With-in Row Plant Spacing in Corn

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Background

- Recent interest in the grain yield response of corn to plant spacing variability.
  - ✓ Planter “tuning” services offered
- Pioneer agronomists estimate yield losses of between 5 and 10 bushels/A in corn stands with non-uniform spacing.
- Some advertisements in popular press claim up to 20% yield increases with properly tuned planters.

Objective

- To determine the relationship between corn yield response and plant spacing variability.

Previous Research on Corn Grain Yield Response to Plant Spacing Variation

- Iowa: Non significant up to 6 inches standard deviation
  - ✓ Erbach et al. (1972)
- Illinois: Non significant
  - ✓ Johnson and Mulvaney (1980)
  - ✓ Dungan et al., (1958): hills
- Indiana: Non significant and Significant (web)
  - ✓ Nielsen (1997)
  - ✓ Nielsen (web): Grain yield decreases 2.5 bu/A for each inch standard deviation > 2 inches
- Ontario: Non significant
  - ✓ Daynard et al. (1983, 1981, 1979)
- Kansas: Significant
  - ✓ Krall et al. (1977): 3.4 bu/A decrease for each inch increase standard deviation
  - ✓ Vanderlip et al (1988): grain yield decreased when standard deviation values were greater than 2.4 inches
- Nebraska: Non significant in hills
  - ✓ Kiesselbach and Weihing (1933)

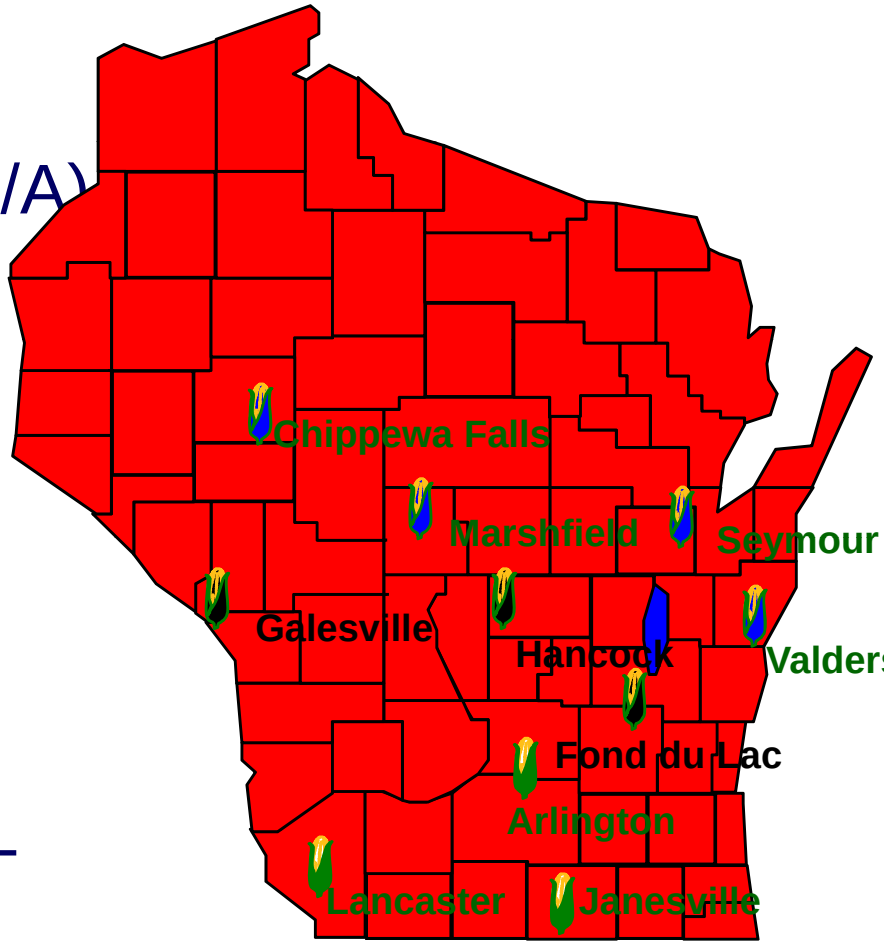
Stand Characteristics of WI Corn Fields Evaluated for Stand Uniformity (n= 127)

	Average	Minimum - Maximum
Standard deviation (inches)	3.3	1.9 – 6.8
Doubles per 50 ft. (≤2”)	5.4	0.1 – 25.9
Gaps per 50 ft. (≥12”)	7.0	1.0 – 16.9
Average spacing (inches)	7.2	4.7 – 14.8
Planting rate (plants/A)	30,553	21,000 – 42,000
Actual plant density (plants/A)	29,727	21,916 – 44,605
Stand as % planted	97	78 - 121

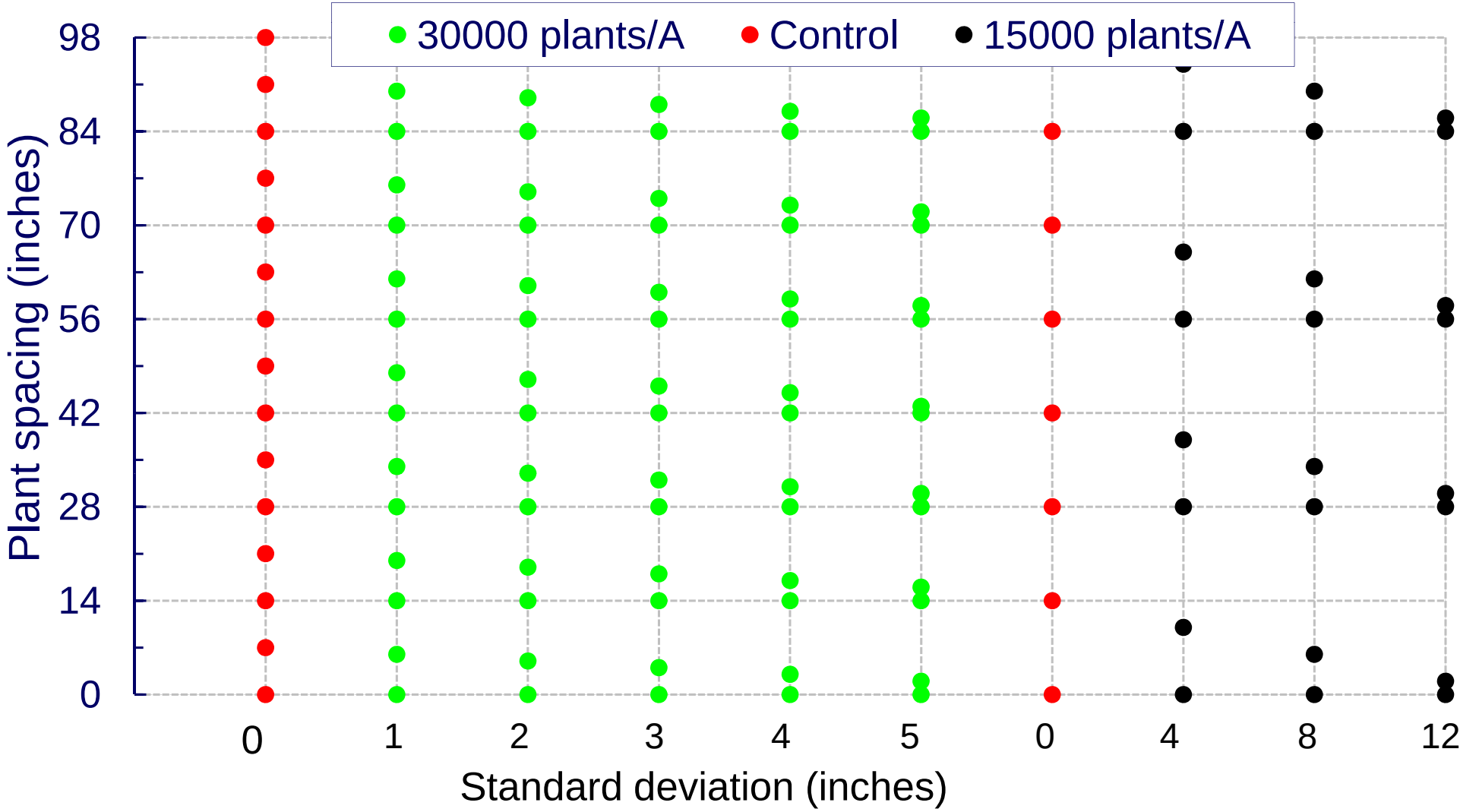
Rankin, 2000

Corn Plant Spacing Variability 1999-2001 Materials and Methods

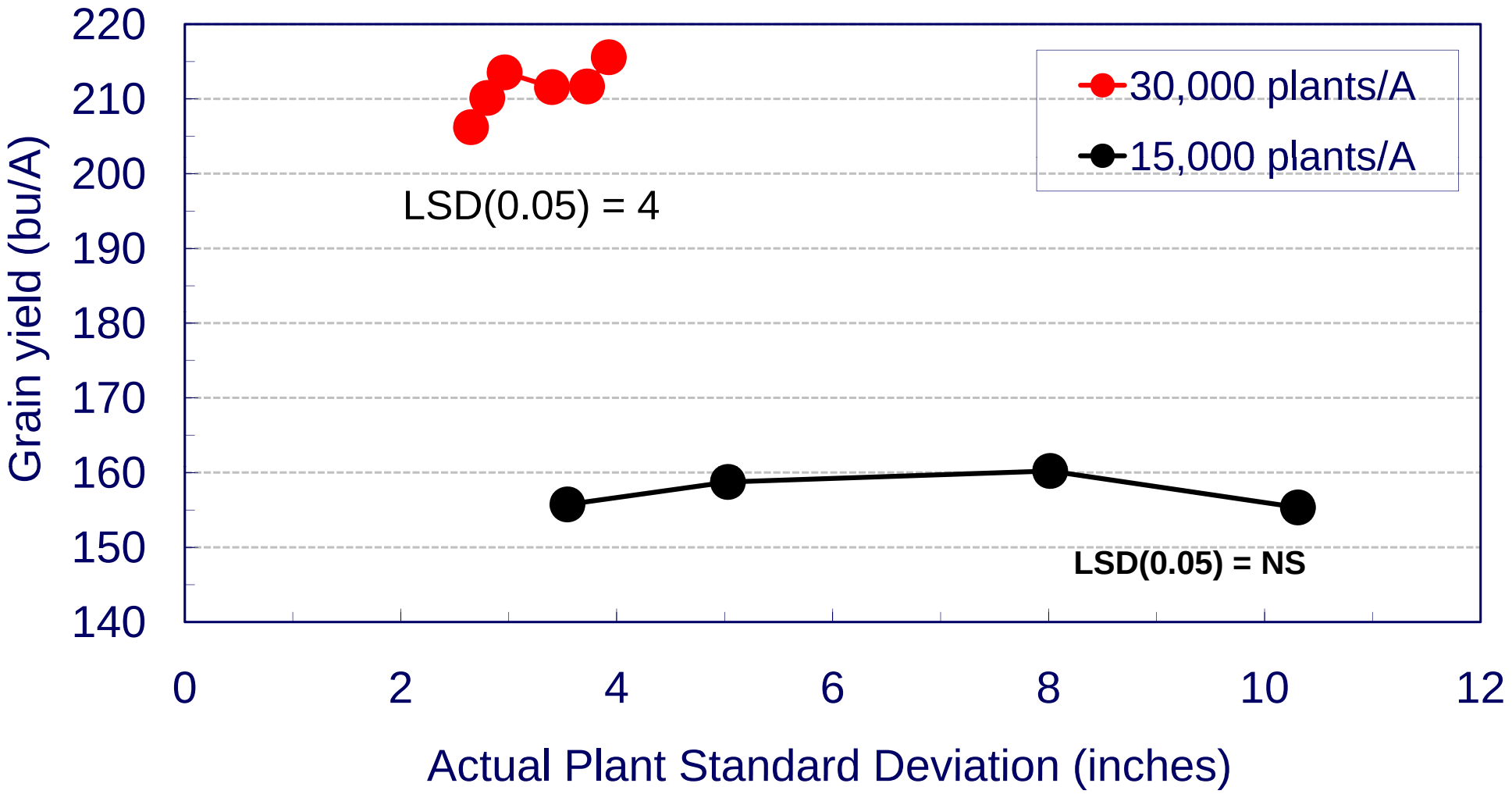
- Target plant population
  - ✓ 7 inches (30,000 plants/A)
  - ✓ 1999: 14 inches (15,000 plants/A)
- Target standard deviation
  - ✓ 0 to 12 inches
- Hybrid
  - ✓ P35R57: ARL, JAN, LAN
  - ✓ C4111: FON, GAL, HAN
  - ✓ N3030Bt: CHI, MAR, SEY, VAL



Plant Spacing Variability Treatments 1999 (2-Plant Pattern)



Corn yield response to plant spacing variability treatments during 1999. Values are averaged across all locations.



Significance of corn plant spacing variability treatments during 1999

30,000 plants/A Location	Plant density	Plant standard deviation	Grain yield	Grain moisture	Lodging	Grain test weight
Arlington	NS	**	NS	NS	NS	NS
Janesville	NS	**	NS	NS	NS	NS
Lancaster	†	†	NS	NS	NS	NS
Fond du Lac	NS	*	*	NS	NS	NS
Galesville	NS	*	NS	*	NS	NS
Hancock	NS	*	NS	NS	NS	NS
Chippewa Falls	NS	**	NS	NS	NS	NS
Marshfield	NS	*	NS	NS	NS	NS
Seymour	*	**	NS	NS	NS	NS
Valders	NS	**	NS	NS	NS	NS

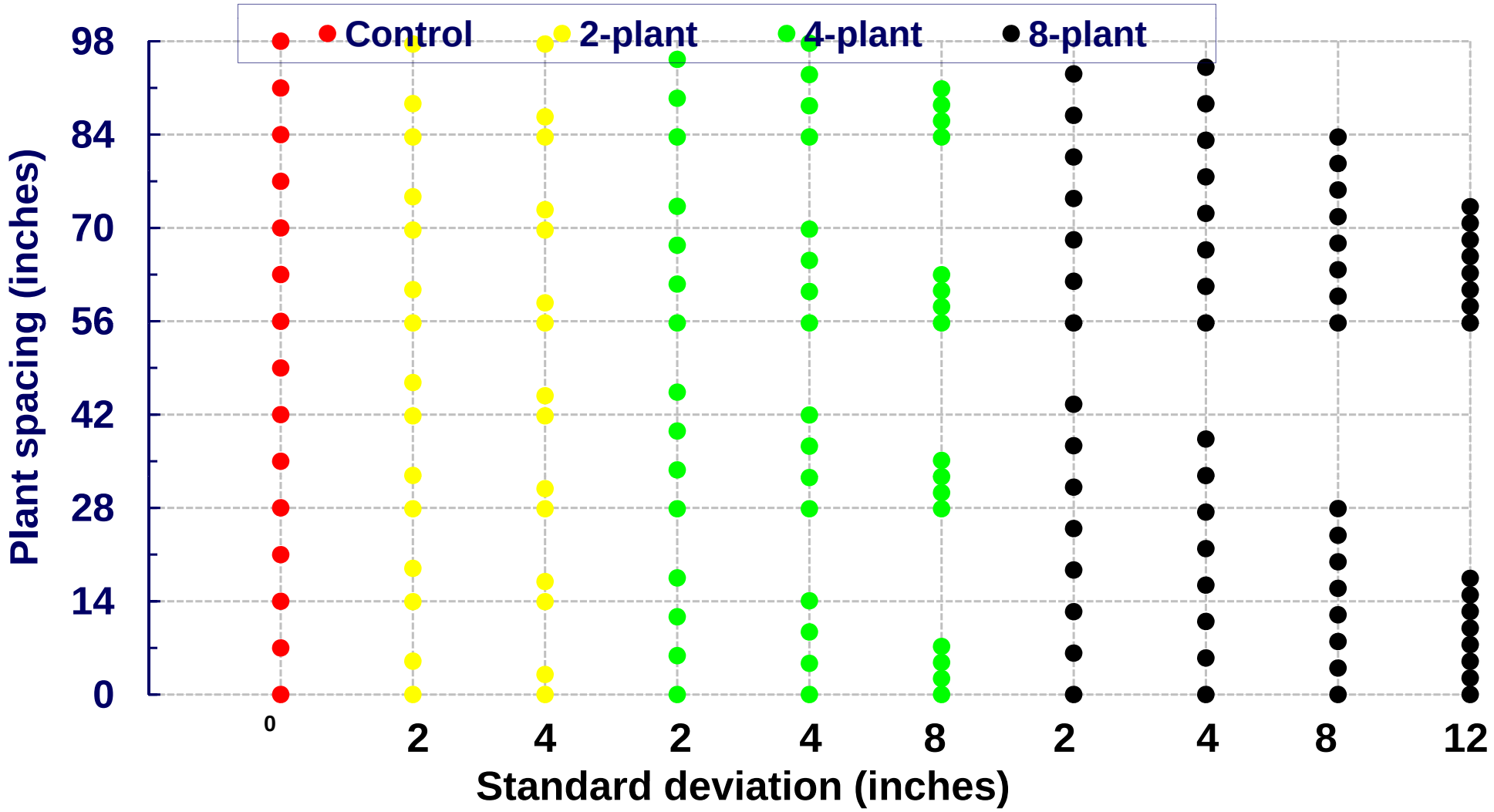
**, *, and † indicates significance at $P \leq 0.01$, 0.05 and 0.10, respectively

Significance of corn plant spacing variability treatments during 1999

15,000 plants/A Location	Plant density	Plant standard deviation	Grain yield	Grain moisture	Lodging	Grain test weight
Arlington	*	**	NS	NS	NS	NS
Janesville	NS	**	NS	NS	NS	NS
Lancaster	**	**	NS	NS	NS	NS
Fond du Lac	NS	**	NS	NS	†	NS
Galesville	NS	**	†	NS	NS	NS
Hancock	NS	**	NS	NS	NS	NS
Chippewa Falls	NS	**	NS	NS	NS	NS
Marshfield	NS	**	NS	NS	NS	†
Seymour	†	**	*	NS	NS	NS
Valders	†	**	NS	NS	NS	NS

**, *, and † indicates significance at $P \leq 0.01$, 0.05 and 0.10, respectively

Plant Spacing Variability Treatments 2000-2001 Plant Population = 30,000 Plants/A

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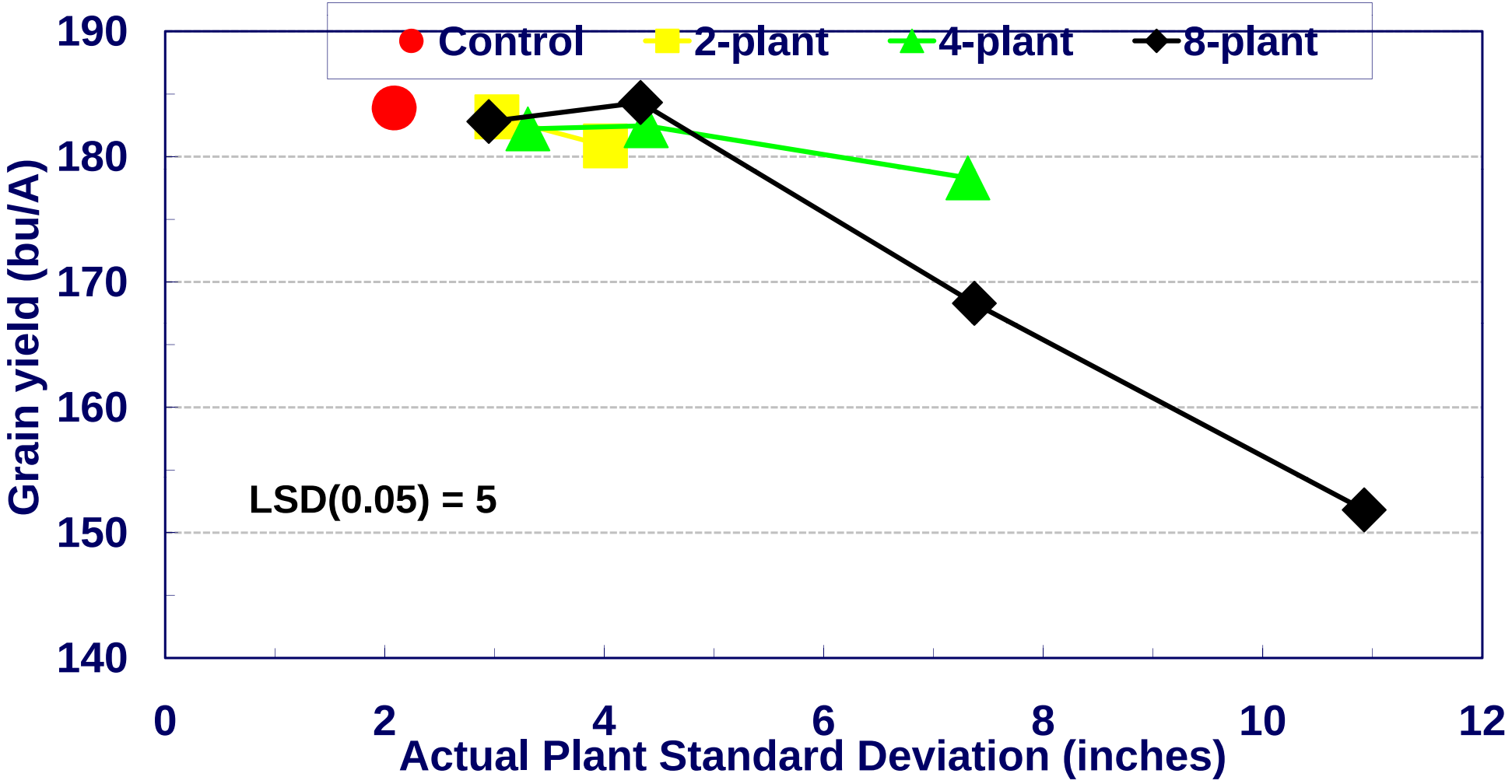
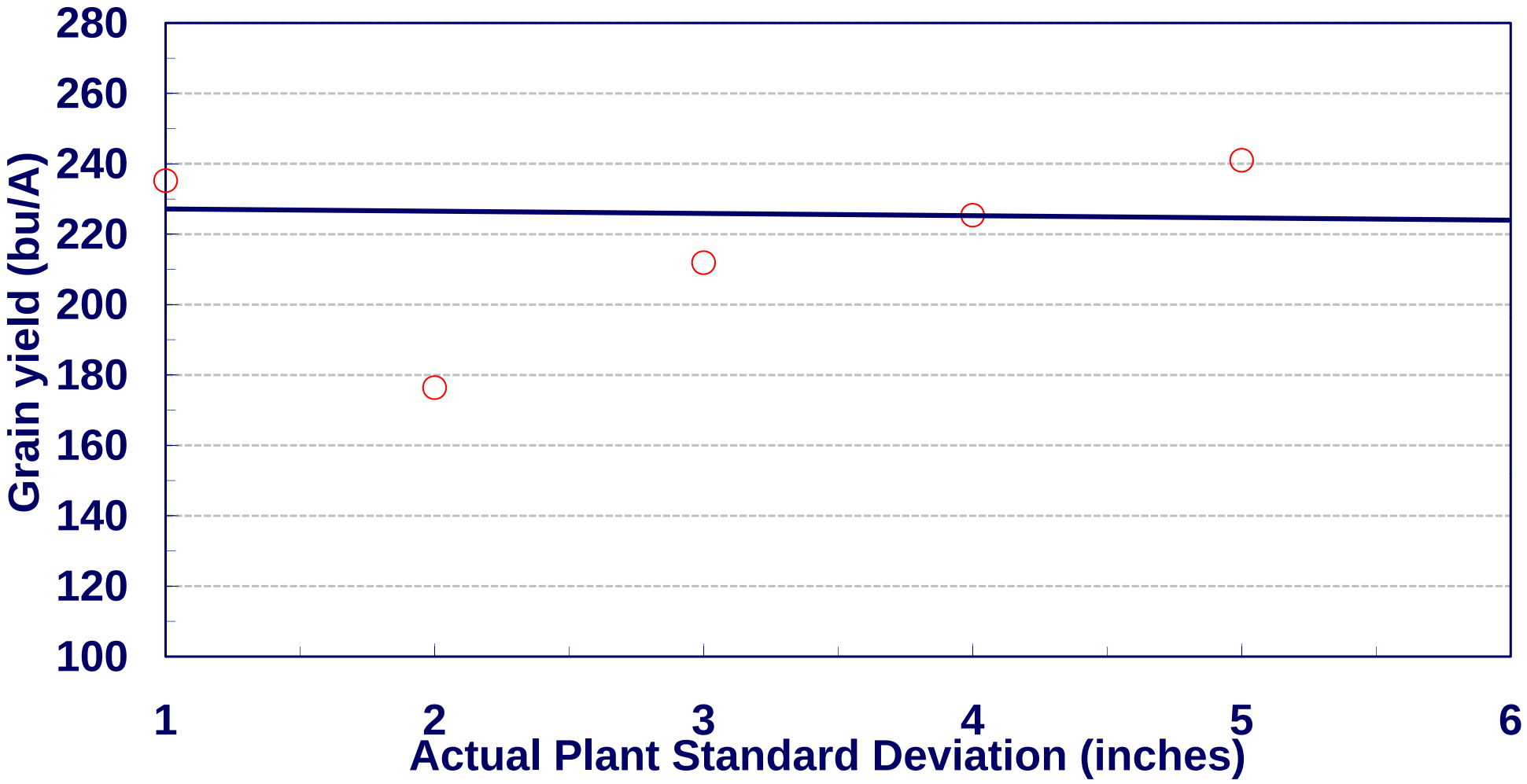
Corn yield response to plant spacing variation during 2000 and 2001. Values averaged across all locations.



Corn yield response to plant spacing variation during 1999 and 2000. Values are individual plots from all locations (n= 20) and include control and 2-plant pattern treatments at 30000 plants/A.



Significance of corn plant spacing variability treatments during 2000

30,000 plants/A Location	Plant density	Plant standard deviation	Grain yield	Grain moisture	Lodging	Grain test weight
Arlington	**	**	**	NS	†	NS
Janesville	**	**	NS	NS	NS	NS
Lancaster	†	**	†	NS	NS	NS
Fond du Lac	†	**	*	NS	NS	NS
Galesville	NS	**	**	NS	NS	NS
Hancock	†	**	**	NS	NS	†
Chippewa Falls	†	**	NS	NS	†	NS
Marshfield	**	**	**	NS	NS	NS
Seymour	NS	**	**	NS	NS	NS
Valders	NS	*	**	NS	NS	NS

**, *, and † indicates significance at $P \leq 0.01$, 0.05 and 0.10, respectively

Significance of corn plant spacing variability treatments during 2001

30,000 plants/A Location	Plant density	Plant standard deviation	Grain yield	Grain moisture	Lodging	Grain test weight
Arlington	**	**	NS	NS	NS	NS
Janesville	**	**	**	NS	NS	NS
Fond du Lac	*	**	†	NS	NS	NS
Galesville	**	**	**	NS	NS	†

**, *, and † indicates significance at $P \leq 0.01$, 0.05 and 0.10, respectively

Summary

- Grain yield decreased in 4- and 8-plant patterns where standard deviation of plant spacing treatments was greater than 5 to 7 inches.
  - ✓ Possibly due to competition and/or a population decrease (plant death)
- In most agronomic situations, plant spacing variation has no effect on grain yield or other agronomic measures as long as population is not affected.
  - ✓ Do planters need to be tuned?
  - ✓ Other types of plant variability?

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