

Evolution of sorghum and corn composition with the harvest period, with focus on the hemicelluloses monosaccharidic composition

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Introduction

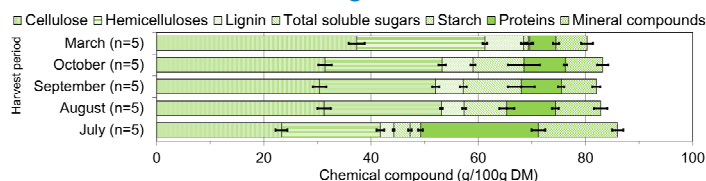
Sorghum and corn are promising annual lignocellulosic crops in the field of bioenergy and biorefinery, owing to their high polysaccharides content and high biomass yield. The optimal valorization of their cellulosic and hemicellulosic components in lignocellulose-based biorefineries requires a good knowledge of their available biomass contents, and of their molecular composition.

Biomass characterization

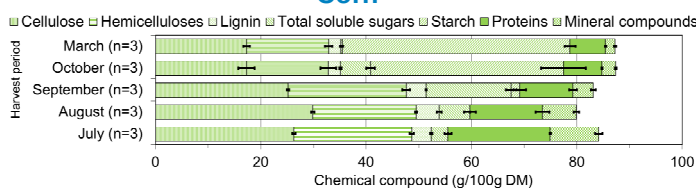
The main chemical components (cellulose, hemicelluloses, lignin, total soluble sugars, starch, proteins and mineral compounds) and more specifically the monosaccharidic composition of cellulose and hemicelluloses (cellulosic glucan, xylan, arabinan, mannan, galactan and hemicellulosic glucan) were analyzed in two annual lignocellulosic crops: sorghum (*Sorghum bicolor* (L.) Moench; fiber cultivars: H133 and CA25; sugar cultivars: Zerberus, Maja and Enr10) grown at Gembloux (Belgium) and corn (*Zea mays* L.; fiber cultivars: Beethoven, Coryphée and Ronaldinio) grown at Libramont (Belgium). These crops were harvested at 5 different periods: July, August, September, October or March. Presented results are the mean of the different cultivars.

Main chemical components according to the plant species and the harvest period

Sorghum



Corn

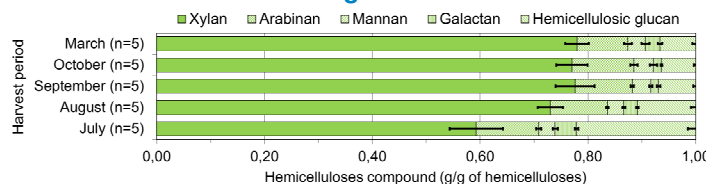


The non-identified fraction is most probably composed of soluble polysaccharides (such as pectin), soluble lignin, organic acids, alcohols, pigments and lipids

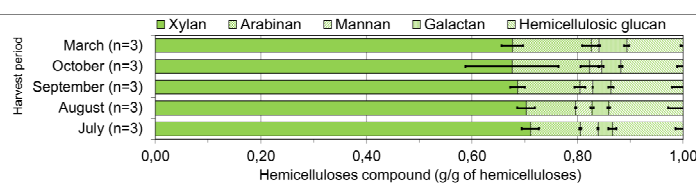
- High carbohydrates content
- During growth → Increase of cellulose, hemicelluloses and lignin in sorghum, but decreases in corn because of the increase of starch
- During growth → Decrease of proteins and mineral compounds

Monosaccharidic composition of hemicelluloses according to the plant species and the harvest period

Sorghum

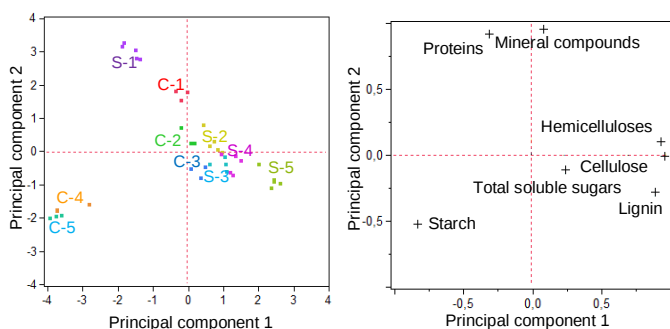


Corn



- High xylan proportion
- During growth → Increase of the proportion of xylan in sorghum
- During growth → Decrease of the proportion of hemicellulosic glucan

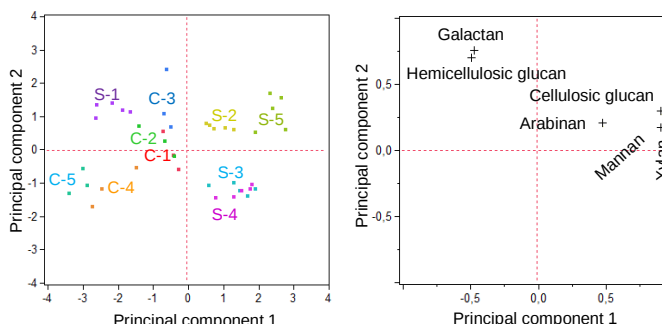
Principal component analysis of the main chemical components



S: Sorghum; C: Corn; 2009; 1: July; 2: August; 3: September; 4: October; 5: March

- Harvest period effect → strong for the first (S-1 and C-1) and last (S-5 and C-4/C-5) harvest period
- Cultivar effect → weak in comparison of the harvest period effect
- Correlation → strong between cellulose, hemicelluloses and lignin, and between proteins and mineral compounds

Principal component analysis of the structural polysaccharide composition



- Harvest period effect → strong for some harvest period (S-1, S-2, S-3/S-4, S-5 and C-4/C-5)
- Cultivar effect → weak in comparison of the harvest period effect
- Correlation → strong between cellulosic glucan, xylan and mannan, and between hemicellulosic glucan and galactan

Conclusions

- The harvest period has the most significant influence on the main chemical components and the structural polysaccharide composition, while the influence of cultivar is only rarely significant.