Environmental Engineering and Management Journal

December 2024, Vol. 23, No. 12, 2643-2651
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu
http://doi.org/10.30638/eemj.2024.212

"Gheorghe Asachi" Technical University of Iasi, Romania

AN INTERVENTION ANALYSIS APPROACH TO WATER ABSORPTION IN WINTER WHEAT ROOT SYSTEMS AT VARYING DEPTHS

Xia Zhang[1]*, Dong Chen[2], Haohao Li[3]

[1]College of Henan River Chief, North China University of Water Resources Electric Power, Zhengzhou 450045, China
[2]China South-to-North Water Diversion Corporation Limited, Beijing 10036, China
[3]Henan Province tobacco company Luoyang company, Luoyang 471012, China

Abstract

The significance of understanding the water absorption by root systems in cultivation and irrigation practices is paramount. While prior studies predominantly utilised data simulations and mechanical models, data-driven models remain underexplored. This research revisits the intervention analysis model to elucidate the water absorption dynamics of winter wheat roots. Data procured from Shangqiu were employed to design distinct intervention patterns. Several intervention analysis models were constructed to examine the influence of water absorption on soil moisture content at varying depths, ranging from 40 cm to 100 cm. Four primary conclusions were drawn. Firstly, rhizomes deeper than 70 cm exhibited a prolonged absorption period compared to those above 60 cm. Secondly, absorption patterns at 40 cm and 80 cm resembled a discrete absorption process, whilst at alternate depths, continuous absorption was observed. Thirdly, immediate effects on soil moisture content were evident at depths of 40 cm and 50 cm. Conversely, rhizomes positioned deeper than 60 cm demonstrated negligible immediate effects. Fourthly, a notable exponential decline in the relative strength of water absorption with increasing depth was observed. The findings were further corroborated through comparative analysis with widely recognised models, diagrams, and established principles from earlier studies. The outcomes of this investigation offer critical insights into water uptake mechanisms within winter wheat root systems during the jointing and booting stages.

Key words: intervention analysis, soil moisture content, water absorption, winter wheat

Received: June, 2022; Revised final: October, 2023; Accepted: November, 2023; Published in final edited form: December, 2024

* Author to whom all correspondence should be addressed: e-mail: zhangxia@ncwu.edu.cn