

整合小尺度氣象資料於灌溉用水量之案例探討- 以新竹縣竹東圳灌區為例

Study on Using Small Scale Meteorological Data for Irrigation Water Consumption - a Case Study of Zhudongzhen Irrigation Area in Hsinchu county

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摘 要

本研究以新竹縣竹東圳灌區為研究案例，灌區內主要種植作物為雙期作水稻，灌溉水源由上坪攔河堰自上坪溪取水，由於灌溉水源與其他用水標的有競合，對於精確掌握灌溉用水量，實有必要進行深入探究。過去為提高農業用水效率，在田間廣布監測儀器所費不貲，不易大規模推廣。本研究透過灌區內所布設的小型氣象站收集氣溫、風速、日照、降雨量等氣象條件，再配合聯合國糧農組織(FAO)所發展之 CROPWAT 模式計算作物需水量，加計不同土壤質地之滲漏量、有效雨量以及輸水損失推估灌溉用水量。首先利用田間氣象站所蒐集之氣象條件進行演算 111 年至 112 年度，一期作田間灌溉用水分別約為 2,130mm 及 2,660mm；二期作田間灌溉用水分別約為 2,558mm 及 2,467mm。經與灌溉計畫比對後，降雨量相對於其他氣象條件對作物需水量影響相對較大，由於降雨量受地形地勢影響較大，因此採用小區域性氣象條件，更能精確掌握灌溉時機，有效提高灌溉配水操作之效率，達到水資源有效利用之目的。

關鍵詞：農業水資源，CROPWAT，灌溉用水量

Abstract

Zhudongzhen irrigation area in Hsinchu County was applied as a case study in this study. The main crop grown in the irrigation area is double-period rice. The irrigation water source is from Shangping Weir from Shangping Creek. Since the irrigation water source competes

with other water sources, it is necessary to conduct research for the accurate amount of irrigation water usage. In the past, for improvement of efficiency of agricultural water use, widely deploying monitoring instruments in fields was expensive and difficult to promote on a large scale. This study collects meteorological conditions such as temperature, wind speed, sunshine, and rainfall through weather station deployed in the irrigation area. The CROPWAT model developed by the Food and Agriculture Organization of the United Nations (FAO) was used to calculate crop water requirements. The infiltration of different soil textures, leakage, effective rainfall and water transmission losses were used to estimate irrigation water consumption. First, the meteorological conditions collected by field weather station were used to calculate the results from 2022 to 2023. The field irrigation water usage in the first period was approximately 2,130mm and 2,660mm respectively; the field irrigation water usage in the second period was approximately 2,558mm and 2,467mm respectively. After comparing with the irrigation plan, rainfall has a greater impact on crop water requirement than other meteorological conditions. Since rainfall is greatly affected by topography, small-region meteorological conditions can be used to get the more accurate timing of irrigation and to improve the efficiency of irrigation water distribution to achieve the purpose of effective utilization of water resources.

Keywords: agricultural water resources, CROPWAT, crop water requirement