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A NEW VBA SOFTWARE AS A TOOL OF FOOD SENSORY TESTS

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Sensory testing is an essential tool for introducing new products to the market. To achieve reliable sensory data several factors should be controlled from the experimental design, through the coding of the samples to the proper conduct of the analysis. To improve the efficiency of sensory testing computer support of the process is necessary.
The target of our project was to develop software, which supports the profile analysis testing method. The selection of the platform (Microsoft Excel) was motivated by its widespread use and easy accessibility. The preparation of the score sheets is performed on the panel leader's computer; afterwards the copies are moved to the panellists' PCs. The software can handle unstructured scales, structured scales, category scales and text fields. Data collection is followed by complex data analysis and graphic presentation.

Keywords: food sensory testing, apple profile analysis, visual basic for excel software

Introduction

Sensory analysis is an essential tool to achieve successful marketing strategy in the food sector. Though sensory quality is not the only key to meet consumer demands (price strategy, promotion, point of sale and other product characteristics are also essential), sensory data can be utilized in several marketing aspects. Sensory testing is generally considered to be subjective, as it relies on human individuals, instead of 'more accurate' equipments of other research fields (e.g.: analytical chemistry, rheology, etc.).

Since no reliable model exists for transforming analytical and other instrumental data to perceive sensory quality [9], it is necessary to reduce the objective character of sensory testing. Due to accelerated research on this field there are several solutions for providing reliable sensory data for decision making [1]. One of the basic principles is, that sensory testing should be considered similarly to instrumental testing. From the practical point of view it means:

- proper experimental design;
- understanding the limitation of our 'equipments' (in our case: the assessors)
- and suitable statistical analysis of the data.

These requirements mentioned above are really just the most basic ones. The importance of these principles is indicated by the fact that already 24 ISO standards deal with different aspects of sensory testing. Quality oriented sensory research in this way might mean more tasks to deal with, so information technology has a huge impact in saving time and energy.

Sensory testing

Before proceeding with the exact details of our research, one more question should be discussed. Sensory testing [5, 6] can be performed with:

- naive assessors (consumers);
- trained and selected assessors and
- experts

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These different groups should be considered as different tools (like we have different instruments in an analytical laboratory).

Consumer tests usually focus on preference, and ask the question *'Which product do you prefer?'*. In this case it is very important that the people involved should be representative to the target population [10].

Testing with selected assessors or experts helps to answer the question *'Why is one product preferred, and why is the other one rejected?'*.

If we use the wrong tool for answering the question (e.g. experts or selected assessors for *'Which product do you prefer?'*) the results will be invalid.

In our research we worked mainly with the second group mentioned above (selected assessors).

Tools of information technology in Sensory Laboratory of SzIU

The Sensory Laboratory of Szent István University, Budapest, Hungary has a specially designed sensory booth system, which was established in accordance with the relevant ISO standards [3].

During the recent period a Local Area Network (LAN) was built in the lab, providing the possibility of PC based testing. This solution greatly improves the efficiency of sensory evaluation.

The critical point of such a system is the software applied. Several software systems are known for supporting sensory analysis.

Since these software are sold in a moderate number of copies, even the academic prices are considerably high. This motivated us to find a solution more suitable to the possibilities of the Hungarian academic sector. Finally it has been decided to develop an own software system in Visual Basic for Applications (VBA [7,8]) for our specific needs [4].

While the staff of the Sensory Laboratory (SzIU) provided the know-how of sensory testing, the Department of Chemical Information Technology, (BUTE) provided all support on the field of information technology.

Since one of the current researches was dealing with the method of profile analysis of apples, in the first step this software module was developed.

Sensory testing methods can be divided into three main groups:

- difference testing methods;
- ranking methods
- and descriptive methods.

Profile analysis [2] belongs to the group of descriptive methods. These kinds of procedures require trained assessors or experts. The testing session has several steps, which indicates the time demand of the analysis. The nature of the method requires some collective work of the assessors in one phase of the analysis.

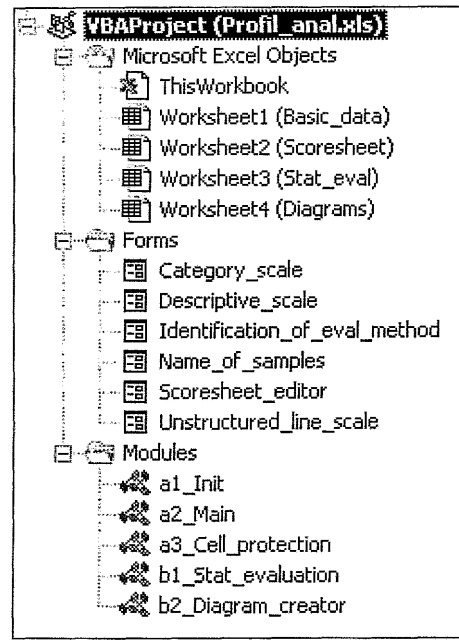

Fig.1 Main parts of the profile analysis supporting VBA software

The VBA software created

Our VBA software consists of 5 modules, 6 user forms, and works on 4 Excel worksheets, as it is shown on the *Fig.1*.

Among the modules the a1, a2, a3 marked ones create the score sheets for the assessors, including the protection of the cells which should remain unchanged during the sensory testing procedure. The subroutines of these modules call the forms, and they fill out the first two worksheets (Basic_data and Scoresheet). The b1 and b2 marked modules supervise the data collection from the filled out score sheet-files, make statistical evaluation in the third worksheet (Stat_eval) and create the diagrams in the fourth worksheet. The usage of the software we show in the next section on a real apple profile analysis.

A real apple profile analysis using the software

In the first step of profile analysis the assessors get the samples, and they are asked to create a list of sensory attributes, which they consider important. In this step the assessors work individually. The second step is the group discussion, when the assessors decide which attributes should remain in the final evaluation system. The discussion is supervised and helped by the panel leader. For each sensory attribute the group has to choose an evaluating method (e.g. unstructured scale, category scale, descriptive evaluation, etc.). Our software makes it easy to choose the evaluating method and specify the further details (*Figs.2-5*). In this step the screen can be projected to help the work of the group.

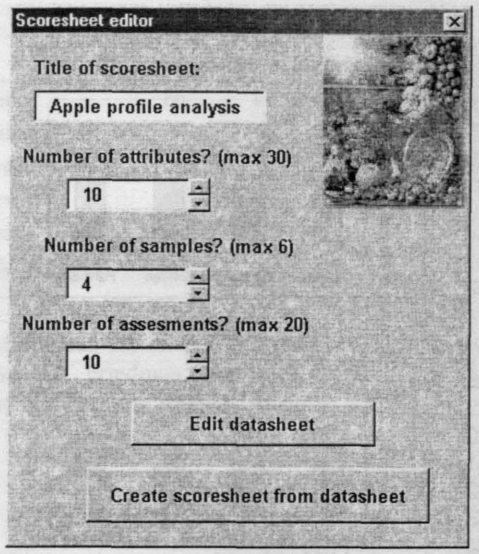

Fig.2 The score sheet editor

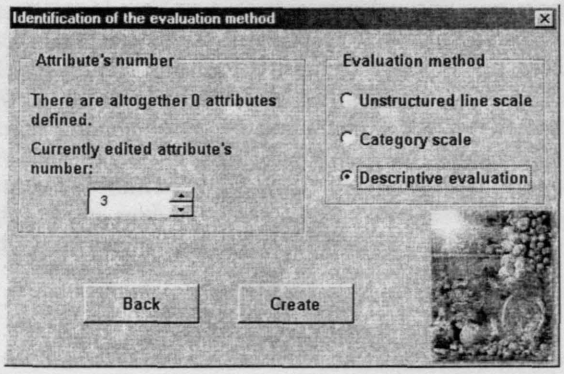

Fig.3 Setting the evaluation method

Using the Score sheet editor form the assessors specify the title of score sheet, and the number of attributes, samples and assessments.

Each attribute has a sequence number and a code corresponding to their type (evaluation method). On the *Figs.4-5* we show the way of setting up two different scales – unstructured line and category scales. In both cases we specify attribute's name, for the first type we give the legends at the start and at the end of the scrollbar belonging to the unstructured line, for the second one the names of the categories are going to be given.

When all the attributes are defined and the evaluation methods are specified, the software asks to type in the name of the samples (varieties) into a form, and thereafter creates a block design for the presentation sequence of the samples. A randomly generated, three-digit number code is also assigned to each sample (*Fig.6*). These techniques are essential to avoid psychological faults during testing.

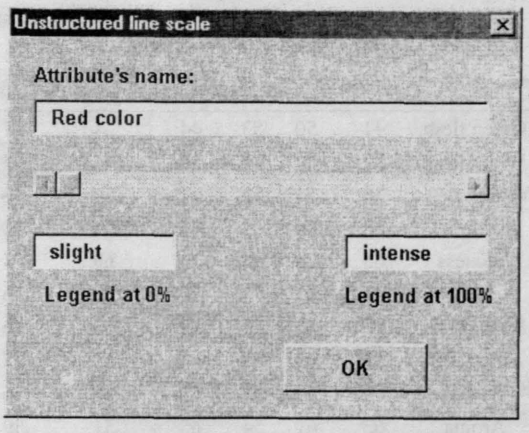

Fig.4 Unstructured line scale

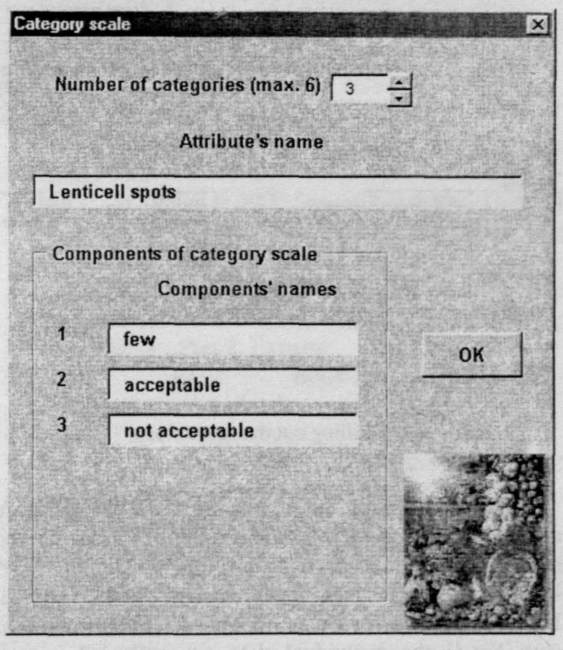

Fig.5 Setting up a category scale

H	I	J	K	L	M	N	O	P	Q
Sample's name	Idared	Jonathan	Topred	Golden					
sample ID	A	B	C	D		3-digit samplecodes			
1	B	A	D	C		584	182	356	289
2	C	D	A	B		351	217	675	967
3	D	C	B	A		396	934	167	342
4	A	B	D	C		609	307	861	796
5	B	A	C	D		219	829	718	492

Fig.6 Creating the test design automatically

With choosing 'Create scoresheet from datasheet' (see *Fig.1*) the software creates the score sheets for each assessor. Then the score sheets are copied to the PCs in the sensory booths, and the assessor is ready to test. This step of the testing means individual work again (*Fig.7*).

Table 1 Sensory test of scab resistant apple varieties using Jonathan as control variety

	Releika	Remo	Resi	Rewena	Reglindis	Jonathan
Green flesh	44	50	53	44	41	47
White flesh	53	59	41	59	47	65
Yellow flesh	76	74	53	74	59	56
Hardness	88	86	78	86	75	78
Juicness	65	78	65	73	69	71
Peel	71	65	74	76	71	76
Sweet taste	70	52	56	52	58	46
Sour taste	57	66	58	64	53	67
Odour	60	59	50	58	50	56
Aroma	62	61	54	65	51	59
Taste + Aroma	62	65	54	64	52	62

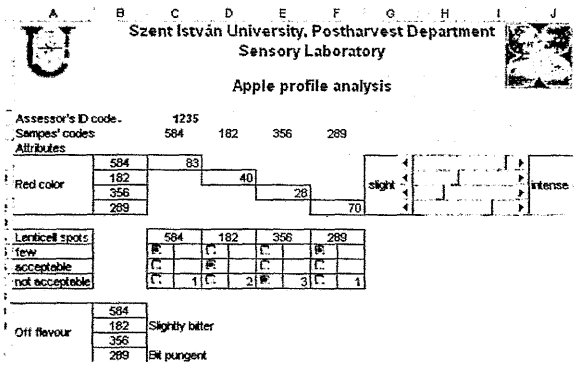

Fig.7 Filling out the score sheets

When the testing session is finished, the data are collected from each PC. The online filling of the questionnaires means, that the time-consuming data input from paper based questionnaires can be skipped. By the VBA macros of the module *b1_Stat_evauationl* (see *Fig.1*) the individual data are collected in one worksheet *(Stat_eval)*, and statistical analysis takes place. Every attribute is analysed for significant differences, and for the better understanding, the results are represented in diagrams (*Figs.8 and 9*).

After the first experiences in the usage of our new software in laboratory (testing) circumstances we tried to use it on the Hortus Hungaricus exhibition for the evaluation of the sensory testing of scab resistent apple varieties, organized by the Postharvest Club. This was a different field where we could use the software. In the circumstances of the Hortus exhibition it was not possible to use computer network and online sensory test data input. We created the score sheets by the software, but in this case we made paper based (hardcopy) questionnaires from the printed out score sheet. On the exhibition the experts filled out these questionnaires, and we could make a real-time evaluation by a laptop. After evaluating the first group of assessors, for the latter visitors we could show a presentation about the results. We investigated six varieties: five resistant apples: Replica, Reno, Resin, Rowena and Regrinds. As control variety we used the

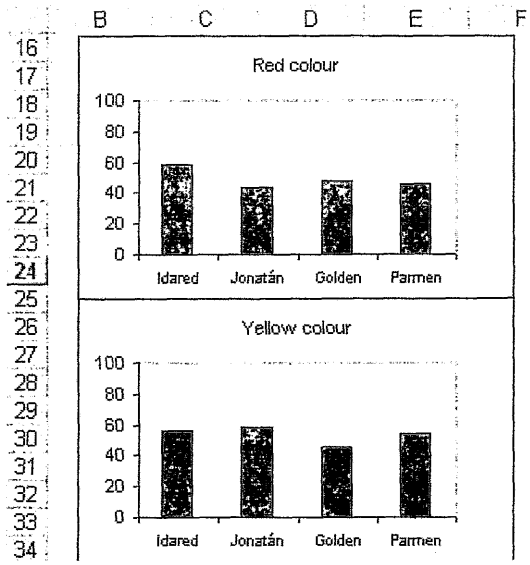

Fig.8 Graphical presentation of the results, according to the properties

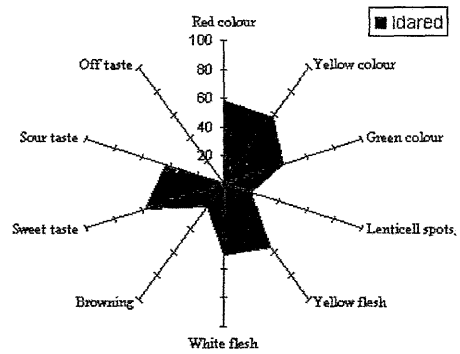

Fig.9 Graphical presentation of the results, according to the apple samples

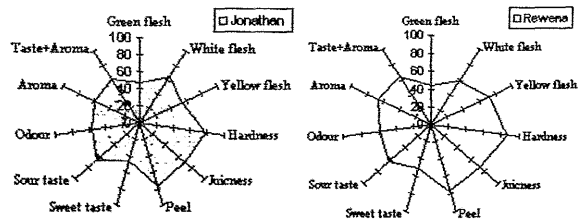

Fig.10 Comparison of apples' sensory profiles. Jonáthan (left) and Rewena (right)

well known and in Hungary preferred Jonathan. From our result we have got in a short way the fact there seems to be no significant difference between some re-apples and on the market preferred Jonathan. (*Table 1, Fig.10*)

The „profile analysis" on the Hortus exhibition was of course only a first attempt to use our software in non-laboratory circumstances. We made ranking tests with more than 200 assessors as well.

Table 2 Comparison of apples, ranking

	Releika	Jonathan	Rewena	Resi	Remo	Reglindis
Releika	-	no	no	1 %	1 %	1 %
Jonathan	40	-	no	5 %	1 %	1 %
Rewena	67	27	-	no	1 %	1 %
Resi	128	88	61	-	no	5 %
Remo	167	127	100	39	-	no
Reglindis	211	171	144	83	44	-

As one can see on *Table 2*, the evaluation of simple ranking by Friedman test doesn't show significant differences between Releika, Jonathan and Rewena.

Discussion

The first experiences with the VBA based sensory analysis supporting software showed, that the time demand of both the preparation and testing step can be considerably reduced. Online questionnaires mean no data input is necessary from paper-based questionnaires. Data analysis and report making is almost real time. Some details of the software will be developed (sample code printing, etc.). In our future work we plan to develop similar software modules for other testing methods (difference testing, ranking and other descriptive methods). A database system managing the different data is also planned to be built.

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SYMBOLS

BUTE	Budapest University of Technology and Economics
LAN	Local Area Network
Re-apple	Disease (scab) resistant apple variety
SzIU	Szent István University
VBA	Visual Basic for Application

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