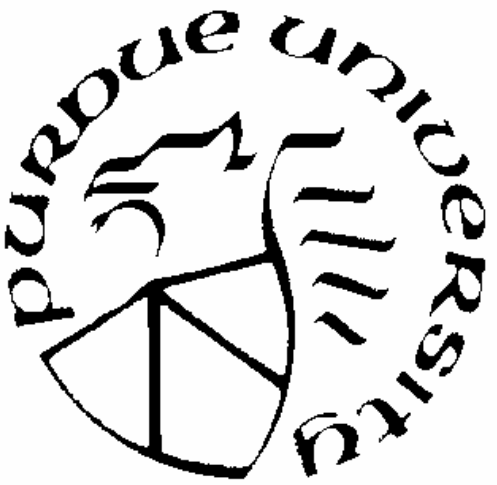
Emergence Uniformity in Corn: Is it Essential for Ear Size Consistency and Improved Yield?

Tony J. Vyn

Graduate Students: Mercedes Murua, Missy Bauer, Ann Kline, Jason Brewer and Martin Gonzalo

Agronomy Department, Purdue University



Accepted Hypothesis:

Delayed Seedling Emergence

↓

Shorter Plants

↓

↑ Delayed Silk Emergence

↓

↑ Delayed Maturity

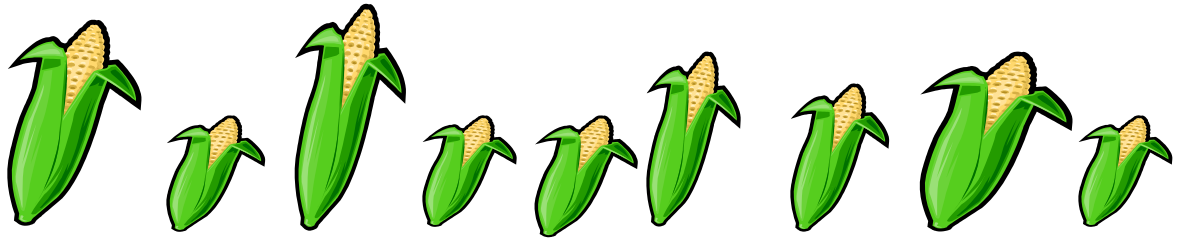
↓

Smaller ears at harvest

Tony Vyn @ Purdue University
(March 17, 2004)

Previous Research on Emergence

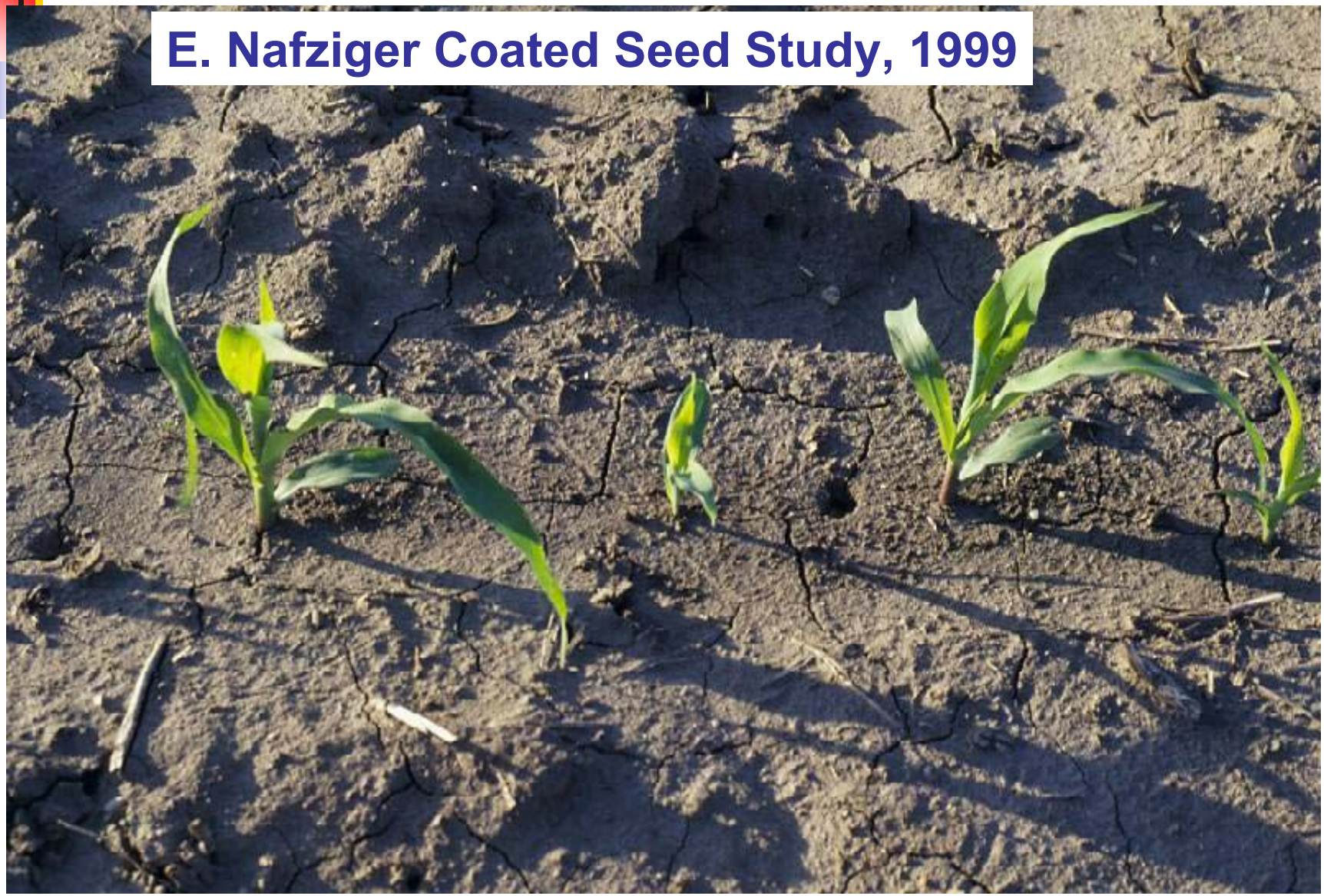
- Part of the stand planted 7-21 days later ↓ Yield 5-22%



Source: Nafziger *et al*. (1991), Ford & Hicks (1992)

- Effects of Emergence variability amongst plants planted on the same day ?????

E. Nafziger Coated Seed Study, 1999



Tony Vyn @ Purdue University
(March 17, 2004)

Yield Evaluation in Research?

Plot Combine

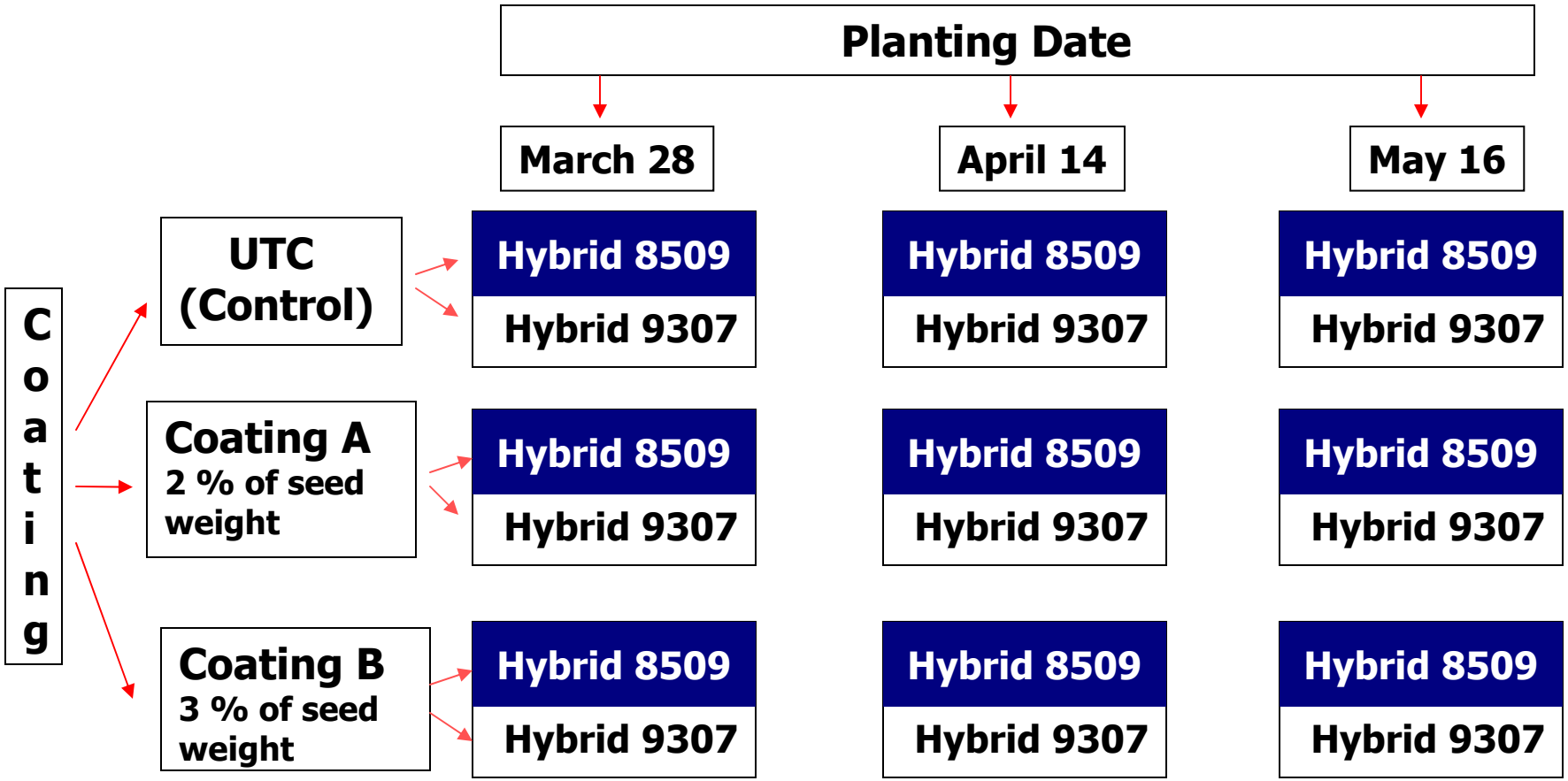
Individual Plant?

Tony Vyn @ Purdue University
(March 17, 2004)

Experimental Design & Methodology (2000-2001)

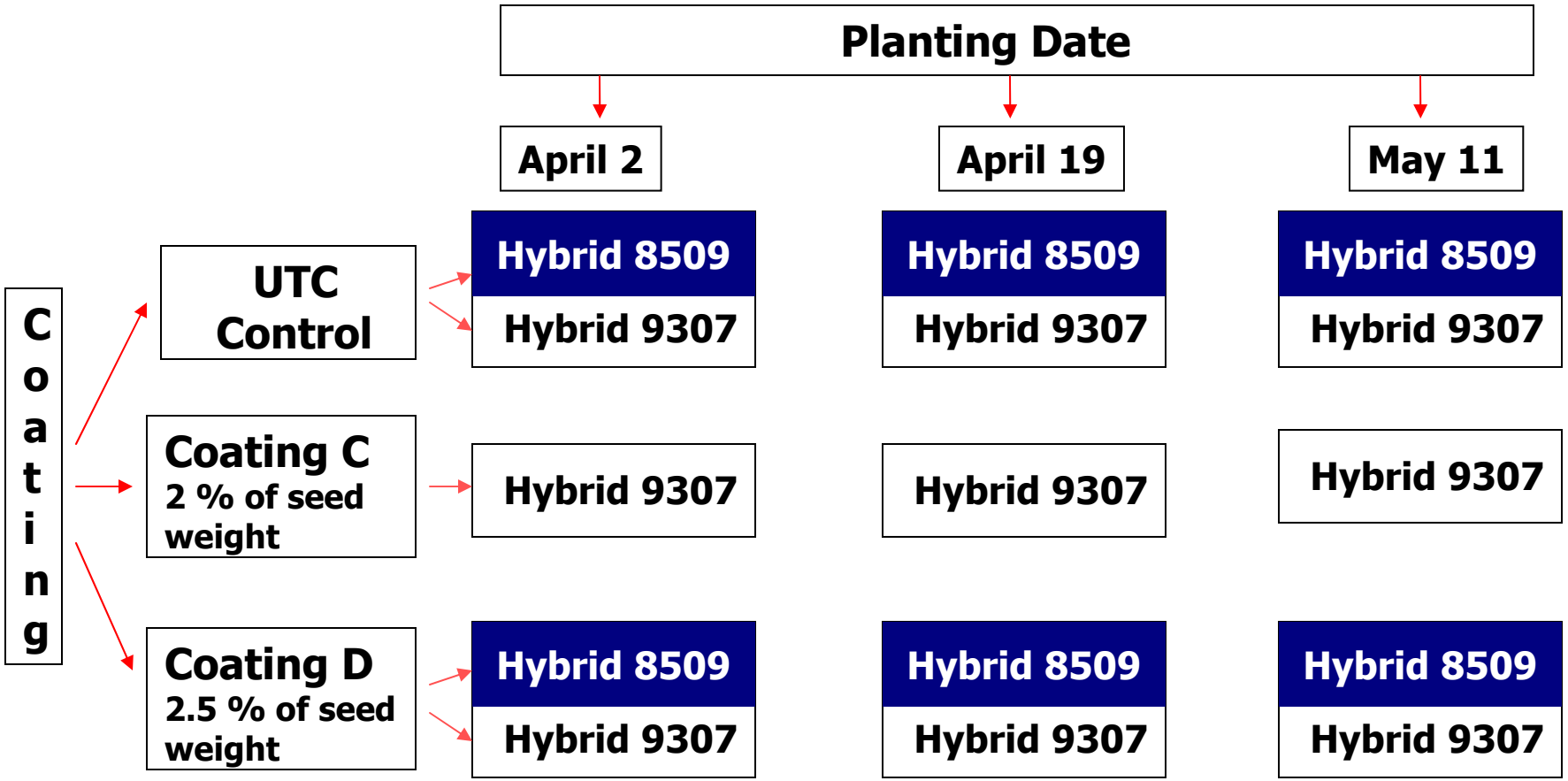
- **Design:** Split-plot design, 4 replications
- **Soil:** Drummers, silty clay loam, 3 to 4.5 % O.M.
- **Tillage System:** No-till
- **Rotation:** Corn/soybeans
- **Hybrids:** Fielder's Choice 9307 & 8509 (106 and 109 days RM)
- **Planting Population:** 80,000 seeds/ha

Experimental Design in Year 2000



Tony Vyn @ Purdue University
(March 17, 2004)

Experimental Design in Year 2001

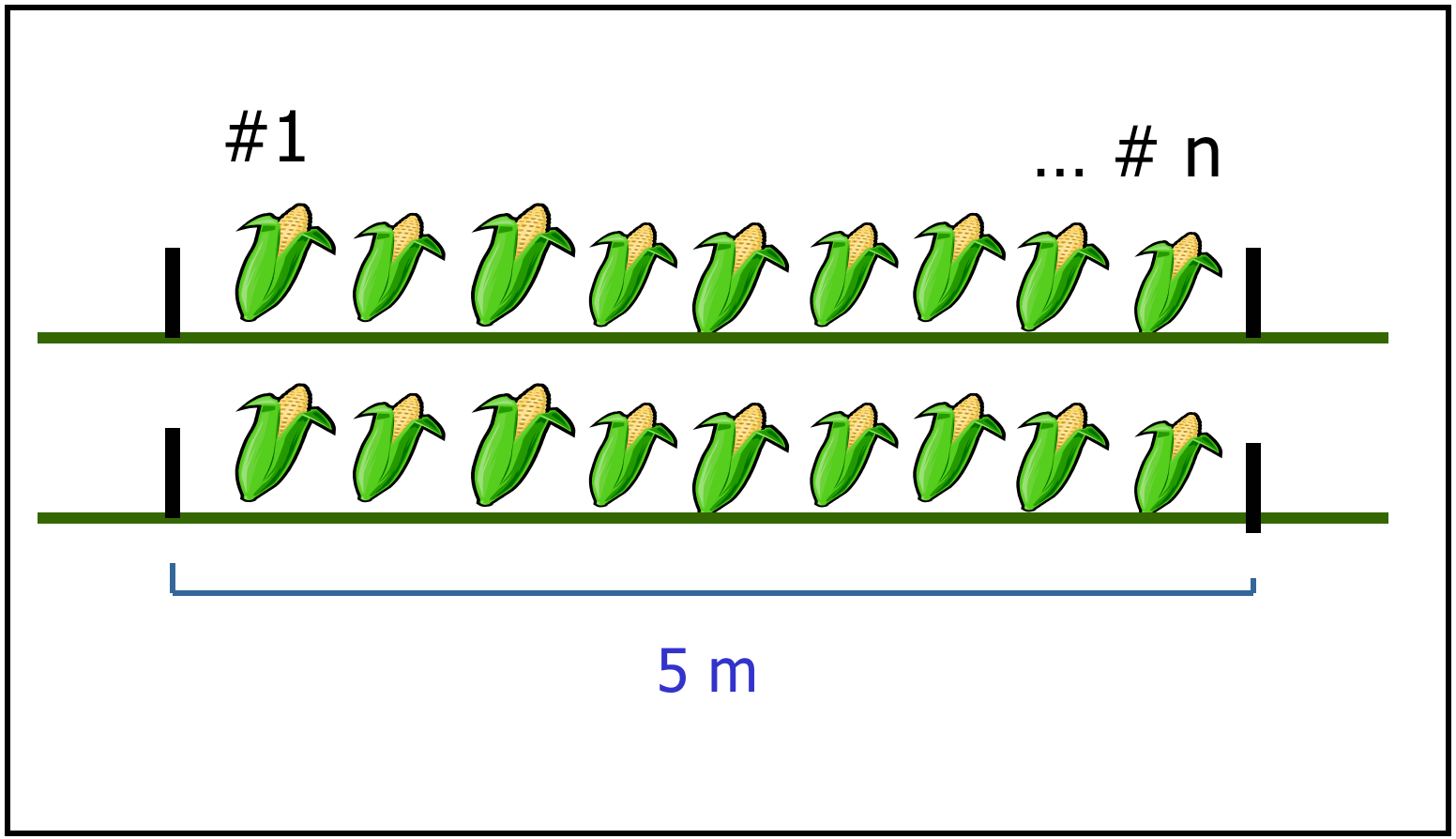


Tony Vyn @ Purdue University
(March 17, 2004)

Measurements

- Daily emergence counts (0 to 100%).
- Plant populations (emergence & harvest).
- Plants heights and V-stages (4-6 & 6-8 weeks).
- Daily silk emergence (0 to 100 %).
- Grain yield.

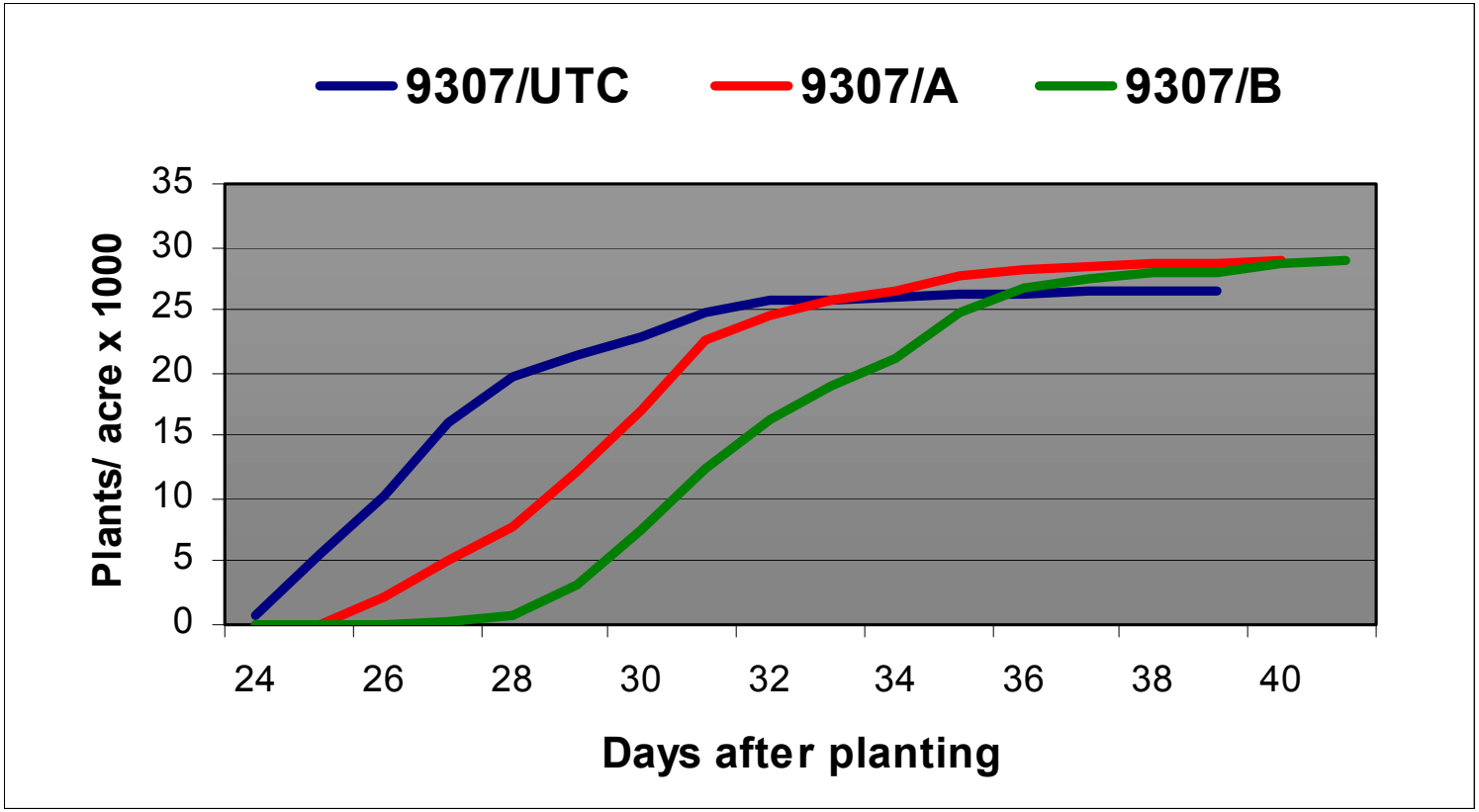
Measurements



Results

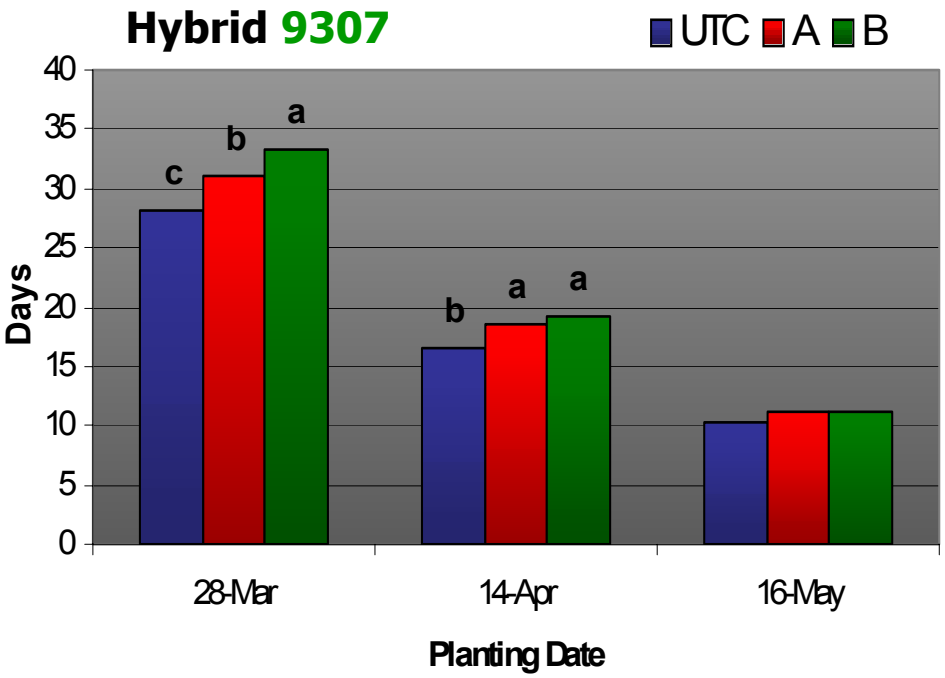
Emergence Profile

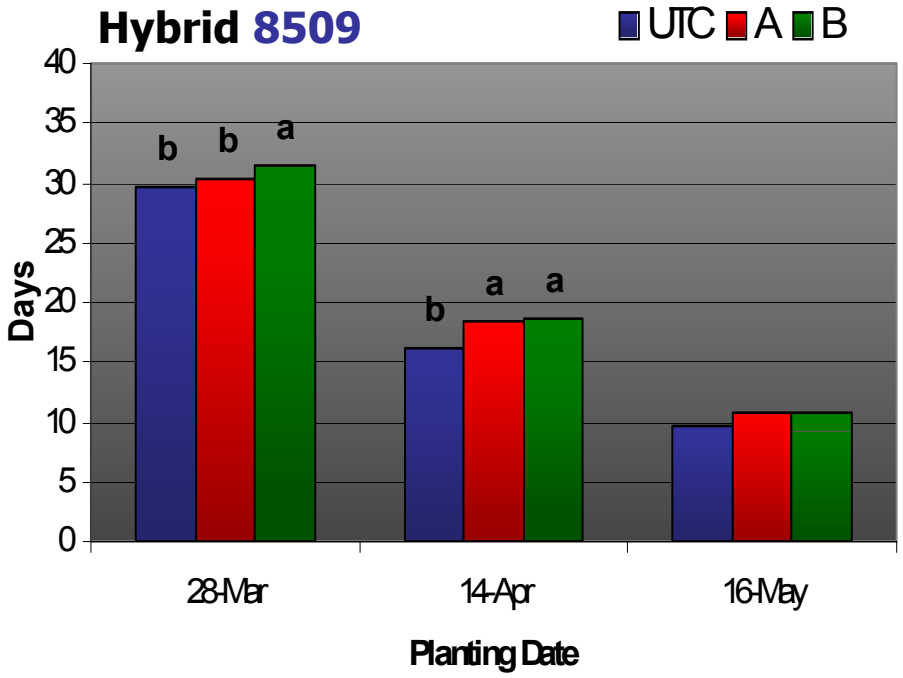
Planting Date: March 28, 2000



Tony Vyn @ Purdue University
(March 17, 2004)

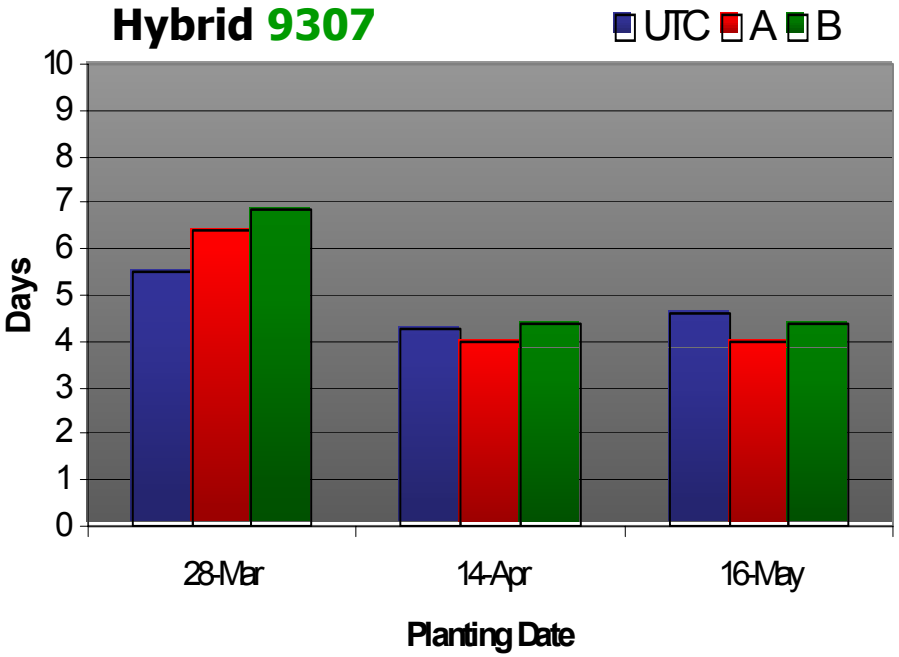
Days to 50% Emergence in 2000

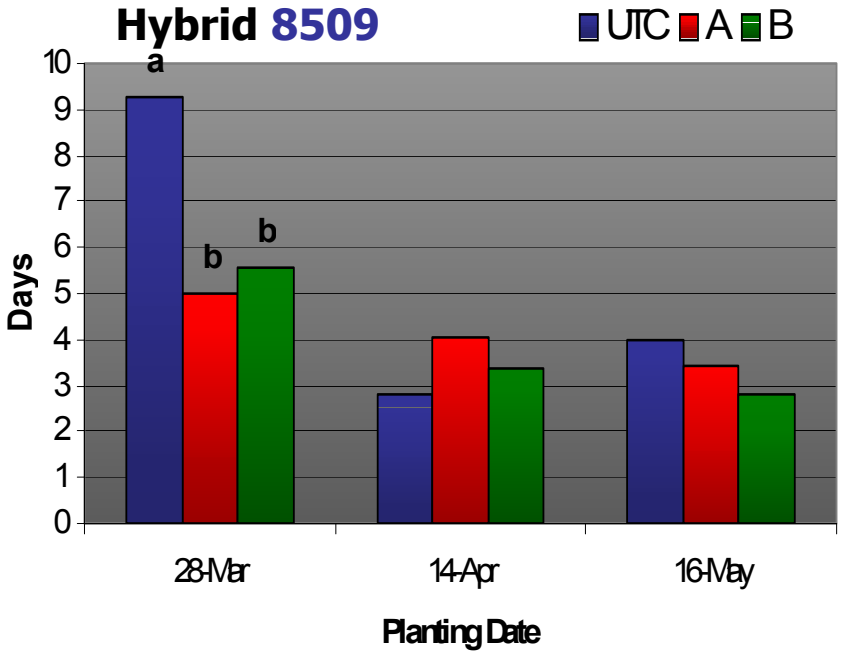




Tony Vyn @ Purdue University
(March 17, 2004)

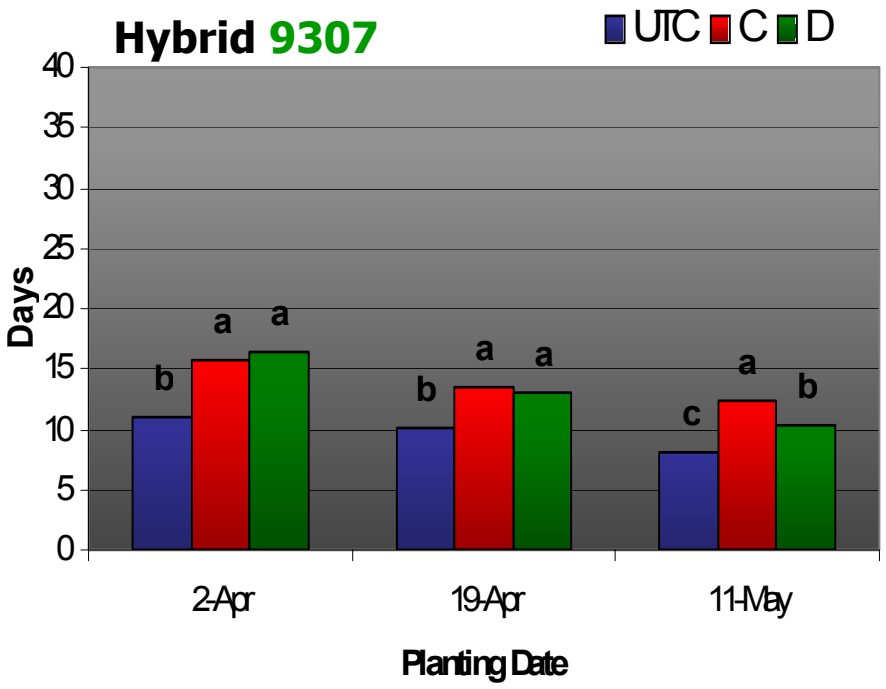
Days from 10 to 90 % Emergence in 2000

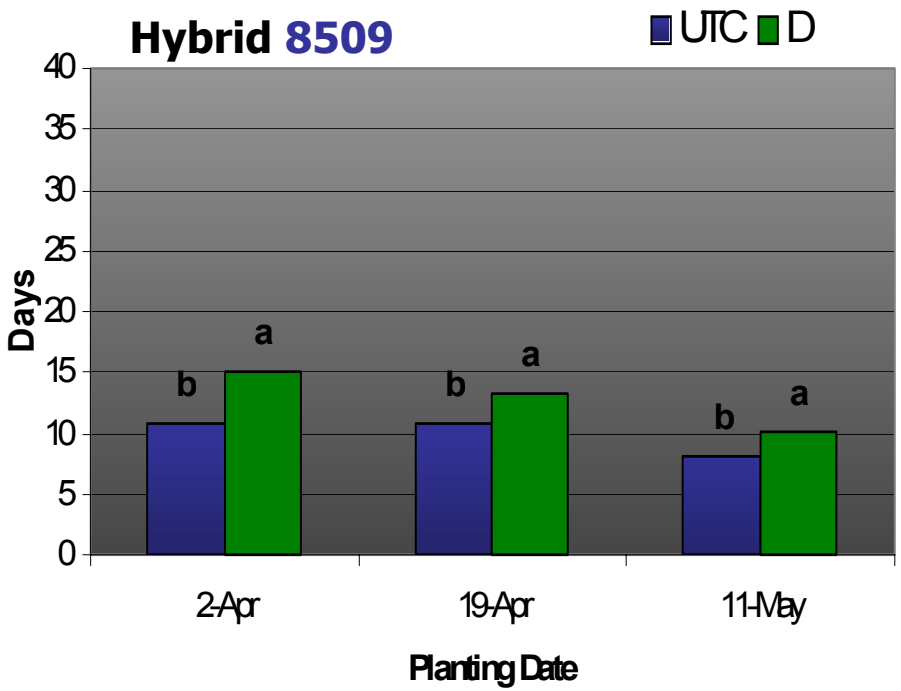




Tony Vyn @ Purdue University
(March 17, 2004)

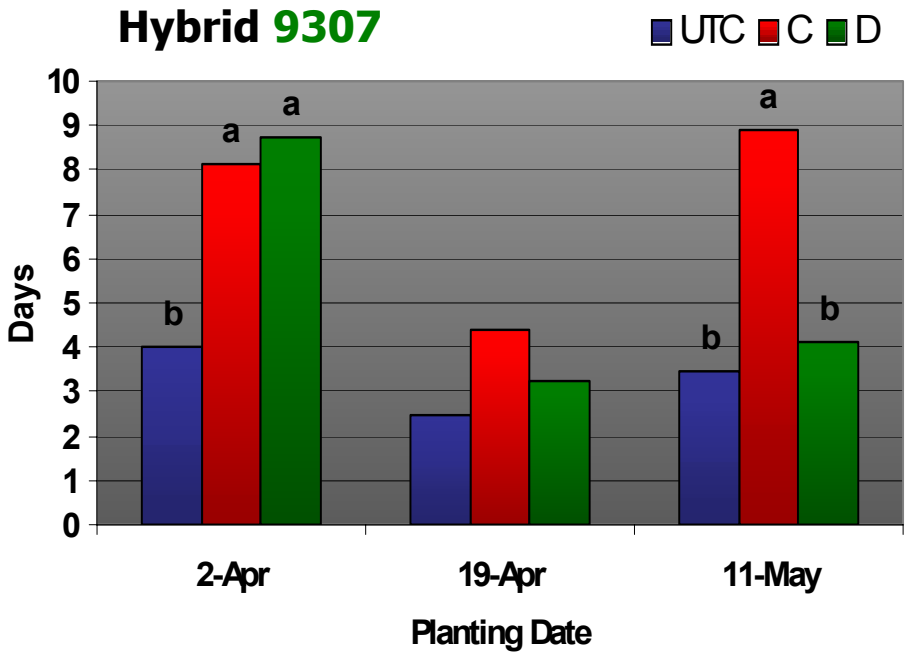
Days to 50% Emergence in 2001

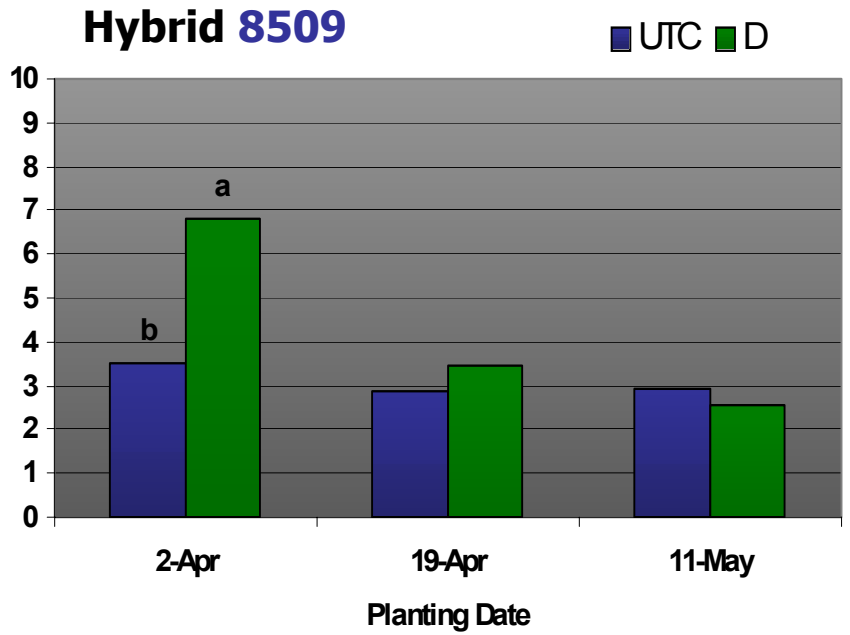




Tony Vyn @ Purdue University
(March 17, 2004)

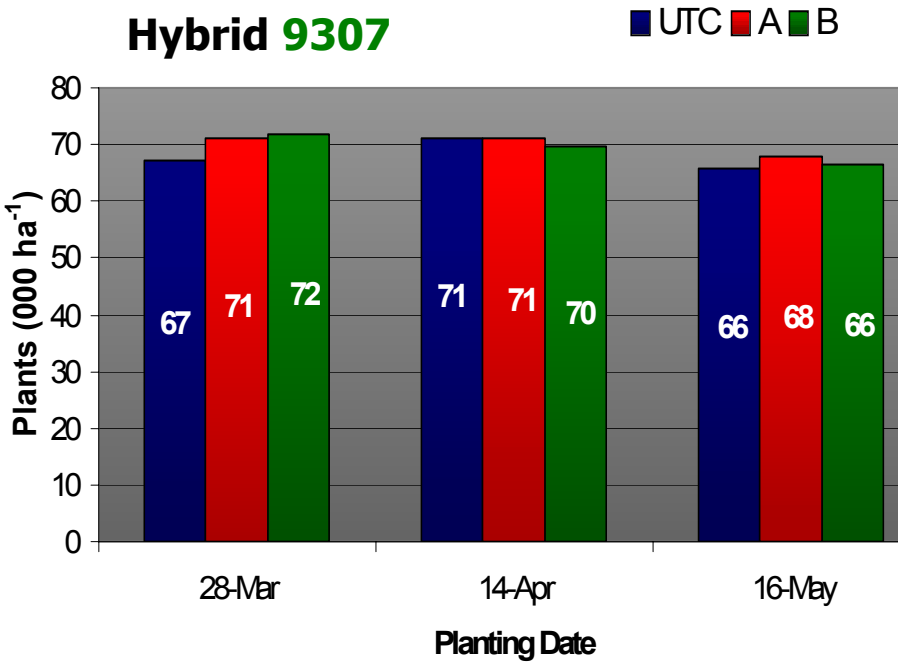
Days from 10 to 90 % Emergence in 2001

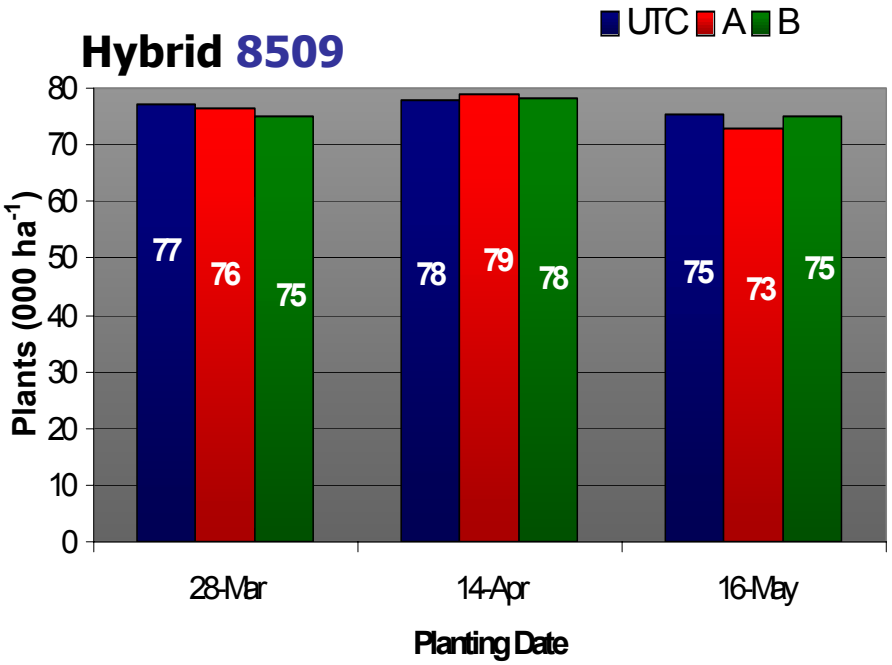




Tony Vyn @ Purdue University
(March 17, 2004)

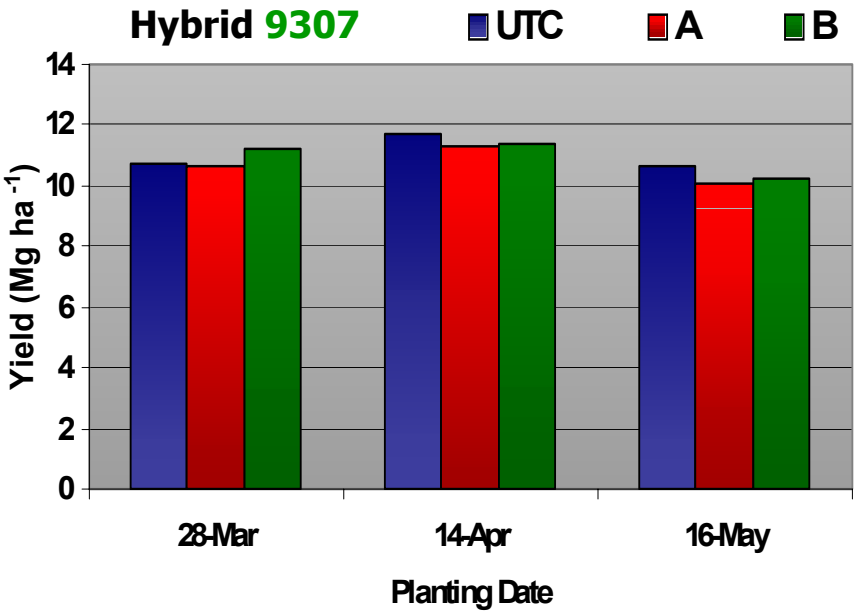
Population after complete emergence in 2000

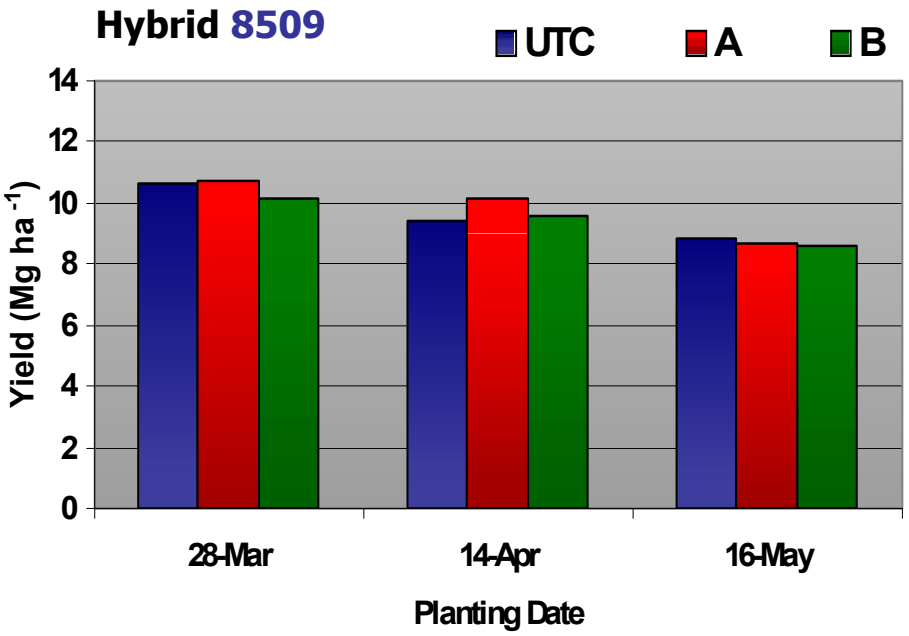




Tony Vyn @ Purdue University
(March 17, 2004)

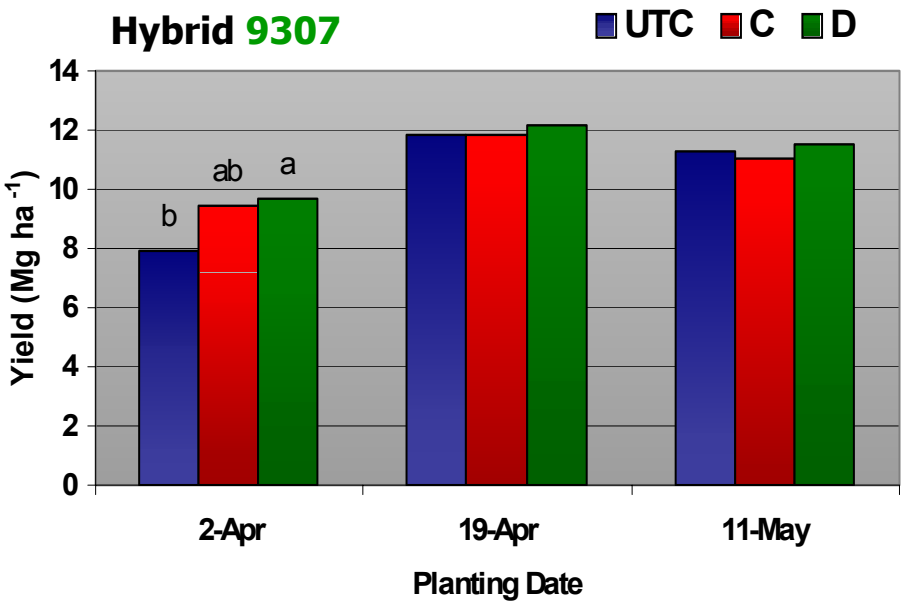
2000 Grain Yields

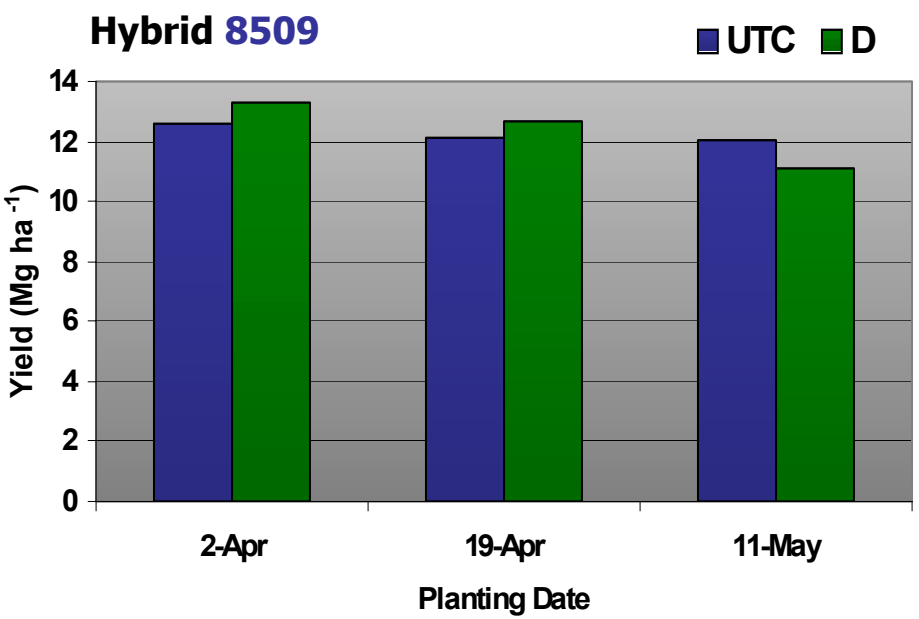




Tony Vyn @ Purdue University
(March 17, 2004)

2001 Grain Yields





Treatment Comparisons	Significance	
	Within Hybrid 9307	Within Hybrid 8509
PD 1 (C) vs PD 2 (UTC)	**	NA
PD 1 (D) vs PD 2 (UTC)	*	NS
PD 1 (UTC) vs PD 2 (UTC)	**	NS

*, ** significant at 0.05 and 0.01 probability levels, respectively.

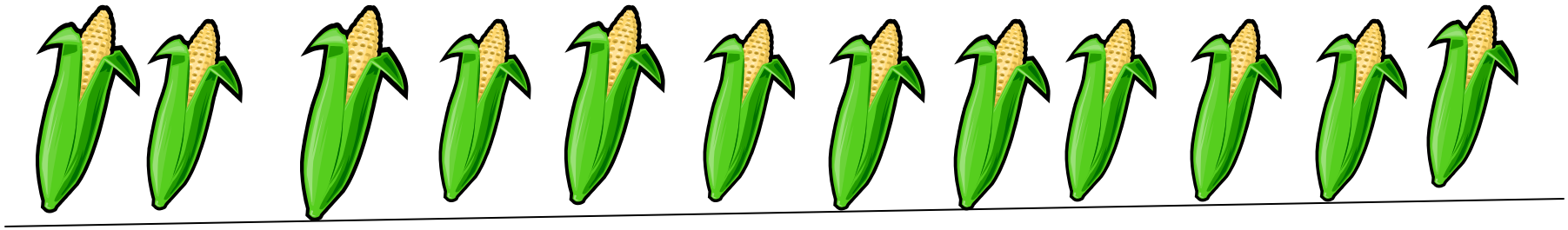
Tony Vyn @ Purdue University
(March 17, 2004)

Analysis of Individual Plant Data

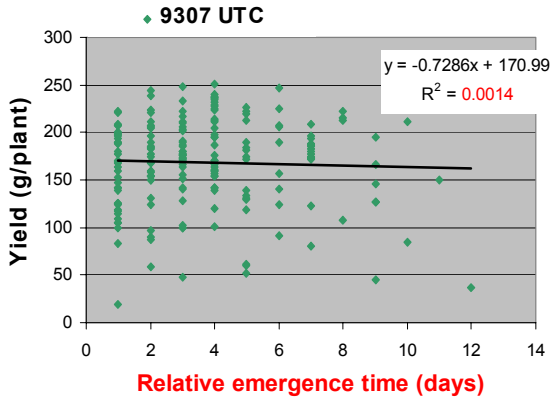
- 1 Simple Linear Regression per Plot:

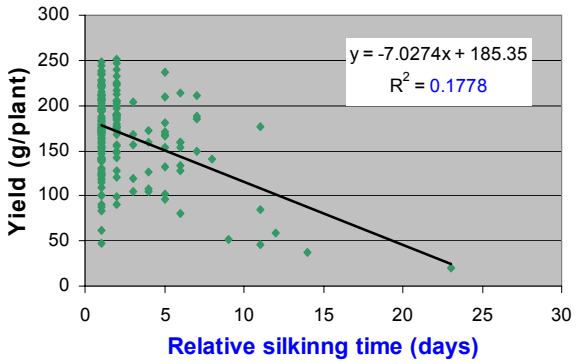
2000 = 3 PD x **2** Hybrids x **3** Coat.Treat**.** x **4** Reps**= 72 plots**

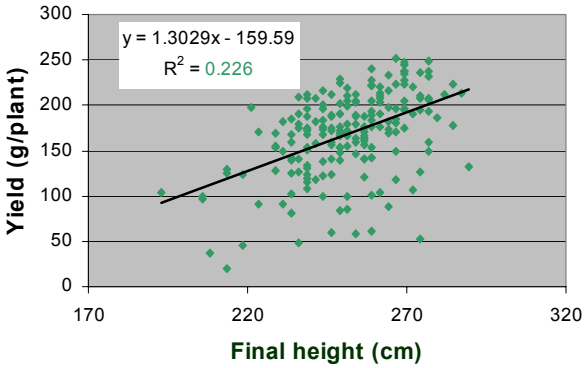
2001 = 3 PD x **5** Treat x **4** Reps**= 60 plots**

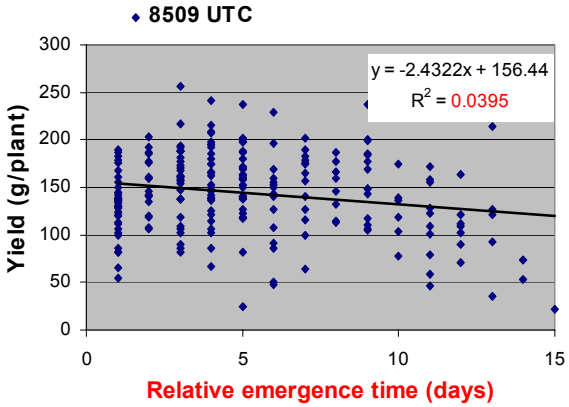


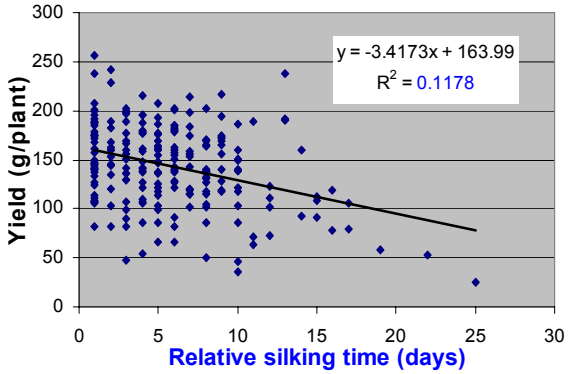
Linear Regressions of Individual Plant Yield for Early Planting in 2000

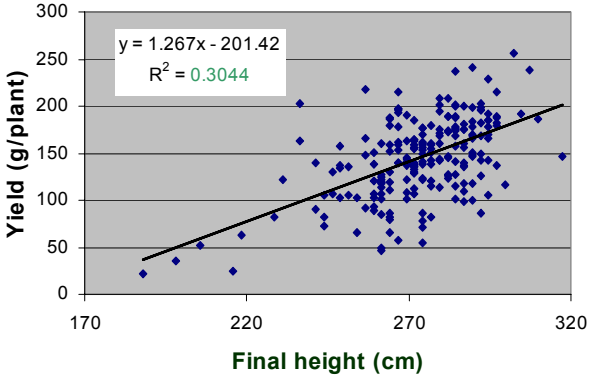










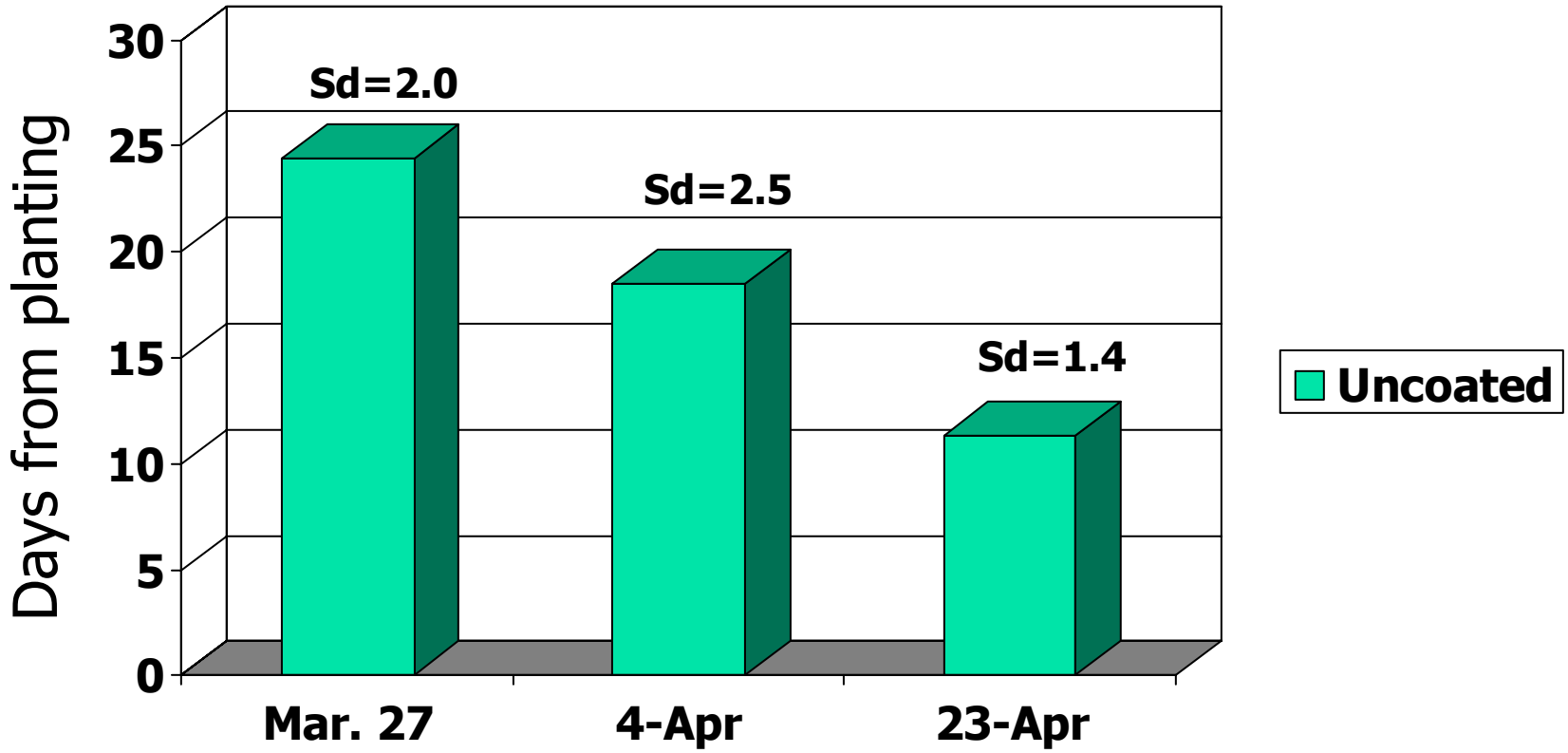


Tony Vyn @ Purdue University
(March 17, 2004)

Yield as a function of "x" (2000-2001)

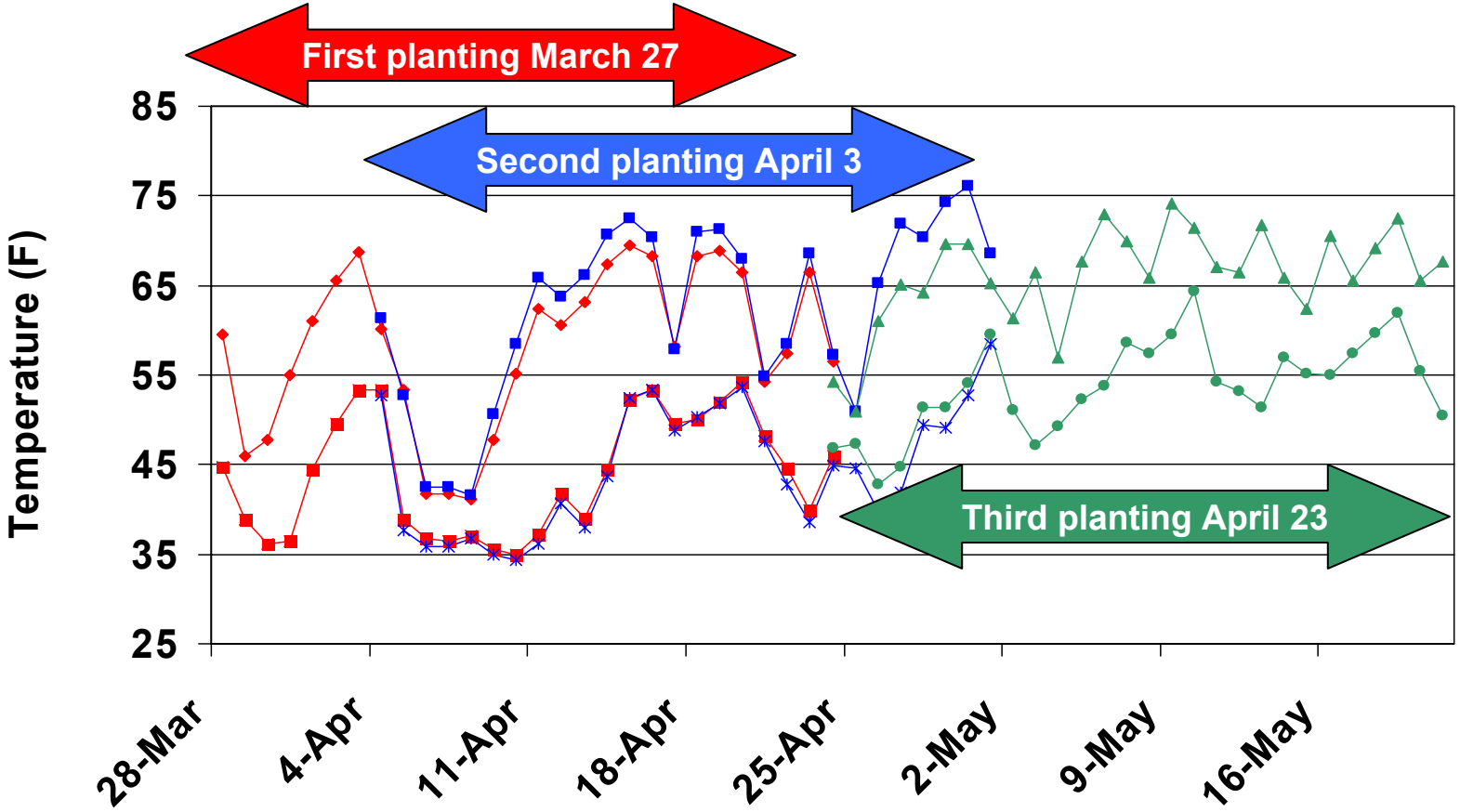
Independent Variable	Significant Regressions (%) P value		
2000	0.01	0.05	0.1
Relative emergence time	13	24	**28**
Relative silking time	46	63	**72**
Final Height	60	71	**74**
2001			
Relative emergence time	10	13	**18**
Relative silking time	38	54	**70**
Final Height	32	47	**52**

Emergence Time in 2003 (average of 3 hybrids at West Lafayette)



Tony Vyn @ Purdue University
(March 17, 2004)

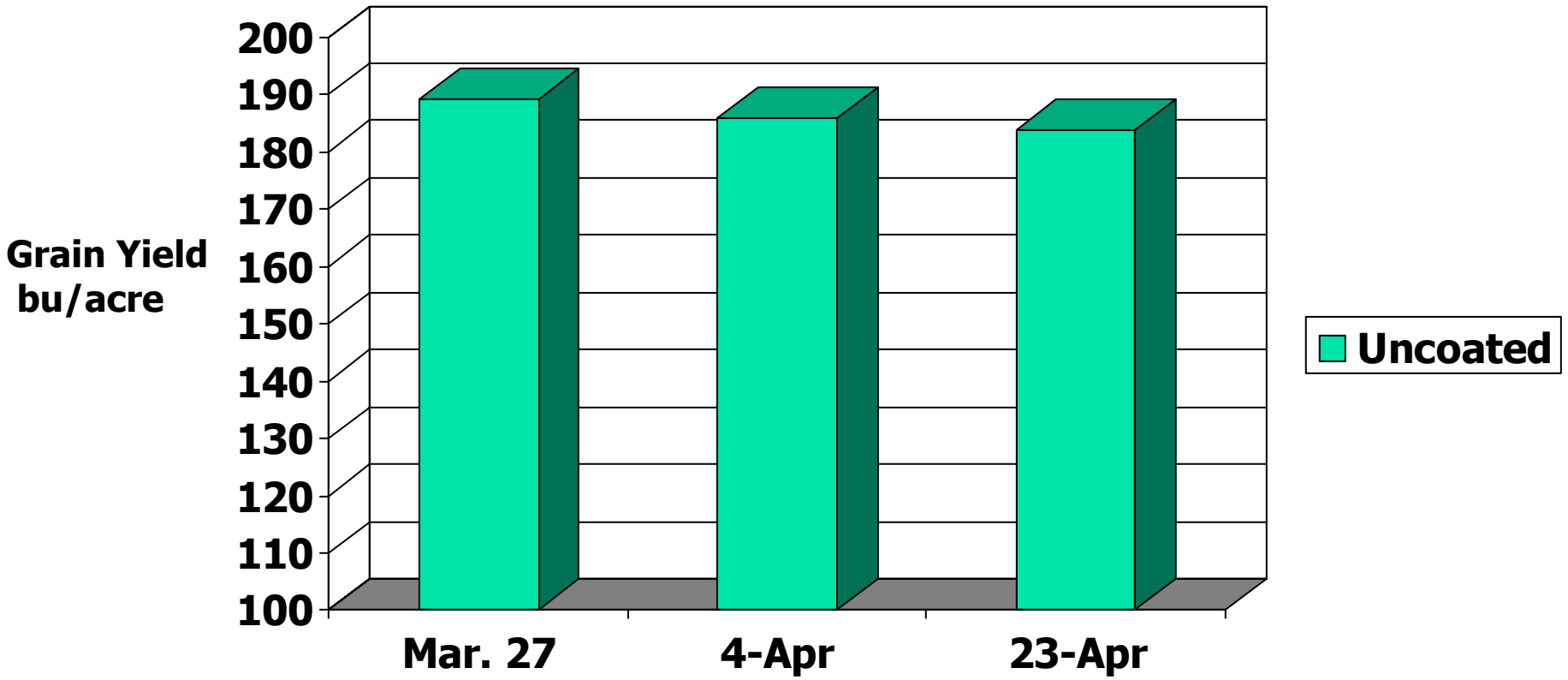
Maximum and Minimum Soil Temperatures after Planting in 2003 (West Lafayette)



Tony Vyn @ Purdue University
(March 17, 2004)

Planting Date Effects on Corn Yield in 2003

(mean of 3 hybrids at West Lafayette)

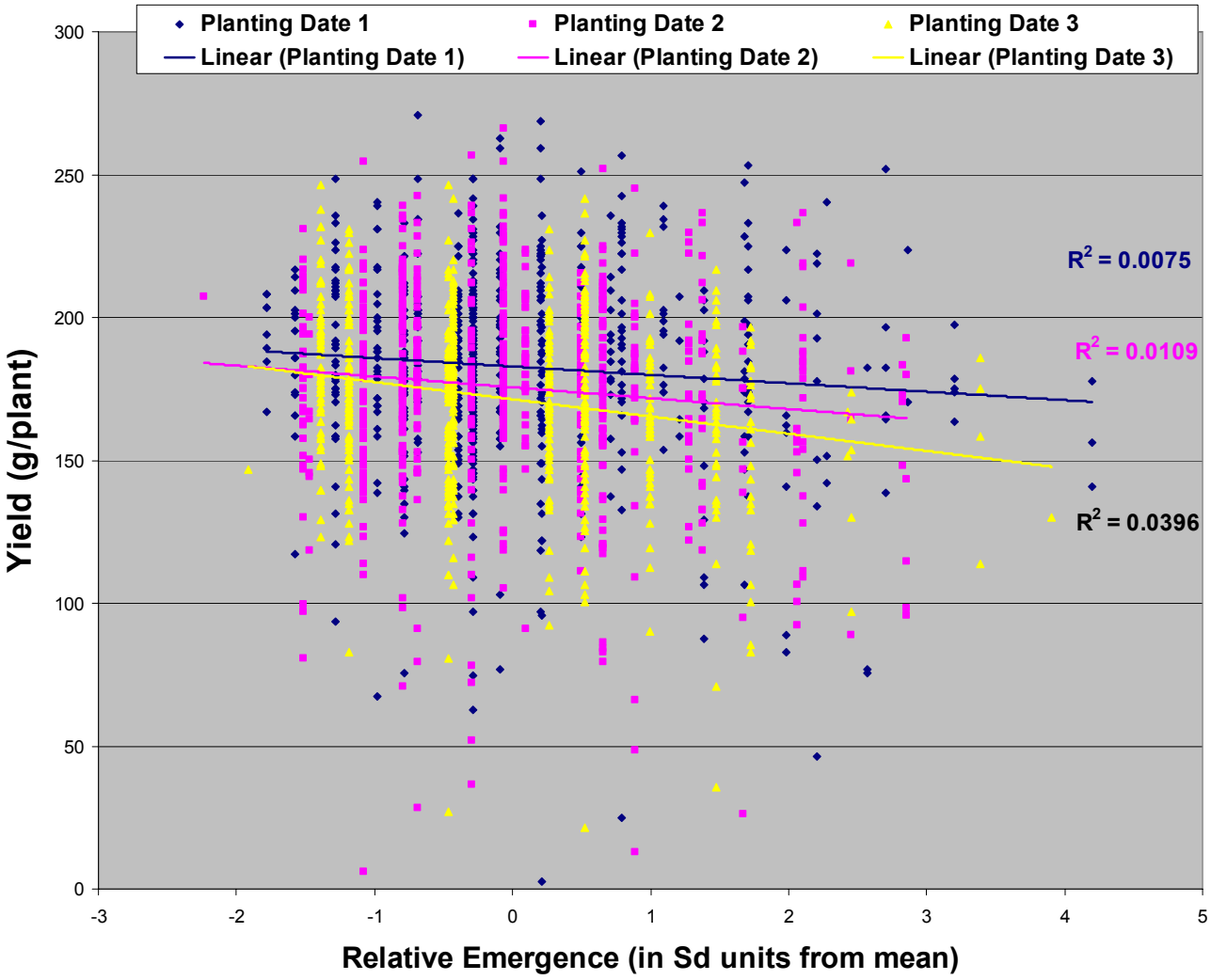


Tony Vyn @ Purdue University
(March 17, 2004)

Relative Emergence for each Plant on each Planting Date

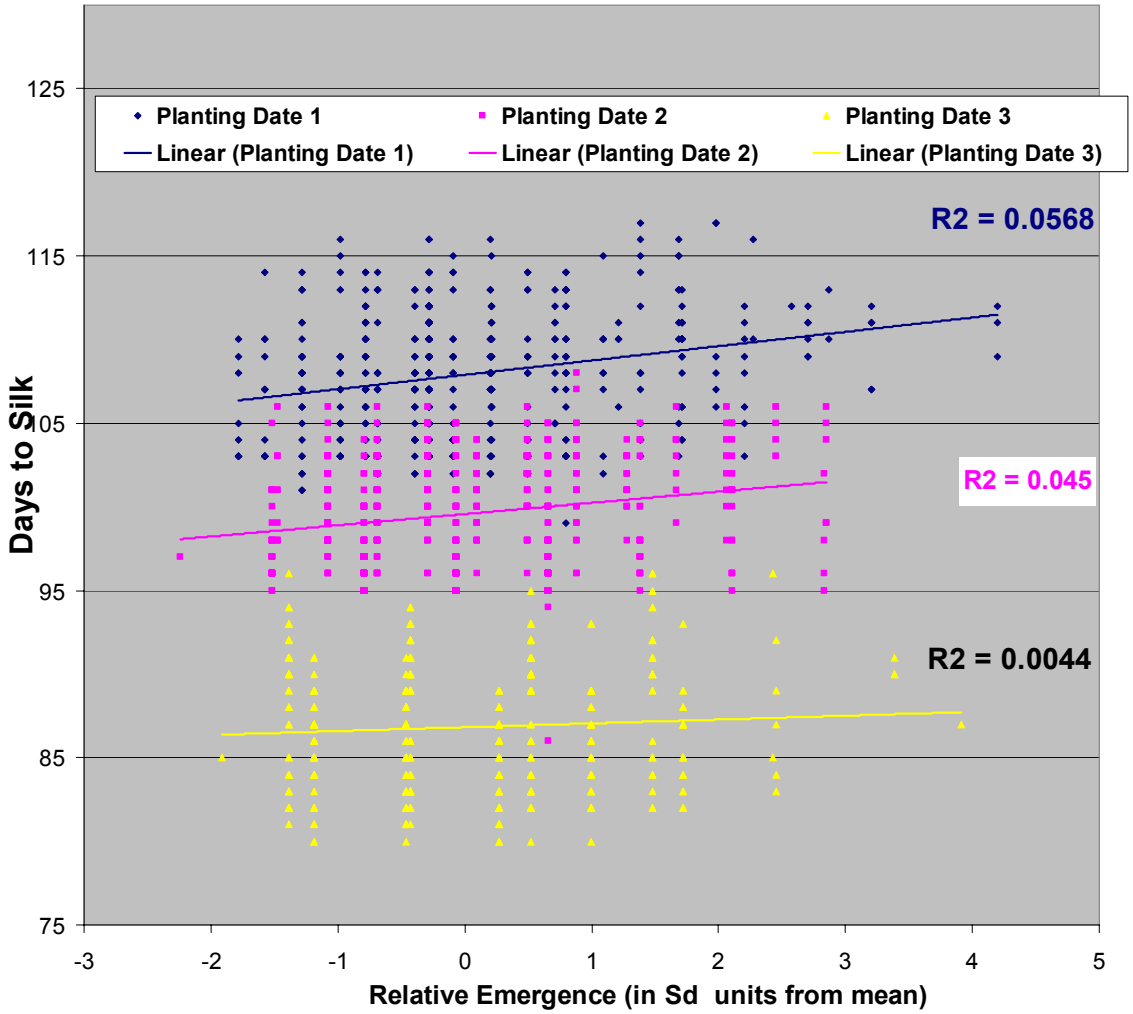
- $\frac{\text{Emergence Date for Plant} - \text{Mean for Emergence Date}}{\text{Standard Deviation for Emergence}}$

Ear Yield vs. Relative Seedling Emergence



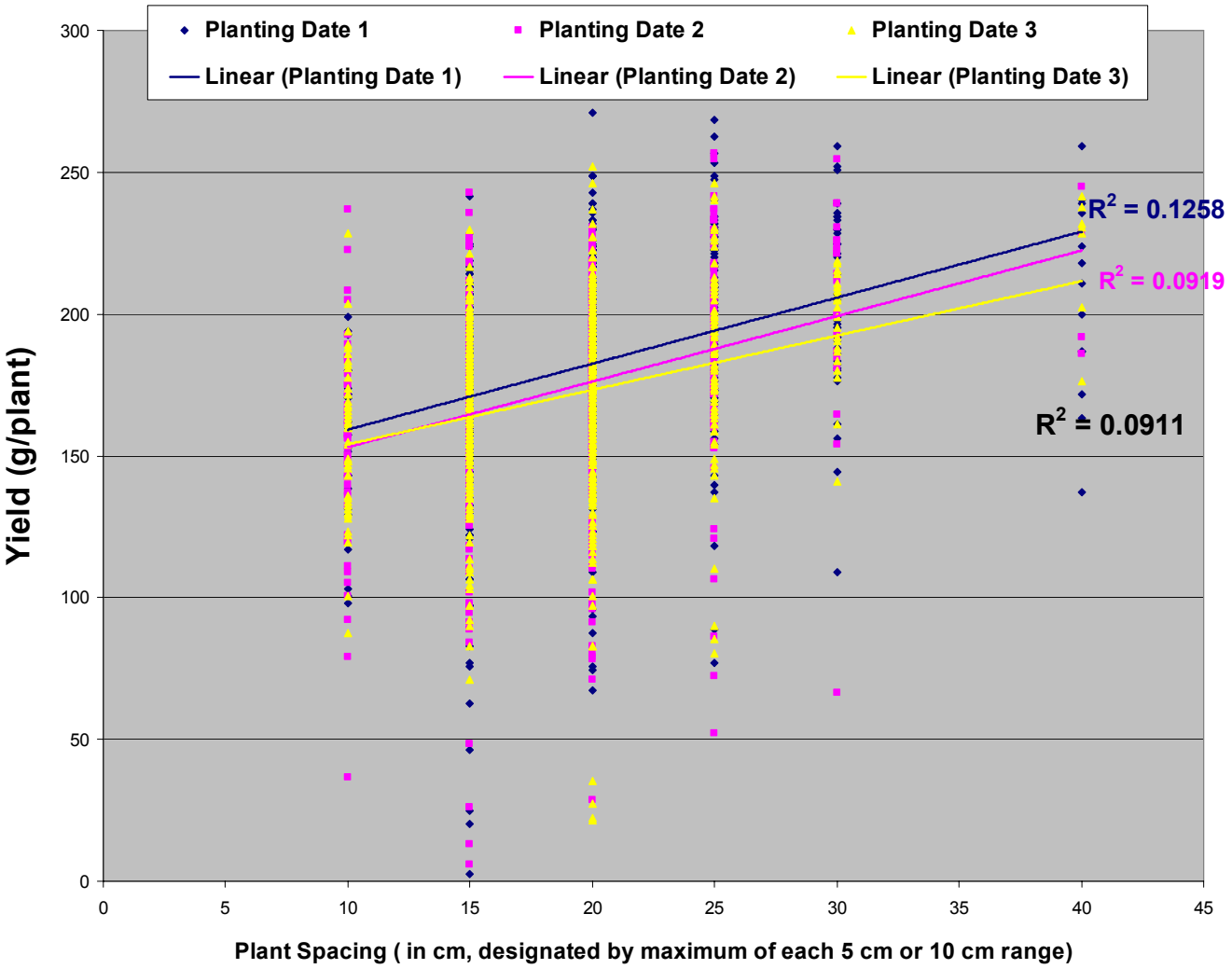
Tony Vyn @ Purdue University
(March 17, 2004)

Time to Silking vs. Relative Seedling Emergence



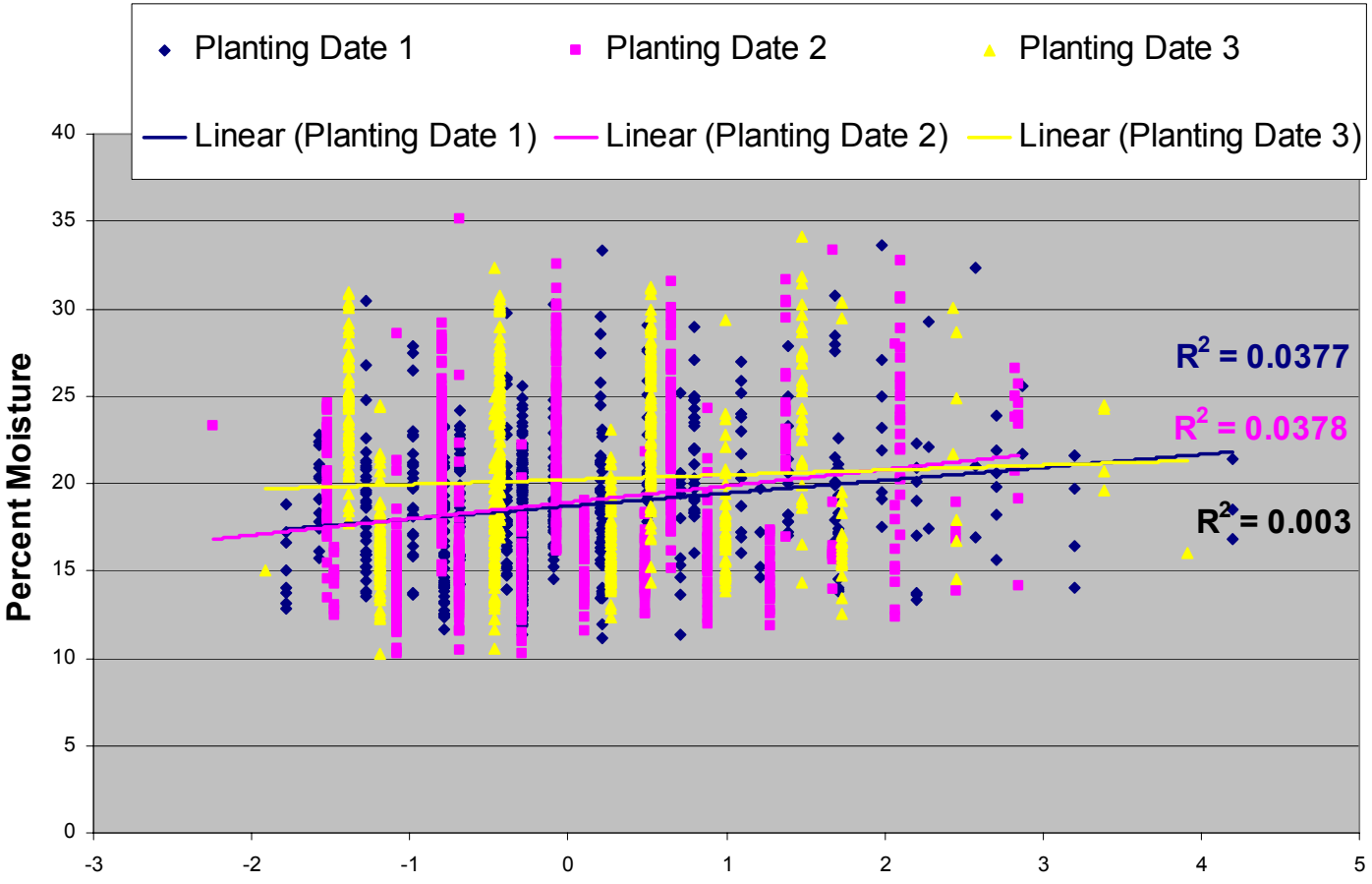
Tony Vyn @ Purdue University
(March 17, 2004)

Yield vs. Relative Plant Spacing



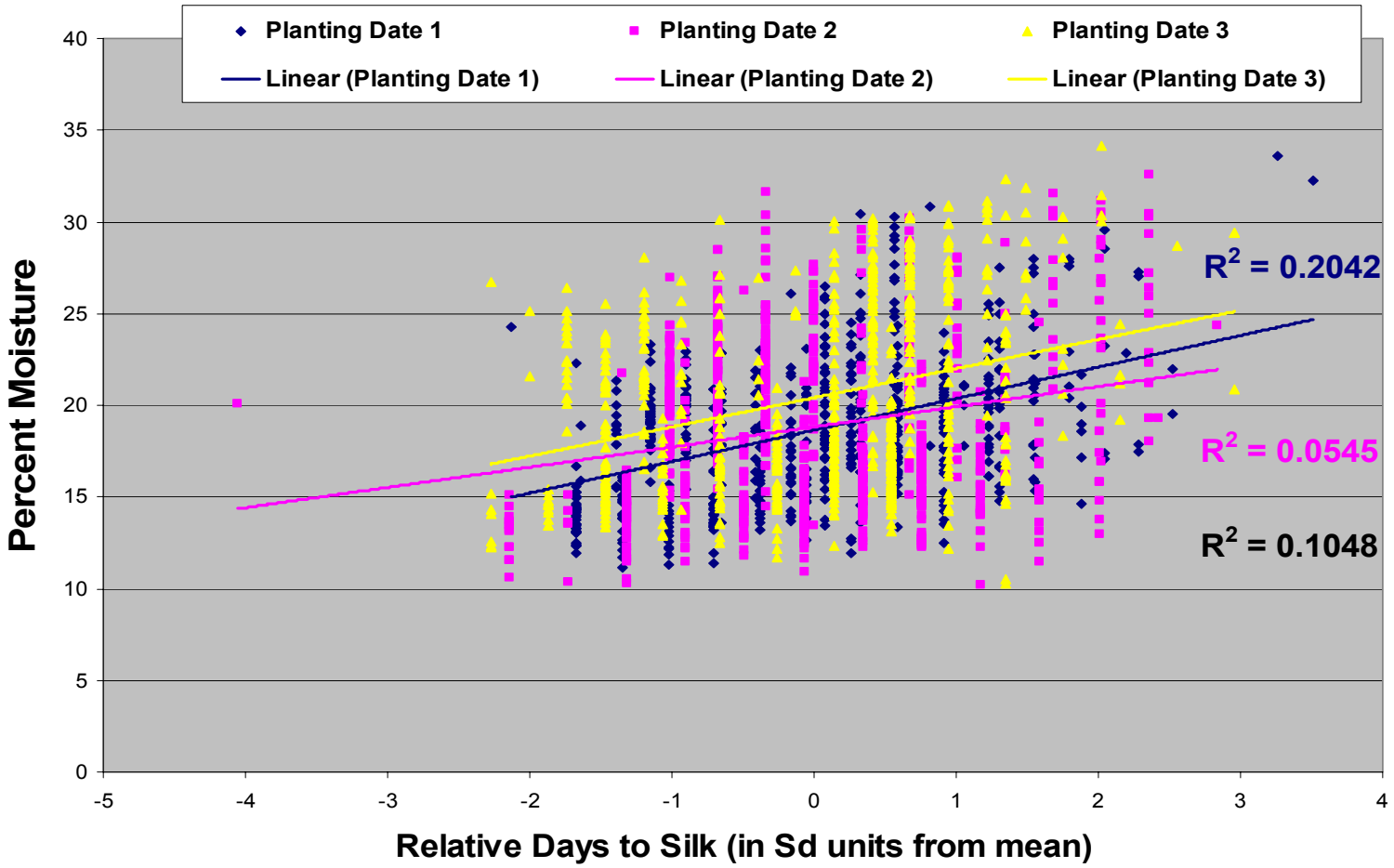
Tony Vyn @ Purdue University
(March 17, 2004)

Plant Grain Moisture vs. Relative Emergence



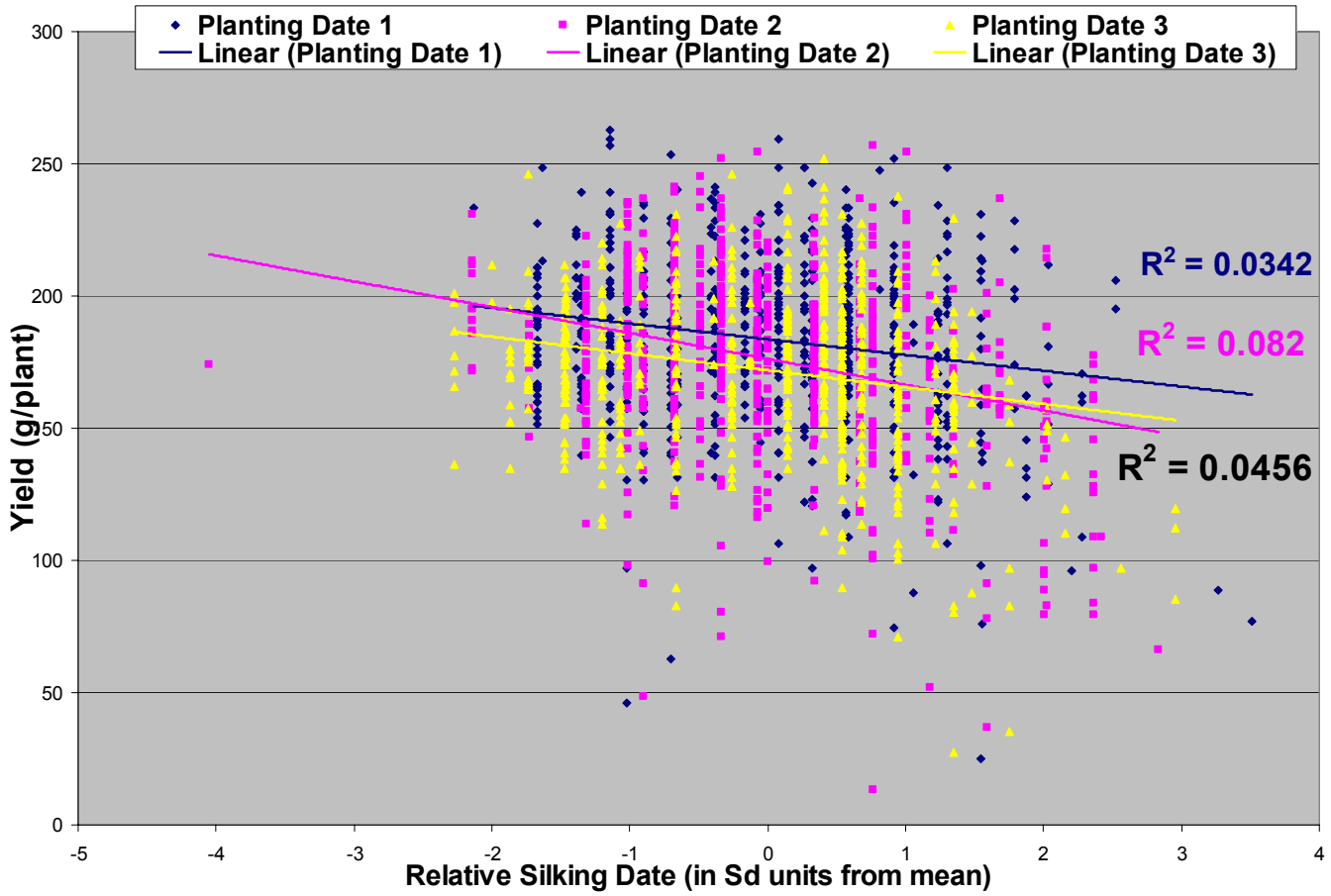
Tony Vyn @ Purdue University
(March 17, 2004)

Grain Moisture vs. Relative Time to Silk



Tony Vyn @ Purdue University
(March 17, 2004)

Individual Grain Yield vs. Relative Silking



Tony Vyn @ Purdue University
(March 17, 2004)

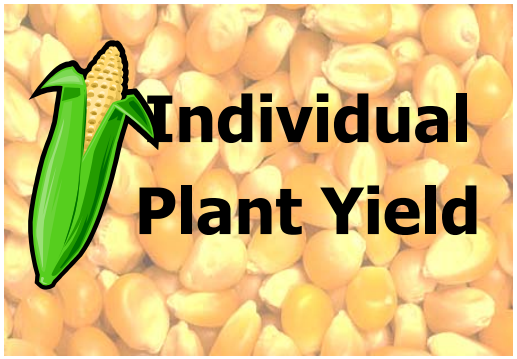
Consistency of Resource Availability in High Population Environments ?

Tony Vyn @ Purdue University
(March 17, 2004)

Tentative Conclusions:

For consistent individual ear weights and high yields we need to make sure "No Plant Left Behind!"

Effect	
-	Emergence date
+	Silking Date & Plant Height



Implications:

- **Concern for emergence uniformity is overrated!**
- Although uniform seeding depth and seed placement are still desirable, it is more important to establish environments which lead to uniform growth and development of adjacent plants after emergence.
- **What can be done to insure all plants have uniform access to resources within the row?**

Acknowledgments

- **Purdue Research Foundation & Agricultural Research Programs**
- **Landec Ag (Monticello and Oxford, Indiana)**
- **John Deere Ltd. (Cropping Systems)**
- **Technical assistants and farm superintendents**