Engineering Continuous Trait Variation in Bioenergy Feedstocks to Optimize Growth on Marginal Lands

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Bioenergy crops constitute an important renewable source of raw material to produce fuels and chemicals. To be economically viable without competing with food and feed crops, these crops must be able to grow in soils with low water and nutrient contents. Sorghum has great potential as a bioenergy crop due to its high biomass yield and drought tolerance. However, new varieties are needed to tolerate increasing water, nutrient, and temperature stresses caused by climate change. A commonly used approach to generate improved yield and stress tolerance in sorghum relies on genetic analysis of large sorghum populations, which takes a long time. Furthermore, relatively little is known about the traits involved in abiotic stress tolerance, hindering crop improvement through breeding and genetic engineering. This research will develop a novel approach to understanding and optimizing root architecture traits. Synthetic biology strategies will be used in sorghum and a model grass to generate a series of plants with increasing root depth or branch density. Engineered plants will be studied to understand the roles of root features in stress resilience. With these tools, this project will accelerate the development of optimal bioenergy crop varieties and contribute to the establishment of a vigorous bioeconomy, ensuring energy stability in the face of a changing climate.

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