



## **The impact exploration of agricultural drought on winter wheat yield in the North China Plain**

Jianhua Yang (1), Jianjun Wu (2), Xinyi Han (3), and Hongkui Zhou (4)

(1) Faculty of Geographical Sciences, Beijing Normal University, Beijing, China (yangjh15@mail.bnu.edu.cn), (2) Faculty of Geographical Sciences, Beijing Normal University, Beijing, China (jjwu@bnu.edu.cn), (3) Faculty of Geographical Sciences, Beijing Normal University, Beijing, China (yixin\_sunny@126.com), (4) Faculty of Geographical Sciences, Beijing Normal University, Beijing, China (hongkuizhou@126.com)

**Abstract:** Drought is one of the most serious agro-climatic disasters in the North China Plain, which has a great influence on winter wheat yield. Global warming exacerbates the drought trend of this region, so it is important to study the effect of drought on winter wheat yield. In order to assess the drought-induced winter wheat yield losses, SPEI (standardized precipitation evapotranspiration index), the widely used drought index, was selected to quantify the drought from 1981 to 2013. Additionally, the EPIC (Environmental Policy Integrated Climate) crop model was used to simulate winter wheat yield at 47 stations in this region from 1981 to 2013. We analyzed the relationship between winter wheat yield and the SPEI at different time scales in each month during the growing season. The trends of the SPEI and the trends of winter wheat yield at 47 stations over the past 32 years were compared with each other. To further quantify the effect of drought on winter wheat yield, we defined the year that SPEI varied from -0.5 to 0.5 as the normal year, and calculated the average winter wheat yield of the normal years as a reference yield, then calculated the reduction ratios of winter wheat based on the yields mentioned above in severe drought years. As a reference, we compared the results with the reduction ratios calculated from the statistical yield data. The results showed that the 9 to 12-month scales' SPEI in April, May and June had a high correlation with winter wheat yield. The trends of the SPEI and the trends of winter wheat yield over the past 32 years showed a positive correlation ( $p < 0.01$ ) and have similar spatial distributions. The proportion of the stations with the same change trend between the SPEI and winter wheat yield was 70%, indicating that drought was the main factor leading to a decline in winter wheat yield in this region. The reduction ratios based on the simulated yield and the reduction ratios calculated from the statistical yield data have a high positive correlation ( $p < 0.01$ ), which may provide a way to quantitatively evaluate the winter wheat yield losses caused by drought.

**Key words:** drought, winter wheat yield, SPEI, EPIC, the North China Plain