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DETERMINATION OF FRAGRANCE IN RICE BY PANEL TEST

Project of a validated method and development of a standard

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Introduction

Aromatic rice constitute a small but special group of varieties which are considered in some part of the world the best of quality. This rice have long been popular in the orient of Asia, and now becoming more popular in middle Est, Europe and the United States.

The aromatic rice are characterized by releasing, after cooking, a flavor (fragrance) similar to the popcorn, as a result of the presence of a pool of molecules including, in particular, 2-acetyl pyrroline.

The presence of fragrance is one of the characters to be evaluated when new rice varieties are registered in the National (Italian) Register of Varieties.

The determination is carried out by the Chemical Laboratory of Ente Nazionale Risi with an internal method proposed at UNI (the Italian standardization body) to the WG Rice and that has started the regulatory process.

Through the application of this method it is possible to characterize rice varieties of interest to the breeder, for the seed producers companies, but also for the large distribution that carries out the quality control of its products.

Currently the only standard method for the evaluation of the fragrance is the CPVO protocol. However, it presents several problems: it is applicable only to brown rice and requires the addition of a chemical reagent (KOH) to the sample, making the frarance emitted artifact and not similar to that of cooking.

Hence the need to create an evaluation method that took into account the sensory analysis on cooked rice.

Goals

The purpose of this study is to validate the internal method for the determination of the fragrance in rice (aroma) and propose it as a national standard.

Following the process of validation of the method, the LCM (n° of accreditation 0760) can request accreditation to the fragrance analysis to ACCREDIA (the Italian Accreditation Body).

Sample preparation	Proceed to reduce the laboratory sample, if necessary, using a sample divider to a quantity of about 30 g to obtain the test sample
Heating	Adjust the heat source so that the water vigourosly and steadily boils in the cooking container
Sample preparation for cooking	Prepare one beaker every assessor, for every single sample; put in each one 8g of sample and add 12 ml of deionized water. Stir and cover the beakers with watch-glasses.
Cooking	Place the beakers prepared on the perforate plate in the cooking container and replace the lid immediately. Remove the heat source after 20 min and allow to stand for 10 min.
Conditioning at room temperature	Remove the beakers from the cooking container and place them in a room at an ambient temperature. Allow to cool to room temperature for at least 1 h.
Panel determination	Make the determination in a test room. Analyze a maximum of three samples in each session. The number of “expert sensory assessors” for each session is 3.
Results	Provide the result as "aromatic" or "non-aromatic“ rice

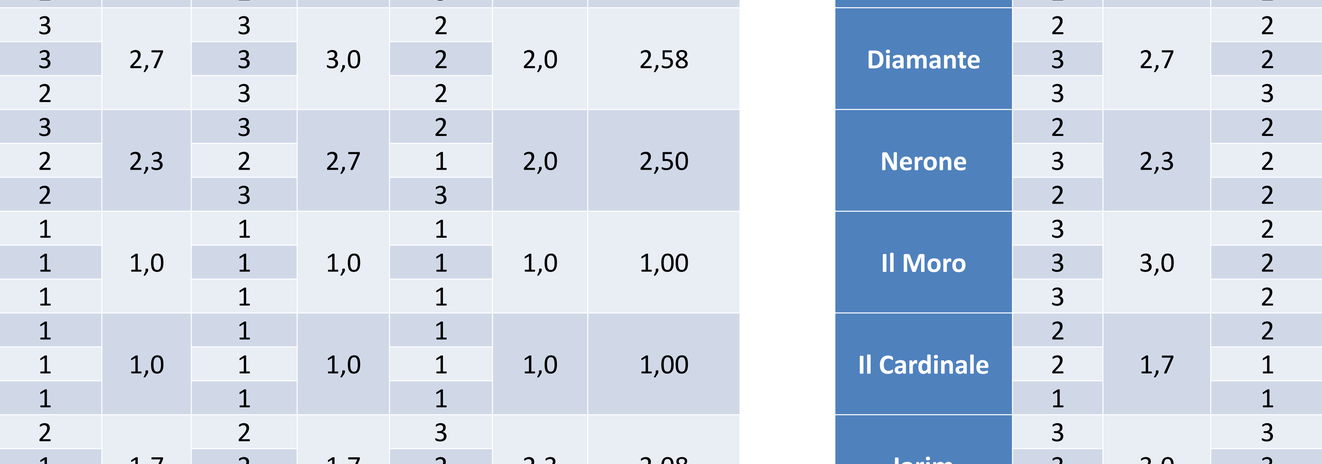
Materials and Methods – Discussion and Results

The internal method consists of performing sensorial evaluation through a panel test and defining the absence or presence (weak or strong) of the fragrance on the cooked rice samples, prepared using a standardized internal method (of LCM).

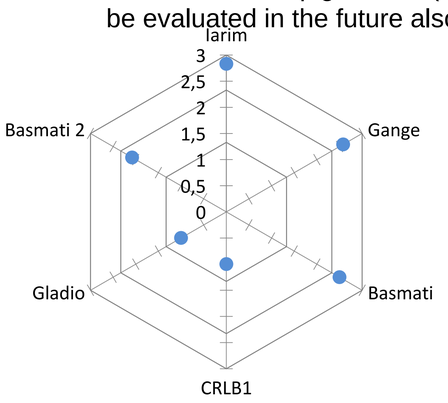
VALIDATION OF THE METHOD

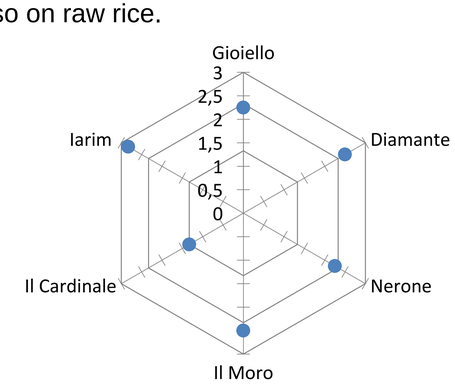
The validation of the internal method is performed in accordance with the specific (sensory) standards and ISO 17025.

Accomodation and environmental conditions	• Room of sample preparation • Test room	There shall be effective separation between the sample preparation laboratory and the test room (in this case it is not necessary that the requirements of ISO 8589 are satisfied because this standard must also be used by organizations that do not have a sensory analysis laboratory).
Selection of the method	• Laboratory developed method (as shown in the diagram below) • Validation of method (repeatability conditions - the results are shown in the tables below. At one session, four assessors gave scores for the attribute “fragrance” on three replicates of six sample for each type of rice), for: • milled cooked rice • brown cooked rice	
Equipment	• Equipment for preparation of sample [beakers, cooking container with heat source, balance (±0,1g), watch-glasses] • Equipment for test • Specific standard (the LCM has chosen two Italian rice varieties: Iarim (aromatic rice); CRLB1 (non aromatic rice)	
Sensory panel	• Selection, training and monitoring of selected and expert assessors (ISO 8586) • Evalutation of the performance of the quantitative sensory panel (ISO 11132)	



The panel is selected, trained, monitored and maintained according to the procedures defined in the ISO 8586 and ISO 11132 standards. Actually, for this determination, the LCM has: 4 “expert sensory assessors”; 4 “selected assessors”; 2 “sensory assessors”.





Conclusions

The internal method is to be considered validated for cooked milled rice and cooked brown rice.

As shown in the tables below, variation between assessors is not significant, so the panel of assessors of LCM is homogeneous. There are differences between samples so it is possible to discriminate from aromatic and non aromatic rice (and between strong or weak fragrance).

The analytical determination is performing on cooked milled and brown rice, also pigmented (black and red). The performance will be evaluated in the future also on raw rice.

Sample (cooked milled rice)	Assessors 1 score	1 mean	2 score	2 mean	3 score	3 mean	4 score	4 mean	mean
Iarim	3	3,0	3	2,7	3	2,7	3	3,0	2,83
	3		3		3		3		
	3		2		2		3		
Gange	3	2,7	3	2,7	3	3,0	2	2,0	2,58
	2		3		3		2		
	3		2		3		2		
Basmati	3	3,0	3	2,3	3	2,7	2	2,0	2,50
	3		2		2		1		
	3		2		3		3		
CRLB1	1	1,0	1	1,0	1	1,0	1	1,0	1,00
	1		1		1		1		
	1		1		1		1		
Gladio	1	1,0	1	1,0	1	1,0	1	1,0	1,00
	1		1		1		1		
	1		1		1		1		
Basmati 2	2	2,7	2	1,7	2	1,7	3	2,3	2,08
	3		1		2		2		
	3		2		1		2		
mean	2,22		1,89		2,00		1,89		2,00

Sample (cooked brown rice)	Assessors 1 score	1 mean	2 score	2 mean	3 score	3 mean	4 score	4 mean	mean
Gioiello	2	2,0	2	2,0	2	2,3	3	2,7	2,25
	2		2		2		2		
	2		2		3		3		
Diamante	2	2,7	2	2,3	3	2,7	2	2,3	2,50
	3		2		2		3		
	3		3		3		2		
Nerone	2	2,3	2	2,0	3	2,7	2	2,0	2,25
	3		2		2		3		
	2		2		3		1		
Il Moro	3	3,0	2	2,0	3	2,3	3	2,7	2,50
	3		2		2		3		
	3		2		2		2		
Il Cardinale	2	1,7	2	1,3	2	1,3	1	1,0	1,33
	2		1		1		1		
	1		1		1		1		
Iarim	3	3,0	3	2,7	3	2,7	3	3,0	2,83
	3		3		3		3		
	3		2		2		3		
mean	2,44		2,06		2,33		2,28		2,28

Source of variation	Degrees of freedom, ν	Assessors 1 MS	1 F	2 MS	2 F	3 MS	3 F	4 MS	4 F
Between samples	5	2,76	24,80	1,82	8,20	2,40	14,40	1,82	8,20
Residual	12	0,11		0,22		0,17		0,22	
	Residual standard deviation	0,33		0,47		0,41		0,47	

Source of variation	Degrees of freedom, ν	Assessors 1 MS	1 F	2 MS	2 F	3 MS	3 F	4 MS	4 F
Between samples	5	0,89	5,33	0,59	3,53	0,80	2,40	1,52	4,57
Residual	12	0,17		0,17		0,33		0,33	
	Residual standard deviation	0,41		0,41		0,58		0,58	

Source of variation	Degrees of freedom, ν	SS	MS	F
Between assessors	3	1,33	MS_5 = 0,44	0,06
Between samples	5	39,50	MS_4 = 7,90	26,33
Interaction	15	4,50	MS_6 = 0,30	1,66
Residual	48	8,67	MS_7 = 0,18	
Total	71	54,00		

Source of variation	Degrees of freedom, ν	SS	MS	F
Between assessors	3	1,44	MS_5 = 0,48	1,93
Between samples	5	15,61	MS_4 = 3,12	12,49
Interaction	15	3,39	MS_6 = 0,23	0,90
Residual	48	12,00	MS_7 = 0,25	
Total	71	32,44		

RESULTS:

It is possible to calculate the average of the judgments as shown below:

Mean ≤ 1,33 NON AROMATIC rice

1,33 < Mean < 2,33 AROMATC rice (weak)

Mean ≥ 2,33 AROMATIC rice (strong)

…standard proposal

The standard project for the determination of fragrance in rice is currently being studied by the Rice Working Group in UNI (the Italian Standard Body). The standard will be divided into two parts: Rice - Evaluation of fragrance in rice:

Part 1 - Routine method

Part 2 - Absolute method by genetic determination

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ISO 8586 «Sensory analysis – General guidelines for the selection, training and monitoring of selected and expert assessors»

ISO 11132 «Sensory analysis – Methodology – Guidelines for monitoring the performance of a quantitative sensory panel»

ISO/IEC 17025 «General requirements for the competence of testing and calibration laboratories”

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