Monolignol based molecular heaters to combat cold stress in crops

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ABSTRACT

Monolignols like *p*-coumaric acid, caffeic acid, and ferulic acid have systemic benefits in plants, such as the protection of wounded sites against insect and fungal infestation as well as natural immune response to viral and bacterial pathogens. Recently, promising research have found that lignin can also help combat abiotic stress, *in vivo*, specifically against unexpected drops in temperature during early planting or late harvest stages. This study focuses on temporarily relieving cold stress during early planting of crops via exogenous application of lignin derivatives. Sinapyl alcohol derivatives were applied to commercial cotton and grain sorghum varieties, at the four-leaf stage, after exposure to 10 °C. Compared to the untreated control, cotton seedlings sprayed with 0.1% of monolignol derivatives exhibited 40% increase in seedling height and 3X increase in photosynthetic assimilation. Sorghum seedlings, which were more susceptible to cold stress, exhibited a 38% increase in plant height and a 2X increase in chlorophyll content. Thus, if commercially feasible, these monolignol derivatives can offer significant crop protection against unpredictable cold-weather events. In the context of circular economy, this presentation will also expound on extracting β-O-4 linkages-preserved lignin from semi-arid crop residues and using the same for developing exogenous crop stimulants.