Commercial Agriculture of Lake Elmo - 2026 - latest experiment results

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Introduction: In previous years, corn seedlings were transplanted from commercially-farmed fields in Lake Elmo to a test strip at the Sally Manzara Interpretive Nature Center, and the differences in results were observed. The reports of those observations are presented on our website. It was noted that more ears per cornstalk, and higher yields of shelled kernels, were obtained at SMINC.

Hypothesis: that the number of ears per stalk correlated with the distance between the stalks. (short answer - yes, but)

Procedures and Observations: This year, about two dozen corn seedlings about 1-2 inches tall were liberated from a "donor field" at approximately 5051 Kirkwood Ave N on May 20th 2026. These were quickly replanted in a strip of soil about 2ft x 10 ft, running W-E just south of the Three Sisters Garden at SMINC. In the test strip three seedlings were located down the midline of the 2 ft width and about 20 inches apart (480 sq in per seedling) , and eighteen seedlings were planted very near each other in three rows of six about 6 inches between rows and 5 inches apart (30 sq in per seedling). In comparison, the mechanical planting in the donor field resulted in rows 28 inches apart and seedling separation of 6 inches within each row. (168 sq in per seedling). Protected from depredation by a "quonset hut" of hardware cloth, by May 25th all the plants in the test strip were well established



Same day view in donor field, rows of seedlings run vertically in this picture and N-S in the field.



The transplanted seedlings all grew well, the hardware cloth was soon removed, and the stalks in the two sections reached about the same height (over six ft),similar to the stalk height in the main portion of the donor field. Picture taken about noon on July 27th at SMINC:



The results at this point were quite clear, while the three separated stalks in the test strip produced 2-3 ears per stalk (average 2-2/3), the 18 tightly-packed stalks produced only one ear per stalk. Almost all the stalks examined in the donor field produced one ear, and no observed stalk in the donor field had two

ears. Only a very few stalks had no ears, especially ones located on the very edge rows that were shorter in height (see possible explanations below). Soil samples were taken from the donor and test locations and sent to Midwest laboratories for testing. Hand weeding in the test plot, and post-emergent glyphosate application in the donor fileld, reserved most of the soil nutrients for the corn.

The second part of the test was stymied by nature. Since the test strip planting area is pretty far from the nearest area of corn planting, i wanted to hand-pollinate the silks to ensure full fertilization and development of all the kernels. This can be done when the tassels are producing loose pollen, if the male flowers at the top of each stalk can be cut off and brushed against the silk on each ear to improve the fertilization rate. However, part-way through the process i was driven away by eastern yellowjackets that had nested in the ground right next to the fence. Luckily only one stung me, but by the time i was able to neutralize that colony, the time for loose pollen formation had passed.

At harvest time, all the ears in the test strip, as well as the single ears from 10 consecutive stalks in the donor row at the edge of the field, and the single ears from 10 consecutive stalks in a more central row of the donor field were removed, husked, photographed and allowed to dry. The kernel pattern from the donor field ears was quite regular, very few open spots and all kernels were a similar size in each ear. The 2-2/3 average number of ears from the three separated stalks in the test plot had many open spaces probably due to incomplete fertilization, and the kernels that did fill in were of large and variable size. The single ears per stalk from the tight-packed section of the test strip had much better kernel fill on the average but they were not quite as complete as those from the donor field. Here is how they looked. Left row, donor field center, second from left, donor row from which seedlings were taken, third row, 8 ears from three separated stalks at SMINC, right two rows, 18 ears from 18 stalks tightly packed at SMINC.



After drying at room temperature and humidity for over a month, the ears were shelled and the kernel yields weighed. The results were 106 grams per stalk for the donor field center row, 88 grams per

stalk from the donor field edge row, 166 grams per stalk from the three separated stalks in the test strip, and 144 grams per stalk from the 18 tightly-spaced test strip plants.

Soil sample results showed higher nutrient levels of each tested substance in the test strip compared to the row in the donor field. In the full report shown below, the samples are identified as 3SIST (taken from the middle of the plot at SMINC where corn, soybeans,, and squash were planted), COMAG (the commercial agriculture test strip) and DOROW (donor row).

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26-218-0160
COMPLETED DATE
Aug 10, 2026
ACCOUNT
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RECEIVED DATE
Aug 6, 2026

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PAGE 1/1
TODAY'S DATE
Aug 10, 2026

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IDENTIFICATION
SMINC
ONLY
3 SISTERS

SOIL ANALYSIS REPORT

INFO SHEET: 1940528

LAB NUMBER *472*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P1 (MEHLICH BRAY) 1:7 ppm	RATE	PHOSPHORUS P2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
56997	3SIST	2.7	M	38	VH	60	VH			176	VH	343	VH	1910	H	44		6.8		13.1	3.4	21.8	73.3	0.0	1.5
56998	COMAG	2.2	L	31	VH	42	H			140	H	225	VH	1209	L	11		5.2	6.7	12.7	2.8	14.8	47.6	34.4	0.4
56999	DOROW	1.8	L	21	M	29	M			114	M	156	H	1484	H	17		6.6	6.9	9.7	3.0	13.4	76.5	6.3	0.8

LAB NUMBER *472*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B HOT H2O ppm	RATE	BUFFER pH	SOLUBLE SALTS 1:1 mmhos/cm	RATE
56997	10	6	0-2							6	179	VH	3.2	H	9	M	26	VH	0.9	M	0.5	L	L	0.8	L
56998	94	56	0-2							56	15	M	1.8	M	10	M	50	VH	0.9	M	0.2	VL	L	0.7	L
56999	60	36	0-2							36	11	L	1.7	M	7	L	17	H	0.5	L	0.3	VL	L	0.5	L

REV. 10/17

The above analytical results apply only to the sample(s) submitted. Samples are retained a maximum of 30 days.
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Discussion

It is clear from the strip comparison that greater separation between stalks drives the formation of more ears per stalk. The remaining question: is the difference in soil nutrients as revealed by the testing by Midwest Labs enough to explain the greater yield per stalk at SMINC in spite of much closer spacing of the plants?

Maybe next year an experiment can be done to shed light on this issue.

Information from AI Google searches:

.why do cornstalks at the edge of a field grow shorther than those in the center of the field?

Cornstalks at the edge of a field grow shorter than those in the center due to a combination of environmental microclimates, biological responses, and soil conditions known as the "field edge effect."

1. The Shading Effect and Auxin Production

The primary biological driver of corn height is light competition. Corn stalks elongate based on a plant growth hormone called auxin. [1, 2]

- **In the center:** Plants are densely surrounded by neighbors, creating a heavily shaded environment. Shading increases auxin production, which triggers the cells to stretch upward so the plant can compete for sunlight. [1, 2]
- **On the edge:** Plants receive intense, direct solar radiation. Strong sunlight actually degrades or breaks down auxin. Because they do not have to fight for light, their internodes (the space between stem joints) remain tightly stacked, resulting in a naturally shorter plant. [1, 2, 3, 4]

2. Wind Stress and Microclimate Humidity

The physical layout of the field impacts how much moisture the plants can retain. [1, 2]

- **In the center:** Thousands of plants undergo transpiration (releasing water vapor) simultaneously. This creates a trapped, highly humid microclimate under the dense canopy, shield from the wind. This low-stress environment allows energy to go toward vertical growth. [1, 2]
- **On the edge:** Plants are directly exposed to raw wind. The wind strips away the protective layer of humid air and replaces it with hot, dry air. This dramatically increases the water demand on edge plants, inducing localized drought stress and slowing down cellular expansion. [1, 2]

3. Soil Compaction

The edges and corners of a field ("end rows" or "headlands") endure the most heavy machinery traffic. Tractors, planters, and massive harvest combines constantly turn around in these specific areas. This severely compacts the soil, making it physically harder for the young corn roots to penetrate the dirt, absorb nutrients, and uptake water early in the season. Stunted root systems early on yield stunted stalks later. [1, 2, 3]

4. Nutrient and Resource Competition

Edge plants face unique resource challenges that center-field crops do not:

- **Fertilizer Tapering:** As noted by agriculture enthusiasts on The Scientist Gardener blog, farmers carefully calibrate fertilizer spreaders so they don't accidentally waste expensive nutrients on neighboring roads, ditches, or weeds. As a result, the outermost rows often receive slightly less nitrogen.
- **Wildlife and Weed Incursions:** Edges are directly adjacent to tree lines and ditches. Nearby trees aggressively steal underground water and nutrients, while pests and weeds moving inward from fence rows create additional stress for the outer crops. [1, 2, 3]

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another question

why does corn planted further apart have more ears per stalk than corn planted closer together

Corn planted further apart produces more ears per stalk because wider spacing minimizes resource competition, triggering the plant to direct its abundant excess energy into developing secondary ear buds. [1, 2]

Biologically, a corn plant is capable of producing multiple ears; ear buds initiate at almost every leaf node early in its life cycle. However, how many of those buds actually develop into harvestable ears depends entirely on environmental resources: [1]

🌽 The Impact of Spacing on Ear Development

- **Low Competition / Wide Spacing:** When corn is given ample room, each plant has maximum access to **sunlight, water, and soil nutrients (like nitrogen)**. Because resources are abundant, the plant surpasses the energy needed to grow a single primary ear. It overrides its natural hormonal dominance (which usually suppresses lower ears) and channels its extra energy into developing secondary or even tertiary ears further down the stalk. [1, 2, 3, 4]
- **High Competition / Close Spacing:** When planted tightly together, the roots and leaves aggressively compete for the same limited sunlight, moisture, and nutrients. In response to this environmental stress, the plant enters a survival mode. To guarantee it produces at least some viable offspring, it aborts all secondary ear shoots and focuses 100% of its restricted energy into a single, high-quality primary ear. [1, 2, 3, 4]

⚖️ The Yield Trade-Off

While seeing multiple ears on a single stalk looks impressive, it isn't necessarily ideal for modern farming. On Reddit's r/gardening community, growers emphasize that proper spacing is a delicate balance. [1]

Spacing Type	Ears Per Stalk	Overall Yield Impact
Wide Spacing	2 to 3 ears	Fewer total plants per acre. The secondary ears are often smaller, poorly pollinated, or misshapen.
Optimal/Close Spacing	1 ear	More total plants per acre. Maximizes overall grain yield because energy is concentrated on one large, perfectly filled ear per plant.

Additionally, corn is entirely wind-pollinated. If plants are isolated or spaced *too* far apart, the pollen dropping from the tassels may blow away entirely before it can hit the silks, leading to ears with missing or underdeveloped kernels.