Optimizing Tradeoffs Implicit During Bioenergy Crop Improvement: Understanding the Effect of Altered Cell Wall and Sugar Content on Sorghum-associated Pathogenic Bacteria

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Project Goals: The primary goal of this project is to understand the effect of altered cell wall and sugar content on plant susceptibility phenotypes. To accomplish this goal, sorghum and *Xanthomonas* will be established as a model pathosystem.

High-biomass-yielding crops may harbor modifications to cell walls, which are a major barrier to pathogen entry, and to the tissue distribution of sugars, which are the pathogen's food source; hence they are likely to present previously unseen challenges for disease resistance. *Xanthomonas* is a known pathogen of sorghum (*Sorghum bicolor* (L.) Moench), though the incidence and impact of the disease has historically been low. We are working to establish the sorghum – *Xanthomonas* pathosystem as a model for deducing how latent microbial pathogens might exploit key biofuel crop traits. Our approach will be to quantitatively model the disease triangle that describes sorghum, pathogenic bacteria, and the environment. Field and laboratory experiments will be combined to determine bacterial susceptibility of genetically diverse sorghum genotypes that differ in cell wall and sugar composition. Standard plant pathology techniques combined with powerful phenomics approaches will provide a holistic view of this pathosystem within variable environments. Further, transcriptomics will be employed to elucidate mechanisms used by bacterial pathogens to induce sorghum susceptibility. Microbial pathogens are known to manipulate the sugar and cell wall characteristics of their hosts. Consequently, these characteristics will be analyzed during pathogen invasion. This research will reveal the mechanisms underlying tolerance to pathogens that must be maintained during biofuel trait optimization. The proposed research will yield a detailed understanding of the impact of bioenergy relevant traits on pathogen susceptibility. This is a necessary first step towards the development of novel routes for disease control that can be deployed in parallel with targeted alterations to sugar and cell wall composition during bioenergy crop improvement and breeding efforts.

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