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Water use efficiency (WUE) Modeling at Leaf level of Cotton (*Gossypium hirsutum* L.) in Telangana, India

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Water use efficiency (WUE) plays a vital role in planning and management of irrigation strategies. Considering the spatial scale, WUE can be quantified at scales ranging from leaf to whole-plant to ecosystem to region. However, the inter-relation and their associate is poorly understood. This study is aimed at stimulating WUE of irrigated cotton at leaf () and further investigate the role of environmental and biophysical conditions on WUE dynamics. This study was conducted in an agricultural croplands located in Sangareddy district, about 70 km west of Hyderabad, the capital city of southern state Telangana, India. Ground based observation were made such as soil moisture, photosynthetic parameters and meteorological parameters. Modelling leaf water use efficiency has been established. The stomatal conductance and of cotton leaves exposed to ambient CO₂ were simulated using Ball-Berry (mBB) model. Moreover, the stomatal conductance and of Cotton leaves exposed to ambient CO₂ is simulated using modified Ball-Berry model, with instantaneous gas exchanges measured around noon used to parameterize and validate the model. We observed a large diurnal ($4.3 \pm 1.9 \text{ mmolCO}_2 \text{ mol}^{-1}\text{H}_2\text{O}$) and seasonal ($5.16 \pm 1.51 \text{ mmolCO}_2 \text{ mol}^{-1}\text{H}_2\text{O}$) variations in during the crop period. Model simulated and are in agreement with the measurements ($R^2 > 0.5$, $\text{RMSE} < 0.3$). Our results conclude that WUE_L is ruled by climatic as well as vegetative factors respectively, and are largely controlled by changes in transpiration over photosynthesis. This needs further investigation with extensive analysis by building library of in-situ measurements.

Keywords: Cotton, WUE, Irrigation, Stomatal conductance, Ball Berry Model