Evolution of main chemical components content and monosaccharidic content of hemicelluloses in several lignocellulosic grass crops grown under different crop husbandry conditions

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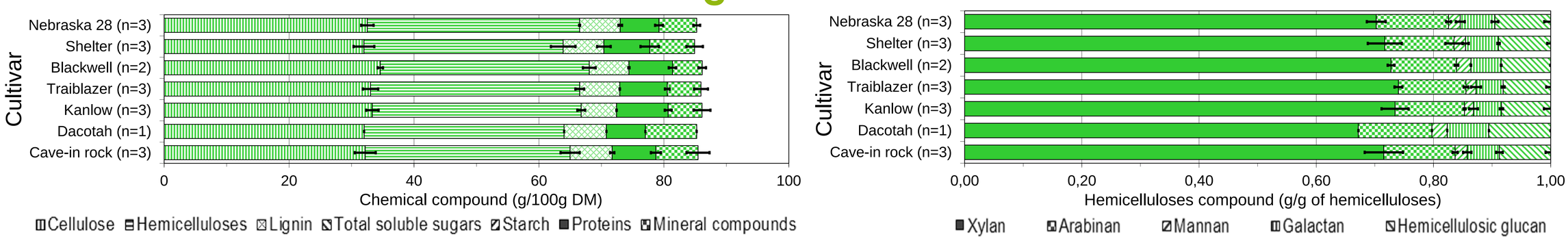
Introduction

● Switchgrass, tall fescue and 'cocksfoot-lucerne' association are promising perennial lignocellulosic grass crops as a source of cellulose and hemicelluloses in the field of bioenergy and biorefinery, owing to their high polysaccharides content and high biomass yields. Their optimal valorization in lignocellulose-based biorefineries requires a good knowledge of the biomass composition , and especially of the molecular composition of hemicelluloses.

Biomass characterization

● The main chemical components (cellulose, hemicelluloses, lignin, total soluble sugars, proteins and mineral compounds) and more specifically the monosaccharidic content (cellulosic glucan, xylan, arabinan, mannan, galactan and hemicellulosic glucan) were analyzed in several lignocellulosic grass crops: switchgrass (*Panicum virgatum* L. ; cultivars: Cave in rock, Dacotah, Kanlow, Trailblazer, Blackwell, Shelter and Nebraska 28 ; late winter harvest) grown at Gembloux (Belgium), tall fescue (*Festuca arundinacea* Schreb. ; cultivars: Kora, Soni, Jordane, Perun and Hykor ; 3 harvest cycles) grown at Gembloux (Belgium) and 'cocksfoot-alfalfa' association (*Dactylis glomerata* L.-*Medicago sativa* L. ; Nitrogen fertilization levels applied in June: 0, 50 or 100 $kg_N\ ha^{-1}$; 3 harvest cycles) grown at Libramont(Belgium) in 2009.

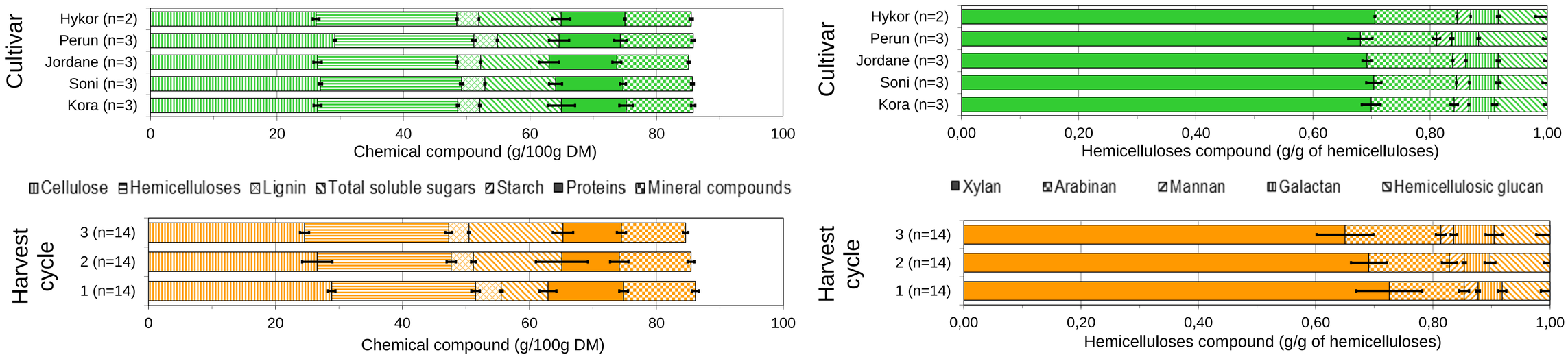
Switchgrass cultivars



● **Switchgrass →** Higher cellulose, hemicelluloses and xylan content as compared to the tall fescue and to 'cocksfoot-lucerne' association

● **Cultivar effect →** No significant influence

Tall fescue cultivars and harvest cycles



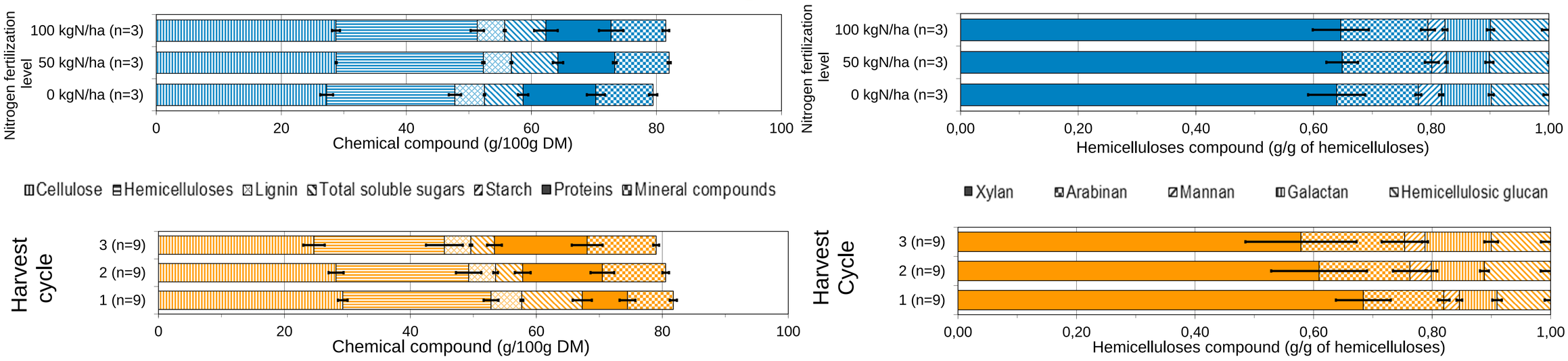
● **Tall fescue →** From spring to autumn, the cellulose content decreased while the total soluble sugars content increased

● **Hemicelluloses →** From spring to autumn, the relative xylan content decreased while the arabinan, galactan and hemicellulosic glucan contents increased

● **Cultivar effect →** Significant influence for most compounds

● **Harvest cycle effect →** Significant influence for most compounds and higher impact than the cultivar effect

'Cocksfoot-alfalfa' association nitrogen fertilization levels and harvest cycles



● **'Cocksfoot-alfalfa' association →** Cellulose, hemicelluloses and total soluble sugars contents decreased while the amount of protein increased because of an increased presence of –alfalfa in the 2nd and 3rd harvest cycle

● **Hemicelluloses →** From spring to autumn relative xylan content decreased while the relative arabinan, galactan and hemicellulosic glucan contents increased, as observed for tall fescue

● **Nitrogen fertilization effect →** Few significant influence on compounds

● **Harvest cycle effect →** Significant influence for most compounds

Conclusions

● Cellulose and hemicelluloses are the major components of the dry matter. The major hemicellulosic components are, by order of decreasing importance, xylan, arabinan, hemicellulosic glucan, galactan and mannan.

● Plant species and harvest cycle has the most significant influence on the structural polysaccharide composition, while the influence of cultivar and nitrogen fertilization were only rarely significant.

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