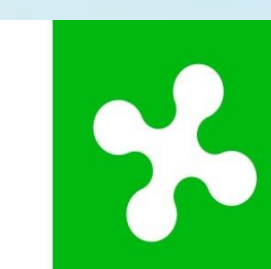




EVALUATION OF COOKING TIME OF ITALIAN RICE VARIETIES

Evaluation by panel test and with gelatinization time



Regione Lombardia

Cinzia Simonelli ¹; Mauro Cormegna ¹; Laura Galassi ²; Piergiorgio Bianchi ²¹ ENR – Laboratorio Chimico Merceologico (LCM) – Centro Ricerche sul Riso; ²ERSAF – Laboratorio di Analisi Sensoriale

Introduction

To know the correct cooking time, specific for each variety of rice, is essential for their correct use.

The international standard does not currently provide any kind of methodology to achieve this goal; the only information available to date regarding rice cooking results from the standard for the determination of the gelatinization time of rice, which is the time required for 90% of the rice grains to be completely gelatinized (ISO 14864:2004). By cooking the rice at that time it, from a sensorial point of view, turns out to be over cooked.

Goals

The goal of this study is to find a robust method for defining the correct cooking time of different rice varieties both through evaluation by a panel of judges and with a correlation by the gelatinization time data.

Materials and Methods

An evaluation was then carried out on 10 heterogeneous varieties of Italian rice [Aiace, Arborio, Baldo, Carnaroli, Loto (*long A*); Gange, S. Andrea, Thaibonnet (*long B*); Selenio (*round*); Vialone Nano (*medium*)], evaluating their behaviour, cooking them at different times, using a panel of assessors.

Rice samples were cooked starting from 10-minutes and repeating cooking every 2-minutes (10, 12, 14, ...minutes). For each session the panel of assessors was called to evaluate the degree of cooking on a pre-established scale (underdone, slightly under cooked, optimal cooking, slightly over cooking, over cooked). At each timing, the data processing graph is processed to provide a Gaussian who sees the correspondence of its maximum with the majority of ratings data (Fig.3).

The optimal cooking time for the single rice variety examined is the time at which the Gaussian average (ie its maximum) is represented by the "optimal cooking" judgment by the assessors (untrained, but simple consumers).



Figure 1 – sensory evaluation of cooking time by a panel of assessors (ENR)



Figure 2 – The testing rooms (ERSAF).

Figure 3 – ideal Gaussian curve

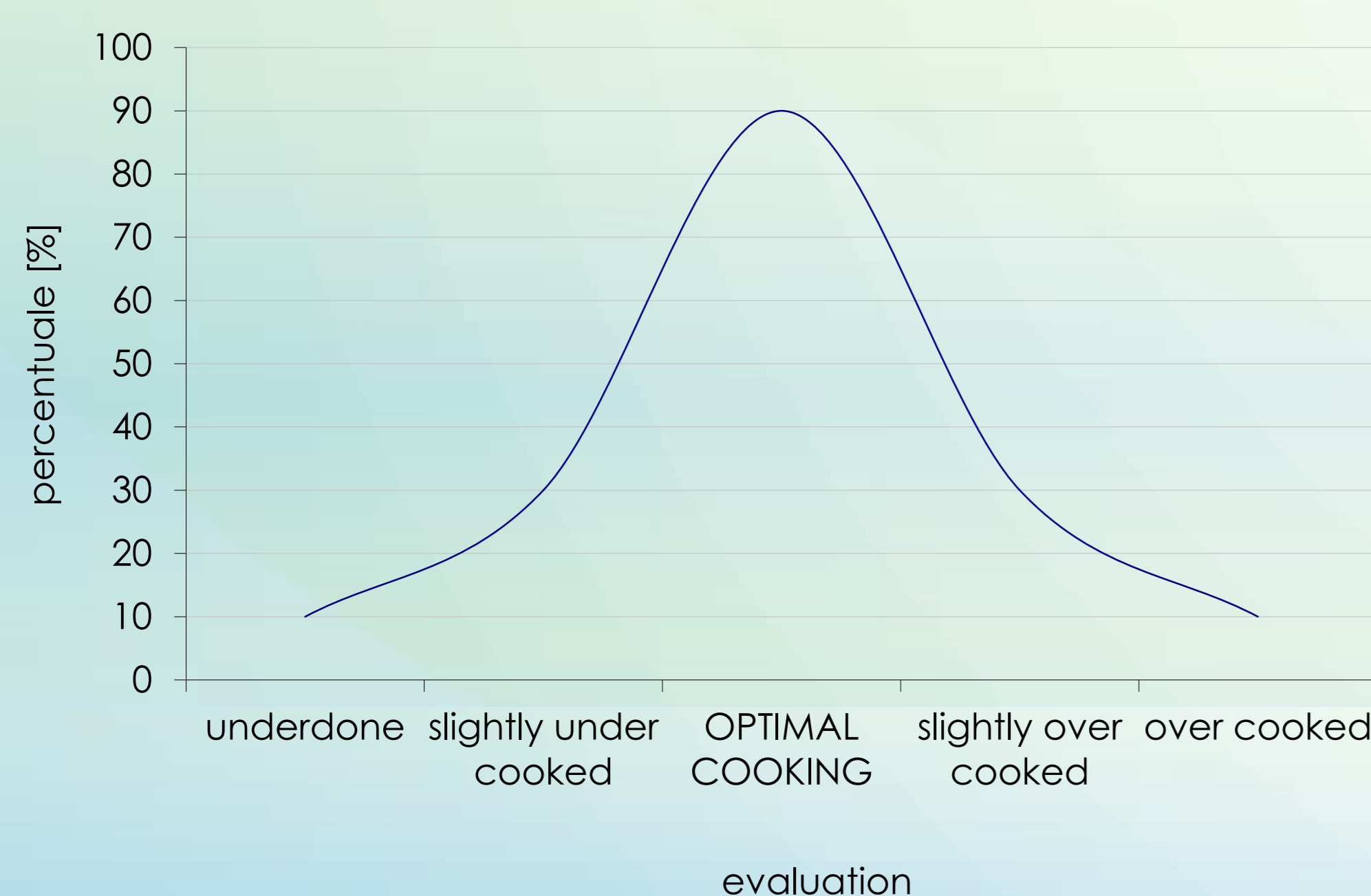
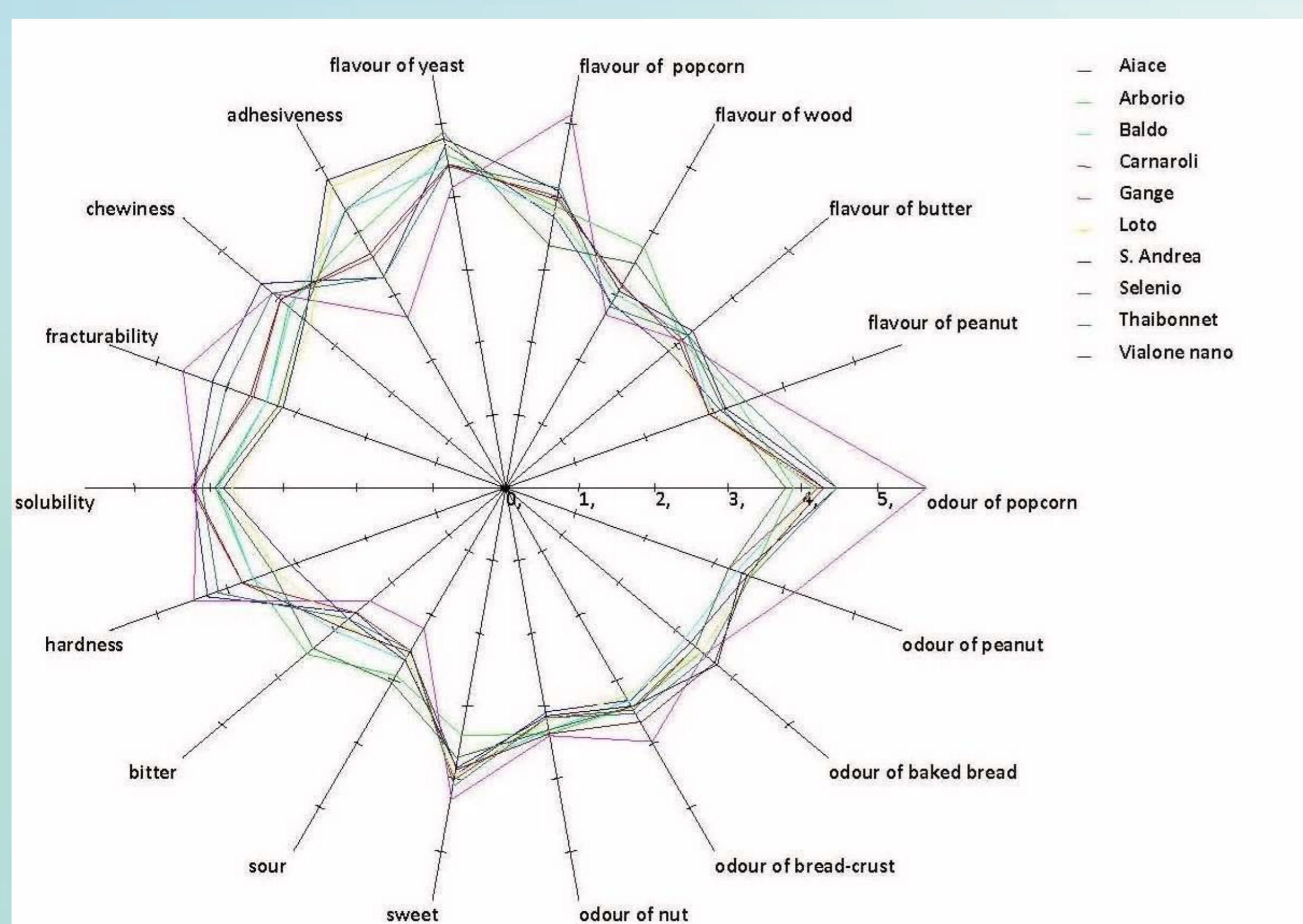


Figure 4 – Spiderplot showing sensory profile of 10 Italian rice varieties



Results and Discussion

SENSORY EVALUATION AND EVALUATION BY GELATINIZATION TIME

The sensory evaluation was conducted by two separate laboratories (ENR and ERSAF), respectively by 13 and 11 judges.

From figure 4 to figure 7 are reported the graphs for the different types of rice (long A, long B, round and medium). With the exception of Aiace and Loto, there is a good agreement between the data of the cooking times found in the two separate laboratories (Table 1). Applying the ISO standard (ISO 14864:2004) it was possible to determine the gel time for all the rice varieties of the study, as showed in Table 2.

Figure 4 – Baldo (*long A*): cooking time by panel test

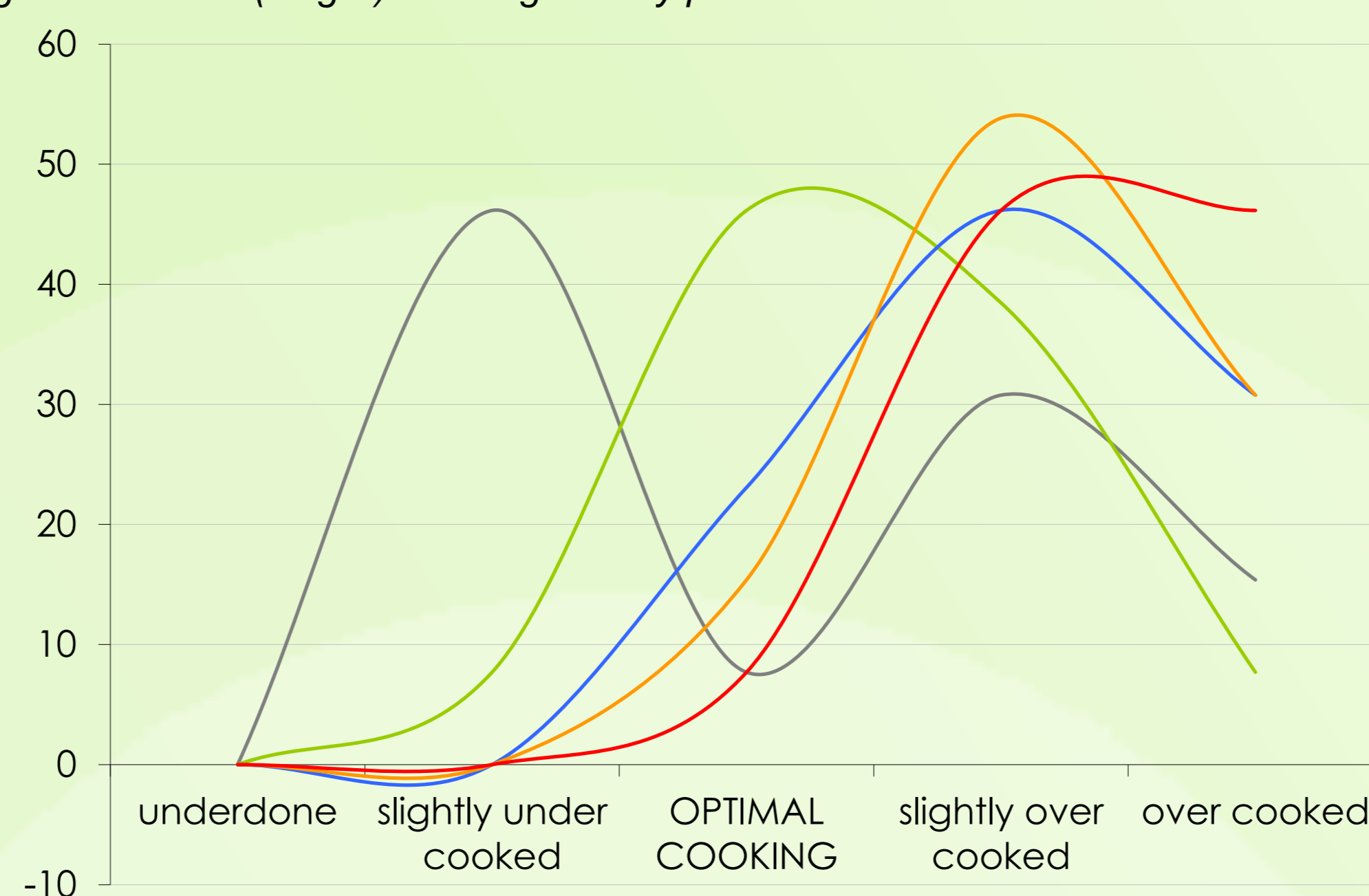


Figure 5 – Thaibonnet (*long B*): cooking time by panel test



Figure 6 – Selenio (*round*): cooking time by panel test

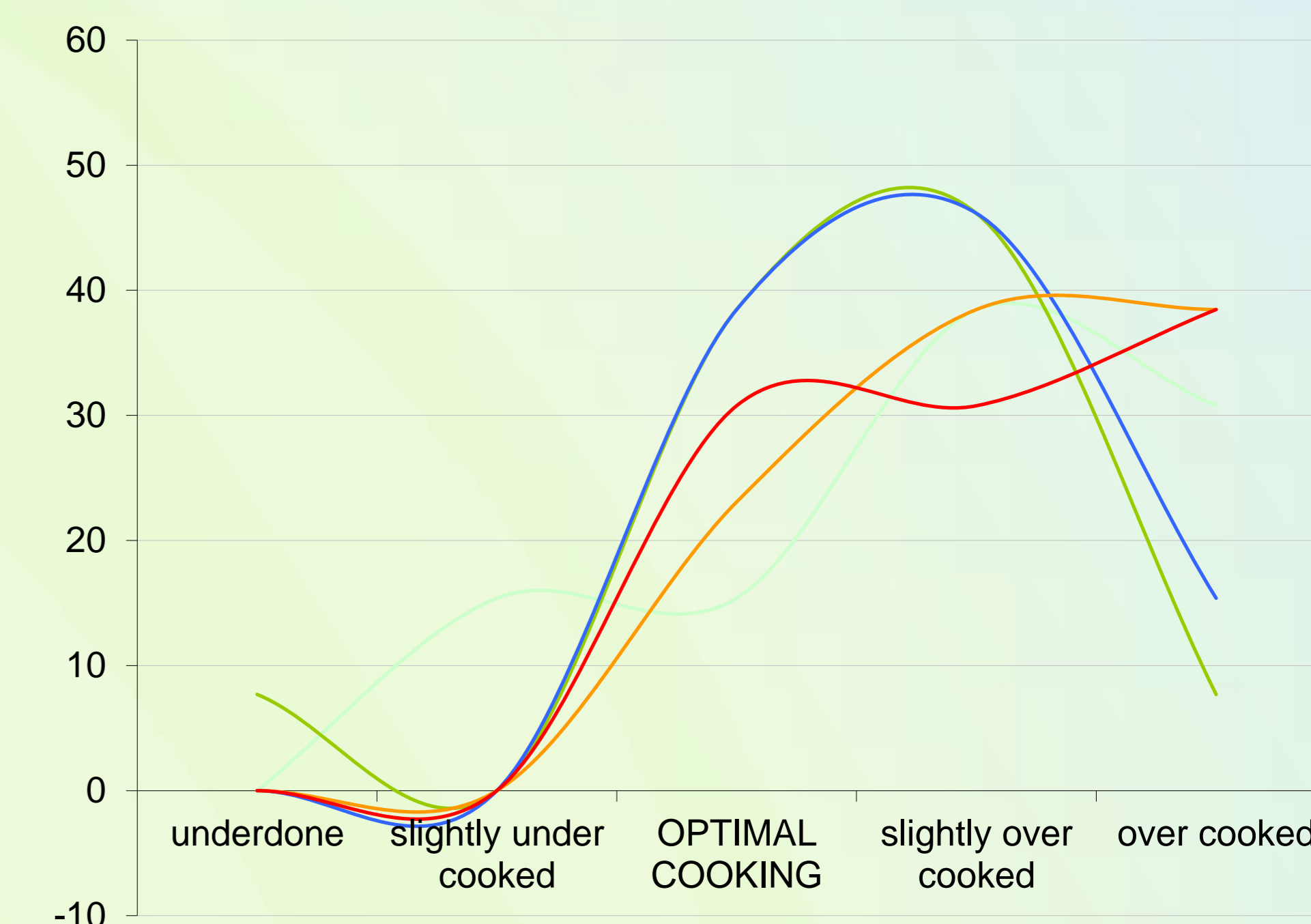
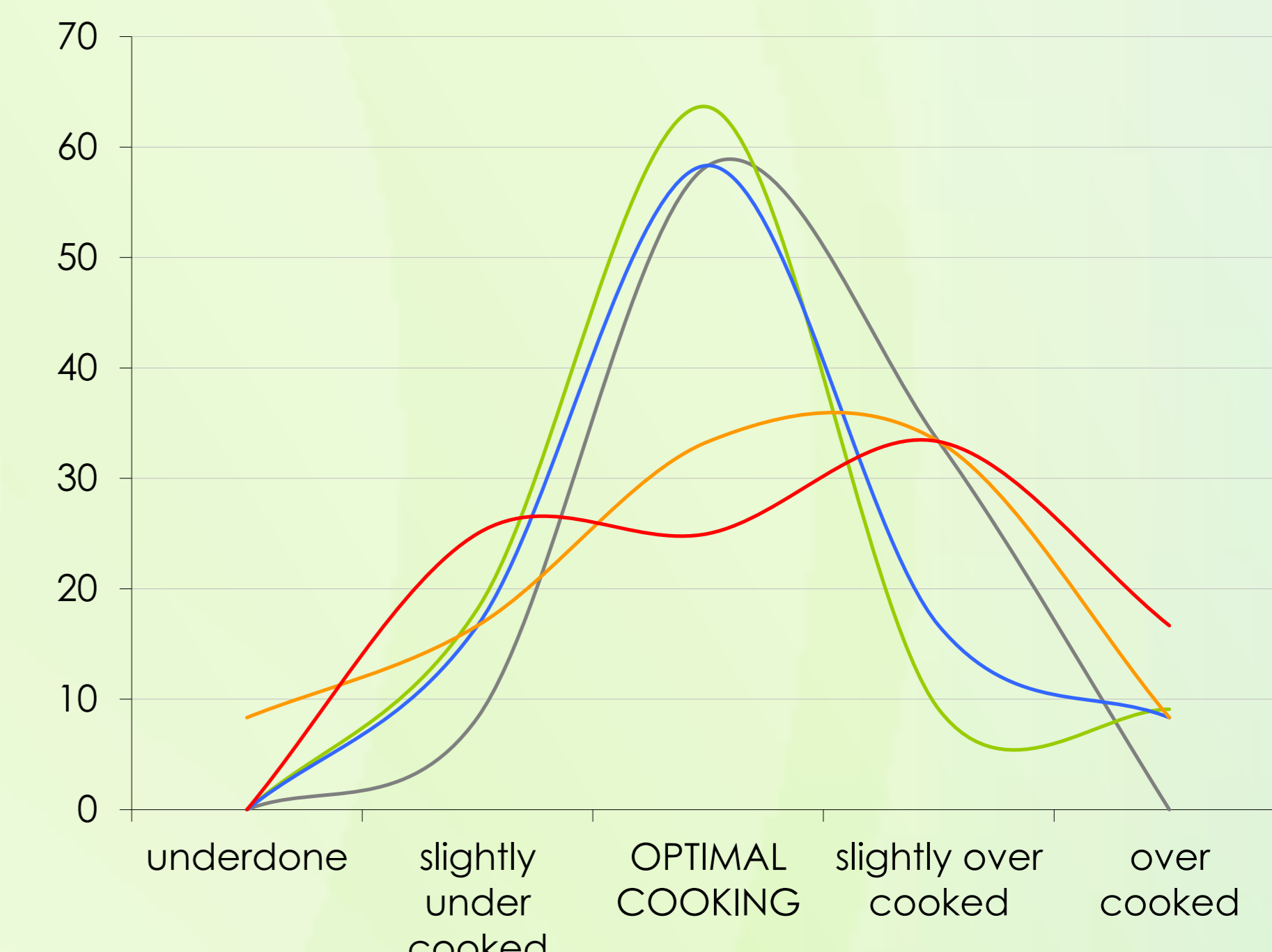


Figure 7 – Vialone Nano (*medium*): cooking time by panel test



Color description: ■ 10 minutes; ■ 12 minutes; ■ 14 minutes; ■ 16 minutes; ■ 18 minutes

Table 2 – Gelatinization time for different rice varieties (ISO 14864)

Rice Variety	Gel time
Aiace	22' 33"
Arborio	19' 32"
Baldo	19' 51"
Carnaroli	19' 43"
Gange	21' 37"
Loto	18' 52"
S. Andrea	19' 30"
Selenio	19' 8"
Thaibonnet	21' 40"
Vialone Nano	15' 57"

Table 1 – Cooking Time (CT) for different rice varieties in two laboratories

Rice Variety	CT (ENR)	CT (ERSAF)
Aiace	14'	19'
Arborio	16'	17'
Baldo	12'	12'
Carnaroli	18'	17'
Gange	18'	16'
Loto	-	16'
S. Andrea	16'	15'
Selenio	14'	15'
Thaibonnet	18'	19'
Vialone Nano	14'	13'

Conclusions

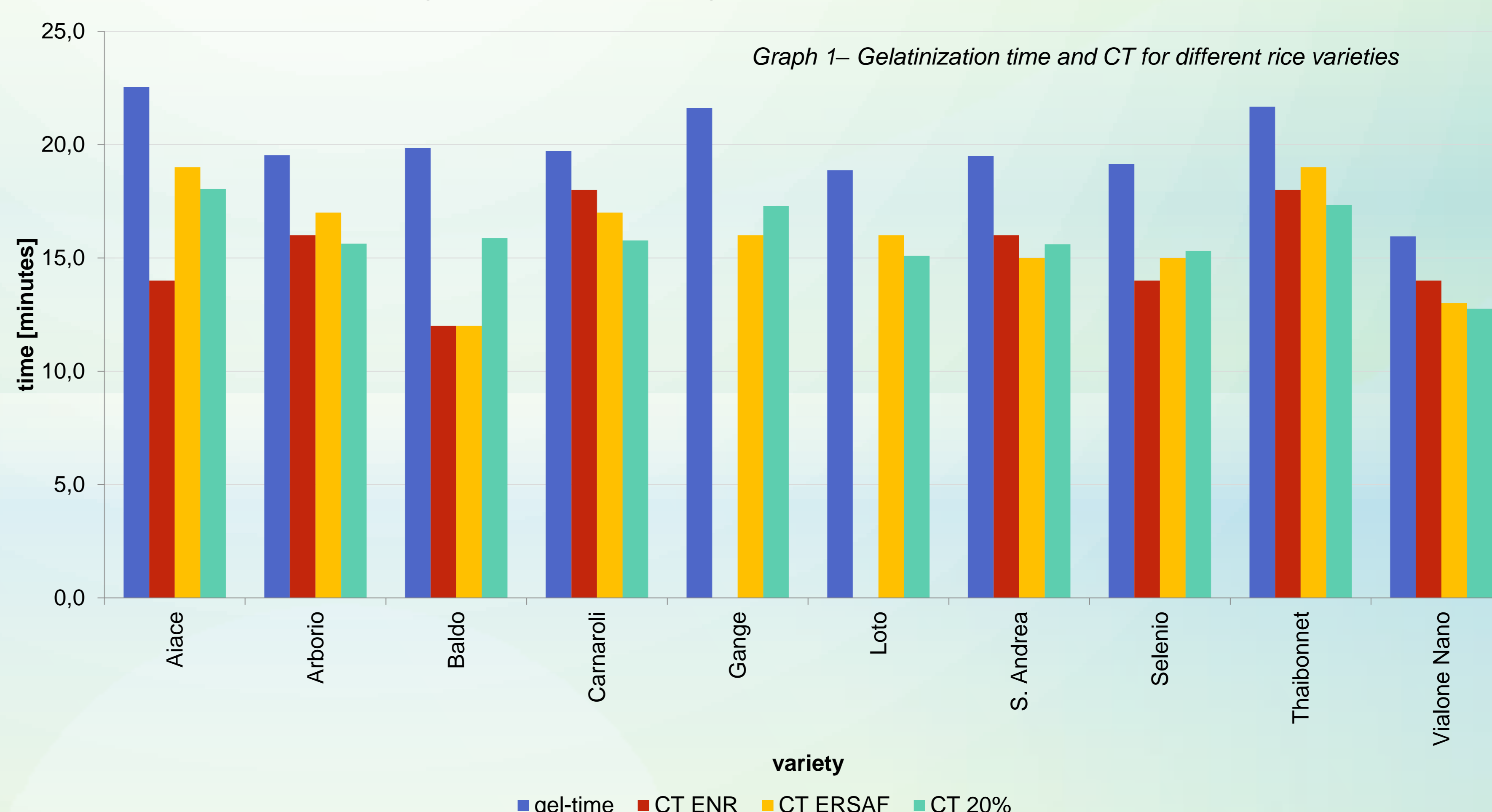
By the results achieved, it is possible to compare graphically the time of gelatinization with the cooking time of the different varieties, obtained by two different laboratories (Graph 1).

There is a good match between the results of cooking times obtained from the two separate laboratories.

It is possible to notice that the gelatinization time is always greater than the corresponding cooking time determined through panel test.

The differences between gel-time and CT are reported in Table 3. There are very high value of difference, such as 8,5 minutes for Aiace (lab 1) and 8 minutes for Baldo in both laboratories. The smallest differences there are for Carnaroli and Vialone Nano (2-3 minutes).

The Table 3 shows the percentage of decrease of the gel-time, compared to CT for both laboratories.



Graph 1– Gelatinization time and CT for different rice varieties

Definitively it can be stated that it's **not possible to indicate the gel-time as CT time because it causes an overcooking of rice of about 2-8 minutes**. It's further complicated to determined the right CT by the value of gel-time, but it's possible to derive an indicative CT.

An indicative 'al dente' CT for rice should be considered as "gel-time minus 20%" (CT 20%), this situation is represented in Graph 1. Only for the variety Baldo (about 4 minutes) there is a large deviation between experimental and calculated CT. Knowing the correct cooking time, it was possible to evaluate the sensory profile of the different rice varieties (Figure 4).

...standard proposal

The standard project for the determination of rice cooking time is currently being studied by the Rice Working Group in UNI (the Italian Standard Body).

The standard will be divided into two parts:

Part 1: Rice – Determination of cooking time by gelatinization test;
Part 2: Rice – Determination of cooking time

Table 3 – Differences between gel-time and CT (minutes)

RICE VARIETY	ENR		ERSAF	
	GEL-TIME - CT	% OF DECREASE	GEL-TIME - CT	% OF DECREASE
Aiace	8,6'	37,9	3,6'	15,7
Arborio	3,5'	18,1	2,5'	13,0
Baldo	7,9'	39,5	7,9'	39,5
Carnaroli	1,7'	8,7	2,7'	13,8
Gange	-	-	5,6'	26,0
Loto	-	-	2,9'	15,2
S. Andrea	3,5'	17,9	4,5'	23,1
Selenio	5,1'	26,8	4,1'	21,6
Thaibonnet	3,7'	16,9	2,7'	12,3
Vialone Nano	2,0'	12,2	3,0'	18,5
	mean:	22,3%	mean:	19,9%

Acknowledgments

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