

EVALUATION OF NEW APPLE CULTIVARS GROWN IN ROMANIAN NORTHEASTERN AREA

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ABSTRACT

The paper presents a 2-years study of the valuable characteristics in four foreign apple cultivars grown in northeastern Romania, named Moldavia area. The phenological stages, quality traits of fruits and some chemical parameters were evaluated. Start flowering was determined at April 17th ('Resse'), while end of flowering was identified the period April 27th -28th. Period of flowering was 9 to 12 days as average for studied years 2019-2020. Fruit's weight have varied between 120.55 g ('Resse') and 179.46 g ('Remo'), while fruit's equatorial diameter have varied between 65.82 mm and 74.87 mm at 'Resse' and respectively 'Remo', but no statistically distinct differences registered between all studied apple cultivars. The values of the soluble dry solids range between 14.65° Brix ('Resse') to 17.05° Brix ('Relinda'), and the total dry solids has recorded values between 17.95% ('Resse') to 21.39% ('Remo'). The studied apple cultivars showed variability but some got remarked through large fruit's size or high level of soluble dry solids.

INTRODUCTION

Apple tree growing is one of the most known and widespread crops in the temperate climates of the globe. The variability of the genus and the main species of *Malus domestica*, favors dissemination and adaptation to various geographical areas (Grădinariu, 2002). Worldwide, approximately 5 million hectares are occupied by apple cultivation providing a total production of 84 million tonnes (FAO, 2020). The share of apple cultivation in the world economy of fruit production is mainly due to the role that fruits have in the rational human diet. They are consumed fresh or processed as alcoholic or non-alcoholic beverages (juices or nectars). In Romania, apple tree growing occupies the leading place in fruit production. According to statistical data of the Ministry of Agriculture and Rural Development of Romania, the area cultivated with this species is about 54 thousand hectares, while the total production of apples in Romania can reach 644 thousand tons (Brodeală et al., 2020). For apple growers, fruit size is strongly correlated with profits, but shape and color are also some of the most important qualities for fruit consumers (Schotzko, 1985). Zajmi et al. (2007) show that in practice there are several methods for determining the maturity of the fruit according to market requirements, both for consumers and the processing sector. In practice, the following methods are mainly used: the number of days from pollination to fruit harvest, the separation of the branch stalk, the change of fruit color, the change of seed color, etc. There are also methods of physiological analysis, such as the spectrophotometric method or the determination of the presence of starch (Lepaja K. et al., 2014). According to Shqahu (2007), apple is a culture that grow well on a wide range of soils, both in texture and soil type. It has moderate demands on temperature, giving good results in areas where the average annual temperature is between 8 and 9.5° C, but can

grow and develop in regions with average temperatures of 7.5-7.9° C. The studied apple cultivars showed high variability but some got remarked through large fruit's size or high level of soluble dry substance.

MATERIALS AND METHODS

The research was performed between 2019-2020, at Research and Delopment Station for Fruit Growing (RSFG) Iași, using as research material four apple cultivars: 'Golden Reinders', originating from Netherland (Militaru et al., 2018) and 'Remo', 'Relinda' and 'Resse', originating from Germany (Hanke et al.,2017), grafted on MM106. The experimental field is located in the Sârca valley, where the annual average temperature was 11.33°C in 2019 and 12.03°C in the first seven months of 2020 while the multiannual average being 11.68°C. The trees were planted at 2 x 4 m distances and led under the shape ofpalmette. On the tree rows, the soil was prepared with the rotary orchard tiller and between the rows, the soil was grassed. The control of diseases and pests was performed according to the received warnings, phytosanitary treatments being applied. To appreciate the flowering and fructification phenophases the Fleckinger system was used (1960). Biometric measurements and determinations were performed as follows:fruit's equatorial diameter(mm), thicknes (mm) and lenght (mm) using slide gauge tool Lumytools (Radu et al., 1957) and its average weight (g) using an analytical balance Radwag. The chemical determinations included for the analysis: the soluble dry solids (SDS%) using a Zeiss refractometer,the determination of the humidity (%) and of the total dry substance (TDS%) using the oven for five hours to 105°C (Cociu, 1989). The experimental data was interpreted statistically by analysing the variance.

RESULTS AND DISCUSSIONS

The main fructification phenophases of studied apple cultivars are presented in table 1. Bud burst start on 4thof April at 'Remo' cv.,but were end on 6th of April at 'Relinda' cv. Flowering beginning was between 17th to 19th of April, and blooming ending was between 27th to 28th of April. Bloom period of studied apple cultivars was between 9 to 12 days.

Table 1. The main fructification phenophases of studied apple cultivars (RSFG Iași, 2019-2020)

Cultivars	Bud burst (data)	Flowering beginning (data)	Flowering ending (data)	Duration period (days)	Ripening time (data)
Golden Reinders	April 5	April 18	April 28	11	September 9
Remo	April 4	April 19	April 27	9	September 4
Relinda	April 6	April 19	April 28	10	September 8
Resse	April 5	April 17	April 28	12	September 4

In order to establish the adaptability of the studied cultivars to the ecological conditions in Iași-Romania, biometric determinations as: weight, diameter and height of the fruits were recorded. Thus, were made centralized averages of the obtained values (Table 2). Through the statistical interpretation of the results compared to the average as control, were obtained insignificant differences for all four cultivars. But we found that the greatest fruit's weight registered 'Remo' and 'Relinda' cvs.with 179.46 g and 168.46 g, respectively.

Regarding the weight of the fruit, the largest differences from the control variant were recorded at 'Resse'cv., with a lower value by 33.5 g (Table 2). However, Zadavec et al. (2013) showed that fruit diameter and fruit weightare positively correlated.

The fruit's length and thickness of the studied four apple cultivars did not have significant differences compared with average as control (Table 2).

Table 2. Physical features of the fruit in the investigated apple cultivars (RSFG Iași, 2019-2020)

Cultivar	Fruit's weight(g)	Fruit's equatorial diameter(mm)	Fruit's thickness(mm)	Fruit's length(mm)
Golden Reinders	147.67 ^{ns}	71.33 ^{ns}	70.03 ^{ns}	63.20 ^{ns}
Resse	120.55 ^{ns}	65.82 ^{ns}	63.37 ^{ns}	56.02 ^{ns}
Remo	179.46 ^{ns}	74.87 ^{ns}	72.84 ^{ns}	66.26 ^{ns}
Relinda	168.46 ^{ns}	73.45 ^{ns}	69.88 ^{ns}	65.83 ^{ns}
Average (control)	154.03	71.37	69.03	62.83
DL 5%	97.13	14.06	13.05	13.74
DL 1%	141.28	20.46	18.98	19.98
DL 0.1%	211.93	30.68	28.48	29.98



Figure 1. Relinda apple cv. (photo Iulia Mineata)



Figure 2. Remo apple cv. (photo Iulia Mineata)

The average soluble dry solids of the studied four apple cultivars was between 14.65% ('Resse') and 17.05% ('Relinda'). By statistically interpreting distinctly significant differences were recorded for 'Relinda' cv. and negative distinctly significant differences for 'Resse' cv. There were no significant differences in the 'Golden Reinders' and 'Remo' cvs. compared with average as control (Table 3).

Table 3. Chemical characteristics of the fruits in the investigated apple cultivars (RSFG Iași, 2019-2020)

Cultivar	SDS(%)	TDS(%)	Humidity(%)
Golden Reinders	15.90 ^{ns}	19.01 ^{ns}	80.98 ^{ns}
Resse	14.65 ⁰⁰	18.96 ^{ns}	81.03 ^{ns}
Remo	15.68 ^{ns}	21.39 ^{**}	78.61 ⁰⁰
Relinda	17.05 ^{**}	17.95 ⁰	82.04 [*]
Average (control)	15.82	19.33	80.66
DL 5%	0.64	1.53	1.53
DL 1%	0.93	2.22	2.22
DL 0.1%	1.41	3.33	3.33

The analyses performed to determine the humidity and total dry solids had insignificant differences of 'Golden Reinders' and 'Resse' cvs. compared to the average as

control. The difference from the average of total dry solids in 'Remo'cv. is distinctly significant, while 'Relinda' variety shows negatively significant differences. The humidity of the fruit's showed significant differences in 'Relinda'cv. and negative distinctly significant differences in 'Remo'cv. However, our results are according with other similar research on apple genotypes. Also, Campeanu et al., (2009) find that TDS recording values between 11.63% to 21.31%, while SDS recording values between 11.00% to 15.50%at ten apple genotypes in Romanian climate conditions.

CONCLUSIONS

- The research shows results that have an impact on the technology of apple growing, both for fresh consumption and for processing, by using foreign cultivars of apple in the climatic region of North-East Romania, the Iași area.
- All the quality parameters observed on the fruits, such as the diameter, the height, the weight and the content of the soluble dry substance demonstrate that 'Golden Reinders', 'Resse', 'Remo' and 'Relinda' cvs. have a good adaptability in the ecological conditions in Iași, keeping the characteristics specific to the cultivar.

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