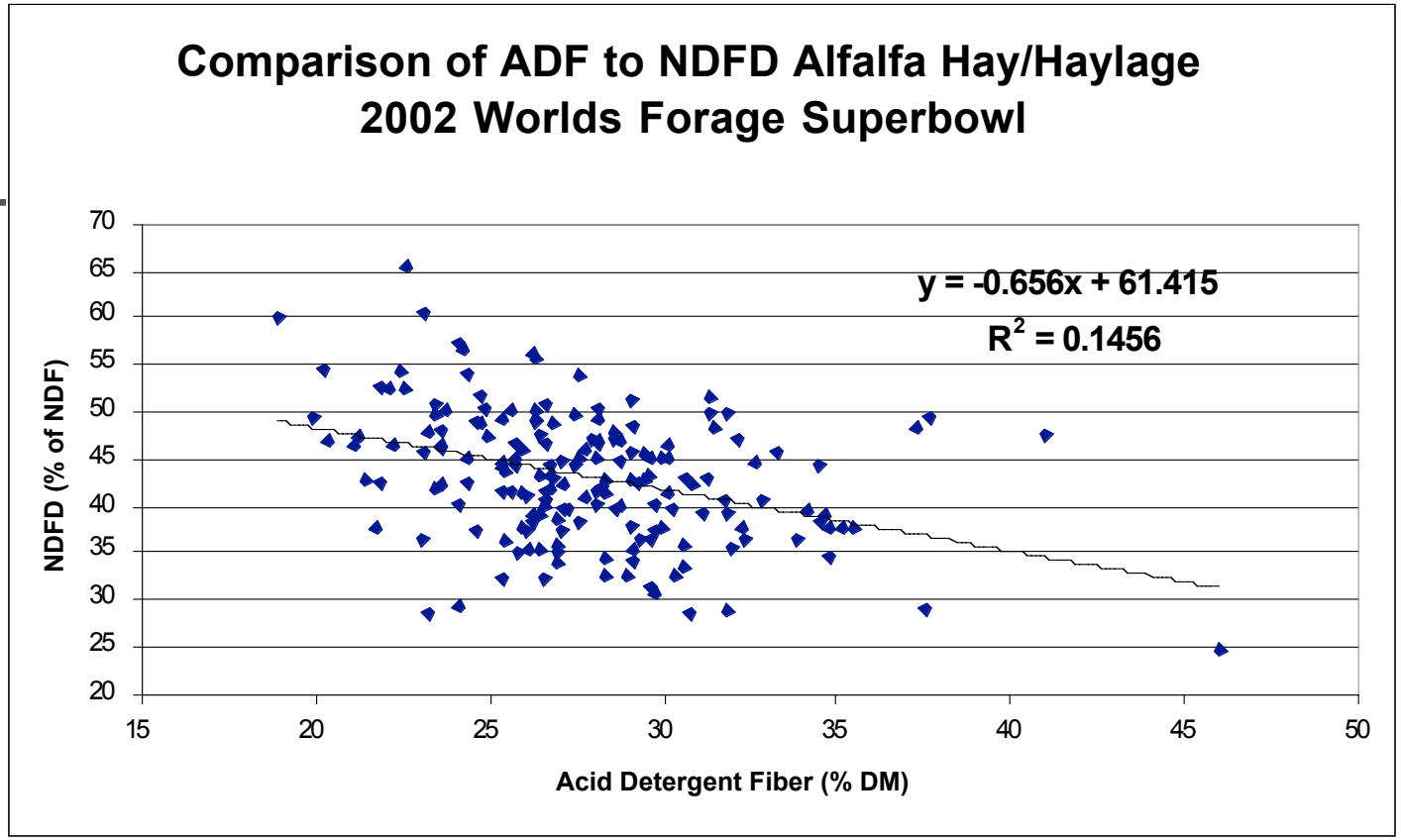

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Relative Forage Quality (RFQ) =

$$\frac{(\text{dIntake Potential} * \text{dTDN})}{\text{Constant}}$$

Relative Forage Quality

Intake potential

= base intake plus adjustment for dNDF

= 120/NDF + ((dNDF-average dNDF) *.374)

From Oba and Allen, 1999, J Dairy Sci

Relative Forage Quality

Intake potential

= base intake plus adjustment for dNDF

= 120/NDF + ((dNDF-average dNDF) *.374)

=(120/NDF) + (NDFD-45)*0.374*1350/100

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Relative Forage Quality

Total Digestible Nutrients (dTDN)

= dNFC + dCP + dFA*2.25 + dNDF - 7

= [(NFC*.98) + (CP*.93) + (FA*.97*2.25) +

NDF * NDFD] - 7

From NRC, 2001

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Relative Forage Quality (RFQ)

$$RFQ = \frac{\text{dIntake potential} * \text{dTDN}}{1.23}$$

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Influence of NDF digestibility on forage energy

$$TDN = tdCP + (tdFA \times 2.25) + (.75 \times NDFD_{48} \times NDF) + tdNFC - 7$$

	NDF	ADF	$NDFD_{48}$	TDN	DDM*
Forage A:	40	30	58	61.6	65.5
Forage B:	40	30	36	53.6	65.5

*DDM = 88.9 * .779(ADF)

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Influence of NDF digestibility on dry matter intake

dIntake = base intake plus adjustment for dNDF
*= base intake + (NDFD-average NDFD) * .374)*

	NDF	ADF	NDFD	dIntake†	DMI*
Forage A	40	30	58	31.0	37.5
Forage B	40	30	36	22.8	37.5

†Oba and Allen, 1999. J. Dairy Sci. 82:589-596

*DMI = 120/NDF

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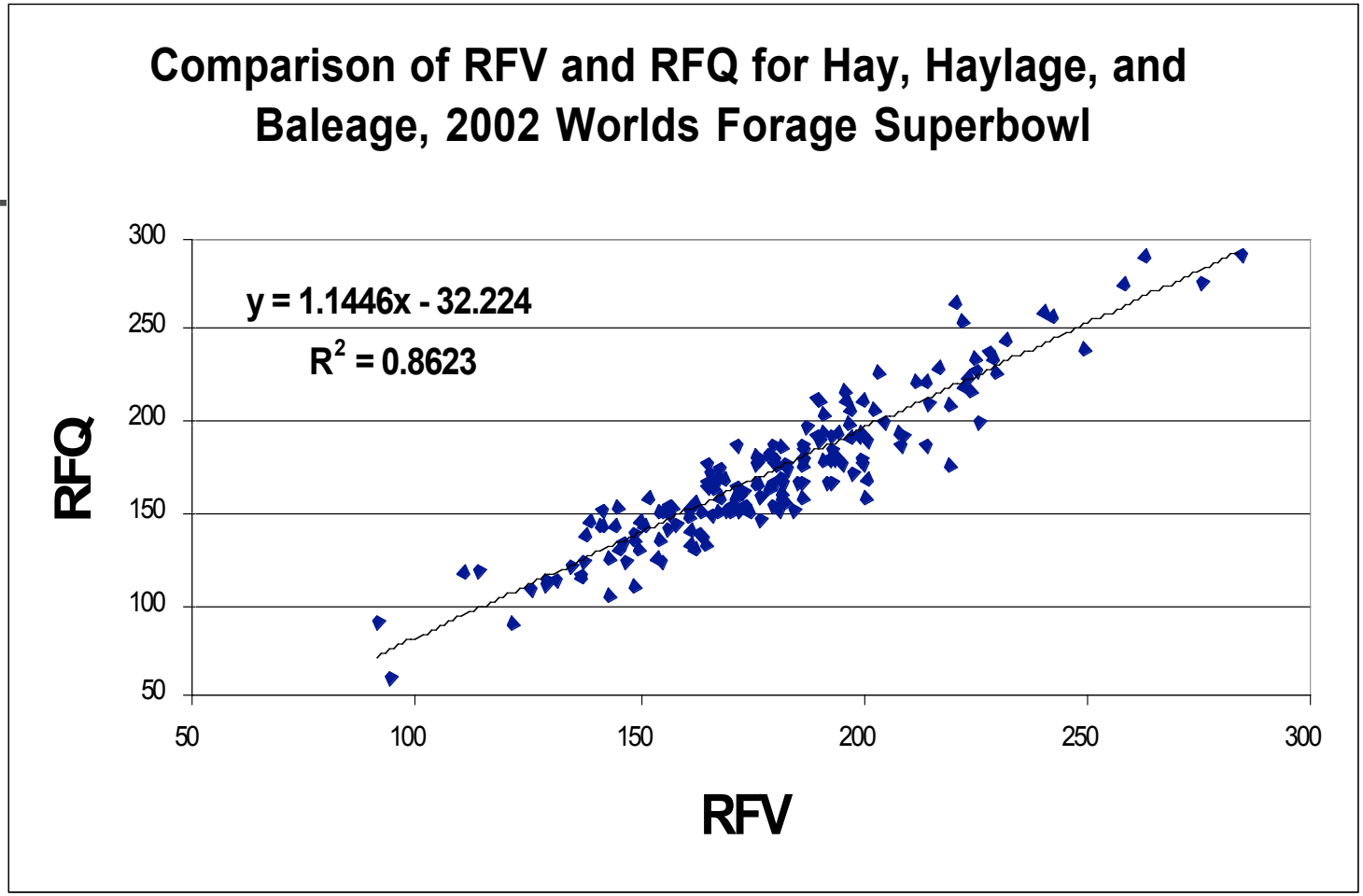

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Comparison of RFQ to RFV

- Was highly correlated (r^2 = 0.86)
- Had similar mean (RFQ=174, RFV=179)
- Had similar response (slope of line was 1.14)
- However, 22% of samples varied by over 20 points and individual samples varied by up to 40 points either way.

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Uses of Relative Forage Quality

- When to harvest
- Allocation of hay to animals
- Buying/selling hay
- Contracting for harvest with quality incentive

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Implications

- **Better linkage between forage quality and cow response**
- **ADF is eliminated**
- **All forage species predicted equally well**
- **Variance of forage quality is increased**
- **Heat damage results in lower energy predictions**
- **Mature forages = very low energy contents**

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Further Information

www.uwex.edu/ces/forage