

## Abstract

Detection of crop stress is one of the major applications of hyperspectral remote sensing in agriculture. Many studies have demonstrated the capability of remote sensing techniques for detection of nutrient stress on cotton with only few on pest damage but none so far on leafhopper (LH) severity. Subsequent to introduction of Bt cotton, leafhopper is emerging as a key pest in several countries. In view of its wide host range, geographical distribution and damage potential, a study was initiated to characterise leafhopper stress on cotton, identify sensitive bands, and derive hyperspectral vegetation indices specific to this pest. Cotton plants with varying levels of LH severity were selected from three locations across major cotton growing regions of India. About 57-58 cotton plants from each location exhibiting different levels of LH damage symptoms were selected. Reflectance measurements in the spectral range of 350-2500nm were made using hyperspectral radiometer. Simultaneously chlorophyll (Chl) and relative water content (RWC) were also estimated from the selected plants. Reflectance from healthy and leafhopper infested plants showed a significant difference in VIS and NIR regions. Decrease in Chl a pigment was more significant than Chl b in the infested plants and the ratio of Chl a/b showed a decreasing trend with increase in LH severity. Regression analysis revealed a significant linear relation between LH severity and Chl ( $R^2=0.505^{***}$ ), and a similar fit was also observed for RWC ( $R^2=0.402^{***}$ ). Plotting linear intensity curves between reflectance at each waveband with infestation grade resulted in six sensitive bands that exhibited maximum correlation at different regions of the electromagnetic spectrum (376, 496, 691, 761, 1124 and 1457nm). Regression analysis of several ratio indices formulated with two or more of these sensitive bands led to the identification of new leaf hopper indices (LHI) with a potential to detect leafhopper severity. These new indices along with 20 other stress related hyperspectral indices compiled from literature were further tested for their ability to detect LH severity. Two novel indices LHI 2 and LHI 4 proposed in this study showed significantly high coefficients of determination across locations ( $R^2$  range 0.521 to 0.825<sup>\*\*\*</sup>) and hence have the potential use for detection of leafhopper severity in cotton.