Leaf day respiration: more than just catabolic CO 2 production in the light

Guillaume Tcherkez[1], Cyril Abadie[2], Corentin Dourmap[1], Julie Lalande[1], and Anis Limami[1]

[1]Institut de Recherche en Horticulture et Semences
[2]Ecophysiologie et Genomique Fonctionnelle de la Vigne

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Abstract

Illuminated leaves assimilate CO $_2$ via gross photosynthesis and liberate CO $_2$ via photorespiration and 'day respiration', often denoted as R_d. Day respiration is a minor CO $_2$-exchange component of net photosynthesis but is important for carbon use efficiency, computations of internal conductance, or the interpretation of net photosynthetic $^{12}C/^{13}C$ fractionation. Unfortunately, there is no simple method to measure R_d and tracing the origin of C-atoms found in day-respired CO $_2$ is difficult. As a result, a common misconception is that day respiration is simply a catabolic, CO $_2$-producing flux through ordinary catabolism (glycolysis and Krebs 'cycle'). In the past few years, considerable progress has been made in our understanding of day respiration. It appears that R_d is a net flux resulting from several CO $_2$-generating and CO $_2$-fixing reactions, not only related to catabolism but also to anabolism (biosyntheses). In addition, there is now direct evidence that decarboxylating reactions are partly fed by carbon sources disconnected from current photosynthesis and this effect has consequences for isotopic mass-balance. Therefore, leaf day 'respiration' is much more than just CO $_2$ production by respiratory catabolism. Rather, it reflects whole metabolic orchestration of leaves from N fixation to secondary metabolism and it perhaps deserves another name, such as "day decarboxylations".

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