Narrow-Row Corn Production – When Does it Increase Yields?

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Introduction – Study Description

The lack of consistent yield increases for narrow-row corn in research trials and on-farm experience in the central Corn Belt has resulted in low grower adoption of this practice. Pioneer Agronomy Sciences researchers conducted small-plot replicated studies in 62 environments (including 11 US states and Ontario, Canada) from 1991 to 1999 and from 2003 to 2006 to evaluate the effects of narrow rows (15 to 22.5 inches wide) on corn yields. These studies included four replicates, three plant population levels, and four to eight hybrids per environment.

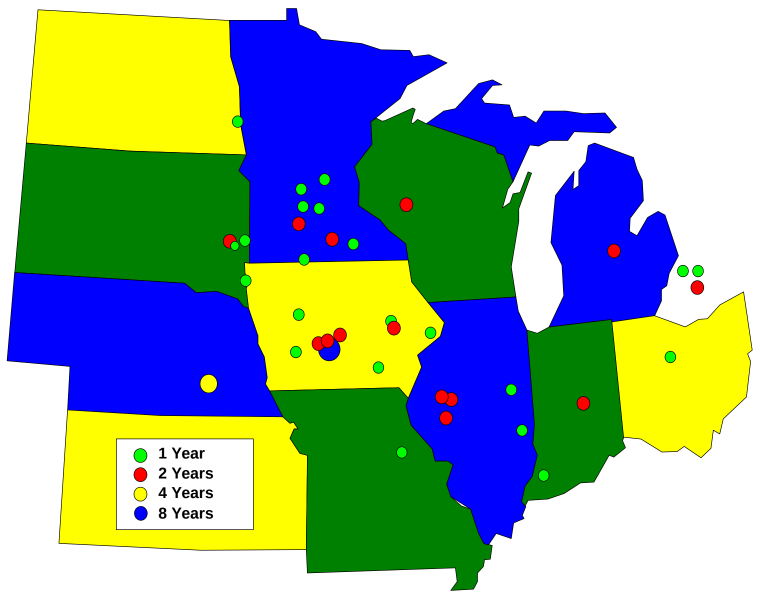

Figure 1. Locations of Pioneer Agronomy Sciences narrow row corn studies in the US and Canada, 1991 to 1999 and 2003 to 2006. See Appendix for exact location and year.

Row Spacing Considerations on Yield

Plant spacing affects competition between plants – the closer they are spaced, the more they compete. Plant canopies compete for light, while the roots compete for water and nutrients. In environments where nutrients, water or sunlight limit yields, the planting arrangement that is able to capture more of these resources should theoretically yield more. Corn planted in narrow rows has a more equidistant plant spacing down and across the row:

Average distance to neighboring plants (plant pop = 32,000 plants/acre)
15" Rows: 13 inches
20" Rows: 10 inches
30" Rows: 6.5 inches

Results and Discussion

The mean advantage for narrow rows over 30-inch rows was 2.0%, with environment means ranging from about -10% to 12%. A response of 2% or greater was achieved at 32 of 62 environments.

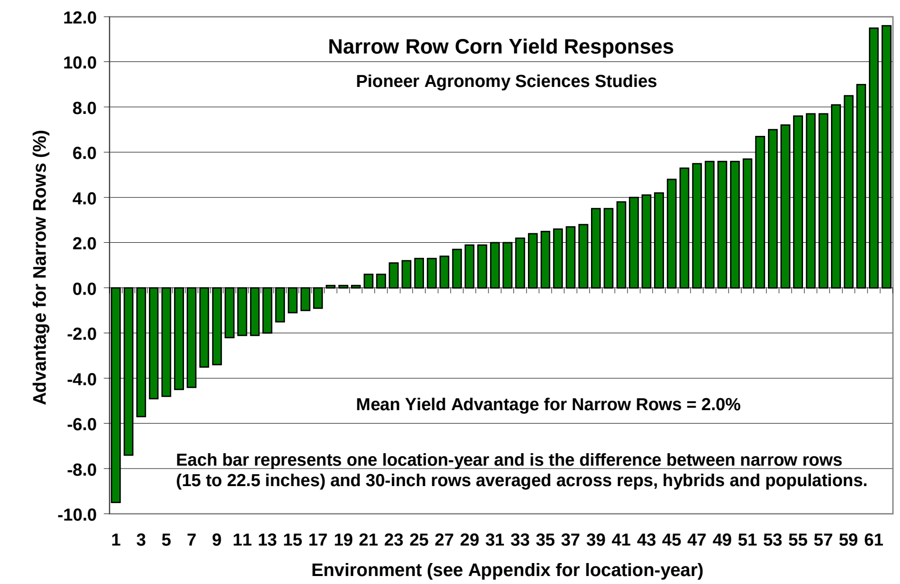

Figure 2. Corn yield response to narrow rows. Data from Pioneer Agronomy Sciences studies in the US and Canada, 1991 to 1999 and 2003 to 2006. See Appendix for description of environments.

Averaged across all environments per state, the advantage for narrow rows over 30-inch rows was 0.1% in Nebraska, 2.0% in Iowa (positive response at 14 of 21 environments) and 1.9% in Illinois (positive response at 6 of 8 environments).

The advantage for narrow rows was greater in the northwest Corn Belt states of Minnesota, North Dakota and South Dakota, where the average yield increase was 3.9% with 15 of 16 environments showing a positive response.

In Indiana, all three environments showed large positive responses, which differed from the results of surrounding states.

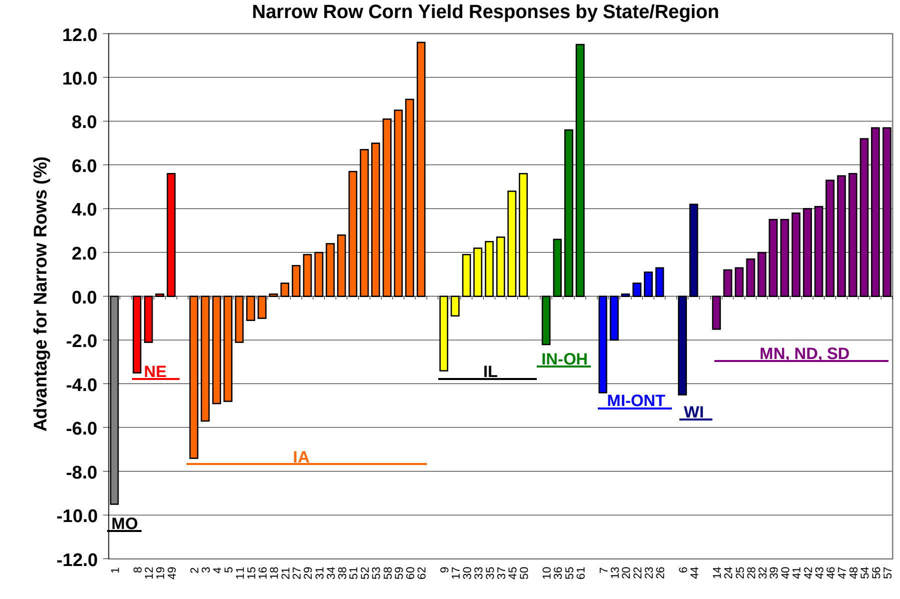

Figure 3. Corn yield response to narrow rows by state/region. Data from Pioneer Agronomy Sciences studies in the US and Canada, 1991 to 1999 and 2003 to 2006. See Appendix for description of environments.

Results and Discussion (continued)

Over all environments, grain yield increased as plant populations increased from 18,000 to 54,000 plants/acre at both row widths. Plant population showed a similar response for narrow rows and 30-inch row widths across environments.

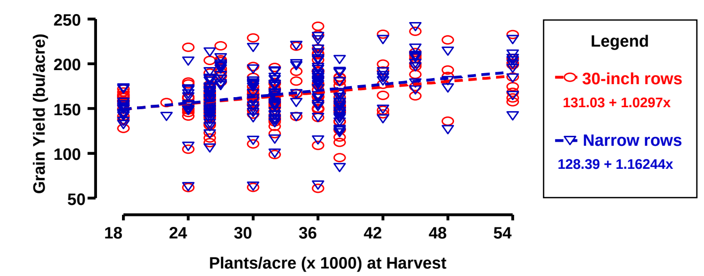

Figure 3. Grain yield response to row spacing and plant population across 62 environments and 78 hybrids, 1991 to 1999 and 2003 to 2006.

Hybrid by row width interactions were rare in these studies, which means that selection of specific hybrids for narrow-row culture is unnecessary (but breeding programs focused on adaptability to narrow rows could change hybrid response in future hybrids).

Other Research

Some researchers have theorized that the inconsistency of narrow-row yield increases can be explained by the principle of yield-limiting light or moisture effects (Lee, 2006, Thelen, 2006). Northern locations that are limited in the solar radiation they receive during critical ear development stages may show greater responses to planting arrangements that are more efficient in collecting available sunlight, such as narrow rows.

In a survey of university research studies conducted throughout the US, the author concluded that south of approximately 43°N latitude (a line that runs through Madison, WI, Mason City, IA and Yankton, SD) narrow rows rarely increase corn yields (Lee, 2006). North of this line, a yield increase may occur. The most consistent yield increases were from Minnesota studies.

Conclusions

Where narrow rows increased yields, it is probable that the efficiency of light interception or moisture extraction by the corn plants was improved by the narrow-row arrangement, however, these factors were not generally measured in the studies. In future studies, careful tracking of field attributes and weather data during critical yield-determining stages (at least up to canopy closure) could help explain the variability in narrow-row yield responses across environments.

Literature Cited

Lee, C. D. 2006. Reducing row widths to increase yield: Why it does not always work. Online. Crop Management doi:10.1094/CM-2006-0227-04-RV. http://www.plantmanagementnetwork.org/pub/cm/review/2006/wide/

Thelen, K. D. 2006. Interaction between row spacing and yield: Why it works. Online. Crop Management doi:10.1094/CM-2006-0227-03-RV. http://www.plantmanagementnetwork.org/pub/cm/review/2006/why/

Appendix.

Location, year, narrow-row advantage and width, and mean location yield for Pioneer Agronomy Sciences studies.

Code	Environment	Narrow-row Advantage (%)	Narrow-row Width (inches)	Location Yield (bu/acre)
1	Mexico, MO 96	-9.5	15	147.7
2	Johnston, IA 04	-7.4	15	212.1
3	Marion, IA 05	-5.7	20	147.4
4	Dallas Center, IA 06	-4.9	20	185.0
5	Dewitt, IA 03	-4.8	15	149.8
6	Eau Claire, WI 98	-4.5	15	155.6
7	Chatham, ONT 98	-4.4	15	155.2
8	York, NE 05	-3.5	20	222.7
9	Adair, IL 04	-3.4	15	197.0
10	Bucyrus, OH 98	-2.2	15	139.6
11	Dallas Center, IA 04	-2.1	15	186.9
12	York, NE 06	-2.1	20	187.4
13	Wallaceburg, ONT 98	-2.0	15	163.2
14	Chester, SD 93	-1.5	20	90.7
15	Alburnett, IA 03	-1.1	15	150.6
16	Johnston, IA 96	-1.0	15	164.2
17	Casey, IL 96	-0.9	15	115.6
18	Hedrick, IA 94	0.1	22.5	167.7
19	York, NE 97	0.1	15	183.0
20	Chatham, ONT 99	0.1	15	158.2
21	Atlantic, IA 97	0.6	15	93.6
22	Dresden, ONT 99	0.6	15	140.4
23	Ithaca, MI 97	1.1	15	151.4
24	Redwood Falls MN 94	1.2	22.5	172.4
25	Madison, SD 94	1.3	22.5	161.2
26	Ithaca, MI 98	1.3	15	120.1
27	Ankeny, IA 98	1.4	15	153.6
28	Bird Island, MN 91	1.7	20	157.3
29	Baxter, IA 98	1.9	15	130.4
30	Macomb, IL 98	1.9	15	145.3
31	Johnston, IA 94	2.0	22.5	192.6
32	Brownton, MN 99	2.0	15	178.0
33	Rushville, IL 04	2.2	15	197.0
34	Johnston, IA 93	2.4	20	214.5
35	Adair, IL 03	2.5	15	165.0
36	Tipton, IN 99	2.6	15	184.2
37	Melvin, IL 97	2.7	15	139.0
38	Johnston, IA 92	2.8	20	143.0
39	Madison, SD 95	3.5	22.5	147.0
40	Mankato, MN 99	3.5	15	171.0
41	Redwood Falls MN 93	3.8	20	62.8
42	Kimball, MN 92	4.0	20	110.5
43	Owatonna, MN 94	4.1	22.5	154.2
44	Eau Claire, WI 99	4.2	15	188.4
45	Macomb, IL 99	4.8	15	156.4
46	Kindred, ND 94	5.3	22.5	153.0
47	Mankato, MN 98	5.5	15	178.8
48	Jackson, MN 97	5.6	15	128.1
49	York, NE 98	5.6	15	183.6
50	Rushville, IL 03	5.6	15	169.6
51	Johnston, IA 97	5.7	15	166.8
52	Baxter, IA 97	6.7	15	102.2
53	Marion, IA 04	7.0	15	185.9
54	Willmar, MN 98	7.2	15	155.5
55	Tipton, IN 97	7.6	15	149.6
56	Flandreau, SD 91	7.7	20	146.6
57	Canton, SD 92	7.7	20	170.3
58	Johnston, IA 95	8.1	22.5	184.3
59	Ankeny, IA 97	8.5	15	141.5
60	Early, IA 94	9.0	22.5	165.4
61	Princeton, IN 98	11.5	15	152.4
62	Johnston, IA 99	11.6	15	187.3

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