SENSORY ANALYSIS OF CUCUMBER VARIETIES AT DIFFERENT HARVEST TIMES II. PICKLING CUCUMBERS

СЕНЗОРЕН АНАЛИЗ НА СОРТОВЕ КРАСТАВИЦИ ПРИ РАЗЛИЧНИ СРОКОВЕ НА БЕРИТБА II. КОРНИШОНИ

Galina PEVICHAROVA, Nikolay VELKOV

Department of Breeding, Variety Maintenance and Introduction, Maritsa Vegetable Crops Research Institute, Plovdiv 4003, Bulgaria, e-mail: gpevicharova@abv.bg

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ABSTRACT

During the period 2001-2002 sensory analysis of Bulgarian pickling cucumber varieties Toni, Iren and Pobeda was carried out. The varieties had identical parent female breeding line G-3. Fresh and canned fruits were evaluated at three harvest times. It was established that sensory properties of canned fruits cannot be entirely prognosticated from panel test data of the fresh ones. For breeding purposes sensory analysis of pickling cucumbers for processing should be performed using sterilized pickling cucumbers but not only fresh ones. More precise information about visual and gustatory properties of new created lines and hybrids will be obtained by performing of sensory analysis at different harvest times.

KEY WORDS: Cucumis sativus, canned fruits, sensory properties

РЕЗЮМЕ

През периода 2001-2002 г. е извършен сензорен анализ на българските сортове корнишони Тони, Ирен и Победа. Трите сорта са създадени на базата на майчин компонент от gynoecious - линия G-3. Плодовете са оценени като свежи и стерилизирани при три срока на беритба. Установено е, че сензорните качества на консервираните плодове не могат да се прогнозират изцяло от данните за сензорния анализ на свежите плодове. Селекционният материал от корнишони, предназначен за суровина в преработвателната промишленост, трябва да се оценява по сензорни показатели след приготвяне на стерилизирани консерви, а не само в свежо състояние. С провеждането на сензорен анализ в повече от една беритба се получава по-точна информация за визуалните и вкусовите качества на новосъздадените линии и хибриди.

КЛЮЧОВИ ДУМИ: Cucumis sativus, консервирани плодове, сензорни качества

ПОДРОБНО РЕЗЮМЕ

Целта на настоящето изследване е да се оцени влиянието на срока на реколтиране върху сензорните качества на корнишоните, реколтирани в многократни беритби.

Експериментът се проведе през периода 2001-2002 г. с българските сортове дребноплодни краставици Тони, Ирен и Победа. Майчина линия и на трите сорта е G-3, gynoecious. Семената се засяваха в края на март и растенията се отглеждаха до края на юли. Плодовете се оценяваха свежи и стерилизирани при три срока на беритба в периода на масово плододаване. Сензорният анализ се извършваше по показателите: външен вид, цвят на кората, цвят на месото, аромат, текстура и вкус.

Оценките за сензорните показатели на свежите корнишони от трите хибрида се променяха в зависимост от срока на беритба. С изключение на Победа, при всички останали показатели тестът на Дънкан доказваше различия между стойностите на оценките поне в една от експерименталните години. Непостоянството в числените стойности на корелационните коефициенти, отчитащи промяната на сензорните оценки в отделните беритби, подкрепи тезата, че срокът на реколтиране е фактор, който не може да се пренебрегне при формирането на окончателни изводи от сензорния анализ.

За разлика от свежите плодове, при стерилизираните се установиха много по-слаби различия в сензорните оценки при отделните беритби. Най-неразличими бяха оценките за сорт Ирен. Консистенцията и вкусът бяха показателите, върху които срокът на реколтиране е оказал несъществено влияние при всички изследвани сортове. Нееднопосочността на резултатите за свежи и преработени плодове показва, че органолептичните свойства на консервираните не могат да се прогнозират изцяло от данните за сензорния анализ на свежите плодове. Следователно, селекционният материал от корнишони, предназначен за суровина в преработвателната промишленост, трябва да се оценява по сензорни показатели след приготвяне на стерилизирани консерви от няколко срока на реколтиране. С провеждането на сензорен анализ в повече от една беритба се получава по-точна информация за визуалните и вкусовите качества на новосъздадените линии и хибриди.

INTRODUCTION

Sensory analysis of food is based on subjective evaluation related with visual, olfactory and gustatory senses of man. Precise criteria to achieve maximum objective evaluation

Table 1. Sensory traits of fresh fruits
Таблица 1. Сензорни показатели на свежите плодове

Variety Сорт	Harvest time Срок на беритба	Appearance Външен вид		Skin colour Цвят на кората		Flesh colour Цвят на месото		Aroma Аромат		Texture Текстура		Taste Вкус		Total sensory evaluation Обща сензорна	
		2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
Tony	I	4.50 a	4.18 c	4.56 a	4.37 b	4.63 a	4.26 b	4.79 n.s.	4.84 a	4.40 ab	4.69 b	4.30 ab	4.59 b	4.31 b	4.43 b
	II	3.90 b	4.78 a	3.87 b	4.66 a	4.43 b	4.53 a	4.73 n.s.	4.94 a	4.62 a	4.91 a	4.22 b	4.91 a	4.22 b	4.78 a
	III	4.53 a	4.59 b	4.56 a	4.54 ab	4.53 ab	4.50 a	4.67 n.s.	4.71 b	4.28 b	4.87 ab	4.60 a	4.79 ab	4.60 a	4.75 a
Iren	I	4.29 a	4.47 b	4.33 ab	4.60 n.s.	4.48 n.s.	4.37 b	4.82 a	4.72 n.s.	4.51 ab	4.60 b	4.28 n.s.	4.57 ab	4.26 n.s.	4.53 b
	II	4.03 b	4.69 a	4.19 b	4.59 n.s.	4.57 n.s.	4.56 a	4.33 b	4.75 n.s.	4.66 a	4.81 a	4.09 n.s.	4.53 b	4.18 n.s.	4.62 b
	III	4.53 a	4.46 b	4.56 a	4.46 n.s.	4.44 n.s.	4.67 a	4.54 b	4.71 n.s.	4.27 b	4.79 a	4.22 n.s.	4.79 a	4.31 n.s.	4.75 a
Pobeda	I	4.23 a	4.54 b	4.42 a	4.47 b	4.30 b	4.34 b	4.73 a	4.88 a	3.71 n.s.	4.63 b	4.33 n.s.	4.75 n.s.	4.33 n.s.	4.56 b
	II	3.85 b	4.54 b	4.00 b	4.66 a	4.53 a	4.59 a	4.44 b	4.81 a	4.53 n.s.	4.81 a	4.32 n.s.	4.75 n.s.	4.28 n.s.	4.69 a
	III	4.50 a	4.75 a	4.53 a	4.37 b	4.44 ab	4.58 a	4.63 a	4.71 b	4.44 n.s.	4.83 a	4.47 n.s.	4.79 n.s.	4.47 n.s.	4.71 a

a. b. c… - Duncan's multiple range test ($p<0.05$). n.s. – not significant

Table 2. Coefficients of correlations between the studied sensory traits of fresh fruits at the three harvest times
Таблица 2. Корелационни коефициенти между изследваните сензорни показатели на свежите плодове в трите срока на беритба

2001 \ 2002	I	II	III
I	♦	-0.587	-0.620
II	0.002	♦	0.999
III	0.680	0.733	♦

a) Appearance/Външен вид

2001 \ 2002	I	II	III
I	♦	-0.920	-0.455
II	-0.974	♦	0.071
III	0.110	0.116	♦

b) Skin colour/Цвят на кората

2001 \ 2002	I	II	III
I	♦	0.733	0.948
II	-0.687	♦	0.478
III	0.844	-0.970	♦

c) Flesh colour/Цвят на месото

2001 \ 2002	I	II	III
I	♦	0.942	0.945
II	0.024	♦	0.782
III	-0.440	0.888	♦

d) Aroma/Аромат

2001 \ 2002	I	II	III
I	♦	0.936	0.985
II	0.989	♦	0.862
III	-0.999	-0.981	♦

e) Texture/Текстура

2001 \ 2002	I	II	III
I	♦	0.211	0.993
II	0.984	♦	0.092
III	0.599	0.730	♦

f) Taste/Вкус

2001 \ 2002	I	II	III
I	♦	-0.816	-0.667
II	0.925	♦	0.114
III	0.722	0.404	♦

g) Total sensory evaluation / Обща сензорна оценка

of trained expert-panelists have been worked out. Exact rules are used for performing of a panel test including preparation of the samples, light, air conditions in the sensory laboratory, methods of tasting and processing of obtained data [1,2,3,5].

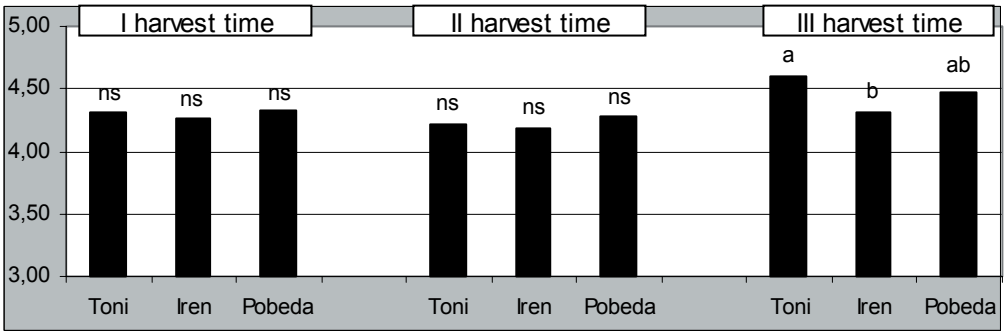
When sensory analysis is carried out for the purpose of scientific work on vegetable crops, additional criteria are necessary in order to receive more precise information. Similar investigations are very important for breeding of pickling cucumber quality where sensory evaluation is made at different stages of creation and exploitation of genetic material.

The aim of this study was to assess the influence of harvest time on the fruit sensory properties of pickling cucumbers as a raw and canned material, picked at different harvest date.

Table 3. Two-way analysis of variance for the studied sensory traits of fresh fruits depending on cultivar (factor A) and time of harvest (factor B)

Таблица 3. Двуфакторен дисперсионен анализ на сензорните показатели на свежи плодове в зависимост от сорта (фактор А) и срока на беритба (фактор В)

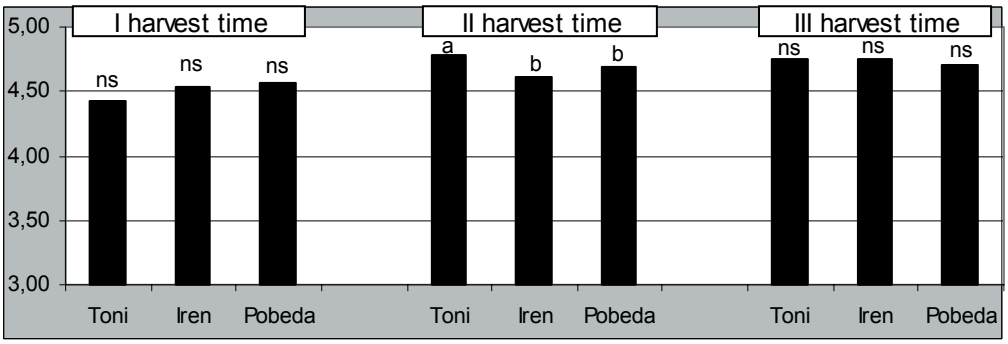
Sensory traits Сензорни показатели	Factors influence /Факторно влияние (η%) - 2001				Factors influence /Факторно влияние (η%) - 2002			
	Variety Сорт (A)	Harvest time Срок на беритба (B)	A x B	Error Грешка	Variety Сорт (A)	Harvest time Срок на беритба (B)	A x B	Error Грешка
Appearance/Външен вид	2.11	52.60**	3.29	42.00	3.04	37.21***	14.29**	45.46
Skin colour/Цвят на кората	0.32	49.88***	8.22*	41.58	1.23	20.34***	14.75**	63.68
Flesh colour/Цвят на месото	5.57	1.14	16.74*	76.55	3.95	29.26***	1.25	65.53
Aroma/Аромат	8.58*	22.17***	9.21	60.04	10.25*	17.16***	5.59	67.00
Texture/Текстура	3.21	7.31	8.75	80.73	4.59	28.94***	0.31	66.16
Taste/Вкус	8.65*	9.90*	5.38	76.07	7.44*	7.63*	11.62	73.31
Total evaluation/Обща оценка	5.53	16.79**	4.36	73.33	0.26	36.19***	9.23*	54.32



a, b, c… - Duncan's multiple range test ($p<0.05$), n.s. – not significant

Figure 1. Comparing of the total sensory evaluations between the studied varieties during the three harvest times in 2001

Фигура 1. Сравняване на изследваните сортове по обща сензорна оценка в трите срока на беритба през 2001 г.



a, b, c… - Duncan's multiple range test ($p<0.05$), n.s. – not significant

Figure 2. Comparing of the total sensory evaluations between the studied varieties during the three harvest times in 2002

Фигура 2. Сравняване на изследваните сортове по обща сензорна оценка в трите срока на беритба през 2002 г.

Table 4.Sensory traits of canned fruits
Таблица 4. Сензорен анализ на консервираните плодове

Variety Сорт	Harvest time Срок на беритба	Appearance Външен вид		Skin colour Цвят на кората		Flesh colour Цвят на месото		Texture Текстура		Taste Вкус		Total sensory evaluation Обща сензорна	
		2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
Tony	I	4.38 b	4.47 b	4.53 ab	4.62 n.s.	4.56 ab	4.62 n.s.	4.50 n.s.	4.59 n.s.	4.50 ab	4.50 b	4.44 b	4.66 n.s.
	II	4.59 a	4.69 a	4.69 a	4.63 n.s.	4.62 a	4.76 n.s.	4.53 n.s.	4.72 n.s.	4.56 a	4.79 a	4.56 a	4.75 n.s.
	III	4.24 b	4.60 ab	4.38 b	4.78 n.s.	4.50 b	4.69 n.s.	4.41 n.s.	4.62 n.s.	4.41 b	4.59 b	4.41 b	4.62 n.s.
Iren	I	4.47 n.s.	4.47 n.s.	4.47 n.s.	4.66 n.s.	4.53 n.s.	4.59 n.s.	4.50 n.s.	4.50 b	4.53 n.s.	4.50 n.s.	4.50 n.s.	4.59 n.s.
	II	4.47 n.s.	4.62 n.s.	4.59 n.s.	4.66 n.s.	4.60 n.s.	4.66 n.s.	4.44 n.s.	4.66 a	4.47 n.s.	4.56 n.s.	4.47 n.s.	4.66 n.s.
	III	4.50 n.s.	4.47 n.s.	4.50 n.s.	4.66 n.s.	4.50 n.s.	4.60 n.s.	4.44 n.s.	4.56 ab	4.41 n.s.	4.50 n.s.	4.40 n.s.	4.59 n.s.
Pobeda	I	4.44 b	4.47 b	4.72 a	4.43 ab	4.56 b	4.50 n.s.	4.53 n.s.	4.50 n.s.	4.50 n.s.	4.44 n.s.	4.62 a	4.50 n.s.
	II	4.72 a	4.69 a	4.75 a	4.63 a	4.72 a	4.47 n.s.	4.47 n.s.	4.59 n.s.	4.47 n.s.	4.56 n.s.	4.53 ab	4.60 n.s.
	III	4.25 c	4.25 c	4.44 b	4.28 b	4.50 b	4.60 n.s.	4.59 n.s.	4.50 n.s.	4.53 n.s.	4.53 n.s.	4.47 b	4.56 n.s.

a. b. c… - Duncan's multiple range test ($p<0.05$). n.s. – not significant

MATERIALS AND METHODS

The experiment was performed during the period 2001 – 2002 in plastic greenhouse. The studied pickling cultivars Toni F_1, Iren F_1 and Pobeda F_1 are of gynoecious type and indeterminate growth. The trial was carried out by block method in four replications at 100 + 50 x 35 cm scheme of planting and 2.6 m^2 area of experimental plot with 10 plants per each one. The seeds were sown at the end of March and the plants were cultivated up to the end of July. The fruits for sensory analysis were picked at three harvest times every 15 days during the mass fruiting period. Sensory analysis was done on 20 fruits from each replication no later than three hours of their harvesting.

The fruits were canned immediately after harvesting by the Technological instruction accepted for Bulgaria [4]. They were of size 6-9 cm. The quantities of added spices were minimal in order to keep the cultivar characteristics concerning their gustatory properties unmasked. The panel test of canned fruits was made after four month storage. Sensory analysis of the fresh and canned fruits and data processing were performed by methods used in the experiment with salad cucumbers [6]. The sensory characteristic aroma was not reported on the canned fruits test because of the influence of the added spices.

RESULTS AND DISCUSSION

The evaluations of sensory traits of the fresh fruits for the hybrids were changed depending on the harvest time (Table 1). For all varieties except Pobeda Duncan's test proved significant differences between their values at least in one of the experimental years. Two statistical separated groups were formed for predominant variants and this indicated that assessments were not different at two harvest times. However, there was no relation to fruiting period. Differences between I and II harvest as well as between II and III harvest were not established.

Correlations between evaluations of skin colour and texture for I and II harvests and flesh colour for I and II harvests were strong (Table 2). Changeability of the values of the other correlation coefficients support the idea that harvest time is a factor which could not be ignored when we form final conclusions from sensory analysis.

The data from two-way analysis of variance proved stronger influence of harvest time on the sensory evaluations than on the cultivar during the whole experimental period (Table 3). Weaker influence of the cultivar could be explained to some extent with the fact that the three hybrids have the same female parent component. Harvest time had the strongest influence on the evaluations of appearance, skin colour, aroma and

Table 5. Two-way analysis of variance for the studied sensory traits of canned fruits depending on cultivar (factor A) and time of harvest (factor B)
Таблица 5. Двуфакторен дисперсионен анализ на сензорните показатели на консервирани плодове в зависимост от сорта (фактор А) и срока на беритба (фактор В)

Sensory traits Сензорни показатели	Factors influence /Факторно влияние (η%) - 2001				Factors influence /Факторно влияние (η%) - 2002			
	Variety Сорт (A)	Harvest time Срок на беритба (B)	A x B	Error Грешка	Variety Сорт (A)	Harvest time Срок на беритба (B)	A x B	Error Грешка
Appearance/Външен вид	2.75	27.73***	18.54***	50.98	5.72*	25.61***	12.32*	56.35
Skin colour/Цвят на кората	7.40*	24.81***	8.94	58.84	21.44***	1.65	14.82**	62.10
Flesh colour/Цвят на месото	3.09	25.88***	3.81	67.23	23.14***	2.92	7.66	66.28
Texture/Текстура	3.68	0.90	7.53	87.89	7.20	8.78*	0.43	83.59
Taste/Вкус	0.66	3.11	6.86	89.37	8.16*	12.01**	5.09	74.75
Total evaluation/Обща оценка	8.15*	11.67**	8.59	71.60	13.41**	6.94	1.88	77.76

Table 6. Coefficients of correlation between the sensory evaluations of fresh and canned cucumber fruits
Таблица 6. Корелационни коефициенти между сензорните оценки на свежи и консервирани плодове

Variety		Appearance Външен вид	Skin colour Цвят на кората	Flesh colour Цвят на месото	Texture Текстура	Taste Вкус	Total sensory evaluation Обща сензорна оценка	Appearance Външен вид	Skin colour Цвят на кората	Flesh colour Цвят на месото	Texture Текстура	Taste Вкус	Total sensory evaluation Обща сензорна оценка
		2001						2002					
Toni	I	0.637	0.165	0.071	-0.046	-0.513	-0.068	0.200	-0.086	-0.350	0.771	0.479	0.383
	II	-0.305	-0.106	-0.442	0.002	0.071	-0.068	0.222	0.378	0.225	0.108	0.120	0.184
	III	-0.210	-0.636	-0.250	0.525	-0.152	-0.027	0.645	-0.031	-0.157	0.248	0.028	0.053
Iren	I	-0.716	-0.181	0.036	-0.350	0.386	0.521	-0.064	0.155	0.589	0.377	0.277	0.212
	II	-0.725	-0.049	-0.662	0.273	-0.503	-0.640	0.251	-0.836	0.045	-0.455	0.138	-0.131
	III	0.426	-0.445	0.074	-0.729	-0.535	0.330	0.182	0.382	0.051	-0.515	-0.092	-0.135
Pobeda	I	0.357	0.708	0.328	-0.140	-0.344	0.070	0.471	-0.151	-0.577	0.184	0.499	0.616
	II	-0.248	-0.055	0.873	-0.253	0.487	-0.009	0.290	-0.123	0.169	-0.027	-0.506	-0.338
	III	-0.073	0.653	0.152	0.751	-0.227	-0.055	-0.479	-0.268	0.418	-0.093	-0.394	-0.419

total sensory assessment. The effect of this factor on the gustatory traits of fruits at different harvest time was comparatively weaker.

Data analysis for fresh pickling cucumbers permits us to make conclusions on the analogy of the salad ones (Part I, [6]) i.e. one harvest time is not sufficient to characterize sensory quality of pickling cucumbers.

The sterilized fruits had weaker differences in sensory values at separate harvest times in contrast to fresh ones (Table 4). Variety Iren had the most indistinguishable evaluations. Texture and taste were the traits on which harvest time had no influence in all studied varieties. The data of two-way analysis of variance confirms this conclusion (Table 5). As a whole, influence of harvest time on sensory evaluations of the canned fruits is weaker in contrast to fresh ones. Probably this is due to two reasons. The thermal processing changes structure of the fruits and they loose a part of own crisps, which is possibly reason to obtain close values of assessment for the variants. On the other side, supplementation of spices even though in minimum quantity masks a part of gustatory senses and erases the small differences established in fresh fruits.

The fresh and canned fruits were differed in their total sensory evaluations. At the first harvest time in 2000 significant differences between the fresh fruits of studied

varieties were not established while the canned fruits were divided in two groups (Fig. 1, 2). At the third harvest time of the same year the varieties evaluated in fresh condition were divided in two groups and these evaluated as canned ones did not differ. The heterogeneity of results for fresh and processed fruits was also proved by correlation coefficients calculated for all studied traits (Table 6). This shows that sensory properties of canned fruits cannot be entirely prognosticated from panel test data of the fresh ones.

CONCLUSION

For breeding purposes sensory analysis of pickling cucumbers for processing should be performed using sterilized pickling cucumbers but not only fresh ones. More precise information will be obtained by assessment of number of samples collected at different harvest times. Following these provisos sensory analysis will really support breeding process and we could receive more reliable evaluation of various breeding materials.

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