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This Week's Citation Classic

Jackson W A & Volk R J. Photorespiration. *Annu. Rev. Plant Physiol.* **21**:385-432, 1970. [Dept. Soil Sci., North Carolina State Univ., Raleigh, NC]

Current evidence, based on carbon dioxide and oxygen exchange measurements and on studies of glycolate metabolism, reveals a marked difference between photorespiratory and dark respiratory processes. Some of the assumptions involved in the gaseous exchange estimate of photorespiratory rates are examined. [The *SCI*® indicates that this paper has been cited over 250 times since 1970.]

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"When we were asked to prepare this review, it had been clearly established that the respiratory activity of green leaves during illumination (photorespiration) differed from dark respiration, and that plant species differed, at least quantitatively, in their photorespiratory behavior. Most of the evidence had been obtained from various CO_2 measurements. Some evidence was also available from studies of O_2 transients upon illumination or darkening, and from a few studies of $^{18}O_2$ uptake. It further had become clear that the initial CO_2 fixation process in photosynthesis differed appreciably among plants, permitting their separation into C_3 and C_4 species. Estimates of photorespiration of the C_4 species gave values significantly less than those of the C_3 species, providing a rationale for the former being more efficient in net photosynthesis. Anatomical differences between C_3 and C_4 species at the cellular and subcellular level had been described. Many details of the metabolic conversions and transport events responsible for the C_3 and C_4 photosynthetic processes had been established, as well as those involved in the photorespiratory processes.

"We therefore attempted to bring these various observations together. We first presented an elementary view of the fluxes of CO_2 among the various leaf components. The primary emphasis in this section was that all estimates of photorespiration involved certain assumptions which were likely to provide minimal estimates of the true rates. We then summarized a number *of* O_2 exchange studies because we felt they revealed some insights not afforded by the more commonly used CO_2 procedures. Finally, we attempted to describe the biochemical evidence concerned with glycolate metabolism in sufficient detail to be related to the physiological studies of photorespiration.

"There was no exceptional insight involved in all this. We feel that the paper has been cited frequently because it appeared at a time when enough ground had been plowed to excite the interest of scientists in a number of fields. For the physiologist, photorespiration had become recognized as a major component of the activity of green leaves, and techniques and concepts were now available to examine the process and its interrelationship with other processes. Taxonomists, ecologists, and anatomists were all drawn in, and biochemists greatly expanded their study of organelle metabolism and the transport of substrates and products into and out of various organelles as they worked out the metabolic pathways. Agronomists also were becoming interested in photorespiration and the differences in photosynthetic efficiency between C_3 and C_4 species as concerns about the increasing world population and potential world hunger were emerging. This surge of research activity in many different areas coincided with the appearance of the review and is in our opinion the dominant reason for its frequent citation. An additional factor was its publication in a review series commonly examined by scientists having both direct and peripheral interests in plant physiology. A more recent review has been prepared by Chollet and Ogren."[1]

1. **Chollet R & Ogren W L.** Regulation of photorespiration in C_3 and C_4 plants. *Bot. Rev.* **41**:137-79. 1975.