Effect of Corn Spacing and Emergence Variation on Grain Yield

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http://corn.agronomy.wisc.edu/Extension/CC04

Uniform Stand:

- Plants emerged in adequate numbers, with uniform spacing and emergence time

(Hoeft, R.G., E.D. Nafziger, R.R. Johnson, and S.R. Aldrich)

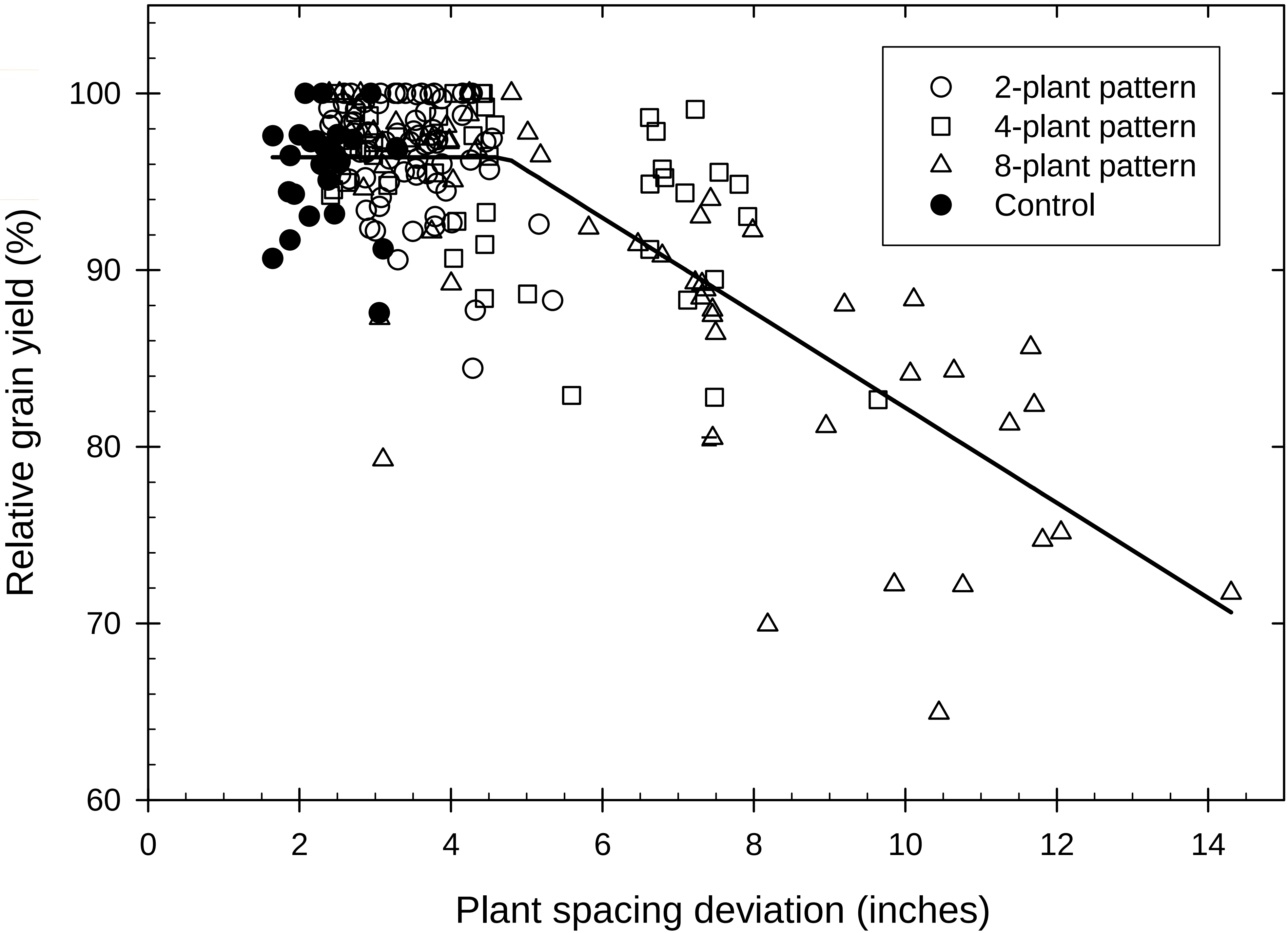
Previous Research on Corn Grain Yield Response to Plant Spacing and Emergence Variation

- 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
- Uneven emergence can reduce yield by 10-20% when 1/3 plants emerged 2 weeks late or later (Carter, 1989; Nafziger, 1991)
- 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)

Objectives

- To measure the effects and interactions of plant spacing variation and plant emergence variation on plant growth and grain yield.
- To quantify the grain yield compensation of individual plants in variable corn stands
- To quantify the grain yield of corn in communities with variable corn stands

Plant Spacing Variability Treatments 2000-2002; Plant Population = 30,000 Plants/A


2-plant pattern
4-plant pattern
8-plant pattern
Control
Relative grain yield (%)
Plant spacing deviation (inches)
100
90
80
70
60
0
2
4
6
8
10
12
14

Deen et al. University of Guelph Field Descriptions

Locations:
- Elora (E)
- Woodstock (W)

CHU:
- 2700 (E)
- 2900 (W)

Soil Types:
- London Loam (E)
- Guelph Loam (W)

Previous Crops:
- Alfalfa (E)
- Soybeans (W)

Treatments using Roundup Ready seed to establish Plant Spacing Variability

Treatment	Roundup Ready	Normal Corn
	Seeds/A	
RR	28250	0%
RR + 10% Normal	28250	10%
RR + 20% Normal	28250	20%
RR + 35% Normal	28250	35%
RR + 50% Normal	28250	50%
RR + 70% Normal	28250	70%

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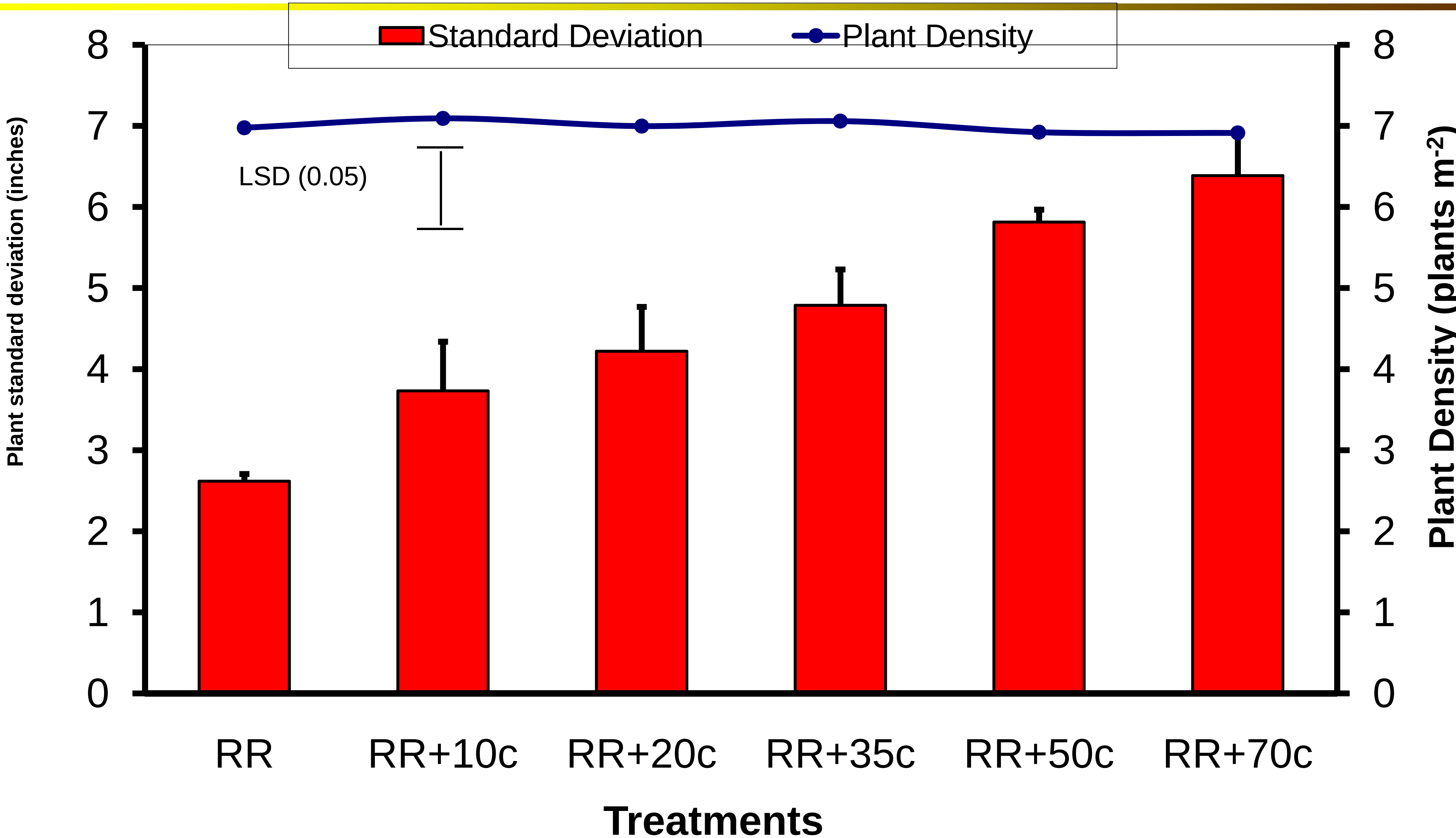
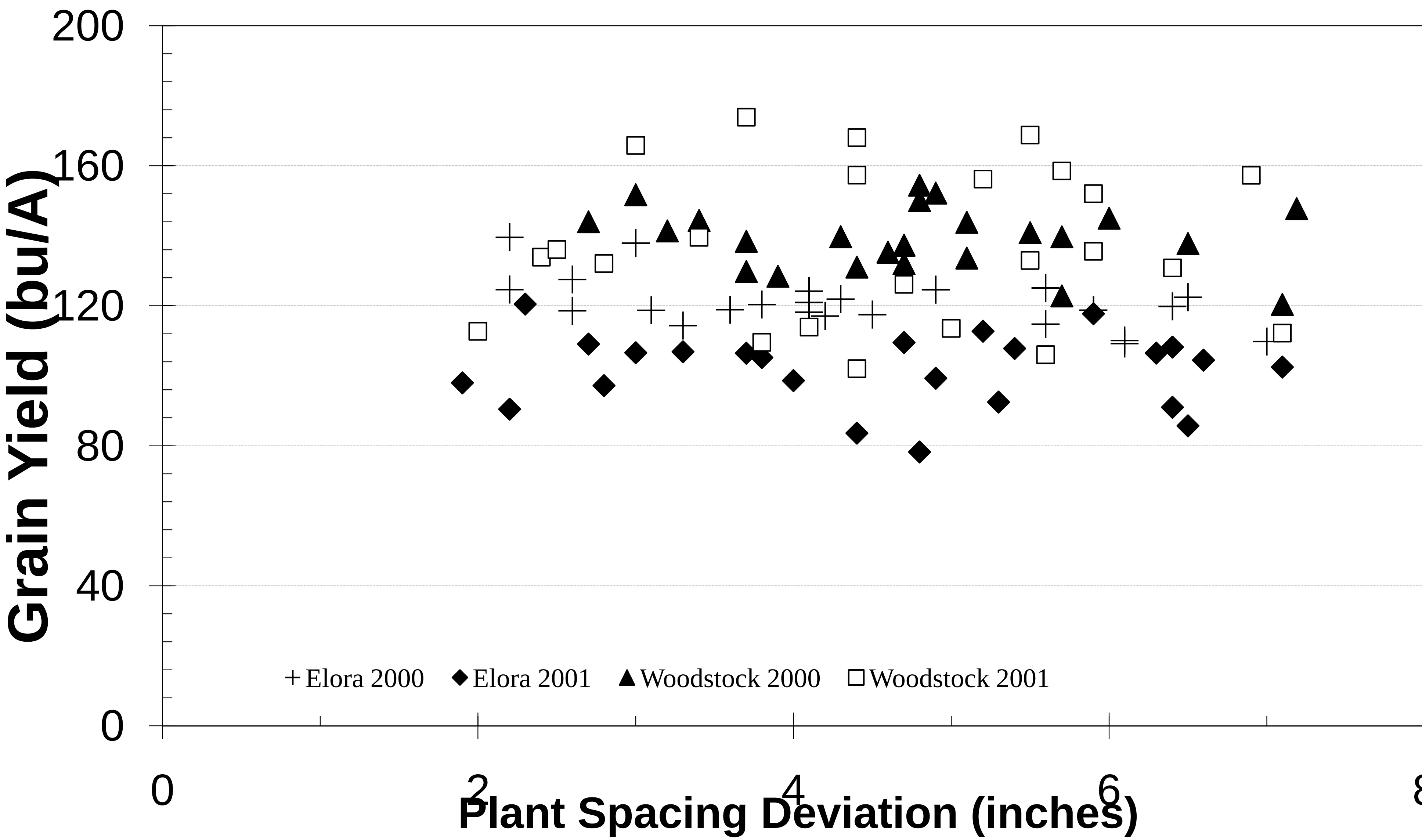
Establishment of Plant Standard Deviation and Plant Density



Grain yield response to Plant Standard Deviation using Roundup Ready Treatments



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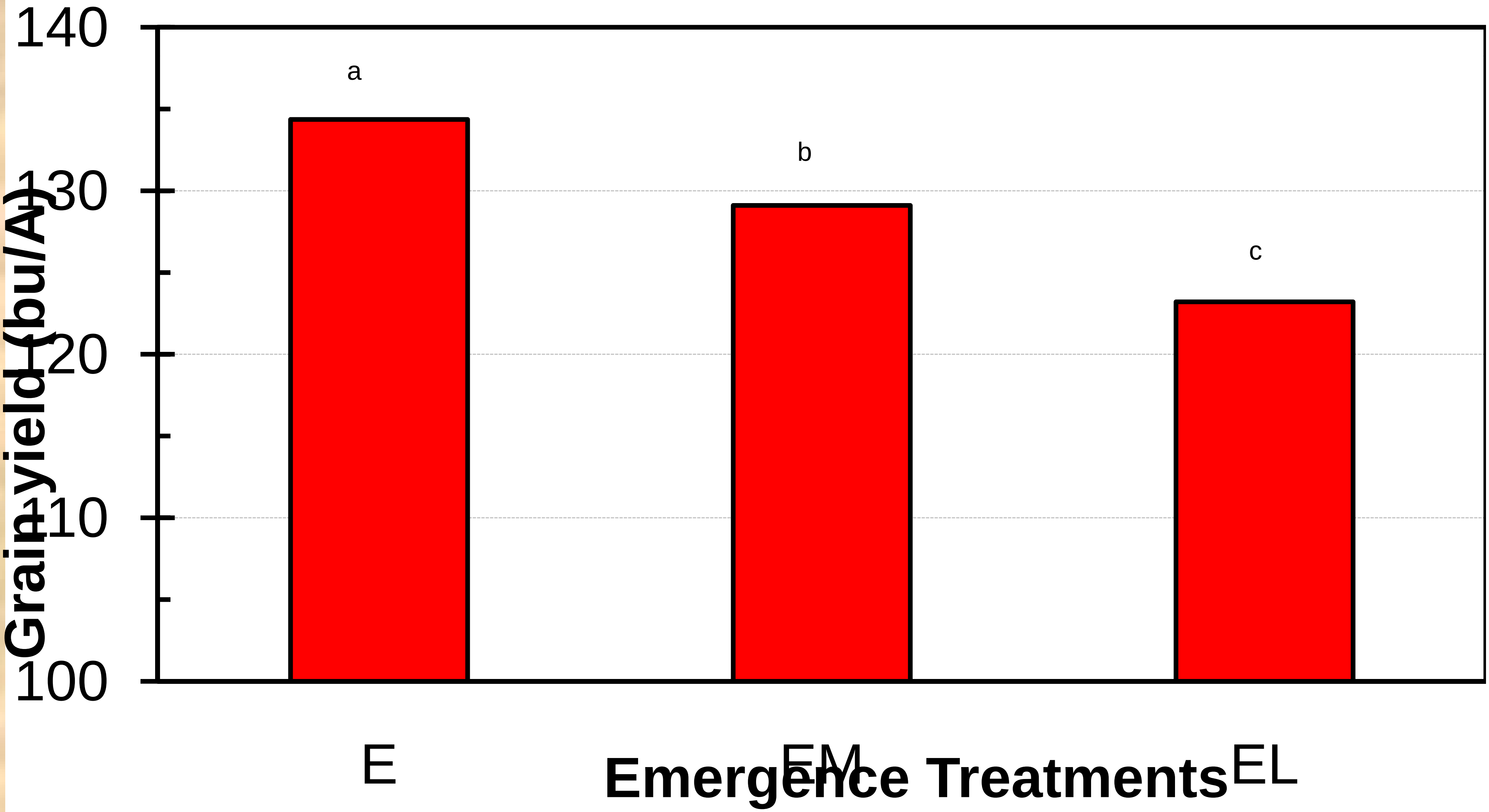
Impact of Plant Spacing and Emergence Variation on Yield

Summary of variance analysis

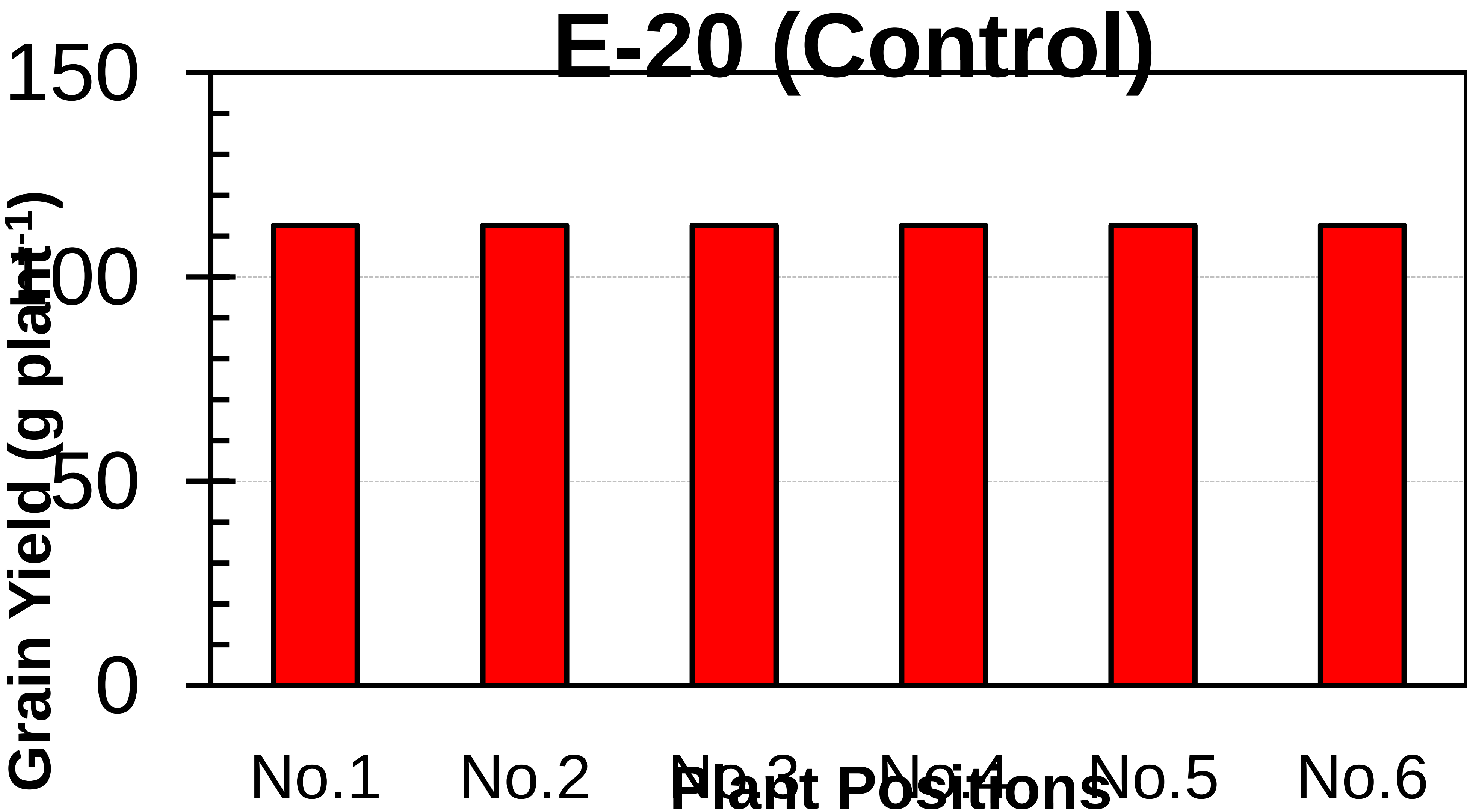
Factor	Plant height	LAI	Forage yield	Grain yield
Emergence	**	**	**	**
Spacing	NS	NS	NS	NS
E X S	NS	NS	NS	NS

** Significant at $P \leq 0.05$, NS = Non significant

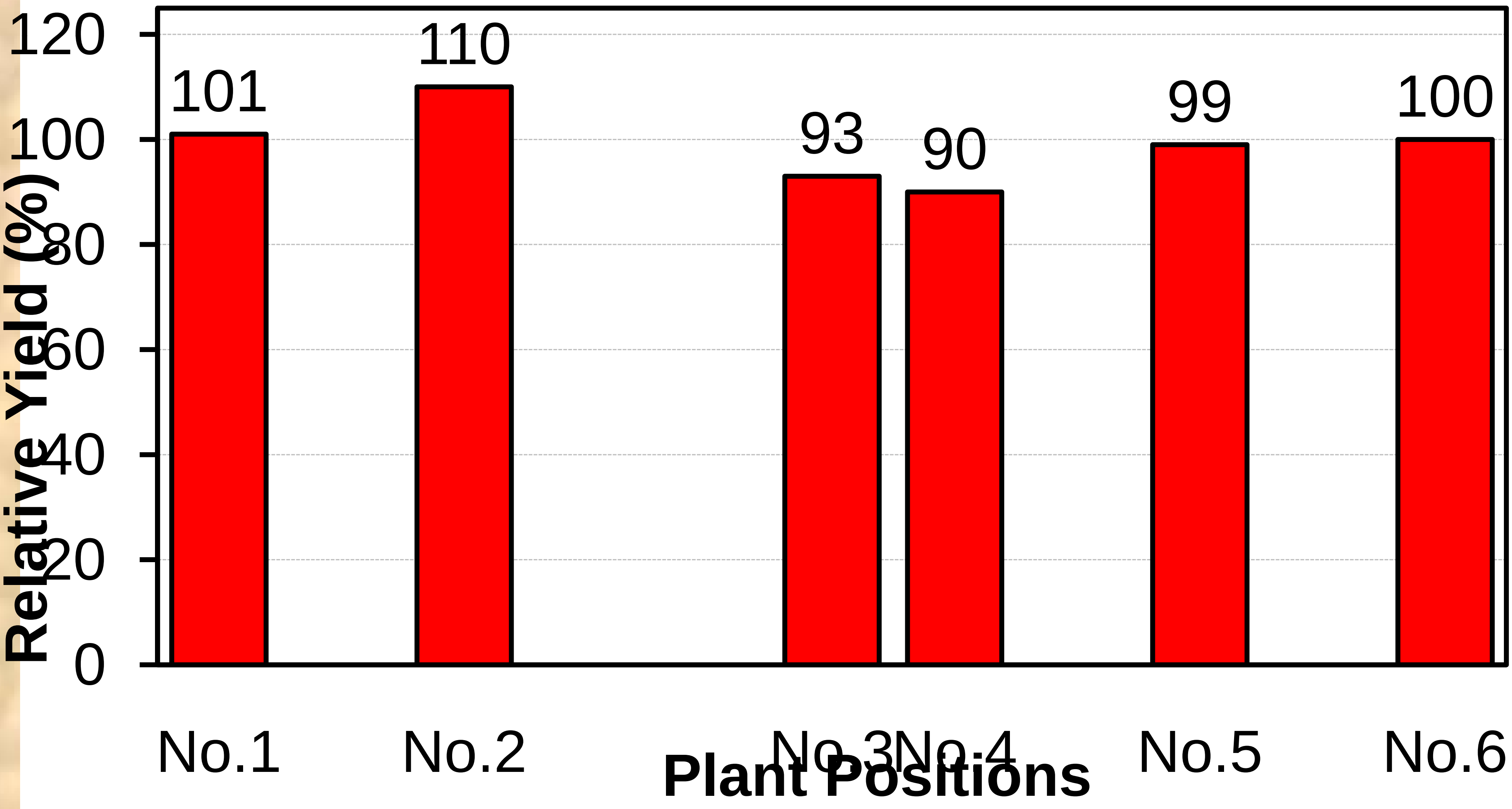
Grain Yield Response to Emergence



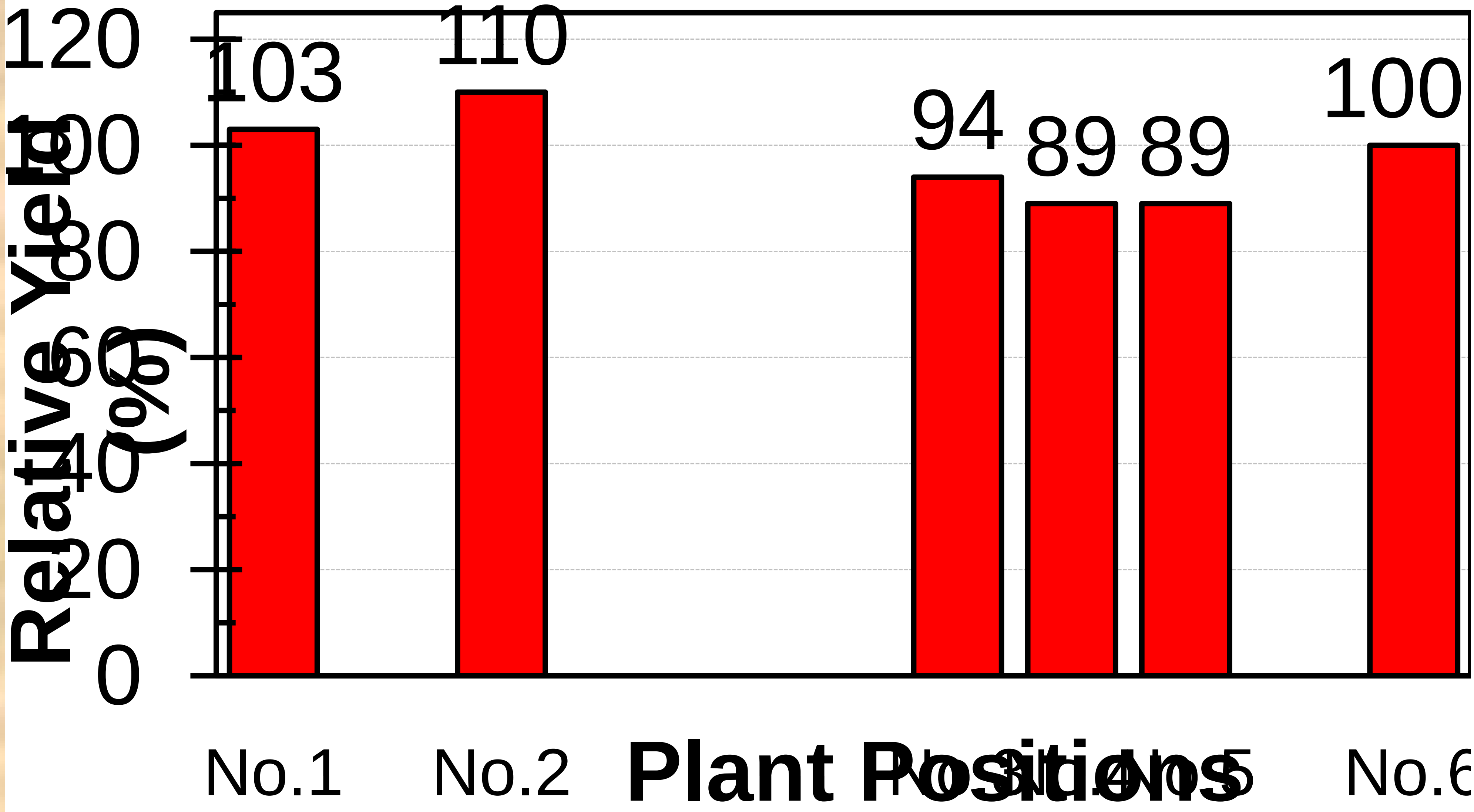
Dry Grain Yield per Plant



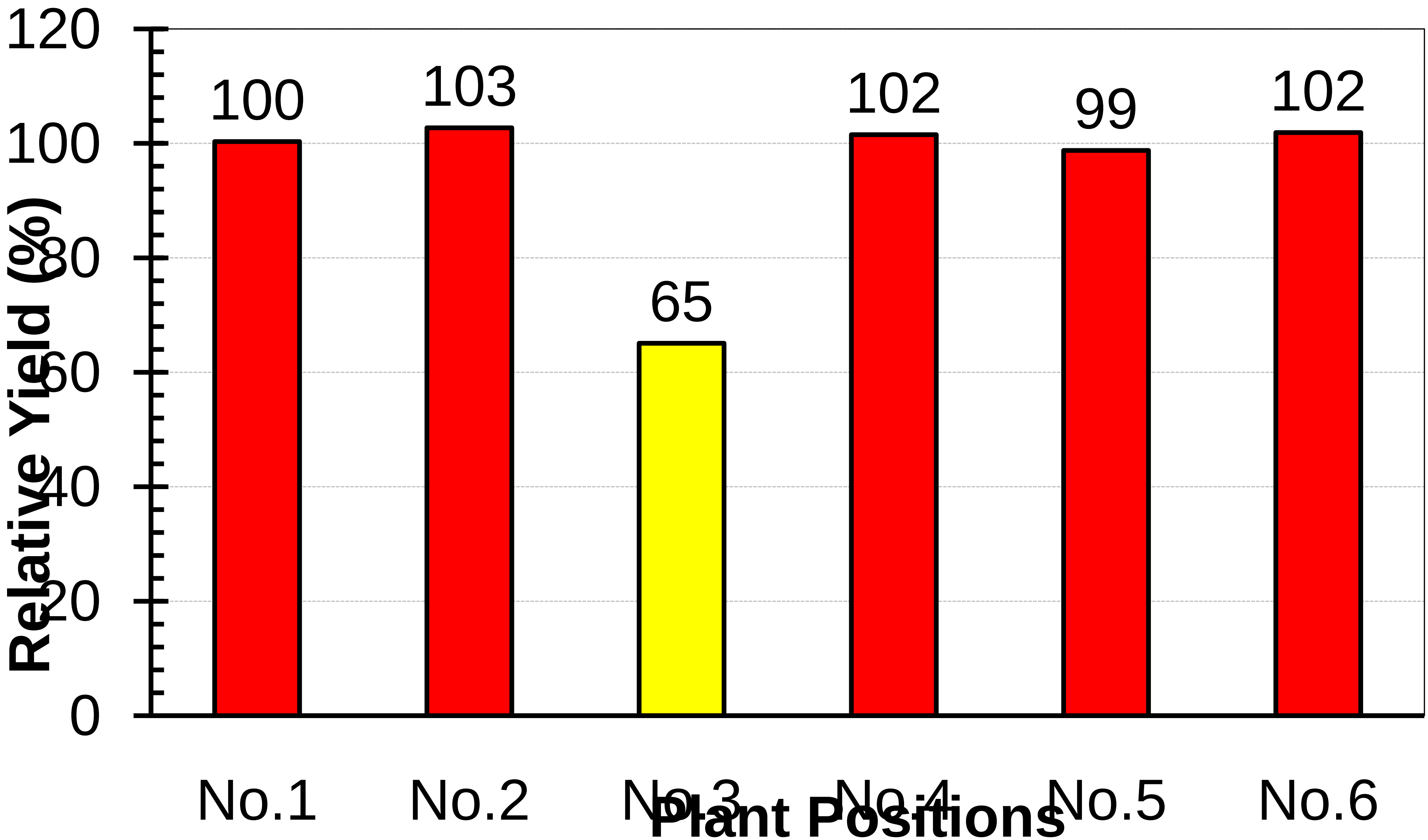
E-40 Relative Yield



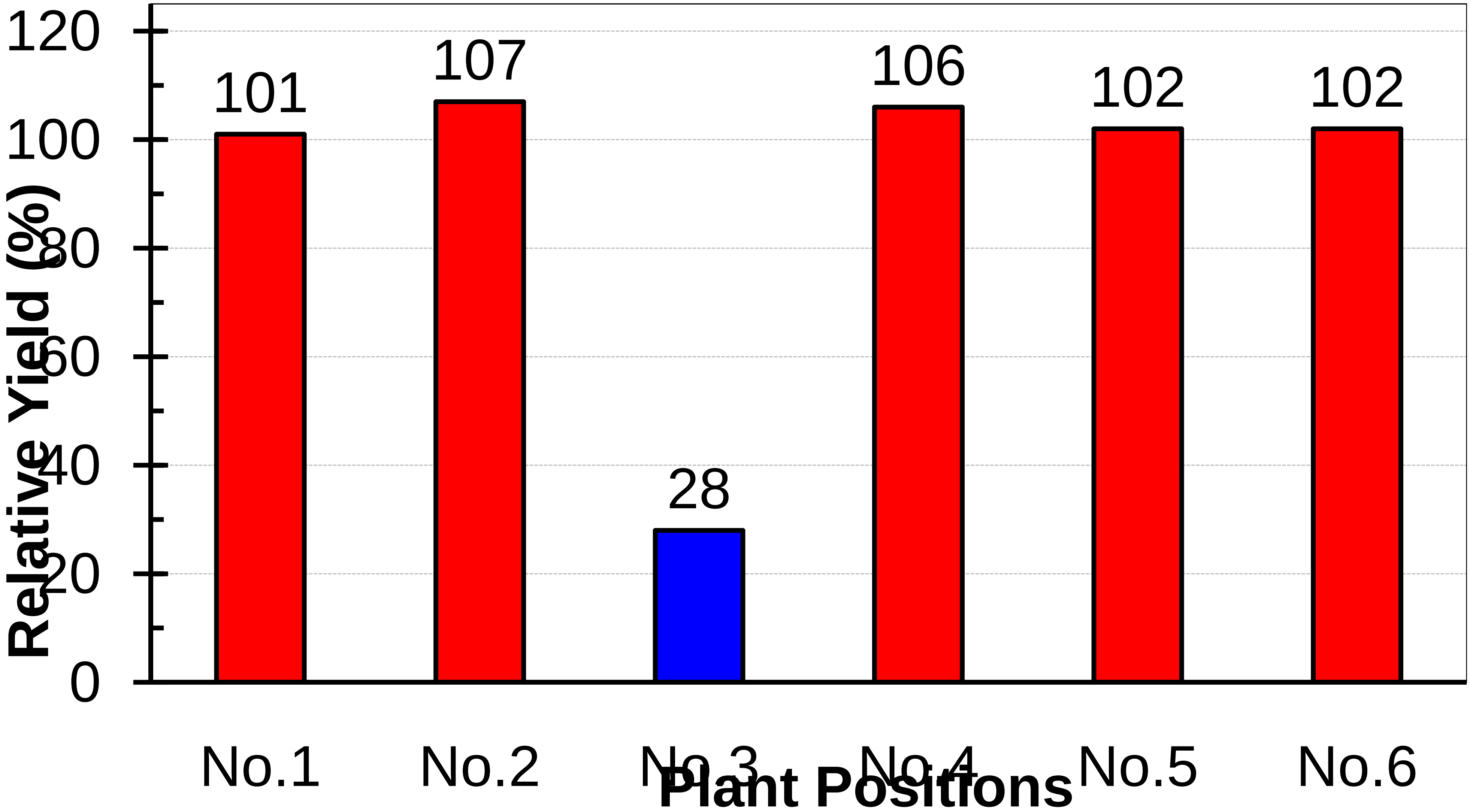
E-60 Relative Yield



EM-20 Relative Yield



EL-20 Relative Yield



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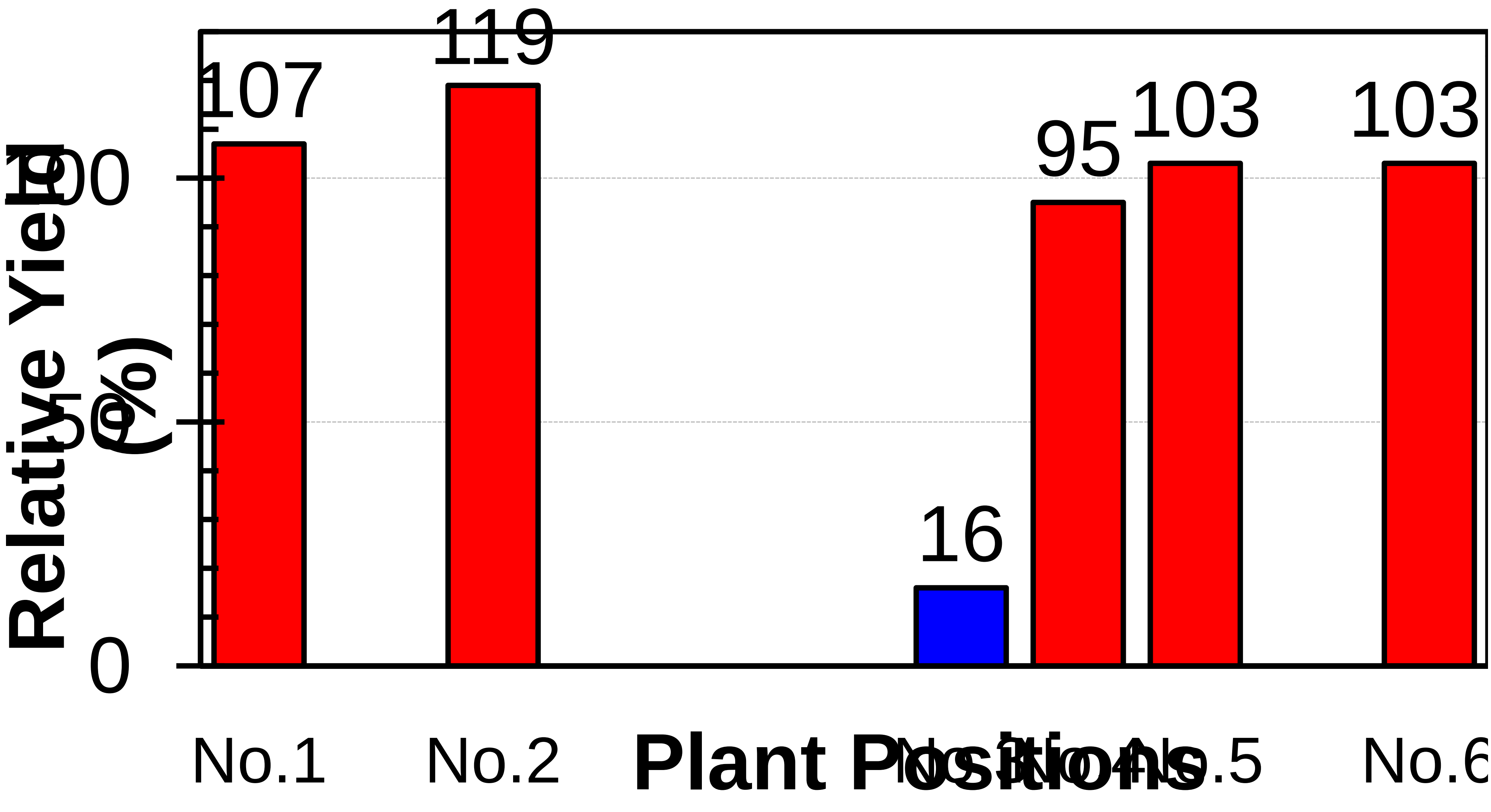
EL-60 Relative Yield

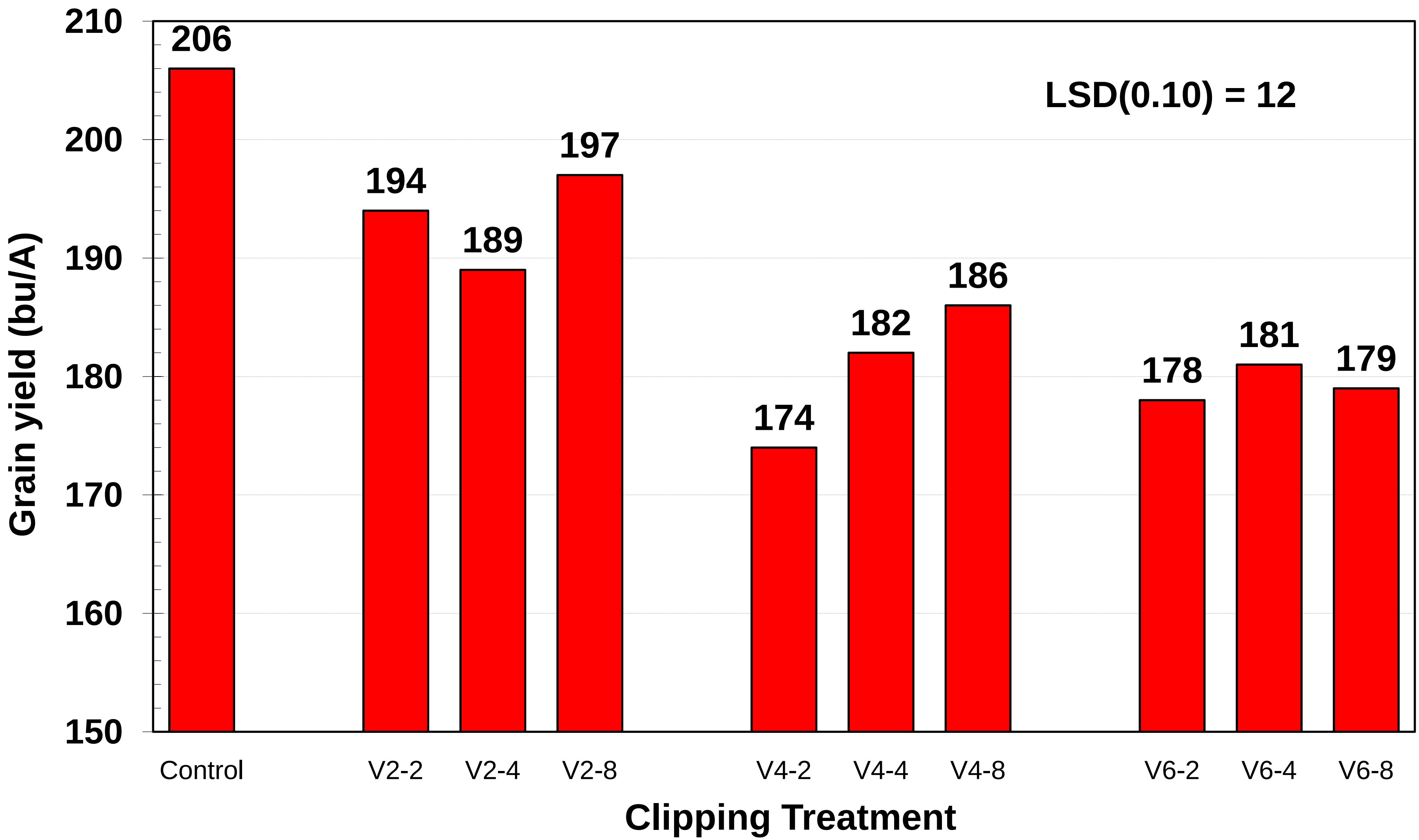


Clipping Studies at Arlington

Plant Clipping at Arlington (2000-2003)

- Growth stages:
  - ✓ All leaves clipped at V2, V4 and V6
- Plot plant patterns for clipping treatments:
  - ✓ Untreated check, 2-, 4-, and 8-plant patterns, All

Corn Grain Yield Response to Clipping on a Plot Basis at Arlington (2000-2003)



Conclusions

- Corn was more responsive to plant emergence variability than plant spacing variability.
- Plant growth and grain yield were unaffected by within-row plant spacing variability (SD= 1-7 inches)
- Yield decreased 4-8% as 1/6 plants emerged 2 to 4 leaves late.
- Yield reduction due to emergence delay was not intensified by increased spacing variability.
- Planter performance evaluation and subsequent maintenance must consider crop emergence uniformity.
- Management and planting decisions that influence emergence pattern can have a significant impact on yield.