



Evaluation of the productivity value of new apple clones bred at the National Institute of Horticultural Research

INTRODUCTION

One of the aims of the apple breeding program conducted at the National Institute of Horticultural Research in Skierniewice, Poland, is to develop new genotypes either resistant or showing low susceptibility to apple scab (*Venturia inaequalis*), apple powdery mildew (*Podosphaera leucotricha*) and fire blight (*Erwinia amylovora*). New cultivars should produce high yields of a good fruit quality and should be well adapted to climatic conditions of Poland. Cultivation of such cultivars is enabling the production of apples without or with very low level of chemical residues harmful to human health at markedly reduced production costs.

MATERIAL AND METHODS

17 new apple clones: J-2002-21-01 ('Rubin' x 'Gold Milenium'), J-2002-12-02 (J-79 x 'Rubin'), J-2002-05 ('Melfree' x J-79), J-2002-25-01 ('Sawa' x 'Rubin'), J-2003-04 ('Free Redstar' x 'Sawa'), J-9805-03 ('Braeburn' x 'Pinova'), J-2003-11-01 ('Gold Milenium' x 'Szampion'), J-9805-02 ('Braeburn' x 'Pinova'), J-9805-01 ('Braeburn' x 'Pinova'), J-2004-43 ('Rajka' x 'Rubinola'), J-2002-09-01 ('Gold Milenium' x 6518 *Malus floribunda* 821), J-2004-22 ('Gold Milenium' x 'Rajka'), J-2004-14 ('Melfree' x 'Topaz'), J-2004-13 ('Melfree' x 'Retina'), J-2002-14-02 (J-79 x 'Szampion'), J-2004-03 ('Free Redstar' x J-79), J-2004-19 ('Gold Milenium' x 'Ariwa') were evaluated at the National Institute of Horticultural Research, Skierniewice, Poland. The seedlings, grafted on M.9 rootstock were compared to 'Szampion', 'Topaz' and 'Ligolina' (standard cultivars). The plant material was produced by the hand-winter genotype grafting of on M.9 rootstock. Trees, about 1.5 m height single shoots, were then grown (2012) on a medium fertile soil in the orchard. In the performed experimental trial, trees were planted at the density of 3.5 m x 1.0 m in the randomized block design (3 replications, 3 trees per plot). Studies and observations were conducted during eight consecutive seasons (2015-2022). The vigour of trees, flower intensity, ripening time, fruit yield and fruit quality (including: weight, skin color, shape, attractiveness and taste) were assessed (table 1 and table 2).

CONCLUSIONS

The most promising late ripening genotype J-2002-09-01 obtained from the cross combination of 'Gold Milenium' and 6518 *Malus floribunda* 821 was selected. Its fruit yield was approximately 15 % lower in comparison to 'Szampion' standard cultivar, but surpassed it in fruit taste and attractiveness. This apple clone was submitted to the Polish National List of Fruit Plant Varieties as the new cultivar 'Freemal'. Moreover, it is resistant to apple scab and low susceptible to the most economically important pathogens and pests.



Photo 1 and 2. Fruit of J-2002-09-01 clone ('Gold Milenium' x 6518 *Malus floribunda* 821)

RESULTS

Table 1
List of apple clones and traits of trees and fruits evaluated in the comparative experiment (Skierniewice, Sad Pomologiczny 2015-2022)

Lp.	Clone (Cultivar)	Pedigree	Flowering intensity	Yield (kg/tree)	Fruit weight (g)	Trunk diameter (mm)
1	J-2002-21-01	Rubin x Gold Milenium	3,7* a-d**	8,6 a	215 b-f	68,6 e
2	J-2002-12-02	J-79 x Rubin	4,1 c-f	7,4 a	217 b-f	60,6 c-e
3	J-2002-05	Melfree x J-79	4,3 d-g	9,9 a	243 f	49,4 a-c
4	J-2002-25-01	Sawa x Rubin	4,5 e-g	7,6 a	204 bc	54,5 a-d
5	J-2003-04	Free Redstar x Sawa	4,0 c-f	7,5 a	270 g	57,6 b-e
6	J-9805-03	Braeburn x Pinova	3,1 a	6,6 a	220 b-f	45,6 a
7	J-2003-11-01	Gold Milenium x Szampion	4,5 e-g	8,7 a	202 bc	49,5 a-c
8	J-9805-02	Braeburn x Pinova	3,5 a-c	8,9 a	214 b-f	48,1 ab
9	Ligolina (standard)	Linda x Golden Delicious	3,1 a	7,3 a	211 b-e	55,0 a-d
10	J-9805-01	Braeburn x Pinova	3,2 ab	7,9 a	277 g	63,0 de
11	Topaz (standard)	Rubin x Vanda	3,8 b-d	10,6 a	197 b	50,7 a-c
12	Szampion (standard)	Golden Delicious x Koksa Pomarańczowa	4,9 g	16,5 b	223 b-f	45,7 a
13	J-2004-43	Rajka x Rubinola	3,3 ab	8,5 a	165 a	46,6 ab
14	J-2002-09-01	Gold Milenium x 6518 <i>Malus floribunda</i> 821	3,8 b-d	9,9 a	238 ef	53,8 a-d
15	J-2004-22	Gold Milenium x Rajka	3,8 b-d	9,1 a	239 ef	67,9 e
16	J-2004-14	Melfree x Topaz	4,5 e-g	14,5 b	229 c-f	55,0 a-d
17	J-2004-13	Melfree x Retina	4,1 c-f	6,1 a	235 de	66,5 e
18	J-2002-14-02	J-79 x Szampion	4,7 fg	8,2 a	203 bc	57,8 b-e
19	J-2004-03	Free Redstar x J-79	3,3 ab	6,7 a	196 b	51,7 a-d
20	J-2004-19	Gold Milenium x Ariwa	3,5 a-c	7,6 a	208 b-d	48,1 ab

Explanation:

* – Point scale 1 – 5: 1 – lack of flowers, 5 – very abundant flowering; ** – Means in the columns followed by the same letter are not significantly different at P=0.05

Table 2
List of apple clones and fruit traits evaluated in the comparative experiment (Skierniewice, Sad Pomologiczny 2015-2022)

Lp.	Clone (Cultivar)	Pedigree	Skin color / Dominant shape ^z	Appearance ^y	Taste ^x	Ripening time
1	J-2002-21-01	Rubin x Gold Milenium	100% green-yellow / 6	3,9	4,0	winter
2	J-2002-12-02	J-79 x Rubin	85% bright-red / 6	3,9	3,5	autumn
3	J-2002-05	Melfree x J-79	100% intently red / 6	4,0	3,7	autumn
4	J-2002-25-01	Sawa x Rubin	100% orange-red / 2	3,8	3,6	autumn-winter
5	J-2003-04	Free Redstar x Sawa	75% bright-red / 2	3,9	3,3	autumn-autumn
6	J-9805-03	Braeburn x Pinova	75% bright-red / 2	4,5	3,6	winter
7	J-2003-11-01	Gold Milenium x Szampion	90% pink-red / 2	4,5	4,0	autumn-winter
8	J-9805-02	Braeburn x Pinova	95% bright-red / 6	3,9	3,7	autumn-winter
9	Ligolina (standard)	Linda x Golden Delicious	95% bright-red / 2	4,0	3,7	winter
10	J-9805-01	Braeburn x Pinova	100% intently red / 6	4,2	3,5	autumn-winter
11	Topaz (standard)	Rubin x Vanda	75% pink-orange / 7	3,6	3,2	late winter
12	Szampion (standard)	Golden Delicious x Koksa Pomarańczowa	80% pink-red / 2	4,0	3,7	autumn-winter
13	J-2004-43	Rajka x Rubinola	40% pink-red / 2	3,8	3,5	winter
14	J-2002-09-01	Gold Milenium x 6518 <i>Malus floribunda</i> 821	85% bright-red / 2	4,3	4,2	autumn-winter
15	J-2004-22	Gold Milenium x Rajka	50% pink-red / 2	3,9	3,6	autumn
16	J-2004-14	Melfree x Topaz	90% pink-red / 2	4,0	3,8	autumn-winter
17	J-2004-13	Melfree x Retina	95% bright-red / 4	3,8	3,7	autumn
18	J-2002-14-02	J-79 x Szampion	80% bright-red / 2	3,5	4,0	autumn
19	J-2004-03	Free Redstar x J-79	95% intently red / 7	2,9	3,0	autumn-winter
20	J-2004-19	Gold Milenium x Ariwa	80% bright-red / 2	1,8	1,6	autumn-winter

Explanation:

^z – Point scale 1-7 (based on UPOV-TG/14/9 methodology): 1 - cylindrical waisted, 2 - conic, 3 - ovoid, 4 - cylindrical, 5 - ellipsoid, 6 - globose, 7 - obloid

^y – Point scale 1-5: 1 - least attractive, 5 - most attractive

^x – Point scale 1-5: 1 – least tasty, 5 - most tasty

The research was carried out in the frame of subsidy of the Ministry of Agriculture and Rural Development special-purpose – Task 3.13: „Developing of an initial apple plant material (*Malus domestica* Borkh.) with the solid skin color, annually fruiting and resistant to apple scab”.