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IMPROVING EXPLOITATION AND SACCHARIFICATION OF BIOMASS FOR BIOCONVERSION

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Cell wall recalcitrance to enzymatic hydrolysis is the main bottleneck for the industrial scale-up of biomass processing and bioconversion. Our research may help in overcoming the difficulties of converting plant biomass into usable products. Engineering or selecting plants with altered expression of cell wall related proteins may help either breakdown the components of the cell wall or prevent the cell wall polysaccharides from forming cross-links. Pectin contributes to cell wall rigidity through homogalacturonan (HGA) calcium-mediated cross-links. We have demonstrated that saccharification efficiency of dicot and monocot biomass is improved by reducing the amount of acidic HGA domains through the constitutive expression of a fungal polygalacturonase (PG) or the overexpression of a pectin methylesterase inhibitor (PMEI). We show now that an improved saccharification efficiency without affecting biomass production (as observed previously for the constitutive expression of PG) can be obtained through the conditional expression of genes encoding pectin degrading enzymes, for example a bacterial pectate lyase (*pel1*) or fungal PG genes, at selected stages of development using a chemically- or senescence- inducible promoter. We show also that enzymatic saccharification is improved in different Arabidopsis mutants with a lower content of de-methylated stretches of HGA as compared to the wild type. We propose the use of an immunoassay for detecting unesterified HGA levels as a tool to isolate natural variants with improved saccharification efficiency. We are also performing the analysis of the cell wall components of different varieties of tomato, barley, grapevine and wheat, in relation to their different degrees of saccharification. This will help us to identify useful markers for breeding new varieties suited to food and bioenergy purposes.