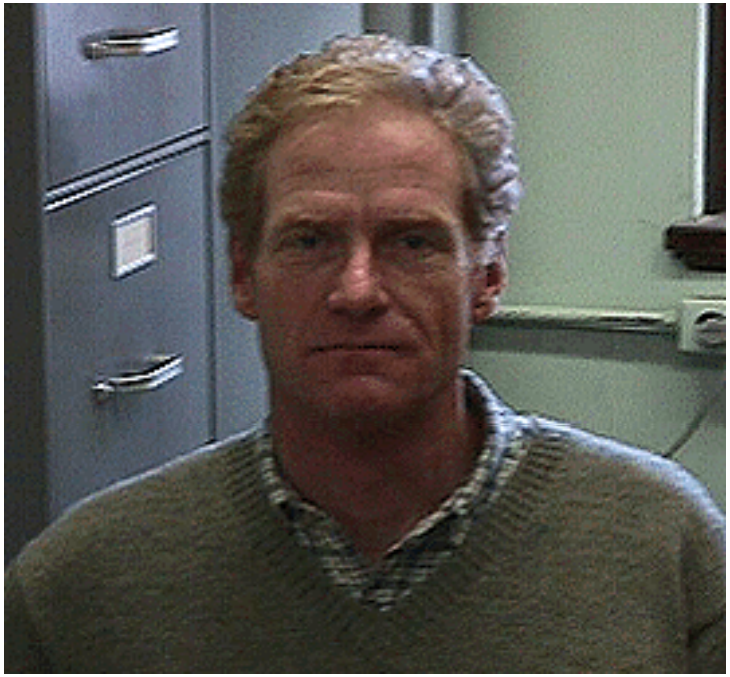
Corn Silage Hybrids for Best Performance

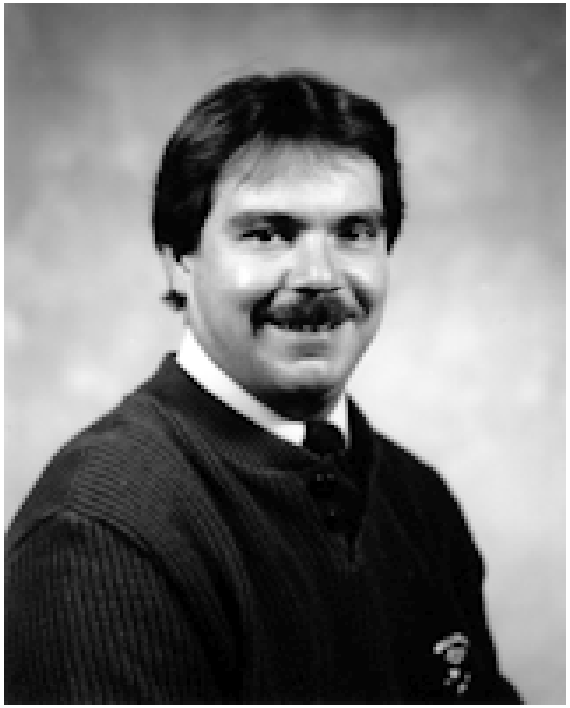
Joe Lauer

University of Wisconsin

The UW Corn Silage Team



Dr. Jim Coors
Corn Breeder



Dr. Randy Shaver
Dairy Nutritionist

Dr. Joe Lauer
Corn Agronomist

Desirable Forage Characteristics

- What makes a good forage? (Carter et al., 1991)
  - ✓ High yield
  - ✓ High energy (high digestibility)
  - ✓ High intake potential (low fiber)
  - ✓ High protein
  - ✓ Proper moisture at harvest for storage
- Ultimate test is animal performance
  - ✓ Milk2000 is our best predictor for performance (Schwab - Shaver equation)

What Do We Want in Grain versus Silage Hybrids?

Trait	Grain	Silage
Grain yield	High	Adequate
Forage yield	Adequate	High
Hybrid range	60 bu/A	8,000 lb Milk/A
Stalks	Standability	Digestibility
Leaves	Unknown	Digestibility
Kernel hardness	Hard	Soft
Plant drydown	“Stay-green”	Synchronous
Plant maturity	“Full-season”	5-10 d longer

Corn Silage

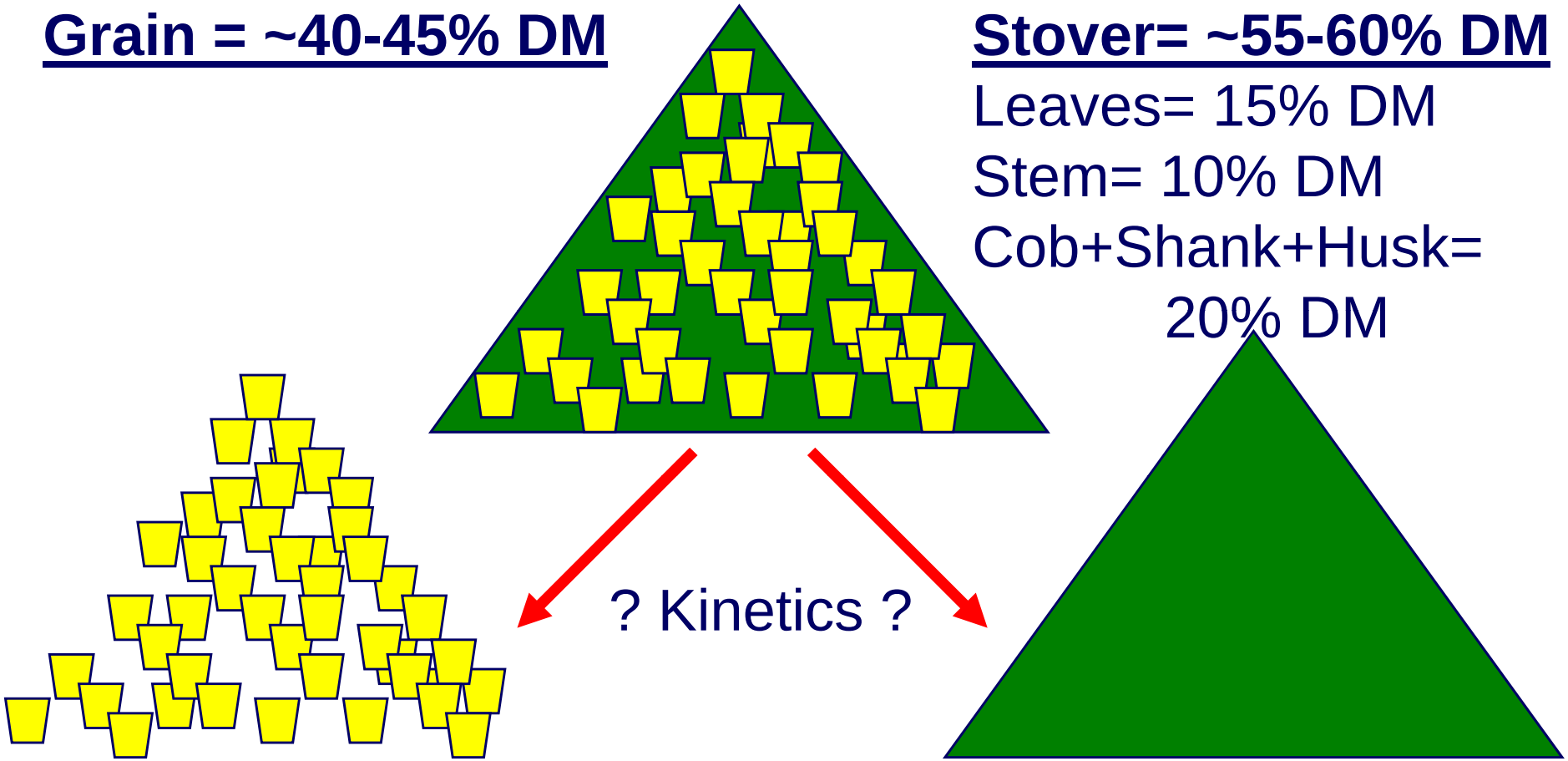
Grain = ~40-45% DM

Stover= ~55-60% DM

Leaves= 15% DM

Stem= 10% DM

Cob+Shank+Husk= 20% DM

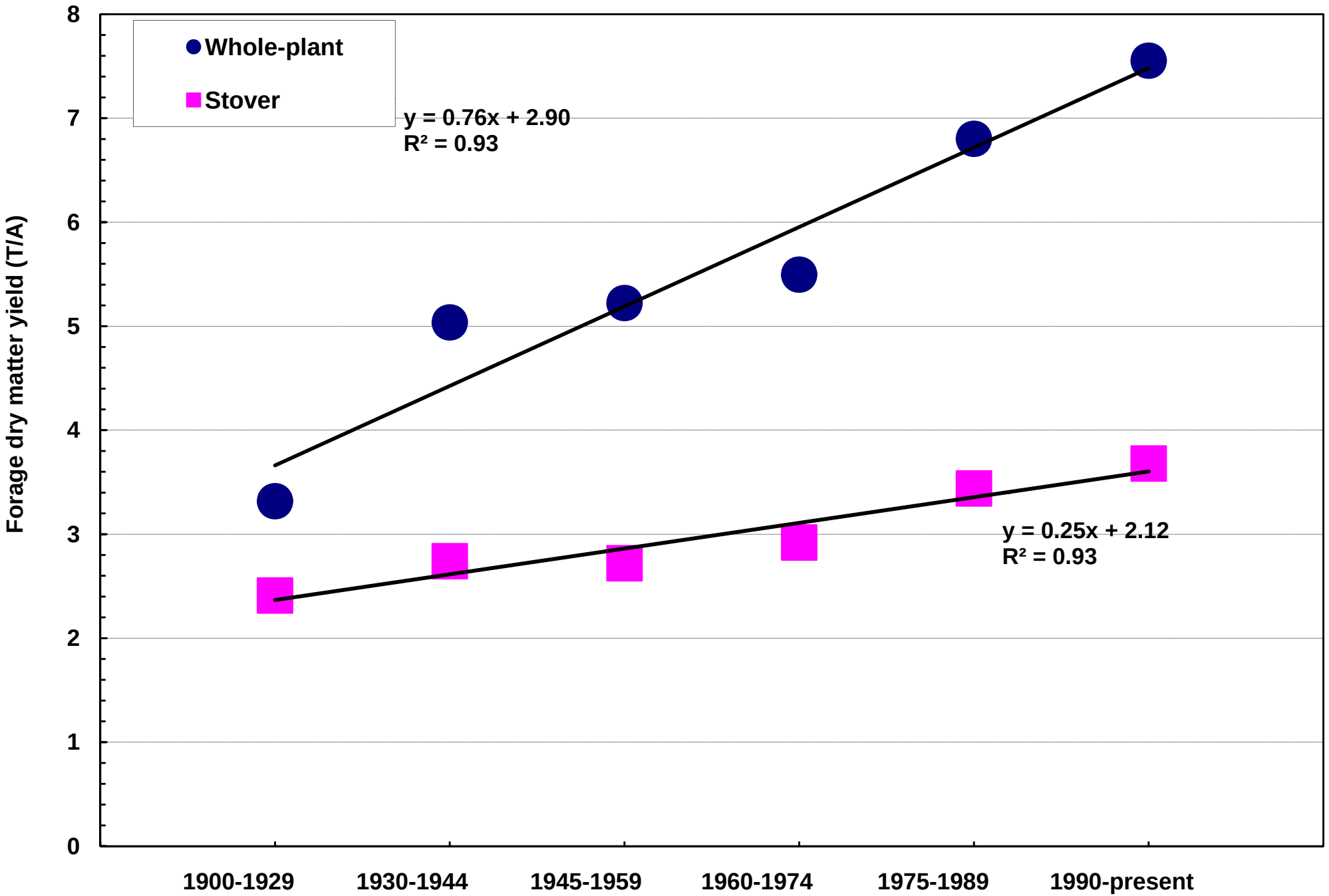


80 to 100% digestible

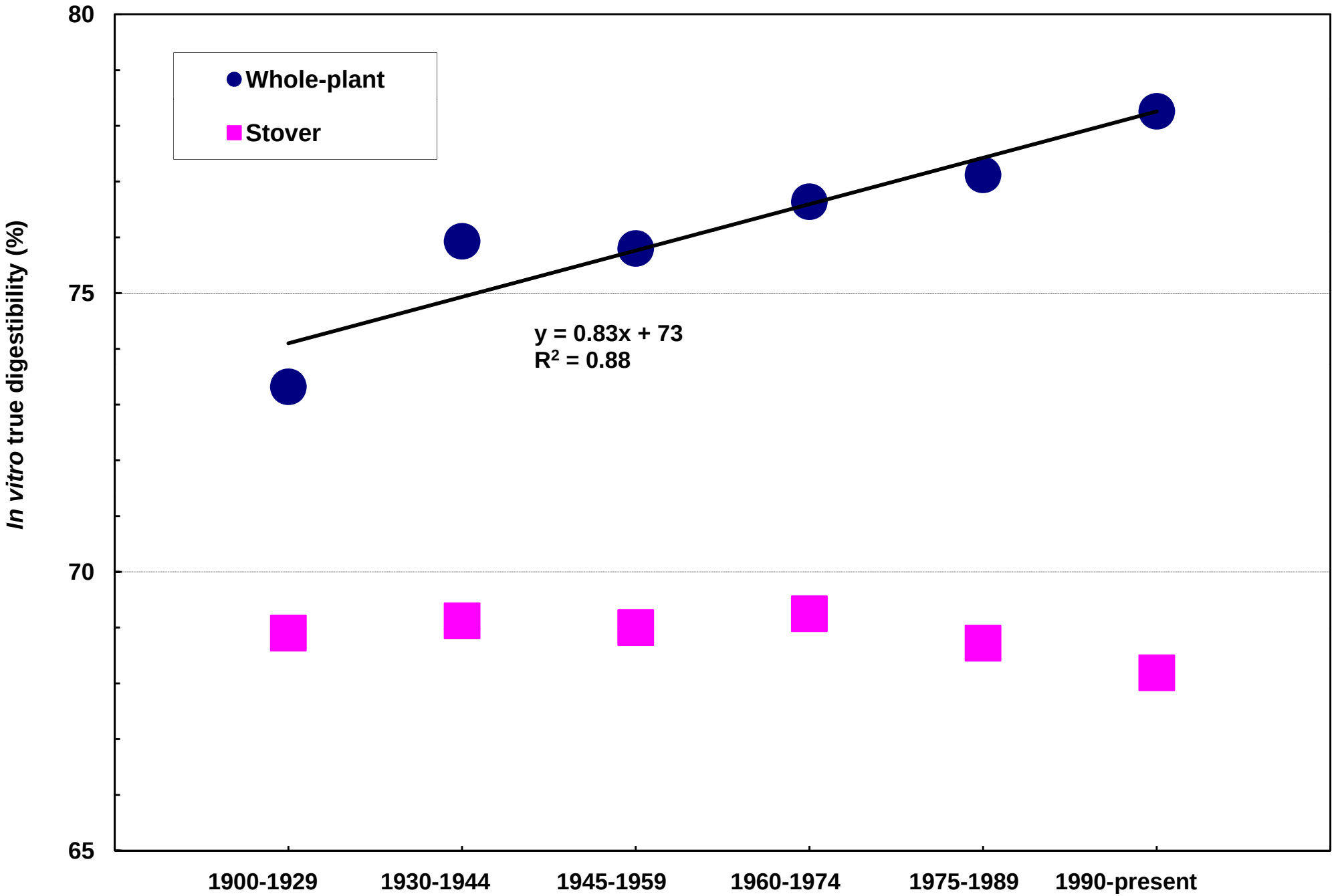
- Kernel maturity
- Starch digestibility

40 to 55% digestible

- Cell wall digestibility

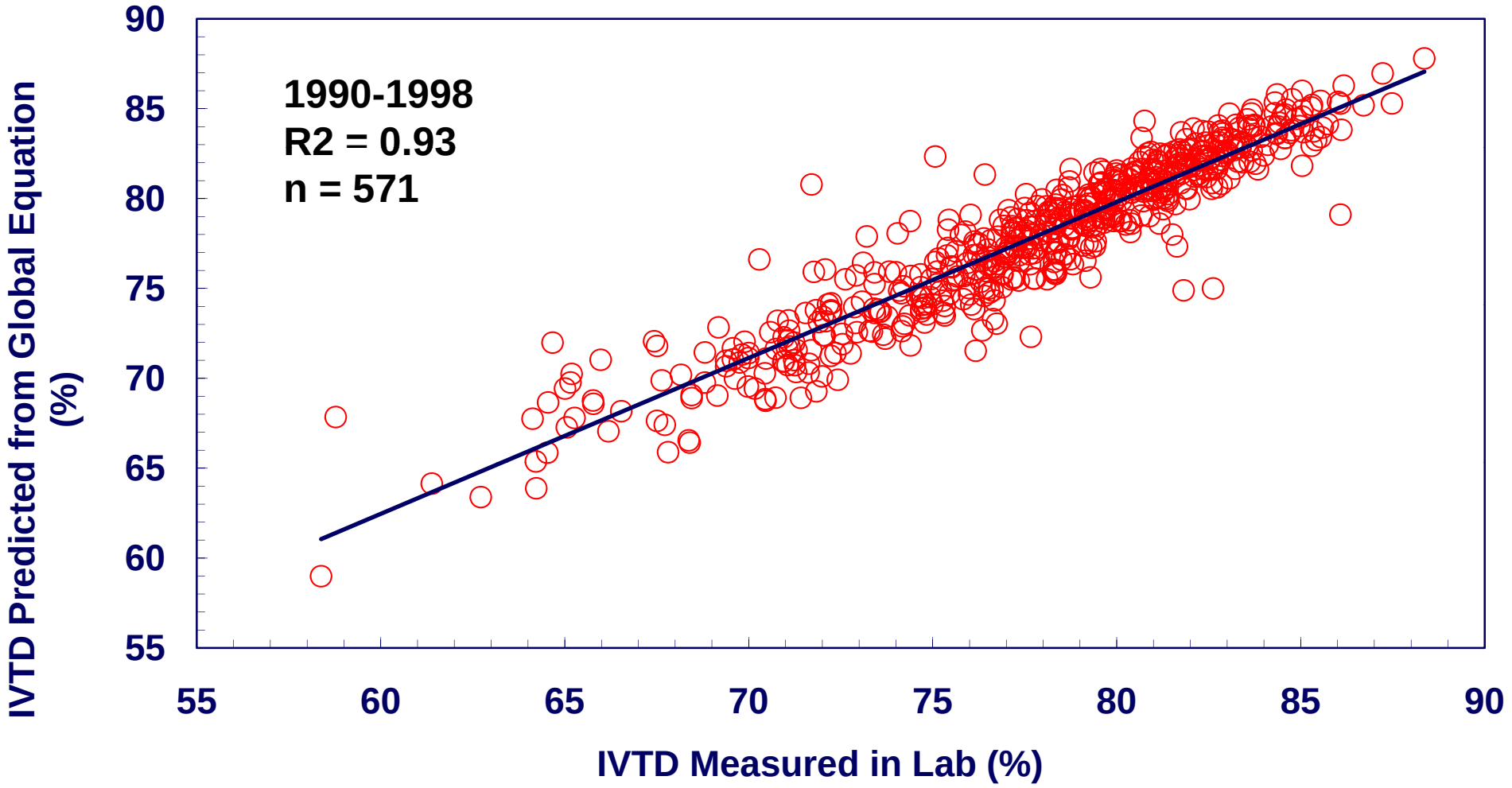


Relationship between corn forage dry matter yield and era of release for whole-plant and stover.

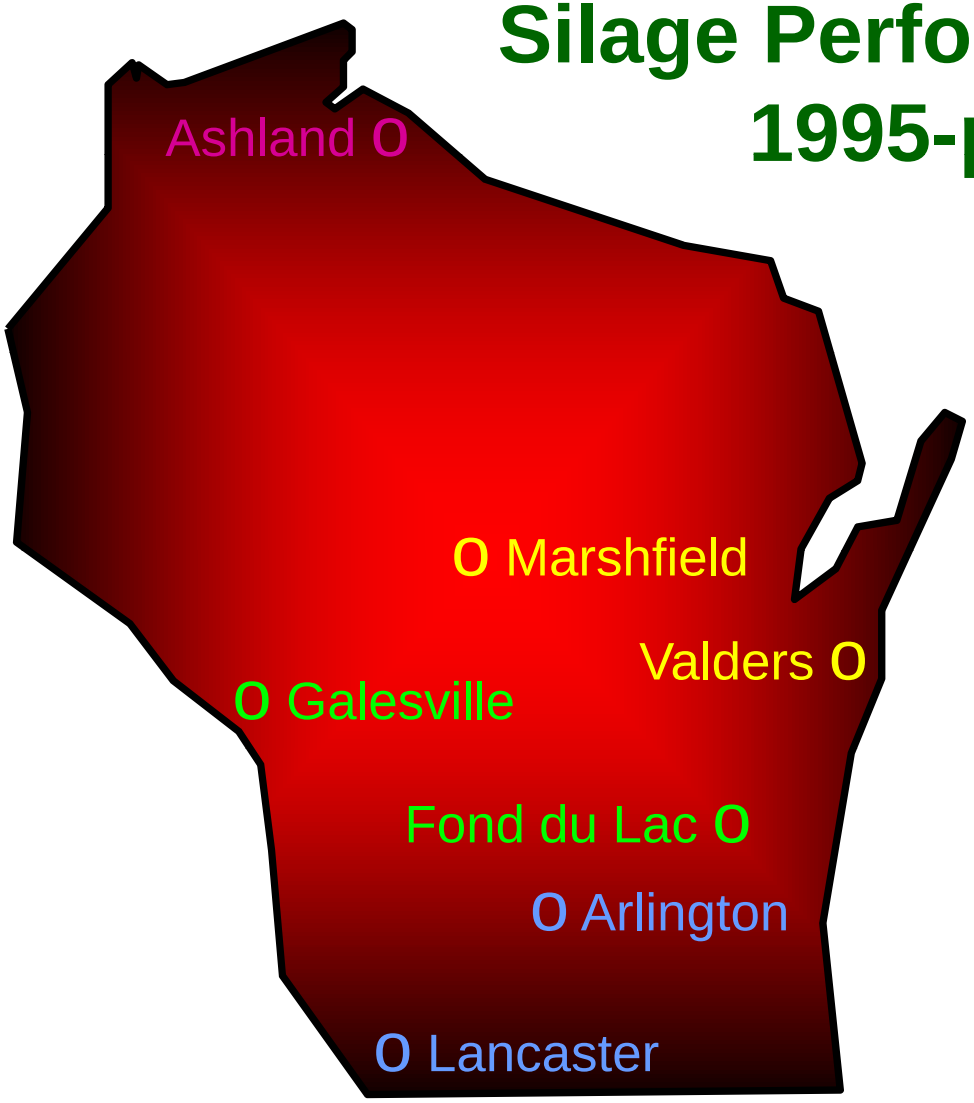


Relationship between corn forage *in vitro* true digestibility and era of release for whole-plant and stover.

NIRS Global Equation Calibration for *in vitro* True Digestibility (602 samples submitted)



Wisconsin Corn Hybrid Silage Performance Trials 1995-present



2001 Wisconsin Corn Performance Trials - Silage Summary

Location	1991-2000		2001		Percent Change
	N	Yield	*N*	Yield	
		T/A		T/A	
Arlington	463	9.5	75	10.5	+ 11
Lancaster	386	7.8	75	8.0	+ 3
Fond du Lac	352	8.6	68	8.2	- 5
Galesville	352	8.3	68	9.6	+ 16
Marshfield	428	6.8	55	7.3	+ 7
Valders	387	6.7	57	4.1	- 39
Ashland	125	6.8	16	7.3	+ 7

Table 15. North Central Zone - Early Maturity Silage Trial 2000

BRAND	HYBRID	Kernel Yield T/A	Moist %	Milk %	CP %	ADF %	NDF %	IVD %	CWD %	Starch %	MILK PER TON	MILK PER ACRE	MAR Yield T/A	VAL Yield T/A
Trelay	2008	8.3 *	55.3	30	7.0	25	52	72	46	28	2670	22300 *	8.3 *	8.3 *
Carhart's Blue Top	CX8500A	7.4	58.7	50	7.3	24	49	73	46	29	2770 *	20700	7.9 *	7.0
NK Brand	N27-M3	7.0	59.2	30	7.1	24	48	74	45	31	2810 *	19800	7.4	6.7
Pioneer	39D81	5.2	59.6	10	7.1	26	53	71	45	26	2620	13600	5.7	4.6
Renk	RK394	7.8 *	59.6	30	7.0	28	55	70	46	24	2580	20200	8.3 *	7.3
Dairyland	Stealth 1280	7.7 *	59.9	30	7.1	25	52	72	45	28	2690	20800	8.3 *	7.1
85-DAY HYBRID TRIAL AVERAGE##			60.3											
LG Seeds	LG2367	7.3	60.4	30	6.9	26	53	72	47	27	2700	19800	8.3 *	6.3
Carhart's Blue Top	CX290A	7.4	60.6	40	7.2	22	46	75	45	34	2900 *	21300	7.2	7.5 *
Dairyland	Stealth 1289	7.0	60.7	20	8.1	28	55	70	46	24	2570	18100	7.3	6.7
Brown	2080	6.8	61.3	40	7.0	23	48	74	45	31	2830 *	19200	6.5	7.1
Carhart's Blue Top	CX1187A	6.9	61.4	30	7.2	25	51	73	46	29	2780 *	19200	6.8	7.0
90-DAY HYBRID TRIAL AVERAGE##			62.9											
Dekalb	DKC39-45	7.1	63.8	40	6.8	23	47	74	45	31	2920 *	20600	6.7	7.4 *
NK Brand	N2555BT	7.1	64.2	40	7.4	26	51	72	45	27	2760 *	19800	7.7 *	6.6
Ramy Seed	PG1455	8.6 *	64.6	60	7.3	25	50	73	46	28	2850 *	24500 *	8.7 *	8.4 *
Golden Harvest	H6675	8.2 *	66.4	40	7.7	25	50	72	44	26	2780 *	22900 *	8.4 *	8.1 *
MEAN		7.3	61.1	40	7.2	25	51	72	46	28	2750	20200	7.6	7.1
LSD(0.10)**		0.9	3.9	10	0.5	3	4	3	1	4	200	3100	1.1	1.1

Calculating Milk per Ton
Milk per Acre = Yield x Milk per Ton

Milk1991

- Dry matter intake estimated using NDF
- Net energy of lactation (Mcal/lb) estimated using ADF

Milk1995

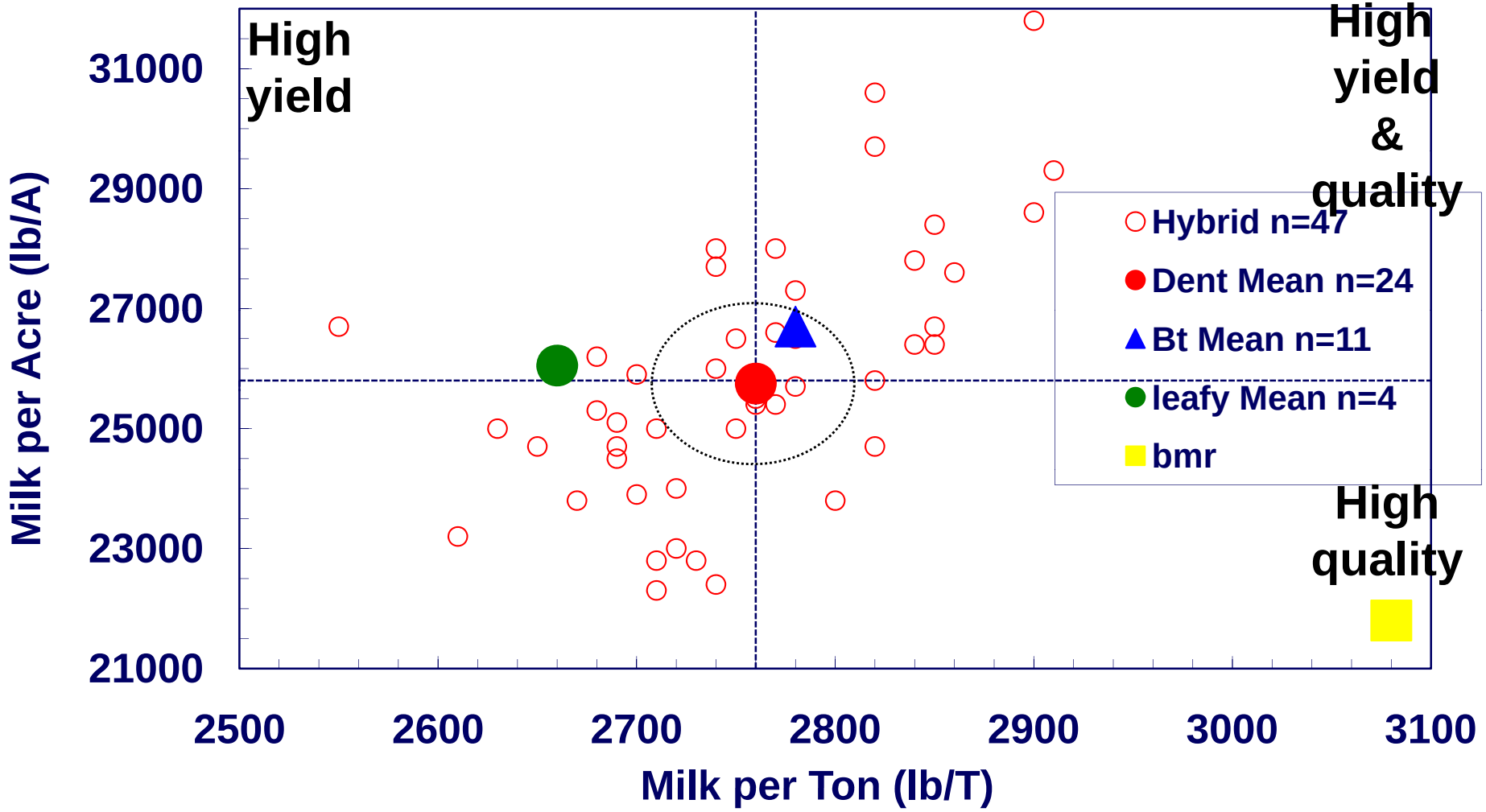
- Dry matter intake estimated using NDF
- Net energy of lactation (Mcal/lb) estimated using IVD

Milk2000

- Dry matter intake estimated using NDF and Cell wall digestibility
  - ✓ Base dry matter intake adjusted 0.374 lb. per 1% unit change in CWD above or below the trial average CWD (Allen et al.)
- Starch digestibility is adjusted for dry matter content and kernel processing
- Net energy of lactation (Mcal/lb) estimated using multi-component summative equation approach

2001 Wisconsin Corn Hybrid Performance Trial Results – Table 12 Southern Zone,

Late Maturity Trial at Arlington and Lancaster

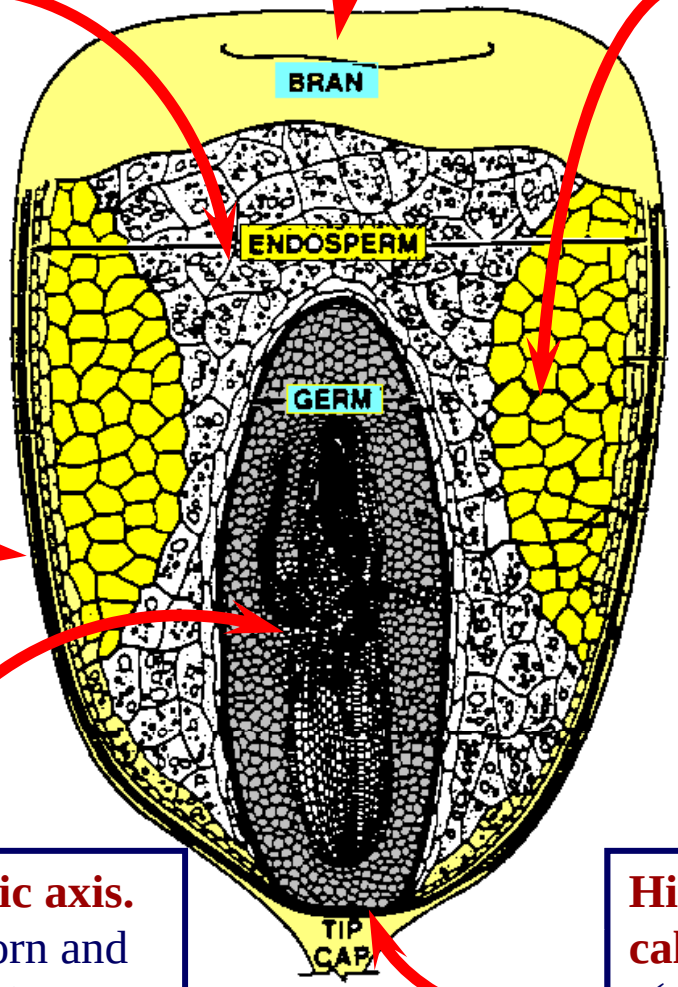


http://corn.agronomy.wisc.edu/select/

Dent (due to soft floury endosperm)

Floury endosperm.
✓More "open" in structure yet opaque in appearance.
✓Dent corn has about equal proportions of horny to floury starch (vs popcorn w/ mostly vitreous starch.

Vitreous endosperm.
✓Also called horneous, corneous or hard endosperm.
✓Primary starch in flint corn.
✓Source of dry milling grits.
✓Tightly compacted and translucent.
✓Higher in CP than floury starch.
✓More of this starch in mature, high test weight kernels.
✓The last starch laid down in the kernel during the last few weeks of development.



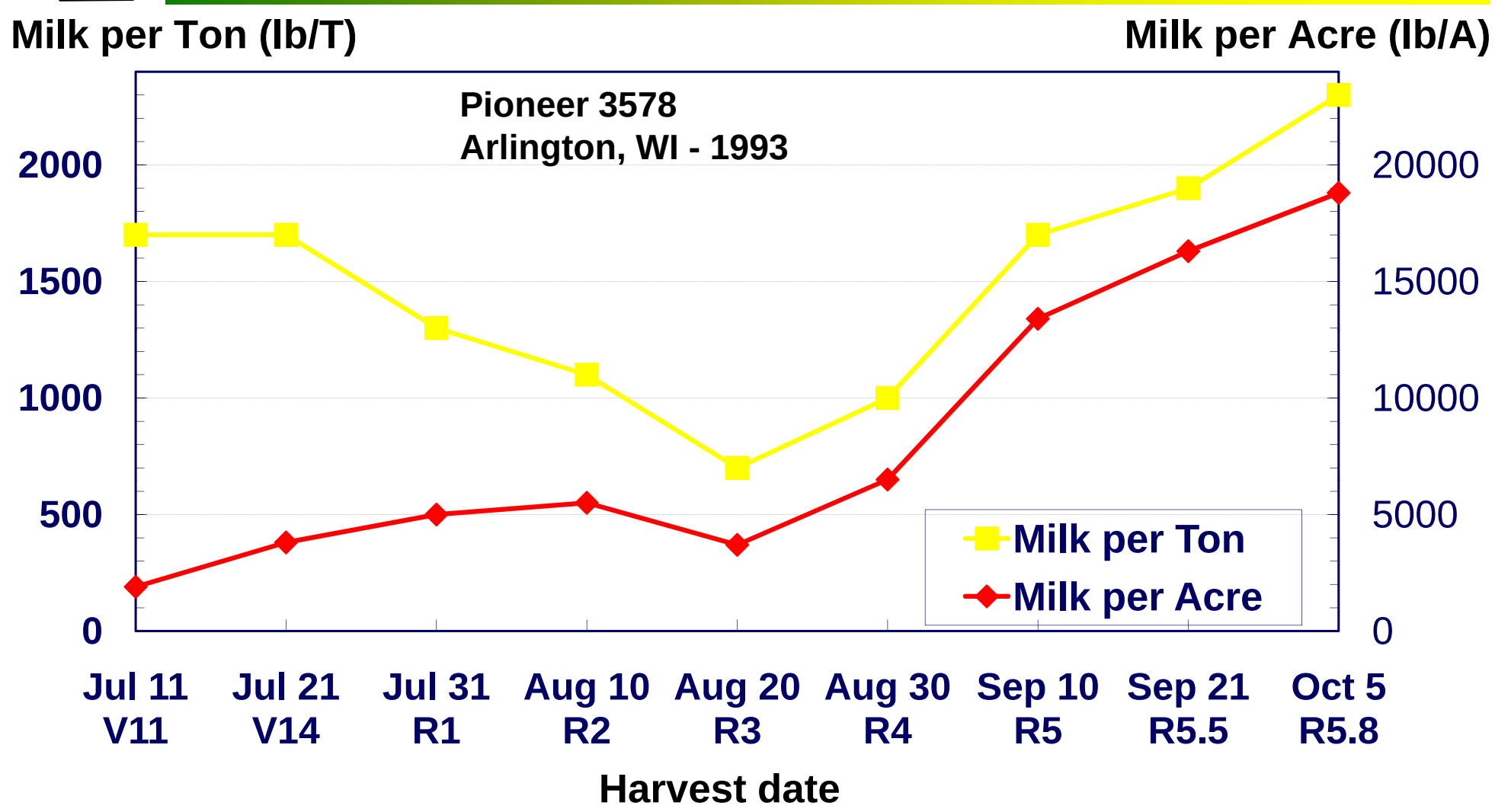
Pericarp(bran)

Germ scutellum and embryonic axis.
✓Germ larger in short season corn and in HOC (at the expense of starch).
✓In HOC, each 1% unit increase in oil, expect 1.3% unit lower starch.

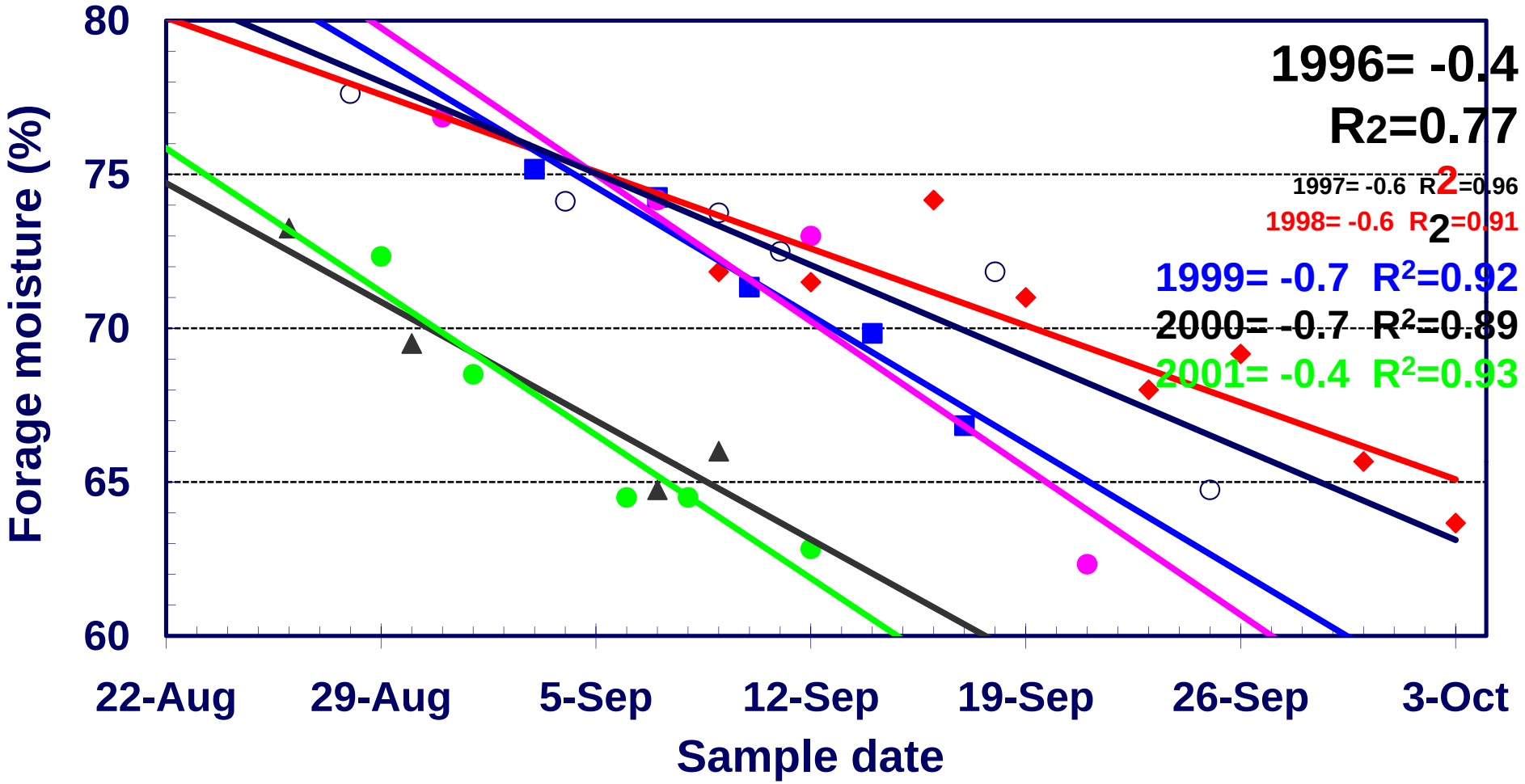
Hilum or abscission layer.Also called black layer.
✓Caused by collapse and compression of several layers of cells at physiological maturity.
✓Cool weather can cause premature BL.

Diagram Source: Hoseney, 1986. Principles of Cereal Science and Technology. Am Assoc of Cereal Chemists, St. Paul, MN

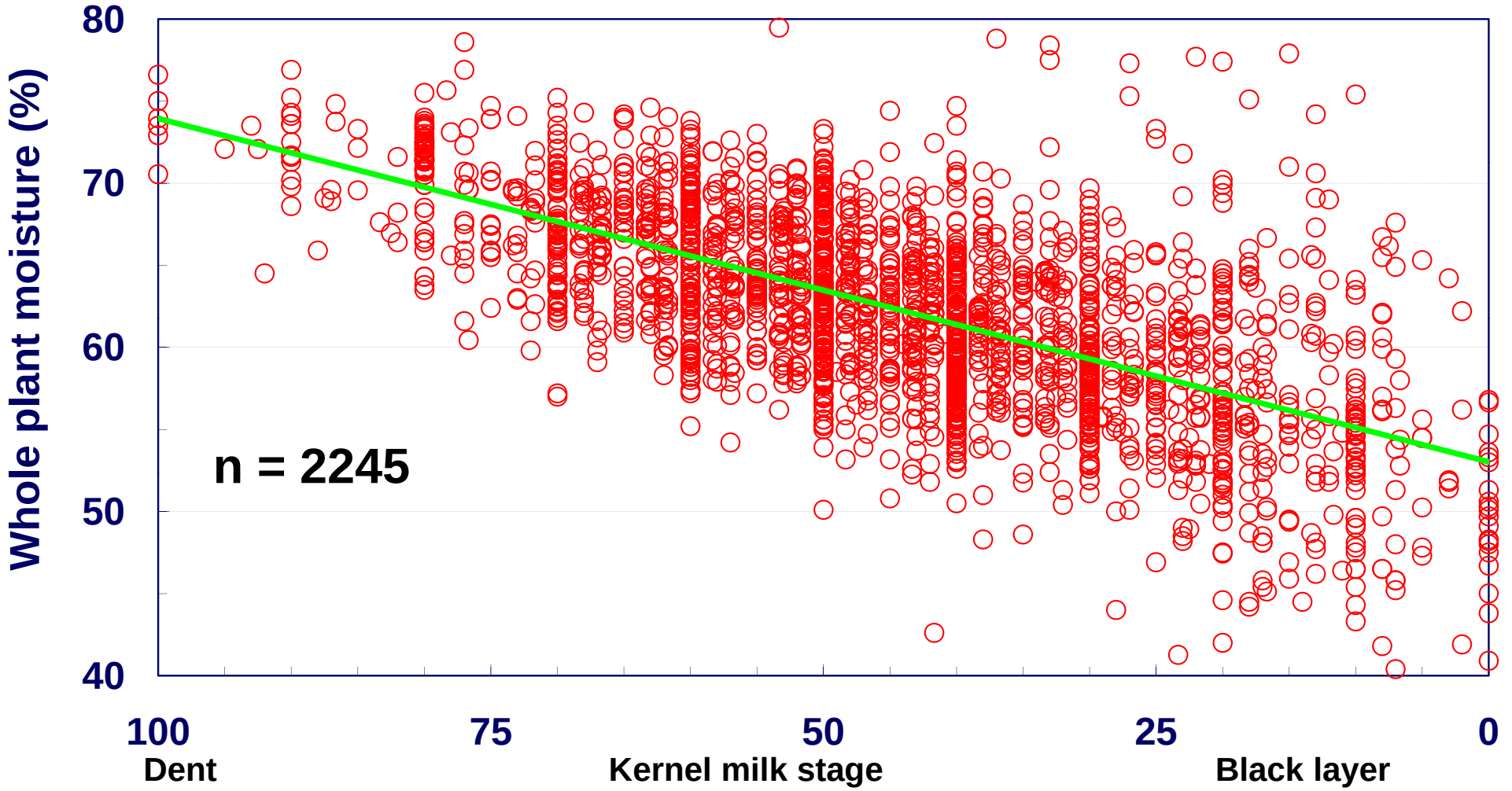
Corn Silage Yield and Quality Changes During Development



Corn Silage Drydown Rate in Manitowoc County, WI.



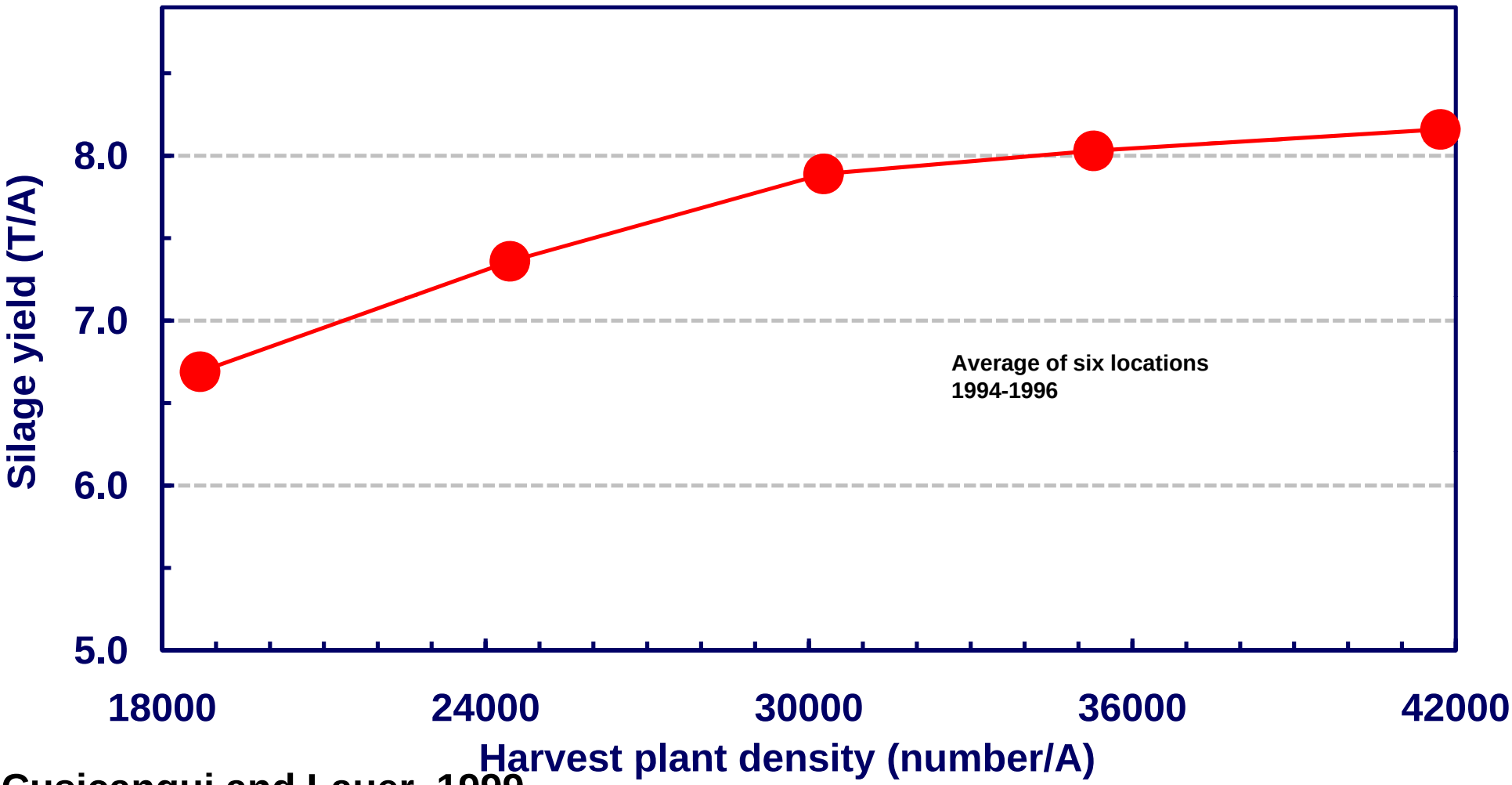
Relationship Between Forage Moisture and Kernel Milk Stage (1990 - 2000)



In-season Guidelines for Predicting Corn Silage Harvest Date

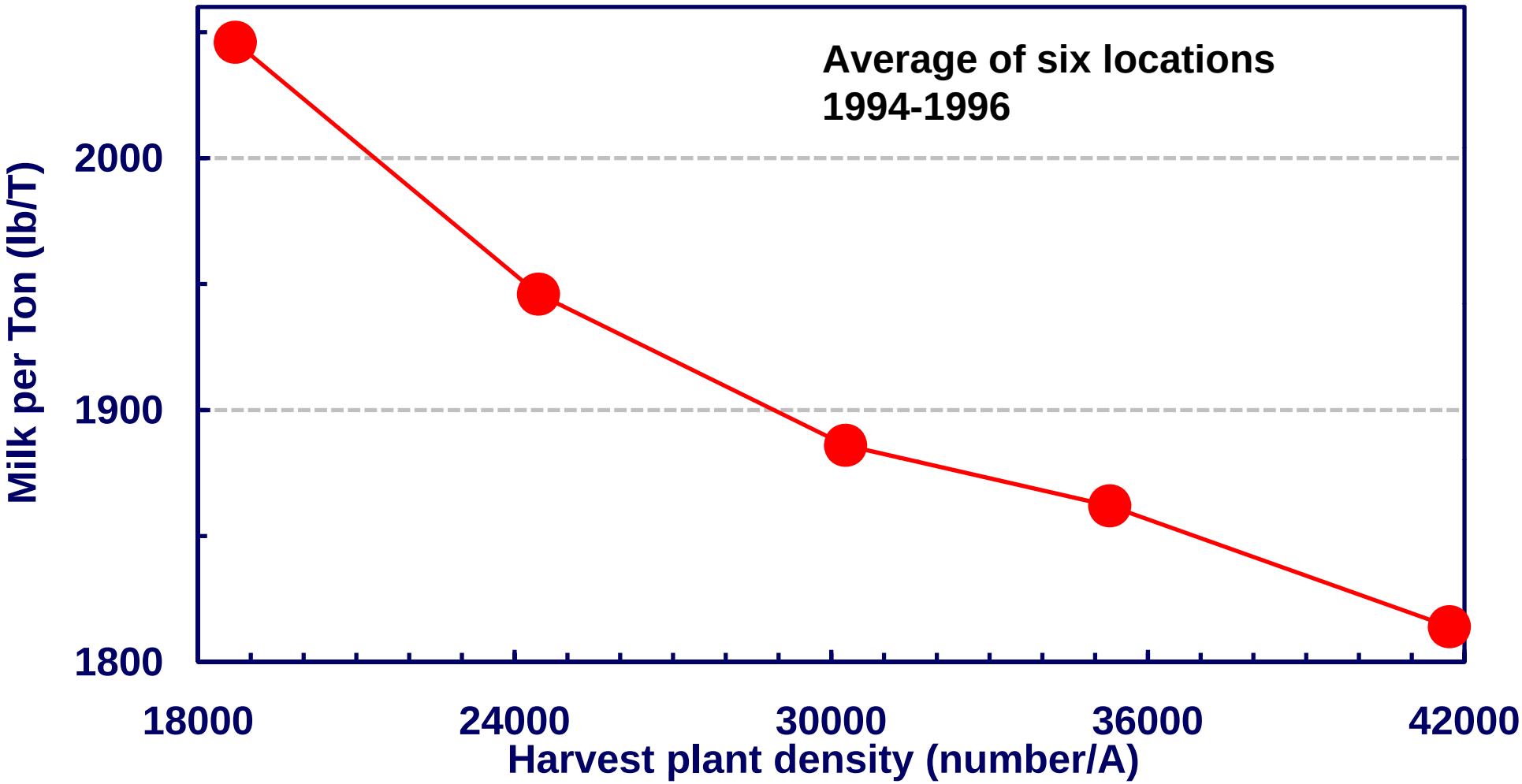
- Note hybrid maturity and planting date of fields intended for silage.
- Note tasseling (silking) date.
  - ✓ Kernels will be at 50% kernel milk (R5.5) about 42 to 47 days after silking.
- After milkline moves, use kernel milk triggers to time corn silage harvest.
  - ✓ Use a drydown rate of 0.5% per day to predict date when field will be ready for the storage structure.
  - ✓ See http://cf.uwex.edu/ces/ag/silagedrydown/
- Do final check prior to chopping.

Relationship between corn silage yield and plant density in WI



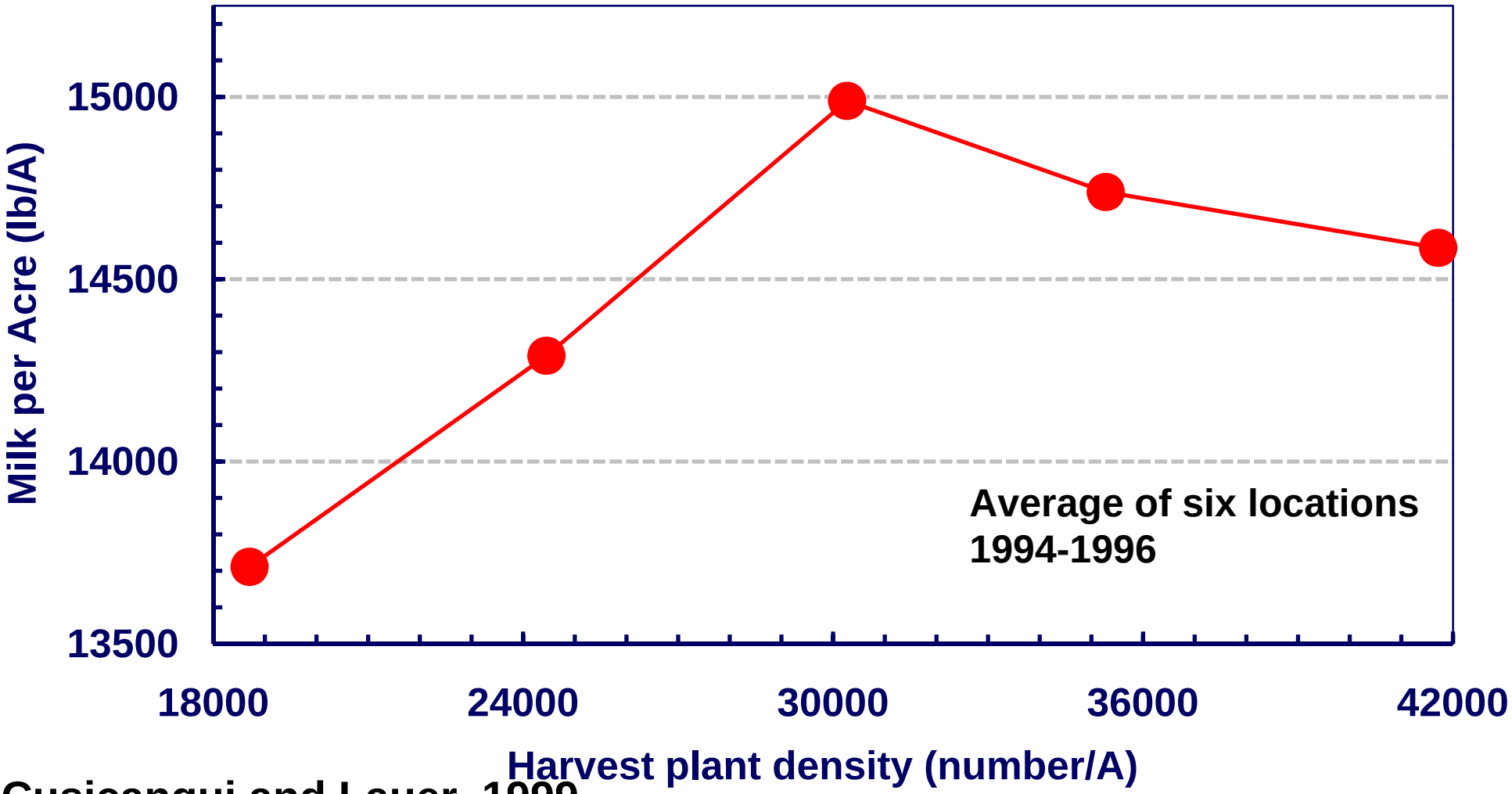
Cusicanqui and Lauer, 1999

Relationship between corn silage Milk per Ton and plant density in WI



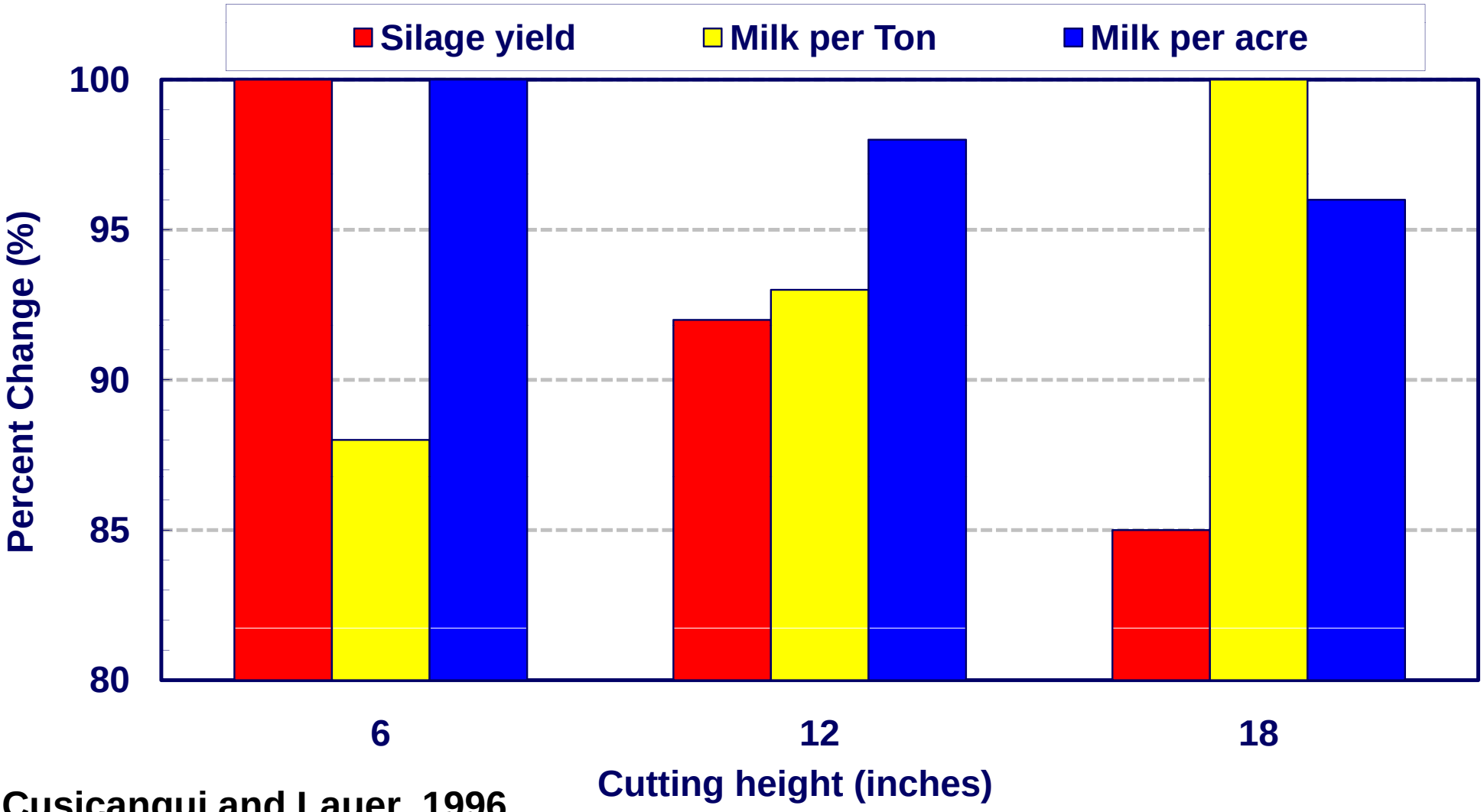
Cusicanqui and Lauer, 1999

Relationship between corn silage Milk per Acre and plant density in WI



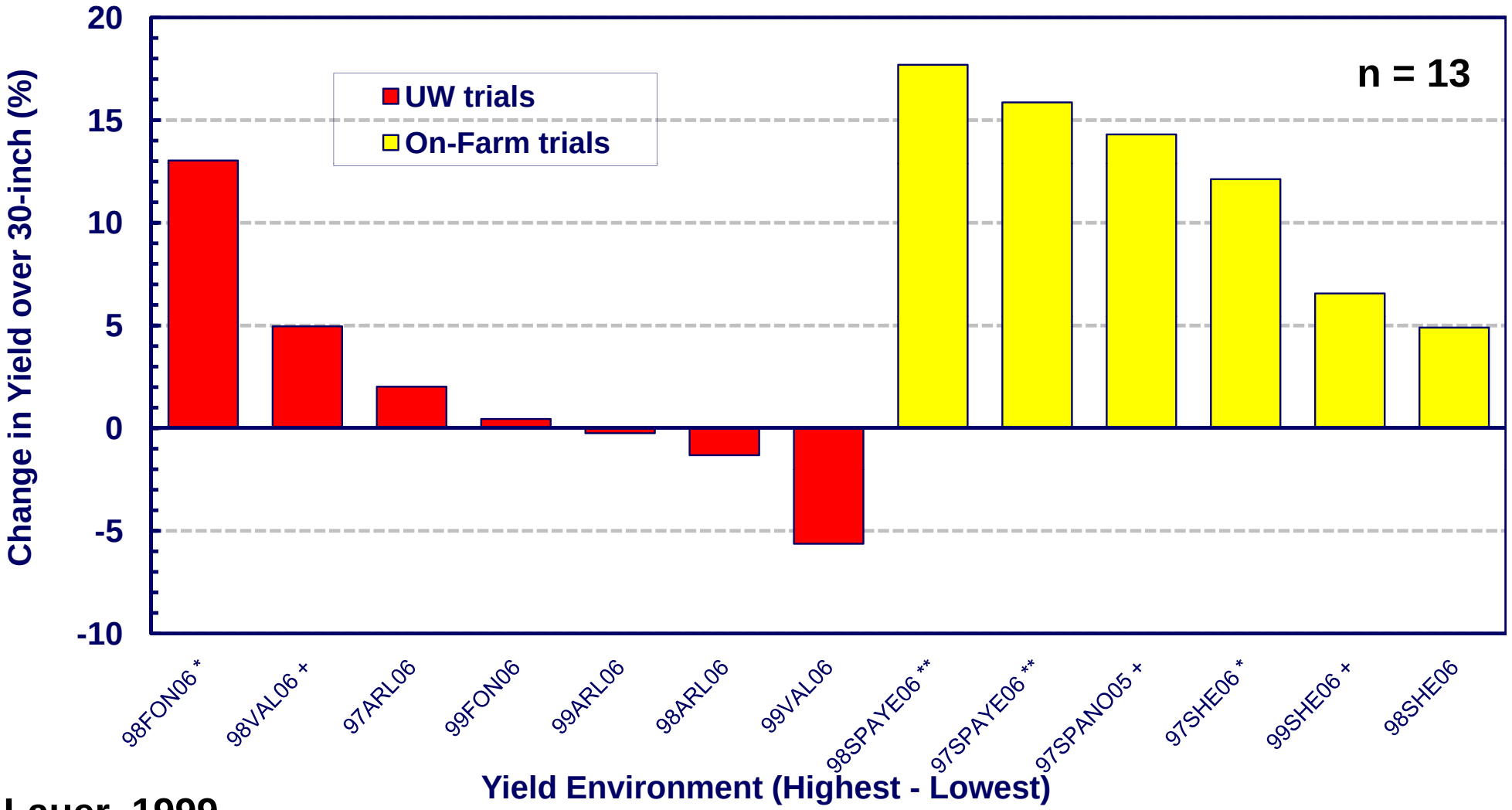
Cusicanqui and Lauer, 1999

Relative change in silage yield & quality at different cutting heights during 1996



Cusicanqui and Lauer, 1996

Corn Silage Yield Response to Row Spacing in WI (UW and On-Farm trials)



Lauer, 1999

Summary

- Many ways to achieve high quality corn silage
  - ✓ Many ways to “skin the cat”
  - ✓ Hybrid selection depends upon objectives of farmer
  - ✓ Management and hybrid selection go hand-in-hand
- Future direction
  - ✓ Starch degradation
  - ✓ Stover digestibility (digestion kinetics)
  - ✓ Continued improvement of Milk2000
  - ✓ Key: Animal feeding verification studies