



Can NIR be as good or better than wet chem?

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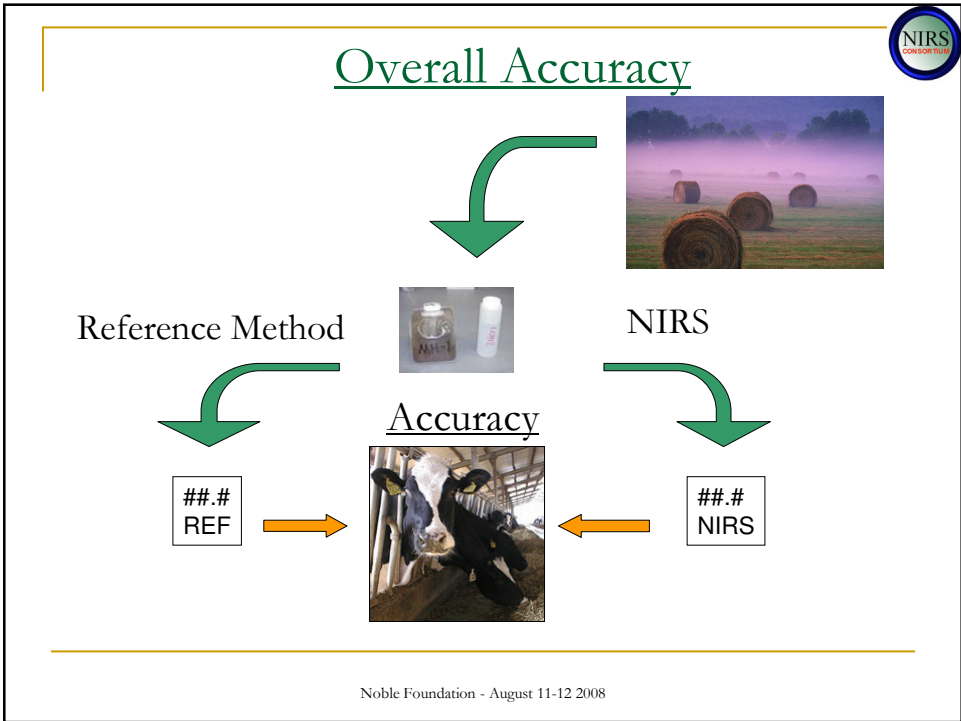
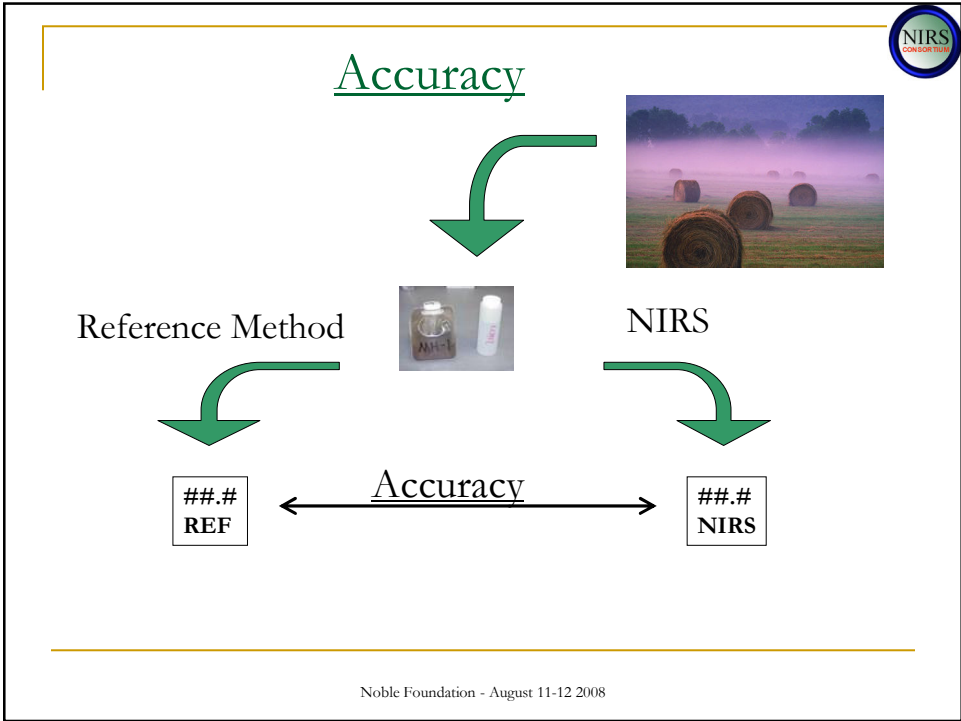
Near infrared (NIRS) vs. Reference Analysis



NIRS is a secondary method based on regression using a primary method (reference data).

An NIRS prediction can **NEVER** be more accurate than a reference analysis.

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Forage variability

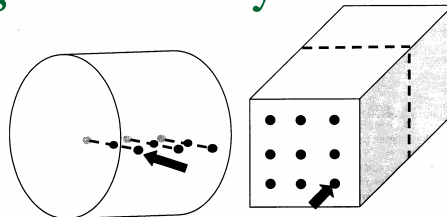


Figure 1. Sampling patterns of round and rectangular bales.

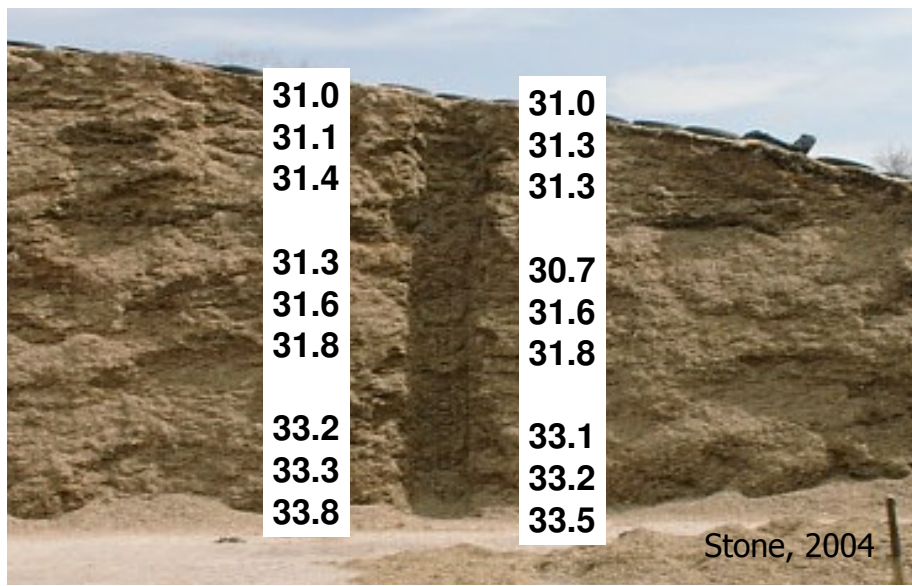
Variability of alfalfa hay bales

constituent	AVG	SD btwn bales	Min - max Btwn bales	SD Wthn bales
NDF	40.2	2.0	36.3 – 44.1	2.1
CP	17.2	0.8	15.7 – 18.7	0.8

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Collins, 2000

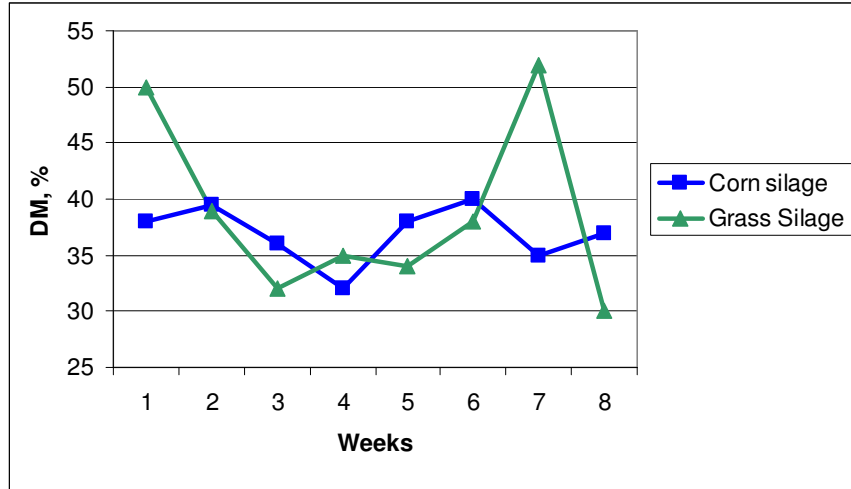
Corn Silage DM – Sampling and Laboratory Consistency Evaluation



Stone, 2004

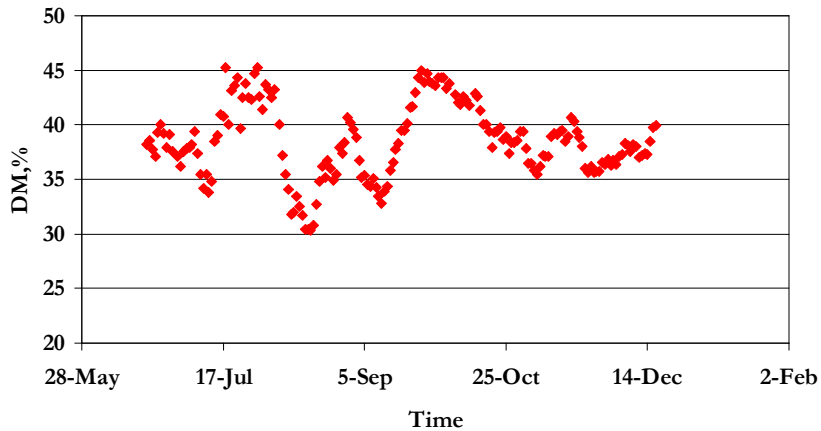


Changes over time



Variation in forages over time

Changes in DM content of Alfalfa haylage – USDFRC Paire du Sac



(modified from Undersander et al., 2005)
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Effects of forage DM changes

Feed	kg/d
Corn Silage	26.0
Grass hay	2.0
HMC	3.0
Ground Corn	2.0
Cotton seed	1.5
SBM	3.0
Extr. Soy	1.5
Prot-min-vit conc.	2.5
Water	2.0

Chem. Comp	CS DM	
	38%	32%
As is, kg	43.5	43.5
DM, kg	23.1	21.5
DM, %	53.1	49.5
CP, %	16.4	17.1
NDF%	30.9	29.9
Starch,%	26.4	26.0
EE%	4.9	5.1
ASH%	8.6	8.5
¹ Milk. Kg/d	40.5	38.5

¹ Predicted by the Dairy NRC 2001
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Feed delivery and bunker management

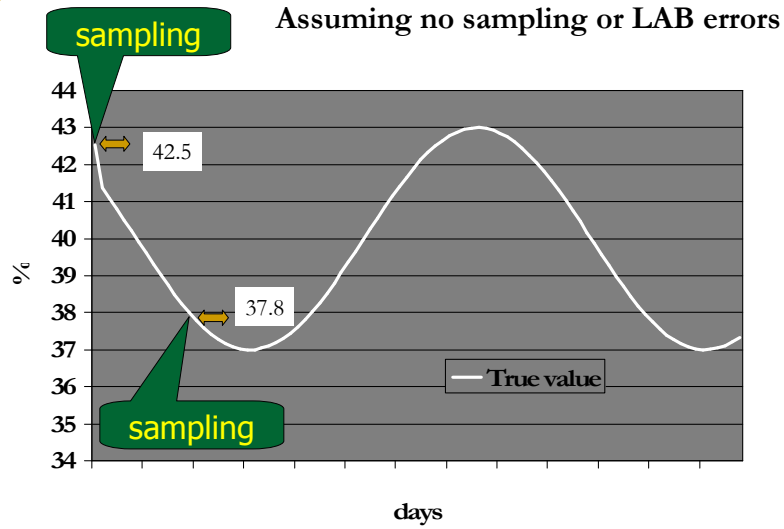
Consistency of feed delivery

- Chemical composition
- Amount
- Time of delivery

Feed delivery	Constant	Variable \pm 10%
Ruminal pH	5.73	5.63
Time at pH <5.5	--	++

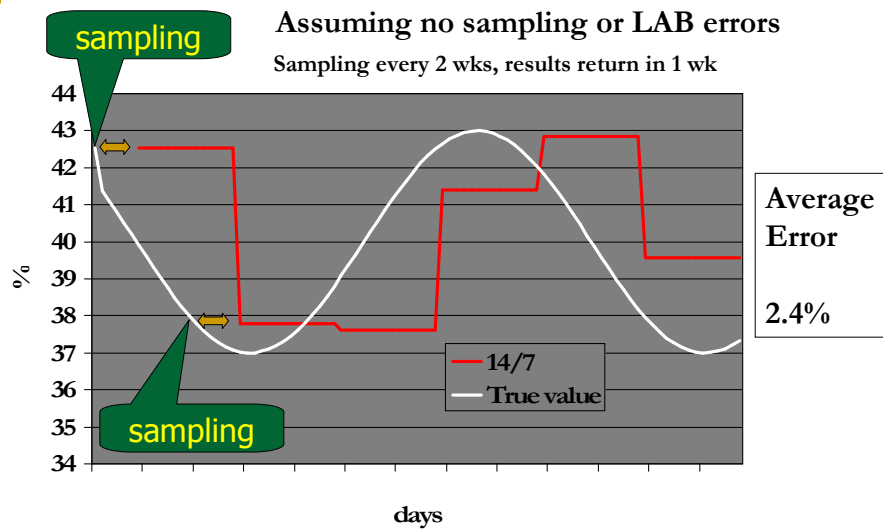
Schwartzkopf-Genswein et al., 2004
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Accuracy also depends on frequency of analysis



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Accuracy and changes in feed composition



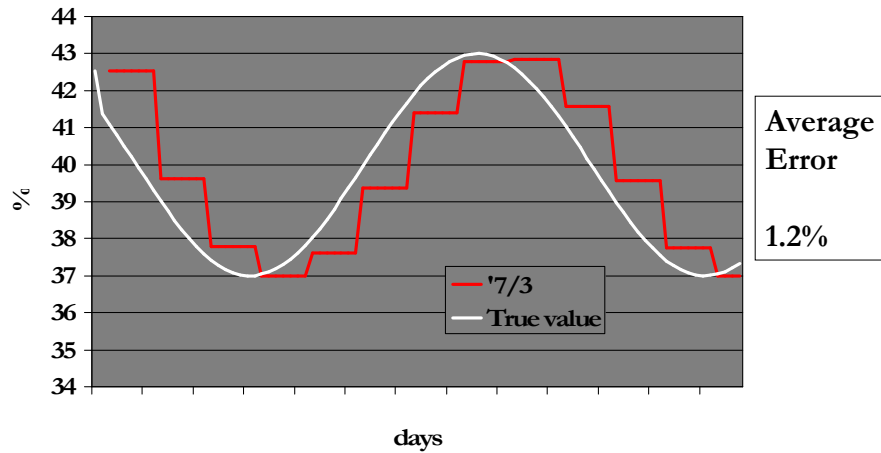
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Accuracy and changes in feed composition



Assuming no sampling or LAB errors

Sampling every 7 days, results return in 3 day



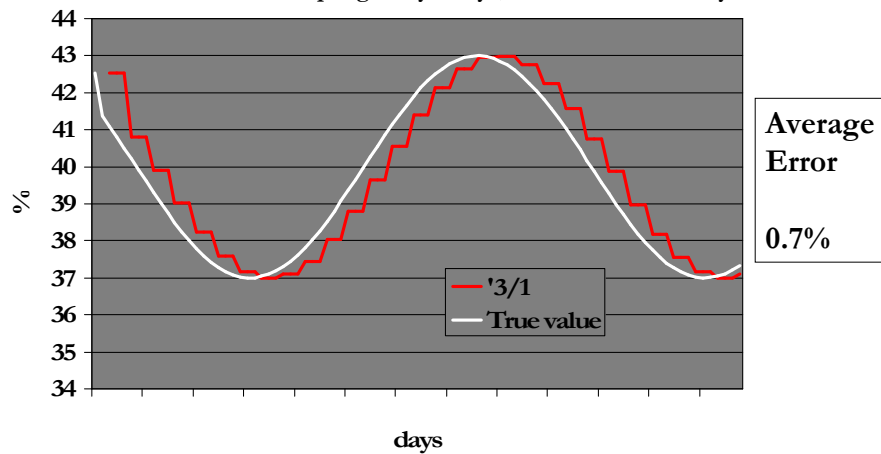
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Accuracy and changes in feed composition



Assuming no sampling or LAB errors

Sampling every 3 days, results return in 1 day



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Overall accuracy



- Variability within a lot High
- +
- Variability over time Medium -High
- +
- Variability due to the analytical methods Medium- low

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Value of analysis: a farm experience

- Frequent adjustments would result in an increase in productivity (every 100 cows) of:
 - 1095 \$/yr with the determination of DM;
 - 2190 \$/yr with chem. analysis of forages;
 - 1095 \$/yr with complete analysis of concentrates;
- TOTAL \$4380 gained per year for 100 cows

(Tylutki et al. 2002)

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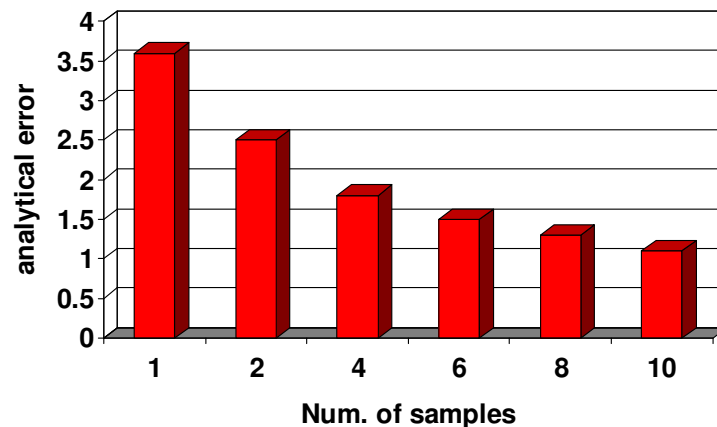
Feed analysis Error

- Assume we have a corn silage bunker:
 - NDF 45 %DM
 - Variability within bunker = 3 %DM
- Send a sample to the chemistry lab (full analysis, \$50)
 - Laboratory Error = 2%DM
- Sampling+ lab error will be equal to a SD = 3.6 %DM;
- That means most of the time the results from that bunker will be between 41.4 and 48.6 NDF% on a DM basis;

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Multiple samples reduce errors



How many farmers are willing to spend \$200 for each feed every month?

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Is it really worth spending money for analysis?

■ Without analysis our diet formulation becomes worthless

- Maximize animal performances;
- Maintaining good health conditions;
- Optimize feeds digestion;
- Maximize farm profitability;

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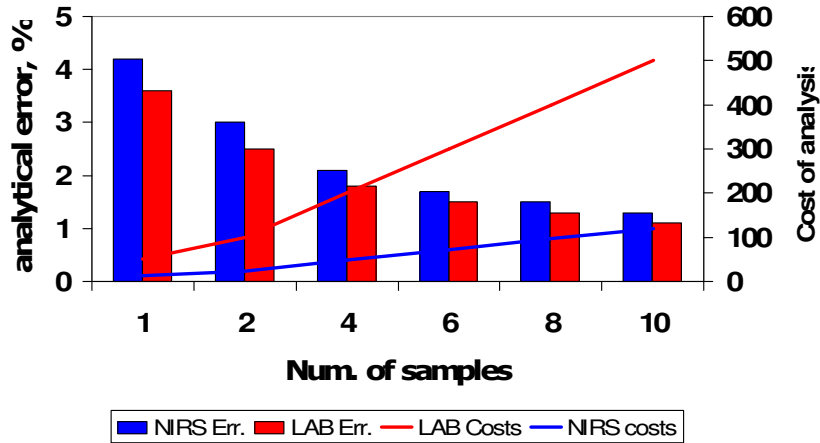


Result Errors (NIRS)

- Assume we have a corn silage bunker:
 - NDF 45 %DM
 - Variability within bunker = 3 %DM
- Sent to the NIRS (full analysis \$12)
 - Laboratory Error = 3%DM
- Overall error (Sampling+ lab) will be equal to a
SD = 4.3 %DM;
- That means that most of the times the results from that
bunker will be between 40.7 and 49.3 NDF%, DM basis;

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Multiple samples reduce errors, but increase costs



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Chemistry or NIRS

what is the return on investment of your analysis?



Chemistry	NIRS
\$50 - 1 analysis	\$48 - 4 analyses
Overall error 3.6 %DM	Overall error 2.1 %DM

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Conclusions

- Overall accuracy is a combination of different steps (sampling, time variation and lab accuracy);
- We need to spend more time and efforts to decrease and manage the largest sources of variation;
- NIRS has features (rapidity and cost) that can improve accuracy of feeding (precision feeding) without increasing costs.

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Conclusions

NIRS issues:

- Accuracy – NIRS can be very accurate, if well managed;
- In wet chemistry there are ‘good’ and ‘bad’ labs and that holds true also for NIRS labs;
- Do not judge ‘any’ lab on a single sample, a bad sample can happen in any lab;
- Find ‘good’ reference and NIRS labs and then evaluate your options

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