UNIVERSITY OF MINNESOTA | EXTENSION

MAKING A DIFFERENCE IN MINNESOTA: ENVIRONMENT + FOOD & AGRICULTURE + COMMUNITIES + FAMILIES + YOUTH

Agronomy with $3.00 Corn

Jeff Coulter – Extension Corn Specialist

coult077@umn.edu

z.umn.edu/corn

Overview

- Seeding rates
- N rates
- Hybrid selection
- Planting date
- Stand establishment
- Crop rotation

Be an economist; pay attention to details

- Control costs without impacting yield
- Conduct simple on-farm tests to assess inputs
- Be timely with field operations
- Do not overlook the basics
  - Hybrid selection
  - Crop rotation
  - Stand establishment
  - Weed control

Growers are adopting higher seeding rates

- No or little yield penalty for too high of seeding rate
- Optimum seeding rates tend to be higher on high productivity soils
- Higher seeding rates can sometimes result in higher yields when favorable growing conditions

Do higher seeding rates require more N?

- Higher seeding rates used to target higher yields
- P & K fertility based on yield goal
- In trials that had high yields & high economic optimum seeding rates, high N fertilizer rates were used

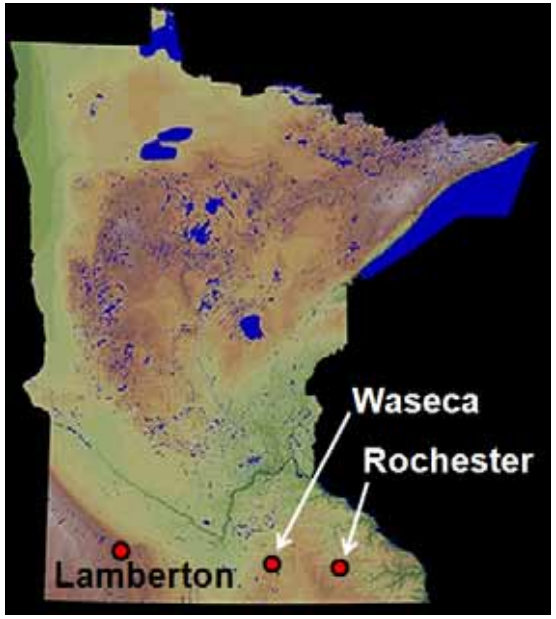
From Lee & Tollenaar (*Crop Science*, 2007)

Seeding rate x N rate study

- Questions addressed:
  - What are the optimum seeding rates in high-yield environments?
  - Do higher seeding rates require more N?
  - What are the maximum corn yields that are possible?
  - How do these vary among growing environments?

Seeding rate x N rate study

Location	Soil series
Lamberton	Normania loam
Waseca	Nicollet clay loam
Rochester	Port Byron silt loam



- **Managed for maximum yield:**
  - Corn followed soybean; spring field cultivation
  - Soil fertility (excluding N) managed for 250 bu/ac
  - Timely planting with 10-34-0 in-furrow
  - 103-day hybrid (DKC53-78RIB BLEND)

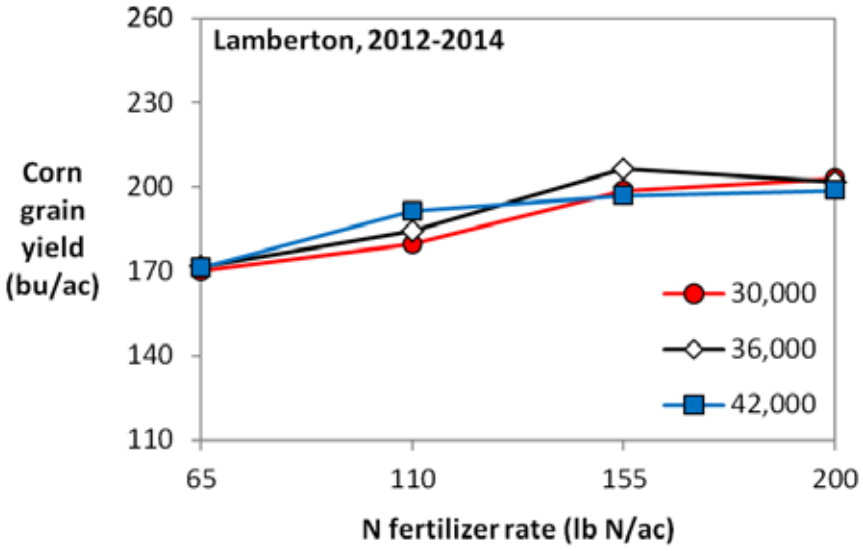
Seeding rate x N rate study

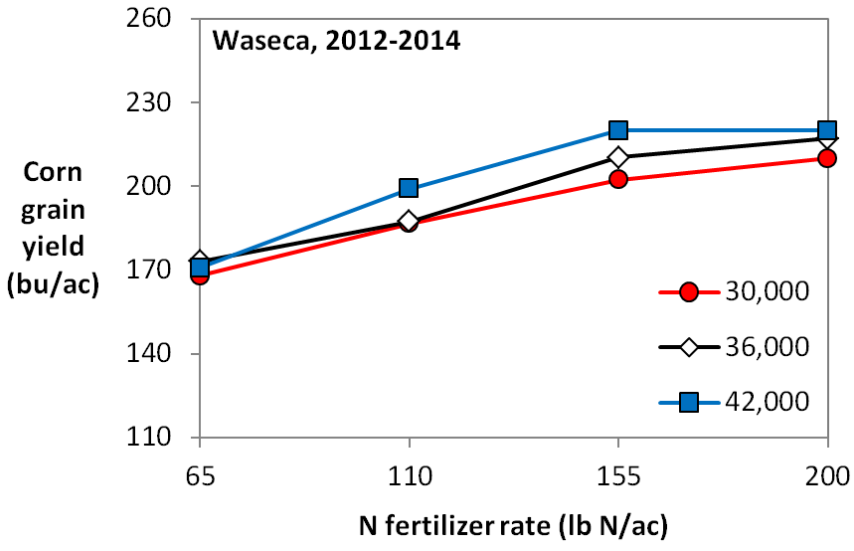
- 3 seeding rates (30,000, 36,000, 42,000 seeds/ac)
- 4 N fertilizer rates (65, 110, 155, 200 lb N/ac)

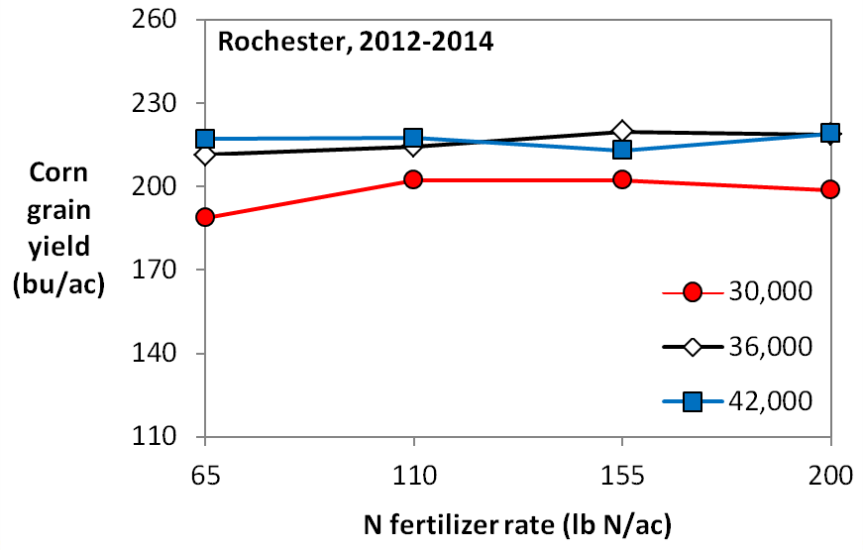
N fertilizer applied (lb N/ac)				
Total	**Preplant MAP**	**Preplant urea**	**Starter (10-34-0)**	**Sideress at V6 (28-0-0)**
65	10	10	5	40
110	10	55	5	40
155	10	100	5	40
200	10	145	5	40

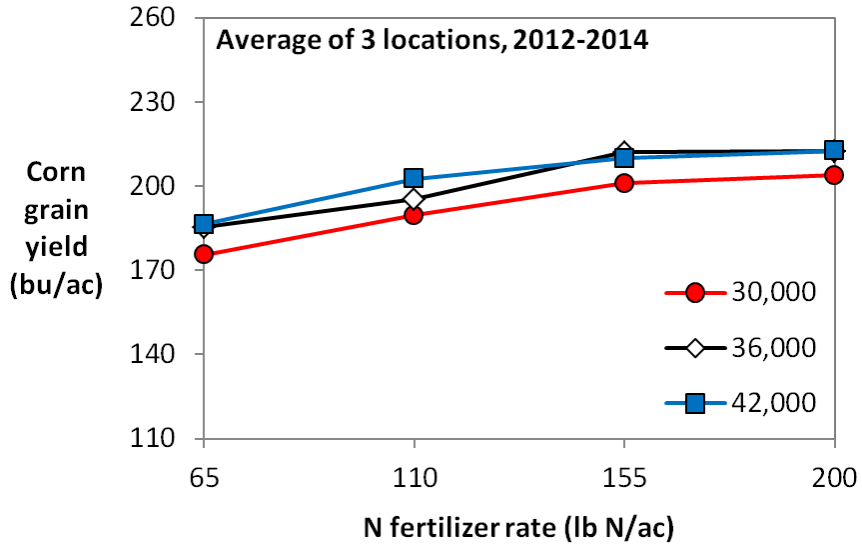
		------- Monthly total rainfall (inches) -------			
Year	**Location**	**May**	**June**	**July**	**August**
2012	Lamberton	10.3	1.3	0.7	3.1
	Waseca	5.7	4.3	2.1	1.5
	Rochester	4.5	4.3	3.8	1.6
2013	Lamberton	4.2	5.3	0.4	1.8
	Waseca	6.5	6.7	5.3	2.1
	Rochester	7.6	4.2	2.8	2.8
2014	Lamberton	1.8	7.4	1.1	3.7
	Waseca	2.9	12.9	1.2	3.2
	Rochester	1.5	5.9	1.4	5.1

High seeding rates did not require more N

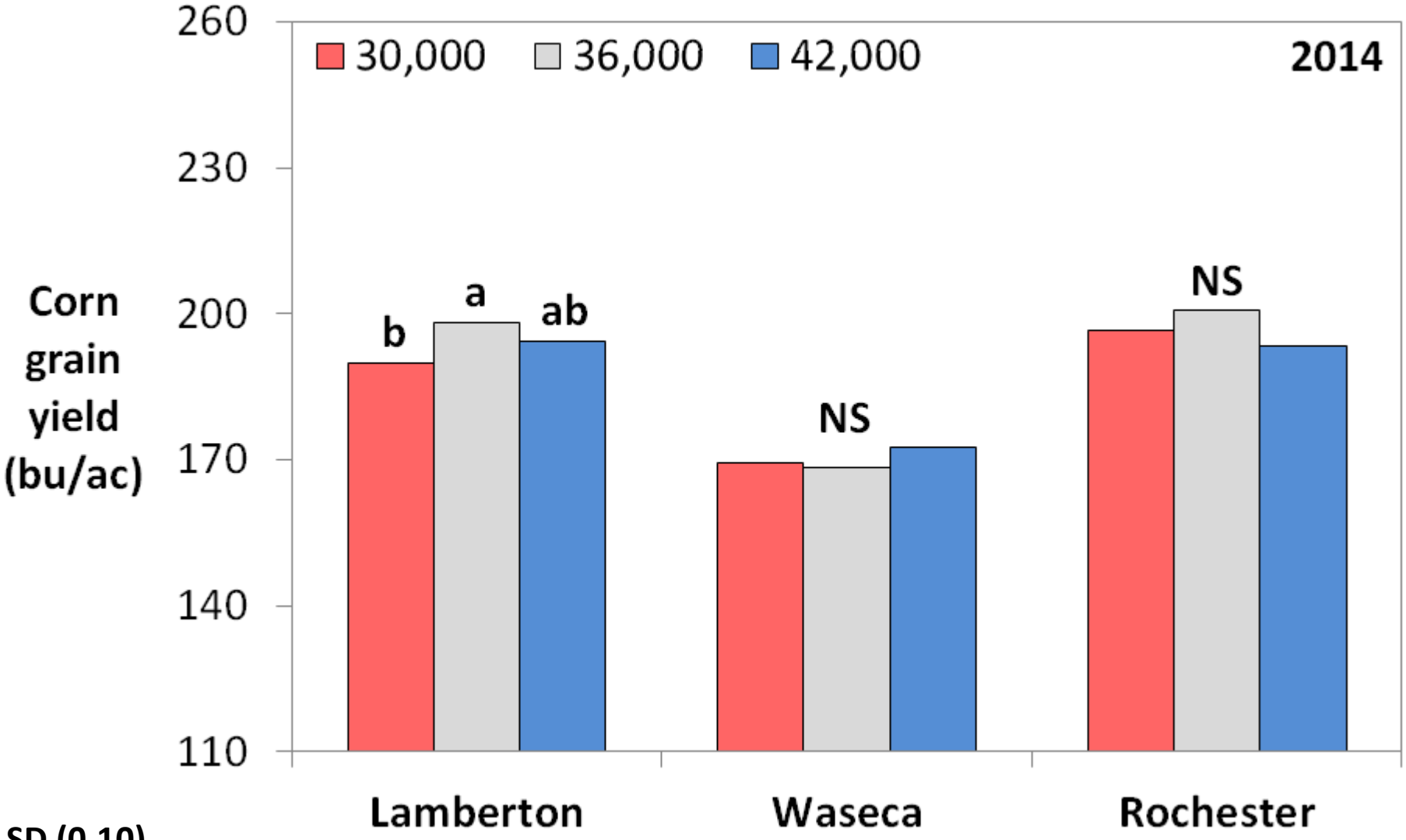






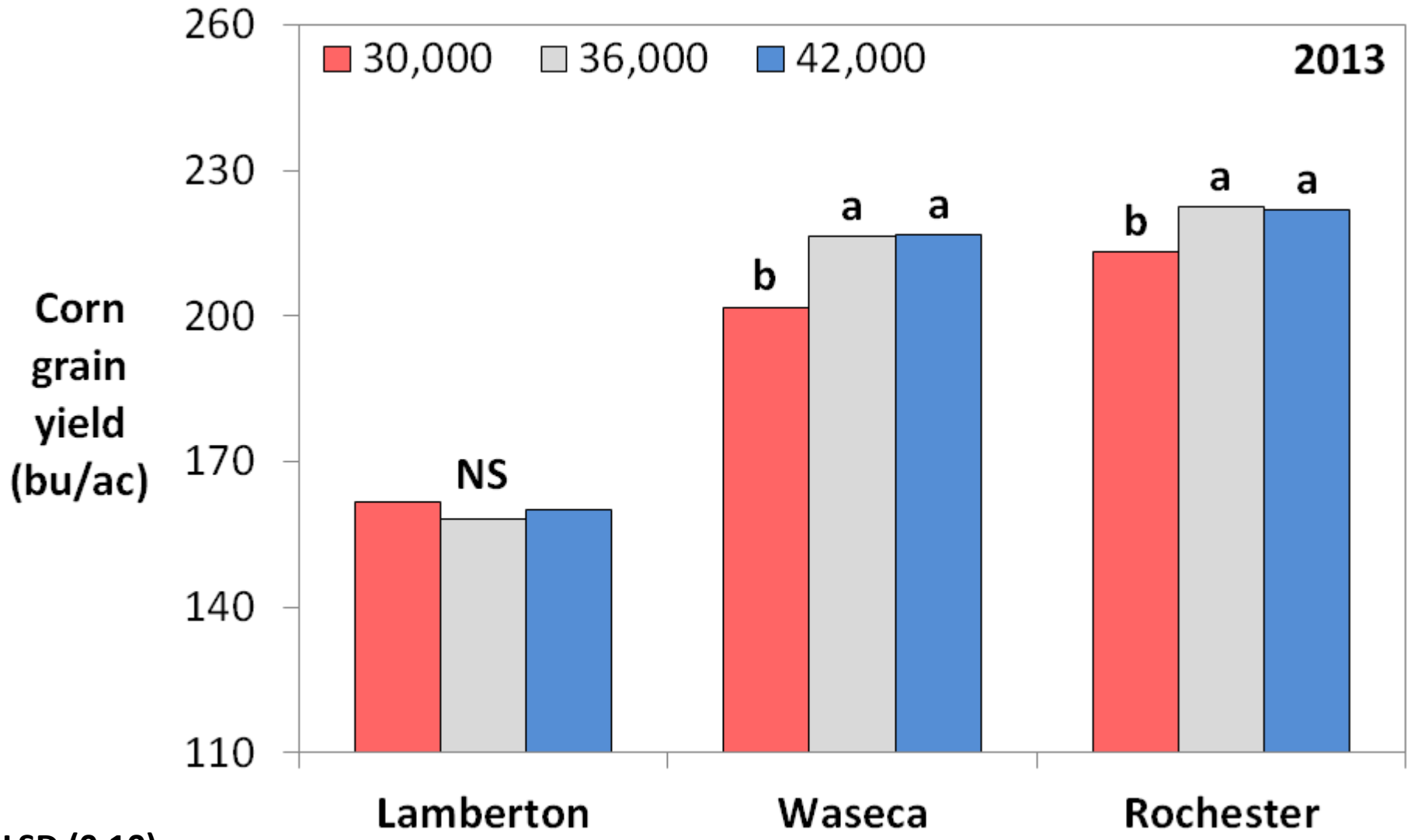


Averaged across N rates



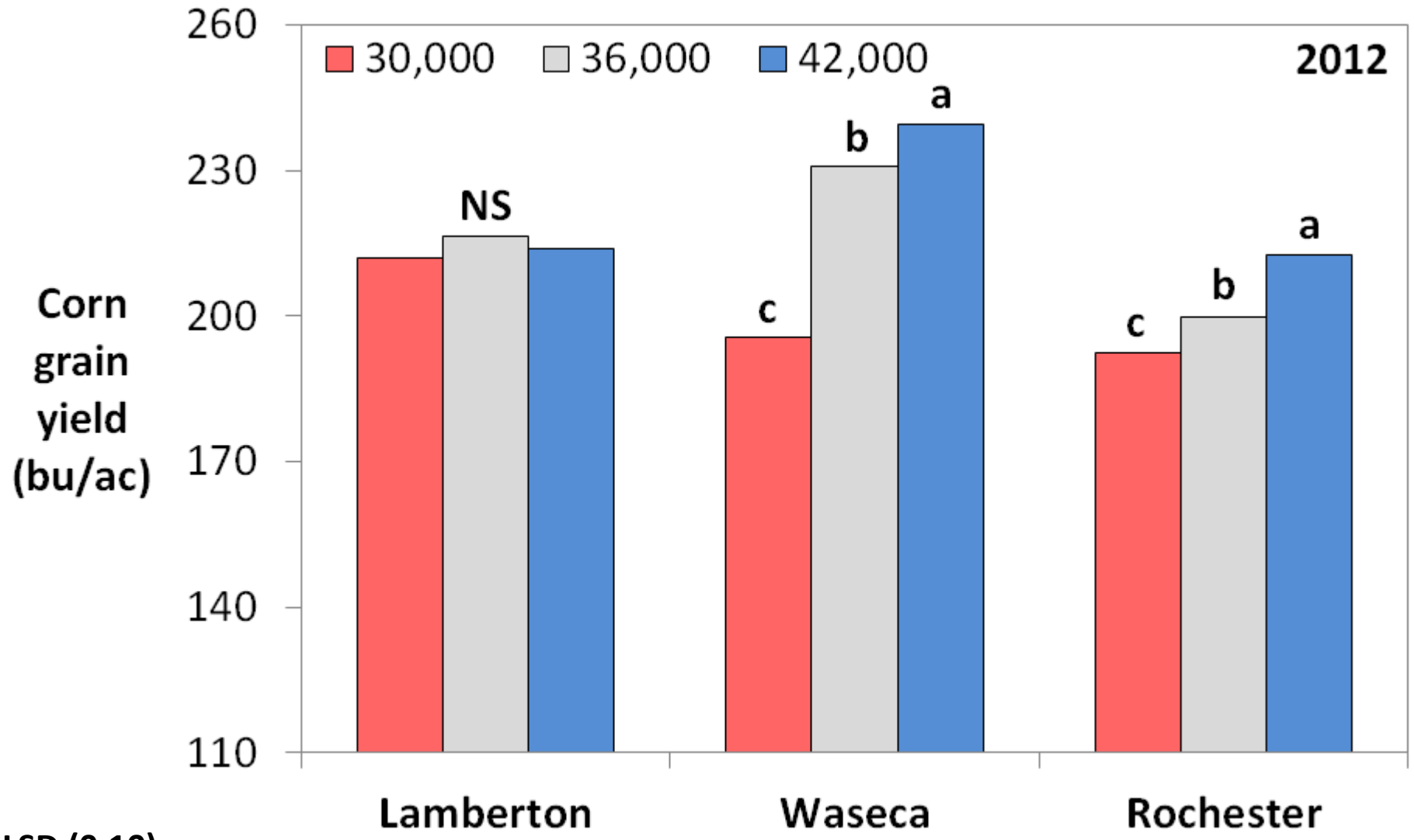
LSD (0.10)

Averaged across N rates



LSD (0.10)

Averaged across N rates



LSD (0.10)

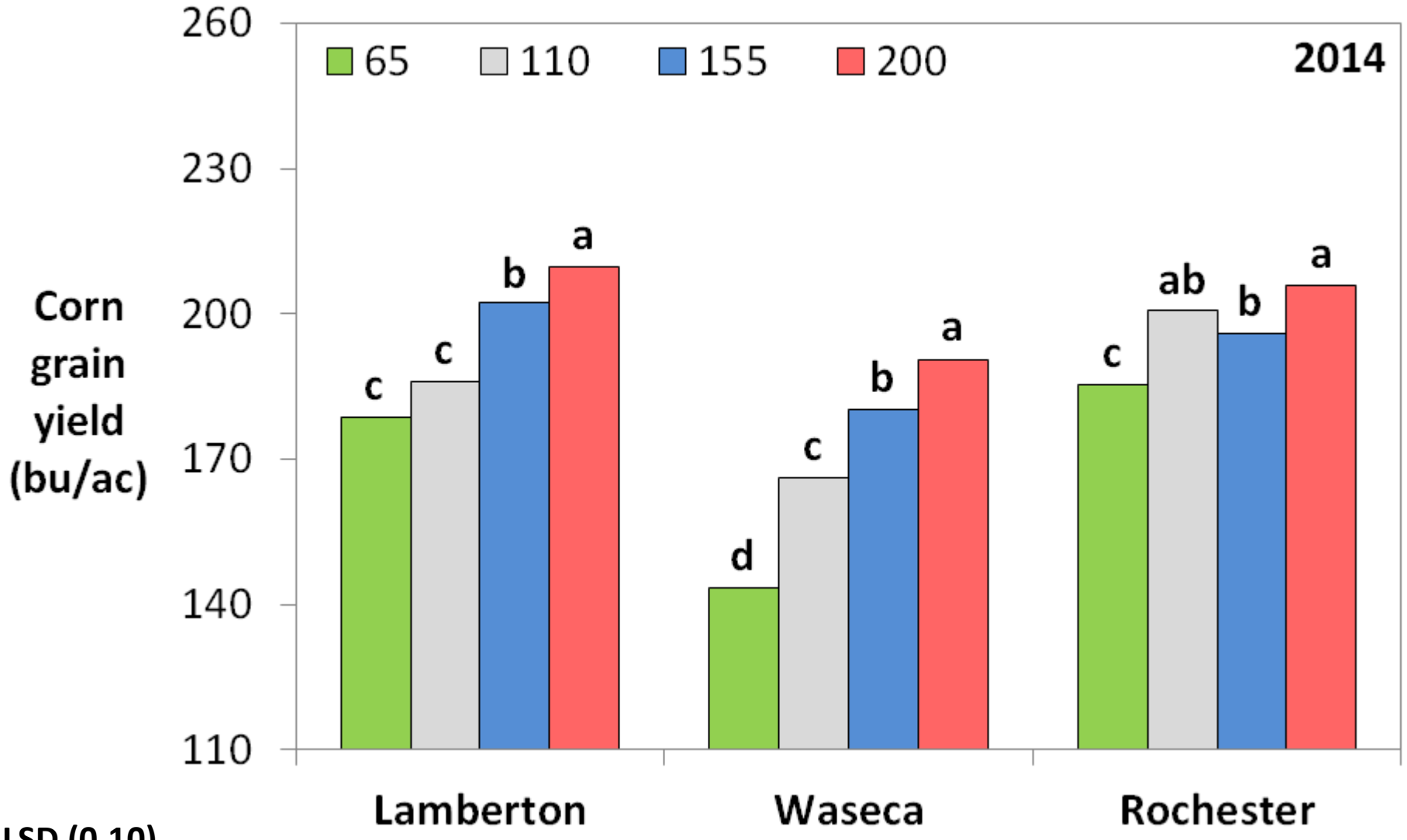
Return over direct costs ($/acre)

Averaged across N rates

Location	Year	30,000	36,000	42,000
Lamberton	2012	**591**	**585**	**556**
	2013	**415**	**382**	**368**
	2014	**513**	**522**	**487**
Waseca	2012	**522**	**527**	**551**
	2013	**595**	**606**	**584**
	2014	**442**	**417**	**410**
Rochester	2012	**533**	**635**	**645**
	2013	**555**	**585**	**565**
	2014	**537**	**529**	**484**

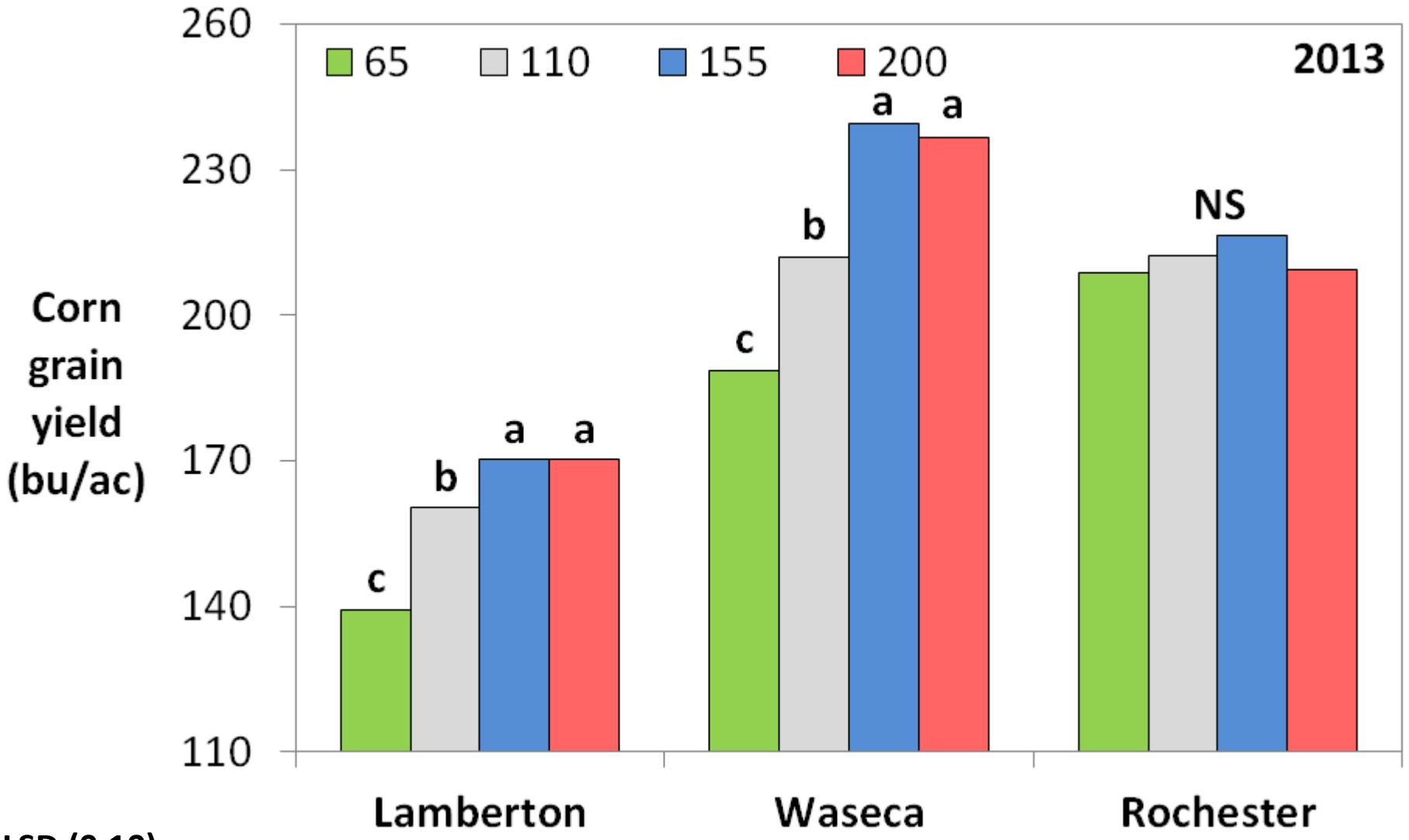
$3.50/bu **$280/80,000 seeds** **$0.35/lb N** **LSD (0.10)**

Averaged across seeding rates



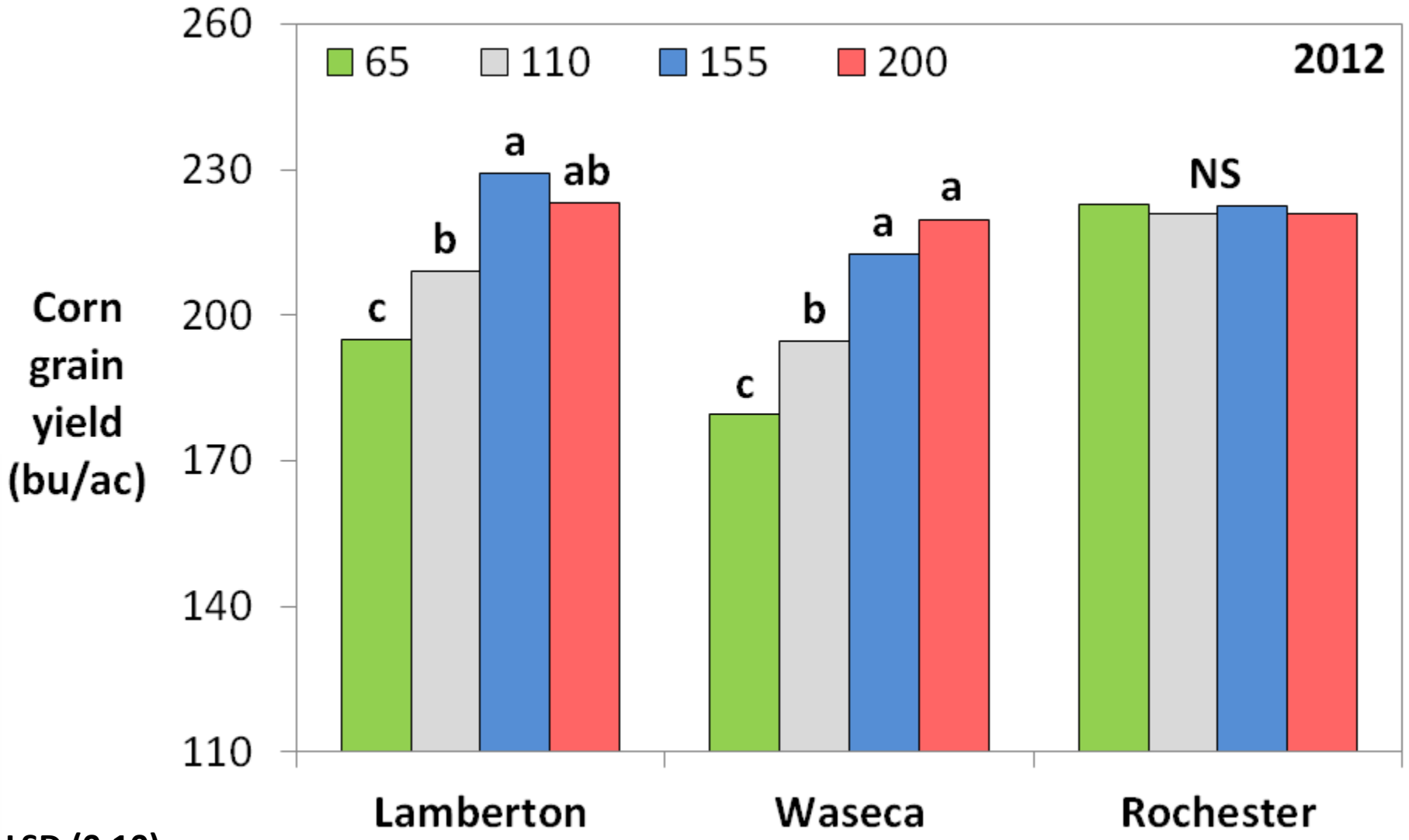
LSD (0.10)

Averaged across seeding rates



LSD (0.10)

Averaged across seeding rates



LSD (0.10)

Return over direct costs ($/acre)

Averaged across seeding rates

Location	Year	65	110	155	200
Lamberton	2012	534	567	622	586
	2013	339	397	416	400
	2014	477	487	528	538
Waseca	2012	480	517	564	573
	2013	512	578	659	632
	2014	353	418	451	471
Rochester	2012	632	609	599	578
	2013	582	579	577	537
	2014	500	538	506	525

$3.50/bu **$280/80,000 seeds** **$0.35/lb N** **LSD (0.10)**

Lamberton, MN

			Difference compared to 36,000 seeds/ac + 155 lb N/ac			
Year	Seeding rate	N rate	Yield	Revenue at $3.50/bu	Input costs	Net return
Year	seeds/ac	lb N/ac	bu/ac	---------- $/ac ----------		
2012	42,000	155	-17	-60	21	-81
	42,000	200	-22	-77	37	-114
2013	42,000	155	-14	-49	21	-70
	42,000	200	-4	-14	37	-51
2014	42,000	155	3	11	21	-10
	42,000	200	3	11	37	-26

$280/80,000 seeds **$0.35/lb N**

Waseca, MN

			Difference compared to 36,000 seeds/ac + 155 lb N/ac			
Year	Seeding rate	N rate	Yield	Revenue at $3.50/bu	Input costs	Net return
Year	seeds/ac	lb N/ac	bu/ac	---------- $/ac ----------		
2012	42,000	155	**10**	**35**	**21**	**14**
	42,000	200	**11**	**39**	**37**	**2**
2013	42,000	155	**13**	**46**	**21**	**25**
	42,000	200	**2**	**7**	**37**	**-30**
2014	42,000	155	**6**	**21**	**21**	**0**
	42,000	200	**16**	**56**	**37**	**19**

$280/80,000 seeds **$0.35/lb N**

Rochester, MN

			Difference compared to 36,000 seeds/ac + 155 lb N/ac			
Year	Seeding rate	N rate	Yield	Revenue at $3.50/bu	Input costs	Net return
Year	seeds/ac	lb N/ac	bu/ac	---------- $/ac ----------		
2012	42,000	155	6	21	21	0
	42,000	200	7	25	37	-12
2013	42,000	155	-2	-7	21	-28
	42,000	200	-6	-21	37	-58
2014	42,000	155	-24	-84	21	-105
	42,000	200	-3	-11	37	-48

$280/80,000 seeds **$0.35/lb N**

Summary – seeding rate x N rate study

- Higher seeding rates never required more N
- Response to seeding rate varied
  - No yield increase with rates above 30,000 seeds/ac in 4 of 9 environments
  - Yield with 36,000 seeds/ac among the highest in 7 of 9 environments
  - 42,000 seeds/ac maximized yield & net return in 2 of 9 environments

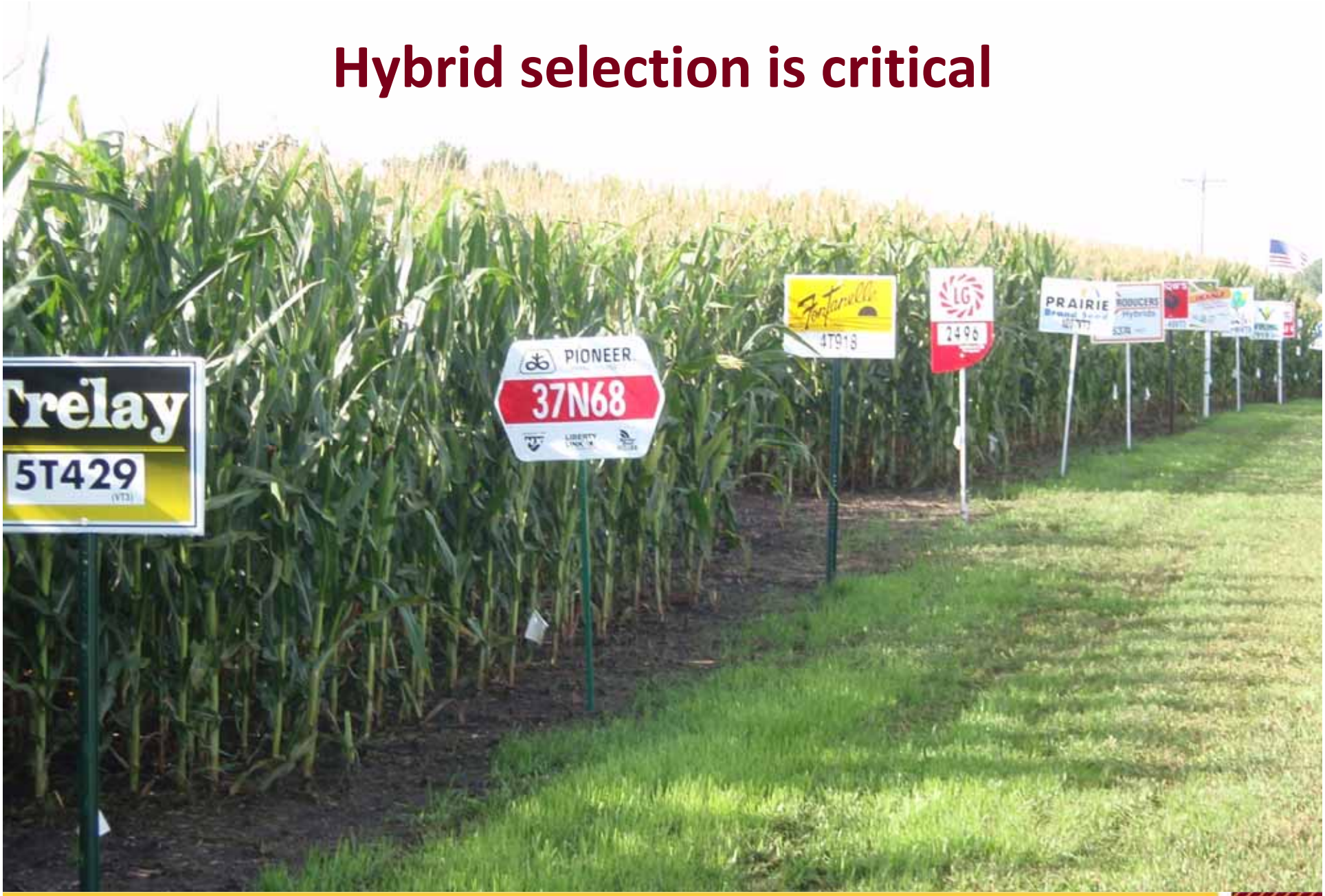
Summary – seeding rate x N rate study

- Response to N rate varied
  - Greater net return with 200 lb N/ac than 155 lb N/ac in 2 of 9 environments (both in 2014)
- When compared to 36,000 seeds/ac + 155 lb N/ac, 42,000 seeds/ac alone or with an extra 45 lb N/ac increased net return only at Waseca

Summary – seeding rate x N rate study

- In above-average fields where corn was managed for maximum yield, increases in yield with above-normal seeding rates & N rates were limited in frequency & magnitude
- Weather can have a much larger impact on yield than agronomic inputs
- Have a 'Plan B' & 'Plan C' in case the weather causes challenges

Hybrid selection is critical



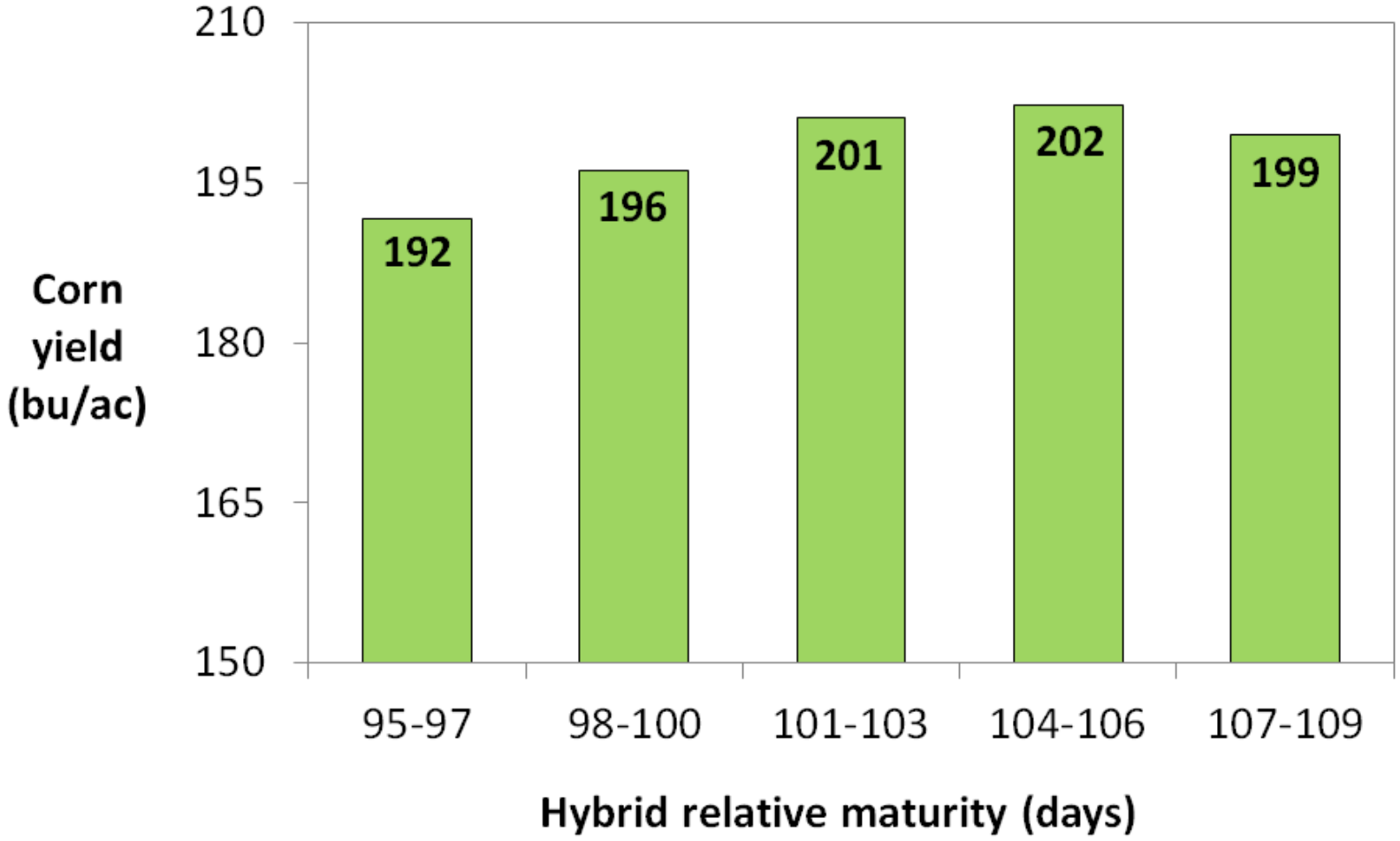
Yield differences among hybrids are huge

Lamberton, MN **(95 - 109 day RM)**

Year	Hybrid entries	Top 10 entries	Bottom 10 entries	Difference (high - low)
	number	-------- bu/acre --------		bu/acre
2008	149	255	186	69
2009	117	224	159	65
2010	96	219	162	57
2011	81	209	172	37
2012	94	237	185	52
2013	84	213	165	48

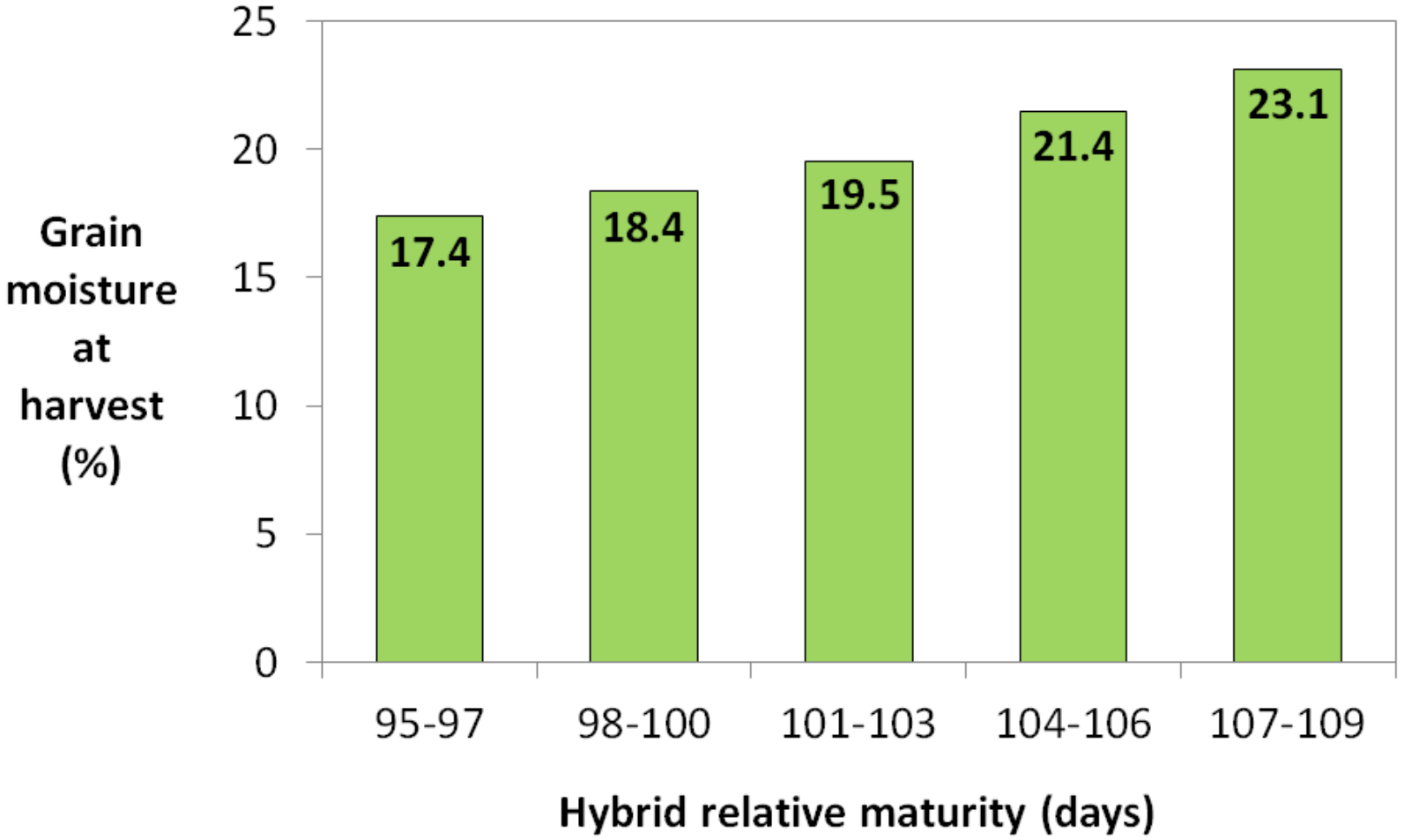
Early-maturity hybrids often yield less

Lamberton, MN (2008-2013) **81-149 hybrid entries/year**



Balance yield potential with harvest moisture

Lamberton, MN (2008-2013) **81-149 hybrid entries/year**

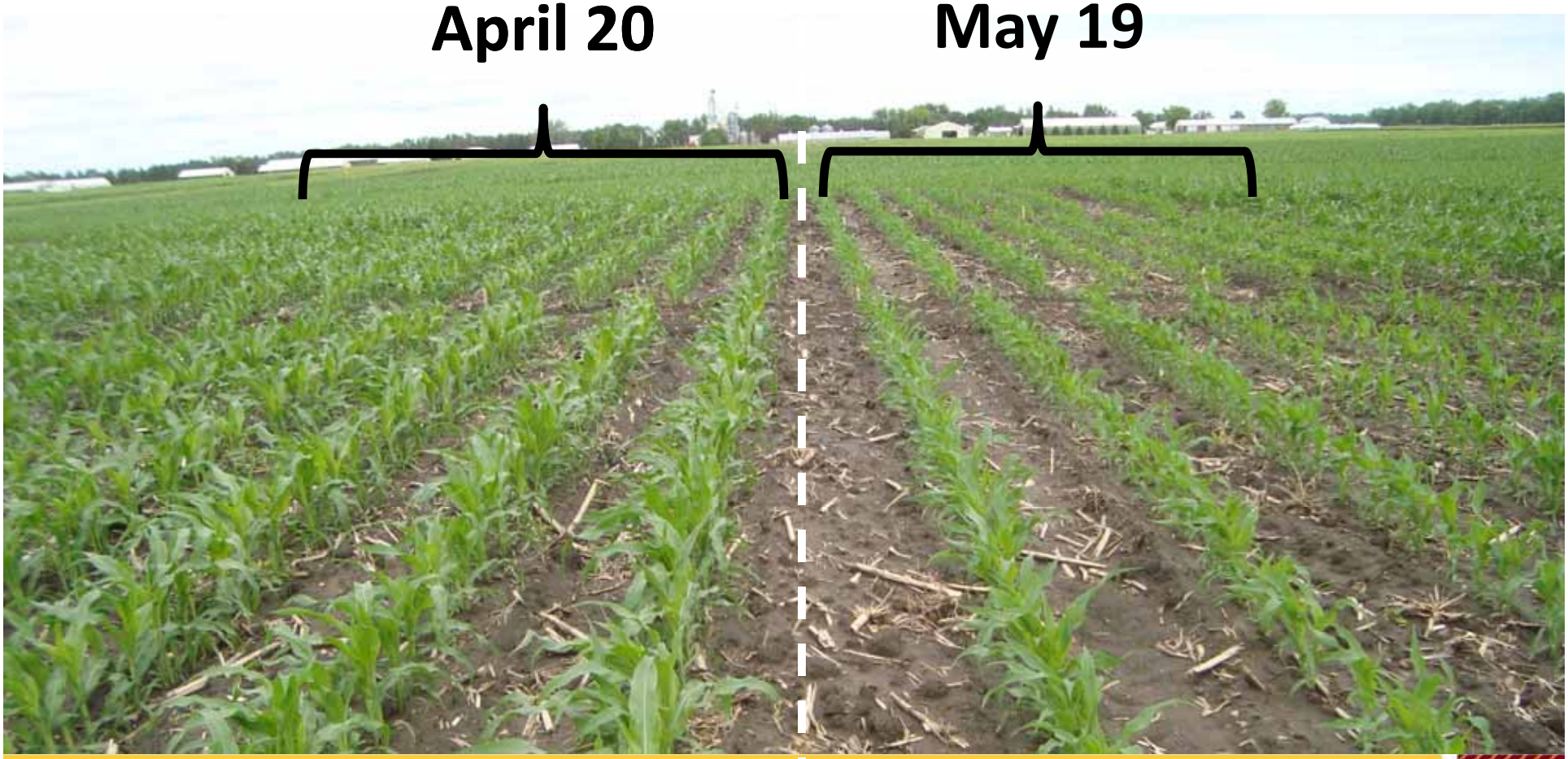


Planting date	Lamberton, MN (1988-2003)	Lamberton, Morris, & Waseca, MN (2009-2011)
	-------- grain yield, % of maximum --------	
April 20	99	98
April 25	100	99
April 30	100	100
May 5	99	100
May 10	98	99
May 15	95	98
May 20	92	95
May 25	87	92
May 30	82	89
June 4	76	84
June 9	69	79

1988-2003 data from Bruce Potter & Steve Quiring

Planting date study - Morris, MN (2010)

Photo on June 14



Uniform emergence is critical

Photo from E.D. Nafziger (Univ. of Illinois)

Plant that was 2 leaf stages behind is late to silk

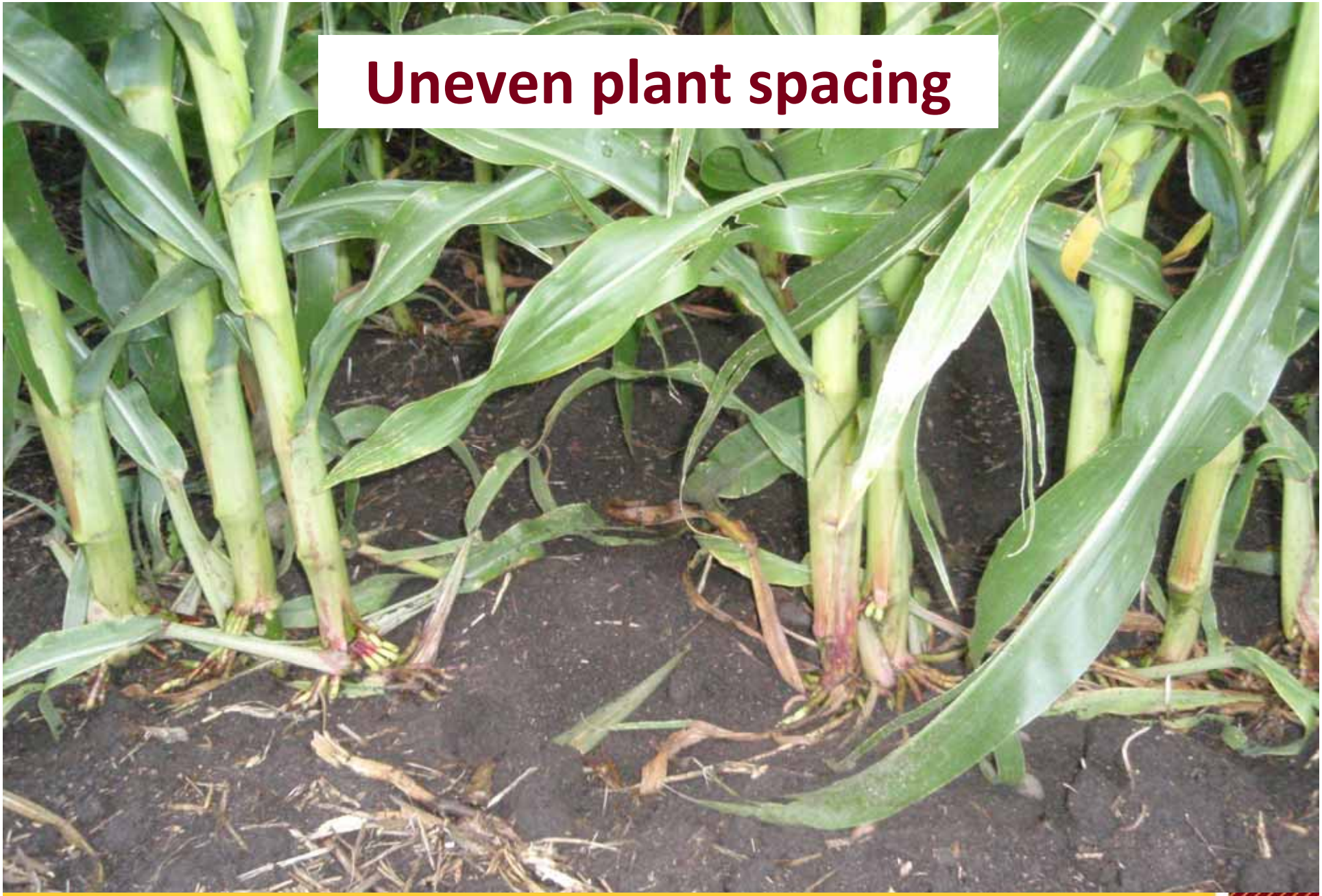
Lamberton, MN (32,000 plants/ac)

Emergence pattern	Avg. of all plants	Early plants	Late plants
	Yield (% of control)		
Uniform	100%	---	---
1 leaf-stage delay on every other plant	94%	107%	80%
2 leaf-stage delay on every other plant	83%	118%	49%
Every other plant missing	73%	---	---

From Ford & Hicks, 1992 (*Journal of Production Agriculture*)

Uniform plant spacing

Uneven plant spacing

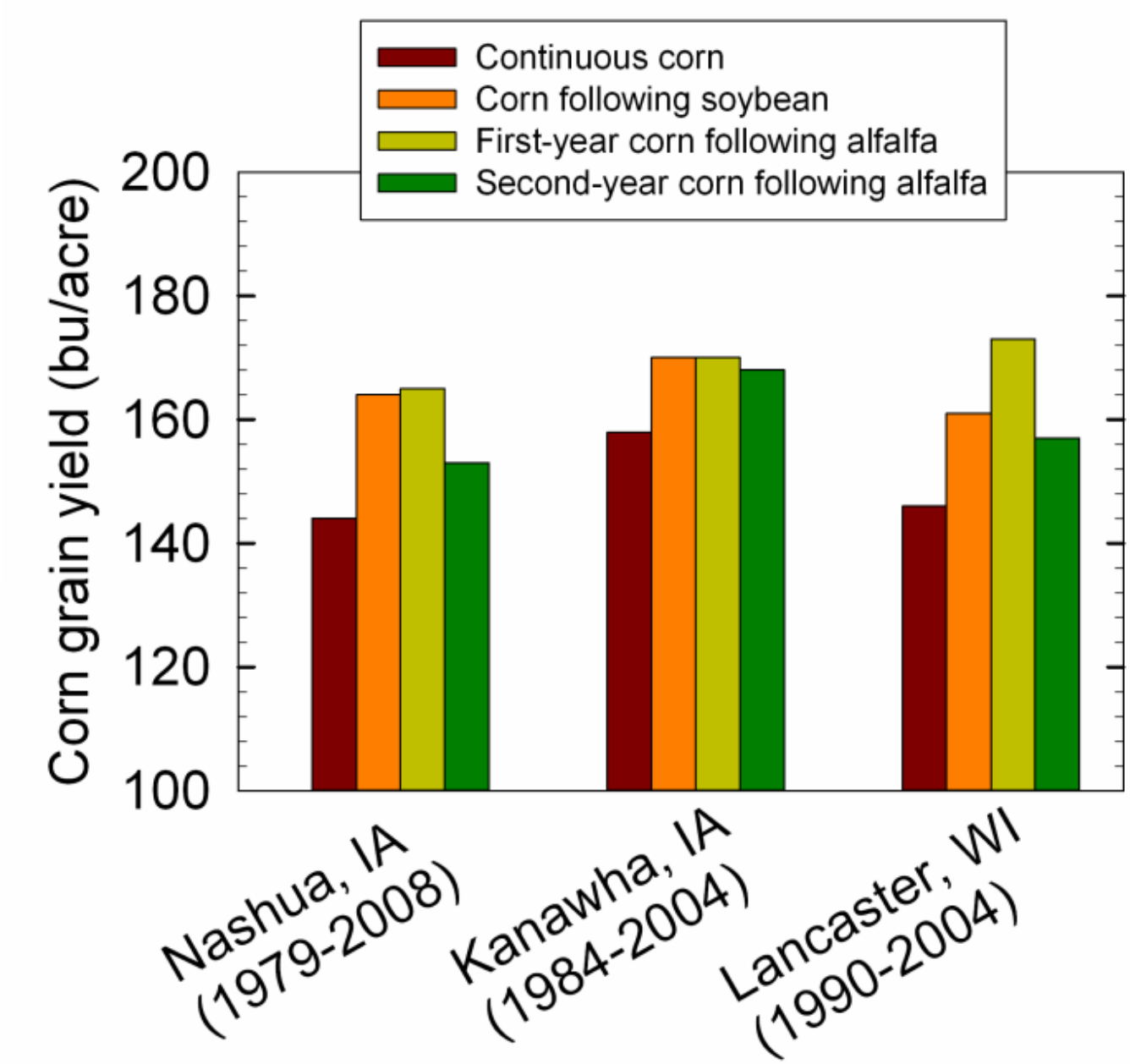


Uneven spacing study – 2 locations in Ontario, 2000 & 2001

Plant spacing	Avg. of all plants	Plant next to gap	Avg. of plants in double or triple
	Yield (% of control)		
Uniform	100%	---	---
1 double in 6	99%	110%	92%
1 triple in 6	98%	110%	91%

From Liu et al., 2004 (*Agronomy Journal*)

Crop rotation increases yield potential



Mallarino & Ortiz-Torres (2006)
Stanger & Lauer (2008)

12 comparisons in northern & central Illinois (2004-2007)

silt loam & silty clay loam soils

Crop and rotation		Yield (bu/ac)
Corn	Corn-soy	197
	1st-year corn in corn-corn-soy	196
	2nd-year corn in corn-corn-soy	184 (-7%)
	Continuous corn	178 (-10%)
Soybean	Corn-soy	54.9
	Corn-corn-soy	58.3 (+6%)

From E.D. Nafziger (*Illinois Agronomy Handbook*, 2009)

Be an economist; pay attention to details

- Control costs without impacting yield
- Conduct simple on-farm tests to assess inputs
- Be timely with field operations
- Do not overlook the basics
  - Hybrid selection
  - Crop rotation
  - Stand establishment
  - Weed control

UNIVERSITY OF MINNESOTA | EXTENSION
Driven to Discover℠

Thank you!

MinnesotaCorn GROWERS ASSOCIATION

Minnesota's Agricultural Fertilizer Research & Education Council