以降低氣候變遷下水稻田間需水壓力為目標之模式模擬與探討

Model simulation and discussion on reducing paddy field water demand under climate change

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摘　要

我國水稻栽種，因北中南東各區氣候的不同，而有不同的適合插秧日期，例如宜蘭插秧日期為二月下旬，台中為 2 月上旬，台南為 1 月上旬，高雄為 12 月下旬。然而，因為氣候變遷的影響，全球暖化升溫，臺灣季節的長短也有了變化，季節的變化將連帶影響水稻的生長以及合適的栽種時機。季節變化的主因來自於全球暖化所造成的升溫，溫度的上升將造成水稻生長的需水量增加，若無適當的評估生長所需的需水量，將可能因為缺水而影響水稻產量；然而，氣候變遷不只造成氣溫的上升，同時也改變了降雨的型態，當水稻因為升溫而造成需水量增加時，若降雨量也呈現減少的趨勢，將連帶影響水稻的供水壓力。在面對氣候變遷所造成的改變，水稻栽種方式其實可以跟著改變，除了可以調整栽種時期，也可以更改栽種方式，以適應未來氣候變遷所造成的衝擊。為了解未來氣候變遷所造成的水稻作物需水量以及田間需水量的變化，本研究以 Python 程式語言開發氣候變遷水稻灌溉需水量評估模式-IrriWaterImpact，以 Hamon 蒸發散量公式推估水稻作物需水量，再以逐日記帳法推估有效雨量，進而模擬推估田間需水量。氣候變遷資料乃申請國家災害防救科技中心資料服務平台所提供的「AR5 統計降尺度日資料 API」服務直接讀取，研究區域以新竹新豐鄉為例，透過 IrriWaterImpact 模擬不同的插秧時期所反映的水稻田間需水量，進而模擬未來氣候變遷影響下，不同插秧時期所反映的水稻田間需水量變化為何，進而從需水量去探討水稻適合的栽種時期。

關鍵詞：氣候變遷，統計降尺度日資料，田間需水量

Abstract

In Taiwan, due to the different climates in the Northern, Central, Southern and Eastern region, there are different suitable transplanting dates for rice planting. For example, Yilan is in late February, Taichung is in early February, Tainan is in early January, and Kaohsiung is in late December. However, due to the influence of climate change and global warming, the length of the seasons in Taiwan has also changed, and the change of seasons will also affect the growth of rice and the appropriate planting time. The main cause of seasonal changes is the increase in temperature caused by global warming. The increase in temperature will increase the water demand for rice growth. If the water demand for growth is not properly assessed, the rice yield may be affected due to water shortage. However, climate change not only causes the temperature to rise, but also changes the pattern of rainfall. When the water demand of rice increases due to the temperature rise, if the rainfall also shows a decreasing trend, it will also affect the water supply pressure of rice. In the face of changes caused by climate change, the way of rice cultivation can actually be changed. In addition to adjusting the planting period, the planting method can also be changed to adapt to the impact of future climate change. In order to understand the changes in rice crop water demand and irrigation water demand caused by future climate change, this study developed a climate change rice irrigation water demand assessment model-IrriWaterImpact in Python programming language, and estimated the rice crop water demand with the Hamon evapotranspiration formula. Then, the effective rainfall is estimated by the daily journal method, and then the irrigation water demand is estimated by simulation. The climate change data is directly read by applying for the "AR5 Statistical Downscaling Daily Data API" service provided by the data service platform of the National Disaster Prevention and Rescue Technology Center. The study area took Xinfeng Township, Hsinchu as an example, and simulated different transplanting periods through IrriWaterImpact. Then, under the influence of future climate change, what is the change of rice irrigation water demand reflected in different transplanting periods, and then discuss the suitable planting period of rice from the water demand.

Keywords：climate change, statistical downscaling daily data, irrigation water demand