



Effect of Vertical Tillage on Corn and Soybean Grain Yield

Trial Objective

- Possible benefits of vertical tillage include improvements in seedbed, root growth, and water infiltration while preventing compaction layers in the soil profile.
- Vertical tillage can also help with residue management, especially in reduced tillage systems where the accumulation of biomass in the soil surface can impede the correct planter operation and keep soil temperatures lower, delaying emergence.
- The objective of these trials was to determine the effect of vertical tillage on corn and soybean yield compared to other tillage practices such as strip-till and no-till.

Experiment/Trial Design

Location	Soil Type	Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)	Previous Crop
Gothenburg, NE	Hord silt loam	Corn	Varied	05/30/2023	10/19/2023	240	32,000	Soybean
	Hord silt loam	Soybean	Varied	05/21/2023	09/27/2023	70	140,000	Corn

- The trial design was a randomized complete block with four replications and four tillage treatments:
 - » Vertical-till at 0 degrees gang angle
 - » Vertical-till at 6 degrees gang angle
 - » Strip-till
 - » No-till
- Both trials (corn and soybean) were planted next to each other using the same experimental design. The Bayer products used were a 111 relative maturity (RM) corn and a 2.5 maturity group (MG) soybean.
- Strip-till and vertical-till were conducted on 05/01/2023 and 05/03/2023, respectively, according to treatments.
- Zero to 3 inch and 3 to 6 inch composite soil samples were taken from each plot in the corn experiment on 05/22/2023 (Table 1).
- The trial received a 2 x 2 starter fertilizer application of 29 lb/acre nitrogen (N), 60 lb/acre P₂O₅, 25 lb/acre sulfur (S), and 0.25 lb/acre zinc (Zn) at planting across all treatments. Both crops were planted in 30 inch rows.
- Nitrogen was side-dressed across all corn plots using 360 Y-DROP® nozzles at a rate of 150 lb/acre on 06/21/2023.
- Two pictures per plot were taken at planting on the corn experiment for soil coverage classification. The software used was the Stover App from Kansas State University.
- Weeds were uniformly controlled with herbicides and no other pesticides were applied.
- Plots were combine-harvested with grain moisture content, test weight, and total weight collected. Statistical analysis for Fisher's Least Significant Difference was performed.

Effect of Vertical Tillage on Corn and Soybean Grain Yield

Understanding the Results

Corn trial

- Several soil test results were affected by tillage treatment, especially in the first 0 to 3 inches of soil. Soil samples were taken 19 to 21 days after the tillage operation (Table 1).
- With more soil disturbance (strip-till and vertical-till at 6 degrees) there was higher nitrogen mineralization. However, increases in phosphorus and potassium levels were only seen under strip-till.

Table 1. Soil sample results in the corn trial 19 to 21 days after tilled (0 to 3 inches and 3 to 6 inches).

Depth	Treatment	Organic Matter LOI (%)	Nitrate-Nitrogen (ppm)	Phosphorus Mehlich-III (ppm)	Potassium (ppm)	Sulfate-Sulphur (ppm)
0–3 in.	Vertical-till 0°	4.6	21.2	31.8	559	8.6
	Vertical-till 6°	4.6	34.8	35.5	551	10.2
	Strip-till	4.9	41.3	51.5	626	10.4
	No-till	4.6	18.1	33.8	512	9.2
	LSD (0.1)	NS*	10.1	9.7	52	NS*
3–6 in.	Vertical-till 0°	3.5	14.8	13.8	398	8.1
	Vertical-till 6°	3.6	20.6	12.3	388	8.3
	Strip-till	3.6	23.0	15.5	433	8.1
	No-till	3.6	15.1	12.3	397	7.1
	LSD (0.1)	NS*	NS*	2.2	NS*	NS*

*ANOVA not significant (p > 0.10)

- The average percentage of soil covered by residue was similar under no-till (66%) and vertical-till at 0 degrees (69%) (Figure 1). Tilling with no angle cut the residue but most of it was left on the surface.
- A statistically significant difference was observed when comparing residue coverage between vertical-till settings. Plots tilled at 6 degrees had less than half of the residue coverage compared to the same equipment but at 0 degrees (28% and 69%, respectively).
- Although no statistically significant effects were found on corn yield between tillage treatments (Figure 3), yield was numerically the highest on plots where vertical-till was done at a gang angle of 0 degrees (198.5 bu/acre). The lowest average yields were achieved using the same equipment but at 6 degrees (179.4 bu/acre). It is important to select the appropriate equipment settings depending on the specific objective.
- Corn yield was on average 8.7 bu/acre higher under no-till compared to strip-till.
- Soil nutrient differences observed between tillage treatments early in the season (Table 1) did not impact in yield. It is important to notice that those lower levels in plots with less soil disturbance were still sufficient to sustain early plant growth. Also, all plots received starter fertilizer at planting.
- No statistically significant results were obtained when looking at corn plant heights at the V5 to V6 growth stage (Figure 4). Corn plants tended to be taller in vertical tilled plots with a gang angle of 6 degrees (24.3 inches). Strip-till and no-till obtained similar plant heights (23.5 and 23.2 inches, respectively) but slightly lower than vertical-till at 6 degrees. The shortest plants were measured under vertical-till at 0 degrees (22.2 inches).



Effect of Vertical Tillage on Corn and Soybean Grain Yield

**Average Percent Soil Coverage by Tillage Treatment
Gothenburg, NE (2023)**

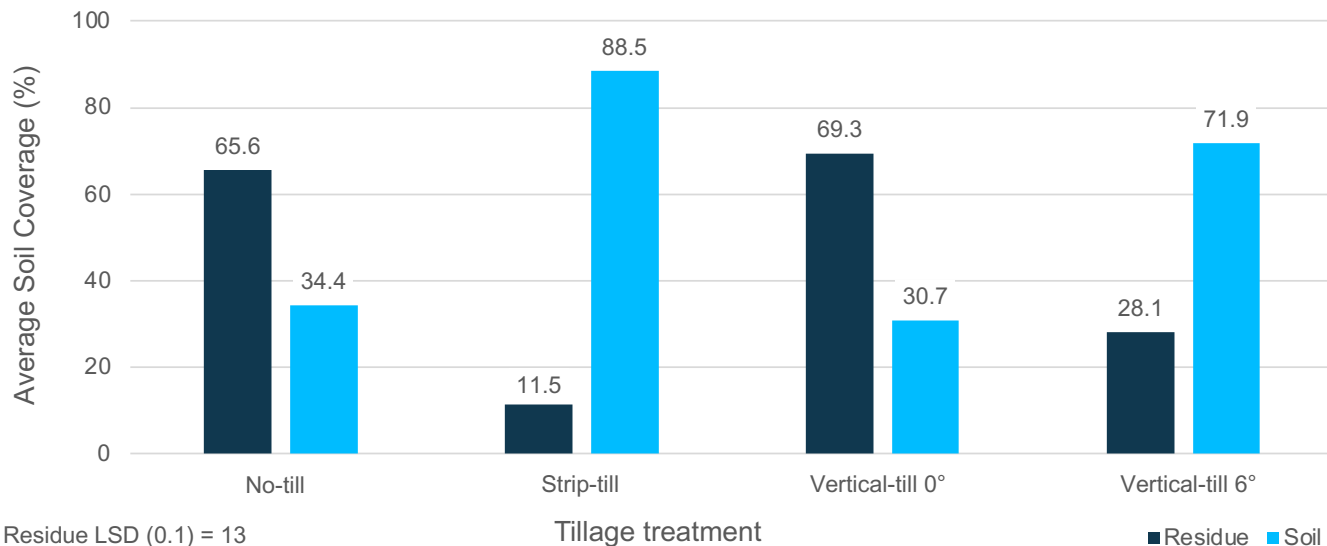


Figure 1. Average soil coverage as affected by tillage at planting at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023).

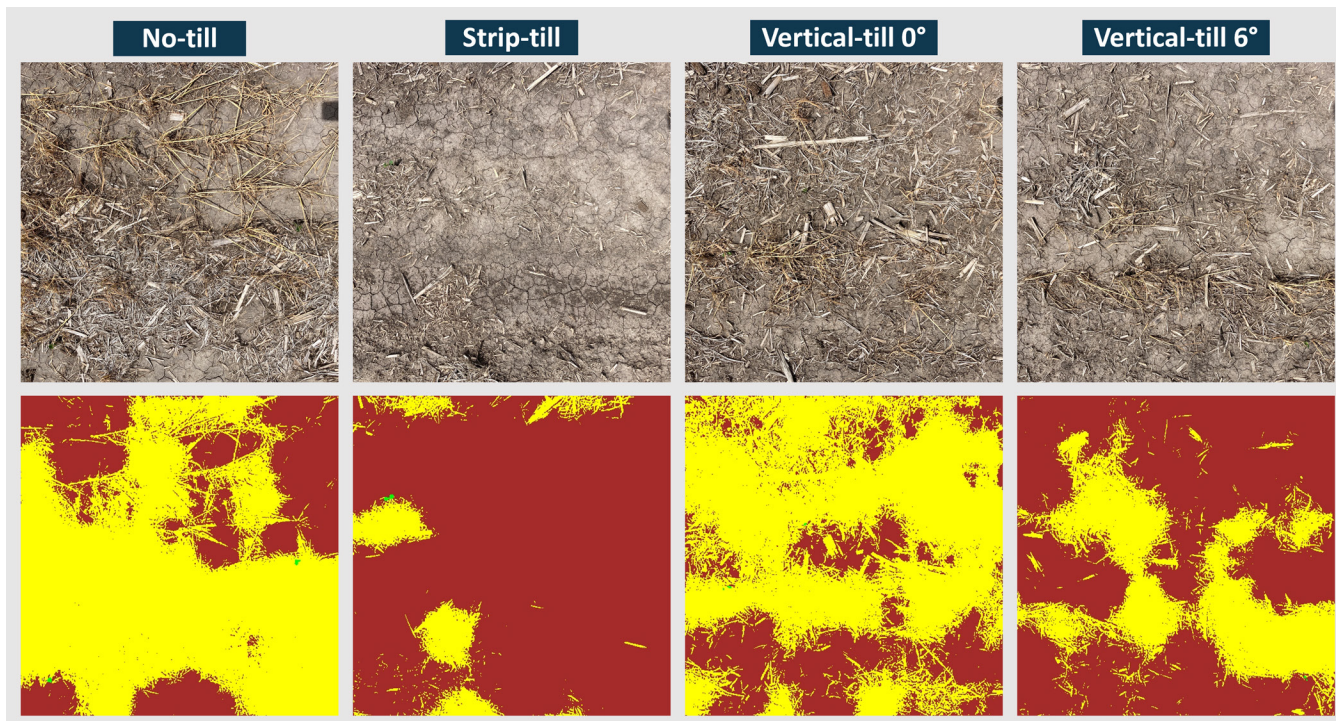


Figure 2. A sample of images taken at planting from the four tillage treatments classified using the Stover App. Yellow represents residue cover.

Effect of Vertical Tillage on Corn and Soybean Grain Yield

Average Corn Yield by Tillage Treatment Gothenburg, NE (2023)

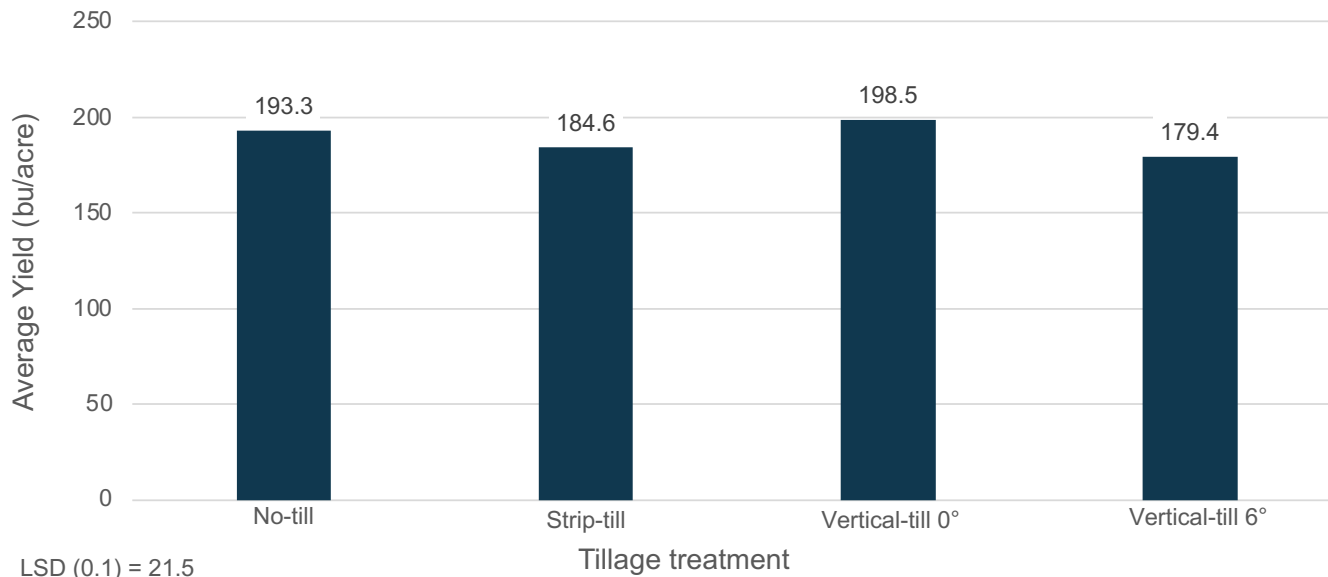


Figure 3. Average corn yields as impacted by tillage at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023).

Average Corn Plant Height by Tillage Treatment Gothenburg, NE (2023)

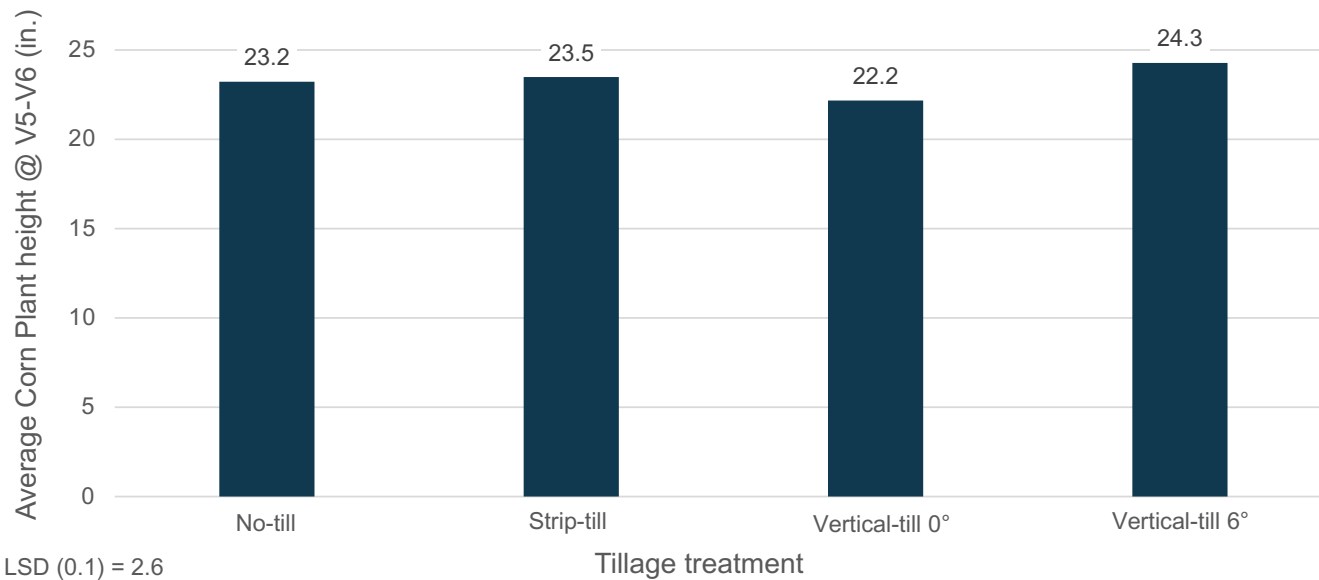


Figure 4. Average plant height at the V5 to V6 growth stage as impacted by tillage at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023).



Effect of Vertical Tillage on Corn and Soybean Grain Yield

Soybean trial

- The effects on average soybean yield between tillage treatments were similar to the effects observed in the corn trial. Vertical-till plots at 0 degrees obtained the highest yield (48.3 bu/acre) but the difference was not statistically significant (Figure 5).
- Small differences in soybean yield were observed between no-till, strip-till, and vertical-till at 6 degrees.

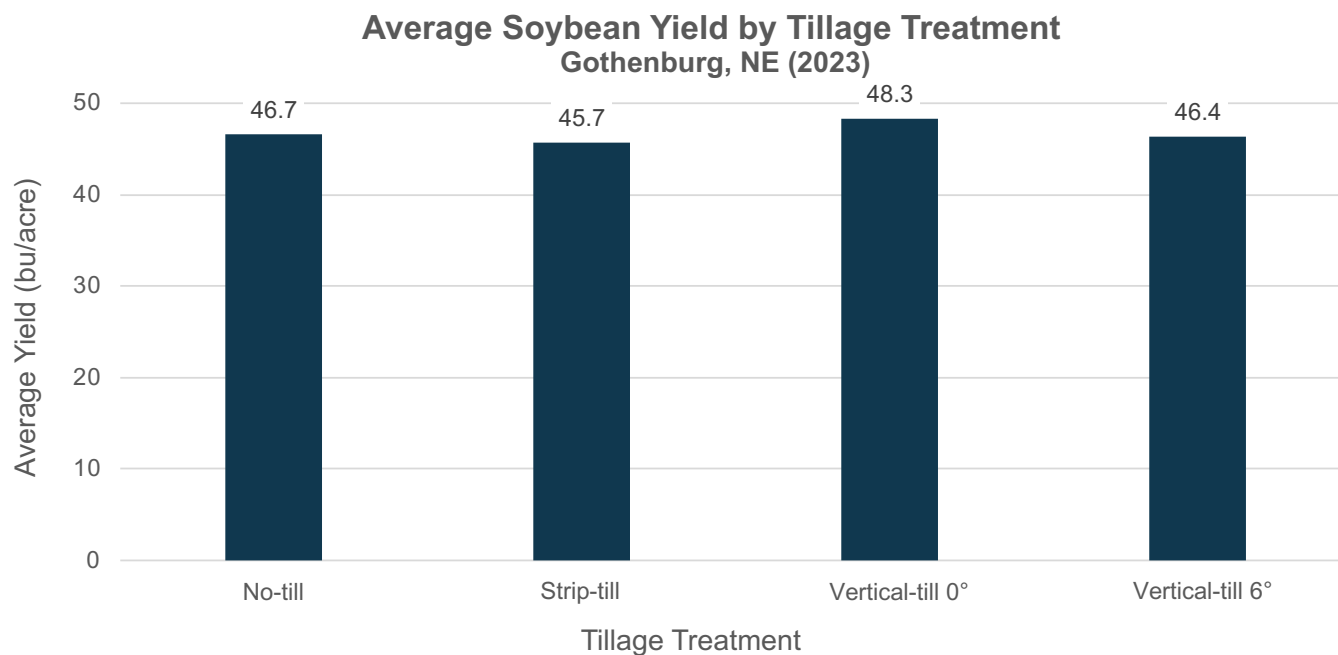


Figure 5. Average soybean yields as impacted by tillage at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023).

Effect of Vertical Tillage on Corn and Soybean Grain Yield

Key Learnings

- Vertical tillage at a gang angle of 0 degrees tended to obtain the highest yields in both corn and soybean studies, though the result was not statistically significant. No numerical yield advantage was detected in plots where the equipment was set up at 6 degrees.
- Nutrients such as nitrogen were more available at planting in tilled plots. The effect was more noticeable under strip-till and vertical-till at 6 degrees. However, this availability did not impact the average yield in these experiments.
- The percentage of soil that was covered by residue at planting was similar in plots under vertical-till and no-till. Residue cover is important when preventing wind and water erosion.
- More research is needed to assess the long-term impacts of vertical tillage on soil test properties.

Legal Statements

The information discussed in this report is from a single site, replicated trial. This informational piece is designed to report the results of this demonstration and is not intended to infer any confirmed trends. Please use this information accordingly.

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS.

Performance may vary, from location to location and from year to year, as local growing, soil and environmental conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on their growing environment.

The recommendations in this material are based upon trial observations and feedback received from a limited number of growers and growing environments. These recommendations should be considered as one reference point and should not be substituted for the professional opinion of agronomists, entomologists or other relevant experts evaluating specific conditions.

Bayer and Bayer Cross are registered trademarks of Bayer Group. All other trademarks are the property of their respective owners. ©2024 Bayer Group. All rights reserved.
1110_378250

