2007 Agronomy Update Meetings

Fond du Lac, Kimberly, Janesville, Platteville, Wausau, Eau Claire, Sparta, Madison

Joe Lauer

University of Wisconsin

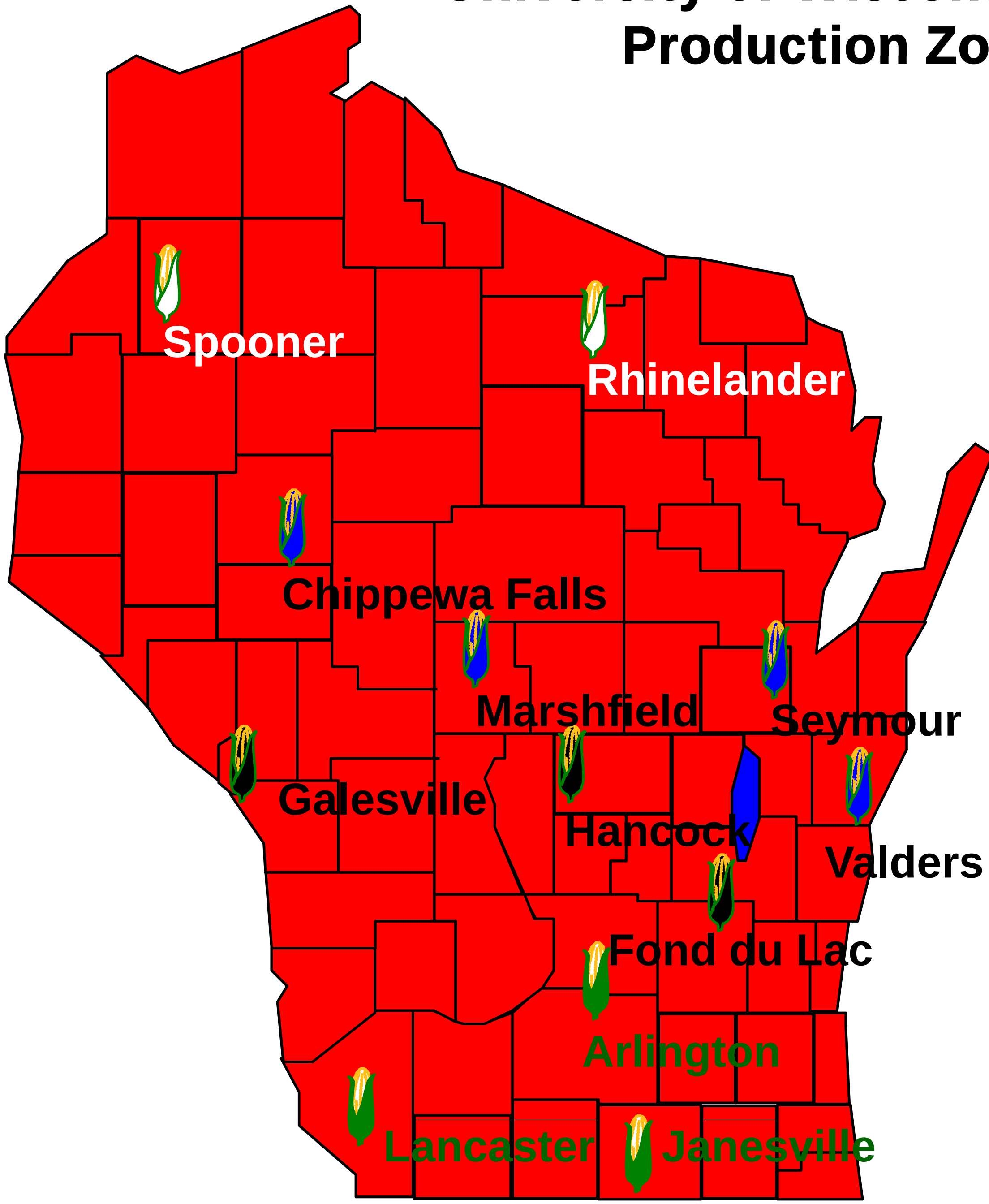
Cooperating with Rock, Fond du Lac, Outagamie, Grant, Marathon, Eau Claire, Monroe, and Dane Counties

January 4 – 11, 2007

Highlights for corn production during 2006

- **Records**
  - ✓ First time a location had a 10-yr average > 200 bu/A = 3 locations
  - ✓ Top 50 Zone performances = 10 hybrids
  - ✓ Top 50 Location performance = 4 hybrids
- **Growing season**
  - ✓ Lost grain trials at four sites
    - ❑ Imbibitional chilling
    - ❑ Second year of drought in NW WI
  - ✓ "Glad it is over!"
- **New things in the Hybrid Trials**
  - ✓ "Systems" trials
    - ❑ RR – S, SC
    - ❑ CRW – S, SC
    - ❑ Organic – S
  - ✓ Silage performance index = Milk2006

University of Wisconsin - Corn Agronomy Program
Production Zones = S, SC, NC, and N



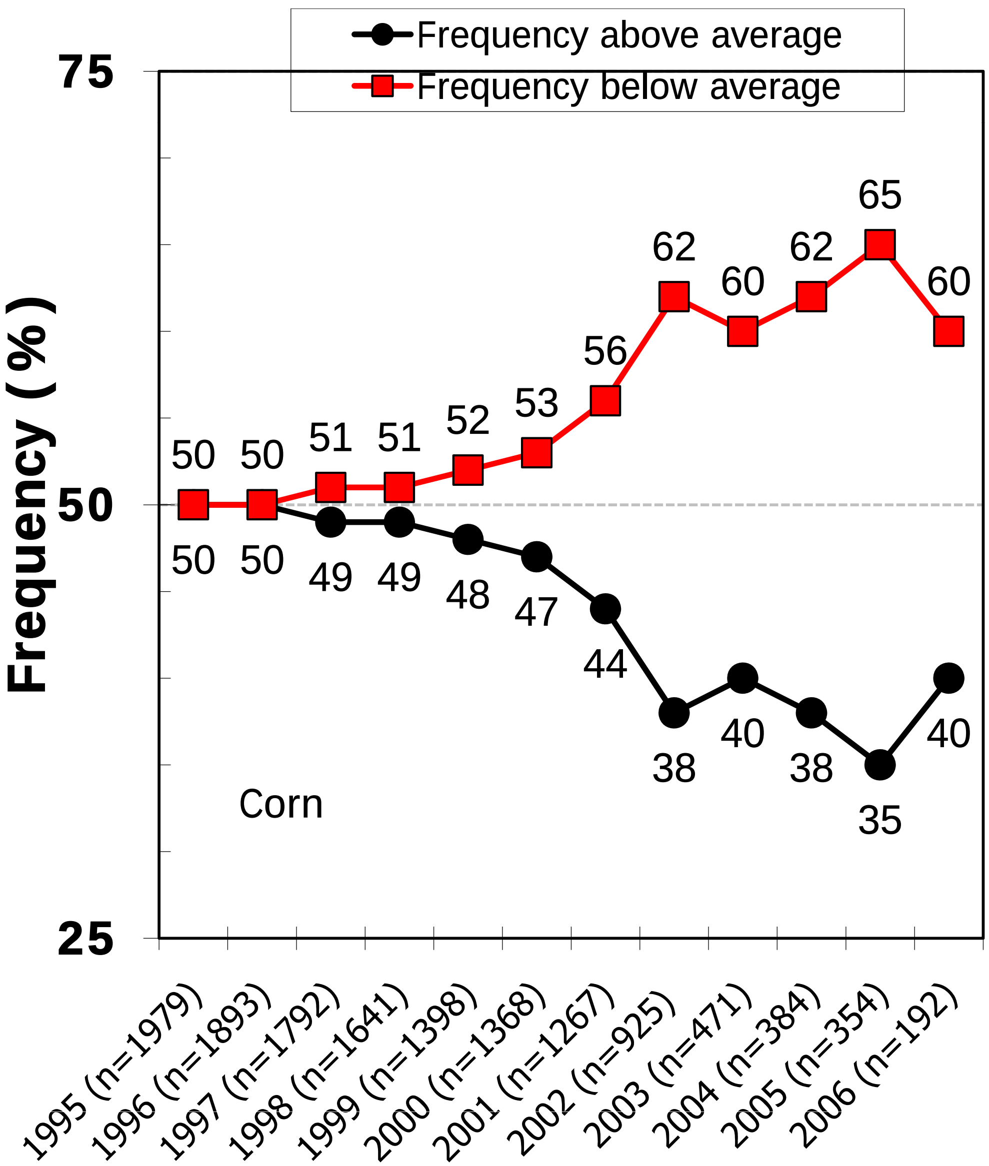
2006 Wisconsin Corn Performance Trials
Grain Summary

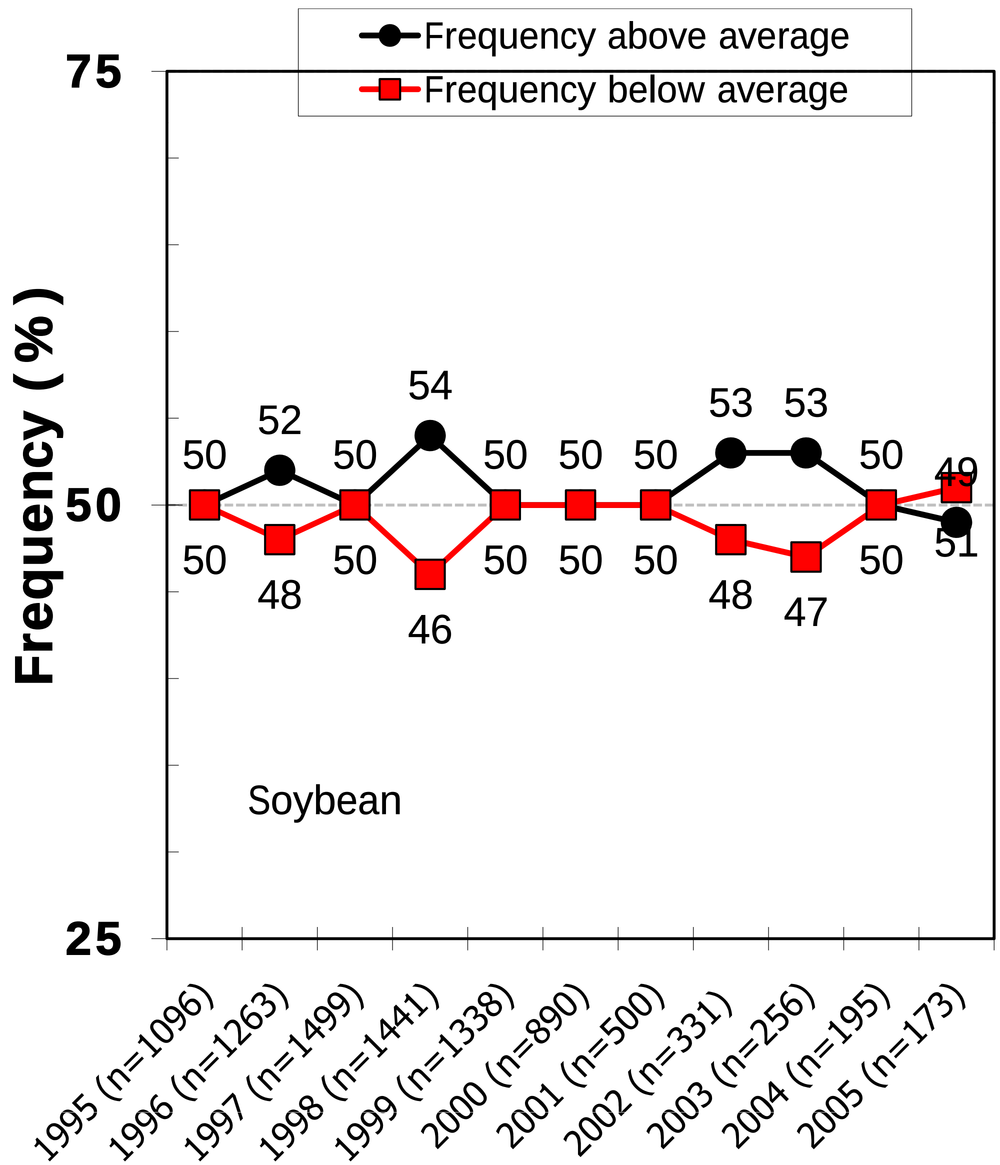
Location	1996-2005 N	1996-2005 Yield	2006 N	2006 Yield	Percent change
Arlington	1821	205	251	215	5
Janesville	1820	204	230	230	13
Lancaster	1819	197	188	225	14
Fond du Lac	1614	178	34	202	13
Galesville	1611	189	170	206	9
Hancock	1610	206	178	234	13
Chippewa Falls	1508	147	--	--	--
Marshfield	1342	163	158	170	4
Seymour	1184	163	--	--	--
Valders	1510	160	142	184	15
Rhinelander/White Lake	493	113	50	190	68
Spooner	1560	142	100	75	-47

2005 Wisconsin Corn Performance Trials
Silage Summary

	1996-2005		2006		Percent
Location	N	Yield	N	Yield	change
Arlington	550	9.5	62	8.8	-7
Lancaster	550	8.4	62	9.3	11
Fond du Lac	593	8.5	70	8.5	1
Galesville	598	8.8	70	9.3	6
Chippewa Falls	205	7.4	55	6.0	-19
Marshfield	526	7.0	55	6.8	-4
Valders	526	6.9	55	8.3	19
Rhinelander	91	6.9	20	8.3	20
Spooner	182	7.5	40	5.1	-33

Frequency of 'Non-Transgenic' Corn Hybrids and Soybean Varieties Yielding Above and Below the Trial Average in UW Trials

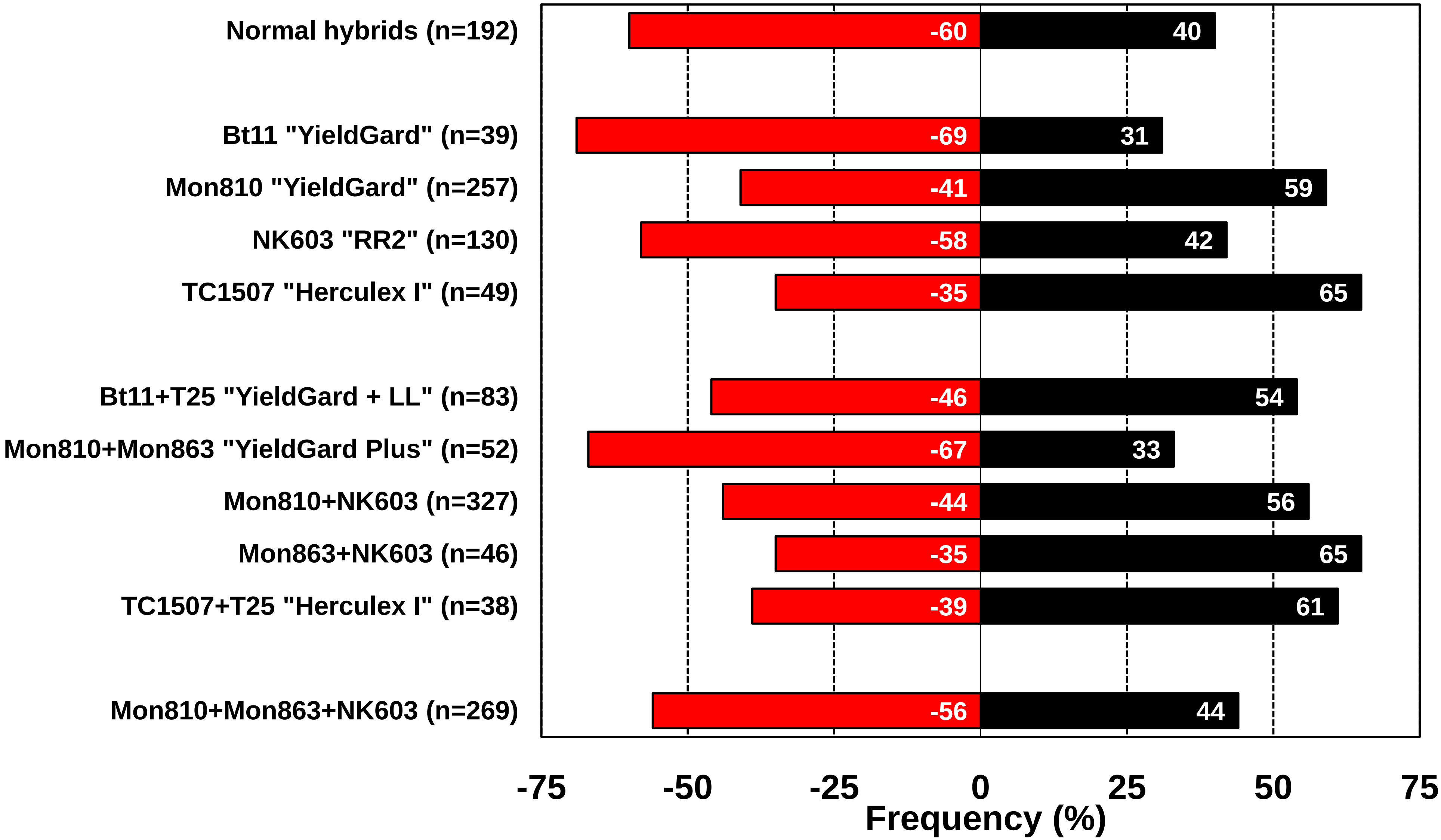




UW Extension

http://corn.agronomy.wisc.edu

Frequency of Transgenic Hybrids Yielding Above the Trial Average in the 2006 UW Corn Trials
(minimum G*E tests N>30)



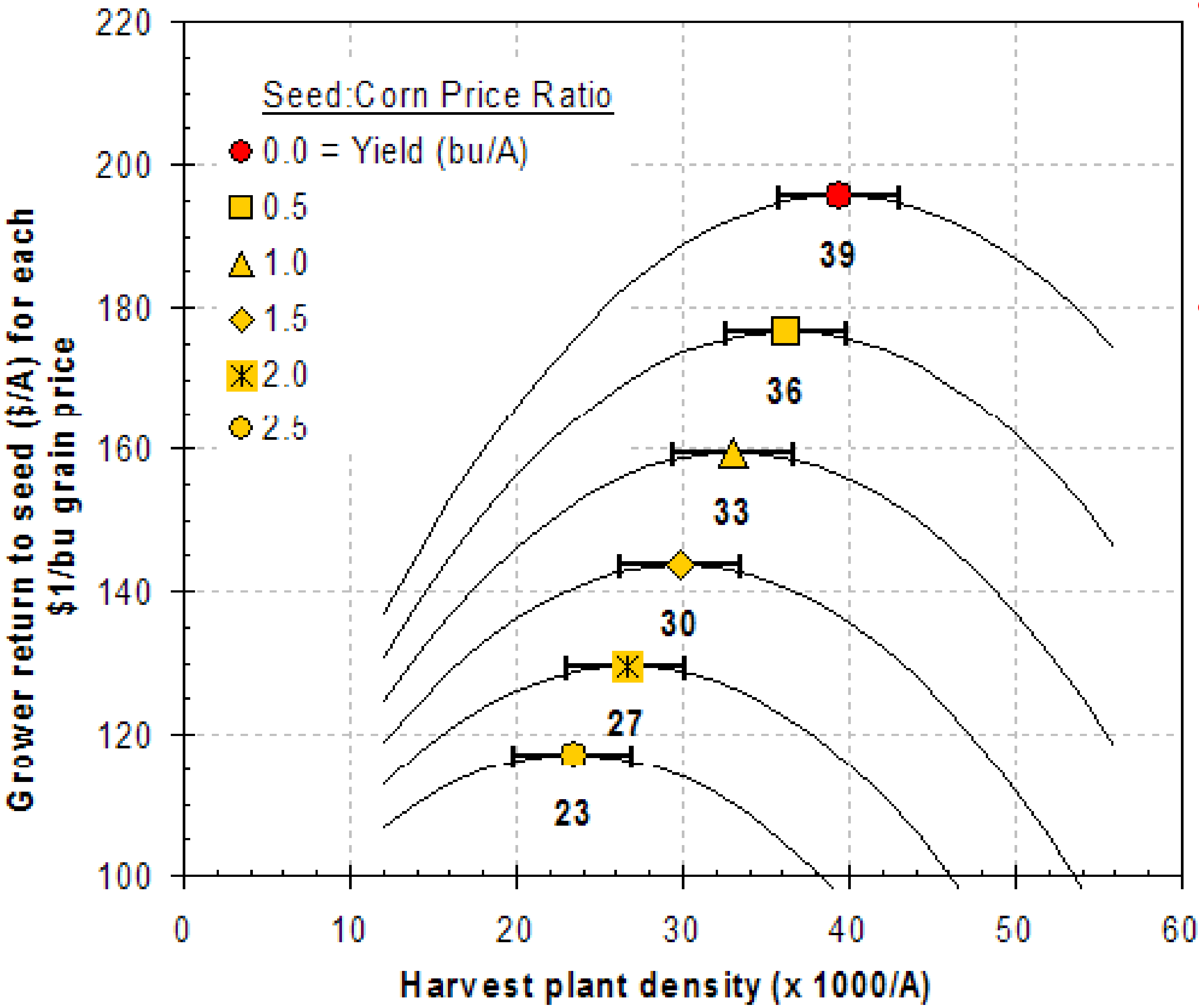
Should We Be Concerned About Seed Costs?

- **Seed costs have dramatically increased over the last few years.**
  - ✓ Transgenic hybrids and technology fees has driven the cost of seed
    - ❑ Premium hybrids cost $160-$180 per bag,
    - ❑ Ten years ago, premium seed would run about $80-$100 per bag.
- **When corn prices are low farmers are concerned about the cost of all inputs for corn production**
  - ✓ High energy prices have
    - ❑ Increased fertilizer price
    - ❑ Increased gasoline/diesel/LP for field operations and grain drying after harvest.
  - ✓ Minimizing field operations (especially moving towards no-till), early planting date, and appropriate hybrid maturity selection are management options that reduce energy costs.
- **Yield response of corn to plant density has increased over time.**
- **Ultimately, optimum plant density is affected by both seed cost and corn price.**

Price Ratio of Seed:Corn
(i.e. $/1000 seeds ÷ $/bu corn)

Price of seed		Price of corn ($/bu)					
$/80 K bag	$/1000 seeds	$1.00	$1.50	$2.00	$2.50	$3.00	$3.50
$40	$0.50	0.50	0.33	0.25	0.20	0.17	0.14
$60	$0.75	0.75	0.50	0.38	0.30	0.25	0.21
$80	$1.00	1.00	0.67	0.50	0.40	0.33	0.29
$100	$1.25	1.25	0.83	0.63	0.50	0.42	0.36
$120	$1.50	1.50	1.00	0.75	0.60	0.50	0.43
$140	$1.75	1.75	1.17	0.88	0.70	0.58	0.50
$160	$2.00	2.00	1.33	1.00	0.80	0.67	0.57
$180	$2.25	2.25	1.50	1.13	0.90	0.75	0.64
$200	$2.50	2.50	1.67	1.25	1.00	0.83	0.71
$220	$2.75	2.75	1.83	1.38	1.10	0.92	0.79

Profitable Harvest Plant Densities for Various Seed:Corn Price Ratios



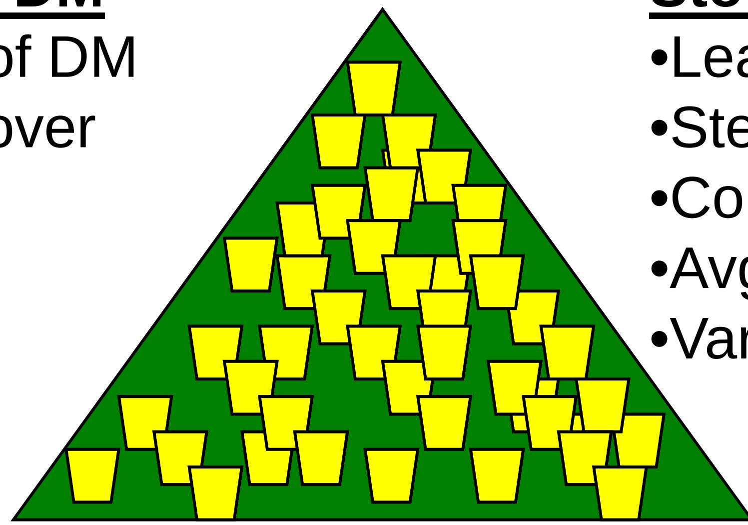
- Symbols represent the economic optimum return to plant density (EOPD).
- Error bars are the low and high ends of the range of profitability (within $1/A of EOPD) at each seed:corn price ratio.

Guidelines for Choosing an Appropriate Plant Density for Corn

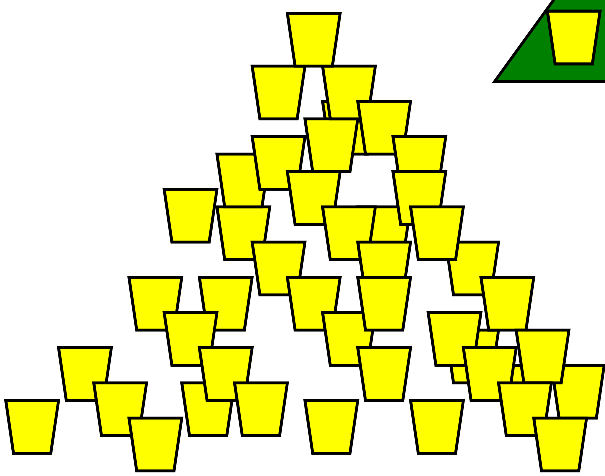
- **Grain yield increases to plant densities of 39,400 plants/A.**
- **The EOPD for seed:corn price ratios between 0.5 and 1.5 is 29,800 to 36,200 plants/A.**
  - ✓ The plant density of 32,700 plants/A is within $1.00 of the EOPD for ratios between 0.5 and 1.5.
- **In general, silage yield increases as plant density increases.**
  - ✓ A trade-off exists where quality decreases with increasing population.
  - ✓ Thus, the EOPD is the same for corn grown for silage or grain.
  - ✓ Corn silage is often more valuable than grain, thus the EOPD follows more closely seed:corn price ratios less than 1.0.

Corn Silage

<u>Grain = ~40-45% of DM</u>
- Ave. starch = 28% of DM
- Varies with grain:stover

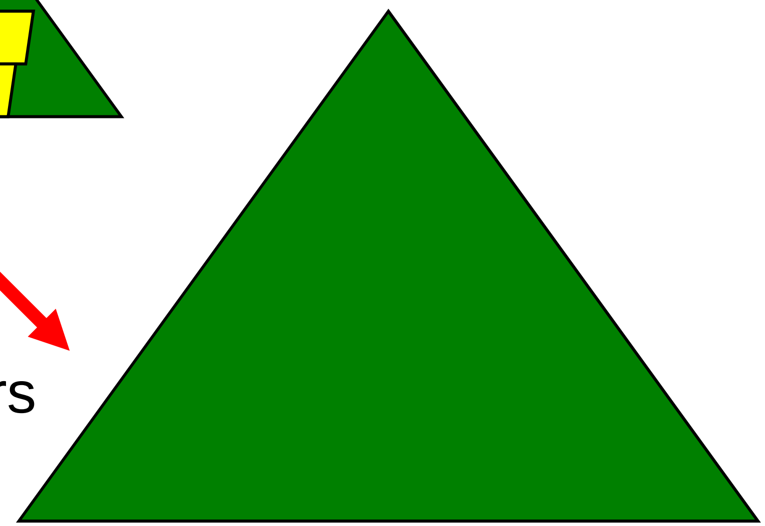


<u>Stover = ~55-60% of DM</u>
- Leaves= 15% of DM
- Stem= 20-25% of DM
- Cob+Shank+Husk=20% of DM
- Avg. NDF= 45% of DM
- Varies with grain:stover



<u>Kinetics</u>

24 v. 30 v. 48 hours



<u>80 to 98% starch digestibility</u>
- Kernel maturity
- Kernel particle size
- Endosperm properties

<u>40 to 70% NDFD</u>
- Lignin/NDF
- Hybrid
- Maturity

NRC (2001) Dairy TDN

TDN 1-X = tdCP + (tdFA x 2.25) + tdNFC + tdNDF – 7

- (+) A more accurate and robust way to estimate TDN of forages than ADF.
- (+) Fiber digestibility (td) and total fiber (NDF) are used to estimate energy values.
- (-) TDN values estimated by NRC(2001) are different than what we are used to.

Schwab-Shaver Energy Equation for Corn Silage

$$TDN_{1\text{-}x} = DIG_{CP} + DIG_{FA} + DIG_{Starch} + DIG_{SUOA} + DIG_{NDF} - 7$$

Source: Schwab et al., 2003, JAFST

Microsoft Excel - milk2006nearfinalv3closed.xls

File Edit View Insert Format Tools Data Window Help Adobe PDF

Milk 2006

University of Wisconsin Corn Silage Evaluation System

Randy Shaver, Dept. of Dairy Science *Patrick Hoffman, Dept. of Dairy Science*
Joe Lauer, Dept. of Agronomy
Jim Coors, Dept. of Agronomy

Sample values entered here must correspond to lab average and incubation time information entered in "UserInputGuide" Worksheet cells G27 and G29.

User must go to "UserInputGuide" Worksheet for key information entry!

Critical Data Entry

Required Inputs

Calculated Outputs

		Form Input	Optional Starch Digestibility Tests			Lab Value	Lab Value	Lab Value	Lab Value	Lab Value	Lab or Book Value	Lab or Book Value	Field Measure	Calculated	Calculated	Calculated	Calculated
Field ID	Lab ID	Kernel Processed yes/no	KPS %	DSA %	IS-IV %	DM %	CP % DM	NDF % DM	NDFD % NDF	Starch % DM	Ash % DM	Fat % DM	DM Yield tons/acre	TDN-1x % DM	NE_L-3x Mcal/lb DM	Milk per Ton Index lb/ton DM	Milk per Acre Index lb/acre
"normal"	L001	no				35.0	8.8	45.0	59	27.0	4.3	3.2	7.0	69.7	0.68	3169	22182
1	L002	yes				35.0	8.8	45.0	59	27.0	4.3	3.2	7.0	71.0	0.70	3273	22910
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UserInputGuide | MILK2006-Corn Silage | Tech Reference

Ready

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User Input Guide

Required Inputs	Optional Inputs

1- Inputs for NDF Digestibility assay (NDFD; % of NDF)

Determined via in vitro incubation of sample in rumen fluid or NIRS calibrated from in vitro data. NRC-01 recommended 48-h incubations. There has been considerable interest within the industry regarding NDFD measured at earlier time points with suggestions of improved accuracy relative to in vivo data for 30-h incubation and improved lab turn around time and lab efficiency for 24-h incubation. There are concerns, however, about reduced precision at the earlier time points. In MILK2006, **the user must** define the incubation time used in the NDFD analysis of their samples by the laboratory and also the average corn silage NDFD for that lab for that incubation time.

Input below the laboratory average for corn silage NDFD (% of NDF) and the time point used by the lab for their incubations (both values must be entered for the worksheet to function properly, and must correspond to the NDFD values entered for the samples being evaluated). Caution: early time point assays (24h or 30h) may lack precision unless sufficiently replicated in the lab.

	Lab NDFD
Average, % of NDF	59
Incubation time hours (24, 30, or 48)	48

UserInputGuide / MILK2006-Corn Silage / Tech Reference

User Input Guide

Required Inputs | **Optional Inputs**

2- Inputs for assays to calculate starch digestibility

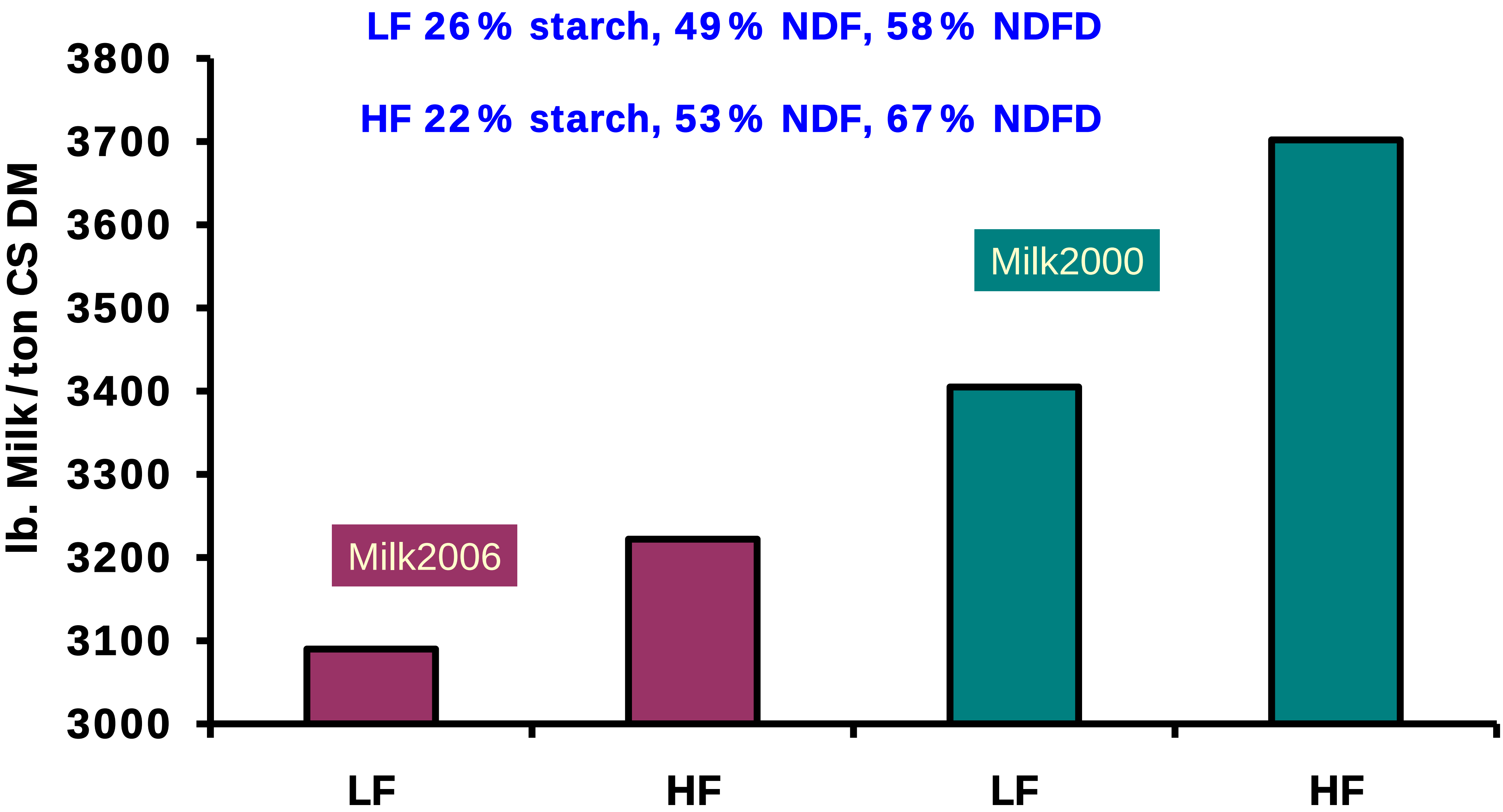
Starch digestibility is a calculated value with minimum set at 0.76 and maximum set at 0.98. If available and desired, either Kernel Processing Score (KPS), Degree of Starch Access (DSA), or In Situ-In Vitro Starch Digestion (IS-IV; total tract) assays can be inputted and used in this calculation by inputting "**yes**" after the assay below. Enter yes only if User desires to use the assay to calculate starch digestibility. Only one "yes" can be entered at a time. **Leave entries as "no" for each assay to default to use of regression based on whole-plant DM content and whether or not kernel processed to calculate starch digestibility.** For using DSA or IS-IV on silage plot samples, comparison across samples harvested by different choppers should be ground to a similar coarse particle size in the lab prior to analysis.

	yes or no
Kernel Processing Score (KPS)	no
Degree of Starch Access (DSA)	no
In Situ-In Vitro Starch Digestion (IS-IV)	no

Enter in "MILK2006-Corn Silage" Worksheet

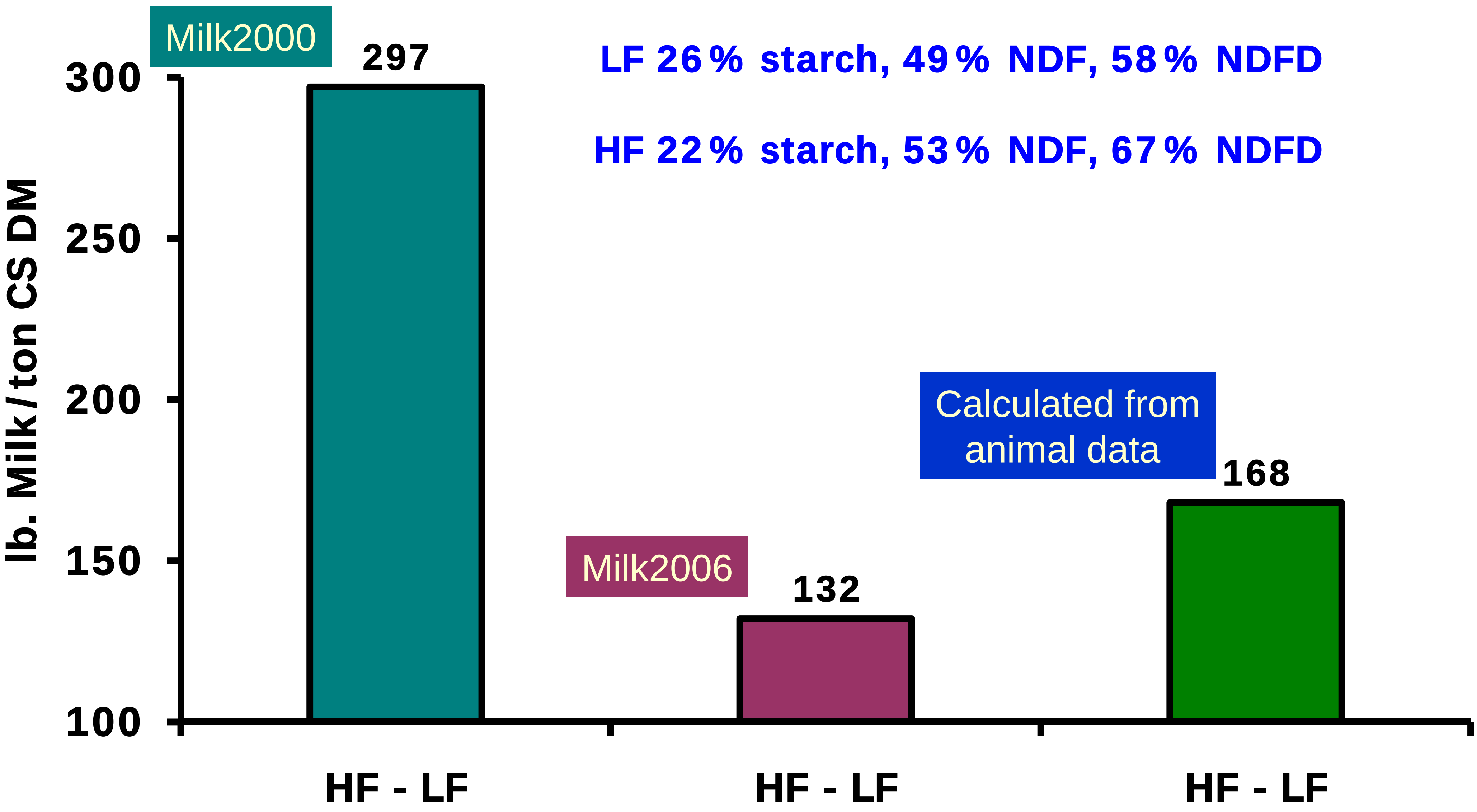
3- Sample ID

Milk per Ton -- High NDF, NDFD vs. Low NDF, NDFD



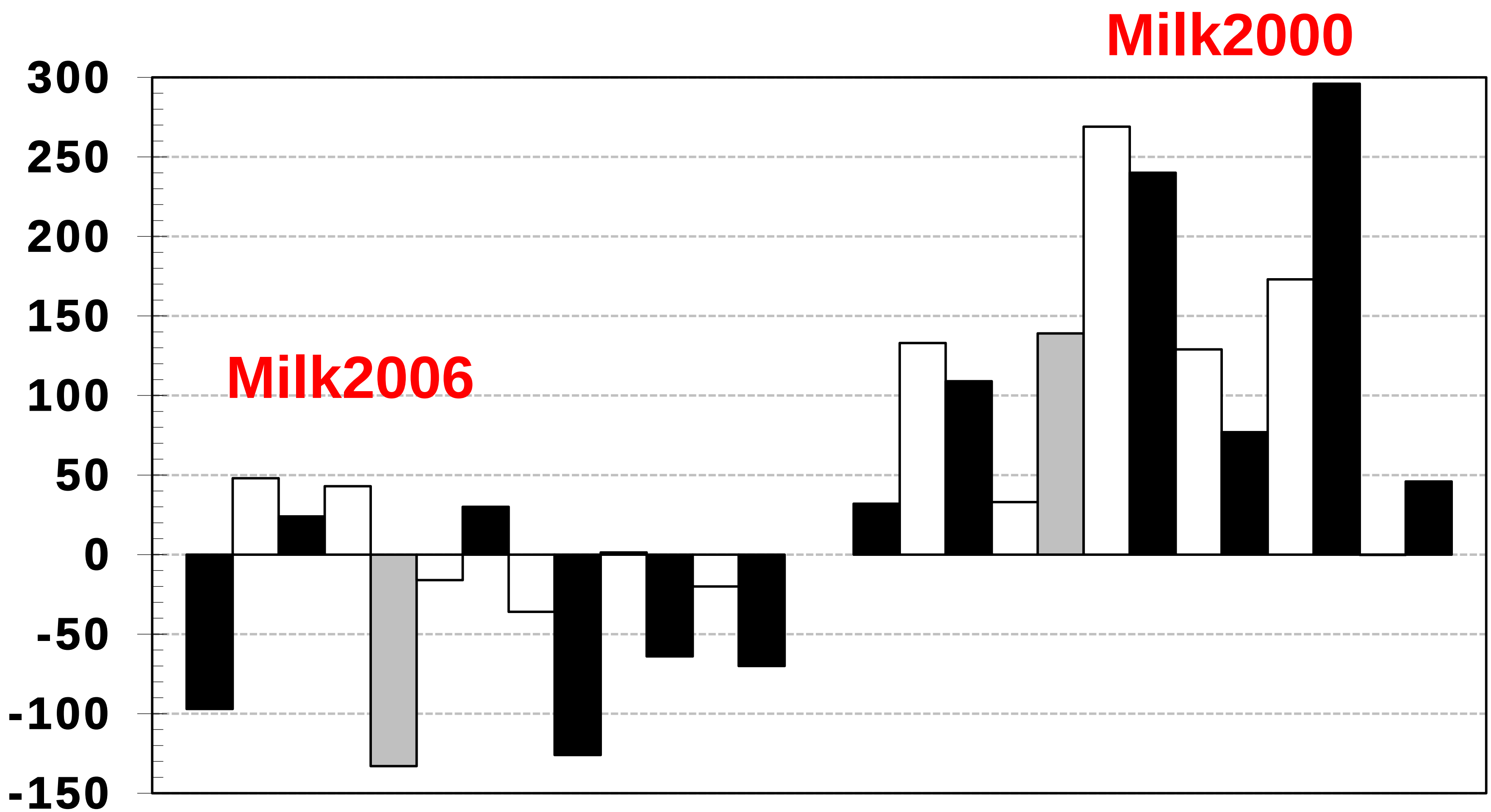
Source: Ivan et al., JDS, 2005

Milk per Ton -- High NDF, NDFD vs. Low NDF, NDFD



Source: Ivan et al., JDS, 2005

Treatment differences for model-predicted milk per ton versus milk per ton from *in vivo* data



Source: Shaver - Calculated from 10 JDS papers with 13 comparisons

Milk Model Rank Correlations for Milk per Ton using UW Data Set

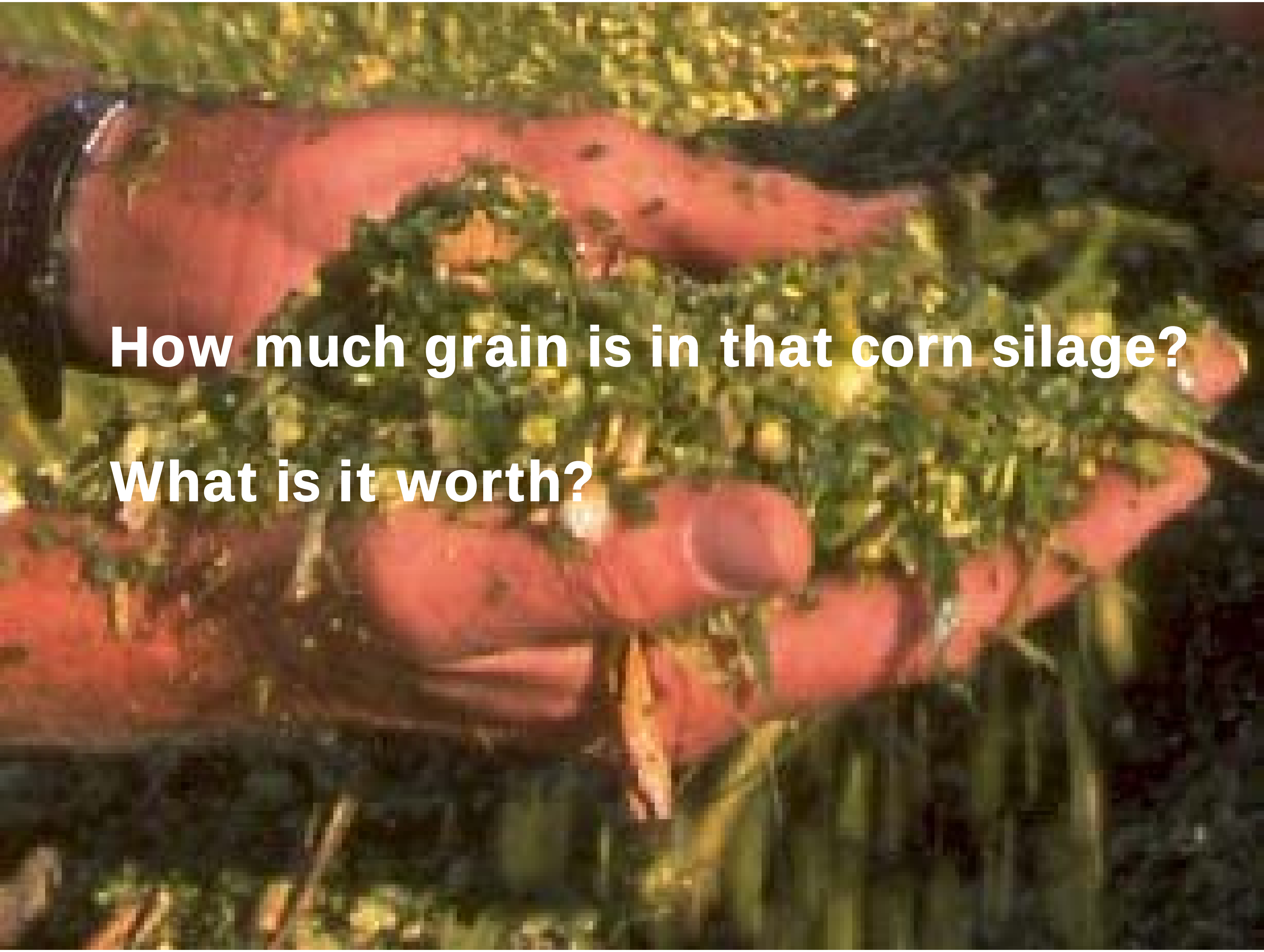
N = 3727 treatment means

r-values	2006	2000	1995	1991
2006	1.0	0.95	0.79	0.70
2000	--	1.0	0.81	0.68
1995	--	--	1.0	0.97
1991	--	--	--	1.0

Source: Lauer

Milk2000 vs. Milk2006

- **Milk2000**
  - ✓ 1%-unit change in NDFD from average NDFD changes DMI 0.37 lb
    - ❑ (Oba and Allen, 1999, JDS)
  - ✓ Double counting of TDN & DMI changes related to NDFD
    - ❑ Tine et al. (2001, JDS) and Oba and Allen (1999, JDS)
  - ✓ At production levels of intake, NDFD has minimal impact on NEL content but impacts NEL intake primarily through impact on DMI
  - ✓ Calculation of NEL_{3x} from TDN_{1x} as per NRC (1989)
- **Milk2006**
  - ✓ 1%-unit change in NDFD from average NDFD changes DMI 0.26 lb
    - ❑ (Jung, 2004, MN Nutr. Conf.; Oba and Allen, 2005, Tri-State Nutr. Conf.)
  - ✓ NDFD used for calculating NEL_{3x} adjusted for impact of NDFD on DMI
    - ❑ (Oba and Allen, JDS, 1999)
  - ✓ Calculation of NEL_{3x} from TDN_{1x} via DE and ME as per NRC (2001)
- **Both equations**
  - ✓ Provide index of quality (milk per ton) & quality by yield (milk per acre)
  - ✓ Provide TDN_{1x} and NEL_{3x} values
  - ✓ Are not an economic models
  - ✓ Does not vary diet formulations
  - ✓ Does not prioritize between quality and yield

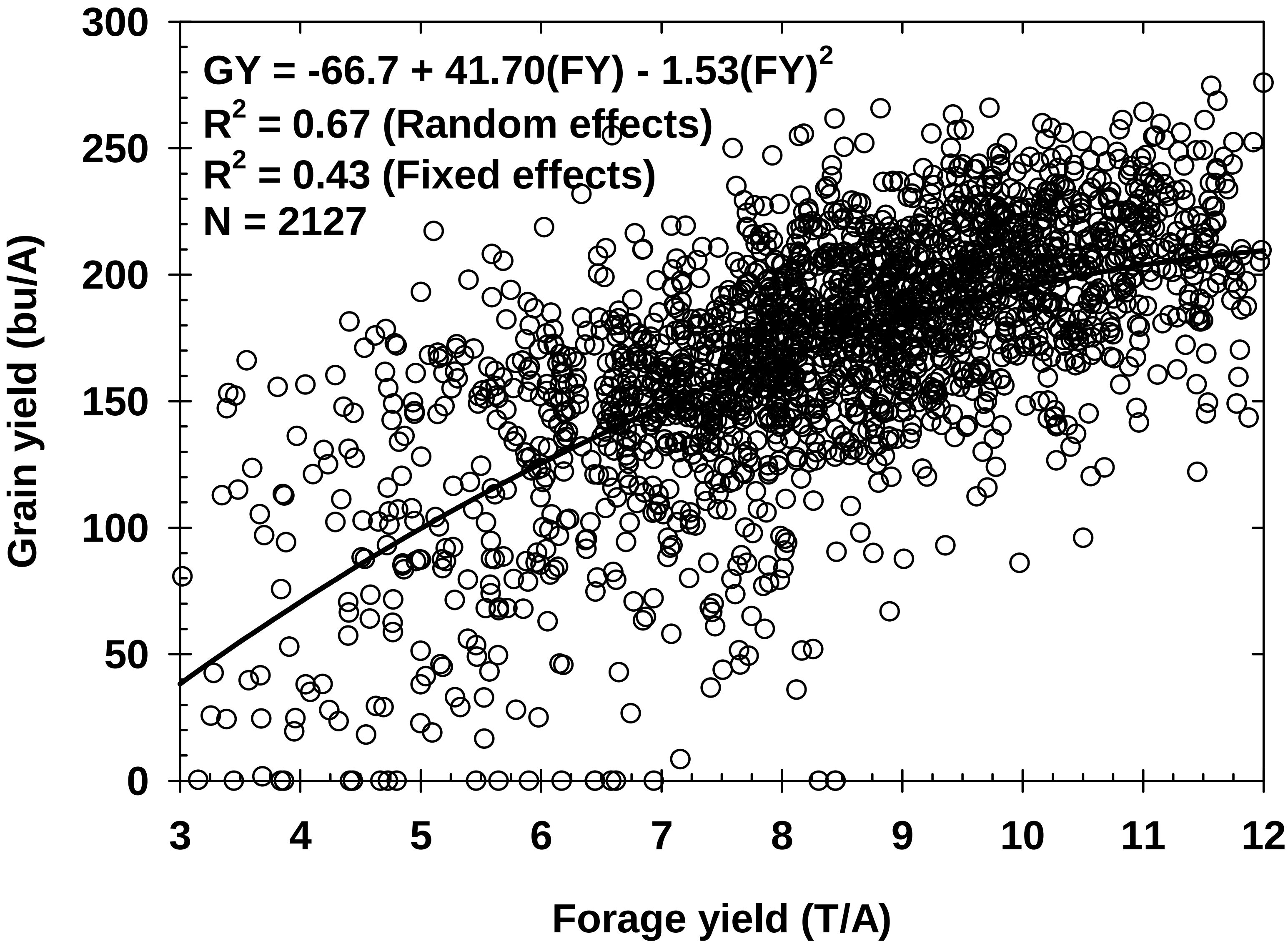

How much grain is in that corn silage?
What is it worth?

Approximate bushels of dry grain equivalent contained in a ton of corn silage

Yield of corn grain	Bushels of dry grain / Ton of Silage (15.5 percent moisture) / (62 to 68 percent moisture)
Bu/A	Bu/T
Less than 90	5.0
90-110	5.5
110-130	6.0
130-150	6.5
Over 150	7.0

Source: Jorgensen and Crowly, 1972 "Corn silage for Wisconsin cattle" - A1178

The relationship between corn grain and forage yield in Wisconsin between 1997 and 2005.



University of Wisconsin – Agronomy

Year effect on grain equivalents contained in corn silage at Arlington, WI

Year	Grain yield equivalent 50	100	150	200	R^2
	bushels of grain (15.5%) per Ton of corn silage (65% moisture)				
2005	9.0	8.3	8.0	7.9	0.65
2004	3.2	5.4	6.8	6.9	0.74
2003	12.4	7.9	7.0	6.7	0.34
2002	---	---	7.7	7.3	0.39
2001	3.1	5.5	7.2	8.0	0.42
2000	4.2	6.6	7.6	---	0.50
1999	2.8	5.0	6.6	6.9	0.37
1998	2.7	4.9	6.4	7.2	0.35
1997	7.1	9.1	9.2	---	0.51

Location and year effect on grain equivalents (bu/T) contained in corn silage for six corn hybrids

Location	Year	Average	Minimum hybrid	Maximum hybrid
		bushels of grain (15.5%) per Ton of corn silage (65% moisture)		
Arlington	2004	7.7	6.5	8.3
	2005	8.6	7.8	10.5
Fond du Lac	2005	7.0	6.0	7.5
Galesville	2004	7.2	5.8	8.2
	2005	8.0	7.0	8.8
Marshfield	2004	7.0	5.5	7.7
	2005	6.3	4.5	7.2
Rhinelander	2005	7.7	6.7	10.3
Valders	2004	7.8	7.0	8.2
	2005	7.5	6.5	8.0
Average	---	7.5	6.4	8.5

Trait effect on grain equivalents (bu/T) contained in corn silage hybrids (2004-2005)

Traits	Bushels of grain (15.5%) per Ton of corn silage (65% moisture)
None	7.8
BMR	6.7
CB,LL	7.6
LSD(0.05)	0.9

Bushels of grain contained in a ton of corn silage.

Values are derived from experiments conducted in Wisconsin between 1997 and 2005

	0% moisture		60% moisture		65% moisture		70% moisture	
Grain yield @ 15.5% moisture	Silage yield	Grain equivalent per ton of silage	Silage yield	Grain equivalent per ton of silage	Silage yield	Grain equivalent per ton of silage	Silage yield	Grain equivalent per ton of silage
Bu/A	T/A	Bu/T	T/A	Bu/T	T/A	Bu/T	T/A	Bu/T
25	2.4	24.9	6.0	4.1	6.9	3.6	8.0	3.1
50	3.2	24.1	7.9	6.3	9.1	5.5	10.6	4.7
75	4.0	23.3	10.0	7.5	11.4	6.6	13.3	5.7
100	4.9	22.4	12.2	8.2	13.9	7.2	16.2	6.2
125	5.9	21.5	14.6	8.5	16.7	7.5	19.5	6.4
150	7.0	20.3	17.5	8.6	20.0	7.5	23.3	6.4
175	8.4	19.0	20.9	8.4	23.9	7.3	27.9	6.3
200	10.2	17.1	25.6	7.8	29.3	6.8	34.1	5.9

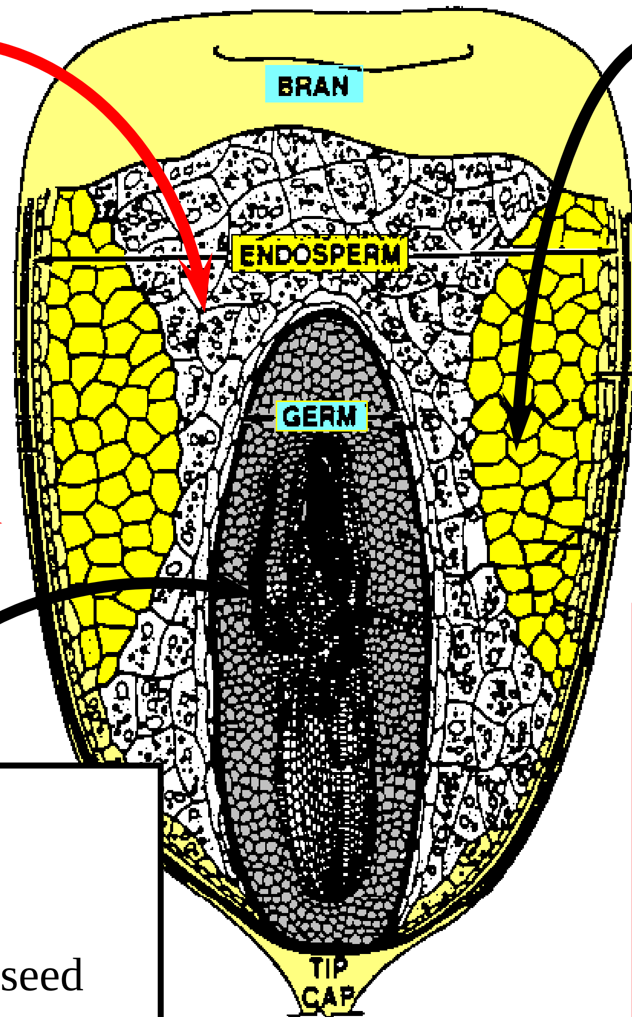
Summary

- **Grain yield equivalents have increased since 1972.**
- **Arriving at a fair and equitable price for corn silage is difficult due to the number of factors involved that are dynamic and biologically variable.**
  - ✓ Moisture
  - ✓ Environment (Location and Year)
  - ✓ Hybrid
- **The relationship between corn grain yield and forage yield is quite variable to the extent that one predetermined grain equivalent value should probably NOT be used in contracts.**
  - ✓ Also LDPs

Germination can be divided into a number of distinct phases:

Step 1: Imbibition.
✓Water and oxygen move slowly into the kernel through the pericarp.
✓Membranes rehydrate
✓Hormones and enzymes are activated.

Step 2: Starch breakdown and energy remobilization
✓Enzymes begin to breakdown starch in the endosperm.
✓Sugars supply embryo with energy for metabolism and cell division.



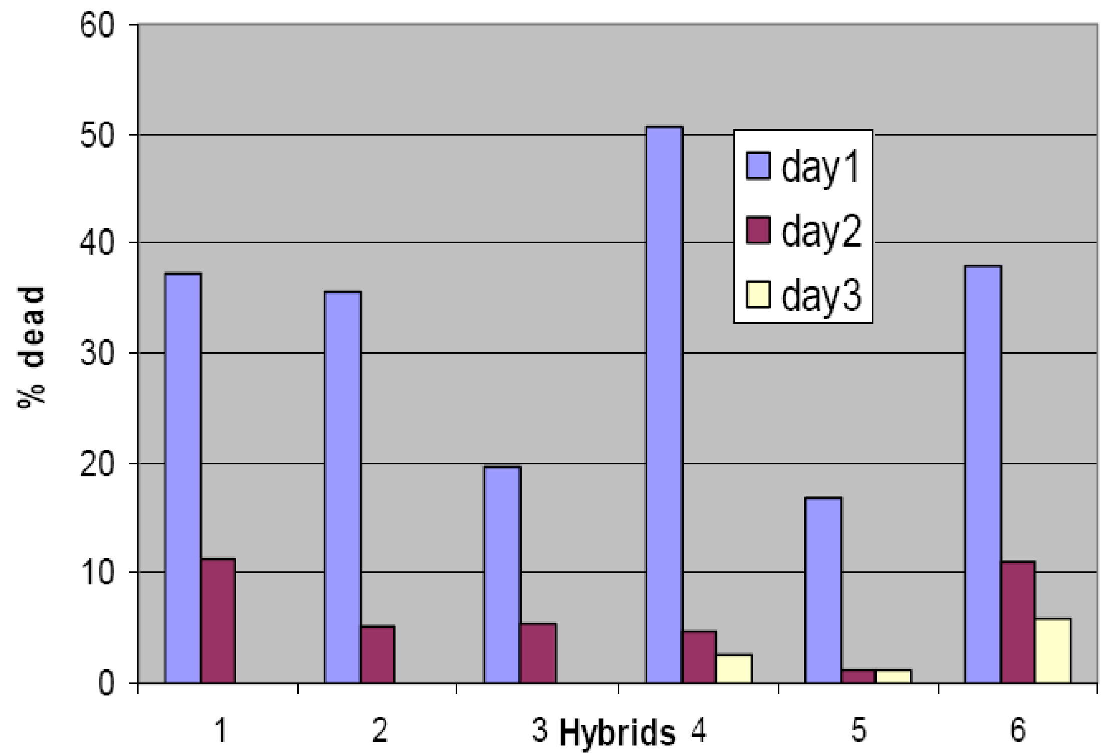
Pericarp(bran)

Step 3. Cell elongation and differentiation
✓Radicle emerges first.
✓The plumule emerges from the seed and then from the soil.
✓Seedling begins photosynthesis.

Imbibitional chilling
✓Membrane rehydration is disrupted by free radicals
✓Cold water is much more disruptive than warm water.
✓Sugars and salts leak from the cells and kernel. Providing a food source for pathogens and other microbes.

Imbibitional chilling is easily observed in sweet corn

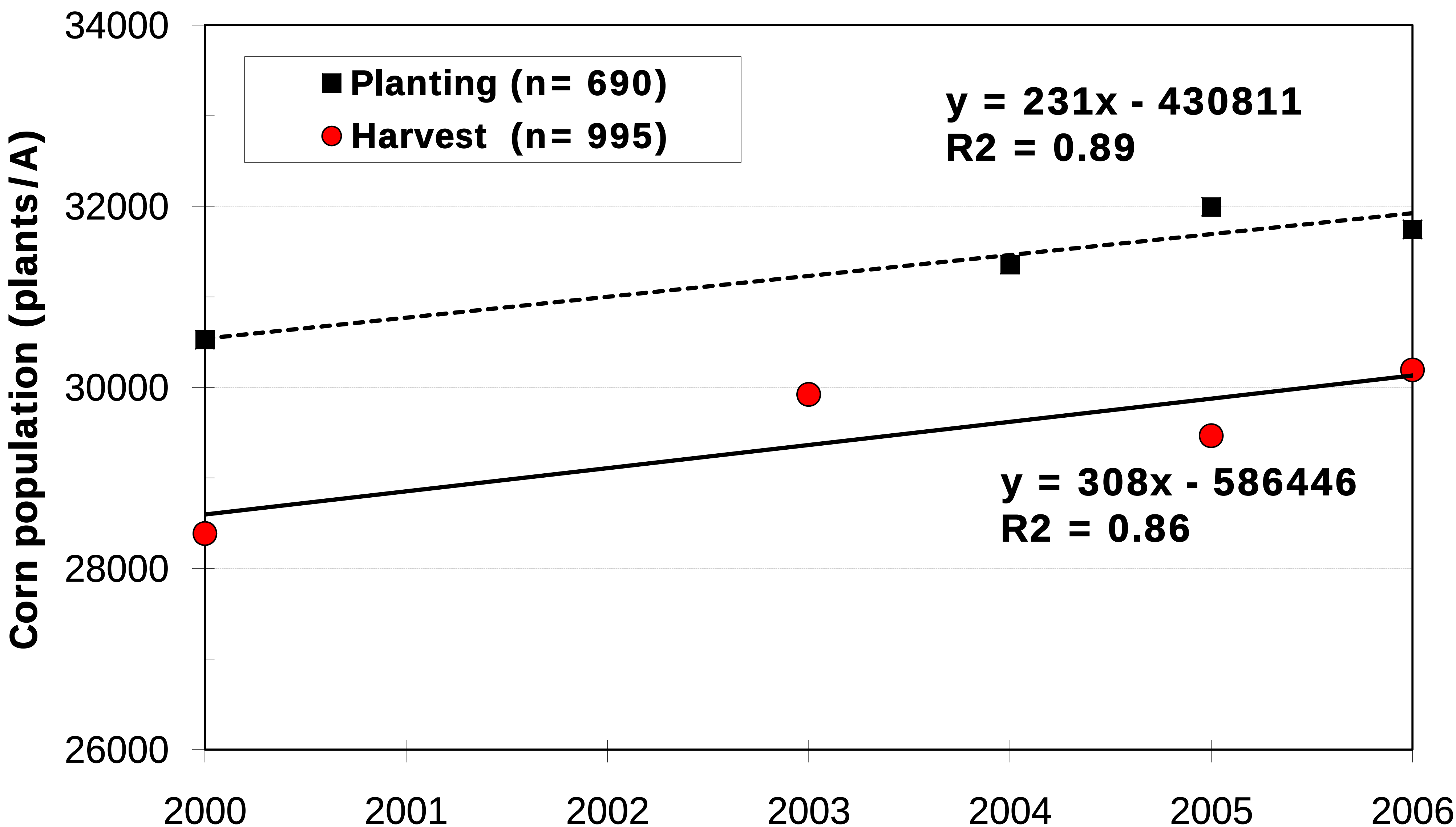
- **Untreated seed of six supersweet hybrids was exposed to six treatments**
  - ✓ **Each treatment consisted of one 24 hour period at 40 ºF and five days at 75 ºF**
- **Rag dolls with no soil.**
- **Eight reps 25 seeds per rep**



Source: Tracy, 2005

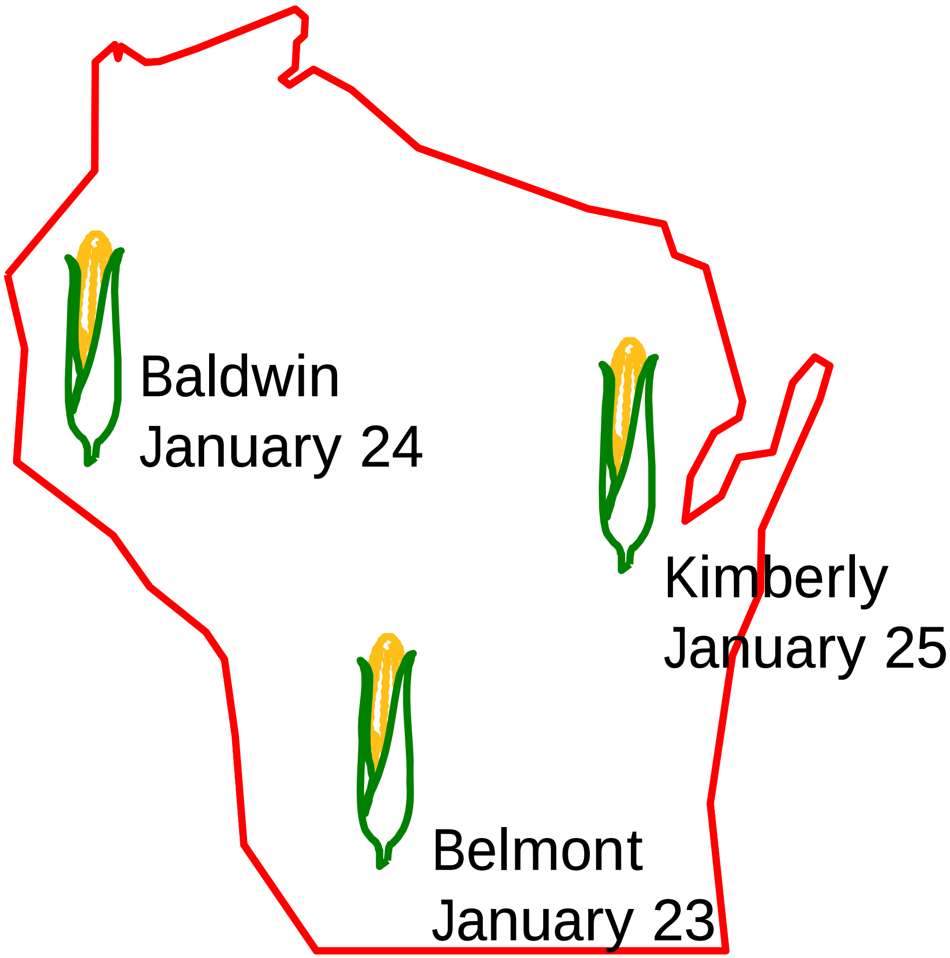
- **In field corn, not much can be done for managing imbibitional chilling, except avoid prolonged cool, wet weather.**

What is your target population: At planting? At harvest?



Thanks for your attention!
Questions?

2007 Corn Conferences



WISCONSIN Corn/Soy EXPO

PEPS

February 1-2, 2007
Kalahari Resort
Wisconsin Dells, WI