PhenoVation
Life Sciences

Correlation CF2GO systems

Why we calibrate

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Short introduction

The CF2GO cameras are powerful instruments capable of measuring photosynthetic parameters in real-time, which is crucial for gaining insight into plant health and performance. To ensure reliable and consistent data, system calibration is essential. Calibration is always an important step for all measuring instruments, as electronic systems inevitably introduce some noise and variation between different units. To calibrate the CF2GO devices, a calibration tile is used that emits a constant and high level of fluorescence. This allows us to synchronize the camera shutter of each system with microsecond precision to match the light pulses, minimizing discrepancies between devices.

In this report, we compare the data from two different CF2GO cameras to assess how well the measurements correlate after calibration.

To compare the CF2GO systems, a setup was built (Figure 1). A Pilea involucrata plant was used as the test plant, positioned 60 cm below the cameras. Each day at 6:35 AM, a blue LED light turned on and stayed on until 6:35 PM, resulting in a 12-hour light period. The room was shielded from external light. Every 30 minutes, one of the two CF2GO systems performed an OJIP measurement using a saturation pulse of ~3500 µmol. The CF2GO systems could not measure simultaneously, as the light flashes would interfere with each other's measurements.

The Fv/Fm values from both systems followed the same trend over a period of 4 days (Figure 2). The average deviation between the two systems across all data was 0.61%. The average deviation during the night was 0.10%. During the light period, it was 1.38%. However, it was observed that during the first measurement of the day, the value from CF2GO 18 was lower than that of CF2GO 19. At these points, the average deviation was 7.68%. This deviation can be explained by the time the plant needs to adapt to the light. The measurement was scheduled 25 minutes after the light turned on and showed an average Fv/Fm value of 0.50, while the next measurement (by the other CF2GO, after 55 minutes) gave a value of 0.54. This is the effect of plant adaptation. The average deviation between the systems during the light period, excluding the first measurement, was 0.60%. The average deviation across all data, without the first measurement, was 0.35%.

The data points from both systems were closely aligned, as shown in the correlation graph (Figure 3). The regression line through these points had an R^2 value of 0.9875 for all data. Without the first measurement of the day, this R^2 value was even closer to 1, namely 0.9911 (Figure 4).*

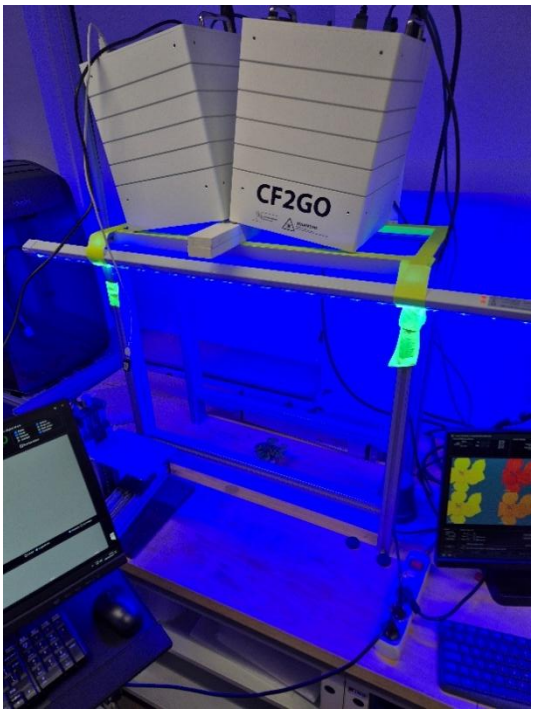

Figure 1: The setup of two CF2GO systems, each performing an OJIP measurement every 30 minutes in alternating turns

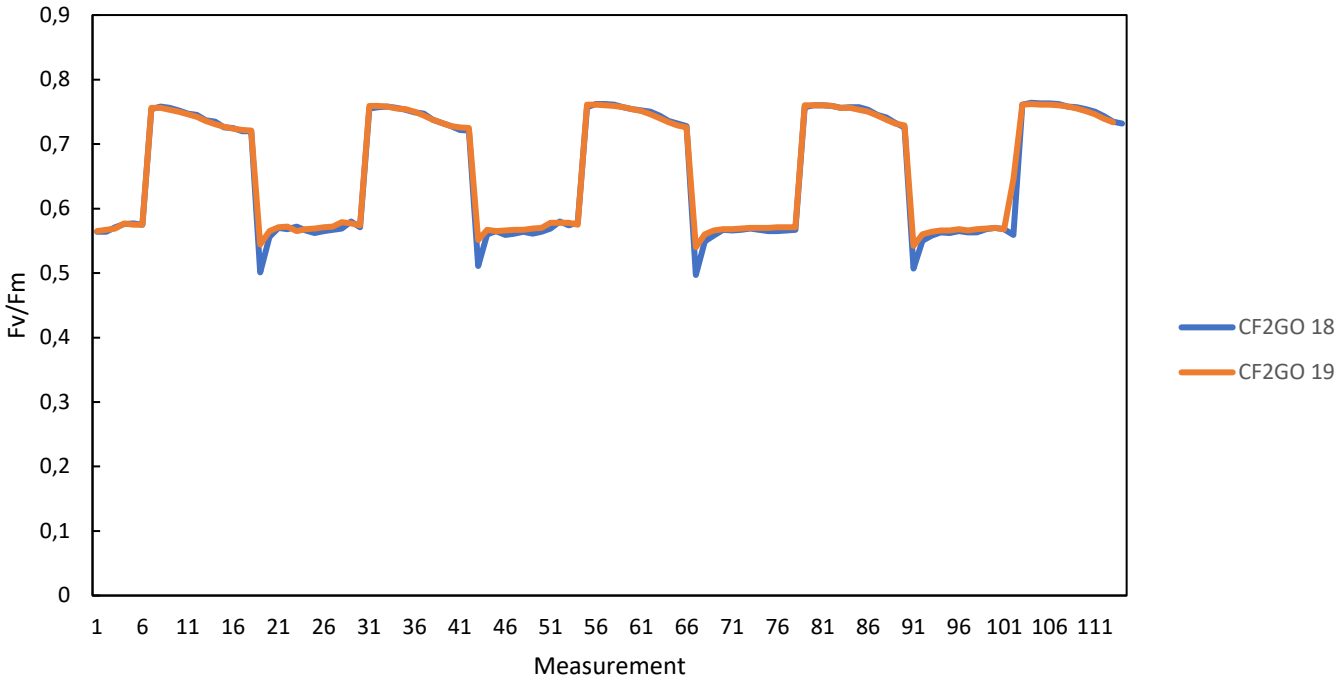

Figure 2: Fv/Fm values from both CF2GO systems over a period of 4 days. The dip in Fv/Fm during the first measurement after lights-on is a plant adaptation effect.

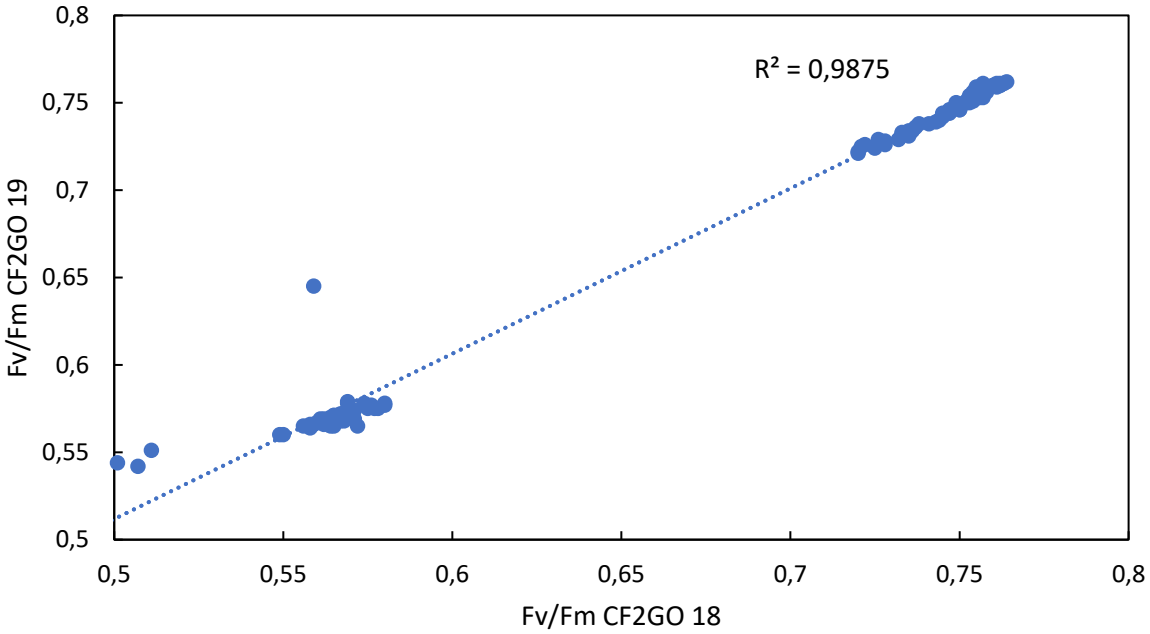

Figure 3: Correlation graph with all data from CF2GO 18 and CF2GO 19. A linear regression line is plotted through the data points. The R^2 value indicates what percentage of the variation can be explained by the linear relationship between the two systems.

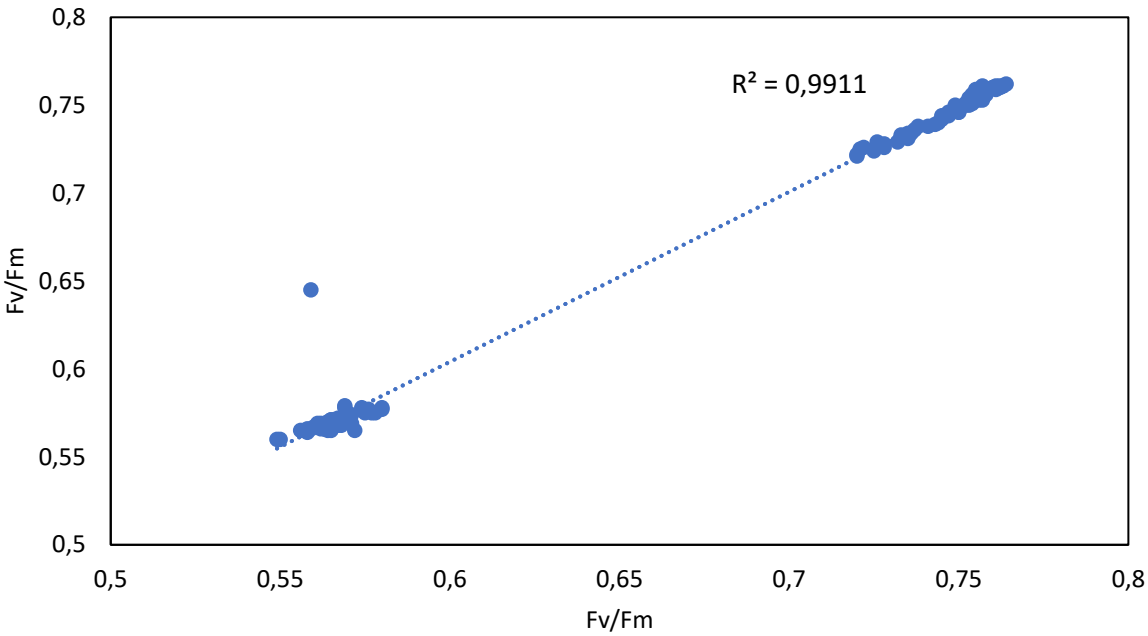

Figure 4:Correlation graph with data from CF2GO 18 and CF2GO 19, excluding the first measurement of the day. A linear regression line is plotted through the data points. The R^2 value indicates what percentage of the variation can be explained by the linear relationship between the two systems.

Conclusion

Calibration is important to minimize the inevitable noise introduced by electronic systems. Measurements between two CF2GO systems showed that the average deviation between their data was 0.61%. The data from the two systems displayed a high degree of correlation, as indicated by the R^2 value of 0.9875 from the regression line. The first measurement of the day was affected by the plant's adaptation time to light, despite a 25-minute adaptation period. Excluding this first measurement, the average deviation across all data was 0.35%, and the regression yielded an R^2 value of 0.9911.