# The use of H2FLO as soil amendment to reduce soil hydrophobicity at arable lands

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H2FLO is liquid soil amendment developed to improve irrigation efficiency and water distribution at the root zone. This product is applied via irrigation systems. Over the recent years it has been widely used to homogenize water distribution at the root zone of golf courses. While it is understood that the H2FLO improves soil wetness and water availability for the roots, understanding of the associated physical processes, the modus of operation and the preferred conditions for application in agricultural environments is more limited. Based on previous works it was hypothesized that the most important role of H2FLO is to reduce soil hydrophobicity of sandy-texture soils. Hydrophobicity, which is a common phenomenon in agricultural soils due to their high levels of organic matter, results in low rates of infiltration and percolation along preferential flow paths, thus soil wetness is not uniform and water and nutrient availability for plants is limited. By applying H2FLO, hydrophobicity of the soils is expected to be reduced, and water infiltration and water distribution at the root zone should be improved.

In this study, we tested the hypothesis stated above and examined the impact of H2FLO on improving water flow processes in various soils with varied textures and organic matter contents. First, we quantified the impact of H2FLO on irrigation water surface tension, contact angle, and viscosity. Then we used synthetic hydrophobic and hydrophilic capillaries in order to quantify the impact of H2FLO, at various concentrations, on the suction of the water into the hydrophilic capillaries and repulsion out of the hydrophobic capillaries. It was shown that adding H2FLO to irrigation water reduced the capillary rise in the hydrophilic capillaries, but in a greater proportion it decreased the repulsion out of the hydrophobic capillaries. The impact of H2FLO on soil hydrophobicity was examined using the 'water drop penetration time' method. This indicated a significant reduction of the water drop penetration time, by more than an order of magnitude. Additional water drop penetration time tests were done for various soils, with various degrees of water content, and with various concentrations of H2FLO solution. These tests enabled us to determine the ideal conditions and concentration of H2FLO application, based on the soil initial water content, organic matter content, and texture. Lastly, Darcy's tests were conducted to study the impact of the H2FLO on flow processes in hydrophobic soils.

The experiments detailed above, and qualitative tests that were carried out in Hele-Shaw chambers to characterize water flow at the subsurface, have shown that the use of H2FLO in light-medium texture soils, that contain up to ~1.5% organic matter is a useful way to reduce the hydrophobic nature of the soils, which ensures faster and better water infiltration and percolation to the root zone.