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## THE INFLUENCE OF FERTILISATION AND IRRIGATION ON SENSORIAL AND CHEMICAL QUALITY OF APPLES

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### Summary

Two varieties – Gala and Idared – and their 4 cultivated variants A, B, C, K were monitored a refrigeration room with modified storing conditions (storing temperature +1,5°C, relative atmospheric humidity 90%, gases 1% O<sub>2</sub>, 3% CO<sub>2</sub> and 96% N<sub>2</sub>) from September to March (Gala), and up to June (Idared). The total content of carbohydrates ranged between 300-930 g.kg<sup>-1</sup> dry matter (DM) for Gala apples and 780-910 g.kg<sup>-1</sup> DM for Idared apples. The total organic acid content was from 30 to 87 g.kg<sup>-1</sup> DM for Gala apples, whereas Idared apples had a higher content (80-180 g.kg<sup>-1</sup> DM). The total content of vitamin C ranged between 0-22,3 mg.100g<sup>-1</sup> fresh matter for Gala and for Idared from 3,25 to 15,56 mg.100g<sup>-1</sup> fresh matter. The content of calcium ranged between 3,21 and 5,69 mg.100g<sup>-1</sup> for Gala and Idared.

**Keywords:** sensorial analyse, chemical analyse, quality of apples, Gala, Idared

### Introduction

The storage potential of different cultivars of apples is determined genetically but for any given cultivar storage life can be extended by the use of refrigeration and controlled atmosphere (CA) storage (Johnson, 1994). The conditions under which apples grown have a major influence on the duration of storage and the quality of fruit available to the consumer.

Fruit harvested before or during the climacteric period achieved better quality retention during long-term storage than those harvested at the post-climacteric storage (Lau, 1985).

The aim of this study was to find out, if there exists contrasts among samples - variants in organoleptic facilities, in total sensorial quality and determined their chemical composition.

### Material and methods

Apples „Gala” and „Idared”, and their cultivated 4 variants on grounds of VPS Most in homogeneous environment, were harvested in the autumn of 2000. Climatic conditions of the experiment has been monitored at meteorological station located approximately 1 km away from grounds. After harvest the apples were put in a storage with conditioned atmosphere. The quality of apples of individual variants has been defined after their gathering and storage in a model storage with conditioned atmosphere (storing temperature +1,5°C, relative atmospheric humidity 90%, gases 1% O<sub>2</sub>, 3% CO<sub>2</sub> and 96% N<sub>2</sub>).

The first evaluation was made immediately after harvest and next evaluations were made in month-intervals. Certain suitable methods and test have been chosen for a sensorial evaluation. A "triangle test" has been used in differential method to find out whether there exists a difference between varieties and variants. Results have been statistically verified by chi-squared method. A pointed test has been used in a scale system created by Kopec and Horčín. The quality of panelists and results has been monitored by the so called "number NVR" (number of a rating reliability), by the interval of reliability and some distribution-free tests (Kramer test, Friedman test for file, Friedman test for pairs, Page's method).

Difficult methods presented the profiled method, where a classic complete profile (smell, taste, texture) and polarity profile texture were applied, by which chosen intensities were compared to polar texture components. In terms of research chosen chemical indices (dry matter, fibre, organic acids, sugar, vitamin C, calcium) were examined and firmness was measured by penetrometrical measurement and statistic dependency was studied by means of regressive responsibly correlation counts.

### Results and discussion

From the beginning of September (1999) till the end of June (2000) there was done 5 valuations of Gala apples and 7 valuations of Idared apples (everything multiplied by 4 variants). Data presented in Table 1 summarize mean chemical composition of Gala and Idared apples distributed by type of variant.

Average dry matter (DM) concentrations in Gala apples was in range from 13,01% to 13,95% and from 12,84% to 13,66% in Idared apples. Dry matter concentration in apples grown in the Slovak republic varies according to the growing conditions in any particular year. The same results reported study by Johnson (2000).

The mean content of organic acids was average from 61 to 77 g.kg<sup>-1</sup> in Gala apples and from 97 to 129 g.kg<sup>-1</sup> in Idared apples. Suni et al (2000) have reported contents of organic acids from 30 to 103 g.kg<sup>-1</sup> in apples.

Average content of vitamin C in Gala was range from 20,14 to 22,30 mg.100g<sup>-1</sup> and from 13,20 to 15,56 mg.100g<sup>-1</sup> in Idared apples. The decreased of vitamin C was more evident at Gala apples, whereas vitamin C content at Idared apples was decrease equally. As time of storage progressed vitamin C content decreased. To similar results inferred Drake et al. (1991).

The mean content of Ca was in range from 3,79 to 5,69 mg.100g<sup>-1</sup> at Gala and from 3,87 to 4,61 mg.100g<sup>-1</sup> at Idared.

Johnson (2000) reported higher content of calcium 7,4 mg.100g<sup>-1</sup> in Gala apples. Low Ca in apples is associated primarily with premature senescence and the development of various types of physiological disorders during storage (Sharples and Johnson, 1987).

The sensorial valuation always begun by discharging of valued samples (selection file) 24 hour before the measurement. Members of rating commission were submitted to wards the test of momentary fitnessliability during analyses. The results of sensorial test are shown in Table 1.

A triangle test has been chosen from several tests of differential methods. This test has not mostly shown contrasts statistically documented in an application for whole files, but in individual pairs a repining process contrast has appeared. Per cent given points in scale method shows the ripping quality of Gala variety, in comparison with Idared variety whereas its quality upgrades during the storage. The total quality in profiled method has not indicated in frames variant statistically

Table 1 Results of chemical and sensorial analysis

Variety	Variant	Parameter	CHEMICAL ANALYSIS						SENSORIAL ANALYSIS				
			Dry matter (%)	Total fibre (%)	Org. acids g/kg	Sugar g/kg DM	Vit. C mg/100 g	Ca mg/100g	Point test		Polarity test (points)		
									Mean points	Mean rank	smell	taste	texture
GALA	A	x	13,79	4,63	61	784	10,2	3,63	92,42	1,97	2,79	2,93	4,77
		x <sub>min</sub>	11,73	3,78	35	470	0	3,44	70,6	1,67	2,39	2,12	3,5
		x <sub>max</sub>	18,17	5,67	87	930	21,88	3,79	104	2,3	3,16	3,52	5,28
	B	x	13,01	4,65	64	728	9,15	3,87	86,65	2,95	2,51	2,31	3,75
		x <sub>min</sub>	11,26	3,84	30	300	0	3,37	55,6	2,13	2,06	1,11	2,0
		x <sub>max</sub>	15,4	6,01	87	900	20,14	4,38	104,25	4,0	3,25	3,38	5,01
	C	x	13,94	4,54	74	826	9,87	3,85	91,54	2,73	2,69	2,71	22,34
		x <sub>min</sub>	12,98	3,77	44	520	0	3,32	72,7	2,3	2,28	2,01	3,4
		x <sub>max</sub>	17,32	6,14	87	890	21,92	4,29	102	3,25	3,62	3,03	5,63
	K	x	13,95	4,51	66	807	10,27	4,36	92,41	2,35	2,88	2,87	4,11
		x <sub>min</sub>	12,71	3,22	48	700	0	3,21	73,6	1,8	2,2	1,95	3
		x <sub>max</sub>	16,31	5,91	76	840	22,3	5,69	103,23	2,88	4,18	3,83	5,12
IDARED	A	x	12,84	5,13	97	793	9,12	3,93	93,24	2,25	2,34	2,16	3,31
		x <sub>min</sub>	12,65	4,42	80	780	3,25	3,38	91,5	1,75	1,8	1,73	2,9
		x <sub>max</sub>	13,09	5,93	117	820	15,12	4,61	95,5	3,1	3,03	2,64	3,8
	B	x	13,06	4,99	129	815	8,57	3,71	86,33	3,08	1,76	1,85	3,16
		x <sub>min</sub>	12,89	4,06	103	780	3,7	3,55	75,75	1,83	1,38	1,51	2,0
		x <sub>max</sub>	13,28	5,84	180	840	13,48	3,87	98,25	4,0	2,35	2,48	4,96
	C	x	13,66	5,01	97	865	10,12	3,95	91,76	2,23	1,98	2,13	3,339
		x <sub>min</sub>	13,4	4,02	82	790	4,82	3,55	85,75	1,7	1,52	1,7	2,5
		x <sub>max</sub>	14,22	6,12	104	910	15,56	4,61	96,8	3,0	2,65	2,42	3,96
	K	x	13,27	5,4	99	888	9,47	3,97	92,47	2,42	1,92	2,18	3,02
		x <sub>min</sub>	12,59	4,6	84	840	6,05	3,61	85,83	1,25	0,94	1,24	2,5
		x <sub>max</sub>	13,73	6,13	110	900	13,2	4,19	94,8	3,83	2,46	2,65	4,0

A - liquid fertilisation with fertilising irrigation, amount of fertiliser 80 kg . ha<sup>-1</sup> N, 80 kg . ha<sup>-1</sup> P<sub>2</sub>O<sub>5</sub> and 25 kg . ha<sup>-1</sup> K<sub>2</sub>, B - as A, only the amount of nitrogen has been increased to 120 kg . ha<sup>-1</sup>, C - stiff fertiliser in amount as in A + irrigation, D- stiff fertiliser in amount as in A without irrigation (only natural rainfalls).

documented results in primary measurement, the quality of Idared variety has improved in later measurement. Gala variety in 5<sup>th</sup> measurement (March) already accounted of indicia survey, mainly in variant B. Variant B already appeared worse in these

last valuations that means it can be only applied up to the end of January for roughly assumed storage. However it is not possible for longer storage. To similar result inferred Drake and Elfving (1999), Drake (1991) and Cliff et al. (1998), who demonstrated that Gala apples are not well adapted long term storage because they rapidly lose firmness and aromatic constituents of flavour during storage. Therefore Meheriuk (1993) suggested a storage life of 5-6 months in 1-5% CO<sub>2</sub> + 1-2,5% O<sub>2</sub> at 0-2 °C. Second variety (Idared) maintained excellent quality up to the 7<sup>th</sup> measurement. The polarity test of profiled methods proves justness to its texture applications mainly because of that texture plays a determining role in a total quality of apples. High texture values in a scale method and in both profile tests can prove it. Soft, floury or hyaline meshes are immediately noticed and cared of low valuation. In this respect the worst variant is B from variants, even though it did not appear during the first valuations and that the results were oscillated. Relationships among some already achieved results of sensorial, chemical and physical analyse have been examined in terms of research quality of monitored apples. Obtained results were determined to parametric t-test. If the calculated t-values were higher than table ones correlation coefficient  $r_{xy}$  was noticeable. And there existed dependence on a chosen level of significance between variable quantities x and y. Tightness of monitoring relations was closer, the more the value of a correlation relation approached to 1. In Gala variety statistically demonstrated dependencies have been proved ( $\alpha = 0,05$ ) between smell and taste, taste and texture (physically measure) and fibre and hardness, whereas fibre was stated chemically. Dependence has not been found between chemical sweet and sensorial taste. There has been shown a relation between smell and taste, hardness and fibre, texture and fibre in Idared variety. The reliance has not been unconfirmed between taste and texture, hardness and texture and between taste and content sugar. Contrasts are caused by another characteristic variety, which is slow ripping during storage. Results indicate that texture evaluated by sensorial analyse is not identical with hardness measured by instrumental engineering.

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## THE INFLUENCE OF VARIETY AND NITROGEN FERTILIZATION ON YIELD AND QUALITY OF MALTING BARLEY

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### Summary

Work evaluates an influence of variety (Kompakt, Garant, Atribut and Expres) and nitrogen fertilization during vegetation season (based on mineral nitrogen content in soil) on yield and crude protein content in barley grain. Variability of yields was most affected by varieties. Garant had significantly higher average yield (7,60 t . ha<sup>-1</sup>) than varieties Kompakt (6,92 t . ha<sup>-1</sup>) and Atribut (7,27 t . ha<sup>-1</sup>). Crude protein content in grain of variety Garant (10,39 %) was significantly lower compared to varieties Expres (10,79 %) and Atribut (11,15 %). Nitrogen fertilization significantly influenced number of ears per 1 m<sup>2</sup>, thousand grains weight and yield of spring barley. The highest yield (7,59 t . ha<sup>-1</sup>) was found out after rate 20 kg of nitrogen per hectare (fertilizer DAM-390) at the end of tillering. Crude protein content in spring barley grain was not significantly influenced by any way of nitrogen fertilization during vegetation.

**Key words:** spring barley, variety, nitrogen fertilization, yield, quality