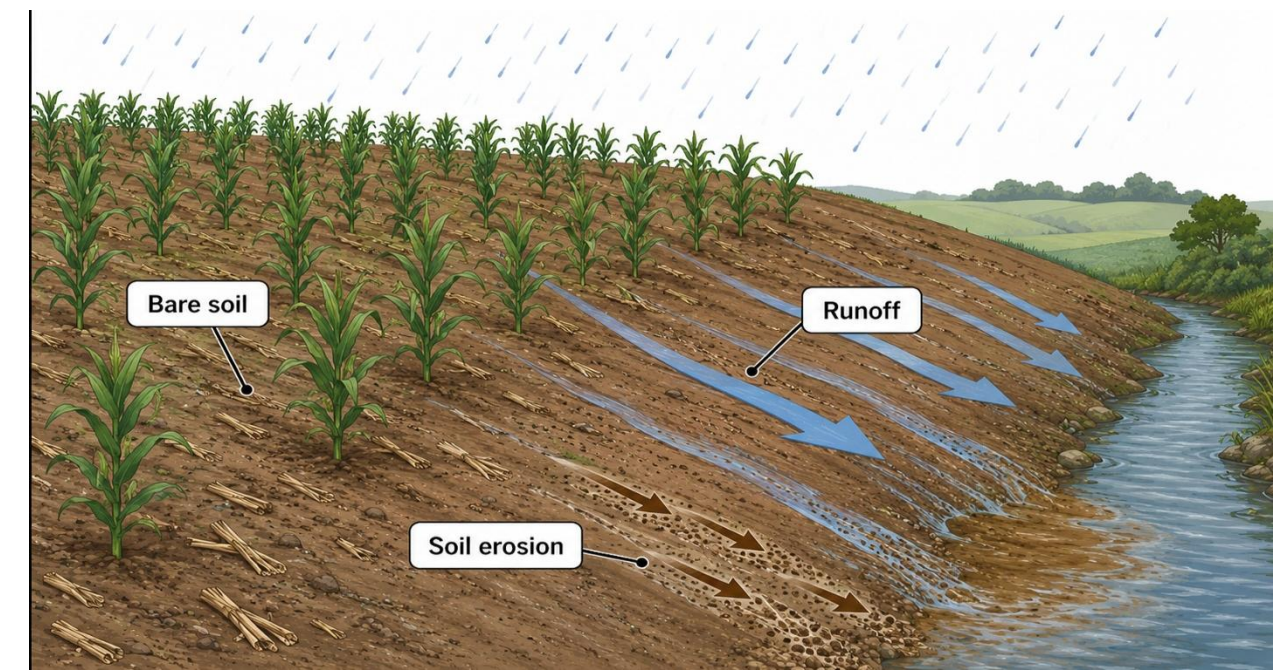


Ralph Danquah-Acquah, Dr. Amy Kaleita

# Green Between the Rows: Modeling Corn-RHb Perennial Groundcover Systems

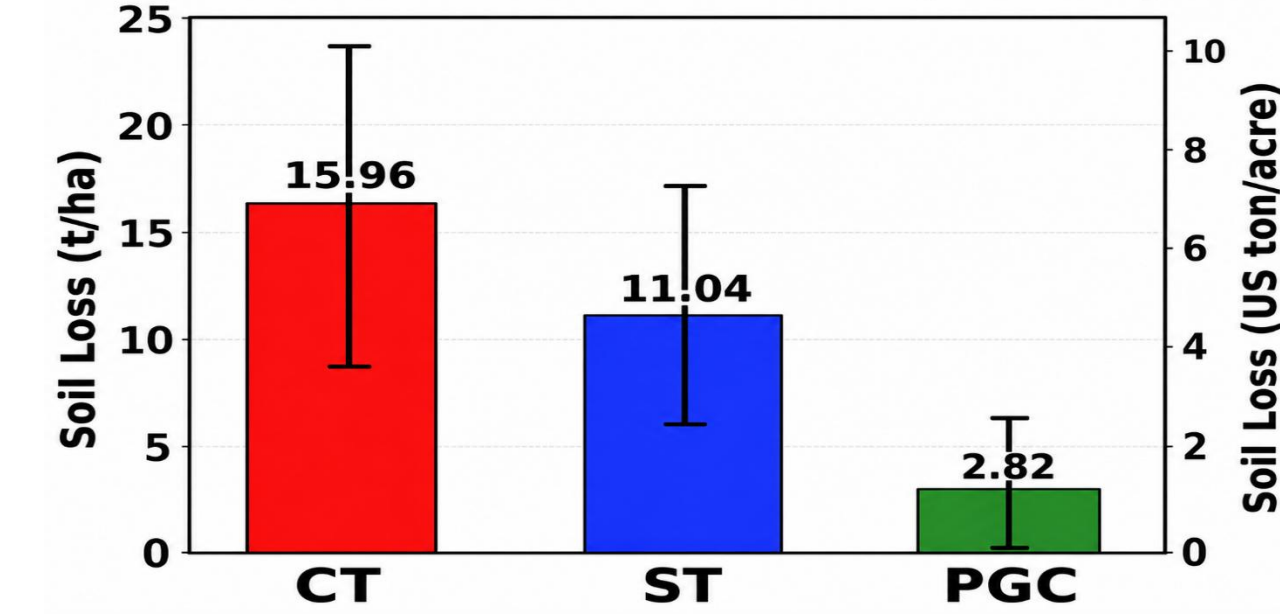
## Introduction

- Corn production in the U.S. Midwest often leaves soil bare for much of the year, increasing runoff, soil erosion, and downstream water quality concerns.
- Perennial groundcover (PGC) systems maintain living cover between corn rows and can reduce soil and water losses while supporting grain production.
- However, PGC systems are difficult to manage because the groundcover can compete with corn for water, light, and nutrients.
- Process-based models such as ALMANAC can help evaluate this tradeoff by simulating corn yield, soil water, runoff, erosion, and crop-groundcover competition across different management systems.



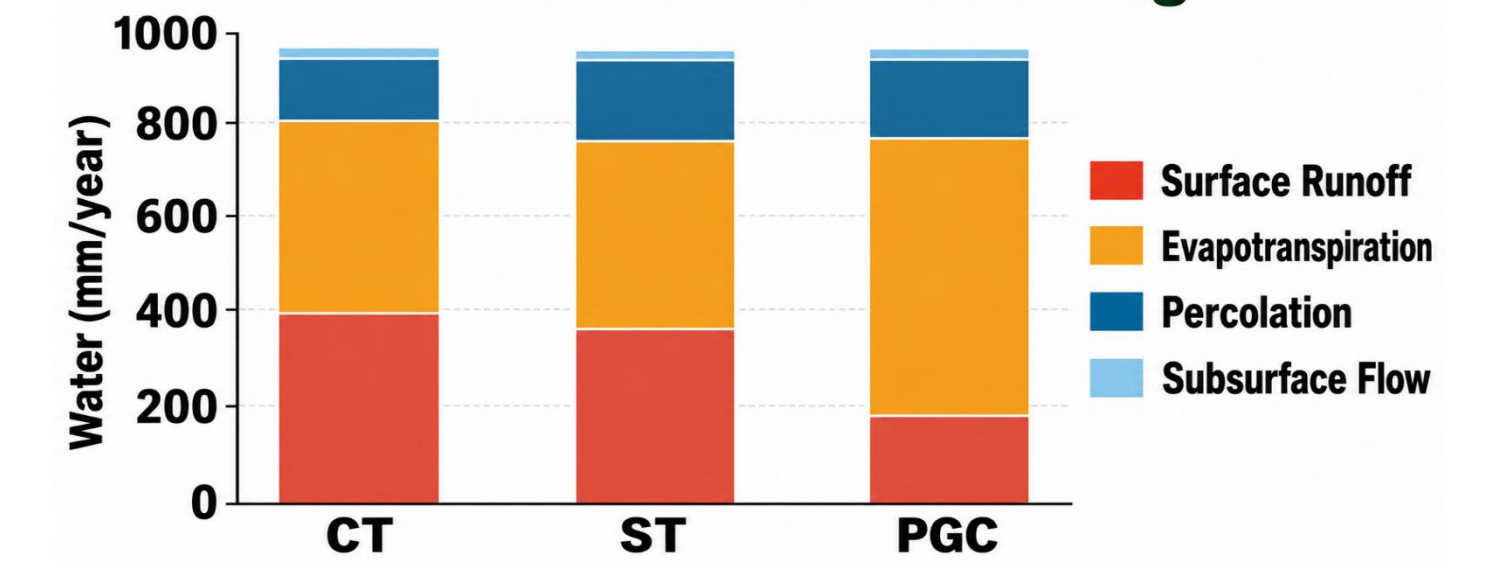
## Results and Discussion

### 41-Year Mean Soil Loss (MUSLE)



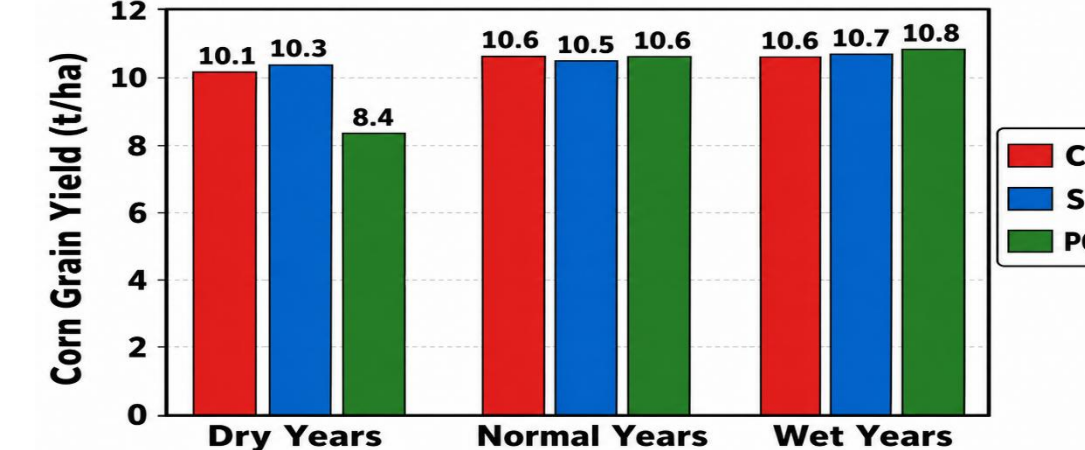
- Mean annual soil loss was much lower under PGC, 2.82 t/ha, compared with CT, 15.96 t/ha, and ST, 11.04 t/ha.
- This confirms that PGC strongly reduced simulated soil erosion compared with both conventional and strip tillage systems.

### Water Balance Partitioning



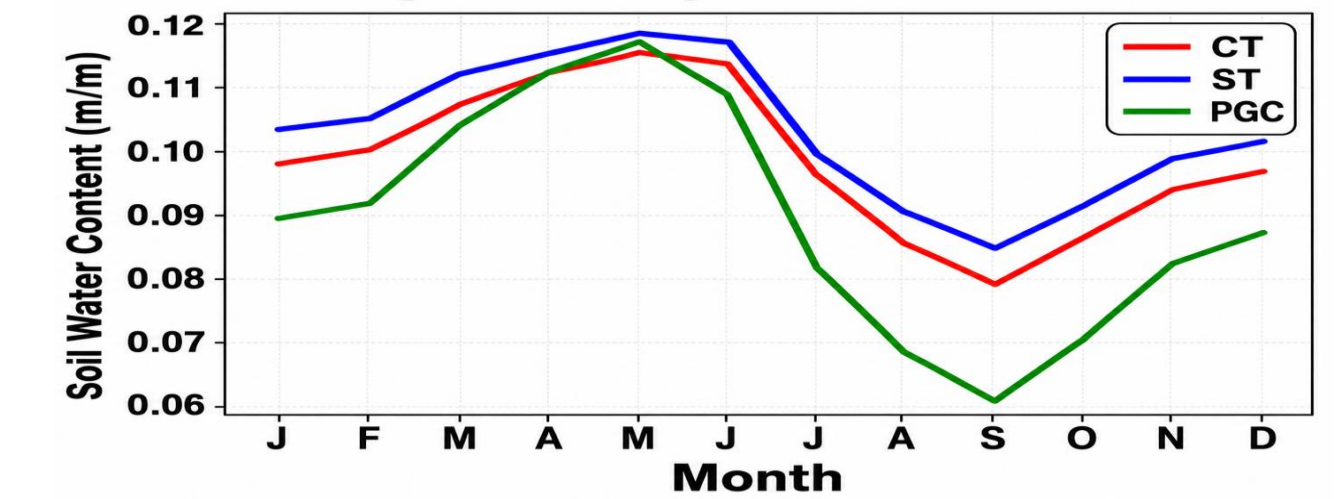
- PGC had the lowest surface runoff and the highest evapotranspiration compared with CT and ST.
- This suggests that perennial groundcover reduced water loss as runoff, allowing more rainfall to enter the soil and become available for plant use.

### Corn Yield by Rainfall Regime



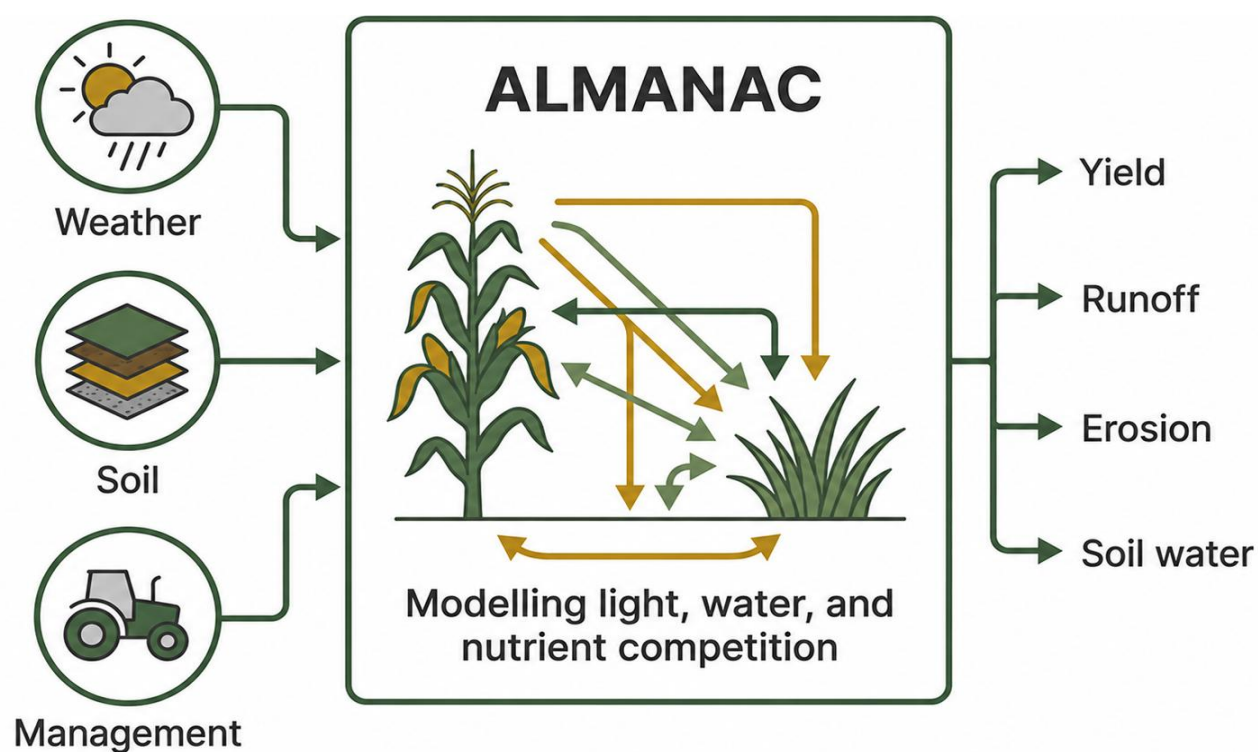
- Corn yield was lower under PGC than CT and ST during dry years, but it was similar to or slightly higher than both treatments during normal and wet years.
- This indicates that water competition is most limiting under dry conditions, while PGC performs well when rainfall is adequate.

### Average Monthly Soil Water Content

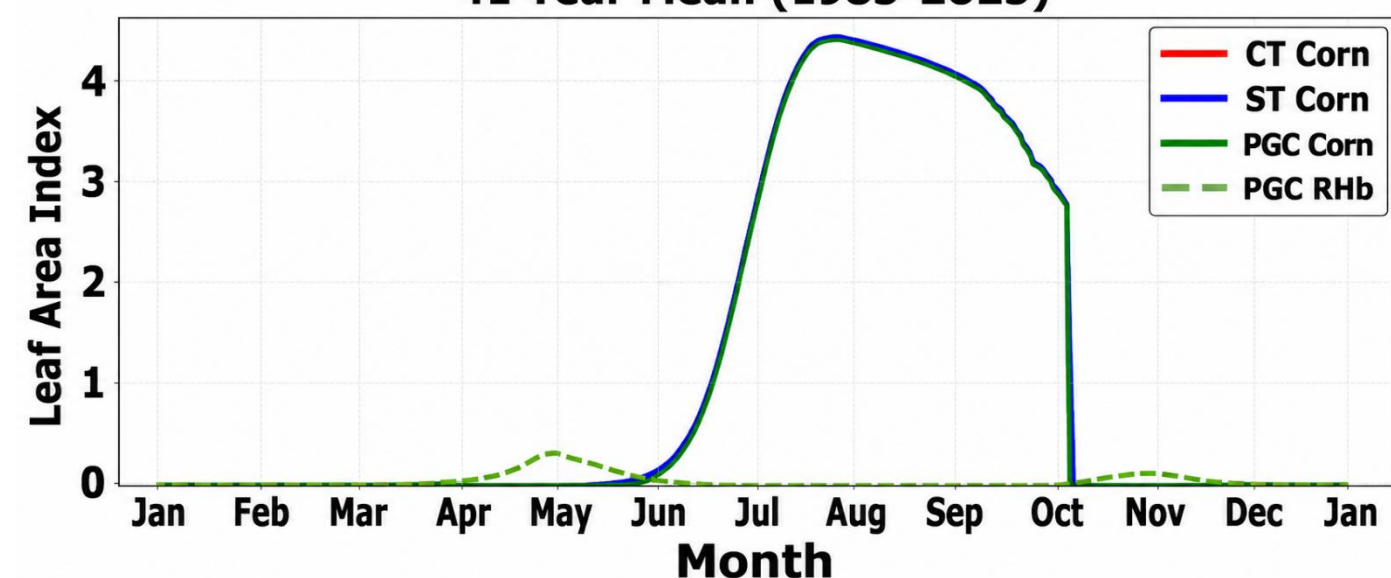


- PGC had lower soil water content than CT and ST for most months, especially during the summer growing season.
- This suggests that even though PGC increased annual crop available water, the additional water was used more actively through crop transpiration, leading to lower stored soil water during the season.

## Materials and Methods



Daily Leaf Area Index Development (Full Season)  
41-Year Mean (1985-2025)



- **Model:** ALMANAC was used to simulate corn production with and without perennial groundcover.
- **Treatments compared:** Conventional tillage (CT), strip tillage (ST), and perennial groundcover (PGC) with corn and RHb.
- **Simulation period:** Long-term simulations were used (1985-2025) to evaluate treatment performance across different weather years.
- **Key outputs analyzed:** Corn yield, soil water, surface runoff, and soil erosion.
- **PGC process evaluation:** RHb growth, dormancy, and surface cover were examined to understand how the groundcover affected water balance and erosion.

## Conclusion

- PGC reduced surface runoff and soil erosion compared with CT and ST, showing strong conservation benefits from year-round groundcover.
- Corn yield under PGC was lower during dry years, but remained comparable to CT and ST under normal and wet conditions.
- The main tradeoff in the PGC system was greater water-use pressure during the growing season, likely due to increased crop water use after runoff was reduced.