190. Improving Cold Tolerance in Lowland Switchgrass

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Project Goals:
The overall objective of our project is to investigate the effects of arbuscular mycorrhizal fungi (AMF) colonization on freezing tolerance and biomass production, to dissect the abilities of the host plant to interact with AMF and to tolerate sub-zero temperatures into their genetic components, and to identify expression quantitative trait loci (eQTL) for genes that are differentially regulated in upland and lowland ecotypes under cold-acclimatization and/or AMF symbiosis.

Switchgrass is a C4 grass that is native to the North-American prairies, and has potential as a cellulosic feedstock for bioenergy production. There are two ecotypes, upland and lowland, that vary in their predominant ploidy levels, overall morphology and regions of adaptation. The first aim of the project is to unravel the genetic basis of the cold-tolerance that is inherent to upland switchgrass but lacking in lowland ecotypes. Our second aim is to investigate whether colonization by arbuscular mycorrhizal fungi (AMF) provides a degree of cold-tolerance. The observed correlation between AMF levels in clonal genotypes grown in the field in Georgia and Oklahoma indicates that availability to AMF colonization is genetically determined. We have identified F1 sib plants from a cross between the upland genotype VS16 and the lowland genotype AP13 that vary greatly in their levels of colonization by AMF. Two crosses between different high and low AMF sibs have been generated and progeny have been planted in the field in Georgia (1 replicate). Since the F1 sibs carry 1 upland and 1 lowland chromosome, the generated populations should also be segregating for cold-tolerance. Efforts so far have been focused on (1) establishing an efficient protocol for producing large numbers of clonally identical plants which are needed for the freezing tests; (2) optimizing plant cultivation conditions to promote AMF colonization in the greenhouse; (3) initial testing of different freezing temperatures that best differentiate the cold tolerant VS16 and cold sensitive AP13 genotypes; and (4) developing a genotyping- by-sequencing methodology for use in switchgrass, an outbreeding tetraploid. We are now in a position to start the genetic mapping, and ramp up the freezing tests.

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