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This Week's Citation Classic

Neales T F & Incoll L D. The control of leaf photosynthesis rate by the level of assimilate concentration in the leaf: a review of the hypothesis. *Bot. Rev.* **34**:107-25, 1968. [Botany Sch., Univ. Melbourne, Parkville, Victoria, Australia]

The photosynthetic rate of leaves normally seems to be less than the potential maximum rates. This 1968 review examined the evidence for the proposition that a buildup of photosynthetic products, perhaps induced by low growth rates, regulated leaf photosynthetic rate. [The *SCI*® indicates that this paper has been cited over 145 times since 1968.]

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"Like real genius, a 'classic' scientific paper is extremely rare and this review of a topic that interested us 13 years ago certainly does not remotely qualify. However, although this might be an example of the abuse[1] of the *Science Citation Index*® *(SCI*®*),* it is difficult to resist an invitation to comment on a paper which both an editor of, and a surreptitious glance at, the *SCI* tell us has 'sold' as well as any of our efforts. Why, we are asked, do we think this is so?

"At that time it was beginning to be fashionable to use gas analysis techniques for studying the factors that affected leaf photosynthesis rates and perhaps, therefore, plant productivity as well. Lynton Incoll and myself were not unaffected by this fashion. A CO_2 I/R gas analyser had been procured for our laboratory on a Wheat Research Grant ('wheat' money was plentiful then) and we were much influenced by Gaastra's[2] pioneering paper of 1959. Therefore we worked on the constraints of leaf photosynthesis in wheat. Also, in the mid 1960s, there was much airing of what we (privately) called the 'constipation hypothesis': that the products of leaf photosynthesis could accumulate and, if not translocated and used for growth, might inhibit leaf photosynthesis. Hence, we, too, attempted to prove this hypothesis, or more correctly and according to Popper, at not disproving it.

"We killed the phloem in the petioles of bean leaves with hot wax, we cooled the culms of wheat ears, we excised the tubers from giant artichoke plants that almost took the glasshouse roof off. Our pipe dream was to 'turn' leaf photosynthesis on and off every hour solely by treating the sinks of assimilates or the translocation pathway, as Geiger[3] has also recently attempted, incidently providing a most useful and more up-to-date review of our 1968 topic. We, like Geiger, did not succeed in demonstrating the validity of the hypothesis in the short term, although others claim to have done so. In the longer term (> 3 days) it seems that the photosynthesis rate of a leaf or a plant may be affected by assimilate demand by an indirect and presently obscure (perhaps hormonal) mechanism.

"Like all good experimental scientists we carefully read 'the literature' after doing experiments that had stimulated our interest. Why not write it up? The editor of *Botanical Review* accepted our manuscript with a pleasing lack of fuss. (We had previously learned that reviews to the *Annual Review of Plant Physiology* are only by invitation.)

"Why was this review to live a reasonably successful life in Citation Index terms? We guess it was because it was then topical, relating as it did to the wider issue of plant productivity; it was perhaps also reasonably readable, and it had a good first sentence."

1. **Garfield E.** Citation indexing for studying science. *Nature* **227**:669-71, 1970. (Reprinted in: **Garfield E.** *Essays of an information scientist.* Philadelphia: ISI Press. 1980. Vol. 1. p. 133-8.)
2. **Gaastra P.** Photosynthesis of crop plants as influenced by light, carbon dioxide, temperature, and stomatal diffusion resistance. *Med. Handb. Wageningen* **59:**1-68, 1959.
3. **Geiger D R.** Effects of translocation and assimilate demand on photosynthesis. *Can. J. Bot.* **54**.2337-45. 1976.