Handheld RGB-based Phenotyping to Assess Groundnut Rosette Disease Resistance and Identify Trait Associated Components

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Groundnut rosette disease remains the most devastating foliar disease of groundnuts in Sub-Saharan Africa (SSA) causing upto 100% yield loss. Advancements of molecular breeding techniques have provided opportunities to understand the gentic components that control GRD resistance variation. However, accurately phenotyping large breeding populations for GRD resistance remains a challenge. Red-Green-Blue (RGB) based phenotyping has has become a popular method in image based plant phenotyping due to the wide availability of RGB cameras. In this study, 200 genotypes of groundnut (*Arachis hypogaea* L.) from the African core collection were grown under field conditions at Nakabango, Uganda which is a hotspot for groundnut rosette disease. The severity was assessed visually and handheld RGB images were collected during the different growth stages across the growing season. RGB indices were derived using the Breedpix plugin of the CIMMYT maize scanner. Strong associations between the visual scores and RGB indices were recorded at 12 weeks after planting. RGB indices Green Area (GA, r = -0.75), Greener area (GGA, r = 0.71) and Crop Senescence Index (CSI, r = 0.55) were the best associated with visual scores. The genome wide association study was performed, identifying genomic regions associated with the image-derived indices CSI, GA, and GGA on chromosomes A04 and B04. A putative gene *Aradu.P5PIT*, a disease resistance protein located next to single nucleotide polymorphisms (SNP) of leaf photosynthesis were detected by both visual scores and CSI (associated with canopy yellowness). These image derived indices and associated genes present an opportunity to improve phenotyping using objective measures and, apply molecular tools to improve breeding of GRD resistant groundnut varieties.