

## **Patterns of Production and Precipitation-Use Efficiency of Winter Wheat and Native Grasslands in the Central Great Plains of the United States.**

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### **ABSTRACT**

The Great Plains of the United States is characterized by a large west–east gradient in annual precipitation and a similar large north–south gradient in annual temperature. Native grasslands and winter wheat are found over a large portion of the precipitation and temperature gradients. In this article, we use long-term data to analyze the differences in the patterns in aboveground net primary production and precipitation-use efficiency between wheat and native grassland ecosystems in the central portion of Great Plains, and their relationships to potential water availability (precipitation). Aboveground net primary production of native grasslands shows a large response to precipitation. Aboveground net primary production of winter wheat has a smaller response to changing precipitation. Annual precipitation use efficiency of native grasslands is unaffected by increases in average annual precipitation, but precipitation-use efficiency of summer-fallow wheat ecosystems decreases substantially with increased average precipitation. Our results suggest that in the wetter portion of the central Great Plains, summer-fallow wheat management is relatively inefficient, because increased water availability results in diminishing returns. Comparisons with data from continuously cropped wheat confirmed this result. Shifts across the region to continuous cropping of wheat potentially could have significant impacts on regional wheat yield, carbon balance, and economic status.

**Key words:** precipitation-use efficiency; summer-fallow wheat management; summer-fallow rotation system; aboveground net primary production; grasslands.