

New Romanian Disease Resistant Pear Genotypes Fruits Evaluated Through Sensorial Analyses

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Abstract This study aims to present the fruit quality evaluation using sensorial analyses of some new Romanian disease resistant pear genotypes. Four varieties (Corina, Euras, Orizont, Romcor) and two new hybrid selections (R3-146, H12-83-79) planted with own roots or grafted on quince and pear were analyzed. The tested parameters were: fruit size and color, attractiveness, firmness, pulp juiciness and color, taste and flavor. The basic analyses like average weight, size, total soluble solids, dry matter and firmness were determined and correlated with the sensorial analysis parameters.

The best appreciations were scored for the R3-146 hybrid grafted on pear and Euras grafted on quince and also on pear. Significant correlations were observed between attractiveness and measured fruit size, taste and total soluble solids. The results of the sensorial evaluations confirmed that the bigger fruits with a higher quantity of sugars were more appreciated by the consumers.

Pear is a well-known and appreciated fruit, having 8.10-14.2% total soluble solids and more, 0.12-0.45% total acidity, 0.06-0.27% tanoide substances, 0.14-0.17% pectic substances, 0.24-0.71% crude protein, vitamins and also a therapeutic value, due to the predominance of basic equivalents over the acid ones (6.10 mg/1.58 mg) [17].

In the last 25 years, pear production doubled according to similar harvesting areas [39], Asia being the biggest producer with 71% followed by Europe with 15.8%. Italy has the largest production in Europe (31%), followed by the Netherlands (16%), Belgium (15%) and Spain (14%). Conference was the most cultivated cultivar followed by Williams and Abate Fetel.

Romania contributed with around 1% at the total European Union production, Williams cultivar having the largest cultivated areas followed by Conference and Abate Fetel [40]. Their sensitivity to pest and diseases, especially to pear psylla (*Cacopsylla pyricola* Förster) and fire blight (*Erwinia amylovora* Burrill) led to a continuous decrease of orchards surfaces in the last years, although the production remained constant, possible due to the new technologies applied [39].

Pear breeding program at Research Station for Fruit Growing Voinești had as objectives new cultivars with disease resistance (*Venturia pirina*, *Erwinia amylovora*), tolerance to black and white spot (*Fabraea maculate*, *Mycosphaerella sentina*), fumagine (*Capnodium salicinum*) and *Psylla sp.*; the extended period for the winter season, good fruit appearance, high biological potential and adaptability [3, 1].

Key words

Corina, Euras, Orizont, *Pyrus communis*, Romcor

Some of the results of this breeding program were represented by the cultivars Euras (1994), Corina, Orizont and Tudor (2003), Romcor and Cristal (2009) [6, 20, 2, 1, 28].

Sensorial testing is an old method that is scientifically systematized in the last decades. Its importance is revealed also through the large use in last years, the consumer preferences being prioritized and their rapid fluctuations monitored [23].

Kappel *et al.* [19] defined, according to a comprehensive study made for North American consumers, the acceptance intervals for sensory attributes of pear cultivars. The most appreciated fruit size was between 150-250 g with a 6-7.5 cm fruit diameter. The yellow color was most acceptable, firmness between 18-22 N (the fruits must not be too hard), total soluble solids more than 14% and total acidity around 180 mg malic acid per 100 ml juice.

Gittins *et al.* [16] defined the sensory descriptive panel for pear quality evaluation in Argentina. Predieri *et al.* [30, 31, 32] conducted a series of tests with a sensory evaluation of pear fruits in Emilia-Romagna. Ozdemir *et al.* [26] evaluated 11 local pear cultivars through appearance, firmness, sweetness, juiciness and overall quality attributes with specific correspondences with laboratory analyses.

Pear attributes according to a sensory evaluation during storage were analyzed by [13], [12], [27], [24] presented the influences of shelf-life time on consumer preferences for 'Rocha' cultivar.

Takácsné Hájos *et al.* [35] determined the main correlations between sensorial scores and data obtained

by laboratory tests on pear fruits on different cultivars. Calvo *et al.* [8] highlighted also the negative correlation between fruit firmness and consumer preferences.

This study aims to present the fruit quality evaluation using sensorial analyses of some new Romanian disease resistant pear genotypes and correlations with several data obtained through laboratory methods.

Material and Method

Description of the study site and experimental design

The tested pear fruits were harvested from the Experimental field of the Faculty of Horticulture in Bucharest, located in the North part of the town. They were kept in the cold storage until they were analyzed.

Biological material

Four cultivars (Corina, Euras, Orizont and Romcor) and two new hybrid selections (R3-146 and H12-83-79) (Figure 1) on own roots, *in vitro* propagated, and grafted on quince (CTS 212) and on pear (Farold 40) were analyzed. The trees were produced at the Research Station for Fruit Growing Voinești. Two canopy shapes were used, according to the used rootstock. The planting distances varied from 3.0 x 0.8 m, for Parallel U to 3.0 x 1.6 m, for Trident canopy. An integrated technology was applied, including drip irrigation.

Corina cultivar (Passe Crassane x (B.C. *Pyrus serotina* x Olivier de Serres) x Decana Comisiei) has a medium vigor. It is resistant to scab and tolerant to fire blight. The ripening period it is between October and November. **Euras** cultivar ((*Pyrus serotina* x Olivier de Serres) x Decana de iarnă) has a medium vigor. It is resistant to scab and tolerant to fire blight and *Psylla* sp. The harvesting period is October and can be consumed until April.

Orizont cultivar [(B.C. *Pyrus serotina* x Oliver de Serres) x Oliver de Serres] x Josephine de Malines has a medium vigor. It is resistant to scab and tolerant to *Psylla* sp. The ripening period is December – February.

Romcor cultivar [Passe Crassane x (*Pyrus serotina* x Oliver de Serres)] x Decana Comisiei has middle to strong vigor. It is resistant to scab and tolerant to *Psylla* sp. No fire blight attack symptoms were observed. The ripening period is between October and January [17, 14, 7, 6, 4, 1].

The two rootstocks used were Farold 40 (Daygon), one of American OHF Selection (Old home x Farmingdale) which gives high vigor and productivity to the grafted cultivar [18, 38, 15, 9] and CTS 212, a quince rootstock obtained in Italia (Pisa), with high productivity to cultivars grafted on it and good fruit quality [17, 9].

Biochemical analyses

The basic analyses like average weight, size, total soluble solids, dry matter and firmness were determined and correlated with the sensorial analysis parameters.

Total soluble solids were determined for each genotype, with a refractive device Kruss DR301-95 (% Brix) [37, 33, 25].

Dry matter and water content of the samples were determined by oven drying for 24 hours at 105°C using a UN110 Memmert oven, a method used also by [21, 34, 11, 10, 22, 36, 5].

Firmness was determined with a digital penetrometer TR Turoni 53205, the results were expressed in kg f/cm².

Sensorial analyzes were performed on a group formed by persons with random gender, age and occupation. The sensorial analyses parameters monitored were: fruit size and color, attractiveness, firmness, pulp juiciness and color, taste and flavor.

There were two testing sessions in autumn – winter 2018. For the first testing session (October 2018), Corina grafted on quince; Euras on own roots and grafted on pear and quince; Orizont on own roots and grafted on pear and quince; H12/83/79 hybrid; R3-146 hybrid grafted on pear were analyzed. At the testing moment, firmness, total soluble solids and dry matter were analyzed.

In the second testing session (December 2018), Euras and Orizont grafted on pear were analyzed.

The analyses were conducted in the Research Center for Studies of Food Quality and Agricultural Products, University of Agronomic Studies and Veterinary Medicine of Bucharest.

Statistical analysis

Data statistical analysis was performed with Excel (MS Office) and Quattro programs. Anova one-way with T and F tests were used. For correlation between two data sets Excel statistical functions with a significance level $p < 0.05$ were used [29].



Corina



Euras



Orizont



Romcor



H12-83-79



R3-146

Figure 1. Scab resistant pear genotypes fruits

Results and Discussions

At the first testing (October 2018), the most appreciated fruits were of R3-146 hybrid grafted on pear followed by Euras grafted on quince and pear and the least were of H12-83-79 hybrid (Table 1).

H12-83-79 hybrid received the highest scores at the size parameter, Orizont on own roots for the color, attractiveness and pulp consistency, and R3-146 grafted on pear for pulp juiciness, taste and flavor. The pulp color was most appreciated on Euras grafted on pear.

At the Euras cultivar, fruit size, color, attractiveness and taste were more appreciated at the quince rootstock. Grafted cultivars (on pear respectively on quince) received overall higher scores than those on own roots.

At the Orizont cultivar, fruit size, pulp juiciness and color, taste and flavor were higher appreciated on pear rootstock. Fruit color, attractiveness and pulp firmness were higher to the own roots plant fruits. For this cultivar, the fruits obtained on the quince rootstock were least appreciated.

Table 1. Sensorial evaluation of pear genotypes fruits

Cultivar/ Hybrid	Size (3..1)	Fruit color (3..1)	Attractiveness (3..1)	Pulp firmness (5..1)	Pulp juiciness (3..1)	Pulp color (3..1)	Sclereides (3..1)	Taste (6..1)	Flavor (3..1)	Total (9-32)
Corina-Q	1.31±0.46	1.81±0.68	1.81±0.75	3.33±1.15	1.86±0.48	2.14±0.57	2.05±0.74	3.33±1.39	1.90±0.77	19.55±3.91
Euras-P	2.00±0.71	1.90±0.70	2.17±0.58	3.33±0.97	2.40±0.62	2.48±0.68	1.88±0.77	3.88±1.69	2.10±0.89	22.14±4.82
Euras-Q	2.09±0.61	2.14±0.71	2.32±0.72	2.86±0.89	2.20±0.59	2.23±0.61	2.05±0.58	4.05±1.33	2.09±0.61	22.02±3.99
Euras-R	1.48±0.75	1.81±0.75	1.93±0.84	3.14±0.79	2.31±0.72	2.14±0.79	2.05±0.80	3.81±1.40	2.24±0.70	20.90±4.84
Orizont-P	1.79±0.46	2.10±0.70	2.07±0.75	3.48±0.93	2.05±0.59	2.14±0.48	2.02±0.60	3.33±1.35	2.10±0.83	21.07±2.40
Orizont-Q	1.67±0.58	1.76±0.62	1.81±0.60	3.14±0.65	1.76±0.62	2.05±0.67	2.33±0.48	3.05±1.24	1.76±0.70	19.33±2.33
Orizont-R	1.64±0.73	2.62±0.50	2.62±0.86	3.62±0.97	1.88±0.74	1.95±0.59	2.00±0.63	3.19±1.29	1.74±0.77	21.26±4.47
R3-146-P	1.68±0.57	2.36±0.66	2.32±0.95	2.91±1.15	2.59±0.67	2.36±0.58	2.05±0.95	4.27±1.08	2.27±0.77	22.82±4.09
Romcor-Q	2.14±0.56	2.32±0.65	2.34±0.84	2.73±1.08	2.05±0.72	2.09±0.75	2.27±0.94	2.36±1.29	1.66±0.64	19.95±3.81
H12-83-79	2.95±0.21	1.77±0.75	2.05±0.90	2.20±1.18	1.61±0.87	1.77±0.75	2.05±0.79	2.36±1.36	1.45±0.67	18.23±4.65
Average	1.87±0.46	2.06±0.30	2.14±0.26	3.08±0.42	2.07±0.31	2.14±0.20	2.07±0.13	3.36±0.66	1.93±0.27	20.73±1.44
	62%	69%	71%	62%	69%	71%	69%	56%	64%	65%

Q= quince, P = pear, R = own roots

Pear attributes were compared with the fruit parameters determined through laboratory analysis (Table 2).

Table 2. Fruit parameters in laboratory analyzed

Cultivar/ hybrid	Fruit diameter (mm)	Fruit height (mm)	Ratio L/D	Firmness (kg f/cm ²)	TSS (%)	Dry matter (%)
Corina-Q	58.82	60.13	1.02	1.23	15.00	19.36
Euras-P	63.65	68.44	1.08	2.42	15.50	24.56
Euras-Q	55.51	63.68	1.15	1.90	18.70	24.43
Euras-R	59.86	62.99	1.05	2.71	15.80	28.05
Orizont-P	64.46	62.03	0.96	2.16	15.30	23.66
Orizont-Q	56.97	55.99	0.98	2.14	16.00	30.59
Orizont-R	58.84	57.54	0.98	2.88	13.40	20.99
R3-146-P	63.46	60.68	0.96	0.89	15.00	24.26
Romcor-Q	63.71	63.82	1.00	1.02	12.70	22.43
H12-83-79	68.98	73.08	1.06	-	10.70	-

Significant correlations were observed and determined between the attractiveness attribute and the measured fruit size, the appreciation of the fruit size and the

measured one, the taste attribute and the total soluble solids (Figure 2). Consumers appreciated the sweeter and bigger fruits, similar results being observed at [19].

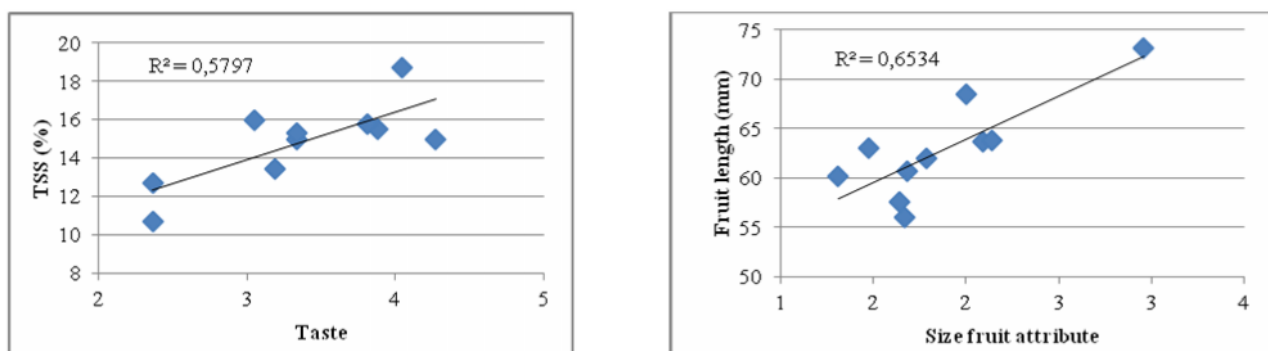


Figure 2. Correlation between taste and total soluble solids content, size attribute and fruit length

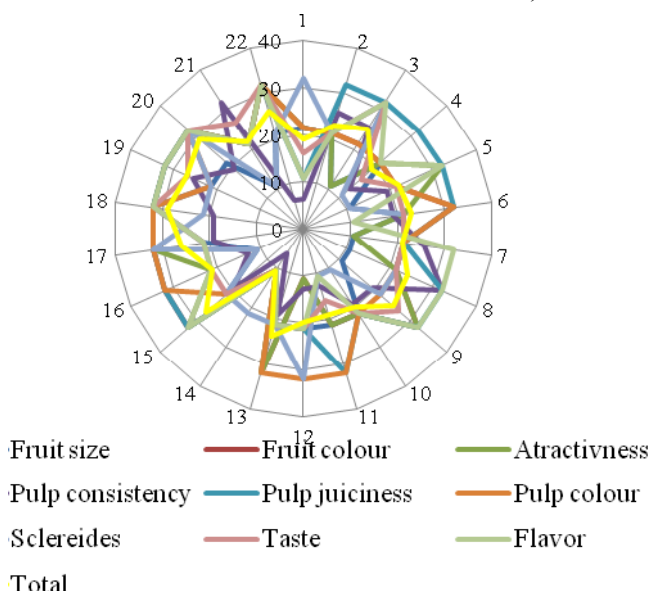


Figure 3. R3/146 hybrid sensorial evaluation attributes

At the second testing session (winter 2018), two winter cultivars (Euras – P and Orizont – P) were tested (Table 3)

Table 3. Sensorial evaluation of two pear cultivars fruits in winter

Cultivar/ Hybrid	Size (3..1)	Fruit color (3..1)	Attractiveness (3..1)	Pulp firmness (5..1)	Pulp juiciness (3..1)	Pulp color (3..1)	Taste (6..1)	Flavor (3..1)	Total (8..29)
Euras -P	2.24±0.83	2.41±0.80	3.41±1.33	3.47±1.37	2.00±0.79	2.35±0.79	3.82±1.74	2.47±1.12	22.18±6.81
Orizont-P	2.20±0.68	2.20±0.77	3.27±1.33	3.87±1.13	2.47±0.74	2.33±0.72	3.33±1.84	2.40±1.35	22.07±6.45
Average	2.22±0.02	2.31±0.15	3.34±0.10	3.67±0.28	2.23±0.33	2.34±0.01	3.58±0.35	2.44±0.05	22.12±0.08

*P = pear

Table 4. Fruit parameters analyzed for the second session

Cultivar	Fruit height (mm)	Fruit diameter (mm)	Ratio H/D	TSS (%)	Dry matter (%)
Euras/F	68.44	63.65	1.08	14.68	22.46
Orizont/F	62.03	64.46	0.96	13.62	23.64

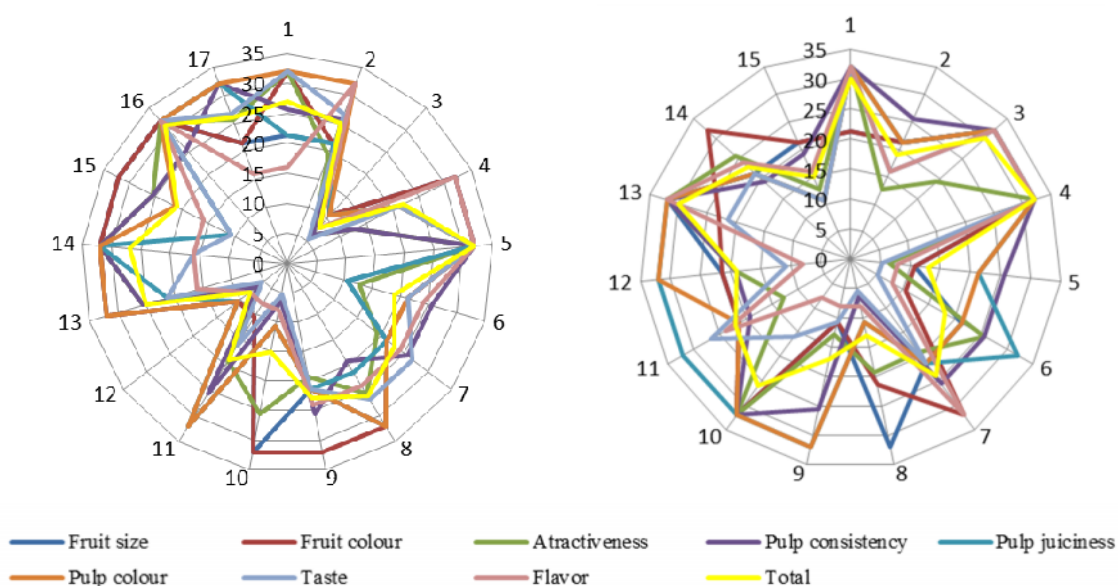


Figure 4. Euras-P and Orizont – P sensorial evaluation attributes

For the two cultivars tested in the second session, the overall score was higher than in the first session. The highest increase was to attractiveness attribute for both cultivars, respectively fruit color for Euras. The taste attribute evaluation was similar for the two periods. The results are similar to [19] regarding the yellow color and fruit size appreciation.

Although, in general, the fruits received good scores but not the best, an important aspect was the optimum period for consumption for each cultivar. Storage conditions and shelf-life time are very important parameters at pears and must be carefully considered for fruit appreciation

Conclusions

The new Romanian disease resistant pear genotypes can be promoted for being cultivated on large orchards. Interesting results of the sensorial evaluations confirmed that the bigger fruits with a higher quantity of sugars were more appreciated by the consumers, most of them have these qualities. R3-146 hybrid was

most appreciated from the tested genotypes followed by Euras grafted on quince and pear.

The appreciation of winter pears increased between the two testing sessions. Further researches are required, considering the storage period and maturity level of fruits.

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