

## Photosynthate Partitioning into Starch in Soybean Leaves—Commentary

Chatterton NJ, Silvius JE (1979) Photosynthate partitioning into starch in soybean leaves: I. Effects of photoperiod versus photosynthetic period duration. *Plant Physiol* **64**: 749–753

This article examined the effect of photoperiod versus photosynthetic period duration on the accumulation of leaf starch. The goal was to discriminate between the hypothesis that starch accumulation results from a limitation in synthesis and translocation of Suc and a competing hypothesis that starch synthesis was programmed by the energy demand of the diurnal dark period. The results by Chatterton and Silvius clearly showed that starch synthesis was programmed to provide enough starch to support respiration during the dark period, at the expense of growth. I thought that this was an exciting insight into the existence of a complex regulatory system that could anticipate demand for carbon. I was also interested in the topic because of a body of loosely related earlier work showing that CO<sub>2</sub> enrichment led to long-term down-regulation of photosynthesis. One of the ideas to explain the negative effects of CO<sub>2</sub> enrichment was that the short-term stimulation of photosynthesis by CO<sub>2</sub> caused increased carbon flux or accumulation that in turn led to a signal that repressed expression of components of photosynthesis such as Rubisco. I had the idea that these apparent regulatory systems might be related and concluded that it would be very useful to be able to vary the

amount of starch and Suc accumulation through genetic manipulations. This led to a collaboration involving my graduate student Tim Caspar and Steve Huber at North Carolina State University in which we isolated and characterized a starch-deficient mutant that has since been widely used for the kinds of studies that we envisioned would be possible (Caspar et al., 1985). Jack Preiss moved to Michigan State University at about that time and we had an enjoyable collaboration in which we subsequently characterized some other starch deficient and starch hyper-accumulators. One of the most interesting phenomena that we observed in those studies has never been adequately explained as far as I am aware (Caspar et al., 1989). In brief, when the starchless mutants were grown in a 12-h photoperiod, we observed that a  $\beta$ -amylase was induced about 40-fold. However, growth in continuous light completely suppressed the effect.

### LITERATURE CITED

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- Caspar T, Lin TP, Monroe J, Bernhard W, Spilatro S, Preiss J, Somerville C (1989) Altered regulation of  $\beta$ -amylase activity in mutants of *Arabidopsis* with lesions in starch metabolism. *Proc Natl Acad Sci USA* **86**: 5830–5833

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