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Analysis of Plant Bioelectric Potential Response to Illumination by Curve Fitting

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Measurement of plant bioelectric potential is one of the promising methods for evaluating plant activities. For example, the photosynthetic rate can be evaluated using the amplitude of the potential response to illumination. In our previous work, we found that this potential response consisted of two potential variations due to photochemical and carbon-fixation reactions. These reactions are important parts of the photosynthetic reaction. However, these potential variations may overlap each other. In this case, a waveform of the potential response differed variously, and it was difficult to evaluate the photosynthetic rate using its amplitude. Therefore, we performed curve fitting for estimating and separating these overlapped potential variations. First, we defined f_1 and f_2 as functions to represent the potential variations due to the photochemical and carbon-fixation reactions, respectively. Additionally, we modelled the potential response to illumination as $F = f_1 + f_2$ and we fit F to the original data of the potential response. As a result of curve fitting, F fit to the original data of the potential response very well. The amplitude of f_2 strongly correlated with the photosynthetic rate. This result suggested that information on the photosynthetic rate was recovered by curve fitting. We consider that this method can be applied to a more accurate evaluation of the photosynthetic activity using the bioelectric potential of the plant.

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