MACHINE LEARNING TECHNIQUES USED TO ESTIMATE COTTON CANOPY NITROGEN AVAILABILITY USING ACTIVE CROP CANOPY SENSORS

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Abstract

Several factors, including genetics, environmental influences, and management approaches, have an impact on cotton plants. Fertilization with nitrogen (N) is a must, and farmers often apply excessive N rates to produce a reasonable yield. This approach has the potential to increase pollution and nitrogen loss in the ecosystem. Therefore, a reasonable strategy for N management in cotton plants are indispensable for higher profits. The goal of this research are i) select the best spectral parameters (VIs and source of data – active or satellite) to predict cotton yield and ii) Evaluate the performance of Random Forest (RF) to predict cotton yield using spectral reflectance data. During 2021 season a whole field on farm precision experimentation were conducted in a 273-acre commercial field in Louisiana (USA). The field was settled in a latin square design, with four N treatments (44, 50, 56, and 62 lb/acre) repeated throughout. To capture numerous georeferenced sensor variables from the plant canopy, a prototype active sensor (Holland Scientific) was used to collect remote sense data. Additionally, to obtain canopy reflectance, we downloaded five dates of Sentinel 2 satellite images. The dependent variable was yield from cotton pickers with yield monitor. All active and passive sensor data and derivatives, such as vegetation indices were used as input for selection of the best 10 variables using stepwise regression. After ranking variables two scenarios using random forest analysis were created (i) the top 10 variables and (ii) With the most important variable. The best RF model was using the ACS data as input with the best 10 variables, achieving R2 of 0.92. Cotton yield can be accurately predicted using our modelling approach. Nitrogen rate are important dependent variable on RF algorithms.