



# Exploring drought dynamics and its impacts on maize yield in the Huang-Huai-Hai farming region of China

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## Abstract

Drought, which negatively affects crop yields, is expected to intensify in the future and will continue to threaten food security. Understanding crop yield responses to drought is essential for seeking more effective strategic adaptations and for reducing the risk of yield failure. However, how to regionally quantify drought-induced yield loss rates remains unclear. We addressed this gap through studying summer maize cultivated in the Huang-Huai-Hai farming region of China during 1981–2010. By incorporating yearly phenological data and dividing the growing season into the vegetative stage and reproductive stage, we used the standardized precipitation evapotranspiration index (SPEI) that is specific to different growth stages to reflect drought conditions. The spatial-temporal characteristics of drought conditions were further depicted, and the drought-induced yield loss rate was analyzed. The results showed that drought was unevenly and spatially distributed throughout the whole region, and extreme drought mostly occurred in the northern and northwestern regions even though they have a lower drought frequency. However, the drought tendency was alleviated across the maize growing season since the accumulated precipitation and average daily maximum temperature together determined the direction of drought severity. The drought-induced yield loss rate is related to both the intensification of extreme drought and the local precipitation conditions. These findings highlight the potential incentive of the drought-induced yield loss rate, and emphasize that innovation on farming activity is urgently needed to enhance maize productivity in regions with overexploited groundwater.

**Keywords** Drought · Climate change · Maize production · Yield loss rate · Irrigation regime

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