

Enhancing the resilience of the Northern Territory's rain-fed cotton; a comprehensive approach to yield prediction and water management.

Abstract

Australian cotton offers high profitability and the potential of becoming a cornerstone crop in the Northern Territory (NT). Rainfed cotton of NT relies on wet season rainfall, which makes it less water-intensive but more vulnerable to irregular rainfall patterns than irrigated cotton. This research will ameliorate the understanding of the flexibility of cotton crop to water in rainfed conditions of NT and propose development of resilient production system. The study will investigate how the changes in physiological and morphological traits over different growth stages informs post-wet-season water use and quantifies water use efficiency. Also, the project will evaluate the role of mulches and soil amendments in maintaining soil moisture and promoting cotton establishment. The project uses in-field trials with frequent physiological and morphological measurements and volumetric and isotopic analysis ($\delta^{18}\text{O}$, $\delta^{13}\text{C}$) to quantify water usage and productivity. Simulations will inform the influence of soil temperature and moisture on germination rates. Additionally, the study will explore the effects of mulch covers and amendments on soil moisture regulation, temperature buffering, and yield. This research will (1) Quantify the relationship of key physiological and morphological processes at different growth stages, and 2) demonstrate how changes in soil moisture over the growing period influences cotton establishment and growth and (3) investigate mulching and soil amendment strategies to improve cotton establishment. The findings of this study will offer growers insights into potential crop performance under challenging conditions and guide optimal supplementary irrigation strategies. It will propose improved soil management practices including mulching and amendments to enhance water retention and crop establishment. These advancements will support a more sustainable cotton production system.