

## Application of Computational Fluid Dynamics in the Analysis of Water Flow in Rice Leaves

**Authors :** Marcio Mesquita, Diogo Henrique Morato de Moraes, Henrique Fonseca Elias de Oliveira, Rilner Alves Flores, Mateus Rodrigues Ferreira, Dalva Graciano Ribeiro

**Abstract :** This study aimed to analyze the movement of water in irrigated and non-irrigated rice (*Oryza sativa* L.) leaves, from the xylem to the stomata, through numerical simulations. Through three-dimensional modeling, it was possible to determine how the spacing of parenchyma cells and the permeability of these cells influence the apoplastic flow and the opening of the stomata. The thickness of the cuticle and the number of vascular bundles are greater in plants subjected to water stress, indicating an adaptive response of plants to environments with water deficit. In addition, numerical simulations revealed that the opening of the stomata, the permeability of the parenchyma cells and the cell spacing have significant impacts on the energy loss and the speed of water movement. It was observed that a more open stoma facilitates water flow, decreasing the resistance and energy required for transport, while higher levels of permeability reduce energy loss, indicating that a more permeable tissue allows for more efficient water transport. Furthermore, it was possible to note that stomatal aperture, parenchyma permeability and cell spacing are crucial factors in the efficient water management of plants, especially under water stress conditions. These insights are essential for the development of more effective agricultural management strategies and for the breeding of plant varieties that are more resistant to adverse growing conditions. Computed fluid dynamics has allowed us to overcome the limitations of conventional techniques by providing a means to visualize and understand the complex hydrodynamic processes within the vascular system of plants.

**Keywords :** numerical modeling, vascular anatomy, vascular hydrodynamics, xylem, *Oryza sativa* L.

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