

# Optimizing Bioenergy Sorghum Productivity and Nutrient Removal in Illinois: Impact of Nitrogen Fertilization Under Diverse Marginal Conditions

## Background/Objective

- Bioenergy sorghum production is expected to target marginal cropland. However, marginal cropland is a broad characterization inclusive of diverse land conditions and limitations.
- Therefore, the management implications associated with the use of marginal cropland remains poorly understood.
- This work assesses how nitrogen (N) fertilization and different limitations associated with marginal cropland impact biomass yield and nutrient removal.

## Approach

The experiment contrasted prime cropland (Urbana) with three marginal environments characterized as low soil phosphorus (P) and potassium (K) fertility (Ewing), leaching and erosion (Fairbury), and spring flooding, erosion, and runoff (Pesotum). Four N rates (0, 56, 112, and 168 kg-N ha<sup>-1</sup>) were applied to bioenergy sorghum at the four sites over two years, resulting in a total of 8 different environmental conditions.

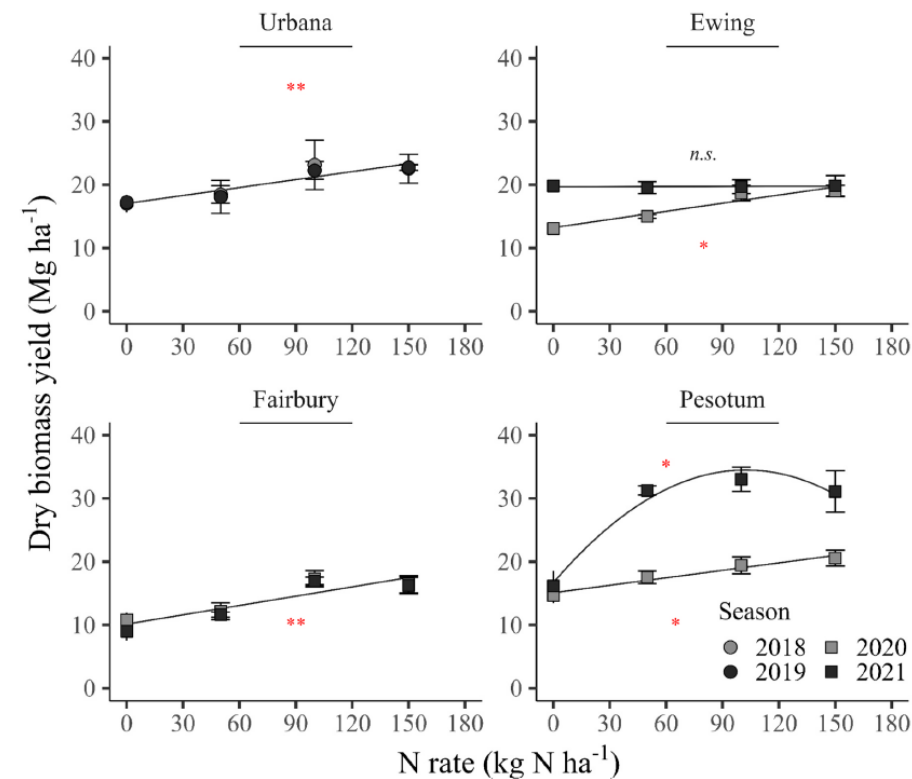
## Results

Comparable sorghum biomass yields were observed between prime and marginal cropland, but optimal N rates varied between 56 N and 112 N, depending on the site. In most study locations, macronutrient removal (N, P, K, and magnesium (Mg)) increased with increasing N rates.

## Significance/Impacts

Bioenergy sorghum yields on marginal lands can be comparable to prime cropland, but site-specific N management is required to close yield gaps. There is a need to revise fertilizer recommendations to incorporate other macronutrients, especially K in K-limited environments. Accumulation of Mg and K in tissues may have implications for feedstock quality.

Jang, et al. 2024. "Optimizing Bioenergy Sorghum Productivity and Nutrient Removal in Illinois: Impact of Nitrogen Fertilization Under Diverse Marginal Conditions." *Field Crops Research*. DOI: 10.1016/j.fcr.2024.109475.



**The relationship between fertilizer N rate and biomass yield over two seasons at four field sites.**