

# This Week's Citation Classic

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**Barber S A.** A diffusion and mass-flow concept of soil nutrient availability.  
*Soil Sci.* 93:39-49, 1962.  
[Purdue University, West Lafayette, IN]

This paper develops a new concept of soil nutrient availability based on the flow of nutrients through the soil to the root by mass-flow and diffusion. Autoradiographs are used to verify that these two processes govern the supply of nutrients. [The *SCI*<sup>®</sup> indicates that this paper has been cited over 140 times since 1962.]

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Stanley A. Barber  
Department of Agronomy  
Purdue University  
West Lafayette, IN 47907

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"This paper resulted from a fortunate sequence of events. I was conducting a soil fertility research program at Purdue University. Research in this area at the time was largely applied and I wanted to get a more basic understanding of the events occurring. One of my students, John Walker, and I decided to try to measure nutrient concentration in the soil around a plant root with autoradiographs. We were very successful. The first autoradiograph was more dramatic than many to follow. It convinced us that diffusion was important. At that point, I took a sabbatical leave to study with Hans Jenny at the University of California, Berkeley.

While there, I continued investigating root-clay interactions with autoradiographs and obtained convincing evidence for mass-flow. Being on sabbatical gave me time to formulate theories and test them on colleagues. A sabbatical at that point in my career was a very profitable event. I had been asked to write a paper on my research for *Soil Science* as part of a special issue from Purdue University. This request couldn't have come at a better time. It stimulated literature searches and the building of concepts of soil nutrient availability and brought out the paper sooner.

"The autoradiographs in this paper have since been reproduced in many books. This article also stimulated others to begin research with this new approach to soil nutrient availability. As a result of this research, I was given the Soil Research Award of the American Society of Agronomy in 1974. This research has also continued with the development of a mathematical model describing the processes<sup>1</sup> and a verification of the model for accurately predicting both potassium and phosphorus uptake<sup>2</sup> by plants growing in soil. The key to my success, I believe, was that I was not frightened by the system's complexity. I kept the concept as simple as possible, and only added complexity when simple concepts didn't give the required answer. I believe this paper was cited often because it was a new approach."

1. Claassen N & Barber S A. Simulation model for nutrient uptake from soil by a growing plant root system. *Agronomy J.* 68:961-4, 1976.
2. Schenk M K & Barber S A. Phosphate uptake by corn as affected by soil characteristics and root morphology. *Soil Sci. Soc. Amer. J.* 43:880-3, 1979.