

## EVALUAREA CALITATII FRUCTULUI LA UNELE SOIURI DE MAR REZISTENTE LA RAPAN (*VENTURIA INAEQUALIS*)

### FRUIT QUALITY EVALUATION OF SOME SCAB (*VENTURIA INAEQUALIS*) RESISTANT APPLE CULTIVARS

Mădălina Militaru<sup>1</sup>, Emmanuel de Lapparent<sup>2</sup>, Mădălina Butac<sup>1</sup>, Claudia Nicola<sup>1</sup>

<sup>1</sup>Research Institute for Fruit Growing Pitești, Romania

<sup>2</sup>International Fruit Obtention Angers, France

#### Abstract

Fruit quality of seven scab resistant varieties (Rebra, Rustic, Enterprise, Goldrush, Chouquette® Dalinette, Ariwa, Topaz) was compared with non-resistant varieties (Golden Delicious). To assess external and internal fruit quality, the following was investigated: standard parameters (fruit weight, firmness, soluble solids, malic acid) and sensorial quality by panel tests (fruit size, shape and skin, firmness, juiciness, taste, flavour). The study confirmed that the resistant varieties were competitive in respect to fruit quality with the non-resistant varieties.

**Keywords:** *Malus x domestica*, scab resistance, fruit quality

**Cuvinte cheie:** *Malus x domestica*, rezistență la rapăn, calitate fruct

#### 1. Introduction

The terms quality and consumer are very complex and may be defined differently by various individuals. Consumers do not always agree what is acceptable quality and instruments do not necessarily measure the same combination of properties that humans integrate into their assessment of acceptability (Abbott et al., 2004). Two apples can have the same instrumental values for firmness, but can be perceived quite differently by consumers (Brown et al, 2006). Certain components of eating quality are more important to some individuals than for others (Kuhn and Thybo, 2001).

Harker et al. (2003) defined quality as "all those characteristics of a food (not just the sensory characteristics) that lead a consumer to be satisfied with the product".

For the future development of sustainable organic fruit production, it will be necessary to introduce pest and disease resistant or tolerant cultivars, which are well adapted to the local climate (Cmelik et al., 2007; Gianfranceschi, 2004). The success of newly developed apple disease resistant varieties is largely dependent on their fruit quality which needs to be at least equal to that of currently popular commercial cultivars (Granger et al., 1992). The introduction of high quality disease resistant apple varieties is widely considered an effective approach to reduce the use of fungicides in sustainable orchard management strategies (Kellerhals et al., 2001, 2004).

At Research Institute for Fruit Growing Pitesti, Romania we have performed fruit quality evaluation for 7 different resistant apple varieties compared with non-resistant varieties (Golden Delicious). The aims of the study are as follows: to compare disease resistant varieties to well accept as commercial varieties, to correlate sensory evaluations with instrumental analysis, define quality parameters determining the success of new apple resistant varieties.

#### 2. Material and methods

The orchard site was located at Research Institute for Fruit Growing Pitesti, Arges. The experiment was conducted on seven apple scab resistant cultivars (Rebra, Rustic, Enterprise, Goldrush, Chouquette® Dalinette, Ariwa, Topaz) grafted on MM 106 rootstock, compared with as well-known commercial standard, Golden Delicious (table 1). The optimal harvest for picking each cultivar was constructed on the basis of reports in the pomological literature and for internal quality of fruits.

To assess external fruit quality at harvest, ten representative apple fruits of each cultivar were used for physical and chemical analysis by standard methods:

- Fruit weight was determined by weighing. (g / fruit).
- Firmness was measured with penetrometer (kg/cm<sup>2</sup>).
- Soluble solids content (SSC) was measured with refractometer (° Brix).
- Titratable acidity was determined as % malic acid by titration of the juice with NaOH to pH 8.1.

Harvested fruits of each cultivar were stored in the same cool room at 2°C (± 1°C) and relative humidity 95-100% (normal atmosphere storage). After storage, the fruits were brought up to room temperature 24 h before evaluation.

Sensory evaluation was performed after 4 months of storage. The panelists had to evaluate the following characteristics: appearance fruit (shape, size, skin, colour) and flesh characteristics (texture,

firmness, juiciness, taste, flavour). For this purpose, a hedonic scale was used (graded from 1 to 9), with descriptive grading from unsatisfactory to excellent.

The differences between cultivars were compared using LSD test at  $P = 0.05, 0.01$  and  $0.001$ .

### 3. Results and discussions

#### 1. Sensory quality of apple cultivars

The cultivars were very different regarding physical and chemical qualities at harvest. Among tested cultivars the highest score for fruit appearance (size, shape, skin) was obtained for 'Enterprise' and 'Choupette® Dalinette' (8.3 and 8 point), followed, in order, by 'Topaz', 'Goldrush', 'Rustic', 'Ariwa' and 'Rebra', with the lowest score found for, 'Golden Delicious'. Large differences in sensory scores were found between cultivars. 'Choupette® Dalinette' cv. had the highest preference for all parameters (firmness, juiciness, taste, flavour) of flesh fruit with 9 point, with a big difference (+ 2.2 point) versus control. Five ('Choupette® Dalinette', 'Topaz', 'Goldrush', 'Enterprise' and 'Ariwa') out of seven apple varieties tested was evaluated better for quality fruit characteristics.

The cultivars were very different regarding the flesh fruit characteristics. 'Goldrush' was very firm, but low crispy and juicy. 'Topaz' was crispy and juicy, but was not firm for  $3.2 \text{ kg/cm}^2$ . Flavour, elusive and complex trait, is determined and influenced by genetics, the environment and cultural practices. Although, Romanian consumers prefer flavoured apple, with medium firmness, the average scores of all together perception of fruit quality (appearance and flesh characteristics), showed that the preference is 'Choupette® Dalinette', followed by 'Enterprise' and 'Topaz' (Table 2, Figure 1).

#### 2. Instrumental analyses

*Fruit weight* is determined by genetics and cultural practices. 'Rebra' cv. has largest fruit, with average weight of 227 g / fruit and 'Ariwa' cv. smallest (fruit average weight 135 g).

*Firmness*. Human perception of fruit texture is determined by the way that the flesh breaks down during chewing. There are three components of texture: 1) the mechanical properties of the tissue, 2) the juiciness of the flesh and 3) the mouth feel or how the apple breaks down. After 4 months of storage, 'Goldrush' cv. was the firmest with  $7.7 \text{ kg/cm}^2$ , and the smallest Rustic' cv. ( $2.4 \text{ kg/cm}^2$ ).

*Soluble solids content (SSC)*. Apples need to differ by more than 1°Brix for trained panelists to detect a difference in taste. For all evaluated cultivars SSC had big values, between 14.6 °Brix at 'Goldrush' cv. and 18.1 °Brix at 'Choupette® Dalinette' cv.

*Malic acid* is the primary acid in apples. Perception of acidity can differ among people due to ratios of sugar and acid. 'Topaz' and 'Enterprise' cvs. were highest in acidity.

The most important quality traits to consumers are a good flavour and juiciness (Figure 2). In apple there are 200 to 3000 different volatiles and 15 to 40 of these aroma compounds contribute to varietal flavour with no one compound responsible for the characteristic flavor of a variety (Cunningham et al., 1985).

### 4. Conclusions

Sensory evaluation is a valuable tool to evaluate the market potential and success of resistant apple varieties.

Of the tested varieties, 'Choupette® Dalinette' cv. was preferred for flesh characteristics and 'Enterprise' cv. for fruit appearance.

'Goldrush' cv. was the firmest; 'Choupette® Dalinette' cv. was highest in soluble solids; 'Topaz' and 'Enterprise' cvs. were highest in acidity.

The paper shows that apples disease resistant are competitive with non-resistant varieties.

### 5. References

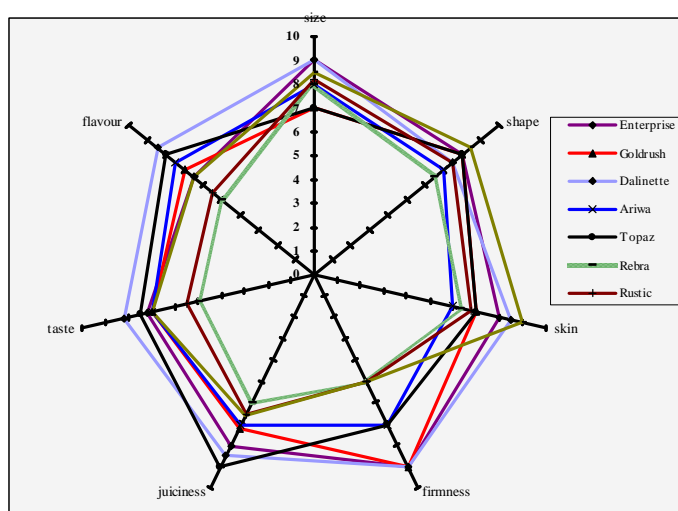
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**Tables and figures**

**Table 1. Apple varieties included in the panel test**

No.	Variety	Origin	Fruit characteristics
1	Enterprise	Illinois, USA, PRI 1661-2 X PRI 1661-1	Medium to large size, bright glossy finish; washed 80 to 100% medium red to slightly orange, attractive, juicy.
2	Goldrush	Illinois, USA, Coop 17 x Golden Delicious	Medium size, yellow, slight red blush, flesh rich spicy flavor with a high degree of acidity and sweetness.
3	Chouquette® Dalinette	Angers, France, Sel. X 4598 x Sel. X 3174	Medium size, red overcolour (70%), flesh sweet – tart, aromatic
4	Ariwa	Wadenswil, Switzerland, Golden Delicious x A 849-5	Small to medium size, yellow, orange overcolour, very firm, slightly sweet
5	Topaz	Strizovice, Czeck Republic, Rubin x Vanda	Medium size, firm, juicy, slightly acid
6	Rebra	Pitesti, Romania, Prima x Florina	Medium to large size, juicy, aromatic
7	Rustic	Pitesti, Romania, Florina x Pionier	Medium size, green, red overcolour, juicy, crispy.
8	Golden Delicious	Westvirginia, USA, Grimes Golden x Golden Reinette ?	Medium size, clear yellow, juicy, sweet sometimes lightly russeted, juicy, sweet

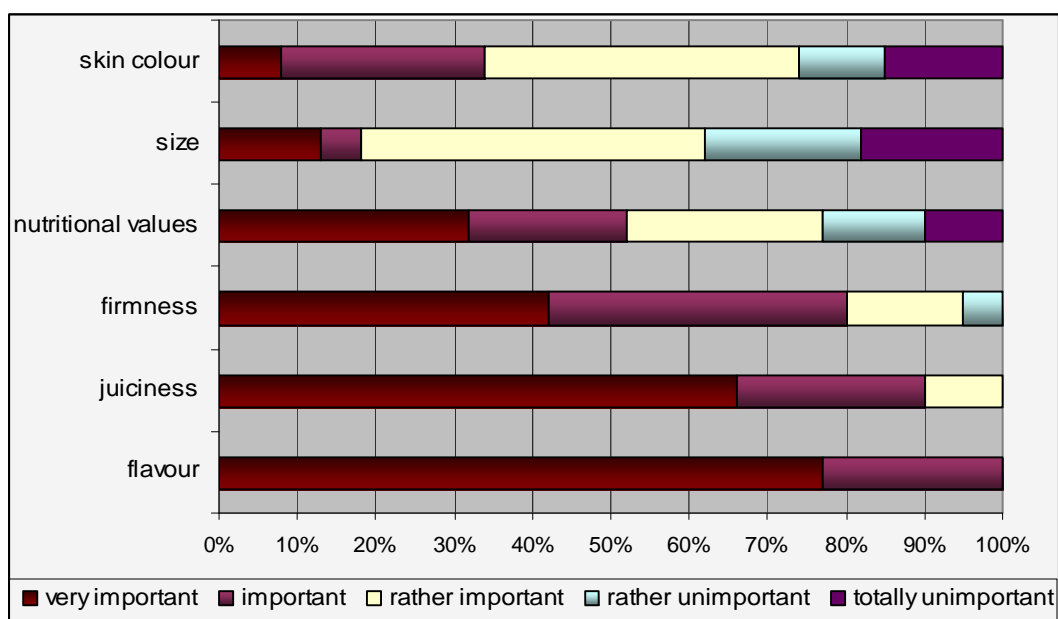


**Figure 1. Diagram of mean attribute scores of apple varieties included in the panel test**

**Table 2. Results of the evaluation test after 4 months of storage**

Varieties / evaluation	Enterprise	Goldrush	Choupette® Dalinette	Ariwa	Topaz	Rebra	Rustic	Golden Delicious
<i>Sensory evaluation</i>								
Appearance (1-9)	8.3 /+ 0.6 7 - 9	7.2 /+0.5 5 - 9	8 /+ 0.3 7 - 9	6.9 /- 0.8 5 - 8	7.3 /- 0.4 5 - 9	6.5 /- 1.2 5 - 8	7.1 /- 0.6 5 - 9	7.7 5 - 9
Flesh characteristics (1-9)	7.6 /+ 0.8 5 - 9	7.7 /+ 0.9 5 - 9	9 /+ 2.2 5 - 9	7.3 /+ 0.5 5 - 9	7.9 /+ 1.1 4 - 9	5.6 /- 1.2 3 - 8	6.3 /- 0.5 3 - 8	6.8 5 - 9
Score	7.95	7.45	8.50	7.10	7.60	6.05	6.70	7.25
% Appearance								
Excellent	83	25	36	0	30	0	20	25
Satisfactory	17	50	64	75	50	56	40	63
Unsatisfactory	0	25	0	25	20	44	40	12
% Flesh characteristics								
Excellent	34	33	52	17	50	0	0	25
Satisfactory	50	50	43	67	30	33	60	31
Unsatisfactory	16	17	5	16	20	67	40	44
<i>Instrumental analyses</i>								
Fruit weight (g)	167**	143	168**	135	153	227***	163*	143
Firmness (kg/cm <sup>2</sup> )	3.5	7.7***	5.4***	4.4***	3.2	3.5	2.4 <sup>000</sup>	3.4
SSC ( <sup>0</sup> Brix)	15.8	14.6 <sup>00</sup>	18.1***	16.9**	15.2	15.8	15.3	15.8
Malic acid (g/l)	4.8	5.4	3.6	4.1	4.8	3.5	3.9	3.2

Fruit weight: LSD 5% = 17.375 g; LSD 1% = 23.931 g; LSD 0,1% = 32.946 g  
 Firmness: LSD 5% = 0.293 kg/cm<sup>2</sup>; LSD 1% = 0.404 kg/cm<sup>2</sup>; LSD 0,1% = 0.557 kg/cm<sup>2</sup>  
 Soluble solids content: LSD 5% = 0.765<sup>0</sup> Brix; LSD 1% = 1.054<sup>0</sup> Brix; LSD 0,1% = 1.451<sup>0</sup> Brix



**Figure 2. Importance of apple characteristics**