INTRODUCTION

- It is necessary to determine maximal fluorescence (Fm') in order to estimate the effective quantum efficiency of Photosystem II (PSII) and the rate of electron transport (ETR) from chlorophyll fluorescence measurements (Genty et al., 1989).
- Fm' is commonly measured using a single saturating, multi-turnover flash of 400-1200 ms duration.

MATERIALS AND METHODS

- Work light-emitting diode (LED) technology, "unusual" light can be applied in several different ways, which are described in Figure 1.
- LI-6400 Portable Photosynthesis Systems with 6400-40 Leaf Chamber Fluorometers (LI-COR, Lincoln, NE, USA) were used to compare the three methods.

THE MULTIPLE FLASH TRAIN SOLUTION

- The new multiphase single flash method (MSF) can be used to derive true estimates of Fm', PSII and ETR in all conditions.

THE NEW “MULTIPHASE” SINGLE FLASH SOLUTION

- The MSF method uses a ramp of rapidly varying light intensity to generate Fm' values over a range of light intensities (B, Figure 3).
- Total duration of one MSF measurement is only about one second.

VALIDATION WITH DMBR

- As a first step to evaluate the MSF method, we vacuum infiltrated leaves of field-grown maize with DBMIB.

RESULTS


CONCLUSIONS

- The new multiphase single flash method can be used to derive true estimates of Fm', PSII and ETR in a flash time duration of approximately 1 s.
- The traditional rectangular single flash method leads to large under-estimates of Fm', PSII and ETR, especially at higher light intensities.
- For the first time, this new approach allows both rapid and valid determination of the rate of photosynthetic electron transport in conditions where Fm' is difficult to saturate, or when leaf physiological and environmental status is changing rapidly (e.g. field conditions).