

Fruit quality in apple tree in the soil and climate conditions of the Didactic Station of Timisoara, Romania

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Abstract Apple tree ranks first as importance among temperate climate fruit tree species due to large cultivated areas, production and ecological plasticity. In Romania, apple tree is cultivated on about 75,000 ha and produces about 600 t, the main apple-producing counties are Argeş, Suceava, Mureş, Maramureş, Dâmboviţa, Iaşi, Cluj, Bihor, Bistriţa, Năsăud, Bacău, Sălaj, and Vâlcea. In Romania, apple is cultivated everywhere, from sea level to pre-mountain areas.

Key words

apple, cultivar, quality, weight, diameter, dry matter

Because of the seasonal character of the apple production, of the unbalance between production and consumption in certain periods and of the increasing need for fruits in human nutrition during the entire year, fruit processing is developing on a constant basis. The apple-based products are increasingly diversified: natural concentrated juices, nectars, syrups, refreshing drinks, alcoholic beverages (both weak and strong), compotes, jellies, jams, marmalades, sweets, candies, ice creams, dehydrated fruit, frozen fruit, etc.

The current trend in fruit consumption, unwanted from a physiological point of view but asked by other factors, is to increase the share of processed fruit detrimental to the consumption of fresh fruit.

In Romania, the structure of fruit consumption is 77% fresh fruit and 23% processed fruit (of which 21% preserved, 0,5% frozen and 1,5% dried).

According to FAO data, apple tree is cultivated in 84 countries on over 4,500,000 ha, World apple production has reached, over the last two decades, about 55,095,000 t, i.e. about 13,2% of the total amount of fruits; apples rank third in the world after bananas, and both fruits ensure 41,2% of the world fruit production,(1, 2, 3).

Material and Method

The research field is located in the fruit tree plantation (a plot of 2,5 ha cultivated with ten apple cultivars) belonging to the Didactic Station of the Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara, Romania.

We studied ten apple cultivars cultivated in Romania: Romus 2, Pionier, Starkrimson, Florina, Wagener Premiat, Generos, Jonathan, Delicios de

Voinesti, Golden Delicios, and Granny Smith. There are summer cultivars (Romus 2), autumn cultivars (Delicios de Voinesti and Pionier) and winter cultivars (Jonathan, Florina, Generos, Golden, Starkrimson, Wagner, and Granny Smith). There are 4 m between the apple tree rows and 2 m between the apple trees in a row, which ensures a density of 1,250 apple trees/ha in the 14th and 15th years. The apple trees were grafted on M26 mother grafts. The leading system we chose was free palmetto, and the cultivation technology was the usual one for the ten cultivars; the only difference consisted in the use of different systems of soil maintenance.

As for biometric aspects, we sampled 25 fruits from each cultivar harvested from different parts of the canopy, and we measured the fruit large diameter, the fruit small diameter and the fruit height determining the size index and dry matter index. Fruit weight was determined by weighing. In these indices, data were statistically processed using the variance analysis method and cultivar mean as a control variant.

Results

As far as the large fruit diameter in the studied cultivars is concerned (Figure 1), in 2012 the highest value of this index was in the apple tree cultivars Granny Smith and Wagener, i.e, 73,33 mm and 71,00 mm, respectively, while the small fruit diameter was in the apple tree cultivar Pionier (49,33 mm).

The apple tree cultivars Granny Smith and Wagener reached the highest values in 2013 too from regarding the large fruit diameter, though smaller than those of the year 2012, i.e, 77,33 mm and 76,00 mm, respectively.

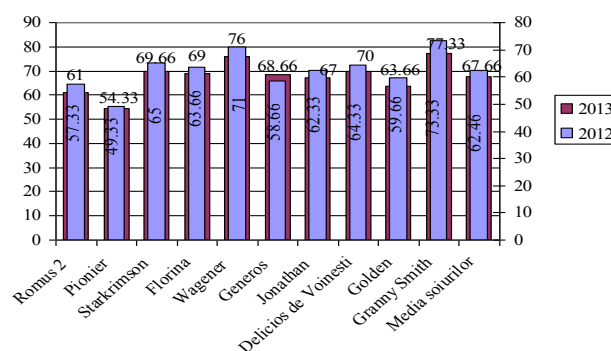


Fig.1. External features of the apples in the studied apple tree cultivars (large fruit diameter)

As far as the small fruit diameter is concerned (Figure 2) in 2012, we can see that the Granny Smith apple tree cultivar reached maximum value (70,00 mm), followed by the apple tree cultivar Wagener (69,33 mm); the smallest value was in the apple tree Pionier (47,66 mm).

In 2013, the apple tree cultivar Granny Smith reached the highest value in small fruit diameter (74,33 mm), while the lowest value was in the apple tree cultivars Romus 2 (59,33 mm) and Pionier (50,66 mm).

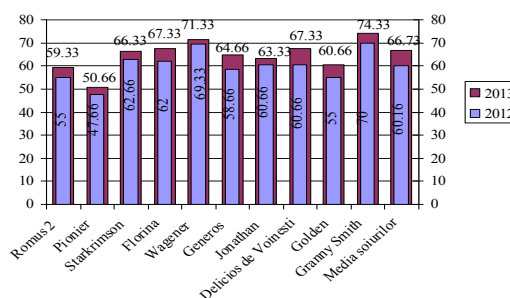


Fig. 2. External features of the apples in the studied apple tree cultivars (small fruit diameter)

As for the fruit height, the highest value in 2012 was in the apple tree cultivars Starkrimson (61,00 mm), Jonathan (61,00 mm), and Granny Smith (60,00 mm).

The lowest value in fruit height was in the apple tree cultivar Pionier (43,33 mm). All the apple tree cultivars reached values close to that of the

control, values that were not ensured statistically (Figure 3).

In 2013, the highest value in fruit height was in the apple tree cultivar Florina (65,66 mm), followed by the apple tree cultivar Granny Smith (62,33 mm), while the lowest value was in the apple tree cultivar Pionier (43,33 mm).

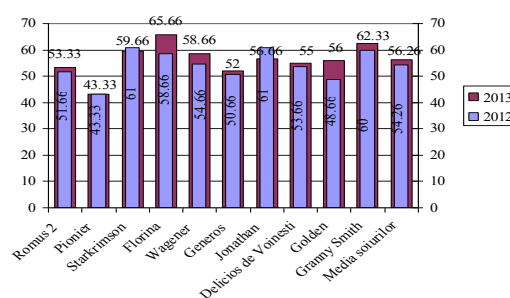


Fig. 3. Fruit height in the studied apple tree cultivars

Data presented in Table 1 show that mean weight of the fruits in the studied apple tree cultivars ranged between 45,53 g and 155,50 g, with a mean of 108,09 g. Thus, the largest weight of apples was in the apple tree cultivar Granny Smith, the difference to the

control being distinctly significantly positive; the lowest value of fruit weight was in the apple tree cultivar Pionier, the difference to the control being very distinctly significantly negative.

Table 1

Fruit weight in the studied apple tree cultivars and biotypes (2012)

| Cultivar | Mean weight (g) | Relative value (%) | Difference to the control | Significance |
|----------------------|-----------------|--------------------|---------------------------|--------------|
| Romus 2 | 85,26 | 78,88 | -22,83 | - |
| Pionier | 45,53 | 42,13 | -62,56 | 000 |
| Starkrimson | 130,64 | 120,86 | 22,55 | - |
| Florina | 124,07 | 114,79 | 15,98 | - |
| Wagener | 144,27 | 133,47 | 36,18 | X |
| Generos | 109,97 | 101,74 | 1,88 | - |
| Jonathan | 86,10 | 79,66 | -21,99 | - |
| Delicios de Voinesti | 105,28 | 97,40 | -2,81 | - |
| Golden | 94,28 | 87,22 | -13,81 | - |
| Granny Smith | 155,50 | 143,86 | 47,41 | XX |
| Mean of cultivars | 108,09 | 100 | 0 | Control |

DL_{5%} = 29,04 g DL_{1%} = 39,24 g DL_{0,1%} = 52,27 g

In 2013, the largest fruit weight was in the apple tree cultivar Granny Smith (176,63 g), with a difference to the control very distinctly significantly

positive; the lowest value was in the apple tree cultivar Pionier (50,70 g), a difference to the control very distinctly significantly negative (Table 2).

Table 2

Fruit weight in the studied apple tree cultivars and biotypes (2013)

| Cultivar | Mean weight (g) | Relative value (%) | Difference to the control | Significance |
|----------------------|-----------------|--------------------|---------------------------|--------------|
| Romus 2 | 76,41 | 63,22 | -44,45 | 000 |
| Pionier | 50,70 | 41,95 | -70,16 | 000 |
| Starkrimson | 141,70 | 117,25 | 20,84 | - |
| Florina | 149,95 | 124,07 | 29,09 | XX |
| Wagener | 144,51 | 119,57 | 23,65 | X |
| Generos | 106,08 | 87,77 | -14,78 | - |
| Jonathan | 119,83 | 99,15 | -1,03 | - |
| Delicios de Voinesti | 123,04 | 101,80 | 2,18 | - |
| Golden | 119,73 | 99,07 | -1,13 | - |
| Granny Smith | 176,63 | 146,15 | 55,77 | XXX |
| Mean of cultivars | 120,86 | 100 | 0 | Control |

DL_{5%} = 21,55 g DL_{1%} = 29,12g DL_{0,1%} = 38,79 g

Data shown in Table 3 show that, in 2012, dry matter reached values ranging between 19,77 g in the apple tree cultivar Starkrimson, with a difference to the control very distinctly significantly positive; the lowest

value (12,93 g) was in the apple tree Pionier, with a difference to the control very distinctly significantly positive.

Table 3

Dry matter in the studied apple tree cultivars and biotypes (2012)

| Cultivar | Mean weight | Relative value (%) | Difference to the control | Significance |
|----------------------|-------------|--------------------|---------------------------|--------------|
| Romus 2 | 14,50 | 89,76 | -1,65 | - |
| Pionier | 12,93 | 80,07 | -3,22 | 000 |
| Starkrimson | 19,77 | 122,37 | 3,61 | XXX |
| Florina | 14,33 | 88,73 | -1,82 | 0 |
| Wagener | 15,40 | 95,34 | -0,75 | - |
| Generos | 14,60 | 90,38 | -1,55 | - |
| Jonathan | 17,47 | 108,13 | 1,31 | - |
| Delicios de Voinesti | 19,23 | 119,07 | 3,08 | XXX |
| Golden | 18,63 | 115,35 | 2,48 | XX |
| Granny Smith | 14,67 | 90,80 | -1,49 | - |
| Mean of cultivars | 16,15 | 100 | 0 | Control |

DL_{5%} = 1,67 DL_{1%} = 2,26 DL_{0,1%} = 3,01

In 2013, the highest value of dry matter was again in the apple tree cultivars Starkrimson (20,17 g) and Delicios de Voinesti (19,33 g), with a difference to the control very distinctly significantly positive; the

lowest value was in the apple tree cultivars Pionier (13,30 g), Romus 2 (14,33 g) and Granny Smith (14,37 g), with a difference to the control distinctly significantly negative (Table 4).

Table 4

Dry matter in the studied apple tree cultivars and biotypes (2013)

| Cultivar | Mean weight | Relative value (%) | Difference to the control | Significance |
|----------------------|-------------|--------------------|---------------------------|--------------|
| Romus 2 | 14,33 | 73,35 | -5,21 | 00 |
| Pionier | 13,30 | 68,07 | -6,24 | 000 |
| Starkrimson | 20,17 | 103,21 | 0,63 | XXX |
| Florina | 14,77 | 75,57 | -4,77 | 0 |
| Wagener | 15,13 | 77,45 | -4,41 | - |
| Generos | 14,27 | 73,01 | -5,27 | 00 |
| Jonathan | 17,90 | 91,61 | -1,64 | X |
| Delicios de Voinesti | 19,33 | 98,94 | -0,21 | XXX |
| Golden | 18,50 | 114,22 | 2,30 | XX |
| Granny Smith | 14,37 | 73,52 | -5,17 | 00 |
| Mean of cultivars | 19,54 | 100 | 0 | Control |

DL_{5%} = 1,28 DL_{1%} = 1,73 DL_{0,1%} = 2,31

Conclusions

- As far as the large fruit diameter in the studied apple tree cultivars is concerned, in the two experimental years (2012-2013), the highest value was in the apple tree cultivar Granny Smith.
- As for the small fruit diameter, both in 2012 and 2013, the apple tree cultivar Granny Smith reached a maximum value (70,0 mm and 74,33 mm, respectively), and the apple tree cultivar Pionier reached a minimum value (47,66 mm and 50,66 mm, respectively).
- Regarding the fruit height, the highest value in 2012 was in the apple tree cultivars Starkrimson (61,00 mm) and Jonathan (61,00 mm); in 2013, the highest value in fruit height was in the apple tree cultivar Florina (65,66 mm).
- Data show that the largest fruit weight was in the apple tree cultivar Granny Smith in both experimental years.
- Data also show that, in 2012, dry matter reached 11,77 g in the apple tree cultivar Starkrimson, with a difference to the control very distinctly significantly positive, and 12,93 g in the apple tree

cultivar Pionier, with a difference to the control very distinctly significantly negative; in 2013, the highest value of dry matter was again in the apple tree cultivars Starkrimson (20,17 g) and Delicios de Voinesti (19,33 g), with a difference to the control very distinctly significantly positive; the lowest value of dry matter was in the apple tree cultivars Pionier (13,30 g), Romus 2 (14,33 g) and Granny Smith (14,37 g), with a difference to the control very distinctly significantly negative.

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