The identification of wheat genetic resources with high dietary fiber content

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Summary: The quality properties of different variety mixtures and composite cross populations were studied with the aim of identifying genetic resources with high dietary fiber content for organic farming purposes and in order to cultivate and examine the effect of these components on the end-use qualities. We could detect two populations and variety mixtures which had significantly higher water extractable arabinoxylan (WEAX) content, than most of the studied samples, with positive effect on the human health. These populations are promising dietary fiber resources and suitable for organic farming purposes.

Background

Arabinoxylan (AX) is quantitatively the most important dietary fiber polysaccharide in wheat (Izydorczyk and Biliaderis 1995). Soluble AX has the good property of reducing the risk for coronary heart disease and type II diabetes (Moore et al., 1998, Lewis and Heaton, 1999). Furthermore insoluble AX particularly lowers transit time and augments fecal bulk, defecation frequency (AACC, 2001) and binding of carcinogens (Moore et al., 1998).
Apart from their nutritional relevance, AX is also important from a technological point of view as it strongly affects wheat functionality during cereal processing, for example, in breadmaking (Courtin and Delcour 2002, Goesaert et al. 2005). AX primarily influence gelation procedure and water absorption.
In this study the aim was to identify new genetic resources with high dietary fiber content and suitable for organic farming purposes and to examine the effect of these components on the end-use qualities.

Main chapter

Physical, compositional and breadmaking properties of Mv-Emese, English-Composite, Elite-Composite, YQ-CCP, YQ-MIX, INRA-60parent-CCP, NIAB-Elite-CCP, and NIAB-Elite-MIX samples grown in five countries (A, CH, FR, UK,HU) at low-input and organic sites in three consecutive years (2011-13) were analysed. According to the results two populations (Elite-Composite and English-Composite) were identified, which had significantly higher WEAX (mg/g) content (9,23; 8,52; respectively), than most of the studied samples. The increased WEAX content had significant effect on the water absorption of the flour. The higher WEAX content resulted higher water absorption of the flour too. Here, we show the results of the Hungarian growing site, but similar tendencies were registered at the other countries and their sites.

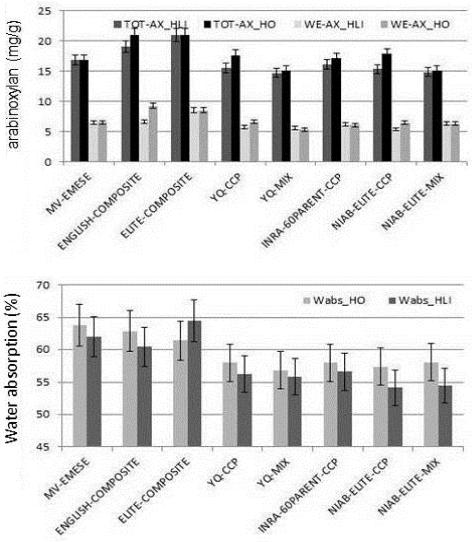

Figure 1. Arabinoxylan content (mg/g) and water absorption (%) of different composite populations in three consecutive years (2011-13) at organic and low input growing sites (HU) (TOT-AX: Total arabinoxylan content, WE-AX: Water extractable arabinoxylan content, Wabs: water absorption, H: Hungary, LI:low input growing site, O: organic growing site)

YQ-CCP wheat population (ORC, UK) was mixed in 1:2 and 2:1 ratio with Stefanus or Midas in Austria, with Mv-Suba or Mv-Regiment in Hungary and with Alchemy or Solstice in the UK. Elite-composite was also mixed with Mv-Suba or Mv-Regiment. Mixes of genotypes were planted in the country where they were produced and were analysed together with the controls. The physical, compositional and breadmaking quality traits of these variety mixtures were studied in 3 consecutive years (2011-13). As Mv-Suba, Elite-Composite and English-Composite have significantly higher WEAX content at organic site, the mixtures of these also have significantly higher WEAX content than the other varieties and mixtures. The TOTAX content of Mv-Suba

and Elite-Composite was also high at organic site resulting high TOTAX content in the mixtures too. No significant differences were recognised in WEAX content of the parental lines or the mixtures at low-input sites. The increased WEAX content had significant effect on the water absorption of the flour.

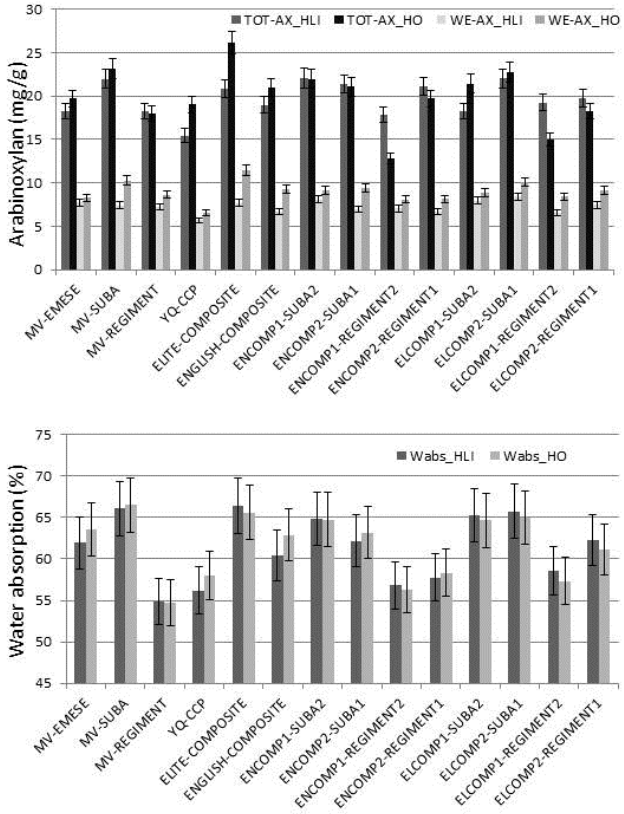

Figure 2. Arabinoxylan content (mg/g) and water absorption (%) of different variety mixtures in three consecutive years (2011-13) at organic and low input growing sites (HU) (TOT-AX: Total arabinoxylan content, WE-AX: Water extractable arabinoxylan content, Wabs: water absorption, H: Hungary, LI:low input growing site, O: organic growing site)

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