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Editorial

Calorespirometry: A Promising Method for Plant Ecophysiology Research

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Metabolic activities produce the required energy for biochemical processes in living tissues. In plants, metabolic activity has commonly been assessed by measuring the rate of CO_2 evolution or O_2 consumption in the dark (dark respiration). However, these measures may not reflect the total metabolic rate accurately because some intermediates of respiratory carbon metabolism can be diverted into synthetic reactions and never appear as CO_2, and the energy use efficiency and temperature dependency of different synthetic pathways using respiratory products varies [1,2]. A more accurate assessment of total metabolic activity and respiration in plants can be made through measuring tissue's metabolic heat production (*Rq*), which reflects total metabolism with an emphasis on the oxidative reactions. This makes *Rq* a more general and informative measure of respiration rate than is CO_2 production or O_2 consumption rate [3]. Measures of *Rq* per unit of CO_2 evolution or O_2 consumption (Calorespirometry) can then be used to detect thermodynamic efficiency of metabolic reactions and quantify catabolic and anabolic components of respiration and their ratio to determine if a plant is experiencing favorable conditions and growing or if it is stressed and in decline. If the efficiency of metabolic activity is assumed to be homogeneous within a plant species, then under optimum environmental conditions when resources (e.g., light, temperature, CO_2 concentration, moisture, nutrients) are not limiting growth, *Rq* should indicate the sink activity in converting photosynthate to structural components or realized growth, and thus, differential growth potential of different genotypes within a species [1,4].

Calorespiromerty has been used successfully in a number of fields such as entomology [5] but its use in plant sciences and main stream plant ecophysiology journals has been limited compared to the use of gas exchange measurements. Calorespirometry is a promising method that can be used in many different fields of plant, soil, and animal sciences. For instance, it can be used in plant sciences to measure metabolic rate in leaf, stem, and root tissues to test hypotheses regarding determinants of growth potential, availability of the source (CO_2, light, nutrients) versus activity of the sink, genotype screening, stress (air pollution, temperature, cold, water, etc.) indicator (inefficient respiration), seed quality, etc. The Calorespirometry theory and methodology are thoroughly discussed by Hansen et al. and Wadsö, Hansen [6,7].

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