SUNLIBB

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Deliverable 1.7
"Insights into the interactions between yield, drought tolerance and cell wall composition in maize"

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Del No: 1.7	**Deliverable Name:** Insights into the interactions between yield, drought tolerance and cell wall composition in maize			
WP: 1	**Lead partner:** INRA	**Dissemination level:** CO	**Delivery due date (project month):** Month 24	**Actual delivery date:** 09/2014 Month 48

Objective:

The objective of this work was to get insights into the interactions between yield, drought tolerance and saccharification in maize. For this purpose, 17 maize genotypes were cultivated in the south of France (Mauguio) in 2013, under two contrasted water regimes: plants were either irrigated following agronomical customs (2 blocs) or under water stress (3 blocs); in the latter case, irrigation was stopped when the fifth leaf of the plants was fully elongated, until 15 days after flowering of the later genotype. The 17 genotypes were selected because they show a wide range of degradability and lignin content (personal communication from Yves Barrière). These 85 stover samples were then harvested at silage stage and sent to the University of York (WP5) for quantification of their saccharification potential. In addition, digestibility was predicted for these samples. The impact of water stress on saccharification and digestibility was investigated (see below).

Results:

a) Impact of water stress on saccharification

Estimation of saccharification potential (University of York; WP5) of 85 samples of maize stover from 17 genotypes cultivated on two contrasted water regimes was carried out. No significant bloc effect per water regime was present in the data set (Pval = 0.48), allowing us to analyze jointly data from different blocs within the same water regime (Figure 1). In contrast, highly significant differences have been observed between the tested genotypes (Pval<2.2^{e-16}). Hence, one can distinguish genotypes with a high saccharification potential such as F4 and F286 and genotypes with a low saccharification potential such as F66 and F7037 (Figure 1). Overall, water stress did not have any significant impact on saccharification potential. Only one genotype (namely Cm484) did show a significant increase in saccharification potential when cultivated under water stress. Accordingly, no significant correlation was observed between drought tolerance and saccharification potential (data not shown).

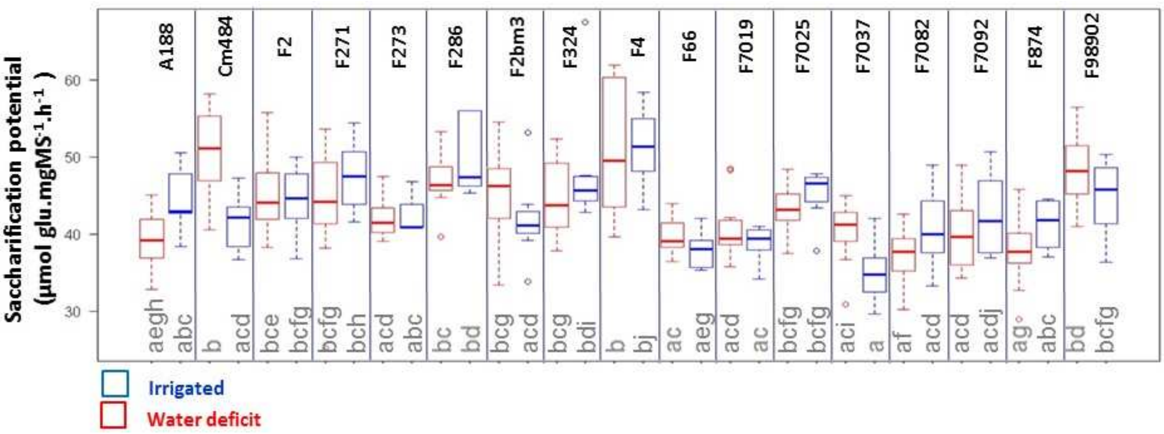

Figure 1: Saccharification potential of the 17 genotypes cultivated in two contrasted water regimes. The code representing each genotype is shown at the top of the chart. Saccharification potential is shown for maize cultivated under water stress (red) and without water stress (blue), respectively. Letters under each box resulted from a Tukey test; no significant difference is denoted for boxes having a letter in common.

b) Correlation between yield, saccharification potential and digestibility.

Lignocellulosic biomass yield (tons of whole plant without cob per hectare) was estimated for each genotype cultivated in each bloc and in each water regime. For each genotype, lignocellulosic biomass yield was significantly impacted by water stress.

As expected from the results presented above, the correlation between saccharification potential and lignocellulosic biomass yield was low (r^2=0.10, Figure 2A). Correlation between saccharification potential and digestibility was also low (r^2=0.01, Figure 2C). These results are consistent with those observed for a population of recombinant inbred lines (deliverable D1.3).

On the other hand, water deficit increased digestibility and correlation between digestibility and stover yield was equal to 0.30 (Figure 2B). To reinforce this observation, lignin content (NIRS predictions) was reduced in stover cultivated under water deficit.

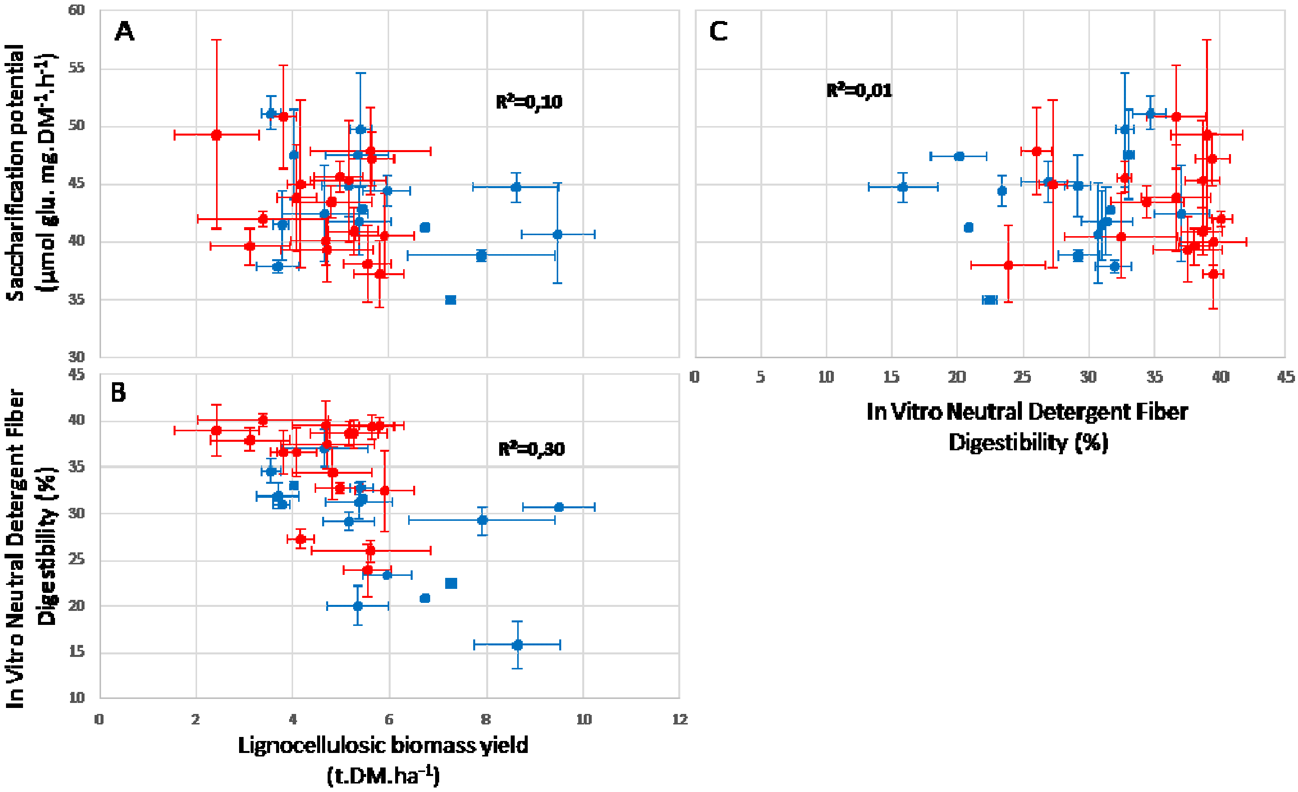

Figure 2: Correlations between lignocellulosic biomass yield and saccharification potential (A) digestibility (B) for maize cultivated under water stress (in red) and maize cultivated without water stress (in blue). Correlation between saccharification potential and digestibility (C) is also presented. Each dot represents one line and bars represent standard deviation.

Discussion /Conclusion:

Applied water stress reduced lignocellulosic biomass yield (Figure 2), indicating that the applied water stress was effective. This water deficit scenario did not significantly impact saccharification potential, resulting in an absence of correlation between stover yield and saccharification. On the other hand, digestibility of the tested lines was increased under this water deficit scenario, resulting in a conserved correlation between both these latter traits.