New non-destructive method to estimate leaf area index in vegetables

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The productivity and health of horticultural crops depends on the ability of the plant cover to intercept light energy. This ability is a function of the amount of leaf area, the architecture of the vegetation cover, and plants' ability to convert light energy. One estimate of a crop's ability to capture light energy is the leaf area index (LAI). Introduced in 1947, the concept of the LAI was defined as the ratio of leaf area to a given unit of land area. Today, understanding LAI is critical for successful crop management.

Many methods have been used to measure LAI directly; most are variations of either leaf sampling or litterfall collection techniques. To date, direct methods for determining leaf area have been restricted to the use of an automatic area-integrating meter (planimeter). Tracing, shadow graphing, and the use of a planimeter to measure LAI are all time-consuming and tedious approaches. These direct, or "destructive" sampling methods also have multiple limitations; equipment handling by different operators, limitations in sample size, and measurement errors in the planimetry can all reduce the reliability of the sampling method.

Scientists Carlos Campillo, M.I. García, C. Daza, and M.H. Prieto designed a research study they describe as "aimed at developing a cheap and simple method to estimate LAI". The researchers measured percentage of groundcover (PGC) in two vegetable crops with prominent differences in leaf type and plant architecture. "Our experiments analyzed digital images obtained with a commercial camera with open-source software", explained Campillo.

At an experimental farm near Extremadura, Spain, the team set up a polyethylene frame along a crop row in an area containing six tomato and four cauliflower plants. Photographs of the selected areas were taken using a commercial camera with a resolution of 8 megapixels at a height of 160 cm above the soil surface at 10-day intervals, with a total of 12 measurements for each crop from transplantation to harvest. Free software (GIMP 2.2) was used to analyze the digital images and to differentiate between the vegetation and the soil or plastic by means of a color reclassification process. A reclassification method as a measure of PGC was used to quantify the percentage of vegetation cover.

Results showed that the method produced non-destructive estimations of LAI comparable to more expensive indirect methods. The method produced rapid, accurate estimation of leaf area. "This method allows non-destructive estimations of LAI measured from complex types of cover compared with other indirect methods that are more expensive and require skilled operators", the researchers concluded.

More information: hortsci.ashspublications.org/c …/abstract/45/10/1459

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