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Abstract Title: A systematic physiological and morphological evaluation of drought tolerance in forty-nine switchgrass lines

Abstract (250 words or less): Switchgrass (Panicum virgatum L.) is a warm-season C4 grass that is a target lignocellulosic biofuel species. Drought stress is one of the major limiting factors for switchgrass growth. We systemically evaluate the relative drought tolerance based on plant height, leaf length, leaf width, leaf sheath length, leaf relative water content, electrolyte leakage, photosynthetic rate, stomatal conductance, transpiration rate, intercellular CO2 concentration and water use efficiency. Principal component analysis (PCA) and the drought stress indexes of each physiological parameter showed significant differences in the drought stress tolerance of the 49 lines. Heatmap and PCA data showed that in switchgrass, the physiological parameters are more important than the morphological parameters in distinguishing the control and drought treatments. Metabolite profiling data showed that under drought stress, the five best drought-tolerant lines tended to have higher levels of abscisic acid (ABA), spermine, trehalose, and fructose than the five most drought-sensitive lines. Based on PCA ranking value, the lowland lines TEM-SEC, TEM-LoDorm, BN-13645-64, Alamo, BN-12323-69, TEM-SLC and T-2086, and the upland lines BN-10860-61, T-2100, T-2101, Caddo and Blackwell-1 are most drought-tolerant of the lines tested. By contrast, upland lines including Grif Nebraska 28, Grenville-2, Central Iowa Germplasm, Cave-in-Rock, Dacotah and Nebraska 28 were relatively sensitive to drought stress. Molecular marker analysis was employed to determine the genetic diversity among the 49 switchgrass lines. Based on the relationship of physiological responses to drought stress, genetic diversity and metabolic profiling, multiple mechanisms that allow switchgrass lines to respond to drought stress.