Improving agriculture through plant and microbial interactions

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Background: Nitrogen (N) limitation is a primary cause for low plant yields in agricultural systems worldwide. A common solution for N-limitation is to apply inorganic fertilizers but, unfortunately, over-application leads to N-enriched, poor quality waterbodies. However, some plants, like soybeans, associate with beneficial microbial communities that synthesize N for them, through a process called N-fixation (taking atmospheric N_2 and making it available to the plant). Plants attract beneficial microbes by providing carbon (food) and receiving N (and other nutrients) in return. Recent studies suggest that some grasses also associate with N-fixing bacteria. Identifying what plant characteristics influence plants' associations with N-fixing microbes has important implications for advancing agricultural sustainability and reducing reliance on water-contaminating inorganic fertilizers.

Native prairie grass species, such as Switchgrass (*Panicum virgatum*), are being considered for bioenergy production on marginal or unproductive, N-limited landscapes. Switchgrass has unique strategies that help it grow in N-limited conditions, such as associating with N-fixing bacteria and saving its N stores for the next season (N resorption). Studies show that microbial communities vary beneath different plant species and diversity plantings (a monoculture verses a diverse prairie). To understand plant-microbial interactions that could improve plant productivity, we will investigate the relationship between N-cycling dynamics, plant traits, and their associated microbial communities.

Project: I am excited to work with an undergrad student to develop an independent project that suits both of our interests. There are several questions that can be developed and pursued within this topic, including the role of intra- and inter-specific plant diversity on microbial communities, N-strategies in switchgrass plants, or the effects of marginal soils (N-limited and drought-prone) on plant-microbial interactions.

Expectations: The KBS REU Program is 11 weeks long and will run from May 21 – August 5, 2017. This will be a full-time (40+hrs/week) research position and compensation includes a summer stipend, travel expenses up to $500, and free room and board. The student should expect to spend 2-3 days/week in the field and the other days developing their microbial ecology lab skills. The Evans lab has a broad range of microbial ecology projects and the student will have the opportunity to work and interact with a larger, collaborative group and learn new skills outside of their project. The student should enjoy outdoor field work, contributing to team efforts, paying attention to details, and solving problems through creativity and perseverance.