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Compositional changes and enzymatic cellulose convertibility of grass ensiled at different conditions of inoculation and dry matter concentrations

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The biological biomass preservation method, ensiling shows promise as a mild, cost-effective pretreatment for bioethanol production that could potentially reduce severe hydrothermal treatments for lignocellulosic biomasses. Here, we correlate different ensiling conditions of dry matter (DM) concentrations and silage inoculants with the change in chemical composition and enzymatic cellulose convertibility. *Festulolium* Hykor, a crossbreed of perennial rye grass and tall fescue grass developed and produced by DLF TRIFOLIUM was harvested and ensiled in vacuum bags at DM concentrations of 22, 32, and 42 percent, - and treated with two commercial lactic acid bacteria (LAB) inoculants from Chr. Hansen. At 47 days the silaged grasses were analysed for their biochemical composition and the enzymatic convertibility was measured using commercial enzymes, CTec2 from Novozymes. Analysis of the chemical composition showed that both cellulose and hemicellulose were stored without any losses. Free sugars and oligomer carbohydrates, were consumed by LABs producing organic acids as well as mannitol. Low DM concentrations gave rise to the highest production of organic acids, and also the largest differences between inoculants treatment. At higher DM concentrations the amount of different organic acids showed high similarity. The acidic conditions in the ensilage treatments gave rise to increased enzymatic convertibility of the cellulose compared to that of dried grass. The results showed the importance of having a controlled and efficient ensiling process to reduce the loss of free sugars during storage, thereby increase the bioethanol potential. Additionally, increased convertibility of cellulose can facilitate higher bioethanol yields in following yeast fermentation.