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Methods to Record Leaf Senescence for Assessing Drought Resistance of Sorghum

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Abstract

Sorghum (*S. bicolor* L. Moench) is one of the most drought resistant crops. It is assumed that drought stress reduces yield via coordinated lowering of photosynthetic capacity and yield potential, and hence both effects were correlated with accelerated leaf senescence. Consequently we tested two non-destructive methods of leaf senescence assessment: measuring light reflection (digital imaging) and light transmission (SPAD-based Hydro-N-Tester).

For light reflection digital photographs of leaves or standardised segments of seven genotypes were taken during a greenhouse experiment and were analysed for the green and red light reflection per unit leaf area using Sigma Scan Pro 5.0 software. With respect to different irradiation in the greenhouse while taking the photographs, adjustment of the original values by simultaneous measurements of white or green standard plates was made. The regression of the original and the adjusted values with chlorophyll content of the segments was calculated. In a second experiment twelve genotypes were used for light transmission measurement with thirty measurement points per leaf. Also regression curves were calculated. Chlorophyll was generally determined by a colourimetric method.

For the light reflection method we found that average red values correlated better (r^2=0.723) with the chlorophyll content than average green values (r^2=0.526) and adjustment with the values of the white and green plates led to a marginal improvement of the correlation (r^2=0.736) and lowering (r^2=0.327), respectively. Genotypes exhibited differences in correlation coefficients (r^2=0.495 to 0.998). The segments chosen for the photographs represented the leaf values very well (r^2=0.853).

The correlation of the N-Tester values of leaf segments with correspondig chlorophyll contents differed considerable between genotypes (r^2=0.474 to 0.922), while the correlation of the leaves'N-Tester values with the leaves'chlorophyll content was weaker (r^2=0.004 to 0.908).

We conclude that light reflection measurement is more labour-intensive than light transmission measurement, but these values represent chlorophyll content of leaves better than N-Tester values of leaves. N-Tester values of segments were as highly correlated to chlorophyll content as average red values of segments. However, use of N-Tester obviously is restricted to leaves with chlorophyll contents not exceeding 5 mg dm^{-2} because of biasses by high scattering within the leaf.

Keywords: Leaf senescence assessment, light reflection, light transmission, *Sorghum bicolor*

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