

This Week's Citation Classic

Hageman R H & Flesher D. Nitrate reductase activity in corn seedlings as affected by light and nitrate content of nutrient media. *Plant Physiol.* **35**:700-8, 1960. [Dept. Agronomy, Univ. Illinois, Urbana, IL]

Both light and substrate, nitrate, are required for the formation (induction) of nitrate reductase in leaves of young maize seedlings. Light was also required for maintenance of nitrate reductase in seedlings well supplied with endogenous nitrate. Correlations between activity and changes in protein content indicated that the *in vitro* activities reflected *in situ* activities. [The *SCI*[®] indicates that this paper has been cited over 165 times since 1961.]

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"This work was undertaken to explain why light enhances nitrate assimilation in green leaves. The study was based on published reports, especially those of Tang and Wu¹ and Candella *et al.*,² that nitrate reductase was substrate inducible and related findings made in 1957-58 by two of our graduate assistants, Almut Gitter and J.W. Knipmeyer. Roy Waygood, a visiting scientist, provided helpful suggestions in designing the experimental techniques.

"Although the results obtained were important and interesting they did not fully meet the objective. The finding in 1974 that oxygen prevents nitrate assimilation in green leaves, in the dark, has provided the critical clue needed to understand the regulatory effects of light on nitrate assimilation.³ The full explanation is currently being developed.

"In writing this, it became obvious how dependent I have been on the

work of others, even though I normally am not very aware of this fact. Therefore it seems pertinent to insert a 'plug' for the Institute for Scientific Information[®] and *Current Contents*[®] in the role they play in supplying the information needed to 'keep up with the Joneses.'

"No obstacle was encountered during the course of the experiment; however the finding that nitrate metabolism exhibited a diurnal pattern ultimately developed into a major problem. While it is easy to find assistants who are willing to sample from noon to midnight it is more difficult to find early morning risers.

"The frequency of citation may be attributed to the following reasons: a) The experiments were simple and direct and the results unequivocal, b) The appearance of the article was timely. The work showed that both light and substrate were involved in induction of the enzyme and that the measured activity was related to the accumulation of protein by the plant. The concurrent, and subsequent development of physiological and biochemical techniques for studying the characteristics of isolated enzymes, the inductive process including involvement of nucleic acids, the role of substrate in induction, reductant supply and light, and the close relationship between nitrate supply and grain yield, led to a proliferation of research and publications on nitrogen metabolism. Agronomic research in nitrogen metabolism was also increased as nitrogen fertilizer became increasingly available and the relationship between grain yields and nitrogen supply was fully recognized. This article provided a starting point or was in some way related to this ongoing work."

1. Tang P S & Wu H Y. Adaptive formation of nitrate reductase in rice seedlings. *Nature* **179**:1355-6, 1957.
2. Candella M I, Fisher E G & Hewitt E J. Molybdenum as a plant nutrient. X. Some factors affecting the activity of nitrate reductase in cauliflower plants grown with different nitrogen sources and molybdenum levels in sand culture. *Plant Physiol.* **32**:280-8, 1957.
3. Canvin D T & Atkins C A. Nitrate, nitrite and ammonia assimilation by leaves: effect of light, carbon dioxide and oxygen. *Planta* **116**:207-24, 1974.