NOV 22, 2019

Flavonol, Anthocyanin, and Chlorophyll Indices using a Force-A Dualix Scientific+

David S LeBauer¹, Maria Newcomb¹, Matthew Herrit², Ebrahim Babaeian¹

¹University of Arizona;

²U.S. Arid Land Agricultural Research Center: Maricopa, AZ

TERRA Reference Phenotyping Platform

OPEN ACCESS

DOI:
dx.doi.org/10.17504/protocols.io.u6yezfw

Protocol Citation: David S LeBauer, Maria Newcomb, Matthew Herrit, Ebrahim Babaeian 2019. Flavonol, Anthocyanin, and Chlorophyll Indices using a Force-A Dualix Scientific+. **protocols.io** <https://dx.doi.org/10.17504/protocols.io.u6yezfw>

MANUSCRIPT CITATION:
References Cerovic, Z.G., Masdoumier, G., Ben Ghozlen, N., Latouche, G. (2012) A new optical leaf-clip meter for simultaneous non-destructive assessment of leaf chlorophyll and epidermal flavonoids. Physiologia Plantarum, ISSN 0031-9317.

License: This is an open access protocol distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited

Protocol status: Working
 We use this protocol and it's working

David S LeBauer
 University of Arizona

ABSTRACT

This protocols describes the use of a hand-held sensor to estimate polyphenols and chlorophyll content of leaves based on absorbance and transmittance of specific wavelengths of visible and near infrared light.

The instrument does not directly measure these chemical concentrations, but measures reflectance and absorbance indices that have been demonstrated to relate to leaf level concentrations.

We use it to measure Chlorophyll, anthocyanin, and a nitrogen balance index.

Chlorophyll Concentration ($\mu\text{g}/\text{cm}^2$): The instrument is factory calibrated to measure leaf chlorophyll concentration.

$$\text{Chl} = \frac{\text{NIR} - \text{Red}}{\text{Red}}$$

Flavanol Index (Flv)

$$\text{Flv} = \log \frac{\text{NIR fluo excited red}}{\text{NIR fluo excited UV-A}}$$

Anthocyanin Index

$$\text{Anth} = \log \frac{\text{NIR fluo excited red}}{\text{NIR fluo excited green}}$$

Nitrogen Balance Index (NBI): a relative measure of nitrogen status

$$\text{NBI} = \frac{\text{Flavanol Index}}{\text{Flavonol Index}}$$

Note that the instrument documentation does not provide specific wavelengths, only

Created: Oct 30, 2018

Last Modified: Nov 22, 2019

PROTOCOL integer ID:
17336

Keywords: chlorophyll,
polyphenol, plant, leaf,
phenomics

approximate wavelengths in this diagram (from [Dualex Brochure.pdf](#)):

ATTACHMENTS

[Dualex Brochure.pdf](#) [Dualex_Manual.pdf](#)

MATERIALS

MATERIALS

Dualex Scientific **Contributed by users**

Dualex Scientific Brochure:

Brochure-DUALEX®-SCIENTIFIC-NEW (1).pdf

BEFORE START INSTRUCTIONS

Make sure that the instrument battery is fully charged.

Take measurements

1

For each two row plot:

For two subsamples per plot: Identify the 1-3 replicate plants per row to measure. For a standard 3 m row, this would be the plant closest to 1.5m from the end.

For six subsamples / plot: Identify the center plant and two adjacent plants in each of the two rows

Identify the youngest fully expanded leaf on each plant

2

On each plant, the youngest, fully expanded leaf should be measured. To determine if a leaf is fully expanded, observe that the leaf is attached at the ligule; a leaf that is not fully expanded will still be partially wrapped around the stem.

[Image from Wikipedia CC-BY 3.0 Kelvin Ma](#)

Identify a sunlit, horizontal location on each leaf to measure

3 The measurement should be taken on a part of the leaf that is

- sunlit
- approximately horizontal to the ground
- approximately halfway between the leaf rib and edge
- free of disease or herbivory.

Attach Dualex and measure

4

Equipment

DUALEX SCIENTIFIC+™ Chlorophyll and Polyphenol-Meter

NAME

Handheld Sensor

TYPE

Dualex

BRAND

E-B90-DUALEX4

SKU

<http://www.dynamax.com/products/optics-for-polyphenol/dualex-scientific-polyphenol-chlorophyll-meter>

LINK

- Clip Dualex sensor to leaf
- Click "OK"
- Instrument will collect measurements

Record plot name and measurement number

5

Format and upload data

6 See Data Entry documentation for BETYdb