Feeding Cows: The Cost of Being Wrong

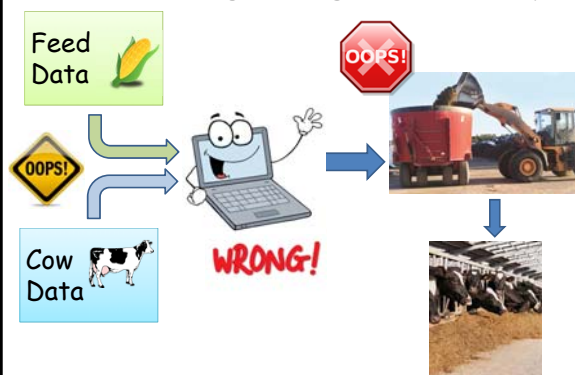THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Bill Weiss
Normand St-Pierre

Ohio Agricultural Research and Development Center   Ohio State University Extension

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Where things can get messed up

Feed Data

OOPS!

Cow Data

OOPS!

WRONG!

Feed Composition Data: Potential Errors

1. Assuming sampling/analytical variation = real change

2. Using table values rather than sampling
   - Are they right, wrong, really wrong ?

3. Assuming short term change reflects long term change

4. Ignoring a real long term change
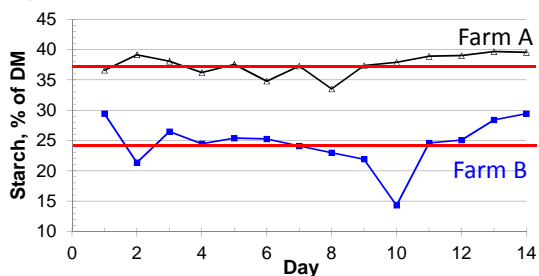

Corn Silage Starch

Farm A

Oct 3, 2016	37% starch
Oct 13, 2016	38% starch

Farm B

Oct 5, 2016	30% starch
Oct 15, 2016	15% starch

Corn Silage Starch: 2 farms

Farm A

Farm B

Starch, % of DM vs Day

Within Farm Variation
Hay Silage over 14 days

Legend: Analytical, Sampling, True Day

% of Within Farm Variance vs DM, CP, NDF, Ash

Within Farm Variation
Corn Silage over 14 days

% of Within Farm Variance

- Analytical
- Sampling
- True Day

DM, NDF, Starch, Ash

True Monthly Variation =50 to 90% of within farm variation (over 1 year)

% of Total Variance

- Samp+Assay
- True Month

Corn Silage: DM, NDF, Ash
Legume Silage: DM, CP, NDF, Ash
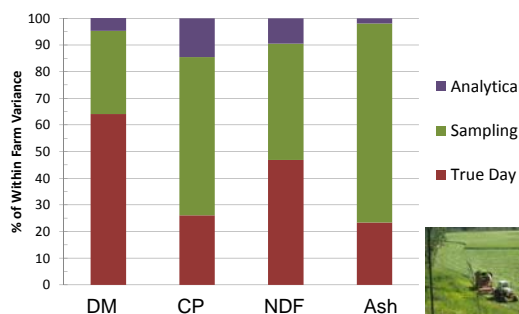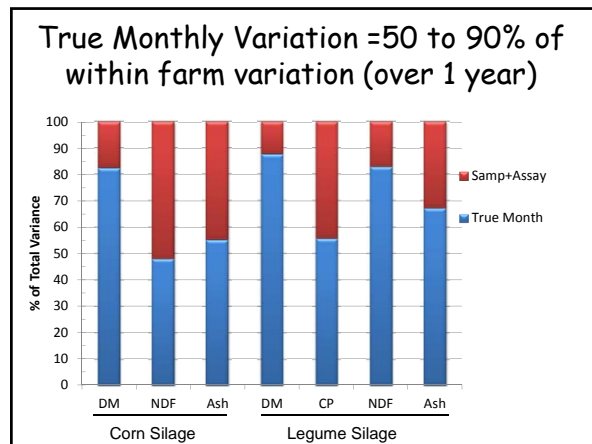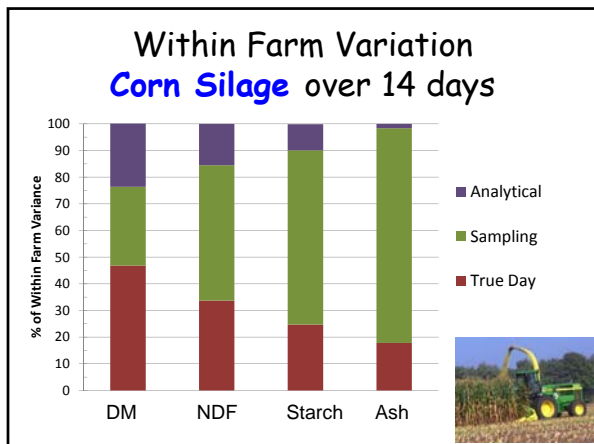
Potential Costs of 'Bad' Feed Data

1. Feed has less CP than entered: ↓milk $

2. Feed has more CP: ↑feed $

3. Feed has more starch: ↓milkfat, sick cows
     (less)   : ↓milk $

4. Feed has more NDF: ↓DMI,↓milk $
    (less)   : ↓ milkfat, sick cows

Cost of change from a balanced diet

True CP Concentration

Apparent CP Conc.	Unchanged	Decrease	Increase
Unchanged	No loss	Milk$	Feed$
Decrease	Feed$	No loss	Feed$$
Increase	Milk$	Milk$$$	No loss

Table values vs. Sampled values

Animalnutrition.org

	Mean	N	SD	CV	Min	Max
CP	19.8	50,015	3.18	16.1	8.4	31.2

Population statistics for some feeds
(forage N >100,000; Conc N > 1500)

	Mean	SD	CV[1]	Range[2]
Alf sil CP	21.5	2.2	10.3	19.3-23.7
Corn sil ST	32.9	6.4	19.5	26.5-39.3
SBM CP	52.6	1.7	3.2	50.9-54.3
Corn ST	70.9	2.4	3.3	68.5-73.3

[1] Analytical CV will be 2-3%
[2] Approximately 2/3 of samples will be in this range

Sampling Non-Forages on Farms

Dry corn, SBM, DCGF canola meal, whole cottonseed	**Farm was NOT a significant source of variation**
All wet feeds tested WCGF, WBG, WDG HM corn	**Farm was significant source of variation**
DDGS	**Farm was OFTEN not an important source of variation**

How much money are we talking about?

Alf silage @ **30% of diet**: 20% CP ± 2 units

- 2% unit less CP (20% ➡ 18%)   Δ Gross
  - Decrease milk by 2.4 lbs   -$0.40

- 2% unit more CP (20% ➡ 22%)
  - Decrease SBM by 0.8 lbs, replace with corn and hulls   -$0.12

Milk @ $16.50, SBM @$320, Corn at $3.25, Soyhull @$110

How much money are we talking about?

Alf silage @ **15% of diet**: 20% CP ± 2 units

- 2% unit less CP (20% ➡ 18%)   Δ Gross
  - Decrease milk by 1.9 lbs   -$0.31

- 2% unit more CP (20% ➡ 22%)
  - Decrease SBM by 0.3 lbs, replace with corn   +$0.03

Milk @ $16.50, SBM @$320, Corn at $3.25, Soyhull @$110

How much money are we talking about?

Corn silage @ 30% of diet: 7.7% CP ± 1 unit

- 1% unit less CP (7.7% ➡ 6.7%)   Δ Gross
  - RDP at req't before change
  - Decrease milk by 1.9 lbs   -$0.31

- 1% unit less CP (7.7% ➡ 6.7%)
 - RDP in base diet 5% excess
  - Decrease milk by 0.6 lbs   -$0.10

What about starch ?

Corn silage @ 30% of diet: 33% Starch ± 6.5 units

- 6.5% unit less starch (33 ➡ 26.5%)
  Actual diet 2% units < formulated
  NDF replace starch: DE loss = 2.5 lbs milk

- 6.5% unit more starch (33 ➡ 39.5%)
  - Maybe +2.5 lbs milk
  - Formulated diet was 30%; actual = 32%:
   Acidosis, lost fat, hoof problems … ???

If you are going to use book values for forages

1. Use best 'book' data available

2. Over formulate for MP
   - At >15% inclusion: Book CP – 1 SD

3. High starch diets with corn silage
   -Consider Book CS starch – 1 SD

4. Moderate starch diet
   - Use book value
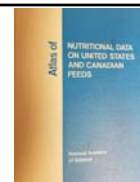
Using Assayed Values

1. Make sure it reflects what is going to be fed over several days

2. Before reformulating have some confidence feed really changed

3. Know within farm variation

4. Means are usually less wrong, than a single data point

Hay Silage NDF, 3 farms

Do Diets Have to Be Correct Every Day?

Avg fNDF = 25%
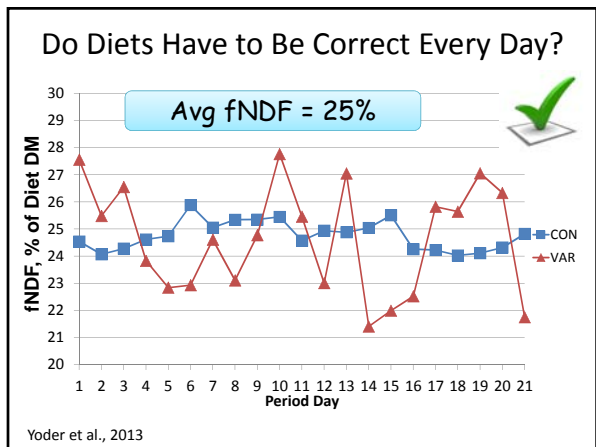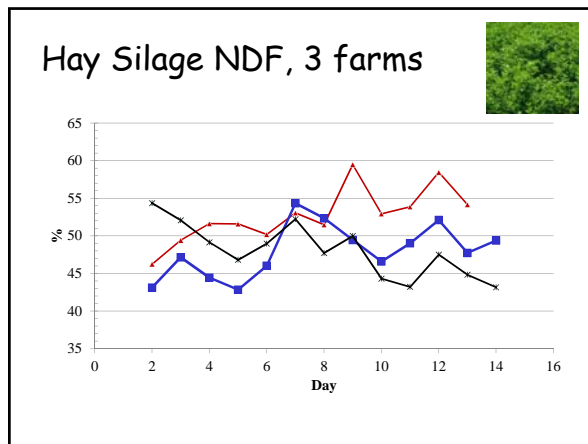
Yoder et al., 2013

You don't need a perfect diet every day, but you can't be wrong forever

	Control	Variable
DMI, lbs/day	53.9	53.4
Milk, lbs/day	94.2	94.8
Milk (mature) lbs/d	106.2	105.6
Milk fat, %	3.49	3.51

↑ SD

Feed offered was adjusted so daily refusal was usually ~5%

Yoder et al., 2013

Hay Silage NDF, 5 farms
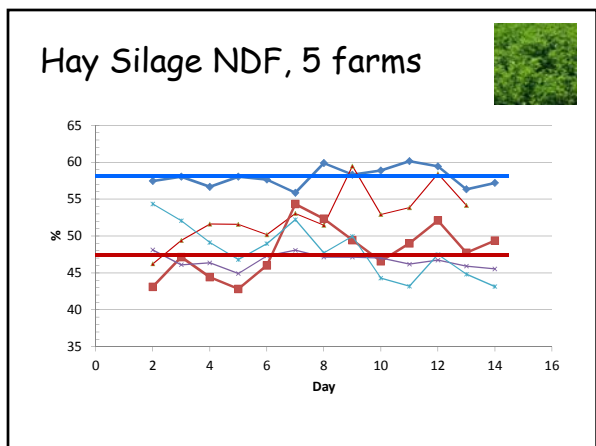
Risk of Being Wrong with 1 Sample (hay silage NDF)

Right = <5% Deviation from mean
Wrong = 5 to 10% Deviation
Really Wrong = > 10% Deviation

	Right	Wrong	Really Wrong
Farm 1	93%	7%	0%
Farm 2	54%	15%	31%
Farm 3	50%	29%	21%
Farm 4	100%	0%	0%
Farm 5	50%	20%	30%

Risk of Being Wrong with mean of 2 Samples (hay silage NDF)

Right = <5% Deviation from mean
Wrong = 5 to 10% Deviation
Really Wrong = > 10% Deviation

	Right	Wrong	Really Wrong
Farm 1	100%	0%	0%
Farm 2	71%	25%	4%
Farm 3	73%	23%	4%
Farm 4	100%	0%	0%
Farm 5	69%	25%	6%

Risk of Being Wrong with 1 Sample (Corn silage starch): 11 farms

21 to 86%
57 to 100% w/ 2 samples
Each bar = 1 farm over 14 days
7 to 43% / 0 to 36%
0 to 36% / 0 to 14%

Right ±5% | Wrong 5 to 10% | Really wrong ≥ 10%
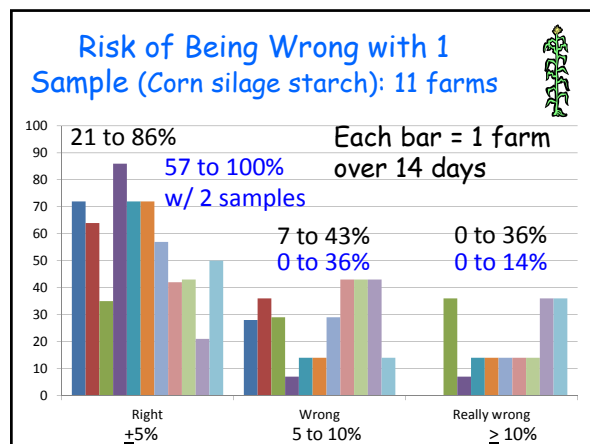
Probability of False Positives
(value changed but feed did not)

Alfalfa Silage Single Sample Error Rate (Sampling+Lab SD = 2% units)

Sample Change	CP, %	NDF, %
1% unit	32%	58%
2% unit	5%	26%
3% unit	<0.5%	9%

If the 'real concentration' did not change, you have a 26% chance, the sample value will have changed by ~2% units

Probability of Being Right
(Feed changed but did sample value change?)

Corn silage starch and NDF (single sample) (Sample+Lab SD = 2% units)

	Real Change		
Sample change	+1%	2%	3%
≥ 1% unit	50%	69%	84%
≥ 2% unit	30%	50%	69%
≥ 3% unit	16%	30%	50%

If feed really increased 1% ⟹ 16% chance sample value decreased at least 1%

Suggested Approach: Corn silage

Month SD: NDF = 1.9; Starch 1.9
Sampling SD: NDF 1.8; Starch 2.2

1. High sampling error: 2 or 3 samples over short period when formulating (average)

2. Sample every few months but always 2 samples (average)

3. Average new mean with running mean (give new data same weight as all older data combined)
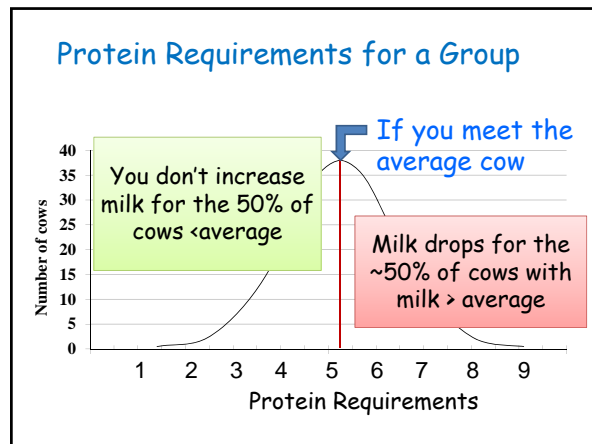
Suggested Approach: Alfalfa Silage

Month SD: NDF = 3.0; CP = 1.4
Sampling SD: NDF 1.8; CP 1.0

1. Multiple samples at first formulation

2. Single samples thereafter

3. Monthly may be ok @≤30% inclusion

4. If NDF Δ ≥ 2% unit use new value, else average

Formulating for a pen of cows

Not a single cow

Protein Requirements for a Group

If you meet the average cow

You don't increase milk for the 50% of cows <average

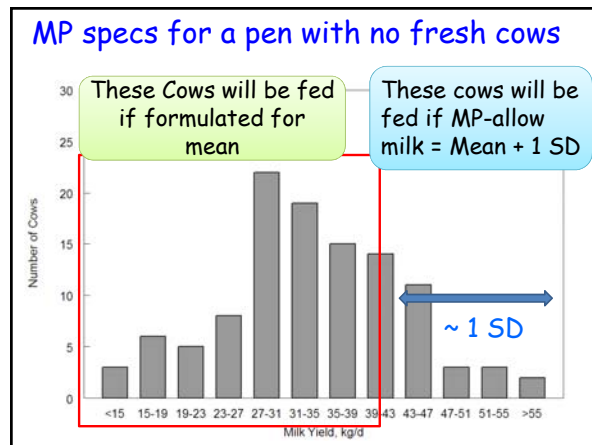Milk drops for the ~50% of cows with milk > average

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Cows the produce more, eat more, but do they eat enough more?

Pen average = 80 lbs milk, 54 lbs DMI
Diet formulated exactly to that spec

A 95 lb cow expected to eat 60 lbs
- MP adequate for 90 lbs

A 150 lb cow expected to eat 77 lbs
- MP adequate for 125 lbs

Estimates only accurate for >30 DIM

MP specs for a pen with no fresh cows

These Cows will be fed if formulated for mean

These cows will be fed if MP-allow milk = Mean + 1 SD

~ 1 SD

Groups w/o Fresh Cows: **MP (dRUP)**

Use pen average DMI
Max MP allowable milk = Mean + 1 SD
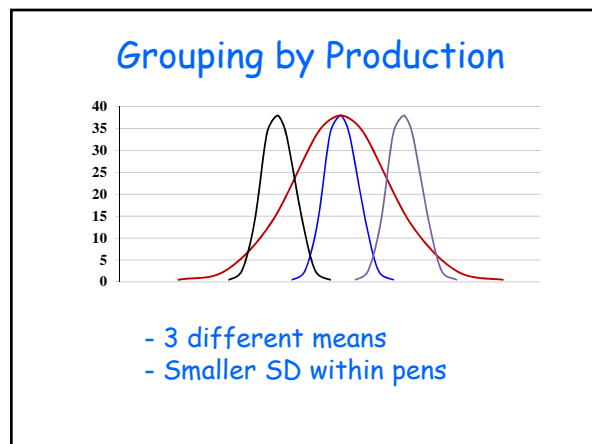If SD not known: Assume SD = 0.16*mean
May need to lower because feed cost/regs

Pen DMI = 58 lbs
Pen average milk = 90 lbs
Pen SD = ? (assume CV = 16)
Max MP-allowable milk = 90*1.16 = 104 lbs

Grouping by Production

- 3 different means
- Smaller SD within pens

6

Formulating for Groups

1 group (mean = 75 lbs, SD = 13)
  Protein for 75 + 13 = **88 lbs**

3 groups
  Low (mean=60 lbs, SD = 5)
      Protein for 65 lbs
  Mids (mean = 75 lbs, SD =6)   **Avg =**
      Protein for 82 lbs   **81 lbs**
  Highs (mean = 90 lbs, SD =7)
      Protein for 97 lbs

Summary

1. Feed composition varies substantially but not all variance is created equal

2. Reformulating when sample comp changed but real comp did not (and vice versa) inflates feed cost or costs milk/health

3. Take multiple samples when formulating first time

4. Sample corn silage less frequently

Summary

4. Averages protect from being really wrong (mean of previous samples+ new sample)/2

5. Over-formulation protects against feed variation; tight formulation requires more samples

6. Emphasize nutrients that matter (DM, NDF, CP, starch)

7. Formulate MP for pen mean milk + 1 SD

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OARDC
Dairy Nutrition Lab

Ohio Agricultural Research and Development Center   Ohio State University Extension