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CHLOROPHYLL A FLUORESCENCE : A TOOL TO ASSESS THE PHOTOSYNTHETIC APPARATUS BEHAVIOR

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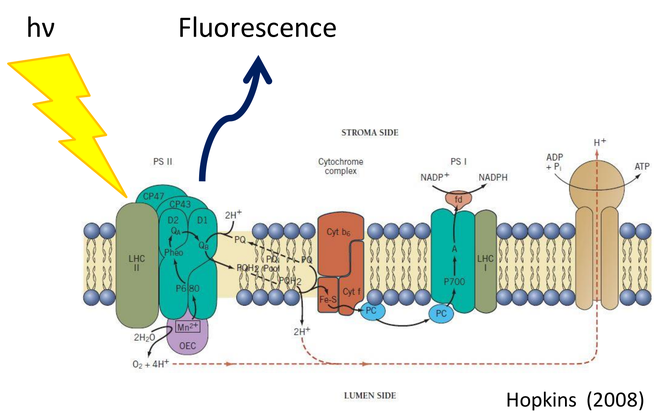
Chlorophyll *a* fluorescence

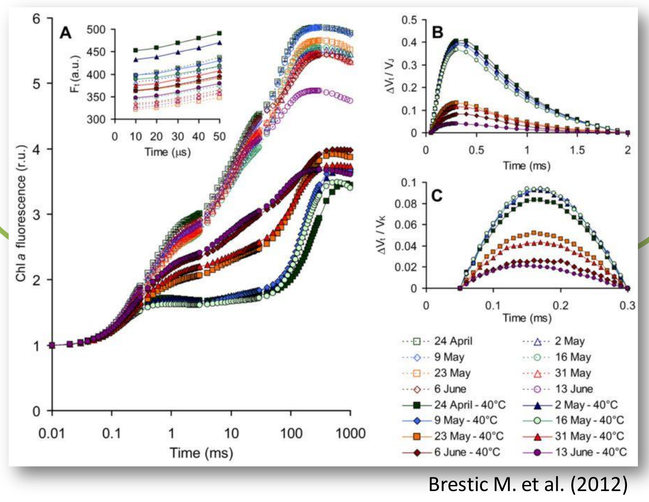
The rise of **fluorescence** following illumination of a dark-adapted **chlorophyll containing material**, known as the Kautsky effect, has been first detected and described in 1931. The study of the chlorophyll *a* fluorescence (CAF) kinetics has been widely used to assess **environmental impact** on the photosynthetic apparatus. The analysis of the CAF enables a phenomenological and biophysical interpretation of the **photosynthetic apparatus behavior** as well as a **quantification** of it's functional activity.



Hopkins (2008)

Fast phase

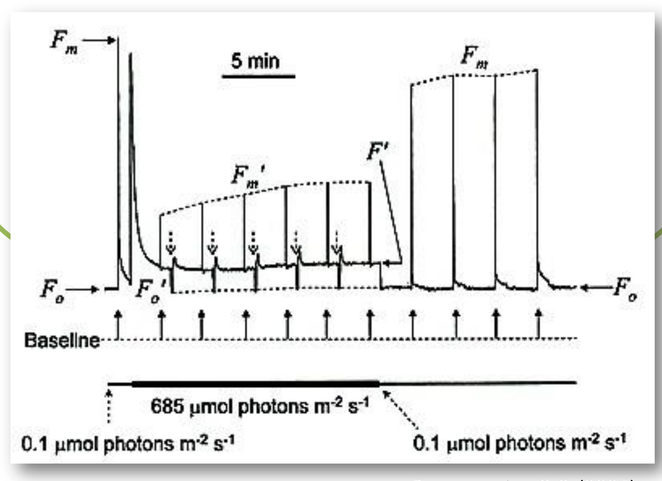
- Rrepresents the **successive reduction** of the e^- acceptors in the **electron transport chain**.
- Gives information about the **energy conservation** from the photons absorbed in the whole electron transport chain.



Brestic M. et al. (2012)

Slow phase

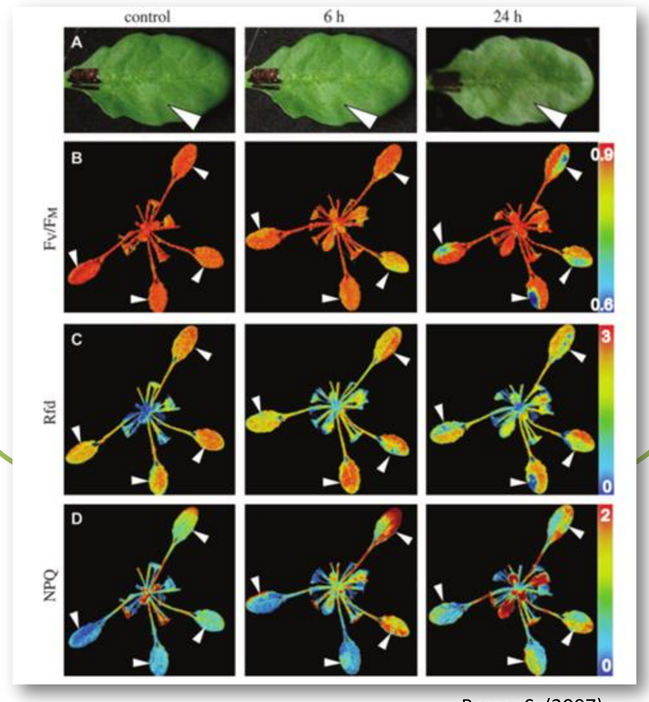
- The fluorescence starts to **decrease**.
- Gives information about **photochemical and non-photochemical process** leading to the **fluorescence *quenching***.



Papageorgiou G.C. (2004)

Imaging

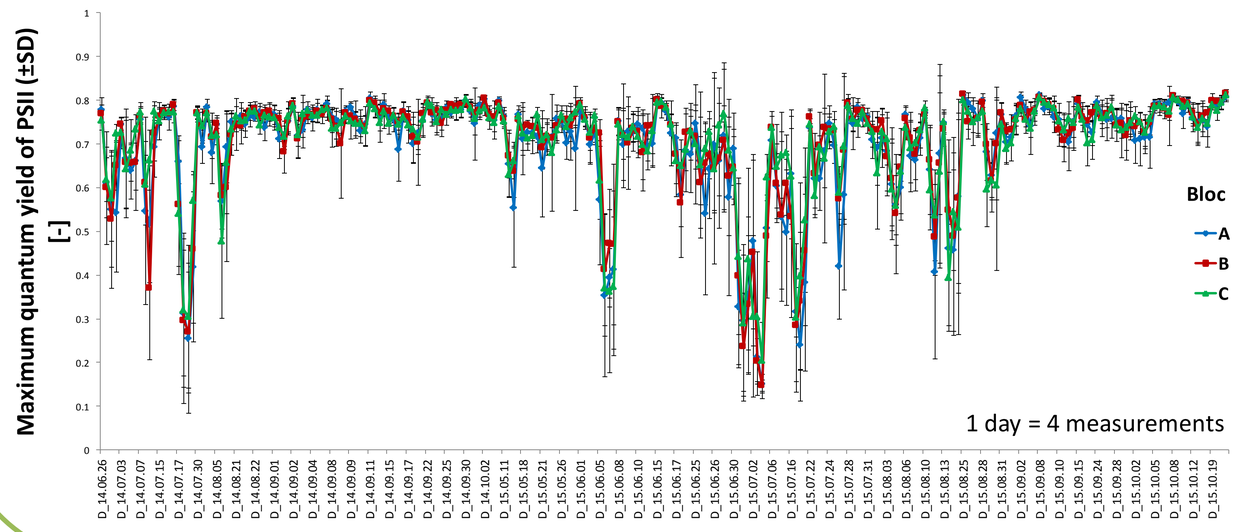
- Imaging of the CAF provides **spatial distribution** of photosynthetic efficiency.

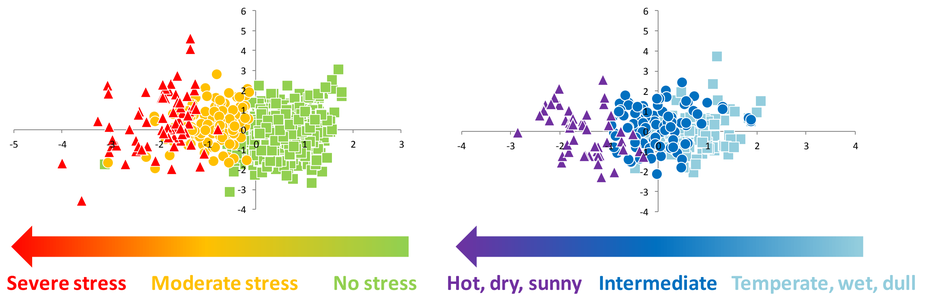


Berger S. (2007)

Case study : photosynthetic apparatus response of *Lolium perenne* L. to climate stress in a temperate grassland (*)

- Photosynthetic activities of the *Lolium perenne* L. exhibited a **seasonal pattern** and **a diurnal dynamic photoinhibition**.
- This photoinhibition was caused by **down-regulation mechanisms** aimed to **reduce the over-excitation** driven by sun irradiance.
- **High light** and **severe drought episodes increased the sensitivity** of the photosynthetic apparatus to increase of **air temperature** and **vapor pressure deficit**.
- **Ozone** was not identified as an important stress-driver in the grassland.





Canonical correlation analysis was performed on CAF and meteorological parameters from the whole measurements campaign. Graphs axis are linear combination of the input variables which were different CAF parameters for the right graph and several meteorological parameters (e.g. soil moisture, PPFD, air temperature, …) for the left graph. Each dot plotted in the graphs represents a linear combination of the different variables used in the construction of the axis. Comparison of two graphs enable a correlation of the photosynthetic apparatus stress with the weather conditions.

References

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(*) CROSTVOC PROJECT – This study is part of the **CROSTVOC project** which investigates the impact of abiotic stresses on the volatile organic compound fluxes from the grassland at ecosystem-scale by eddy-covariance measurements and at smaller scale with six dynamic chambers with automated lid.