

Near Infra-Red Imaging to Monitor the Canopy Growth in an Annual Intercropping System – A Study from Maize-Mung Bean Intercropping in Sri Lanka

R. Eeswaran^{1*}, A. Schmidli², A. Walter² and U.R. Sangakkara¹

¹Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka

²Institute of Agricultural Sciences, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland
r.eeswaran@yahoo.com

Near Infra-Red (NIR) imaging is one of the popular imaging techniques that are used in plant phenotyping and crop health monitoring. This technology is non-invasive, non-contact and non-destructive thus, has wide range of applications. In this study, NIR imaging technique was used to test its applicability to study the canopy growth of a maize-mung bean intercropping system. The experiment consisted of five treatments - (OPV): Open pollinated maize monocrop; (F1): Hybrid maize monocrop; (M): Mung bean monocrop; (OPV+M): Open pollinated maize with mung bean intercropping and (F1+M): Hybrid maize with mung bean intercropping. These five treatments were arranged in a randomized complete block design (RCBD) with four replicates at Peradeniya university experimental station, Kundasale located in the mid country intermediate zone (IM 3a) of Sri Lanka during the Yala season in 2013. The crops were grown under optimum recommended management practices. A commercially available 3-Band vegetation stress hand-held camera (a modified Canon® SX230) with a blue and a green channel for the visible light and a near infrared channel capturing was used in the imaging procedure. Enhanced normalized difference vegetation index (ENDVI) and canopy coverage were derived from the images by using appropriate techniques. The data were analysed by the analysis of variance procedure of RCBD and least significant differences (LSD) at 0.05 probability was used for mean separation. The greatest healthiness and chlorophyll content of leaves observed when the crops reach their reproductive stages as indicated by ENDVI values. The hybrid maize produced a larger and healthier canopy than the OPV maize as elucidated in previous studies. Ageing of mung bean leaves due to post-flowering assimilate re-translocation depicted the behavior of a legume crop. Moreover, the mixed canopy growth courses of maize and mung bean clearly showed complementary use of light which is the top most necessity in an intercropping system. In conclusion, the ENDVI and canopy coverage measurements derived from this NIR imaging technique represents the general growth pattern of the crop canopies of above species in an intercropping system. Thus, this method would be useful and valid to study the canopy growth in an annual intercropping system or crop mixing. It is a simple and quick method; its accuracy could be further improved by following appropriate precautions to enjoy its total benefits in monitoring of crop canopy growth.

Keywords: Canopy growth, ENDVI, Intercropping, Maize, Mung bean, NIR Imaging