

Health-preserving and consumption values of traditional apple cultivars

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The consumption value of cultivars is one of the main factors determining the choice of consumers. Meanwhile there is growing interest in healthy consumption, in the health benefits of fruits. The early breeding was not focusing to reach high levels of health protective compounds in the fruits; hence most of the modern cultivars do not contain high levels of these compounds. However, there are many available old cultivars and their chemical composition shows high diversity (Herbinger et al. 2004a, 204b). Some of these cultivars have outstandingly high polyphenol or pectin content, thus their consumption have definitely good effect on human health. In addition It is not rare that some of the old cultivars have even better taste and consumption value than the most common modern cultivars. The exploration and preservation of old cultivars is a very important task, which includes the characterization of their attributes with modern objective methods. The maintenance of apple cultivar diversity have relevance in several fields, such as culture preservation, rural development, epidemiology and economics.

Recognizing their relevance, many old apple cultivars of the Carpathian basin were collected by the Dept. of Pomology (CUB), and the collection of fruit cultivars located in Soroksár had been established. Some of these cultivars have great potential in traditional orchards, due to their good disease resistance, fruit quality, and suitability to less intensive technology (Tóth 2005). In previous studies some old cultivars had already been recommended for organic farming: 'Batul', 'Vilmos renet', 'Pónyik', 'Sikulai', 'Tordai piros kálvil' and 'Szabadkai szercsika' were characterized with acceptable fruit quality and good overall disease resistance (Tóth et al. 2004, Tóth 2005).

In the present paper we would like to review the consuming and health-preserving value of twenty traditional cultivars maintained in our fruit collection. The results may help to understand the importance of these traditional apple cultivars. The information may also be used for getting scientifically objective knowledge about the traditional cultivars typical to Hungary.

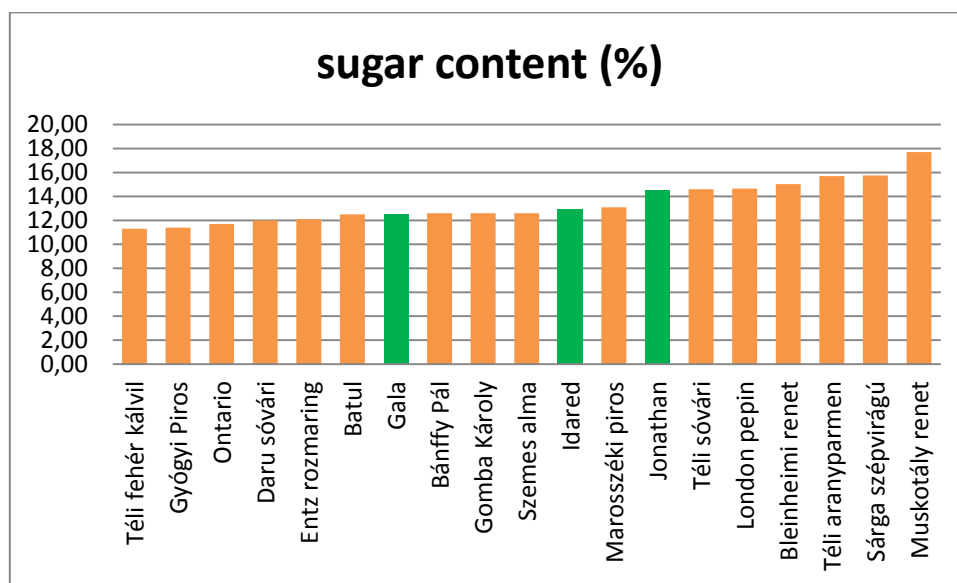
Sugar and acid content

Sugar content

Sugar content determines the taste of cultivars as well as their processability. For example cider apples have typically higher sugar content, which is needed for the fermentation (Pereira-Lorenzo et al. 2009). Sugar content and sugar profile also affects the health benefits of a cultivar's consumption. It is well known that due to the high fructose ratio of apple carbohydrates, ordinary apple consumption lowers the risk of diabetes; as well as it can be consumed by people suffering from diabetes already (Ford and Mokdad 2001). Studying

several modern and old apple cultivars, Hecke et al. (2004) found that information about the sugar content of various apple cultivars may have huge importance for diabetics, since it can differ from the average 12%, resulting in different insulin intake optimum during the treatments.

We determined the sugar content of the investigated cultivars based on their soluble solid content. The results are shown in Brix (%) values:

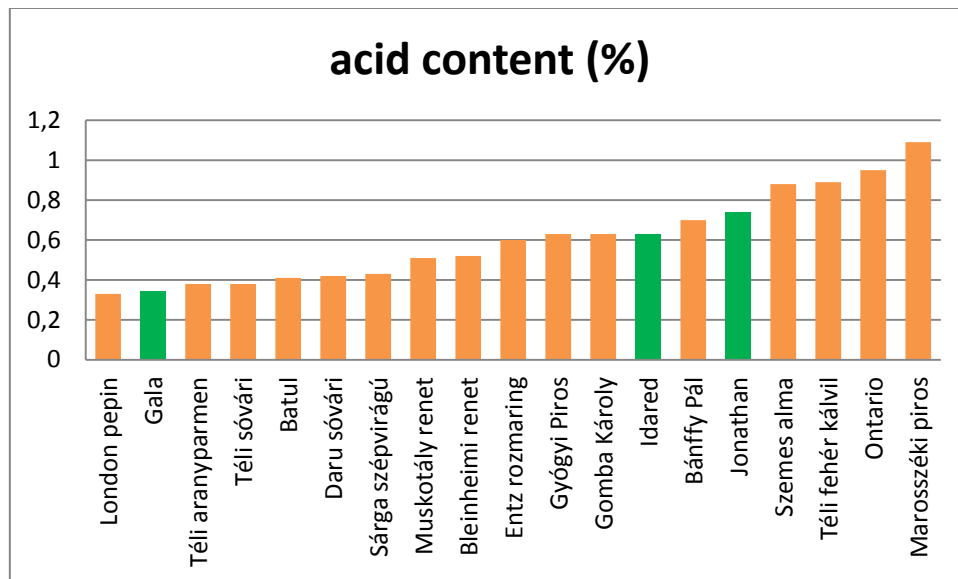


(Ficzek G. Király I. Tóth M. unpublished data)

The high diversity in sugar content is well shown by the data. In some cases extraordinary high carbohydrate content were measured (e.g. ‘Sárga szépvirágú’), which can be highly preferred for some processing methods.

Acid content

Besides carbohydrates, fruits contain organic acids in high quantity; these determine their pleasant taste and processability together. Organic acids have health benefits as well. They stimulate appetite, and help digestion. Apple fruits are good C vitamin sources due to their ascorbic acid content (Rodler 2005).

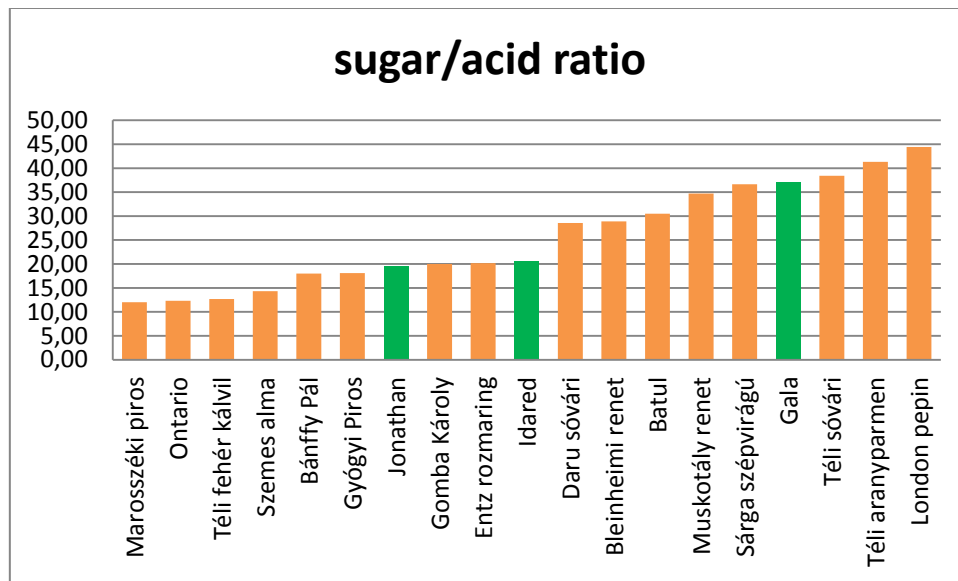


(Ficzek G. Király I. Tóth M. unpublished data)

The values of acid content appears to show greater dispersion compared to sugar content. The cultivar 'Marosszéki piros' contains twice as much acids than 'Idared', while 'London pepin' shows even less acid content than 'Gala' which is one of our least acidic modern cultivars. Cultivars with high acid content are highly preferred for fruit juice production, and their acids are beneficial to human health as well.

Sugar/acid ratio

The sugar/acid ratio determines the sweet, acidic, or harmonic taste of the cultivars. The optimal sugar/acid ratio varies in function of the utilization of cultivars. The harmonic ratio is preferred for fresh consumption in general; however, many consumers like the more sweet or acidic cultivars. The harmonic taste is defined at 25, while the more acidic ratio of 15 is the optimal for fruit juice production (Poll 2006).



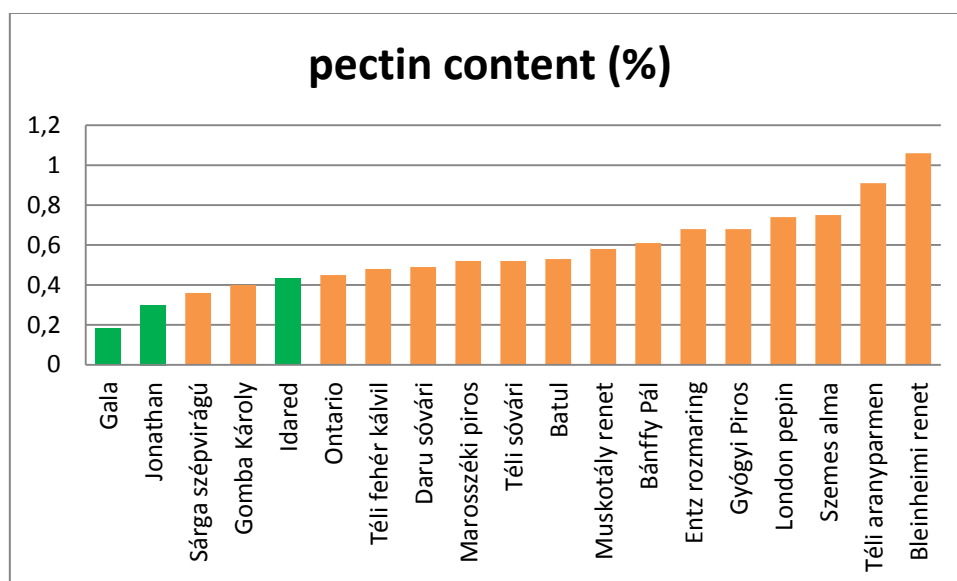
(Ficzek G. Király I. Tóth M. unpublished data)

The values are in an interval from 10 to 45 which means an outstanding variability. Both highly sweet and highly acidic cultivars can be found among the old cultivars; however, plenty have middle sweet/acidic taste similarly to 'Jonathan'. Based on our data, surely any consumer, who prefers either sweet or acidic taste, could find a cultivar among the investigated ones suitable to his/her needs

Pectin content

Pectin is a structural heteropolysaccharide. It can be found also in apple, and it correlates with the storability and hardness of the fruits. Even though it was primarily considered to be relevant for the processing industry, in the last decades several studies were focusing to its health-preserving effects. Due to its structural properties it helps digestion (Zsivanovits 2007). It was proved by animal research, that pectin has an ability to bind heavy metals in vivo, thus they are capable to lower their toxicity (Serguschenko et al. 2007). It lowers the risk of cancer, especially colon cancer. Based on the study of Hideo et al. (1995) in the case of those mice that get apple pectin ordinary, the chance of getting cancer is highly decreased. The modern viewpoint is that the pectin is a component with important health preserving effect, and high pectin content can be an important and preferred character of a cultivar.

In order to determine the pectin content of the cultivars spectrophotometric measurements were made after sulfuric acid digestion which gave the following results:



(Ficzek G. Király I. Tóth M. unpublished data)

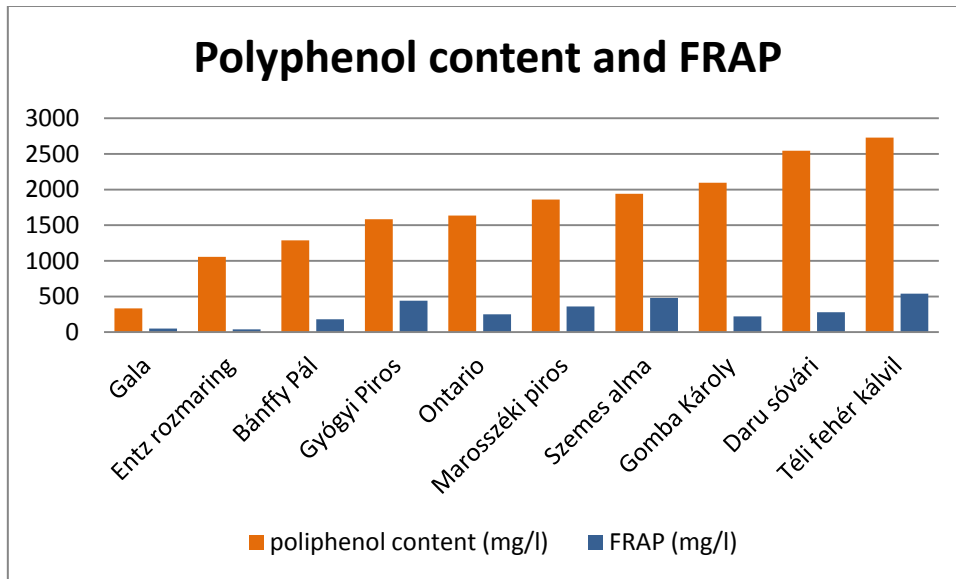
Most of the investigated traditional cultivars have higher pectin content than the modern reference cultivars do. We succeeded to select cultivars with outstanding pectin contents (e.g. 'Bleinheimi renet'). These cultivars may be used as functional foods in the future.

Measurement of total polyphenol content and FRAP

Polyphenols can function as important color and aromatic components (e.g. anthocyanins are responsible for the skin coloration, while tannin content is a basic characteristic of cider apples). On the other hand polyphenols are commonly known to have antioxidant effect, as they are capable to bind free radicals (Schirmacher and Schempp 2003). A higher absorption of phenols leads, among other effects, to a reduction in heart disease and lower cholesterol levels (Craig and Beck 1999).

It has been confirmed many times that the traditional cultivars contain higher levels of polyphenols compared to modern cultivars (Veberic 2004, Hecke et al. 2006), which suggests the importance of measuring polyphenol content and antioxidant capacity in our cultivars.

Total polyphenol content (TPC) was measured by spectrophotometry, while antioxidant capacity was characterized by the FRAP value (Ferric ion reducing antioxidant power):



(Ficzek G. Király I. Tóth M. unpublished data)

Similarly to the previous studies we can conclude, that the traditional cultivars have higher levels of polyphenol and antioxidant capacity than the reference cultivar 'Gala'. The data of total polyphenol content and FRAP show low correlation, probably due to the high variance; however, in extreme cases the linear relationship can be confirmed. The highest polyphenol and FRAP values were measured in 'Téli fehér kálvil', which is no wonder, hence this cultivar was also called „the king of apples”, based on its outstanding consuming value. Based on our results among others this cultivar can be recommended due to its excellent flavour and aroma as well as for its favorable effect on health.

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