RESEARCH REGARDING THE SUITABILITY OF SOME WINTER RIPENING APPLE CULTIVARS FOR THE OBTAINING OF NATURAL JUICE

STUDII PRIVIND COMPORTAREA UNOR SOIURI DE MERE CU COACERE DE IARNĂ PENTRU OBŢINEREA SUCURILOR NATURALE

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Abstract. *The study has been carried out during 2005-2007 years within the laboratory of the technology of horticultural products (T.H.P) of USAMV Cluj-Napoca and it analyzed the main physical and chemical parameters as well as the processing rate capacity of 27 apple cultivars coming from S.C.D.P. Cluj-Napoca. The results obtained show a very good suitability for the natural juice processing of following cultivars: Roşu de Cluj, Wagener premiat, Red Ionagold, Feleac, Creţesc and Granny Smith, alone or in mixture.*

Key words: apple, soluble dry substance, malic acid, C vitamin, processing rated capacity.

Rezumat*: Studiul s-a desfăşurat pe parcursul anilor2005-2007 în cadrul laboratorului de T.p.h. al USAMV Cluj-N şi a urmărit principalii parametri fizico-chimici şi randamentul la prelucrare la 27 soiuri de mere provenite de la S.P.D.P. Cluj-N. Rezultatele obţinute evidenţiează o pretabilitate foarte bună la prelucrare sub formă de suc a următoarelor soiuri: Roşu de Cluj,Wagener premiat, Red Jonagold, Feleac, Creţesc, Granny Smith singure sau în amestec.*

Cuvinte cheie: măr, substanţa uscată solubilă, acid malic, vitamina C, capacitate de prelucrare

INTRODUCTION

Apples are mainly consumed fresh, but they provide as well a valuable raw matter for processing (Radu, 1985): juices and natural syrups, jam, marmalade, dried fruit and other products. The apple natural juices, along with fresh apples constitute one of the most rich and diverse source of nutritional and medical substances necessary for the human body (Segal et al., 1977; Neamţu et al., 1996).

The high demand for juices, including cloudy apple juices, increases every year and it is not at all satisfied.

MATERIAL AND METHOD

The research done between 2005-2007 years, in the T.H.P. laboratory of the USAMV Cluj-Napoca, had analyzed the suitability of some apple cultivars for natural juice processing. The biological material which was studied consisted of 27 cultivars of winter ripening apples coming from S.C.D.P. Cluj-Napoca, which for harvesting maturity doesn't coincide with consuming maturity and technical maturity. The fruit of these cultivars perfect their ripening process during storage period (November-February) depending on cultivar,

when the characteristic features correspond to certain usage directions (fresh consumption or processing). Among the characteristics, which are important for the juice processing, the following were studied: dry soluble substance, organic acids, vitamin C and the processing rate capacity. For the completion of the physical and chemical analyses, average samples collected according to specific methodologies have been used. Each analysis was carried out in three replicates and the results were processed and statistically interpreted as well as compared with the experience's average.

RESULTS AND DISCUSSIONS

The results of determinations concerning the suitability of studied cultivars for the obtaining of natural juice are presented in table 1 and table 2.

Table 1

Variation of soluble solid and organic acid content

Var. No.	Cultivar	Soluble solid content			Organic acid content		
		%	% beside the average value of experiment	Signif. of diff.	% of malic acid	% beside the average value of experiment	Signif. of diff.
1.	Creţesc	14.40	101.6	-	066	126.90	*
2.	Empire	14.73	103.9	-	0.48	92.30	-
3.	Feleac	14.40	101.6	-	0.72	138.50	**
4.	Florina	16.76	118.3	-	0.26	50.00	ooo
5.	Gloria	14.60	103.0	-	0.49	94.23	-
6.	Gloster	15.10	106.6	-	0.65	125.00	(*)
7.	Jonne spur	14.73	103.9	-	0.55	105.80	-
8.	Kaltherer Bohmer	12.00	84.7	-	0.59	113.50	-
9.	Kidd's Orange	14.16	10.,0	-	0.41	78.8	-
10.	Golden spur	13.53	95.5	-	0.68	130.80	*
11.	Granny Smith	12.63	89.1	-	0.82	157.70	***
12.	Jonathan	15.46	109.1	-	0.61	117.30	-
13.	Jonathan Smith	14.56	102.7	-	0.56	107.70	-
14.	Jonathan Watson	13.53	95.5	-	0.47	90.40	-
15.	London Pepping	13.86	97.8	-	0.49	94.20	-
16.	Red Delicios	16.80	118.6	-	0.29	55.80	ooo
17.	Red Ionagold	15.10	106.6	-	0.67	128.80	*
18.	Reinette de Canada	13.50	95.3	-	0.49	94.2	-
19.	Starkrimson	13.46	95.0	-	0.44	84.60	-
20.	Sobotsugam	15.96	112.6	-	0.23	44.20	ooo
21.	Wellspur	14.56	102.7	-	0.19	36.5	ooo
22.	Ionagold	16.30	115.0	-	0.43	85.70	-
23.	Idared	14.80	104.4	-	0.81	155.80	***
24.	Generos	12.70	89.6	-	0.42	80.80	-
25.	Roşu de Cluj	15.90	112.2	-	0.74	142.30	**
26.	Wagener premiat	13.10	92.4	-	0.70	134.60	*
27.	Mutsu	16.03	113.1	-	0.36	69.20	o
Average value of experiment		14.17	100.0	-	0.52	100.00	-
LSD 5%						0.14	
LSD 1%						0.19	
LSD 0.1%						0.23	

From the analyses done for those 27 apple cultivars regarding the dry soluble content determined at harvesting moment it can be observed that the recorded values doesn't present statistical proved differences in comparison with the average value of experiment. If these results are considered as percentage in comparison with average value of experiment it can be observed that this was surpass with 1-10% by 11 cultivars, with 10.1-18.6 % by 6 cultivars, 1 cultivar presents an equal value and 9 cultivars present lower values, comprised between 3.2-15.3%.

The content in organic acids, as an average for three experimental years, presents different values in accordance with cultivar but the differences among cultivars are very high. In comparison with average value of experiment (0.52% malic acid) Granny Smith and Idared cultivars were remarked, which for the differences were very significant. Regarding the organic acid content higher values than average value of experiment, which were statistical proved, were recorded at following cultivars: Feleac (0.72%), Roşu de Cluj (0.74%), Creţesc (0.66%), Golden spur (0.68%), Red Ionagold (0.67%) and Wagener premiat (0.70%). A difference very closed by 5% limit of significant difference (LSD) but statistical not assured was recorded for Goldster cultivar (0.65%). For 13 cultivars more, which represent 41.1% from the analyzed cultivars, the organic acid content presents very close positive or negative deviations from average value of experiment, the differences being not statistical proved. Opposite were situated Subotsugam, Red Delicious, Florina and Mutsu cultivars with negative deviations which were statistical proved.

Analyzing the data presented in table 2 regarding the vitamin C content it can be observed that in comparison with the average value of experiment (12.56 mg/100g D.M.) 6 cultivars present positive deviation which are statistical proved and for over 50% of variants the vitamin C content is situated around the average value of experiment. The highest vitamin C content is recorded at Roşu de Cluj cultivar (17.01 mg/100g D.M.) the recorded difference of 4.45 mg/100g D.M. being very significant. For other cultivars as Jonathan, Wagener premiat, Feleac, Grany Smith and Ionagold the differences are also positive and statistical proved. Fruit of Jonne şpur cultivar accumulate the lowest quantity of vitamin C (8.38 mg/100g D.M.), the difference of 4.18 mg/100g D.M. in comparison with the average value of experiment being very significant negative.

Inferior deviation from the average value of experiment and statistical proved were recorded for 6 cultivars (Empire, Florina, London Pepping, Red Delicious and Subotsugam) while 14 cultivars are placed close to the average value of experiment, the differences in their case being not statistical proved.

Juice rated capacity oscillates between 59.8% at Starkrimson cultivar and 75.2% at Red Delicious cultivar. Regarding the juice rated capacity the analyzed apple cultivars belong to following groups:

- group A, with very good juice rated capacity (over 70%), group which contain 11 cultivars (Creţesc, Feleac, Gloria, Golden spur, Jonathan Watson, Red Delicious, Red Ionagold, Idared, Roşu de Cluj, Wagener premiat);

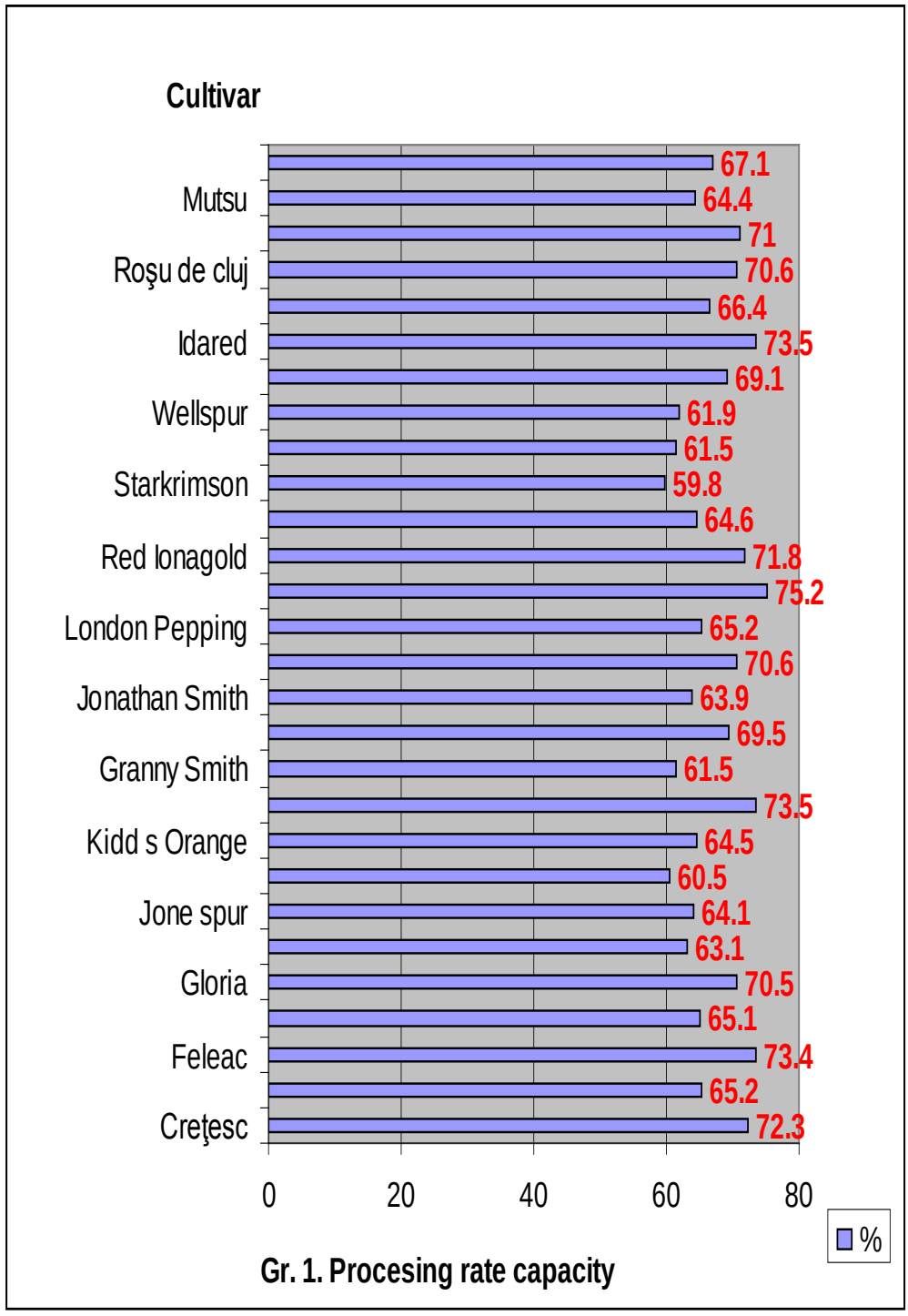
- group B, with juice rated capacity comprised between 65-70%, which contains the cultivars: Empire, Florina, London Pepping, Ionagold and Generos;

- group C, with juice rated capacity comprised between 60-65% which included 10 cultivars which for the differences in comparison with the average value of experiment are inferior and statistical proved.

Table 2

Vitamin C content variation and processing rate capacity

Var. No.	Cultivar	Ascorbic acid content		Processing rate capacity	
		%	Significance of difference	%	Significance of difference
1.	Creţesc	14.40	-	72.3	***
2.	Empire	9.81	o	65.2	-
3.	Feleac	15.98	**	73.4	***
4.	Florina	10.26	o	65.1	(o)
5.	Gloria	9.49	oo	70.5	**
6.	Gloster	10.75	-	63.1	ooo
7.	Jonne spur	8.38	ooo	64.1	oo
8.	Kaltherer Bohmer	11.02	-	60.5	ooo
9.	Kidd's Orange	11.95	-	64.5	o
10.	Golden spur	13.06	-	73.5	***
11.	Granny Smith	15.46	*	61.5	ooo
12.	Jonathan	16.31	**	69.5	*
13.	Jonathan Smith	13.49	-	63.9	oo
14.	Jonathan Watson	10.89	-	70.6	**
15.	London Pepping	9.13	oo	65.2	(o)
16.	Red Delicios	9.98	o	75.2	***
17.	Red Ionagold	13.00	-	71.8	***
18.	Reinette de Canada	11.50	-	64.6	o
19.	Starkrimson	11.01	-	59.8	ooo
20.	Sobotsugam	9.88	o	61.5	ooo
21.	Wellspur	12.85	-	61.9	ooo
22.	Ionagold	15.29	*	69.1	-
23.	Idared	14.02	-	73.5	***
24.	Generos	13.44	-	66.4	-
25.	Roşu de Cluj	17.01	***	70.6	**
26.	Wagener premiat	16.25	**	71.0	**
27.	Mutsu	14.56	-	64.4	o
Average value of experiment		12.56	-	67,1	-
LSD 5%			2.18		22.48
LSD 1%			2.91		30.09
LSD 0.1%			3.83		39.51



Gr. 1. Procesing rate capacity

CONCLUSIONS

The results obtained between 2005-2007 years, concerning the suitability of some winter ripening apple cultivars at processing as natural juice, allow us to draw the following conclusions:

- the analyzed varieties behave differently to this kind of processing;
- from the standpoint of their content in dry soluble substance, 9 cultivars (Florina, Goldster, Jonathan, Red Delicious, Red Ionagold, Subotsugam, Ionagold, Roşu de Cluj and Mutsu) outrun the average value of experiment (14.17%) with over 5%;
- concerning fruit acidity, though the limits of variation of this characteristic are relative big (0.19% malic acid at Wellspur cultivar and 0.82% malic acid at Granny Smith cultivar), statistical proved values were recorded at Creţesc, Florina, Golden spur, Granny Smith, Red Ionagold, Idared, Roşu de Cluj and Wagener premiat cultivars;
- vitamin C content for 22.2% of analyzed cultivars (Feleac, Granny Smith, Jonathan, Jonagold, Roşu de Cluj and Wagener premiat) presents positive and statistical proved differences in comparison with the average value of experiment;
- the biological material used in the experiment is suitable for processing as juice, the processing rate capacity being comprised between 59,8-75,2%. The next cultivars can be remarked from this point of view: Creţesc, Feleac, Gloria, Golden spur, Jonathan Watson, Red Delicious, Red Ionagold, Idared, Roşu de Cluj and Wagener premiat with a processing rate capacity over 70%;
- among the analyzed cultivars Roşu de Cluj, Wagener premiat, Red Ionagold, Feleac, Creţesc and Granny Smith are recommended for processing as juice, alone or in a mixture.

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