

# EVALUATION OF FRUIT QUALITY OF APPLE LAND VARIETIES

Ildikó Király<sup>1\*</sup>, Gyula Kovács<sup>2</sup>, Katalin Molnár<sup>3</sup>, Wojciech J. Florkowski<sup>4</sup>

<sup>1</sup>Department of Horticulture, Faculty of Horticulture and Rural Development, John von Neumann University

<sup>2</sup>Pórszombat, Hungary

<sup>3</sup>Department of Horticulture, Faculty of Technical and Human Sciences, Târgu Mureş, Sapientia, Hungarian University of Transylvania

<sup>4</sup> Department of Agricultural and Applied Economics, University of Georgia, USA

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## Abstract

*The study examines apple fruit quality attributes of eight cultivars, i.e., weight, size, flesh firmness, and soluble dry matter content. Half of the examined cultivars matched the fruit quality of the control 'Golden Delicious'. Additionally, the study evaluated each cultivar's nutritional value and how they can serve as functional foods.*

## 1. Introduction

Numerous apple cultivars are planted globally, but only about ten cultivars are involved in intensive farming and apple producing countries vary somewhat in their cultivar choice. Old Hungarian apple varieties as well as the land varieties cannot compete in intensive farming, but they can have an important role in local markets and be suitable for fresh consumption. Many of the land varieties have unique nutritional values and specific traits that enable them to survive [3]; [7].

Land varieties are typically varieties that can adapt to the climate of a particular region. People grow land varieties for self-supply and local markets. A special variety structure was established in Hungary in the 1800s. Hungary's regional features strongly influenced development of their land varieties. Their exact origins are unknown. Today, they are known as typical varieties of a region [1]; [5]; [15].

Surányi [14] evaluates the benefits and drawbacks of old apple varieties and their scientific, economic, and socio-cultural effects in his book 'Gyümölcsöző sokféleség'. Surányi [14] states that the use of historic and land varieties contribute to biodiversity and successful nature conservation, provides healthy food, and improves the livelihoods of people in less developed regions.

A handful of publications focused on old apple varieties. Several authors reported results of studies carried out on gene bank collections [2]; [6]; [11]; [13]. Another set of studies examined the traditional apple varieties planted in orchards [8]; [10]; [15]; [16]; [17]; [18].

We examined apple land varieties that are excellent functional foods thanks to their role in folk medicine. The varieties originate from western Hungary. This study aims to find out whether the fruit quality of land varieties from traditional orchards can meet the quality of the control variety from a modern commercial orchard. The study examined fruit size, firmness, and soluble solids content. An attempt was made to prove the functional properties of the land varieties using laboratory tests.

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\* Contact person Tel.: +36 76,517,696  
Email: kiraly.ildiko@kvk.uni-neumann.hu

## 2. Material and methods

### 2.1. Examined varieties

We examined apple land varieties that are perceived as excellent functional foods in folk medicine. The fruit quality tests compare eight apple land varieties, i.e., 'Jóalma', 'Rétesalma', 'Bordás alma', 'Pirosuló bőralma', 'Nyári édesalma', 'Piros pogácsa alma', 'Vasalma' and 'Kapitány alma' (Figure 1.) with frequently cultivated 'Golden Delicious' variety. Two samples of 'Golden Delicious' used in the test were from the gene bank of Pórszombat that applies traditional farming practices to fruits purchased at the market, likely originating from an orchard managed by intensive farming techniques. The samples of the examined eight apple land varieties from Gyula Kovács' gene bank in Pórszombat were from apple trees grafted on rootstock according to traditional practices. The examined apple land varieties are not listed in the National List of Varieties. Many of them can be considered classic land varieties from the Göcsej area, and have medicinal properties according to folk medicine. For example, 'Jóalma' should be eaten by women who just gave birth to reduce infant colic. 'Piros pogácsa alma' can be consumed by people with diabetes. There is no information on the healing effects of the other varieties but they are long-cultivated varieties in this area. The description of each apple land variety can be found on Gyula Kovács' website "Tündérbert" [9].



Figure 1. Examined apple fruit by cultivar (from left to right and from top to bottom): 'Jóalma', 'Rétesalma', 'Bordás alma', 'Pirosuló bőralma', 'Nyári édesalma', 'Piros pogácsa alma', 'Vasalma', 'Kapitány alma', and 'Golden Delicious'.

## 2.2. Examined fruit parameters

The laboratory tests were carried out in the Department of Horticulture and Rural Development, John von Neumann University in 2019. Only samples of 'Rétesalma' were collected twice (August 21 and September 16) because of damage caused by frost and wasps. The 'Rétesalma' fruits achieved their consumption maturity when the second sample was collected. The tests involved examination of the physical and chemical parameters of fruits and included height, diameter, weight, flesh firmness, and water-soluble dry matter content. The fruits were harvested when ready for consumption (Table 1.), and tested one or two days after the harvest. We collected 10-20 fruits per variety.

Table 1. Results of measurements of apple fruits of eight land varieties and a control

<i>Apple variety name</i>	<i>Functional properties</i> <sup>[9]</sup>	<i>Harvest date in 2019</i>	<i>Weight (g)</i>	<i>Firmness (kg/cm<sup>2</sup>)</i>	<i>Brix (%)</i>
<i>Early maturing</i>					
Jóalma	fresh consumption	16 July	71.22	5.94	11.30
<i>Mid-season</i>					
Rétesalma	fresh consumption, cooking, store for short time (2-3 weeks), dried fruit, brandy	16 September	103.57	4.60	14.30
Bordás alma	fresh consumption, cooking, juice, cider, cider vinegar	16 September	139.71	4.10	13.64
Pirosló bőralma	fresh consumption, dried fruit	16 September	125.13	7.90	16.81
Nyári édesalma	fresh consumption, store for medium length time (2-3 months), cider, cider vinegar, brandy, dried fruit, feeding	16 September	92.45	8.60	15.45
<i>Late maturing</i>					
Piros pogácsa alma	fresh consumption, store for longest time (4-5 months), cider, cider vinegar, brandy, feeding	4 November	172.83	3.80	13.63
Vasalma	cooking, store for longest time (4-5 months), cider vinegar, brandy, feeding	4 November	179.50	8.34	16.75
Kapitány alma	fresh consumption, store for longest time (4-5 months), cider vinegar, brandy, preserved fruit	4 November	105.14	3.50	12.50
<i>Control</i>					
Golden Delicious (Pórszombat)		4 November	100.25	3.69	9.25
Golden Delicious		8 November*	178.83	4.53	12.25

\*Date of sample purchase at the market

The height and diameter of each apple were measured with a caliper. The weight of each fruit was measured with the use of a gram kitchen scale. After removing the peel, we measured the flesh firmness of the fruits with the help of a manual penetrometer with an 11 mm diameter. Several measurements were made on the shady and sunny side of each fruit. This was done because of the limited number of samples. A manual refractometer was used to measure the water-soluble dry matter content. To establish the water-soluble dry matter content, we collected samples with an increment borer from four to six places on each fruit.

### 3. Results

#### 3.1. Apple fruit physical parameters

The fruit of the variety control 'Golden Delicious' has both a height and diameter of 70 mm. Its configuration index is 0.92 (Figure 2.). The 'Golden Delicious' sample from traditional orchard had a similar fruit size of 80 mm, probably resulting from the intensive growing practices. The fruit size of the land varieties ranges from small to medium-large. 'Kapitány alma' had a similar configuration index (0.94) to 'Golden Delicious'. 'Vasalma' and 'Piros pogácsa alma' had bigger width than the control. Their configuration indexes are 0.75 and 0.65, respectively, implying a flattened fruit shape. Except for 'Piros pogácsa alma' and 'Kapitányalma', the other land varieties had a slightly flattened, roundish shape with a configuration index of 0.8.

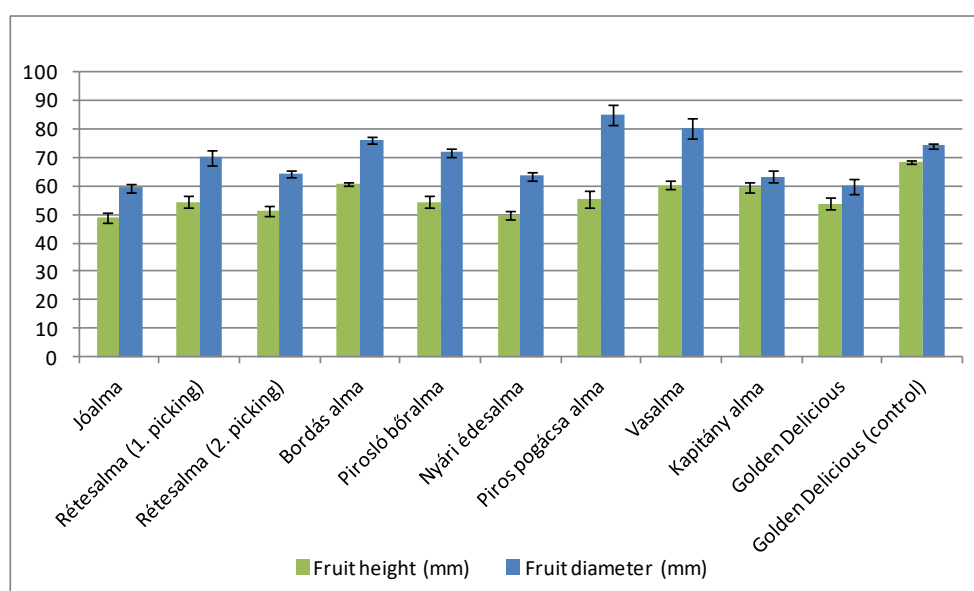


Figure 2. Height and diameter of apple land varieties and a control (Pórszombat, 2019)

The control apple variety, 'Golden Delicious', had an average fruit weight of 180 g. 'Vasalma' and 'Piros pogácsa alma' also had similar average weights per fruit (Figure 3.) 'Golden Delicious' from a traditional orchard had a lighter fruit weight (100 g on average) due to intensive growing practices. The remaining land varieties had small to medium-large average fruit weights of 70g to 140g.

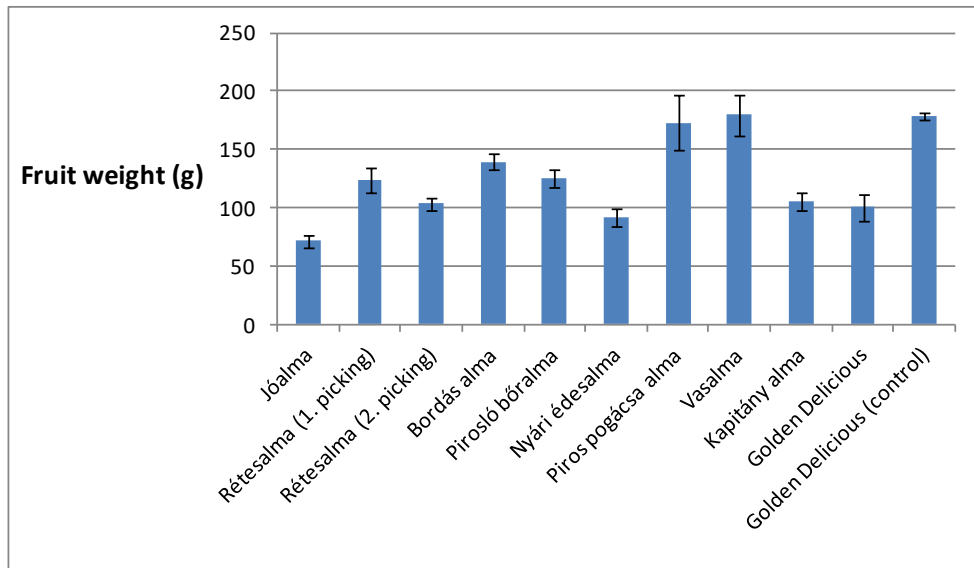


Figure 3. Average fruit weight of apple land varieties and a control (Pórszombat, 2019)

Flesh firmness measurements in apple fruits of five land varieties, 'Jóalma', 'Rétesalma' (first harvest), 'Pirosló bőralma', 'Nyári édesalma', and 'Vasalma', was measured in a larger number of places than in the control variety 'Golden Delicious'. The other land varieties were found to have firmness (4 kg/cm<sup>2</sup>) similar to that of the control sample (Figure 4). Differences between the two samples of 'Golden Delicious' emerge because of their different storage circumstances (cold-storage vs. standard refrigerator). Before the testing began, apple fruit samples collected in Pórszombat were stored in a standard refrigerator (approx in 8°C). Refrigeration slows ripening less effectively than cold-storage since a temperature range of two centigrade to four centigrade cannot be assured in a standard refrigerator.

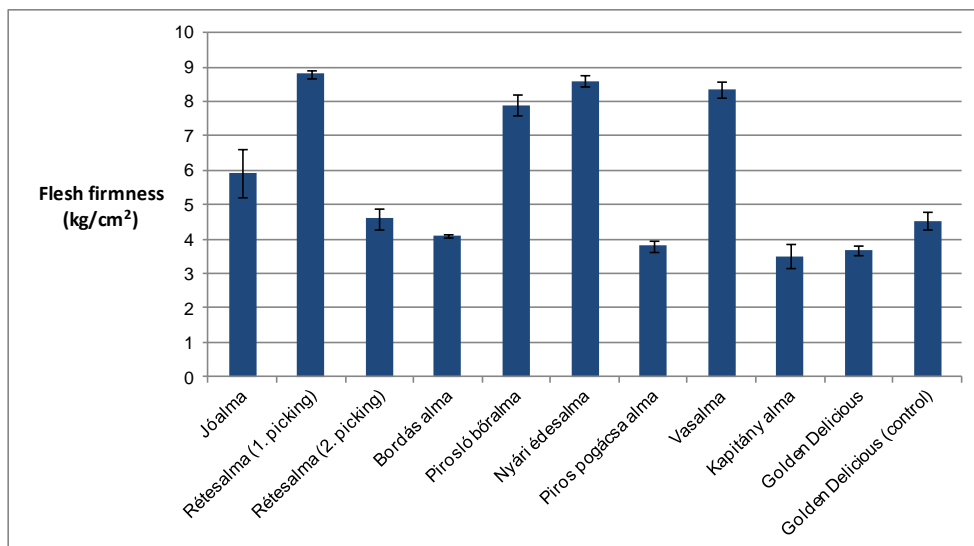


Figure 4. Apple fruit firmness by cultivar (Pórszombat, 2019)

### 3.2. Water-soluble dry matter content (Brix value)

The water-soluble dry matter content of the land varieties ranged from 11 to 17 Brix value and equaled or exceeded Brix of the control 'Golden Delicious' (Figure 5.). The sample of 'Golden Delicious' from a conventional orchard in Pórszombat had a lower Brix value than the sample from a high density orchard which had reached Brix 12. An earlier study [6] also reported a Brix value of 12 in the case of 'Golden Delicious'. Varieties with Brix values higher than 12 are suitable for making apple juice concentrate [12]. Excepting 'Jóalma', the examined land varieties were suitable for processing if their acidity was around 7 g/l. Earlier studies in Hungary confirmed a medium-high (at least Brix value 12) content of water-soluble dry matter from most of the old Hungarian apple varieties [2]; [8]; [11]; [13]; [17].

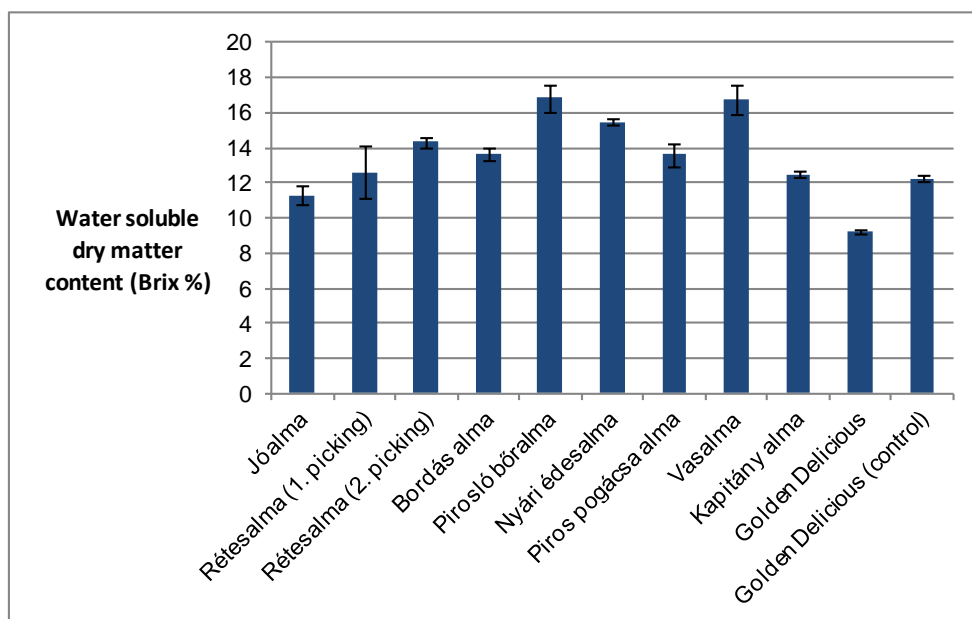


Figure 5. Water-soluble dry matter content of apple fruit of eight land varieties and a control (Pórszombat, 2019)

## 4. Conclusions

The fruit size of apple land varieties from conventional orchards equalled or was smaller than the control variety sample from intensive farming. In most cases flesh firmness and water-soluble dry matter content of the land varieties were higher than the control. As the land varieties can compete in the market thanks to their physical parameters and sugar content, they are worth further testing. In our further examinations we will try to prove the health care values of the land varieties by laboratory tests (sugar and acidic composition, antioxidant and polyphenol content, mineral element content).

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