S-05

A proteomic view of symbiotic nitrogen fixation efficiency in *Bradyrhizobium elkanii*

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Rhizobia bacteroids colonize legumes and reduce N_2 to NH_3 in root nodules. The current model is that bacteroids avoid assimilating this NH_3. Instead, the legume forms glutamine from it, the nitrogen of which is returned to the bacteroid as leucine, isoleucine, valine, dicarboxylates, and peptides. In soybean cells surrounding bacteroids, it is thought that the glutamine also is converted to ureides for systemic transport. One problem for soybean cultivation is N_2 fixation inefficiency, the biochemical basis of which is unknown. Here, the proteomes of *Bradyrhizobium elkanii* bacteroids isolated from N_2 fixation-efficient Peking and inefficient Williams 82 soybean nodules were analyzed by quantitative mass spectrometry. Nearly half of the encoded proteins were interrogated. The results reveal that efficient bacteroids from Peking produced greater amounts of enzymes to form Nod factors to maintain symbiosis. Bacteroids from Peking and Williams 82 had no significantly altered accumulations of nitrogenase, but efficient bacteroids had increased signaling proteins, transporters, and enzymes needed to generate ATP to power nitrogenase, to acquire resources, and to sustain their metabolisms. Parallel investigation of nodules revealed that Peking had no greater accumulation of enzymes needed to assimilate nitrogen. Instead, efficient bacteroids had increased amounts of enzymes to produce all amino acids, including glutamine, and to form ureide precursors. These results support a model for efficient symbiotic N_2 fixation in soybean where the bacteroid assimilates $NH_3$for itself and its partner.