WAT-38 ORAL PRESENTATION · WATER TRACK · IRRIGATION & AGRICULTURAL WATER MANAGEMENT

Assessment of Crop Water Requirement of *Capsicum chinense* Grown in a Protected House: A Stable Water Isotope Based Method

S. A. S. Tharundya[1,2*], R. R. U. R. Perera[1], E. A. N. V. Edirisinghe[1], N. S. Withanage[2], G. Abhiram[2], S. Priyadarshanee[1], M. Kalpage[1] and H. P. K. Liyanage[1]

[1]*Sri Lanka Atomic Energy Board, Orugodawatta, Wellampitiya, Sri Lanka*
[2]*Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka*
**Corresponding author: stharundya@gmail.com*
DOI: https://doi.org/10.31705/ICEWSE.2026.39

Abstract

Sri Lanka is an agricultural country facing several challenges. One of them is that available accessible fresh water is limited for the crop fields. This study aimed to enhance the agronomic performance and Water Use Efficiency (WUE) of Scotch Bonnet (*Capsicum chinense*) under different irrigation levels in a protected house. The experiment was conducted using a Completely Randomized Design with three irrigation treatments and 12 replicates per treatment. Three irrigation treatments were implemented based on Total Available Water (TAW) and Allowable Depletion Levels of the potting mixture. Treatment 01 plot was maintained at 60% moisture of TAW, Treatment 02 at 40% and Treatment 03 at 25%. Once the specified depletion level was reached, each pot was irrigated according to the estimated Net Irrigation Requirement to reinstate soil moisture to Field Capacity. Growth parameters were measured weekly. Stable Water Isotopes were analyzed using water extracted from soil and leaf samples by Vacuum Cryogenic Extraction. WUE is calculated as the yield produced per unit of water used through evapotranspiration. The results revealed that, during transpiration, lighter isotopes (^{1}H and ^{16}O) leave the leaves more easily, while heavier isotopes (^{2}H and ^{18}O) became relatively enriched in leaves. Stable water isotopes extracted from leaf, soil, and atmospheric moisture samples formed three separate clusters around the Local Meteoric Water Line. Isotope data showed distinct signals from evaporation, transpiration, and evapotranspiration. WUE values for T1, T2, and T3 were 0.00058, 0.0017, and 0.0050 kg L^{-1}, respectively. Overall T3 showed the best growth, yield, and WUE. These isotope differences helped distinguish evaporation from transpiration and explain water movement through the soil–plant–atmosphere system.

Keywords: *agronomic performance; evapotranspiration; stable water isotopes; vacuum cryogenic extraction; water use efficiency*