

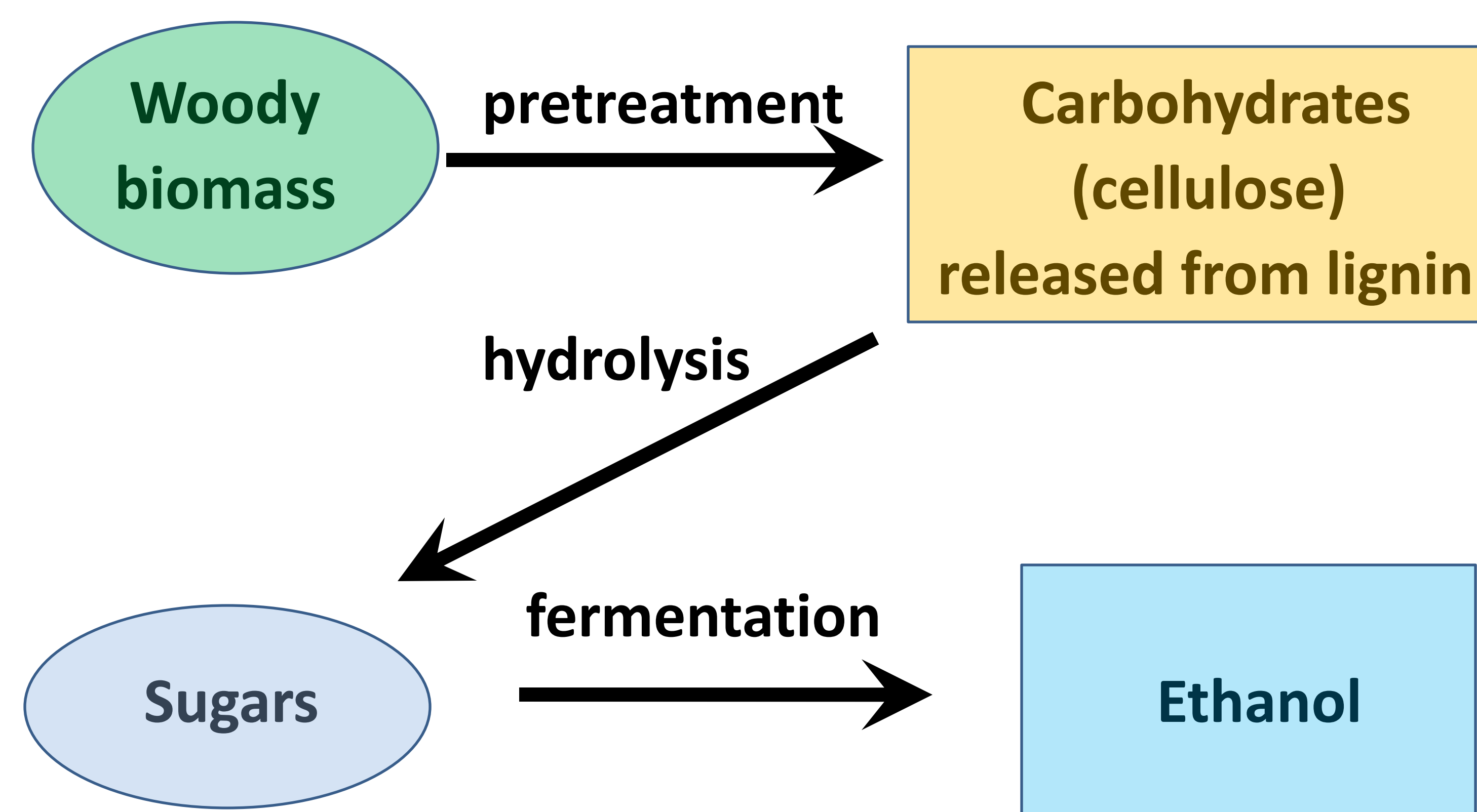
Genetic Potential of Loblolly Pine for Hydrolytic Conversion to Ethanol

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Purpose

Determine the feasibility of using loblolly pine (*Pinus taeda* L.) as a feedstock for ethanol-based biofuels.

This study focuses on the use of loblolly pine in hydrolytic conversion processes, following this general schematic:



- Using loblolly pine for cellulosic ethanol is a challenge given the strong chemical bonds within the wood
- However, loblolly pine is the most productive and widely-planted tree species in the southeastern U.S.
- The ability to use this species for biofuel production will have great value in the push for renewable fuels

Rationale

Wood properties are highly heritable traits and are thought to have significant impacts on conversion yields.

- Different genotypes of loblolly pine should therefore have varying ethanol yields
- Testing different varieties should enable the selection of those well-suited to conversion

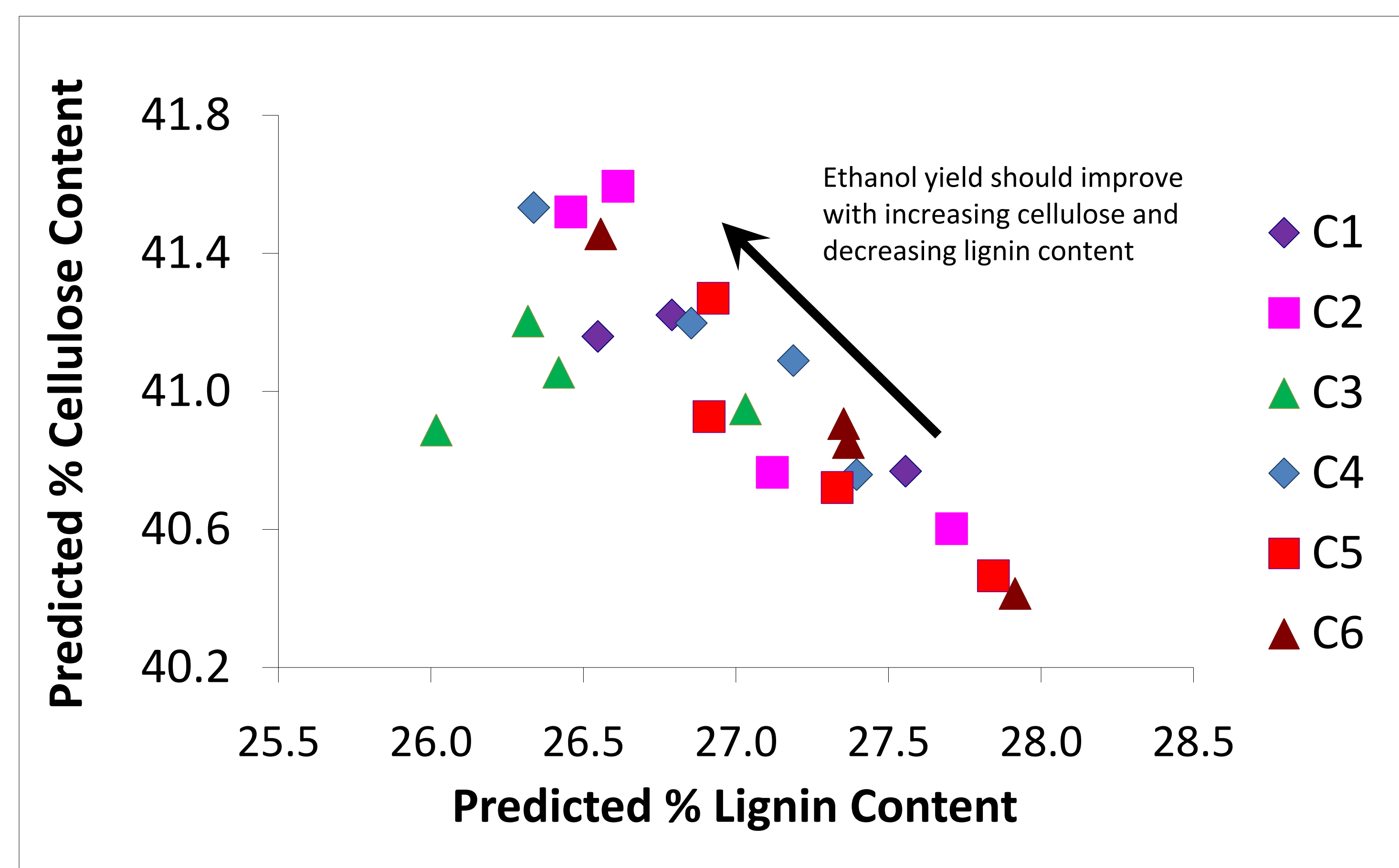


Figure 1. Means of 23 clones for *predicted* lignin and cellulose content. The clones selected for conversion to ethanol represent all six clusters as well as a good cross-section of available variation in lignin and cellulose content. C1 indicates cluster 1, C2 indicates cluster 2, etc...

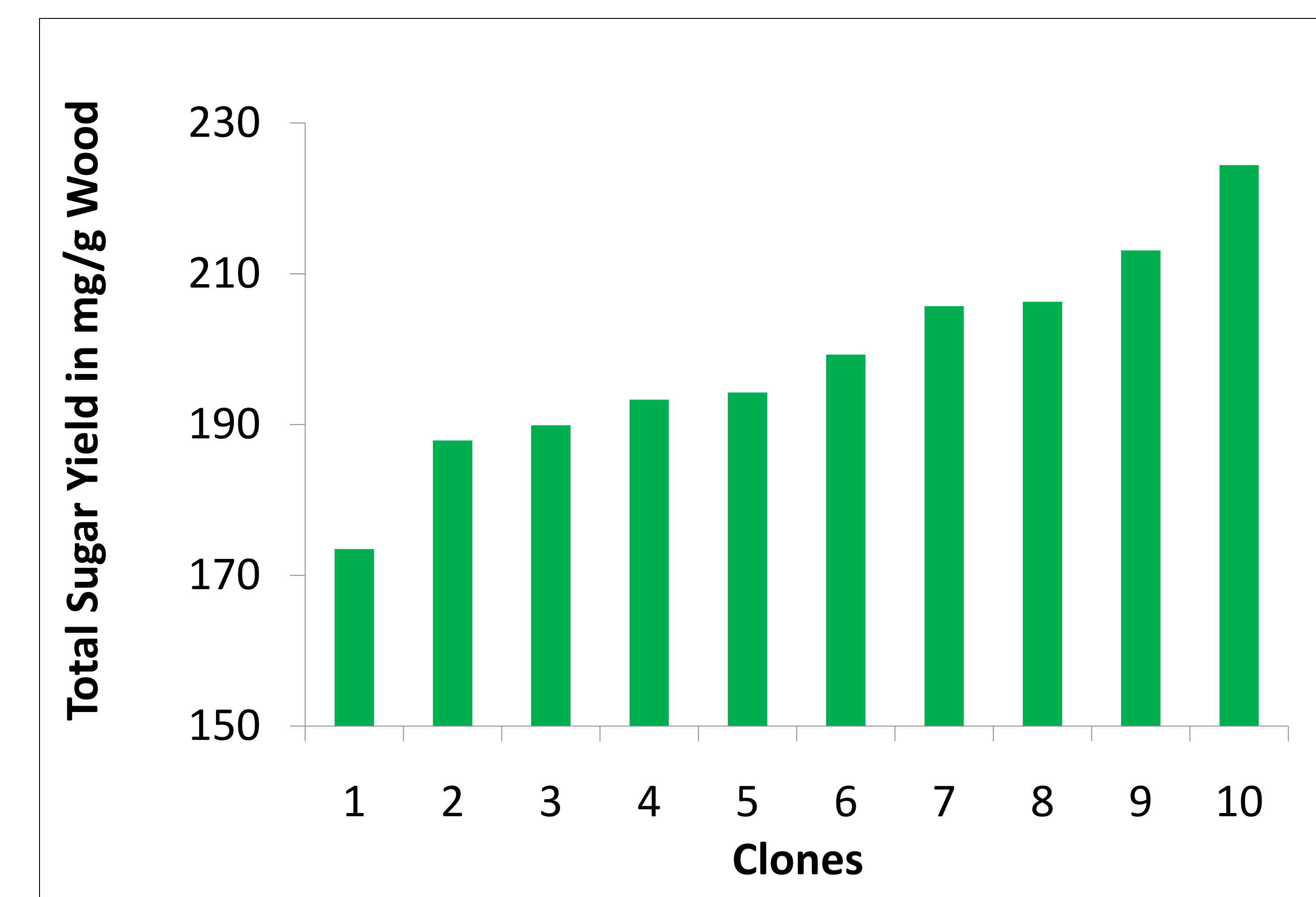


Figure 2. Sugar yields for 10 clones tested to date using a dilute acid pretreatment.

Methods

- Approximately 1700 wood core samples were taken from 187 clonal varieties of loblolly pine
- Cores were dried, ground, and subjected to Near-Infrared Spectroscopy (NIR)
- A subset consisting of 23 clones was selected for conversion to ethanol
- This subset was selected based on: (1) a cluster analysis of the NIR spectra which divided the clones into six different clusters (on the basis that differences between NIR spectra represent differences in wood chemistry) and (2) lignin and cellulose content predictions that were also derived from the NIR spectra (Figure 1)
- The selection of clones for conversion aimed to capture as much of the available genetic variation as possible

Sampled clones are still being tested. The conversion work is being done by associates in the Department of Forest Biomaterials at NCSU.

Preliminary Results

For 10 clones already processed using a dilute acid pretreatment, sugar yields did show substantial variation. The lowest- and highest-yield clones were approximately 13% below and above the mean, respectively. (Figure 2) This variation in sugar yield translates directly into variation in ethanol yield.

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