

Down-regulation of the HCT gene decreases lignin content and increases digestibility of field-grown alfalfa

Kishor Bhattarai¹, Shanmugam Rajasekar¹, Richard A. Dixon², and

Maria J. Monteros¹

¹Forage Improvement Division, Samuel Roberts Noble Foundation, Ardmore, OK 73401

²Plant Biology Division, Samuel Roberts Noble Foundation, Ardmore, OK 73401

Lignin content in biomass increases recalcitrance to enzymatic degradation thus decreasing animal digestibility and processing efficiency for bioethanol production. Two events (3a and 30a) of hydroxycinnamoyl CoA: shikimate hydroxycinnamoyl transferase (HCT) down-regulated alfalfa lines were evaluated for lignin content and digestibility, biomass processing efficiency, and biomass yield in a field site at Ardmore, OK. The experimental design was randomized complete block with four replications consisting of ten individuals in each replication. Lignin quantification and animal digestibility were performed on the aboveground biomass and the stem portion using NIRS prediction equations. Lignin content and composition was also determined using the acetyl bromide extraction method and visualized in different stem cross-sections using UV microscopy. The HCT down-regulated alfalfa lines had reduced lignin and increased digestibility. Under field conditions, the HCT down-regulated alfalfa lines had reduced biomass yields, although this reduction was event specific. The HCT down-regulated alfalfa lines had reduced flowering, shorter plant height and shorter internode length. Down-regulation of the HCT gene resulted in reduced lignin content thus enhancing the potential value of alfalfa as a forage and biofuel feedstock.