



More Yield with Less Water: Increasing Water Use Efficiency by Capitalizing on the Adaptation of Native Shrubs in the Sudano-Sahel

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A changing climate along with human and animal population pressure can have a devastating effect on crop yields and food security in the Sudano-Sahel. Agricultural solutions to address soil degradation and crop water stress are needed to combat this increasingly difficult situation. Significant differences in crop success have been observed in peanut and millet grown in association with two native evergreen shrubs *Piliostigma reticulatum*, and *Guiera senegalensis* at the sites of Nioro du Rip and Keur Matar, respectively. We investigate how farmers can increase crop productivity by capitalizing on the evolutionary adaptation of native shrubs to the harsh Sudano-Sahelian environment as well as the physical mechanisms at work in the system that can lead to more robust yields. Research plots at Keur Matar Arame with no fertilizer added were monitored in 2013 using two soil moisture sensor networks at depths of 10, 20, 40, 60, 100, 200, and 300cm. Cropping season water use total calculated based on beginning and end of season soil moisture and seasonal precipitation data revealed that crop-only plot used 411 ± 32 mm of water, and the crop and shrub plot used 439 ± 42 mm of water. Taking into account the quantity of crop biomass produced and neglecting the shrub biomass produced, the crop and shrub plot had a water use efficiency of $1.60 \text{ kg ha}^{-1} \text{ mm}^{-1}$ and the crop only plot had $0.269 \text{ kg ha}^{-1} \text{ mm}^{-1}$. Water status was measured three times throughout the season on millet leaves and revealed no significant trends. Handheld NDVI readings revealed significantly higher NDVI values in crop and shrub plots at all measurement dates. These findings build on work that was completed in 2004 at the site, but further increases in crop yields have been shown. Increasing water use efficiency by over 500% can be a great advantage in years of limited water availability such as 2013. Using even the limited resources that farmers possess, this agroforestry technique can be expanded over wide swaths of the Sahel.