ASSESSMENT OF IRRIGATION REQUIREMENT FOR GUAYULE USING WINDS MODEL

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With the growing concern/demand for more natural rubber, there comes a dire need to focus on efficient and sustainable growth of industrial crops. Guayule (*Parthenium argentatum*), an indigenous to Southwestern USA, is a perennial shrub, and one of the 2000 species that produces natural rubber. Guayule is a drought tolerant crop; however, it requires more water to achieve maximum rubber and resin yields. Under stress conditions, it would go through a temporary dormancy until water is available, which makes it a suitable crop for the arid regions in the south west such as in Arizona, California, New Mexico and Texas. In this study, irrigation water requirement was evaluated for guayule planted in two fields in the year 2018: one at The University of Arizona, Maricopa Agricultural Center (MAC) in Maricopa, Arizona with sandy loam soil, and the other at the Bridgestone Americas Guayule Research Farm, Eloy, Arizona with clay soil. At both the experiment stations, there are six treatments including subsurface drip and flood irrigation. There are five different irrigation rates on subsurface drip irrigation (SDI) levels with 50%, 75%, 100%, 125% and 150% replacement of estimated soil water depletion (SWD), denoted as D50, D75, D100, D125 and D150, respectively. Additionally, one treatment (100% replacement of SWD) was grown with furrow irrigation and denoted as F100. Plant water use, and irrigation recommendations were calculated using WINDS (Water-use, Irrigation, Nitrogen, Drainage, and Salinity) model, a computer-based tool that runs by soil-water flux and energy distribution equations. Outputs from WINDS include Crop Evapotranspiration (ETc), soil moisture, soil water depletion, and an irrigation schedule (prediction of irrigation amount and date). Using a multispectral sensor carried on a drone, the normalized difference vegetation index (NDVI) was also estimated and correlated to soil moisture content, which is an indicator of crop-water status. Results indicated that the WINDS model was capable of estimating guayule daily ETc and soil moisture content, which correlated well with measured soil moisture content. Moreover, the results from sensors on NDVI depict that sensors can be an effective tool for precision agriculture to assess crop health at each growing stage.

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