Assessment of Autumn – and Winter Apple Varieties with Regard to Certain Traits Conferring Suitability to Juice Production

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Contents

1. Introduction

- The apple, as we know it today, has a 8000-year-old wandering behind him. Starting from its Asian homeland, he began his triumphal march around the world.

- Programmes of apple research include objectives referring to obtaining varieties for processing and identifying cultivars meeting the demands of processing entirely.

2. Objectives

- Study of performances of five autumn-apple varieties and twelve winter ones regarding thirteen characteristics conferring high fitness for juice extraction.
- Obtain data about the fruit yield, dry matter, juice production, fruit weight, fruit volume and density, total acidity, vitamin C and sugar content of autumn and winter apple cultivars from Cluj-Napoca.
- Want to do reference to their role in formulation of conclusions and recommendations for the apple improvement programmes in view of obtaining new cultivars of high fruit qualities fit for fresh consumption (dessert fruit), as well as for juice production.

3. Materials and methods

- The biological material used in the experiments has been represented by five autumn apple varieties and twelve of winter ones to be found in the variety collection of the USAMV Cluj-Napoca.

- Testing has been carried out within comparative cultures set in blocks following a linear model, each including 15 to 25 trees.

3. Materials and methods

Were determined several physicochemical properties of the fruits:

- fruit yield (t/ha);
- dry-matter (%);
- juice yield (hl/ha);
- juice output (%);
- fruit weight (g);
- fruit volume (cm^3);
- fruit density (g/cm^3);
- sugar content (%);
- total acidity (%);
- vitamin C (%);
- juice density (g/cm^3);
- output index;
- losses (%).

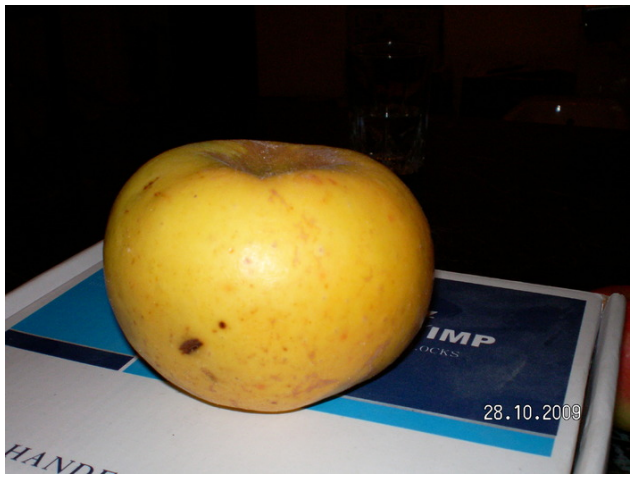
Why was used DL test?

- The DL test (the analysis of variance), has been used in order to compare the varieties of autumn and winter apples tested within the collection.
- Classification of variety according to the differences compared to the control.
- DL was calculated by comparison with the error variance (s^2_E) and with interaction variance (s^2_{VXA}).

4. Results and discussions

- Two of the most popular Romanian apple variety ‘Pătul’ and ‘Poinic’ where chosen as controls for comparison suitability such cultivation for the production of juice

- They are famous for their juicy high and sweet taste and well balanced.



Autumn apple varieties

- It was necessary to assess their suitability for juice production because these varieties have a very low shelf life and their water content is lost very quickly.

- Recorded values regarding the characters studied with the five autumn apple varieties tested at Cluj-Napoca over three years are displayed in (Tab. 1).

Tab. 1. Traits in autumn-apple varieties conferring adequacy of juice production 1

Variety	Fruit yield	Significance of difference		Dry matter	Significance of difference		Juice production	Significance of difference	
	t/ha	s^2_E	s^2_{VXA}	%	s^2_E	s^2_{VXA}	hl/ha	s^2_E	s^2_{VXA}
Ancuța	25,17	xxx	xx	12,33	xxx	xx	169,16	xxx	xxx
Florina	21,93	xxx	-	**11,97**	xxx	-	**145,76**	xxx	xx
Generos	21,86	xxx	xxx	13,47	xxx	xxx	139,65	xxx	x
Pătul	12,98	-	-	11,48	-	-	102,40	-	-
Prima	20,68	xxx	xx	12,34	xxx	xx	146,77	xxx	xx
DL5%		0,98	1,96		0,03	0,58		20,0	26,4
DL1%		1,33	2,85		0,04	0,84		27,1	38,4
DL0,1%		1,78	4,28		0,06	1,26		36,3	54,6

Tab. 1. Traits in autumn-apple varieties conferring adequacy of juice production (continuation) 2

Variety	Fruit weight	Significance of difference		Fruit volume	Significance of difference		Fruit density	Significance of difference	
	g	s^2_E	s^2_{VXA}	cm^3	s^2_E	s^2_{VXA}	g/cm^3	s^2_E	s^2_{VXA}
Ancuța	184,67	xxx	-	230,11	xxx	-	0,80	xx	x
Florina	180,11	xxx	-	240,78	xxx	-	0,75	-	-
Generos	147,44	xx	-	172,44	-	-	0,85	xxx	xxx
Pătul	120,44	-	-	158,56	-	-	0,76	-	-
Prima	124,89	-	-	156,56	-	-	0,80	xx	x
DL5%		18,36	64,43		30,59	84,14		0,03	0,04
DL1%		24,95	93,71		41,57	122,39		0,04	0,06
DL0,1%		33,42	140,56		55,68	183,58		0,06	0,07

Tab. 1. Traits in autumn-apple varieties conferring adequacy of juice production (continuation) 3

Variety	Total acidity	Significance of difference		Vitamin C	Significance of difference		Losses	Significance of difference	
	%	s^2_E	s^2_{VXA}	mg	s^2_E	s^2_{VXA}	%	s^2_E	s^2_{VXA}
Ancuța	0,511	xxx	xxx	10,07	xxx	xxx	2,33	xxx	-
Florina	0,139	ooo	-	5,45	oo	-	2,27	xxx	-
Generos	0,465	xxx	xx	10,97	xxx	xxx	2,41	xxx	-
Pătul	0,174	-	-	5,77	-	-	1,39	-	-
Prima	0,124	ooo	-	4,39	ooo	-	1,27	-	-
DL5%		0,14	1,55		0,19	1,71		0,36	1,84
DL1%		0,20	2,25		0,26	2,48		0,49	2,67
DL0,1%		0,26	3,21		0,34	3,53		0,66	4,01

Tab. 1. Traits in autumn-apple varieties conferring adequacy of juice production (continuation) 4

Variety	Juice output	Significance of difference		Sugar content	Significance of difference		Juice density	Significance of difference		Output index	Significance of difference	
	%	s^2_E	s^2_{VXA}	%	s^2_E	s^2_{VXA}	g/cm^3	s^2_E	s^2_{VXA}		s^2_E	s^2_{VXA}
Ancuța	67,2	ooo	ooo	8,20	xxx	xxx	1,079	xx	x	2,30	ooo	ooo
Florina	66,5	ooo	ooo	3,29	-	-	1,040	-	-	2,25	ooo	ooo
Generos	63,8	ooo	ooo	9,16	xxx	xxx	1,092	xxx	xxx	2,49	ooo	ooo
Pătul	78,9	-	-	3,63	-	-	1,024	-	-	3,98	-	-
Prima	70,9	ooo	ooo	2,17	ooo	-	1,041	xx	x	2,59	ooo	ooo
DL5%		0,85	3,86		0,49	1,86		0,03	0,04		0,04	0,33
DL1%		1,16	5,61		0,67	2,71		0,04	0,06		0,05	0,48
DL0,1%		1,55	7,99		0,89	3,85		0,06	0,07		0,07	0,72

Winter apple varieties

- Are resistant to transport and storage much better than autumn varieties, and maintain their water content and gustative qualities.

- Occupy an area much larger than the autumn ones. In this way, they constitute a large source of raw material for juice extraction, source much richer and more lasting.

- It was necessary to assess their suitability for juice production because these varieties are usually used by food industry.

Tab. 2. Traits with winter-apple varieties conferring adequacy for juice production 1

Variety	Fruit yield	Significance of difference		Dry matter	Significance of difference		Juice prod.	Significance of difference	
	t/ha	s^2_E	s^2_{VXA}	%	s^2_E	s^2_{VXA}	hl/ha	s^2_E	s^2_{VXA}
Goldspur	26,43	xxx	xxx	14,27	xxx	-	185,02	xxx	xxx
Granny Smith	16,03	-	-	13,86	xxx	-	100,43	-	-
Gustav Durabil	24,63	xxx	xxx	14,16	xxx	-	156,53	xxx	x
Idared	27,00	xxx	xxx	12,70	xxx	-	176,01	xxx	xx
Jonagold	27,77	xxx	xxx	12,47	xxx	-	195,07	xxx	xxx
Jonathan	21,83	xxx	xx	12,39	xxx	-	158,62	xxx	xx
Pinova	25,47	xxx	xxx	12,81	xxx	-	173,52	xxx	xx
Poinic, Mt	14,27	-	-	11,71	-	-	108,70	-	-
Starkrimson	25,73	xxx	xxx	13,16	xxx	-	172,62	xxx	xx
Topaz	20,50	xxx	x	13,98	xxx	-	130,43	x	-
Wagener Premiat	26,23	xxx	xxx	13,62	xxx	-	161,36	xxx	xx
Golden Reinders	28,53	xxx	xxx	12,67	xxx	-	185,62	xxx	xxx
DL5%		2,50	4,51		0,40	2,77		17,52	34,10
DL1%		3,32	6,56		0,53	4,03		23,27	49,60
DL0,1%		4,28	9,33		0,68	5,74		29,99	70,56

Tab. 2. Traits with winter-apple varieties conferring adequacy for juice production (continuation) 2

Variety	Fruit weight	Significance of difference		Fruit volume	Significance of difference		Fruit density	Significance of difference	
	g	s^2_E	s^2_{VXA}	cm^3	s^2_E	s^2_{VXA}	g/cm^3	s^2_E	s^2_{VXA}
Goldspur	136,06	-	-	166,33	-	-	0,797	-	-
Granny Smith	215,33	xxx	x	241,78	xxx	x	0,807	-	-
Gustav Durabil	180,22	xxx	-	212,00	xxx	-	0,850	-	-
Idared	254,56	xxx	xx	325,78	xxx	xx	0,787	-	-
Jonagold	222,89	xxx	x	275,33	xxx	x	0,811	-	-
Jonathan	137,11	-	-	169,11	-	-	0,811	-	-
Pinova	160,56	xxx	-	188,67	xx	-	0,824	-	-
Poinic, Mt	122,44	-	-	149,56	-	-	0,820	-	-
Starkrimson	177,22	xxx	-	213,78	xxx	-	0,829	-	-
Topaz	179,00	xxx	-	201,89	xxx	-	0,848	-	-
Wagener Premiat	141,33	-	-	162,89	-	-	0,866	x	-
Golden Reinders	151,00	xx	-	185,11	xx	-	0,814	-	-
DL5%		21,24	75,08		24,58	89,08		0,040	0,062
DL1%		28,22	109,21		32,65	129,58		0,056	0,079
DL0,1%		36,37	155,37		42,09	184,34		0,072	0,093

Tab. 2. Traits with winter-apple varieties conferring adequacy for juice production (continuation) 3

Variety	Total acidity	Significance of difference		Vitamin C	Significance of difference		Losses	Significance of difference	
	%	s^2_E	s^2_{VXA}	mg	s^2_E	s^2_{VXA}	%	s^2_E	s^2_{VXA}
Goldspur	0,276	xx	-	7,40	xxx	-	1,441	x	-
Granny Smith	0,531	xxx	xx	8,65	xxx	-	2,258	xxx	x
Gustav Durabil	0,335	xxx	-	8,34	xxx	-	2,522	xxx	x
Idared	0,280	xx	-	2,75	ooo	o	1,813	xxx	-
Jonagold	0,346	xxx	-	3,80	ooo	o	1,587	xx	-
Jonathan	0,533	xxx	xx	9,00	xxx	-	1,053	-	-
Pinova	0,194	-	-	4,00	ooo	-	1,489	x	-
Poinic, Mt	0,137	-	-	6,76	-	-	0,960	-	-
Starkrimson	0,182	-	-	2,86	ooo	o	1,891	xxx	-
Topaz	0,668	xxx	xxx	8,56	xxx	-	2,596	xxx	x
Wagener Premiat	0,498	xxx	xx	17,75	xxx	xxx	2,244	xxx	x
Golden Reinders	0,290	xxx	-	4,57	ooo	-	1,287	-	-
DL5%		0,087	0,237		0,29	2,82		0,467	1,250
DL1%		0,115	0,344		0,39	5,92		0,621	1,818
DL0,1%		0,149	0,490		0,50	9,12		0,800	2,587

Tab. 2. Traits with winter-apple varieties conferring adequacy for juice production (continuation) 4

Variety	Juice output	Significance of difference		Sugar content	Significance of difference		Juice density	Significance of difference		Output index	Significance of difference	
	%	s^2_E	s^2_{VXA}	mg	s^2_E	s^2_{VXA}	g/cm^3	s^2_E	s^2_{VXA}		s^2_E	s^2_{VXA}
Goldspur	69,99	ooo	o	12,66	xxx	x	1,027	x	-	2,516	ooo	oo
Granny Smith	62,71	ooo	ooo	12,22	xxx	x	1,051	xxx	xx	2,072	ooo	ooo
Gustav Durabil	63,56	ooo	ooo	12,54	xxx	x	1,063	xxx	xxx	2,063	ooo	ooo
Idared	65,17	ooo	ooo	10,99	xxx	-	1,029	xx	-	2,124	ooo	ooo
Jonagold	70,28	ooo	o	10,75	xxx	-	1,027	x	-	2,485	ooo	oo
Jonathan	72,66	ooo	-	10,66	xxx	-	1,038	xxx	x	2,665	ooo	o
Pinova	68,18	ooo	oo	11,11	xxx	-	1,034	xxx	-	2,326	ooo	oo
Poinic, Mt	76,16	-	-	9,94	-	-	1,019	-	-	3,065	-	-
Starkrimson	66,91	ooo	oo	11,48	xxx	-	1,035	xxx	-	2,273	ooo	ooo
Topaz	63,18	ooo	ooo	12,35	xxx	x	1,057	xxx	xx	2,065	ooo	ooo
Wagener Premiat	61,50	ooo	ooo	11,97	xxx	-	1,052	xxx	xx	1,933	ooo	ooo
Golden Reinders	65,04	ooo	ooo	10,96	xxx	-	1,033	xxx	-	2,075	ooo	ooo
DL5%		1,06	5,04		0,14	2,04		0,008	0,020		0,104	0,372
DL1%		1,41	7,33		0,19	2,97		0,011	0,029		0,138	0,542
DL0,1%		1,82	10,43		0,24	4,22		0,014	0,042		0,178	0,771

5. Conclusions

- In the collections studied display the possibility of identifying cultivars of high and very high yields per surface unit, as well as of high juiciness.

- These might be utilised mainly for juice production or, might be implied as genitors in apple-melioration programmes.

- Of the traits analyzed with both autumn- and winter apples, the widest variability has been displayed by: fruit yield, juice production, total acidity, and vitamin C-content.

5. Conclusions

- The winter apple varieties are more precious than the autumn ones for juice extraction.
- There exist precious autumn varieties such as ‘Florina’, uniting several fruit characteristics that confer suitability for juice extraction thus recommending it as possible genitor.
- Selecting genitors for suitability to juice production only on basis of the analyzed traits, could be totally mistaken when complimentary data able to reveal the correlations among these traits and their effect upon juice output are missing.

6. References

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“If Eve had not eaten the apple, that it would be interesting could happen in the next billion years?”

by Paulo Coelho