

## **Development of smartphone-based imaging techniques for the estimation of chlorophyll content in lettuce leaves**

### **ABSTRACT**

Leaf color is a good indicator of plant's health status. In this study, a new image acquisition technique was developed to estimate chlorophyll content of lettuce leaves. The images of lettuce leaves grown under artificial light were acquired using a smartphone. Leaves images were captured by directly attaching the leaves to the camera lens with the aid of background illumination from SMD LED. Red, green, blue (RGB) color indices were extracted from leaves color images and some vegetation indices were also calculated. Then, the correlation between these indices and chlorophyll content obtained from SPAD502 chlorophyll meter were evaluated. Significant correlation was found between all the image indices and chlorophyll content with the  $R^2$  ranging from 0.63 to 0.85 except for G and B indices from RGB component. Highly significant correlation was found between vegetation indices (VI) and chlorophyll content ( $R^2 = 0.85$ ) with the lowest root mean square error (RMSE) of 8.07 g of chlorophyll/100 g fresh tissue. This demonstrated that the chlorophyll content of lettuce leaves can be successfully estimated using regular smartphone with added background light illumination from SMD LED.

**Keyword:** Color image processing; Color indices; Leaves color; Chlorophyll content