Evolution of miscanthus and switchgrass composition with the harvest period, with different crop husbandry conditions and with focus on the hemicelluloses monosaccharidic composition

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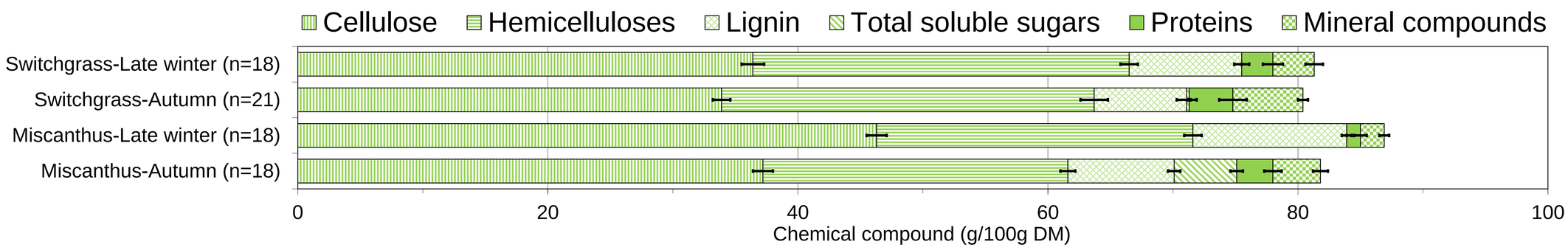
Introduction

- Miscanthus and switchgrass are promising perennial lignocellulosic crops in the field of bioenergy and biorefinery, owing to their high fiber content, high biomass yield, high dry matter content and low input needs for their growth. 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 perennial lignocellulosic crops: miscanthus x giganteus (*Miscanthus x giganteus* J.M.Greef & Deuter ex Hodk. & Renvoize ; cultivar: Bical) and switchgrass (*Panicum virgatum* L. ; cultivar: Cave-in-rock). These crops were grown at Tinlot (Belgium), fertilized in May with 0, 80 or 160 $kg_N\ ha^{-1}$ and harvested in October or March. Presented results are the mean of the different harvest periods.

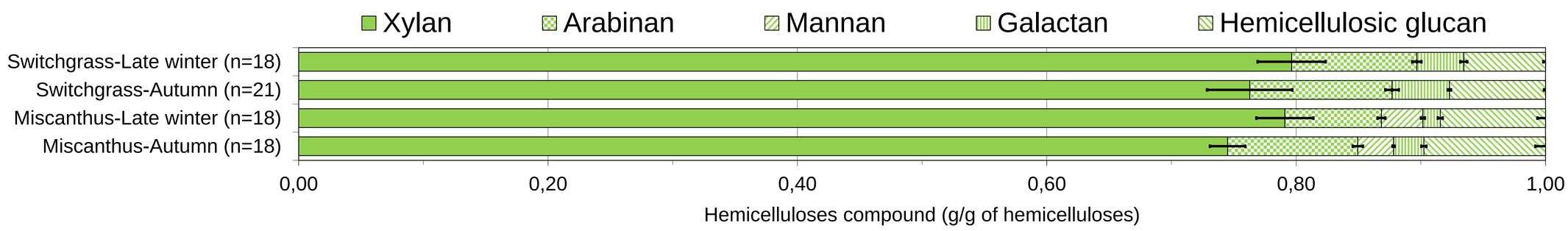
Main chemical components according to the plant species and the harvest period



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

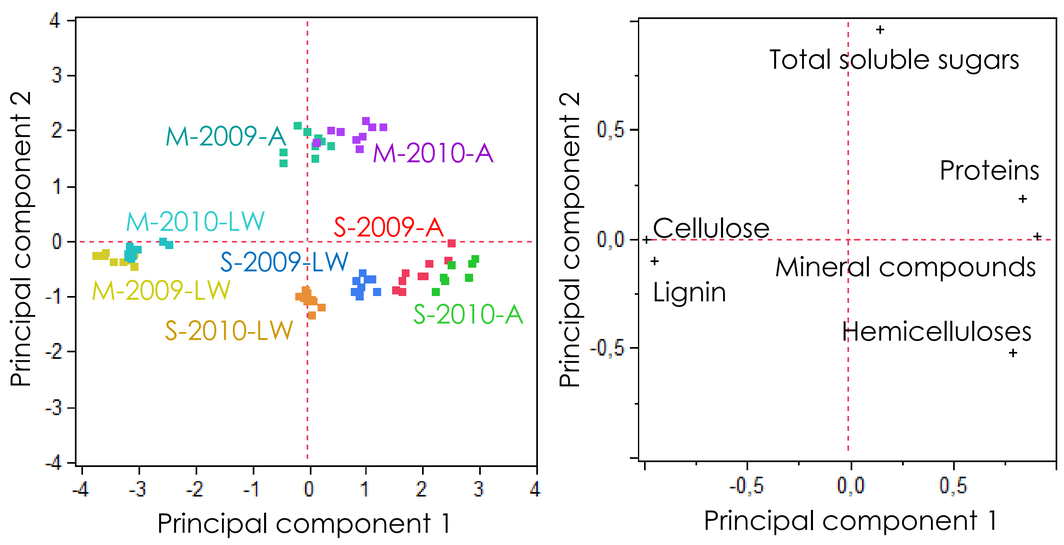
- **Miscanthus** → Higher cellulose and lignin content
- **Switchgrass** →Higher hemicelluloses, proteins and mineral compounds content
- **Autumn** → Higher protein, mineral coupounds and total soluble sugars content
- **Late winter** → Higher cellulose, hemicelluloses lignin content

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

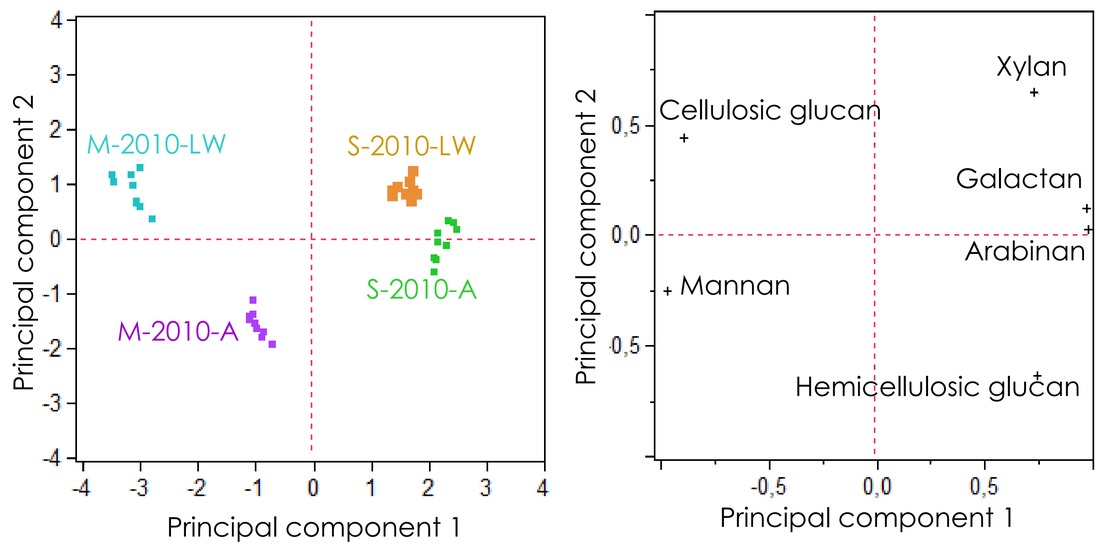


- **Hemicelluloses** are **mainly** made of **xylan**
- **Late winter** → Higher **xylan** proportion

Principal component analysis of the main chemical components



Principal component analysis of the structural polysaccharide composition



M : Miscanthus ; S : Switchgrass ; 2009 : Cultivation year 2009 ; 2010 : Cultivation year 2010 ; A : Autumn ; LW : Late winter

- **Year effect** → weak
- **Harvest period effect** → strong
- **Treatment effect** → weak except for the **protein** content which increases with the nitrogen fertilization
- **Correlation** between chemical components → **strong** except for total soluble sugars

- **Harvest period effect** → strong
- **Treatment effect** → weak

- **Correlation** between monosaccharidic components → **strong** except between xylan and hemicellulosic glucan

Conclusions

- Plant species and harvest period has the most significant influence on the main chemical components and the structural polysaccharide composition, while the influence of nitrogen fertilization is only rarely significant except on the protein content.

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