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**Studies on the Photosynthetic Carbon Acquisition of
Azolla-Anabaena Symbiosis**

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Abstract

Azolla spp. is small ferns floating on water surfaces. They contain cyanobacterial microsymbionts (*Anabaena azollae*) in leaf cavity are able to fix elemental nitrogen. The combination of photosynthetic acquisition of carbon and energy and biological nitrogen fixation provides a basis for potentially high productivity of the symbiotic system. Consequently, *Azolla* have been used for centuries to fertilize rice paddies without need for supplementary manure. When combined with urea as a fertilizer, *Azolla* layers reduce the volatilization of ammonia originating from urea hydrolysis by decreasing the pH of floodwater. This effect is accomplished by reduction of algal photosynthetic activity during the day. More insight into the physiology of *Azolla* system and into the interactions between *Azolla* and *Anabaena* may increase the benefit from using *Azolla* in agriculture and in this way contribute to a sustainable land use. Photosynthesis is the ultimate source of ATP and reductant required for nitrogen fixation and there is a close relationship between both processes. Thus carbon fluxes into and out of *Azolla* and between the symbiotic partners are of interest. Studying *Azolla carolinia* and *A. pinnata* var. *imbricata* involving the measurement of ¹⁴C incorporated from ¹⁴CO₂ into symbiotic *Anabaena* filaments and *Azolla* tissues, we found that less than 15% of the fixed carbon in the system was located in the *Anabaena*. KAPLAN and PETERS (1988), comparing net photosynthesis rates of symbiotic association and *Anabaena*-free *Azolla* plants, suggested that *Anabaena* contributes little to carbon fixation. Sucrose is assumed to be the photosynthetic product transferred from *Azolla* to *Anabaena* (KAPLAN & PETERS, l.c.). Some approaches to verify the existence of carbon metabolism in *Anabaena* symbionts are presented.

Keywords: *Azolla*, carbon acquisition