Corn silage yield and quality varies from field to field and farm to farm, but not by much

Joe Lauer
University of Wisconsin-Madison

World Dairy EXPO

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http://corn.agronomy.wisc.edu

Overview

- ✓Background: Some are concerned that specific hybrids have high variability for yield and quality.
- ✓Forage variability: What is it in the field? On the farm?
- ✓How can we manage variability?
- ✓How should hybrids be selected?

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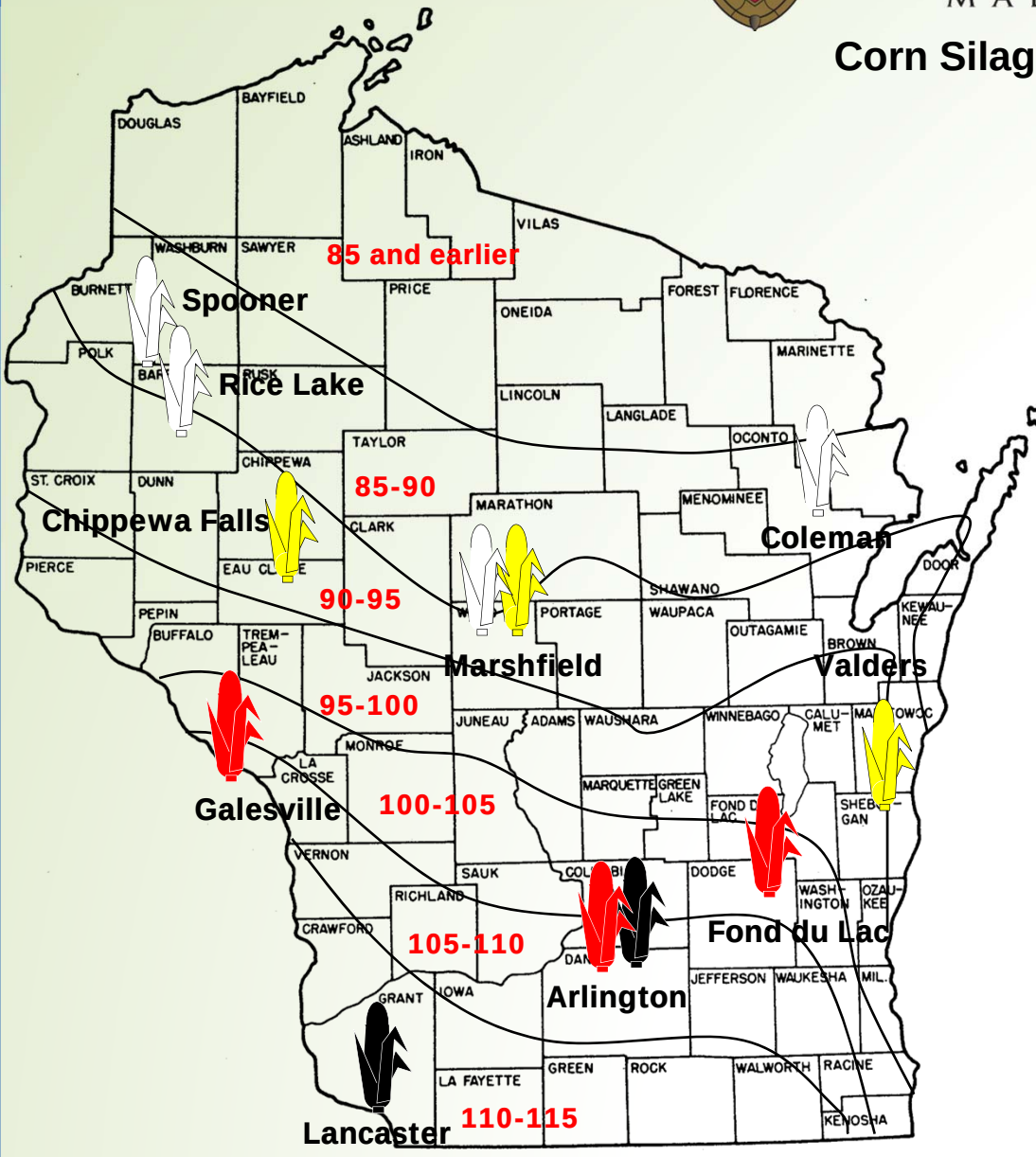
Corn Silage Program



Rationale and Situation

- ✓ A one Bushel/Acre increase by WI corn grain producers increases farm income $8 to $32 million dollars.
- ✓ A one Ton/Acre increase by WI corn grain/dairy producers increases farm income $20 to $60 million dollars.
- ✓ The UW silage evaluation program was initiated in 1995.
- ✓ In 2012, 512 corn hybrids were tested at 14 WI locations.

Objective

- ✓ To provide unbiased performance comparisons of corn hybrids available to Wisconsin farmers.

UW Extension

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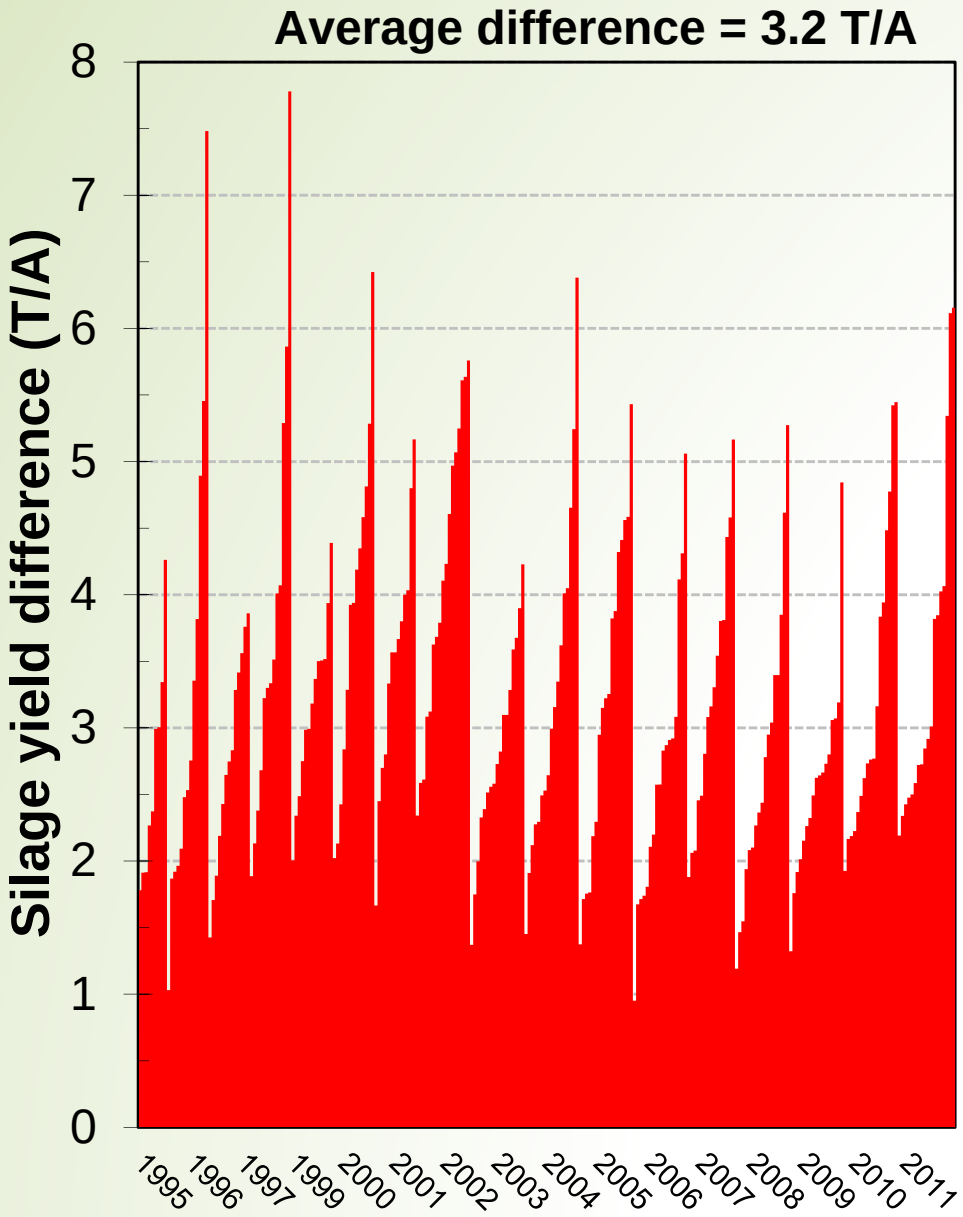
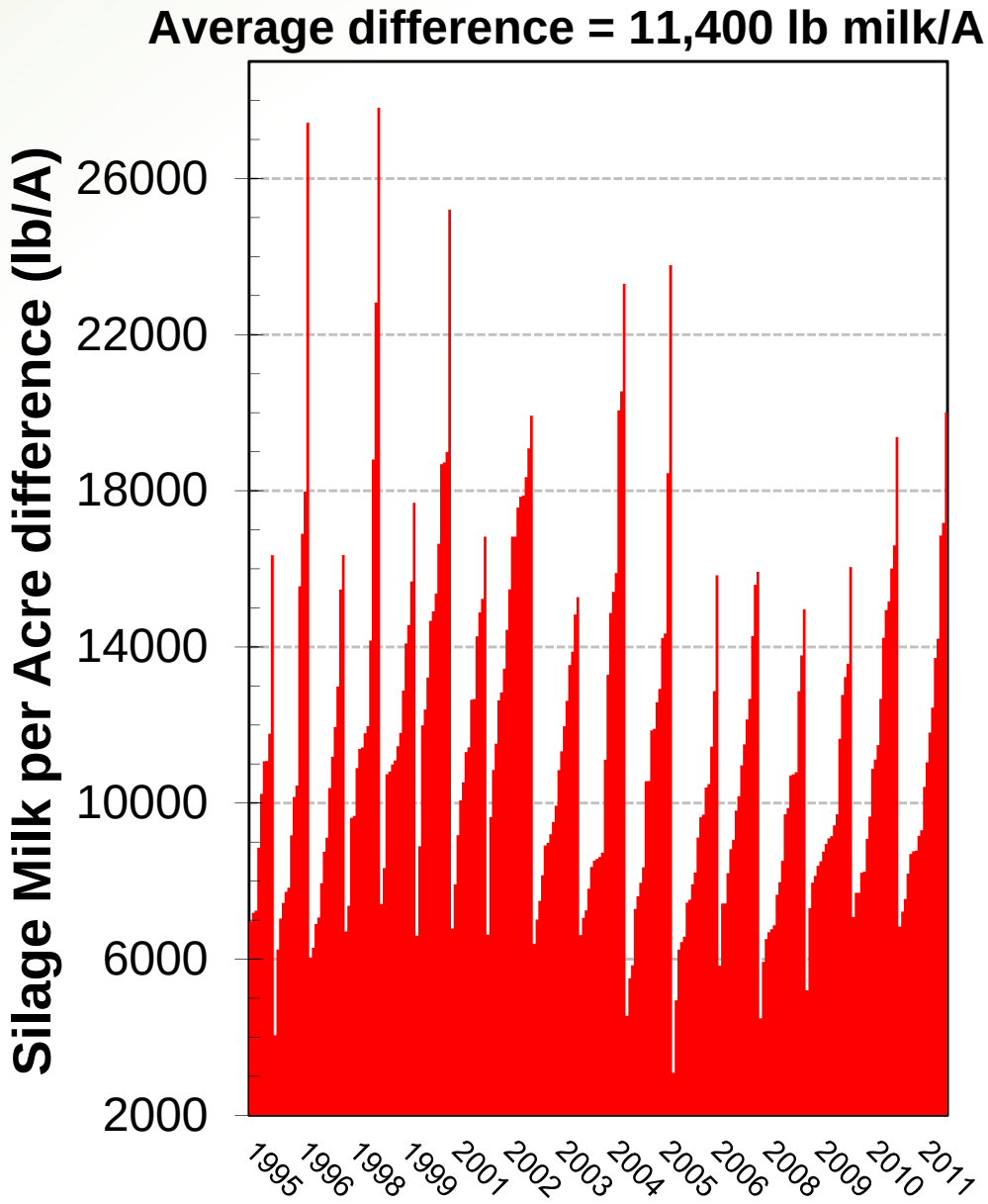
Silage yield and Milk per Acre difference between the highest and lowest corn hybrid in UW trials





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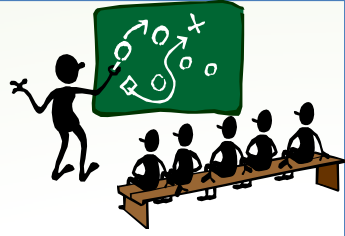
Lauer et al., 1995-2011
N= 256 trials; 22,917 plots

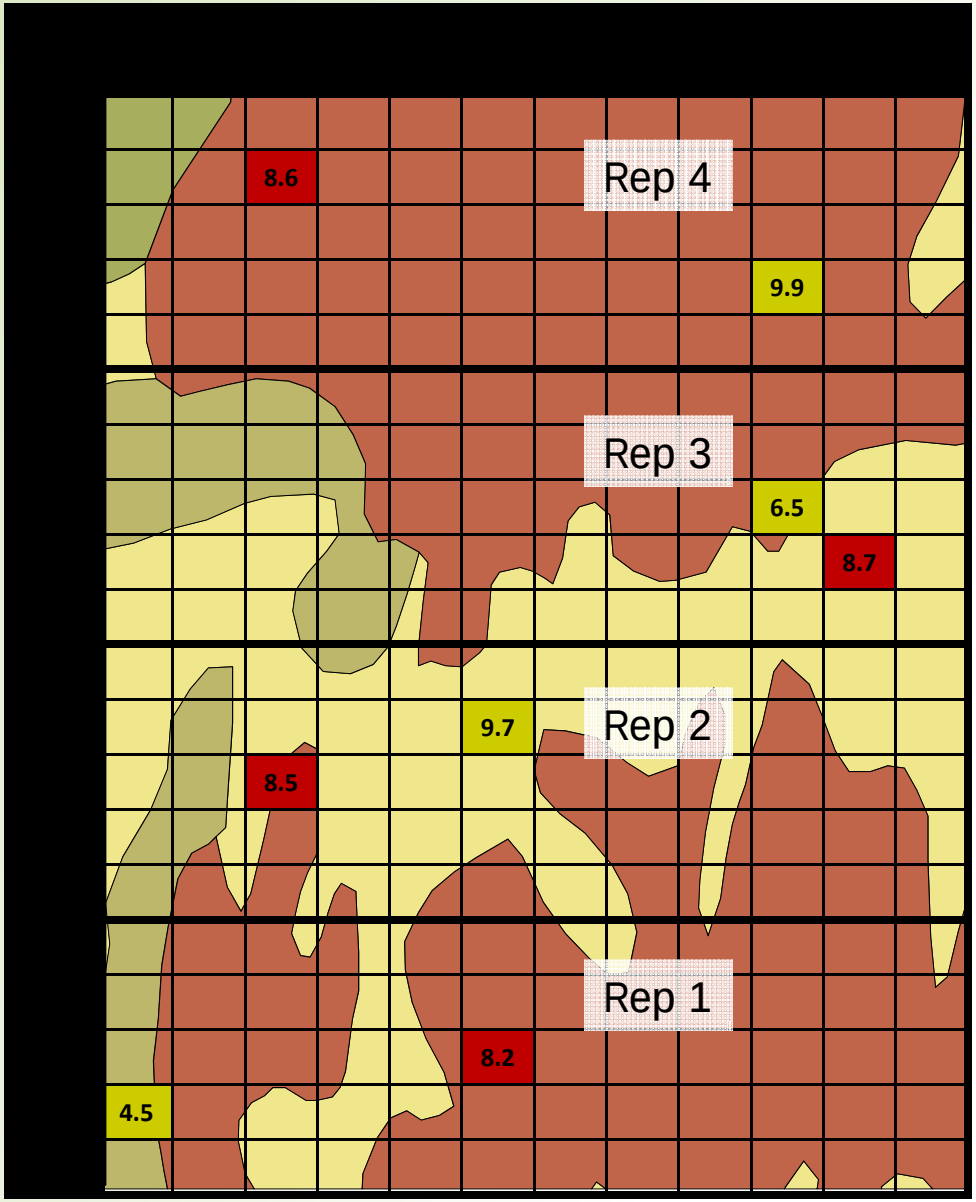
Why should we be concerned?



- ✓Goal of forage production: To produce a consistent feed product for livestock.
- ✓Variation exists in the field due to:
  - Environment (warm, cool, wet, dry)
  - Soils (series, slope, aspect, elevation)
  - Hybrid and management interactions
- ✓How much variation exists within a field AND among fields or farms?
- ✓How do we analyze and estimate variability?
  - Variance: risk
  - Skewness: upside v. downside
  - Kurtosis: frequency of extreme events
- ✓What is important in a silage trial?
  - Precision v. Accuracy
  - Consistency (Ranking v. Productivity)
  - Predictability

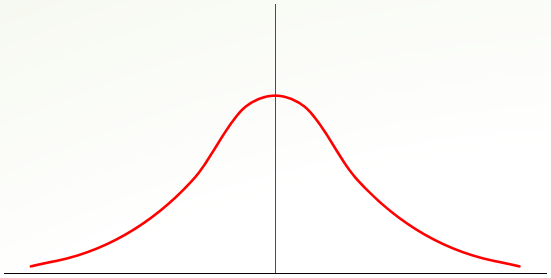
Most people are risk averse favoring low variance, minimal downside risk and consistent performance.

What does field variability look like?

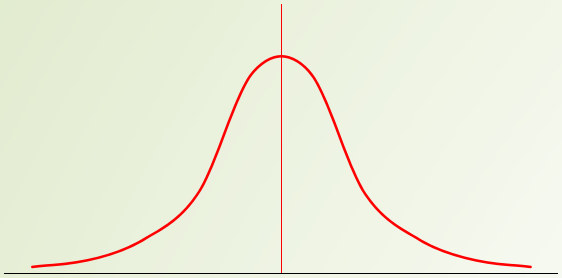


Statistic	Hybrid A	Hybrid B	Trial Average
Rep 1	8.2	4.5	8.0
Rep 2	8.5	9.7	8.7
Rep 3	8.7	6.5	8.5
Rep 4	8.6	9.9	8.8
Mean	8.5	8.5	8.5
Max	8.7	9.9	8.8
Min	8.2	4.5	8.0
Range	0.5	4.4	0.8
S. Deviation	0.2	2.6	1.4
S. Error	0.1	1.3	0.7
Variance	0.05	6.8	3.5
Skewness	-1.2	-0.5	0.1
Kurtosis	1.5	-3.3	2.1

Risk Distributions



- **Normal** +

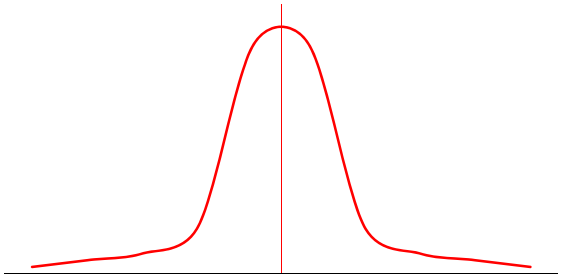


- **Low Standard Deviation** +

Low risk

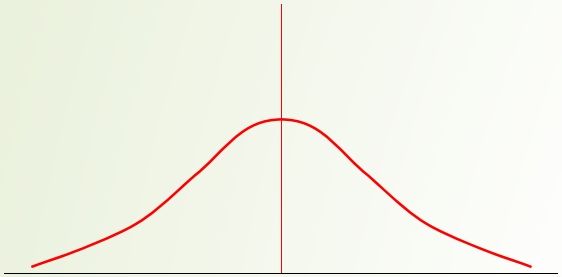
- **Positive Skew** +

High “upside” risk



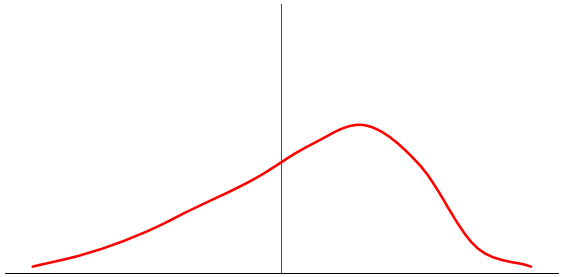
- **Positive Kurtosis** +

“Leptokurtic”
Infrequent extremes



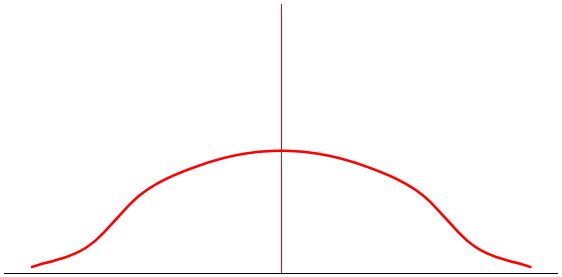
- **High Standard Deviation** +

High risk



- **Negative Skew** +

High “downside” risk



- **Negative Kurtosis** +

“Platykurtic”
Frequent extremes

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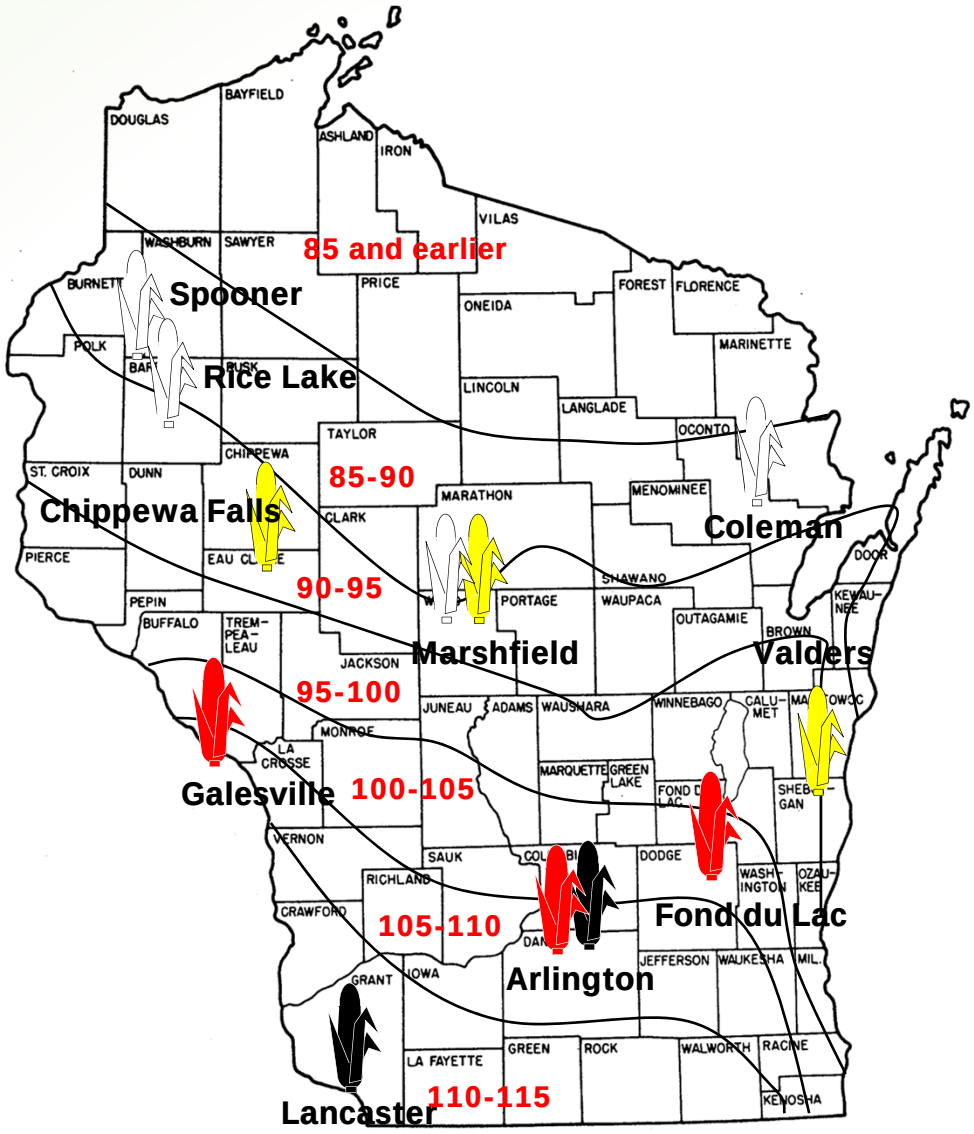
Materials and Methods:
Simulating field and farm variabilitv

Range/ Row	1	2	3	4	5	6	7	8	9	10	11	12
1												
2			8.6				Rep 4					
3												
4										9.9		
5												
6												
7							Rep 3					
8										6.5		
9											8.7	
10												
11												
12						9.7	Rep 2					
13			8.5									
14												
15												
16												
17							Rep 1					
18						8.2						
19	4.5											
20												

Farm variability



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Materials and Methods

- ✓Step 1: Simulated **field variability** by calculating the standard deviation of every hybrid in a trial.
  - Data included ALL hybrids (N= 7660)
  - Analyzed by Trial
- ✓Step 2: Simulated **farm variability** by calculating the standard deviation of every hybrid in a zone within a year.
  - Data included ALL hybrids (N= 3412)
  - Analyzed by Zone within a Year
- ✓Step 3: Simulated **years variability** by calculating the standard deviation of every hybrid in a zone across years.
  - Data only included hybrids tested 2 or more years (N= 607)
  - Analyzed by Zone across Years

How much Yield (T/A) variability exists?

Year	N	Mean	± Standard Deviation	
			Field	Farm
1995	248	6.9	0.6	0.8
1996	232	7.4	0.9	1.3
1997	332	6.3	0.8	1.0
1998	323	9.0	1.1	1.5
1999	402	8.7	0.8	1.2
2000	412	8.1	0.9	1.2
2001	421	8.0	0.8	1.5
2002	450	8.2	0.8	1.3
2003	442	7.7	0.7	1.2
2004	458	8.4	0.7	1.0
2005	448	8.3	0.8	1.3
2006	495	8.0	0.7	1.2
2007	544	7.6	0.7	1.6
2008	530	8.3	0.7	1.2
2009	641	8.5	0.6	1.3
2010	664	7.9	0.8	1.3
2011	618	8.6	0.7	1.0
LSD (0.05)		0.2	NS	0.1
Average		8.1	0.8	1.2

Lauer et al., 1995-2011

How much Yield (T/A) variability exists?

Zone	Location	N	Mean	± Standard Deviation		
				Field	Farm	Years
North	Ashland	121	6.8	0.9	1.6	1.6
	Coleman	83	7.9	1.0		
	Rhinelander	144	7.2	0.7		
	Spooner(I)	246	8.3	0.7		
	Spooner(S)	246	5.5	0.7		
North Central	Chippewa Falls	604	7.0	0.7	1.1	1.3
	Marshfield	1015	7.1	0.7		
	Valders	995	7.3	0.6		
South Central	Fond du Lac	1024	8.4	0.8	1.1	1.3
	Galesville	1029	9.1	0.8		
South	Arlington	1092	9.5	0.8	1.1	1.4
	Lancaster	1016	8.7	0.8		
LSD (0.05)			0.2	0.1	0.1	0.1
Average			8.1	0.8	1.2	1.4

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Lauer et al., 1995-2011

How much NDFD (%) variability exists?

Zone	Location	N	Mean	± Standard Deviation		
				Field	Farm	Years
North	Ashland	121	61	1.5	2.4	3.5
	Coleman	83	55	2.2		
	Rhinelander	144	61	1.6		
	Spooner(I)	246	58	1.4		
	Spooner(S)	246	61	1.7		
North Central	Chippewa Falls	604	57	1.7	2.4	2.9
	Marshfield	1015	60	1.6		
	Valders	995	60	1.5		
South Central	Fond du Lac	1024	58	1.7	1.9	2.8
	Galesville	1029	57	1.5		
South	Arlington	1092	57	1.4	1.9	2.9
	Lancaster	1016	57	1.5		
LSD (0.05)			2	0.1	0.1	0.2
Average			58	1.6	2.1	2.9

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Lauer et al., 1995-2011

How much Starch Content (%) variability exists?

Zone	Location	N	Mean	± Standard Deviation		
				Field	Farm	Years
North	Ashland	121	28	3	4	5
	Coleman	83	32	3		
	Rhinelander	144	26	3		
	Spooner(I)	246	33	3		
	Spooner(S)	246	28	3		
North Central	Chippewa Falls	604	26	3	6	6
	Marshfield	1015	30	3		
	Valders	995	32	3		
South Central	Fond du Lac	1024	32	3	3	4
	Galesville	1029	31	3		
South	Arlington	1092	31	3	4	4
	Lancaster	1016	32	3		
LSD (0.05)			2	0	1	1
Average			30	3	4	4

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Lauer et al., 1995-2011

How much Milk per Ton (lb/T) variability exists?

Zone	Location	N	Mean	± Standard Deviation		
				Field	Farm	Years
North	Ashland	121	3100	100	100	200
	Coleman	83	3200	100		
	Rhinelander	144	3100	100		
	Spooner(I)	246	3100	100		
	Spooner(S)	246	3200	100		
North Central	Chippewa Falls	604	3000	100	200	200
	Marshfield	1015	3200	100		
	Valders	995	3200	100		
South Central	Fond du Lac	1024	3100	100	100	100
	Galesville	1029	3100	100		
South	Arlington	1092	3100	100	100	100
	Lancaster	1016	3100	100		
LSD (0.05)			100	NS	0	0
Average			3000	100	100	200

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Lauer et al., 1995-2011

How much Milk per Acre (lb/A) variability exists?

				± Standard Deviation		
Zone	Location	N	Mean	Field	Farm	Years
North	Ashland	121	22000	3000	5000	5000
	Coleman	83	24000	4000		
	Rhinelander	144	22000	2000		
	Spooner(I)	246	26000	3000		
	Spooner(S)	246	17000	2000		
North Central	Chippewa Falls	604	21000	3000	4000	4000
	Marshfield	1015	22000	2000		
	Valders	995	23000	2000		
South Central	Fond du Lac	1024	26000	3000	4000	4000
	Galesville	1029	28000	3000		
South	Arlington	1092	29000	3000	4000	5000
	Lancaster	1016	27000	3000		
LSD (0.05)			1000	NS	0	0
Average			25000	3000	4000	5000

Lauer et al., 1995-2011

Performance of Pre-selected Quality Check Hybrids

Criteria: 1) 5% Yield increase, 2) NDF= high v. low, 3) Milk per ton – Milk1995 and Milk2000

Cohort	Forage yield	NDF	NDFD	Starch	Milk2006	
	T/A	%	%	%	Lb/T	Lb/A
HQ: Low NDF hybrid	7.87	46.0	61.1	31.2	3290	25900
LQ: High NDF hybrid	8.12	48.2	60.8	28.6	3210	26100
Other hybrids	7.70	46.8	61.0	30.4	3260	25200
LSD (0.05)	0.14	0.4	NS	0.50	20	500

Lauer et al., 1995-2006
N= 139 trials

Corn Silage Hybrid Selection

"Variation for silage yield and quality exists among commercial hybrids in Wisconsin."

- ✓ Advice for selecting hybrids
  - Use independent yield trial data conducted over multiple locations
  - Focus on yield consistency
  - Every hybrid must stand on its own
  - Buy the traits you need
  - Pay attention to seed price
- ✓ Focus on:
  - Whole-plant forage yield
  - Forage quality
  - Grain yield: allows flexibility (dual purpose)
  - Moisture (Maturity): 5-10 days later than grain hybrids
  - Pest resistance
  - Standability: allows flexibility
  - Specialty genes (management v. markets)

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Conclusions

- ✓Estimating variability using multiple locations within a year is similar to more environments across years.
  - Increasing environments (i.e. fields) improves variability estimates.
  - Select hybrids using multiple-locations and consistent performance
- ✓Variability estimates of forage quality measurements (cp, adf, ndf, ivd, and ndfd) are lower than for yield.
  - Assume the amount of variation = Mean / Standard Deviation
    - Yield: Field= 10%; Farm= 15-17%
    - NDFD: Field= 3%; Farm= 4-5%
    - Starch content: Field= 10%; Farm= 13-14%
    - Milk per Ton: Field= 3%; Farm= 3-7%
    - Milk per Acre: Field= 12%; Farm= 16-20%
  - Need more environments to estimate yield variability than you need for quality variability.

Thanks for your attention!
Questions?

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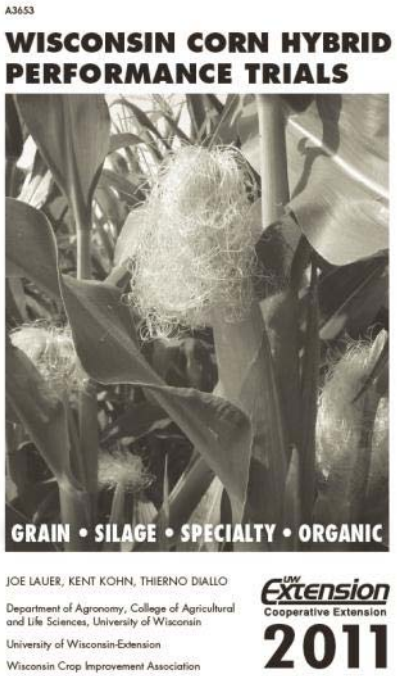

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