

PERFORMANCE IN BREEDING SCAB RESISTANT APPLE VARIETIES AT RESEARCH AND DEVELOPMENT STATION FOR FRUIT GROWING VOINEȘTI

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Abstract

The last fifteen years of research activity at Research and Development Station for Fruit Growing Voinești, conclude in a large number of patented apple varieties with genetic resistance to diseases which proved high quality and performance in the orchards. Therefore, the aim of the paper is to present and highlight the wide range of achievements in terms of apple resilient national breeds. The trees vigour defined by the circumference of the trunk measured in the 10th year apple varieties, grafted on the M9 rootstock recorded values between 14.9 cm for 'Cezar' variety and 18.4 cm for 'Redix' variety. The crown volume calculated per unit area, was of 6,800 m³/ha for the 'Iris' variety and 8,800 m³/ha for the 'Redix' variety, which proved to be more vigorous. The productivity during the full fruiting period of the nine scab resistant apple varieties, grown in a high-density system, was between 28-45 t/ha, the most productive being considered 'Iris', 'Real', 'Remar', 'Valery' and 'Cezar' with constant yields over 35 t/ha. The fruit size varied between 155 g and 180 g, smaller ones remarked at the varieties 'Iris', 'Inedit', 'Voinicel' and 'Revidar' and larger fruits at the varieties 'Cezar', 'Valery', 'Remar' and 'Redix' with fruits over 170 g that match to the market requirements.

Key words: scab resistant variety, productivity, quality, crossing, genotypes.

INTRODUCTION

Last decades were marked by the trend of the global apple market to focus of performant apple varieties but with disease-resistant traits (Luo F. et al., 2020). Nevertheless, new breeding techniques have been experimented and driven in the same direction for apple breeding (Kellerhals M. et al., 2014, 2020)

The Research and Development Station for Fruit Growing Voinești has been a great contributor in breed apple scab resistant apple varieties and demonstrated a prolific and successful activity (Petre, V. and Petre, Gh., 2014). Also, steadily promote such apple varieties with genetic resistance to diseases for the new plantations with higher economic performance (Comanescu et al., 2012).

Latest achievements (Petre V. et al., 2017) named 'Valery', 'Cezar' and 'Revidar' already gained a well-deserved respectfully place in the Romanian apple assortment and looking forward for an extensive spread in the new orchards.

The mainstream of apple varieties apart from the disease resistant traits is to assure quality attributes requested by the consumers. Appearance and excellent eating quality are demanded to all the varieties and independent of the maturity class.

Present paper objectives are to emphasize the outcomes of the breeding activity over the past years at the RDSFG Voinești and to highlight the performances of apple resistant varieties in the national frame.

MATERIALS AND METHODS

A multiannual evaluation program of apple varieties bred at the RDSFG Voinești has been organized in order to point out the valuable and particular qualities.

The research was organized in the experimental fields of RDSFG Voinești. The genetic bio-base is composed by selection plots, hybrid nursery fields, higher level plots for elite testing etc. Also, all the patented varieties were tested and validated by the ISTIS protocols.

In the trial fields, the trees have been planted at a distance of 3.5 m x 1.0 m corresponding to a density of 2,857 trees/ha. Varieties were grafted on M9 rootstock and the training system of the crown was slender spindle.

Research conducted during last ten years reveal the great growing and fruiting potential of apple varieties. Biometrical measurements of the tree growth were done according to the experimental protocol and took into consideration the trunks dynamic growth, the size of the crown and completed with observations on the specific behaviour of growing. Regarding the productivity of the trees, the indicator considered the annual yield, fruit quality, content of dry soluble substance etc.

Nine apple varieties were studied: 'Redix', 'Iris', 'Real', 'Remar', 'Inedit', 'Voinicel', 'Valery', 'Cezar', 'Revidar'.

RESULTS AND DISCUSSIONS

The apple variety obtaining procedure is time consuming and of a high complexity especially when one major objective is disease resistance. For a new variety many traits have to comply with the breeder expectations and market demand.

Besides common breeding goals such as productivity, high quality of fruits, resistance to pest and diseases, a lot of complementary requirements have to be achieved:

- ecological adaptation of the new cultivar;
- destination of the production according to the inner particularities;
- consumer preferences;
- cost/efficiency ratio for the growing technology;
- suitability for nursery and propagation.

Tree vigour was estimated combining four indicators: trunk circumferences, height of the tree, fruiting wall thickness and the crown volume.

According to the data presented in the Table 1, the trunk diameter oscillated from 14.9 cm

('Cezar') to 18.4 cm ('Redix') with an average value of 16.27 cm.

Looking to the tree height, there was no big differences seized. The smallest trees were measured at 'Iris' (220 cm) with 33 cm less than the average tree height. 'Redix' confirm again as a vigorous variety (270 cm).

Crown volume express similar ranked values as tree height and the thickness of the slender spindle showed insignificant differences.

The blossom behaviour of the apple varieties indicated the early start of flowering of 'Iris' variety and 'Voinicel' and a late start of the blossom at the 'Valery' variety.

The yield of the nine apple varieties in a high-density system varied from 28 t/ha to 45 t/ha. Varieties which exceed 35 t/ha are the following: 'Iris', 'Real', 'Remar', 'Valery' and 'Cezar'.

Most of the apple varieties are producing fruits around 155-180 g such as 'Cezar', 'Valery' and 'Remar' that overpass 180 g/fruit while smaller fruits have been registered for 'Iris', 'Inedit' and 'Voinicel'.

The soluble dry substance (SDS) has a different distribution among the varieties that the size of the fruits. Only 'Valery' variety proved to be also rich in SDS.

Concerning the harvest date for the scab resistant apple varieties combined with the fruit's storability group the varieties in two classes.

First group ('Revidar', 'Real', 'Remar', 'Voinicel', 'Iris') is represented by the apples with only one to maximum 2-3 months storability and the harvest date in late August or September.

The second group ('Valery', 'Cezar', 'Inedit', 'Redix') has a longer shelf life and the harvest date at the end of September in the growing area conditions.

Below there are presented the main apple varieties characteristics and superior value of the forementioned nine varieties bred at the RDSFG Voinesti.

Table 1. Growth and fruiting particularities of the new scab resistant apple varieties created at RDSFG Voinești

Item	Variety								
	Redix	Iris	Real	Remar	Inedit	Voinicel	Valery	Cezar	Revidar
I. Growth (vigour)									
Trunk circumference (cm)	18.4	15.2	17.2	17.9	16.2	15.2	16.5	14.9	15.0
Tree height (cm)	270	220	250	260	240	240	280	260	260
Thickness of the fruiting wall (cm)	140	140	130	140	130	130	130	130	130
Crown volume (mc/ha)	8,800	6,800	7,430	8,400	7,060	7,060	8,550	7,800	7,800
II. Fructification									
Yielding phenophases									
Beginning of flowering	20 - 26.04	15 - 20.04	20 - 24.04	20 - 26.04	18 - 22.04	16 - 20.04	24 - 29.04	22 - 28.04	22 - 28.04
End of flowering	28-04-03.05	26 - 30.04	28.04 - 04.05	28.04 - 03.05	28.04 - 02.05	24 - 30.04	01 - 06.05	30.04 - 05.05	30.04 - 05.05
Blossom period (days)	9-10	9-12	9-10	10-11	9-12	11-12	7-9	7-9	7-9
Ripening period	26 - 30.09	15 - 20.09	26 - 31.08	01 - 10.09	25.09 - 01.10	10 - 15.09	25.09 - 01.10	15 - 20.09	25 - 31.08
Consumption period	oct. - ian.	sept. - nov.	sept.	sept. - oct.	oct. - febr.	sept. - nov.	oct. - martie	oct. - dec.	sept.
Storability (days)	125 - 130	70 - 75	25 - 30	40 - 50	145 - 150	70 - 75	145 - 150	80 - 86	30 - 35
Yield (t/ha)	30-35	40 - 45	35 - 40	38 - 42	30 - 35	28 - 30	35 - 40	35 - 40	28 - 30
Production quality									
Fruit weight (g)	170	155	180	170	155	155	185	190	160
Dry matter content (%)	14.5	14.2	13.5	13.8	15.0	14.5	16.5	13.8	13.0

Redix sin. H 3/73-83 Voinești

The variety has been approved in 2004.

The fruits are medium to large (170 g) and very similar to 'Starkrimson' in shape, with a violet-red skin which became lighter during the storage period.

The firmness is good and help during the harvest and transportation process.

The flesh is white-yellowish at the consumption right time, juicy and well-balanced sweetness and acidity.

The tree is resistant to scab and mildew tolerant.

It is recommended for the great appearance of the fruits and for the excellent dry chips that can be obtained through dehydration.



Figure 1. 'Redix' apple at the harvest time

Iris sin. H 8/94-82 Voinești

Apple variety is present in the ISTIS catalog from 2005.

The fruits are medium in size (155 g), rounded and slightly compressed at the extremities with a green-yellow base colour covered by carmin-red colour over 2/3 of the fruit surface. The flesh is white-yellowish, sweet and with a pleasant acidity. The fruit are crunchy at the harvest time and excellent in taste. Tree is very precious and never affected by biannual production even the yield is high. Is scab resistant and tolerant to mildew.



Figure 2. 'Iris' apple scab variety

Real sin. H 9/78-82 Voinești

The variety is patented in 2007 and was spread in production mainly in the Voinești basin.

The fruits are big (180 g) with ridges near the calyx area and waved profile. Flesh is firm, juicy, white-yellowish and with great taste. It is a scab resistant variety and tolerant to *Podoshaera leucotricha*. Some more advantages are related to the precocity and economic stability due to its annual production of high-quality fruits.



Figure 3. 'Real' apple scab variety

Remar sin. H 1/26-90 Voinești

The variety is patented in 2008.

Fruits are medium in size (170 g), truncated with a green-yellow behind colour. The skin is covered almost entirely in dark-shiny red. Flesh is white, juicy and with a very good taste and pleasant aroma. Is immune to *Venturia inaequalis* and rarely attacked by mildew. It is precocious and with a high yield each year.



Figure 4. 'Remar' apple scab variety



Figure 5. 'Inedit' apple scab variety

Inedit sin. H 3/5-90 Voinești

The variety is patented in 2009.

Fruits are medium is size (155 g), round-cone-shaped with a greenish-yellow under overlay vivid red colour that cover 2/3 of the fruit surface.

Flesh is crunchy, very juicy, white to yellowish in colour, very good in taste.

Trees are immune to scab and tolerant to mildew. Is precocious and the storability is good. The fruits could be consumed by February in cold condition.

Voinicel sin. H 2/5-90 Voinești

The variety is patented in 2009.

Fruits are medium (155 g), globulous and slightly flattened at the poles, nice coloured in red over most of the skin. Taste is good.

Manifest very strong resistance to scab and mildew and is precocious.



Figure 6. 'Voinicel' apple scab variety



Figure 7. 'Valery' apple scab variety

Valery sin. H 4/37- 04 Voinești

The variety was patented in 2016.

The fruit is large (185 g) of conical shape and with visible ridges on the surface. The skin is yellow with blush of orange on the sunny side. The flesh is crunchy, white-yellowish and with a very good taste. It is scab resistant and demonstrate a high yearly productivity. Apples can be ready for consumption until March due to a very good storability and shelf life.

Cezar sin H 1/78-90 Voinești

The variety was patented in 2016.

Fruits are large (190 g) round-conical in shape, with irregular outline. The covering colour is shiny red over almost entirely surface of the skin. Flesh is white, sweet and delicate acidic taste, crunchy and fine texture. Tree is medium to small in size, precocious and with economic yields.



Figure 8. 'Cezar' apple scab variety

Revidar sin H 1/16-90 Voinești

The variety was patented in 2016.

Fruits are medium in size (160 g) round-conical in shape, with a shiny red over 2/3 of the fruit surface. Flesh is white, sourish, crunchy and fine texture. Tree is medium to small in size, precocious and with constant yields.



Figure 9. 'Revidar' apple scab variety

CONCLUSIONS

The apple assortment bred at the Research and Development Station for Fruit Growing Voinești between 2004-2016 overlap a big part of the consumption season and offer a great opportunity for growers to start new orchards with very well adapted and performant scab resistant apple conveyer.

Using resistant to scab and tolerant to mildew varieties such as ones created at the RDSFG Voinesti, there are good premises in higher economic benefits and healthier apple production along with a smaller risk for the environment.

Each variety highlights specific and particular performances that indicate the right option for new investments in apple plantations.

In the context of winter variety demand, 'Valery' and 'Inedit' are the most suitable for this, matching in the same time the fruit quality major parameters.

The apple breeding activity must continue in order to better valorize the genetic heritage of the Romanian achievements.

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