

## SOYBEAN SEEDS GERMINATION: THE EVOLUTION OF SENSORIAL CHARACTERISTICS WITH TIME AND TEMPERATURE

Gratzuela Victoria Bahaciu<sup>1</sup>, Lucica Nistor<sup>1</sup>, Daniela Ianitchi<sup>1</sup>

<sup>1</sup>University of Agricultural Sciences and Veterinary Medicine, Marasti Blv. 59, Bucharest, Romania

E-mail: gratzybah@yahoo.com

### Abstract

Germination is a miraculous process that determines important changes of the physical chemical characteristics of the seeds and also improving its nutritive value, increasing the bioavailability of mineral and vitamins being the most important ones. Soybean seeds are recognized as good source of protein, minerals and vitamins, but also known for the poor sensorial characteristics (legume or bitter taste and flavor), as well as the presence of the antinutritional factors which make consumers to avoid it. The present work was focused on the evaluation of the germination influence on the sensorial characteristics of soybean seeds. Thus, the soybeans were germinated in controlled conditions (at 15, 20 and 25 °C for 2, 3, 4, 6 and 8 days). Each sample was analyzed by the profile method evaluating color, aroma, taste and general acceptability. The results of the experiments shown that germination did improve mostly the color and general acceptability, but also the flavor and taste and this improvement depends on germination time and temperature. The most appreciated seeds were those germinated at 25 °C for 8 days for which the sensorial profile area has had the highest value.

Keywords: soybean, germination, sensorial characteristics, taste, color, aroma, acceptability, profile analysis.

## 1. INTRODUCTION

The presence of fructooligosaccharides (FOS) in soybean seeds, associated with flatulence effect might determine the consumers to avoid or reduce the consumption of those seeds in their diet. But there are a lot of scientific studies that shown the health benefits of soy consumption (Messina, 1999). That determined the nutritionists to become focused on determining the method for sensorial improvement of the soybean seeds. In the meantime, it was observed that a natural process as germination can determine an improvement of soybean seeds sensorial but also nutritional profile (Bau, 2000).

By germination in controlled conditions of time/temperature it was observed that the nutritional and sensorial characteristics of soybean seeds were highly improved (Bahaciu, 2008).

## 2. MATERIAL AND METHOD

### Germination of soybean seeds

The soybean seeds were obtained from the local market; the seeds were washed and soaked in tap water for 12 hours. Seeds were drained, washed and

the imbibed seeds were germinated by layering them on a moist filter paper continuously watered by capillarity. The germination process was conducted separately at 15, 20 and 25 °C for 2, 3, 4, 6, or 8 days (the notations are shown in table 1).

Table 1 Notations for germinated soybean seeds

Time, days	Temperature, °C		
	15	20	25
0	SM		
2	G15-2	G20-2	G25-2
3	G15-3	G20-3	G25-3
4	G15-4	G20-4	G25-4
6	G15-6	G20-6	G25-6
8	G15-8	G20-8	G25-8

Each sample was investigated to determine the sensorial profile using the expertise of a sensorial tea, which graded it.

The sensorial analysis was determined using the methodology described by SR ISO13299:2003 and SR ISO11035:1994, provided by Romanian Standard Association (ASRO).

## 3. RESULTS AND DISCUSSION

The members of the evaluation team described the control samples (ungerminated soybean

seeds) as products with legume and bitter taste and aroma, good appearance (due to the water swallowing by soaking), pale yellow color.

The germinated soybean seeds were characterized as beans with a slight improved taste, pale legume aroma, better color and appearance, crispy consistency which were better appreciated (as taste and general appearance than the control samples (ungerminated soybean seeds).

All the experimental data obtained from the sensorial analysis are shown in table 2.

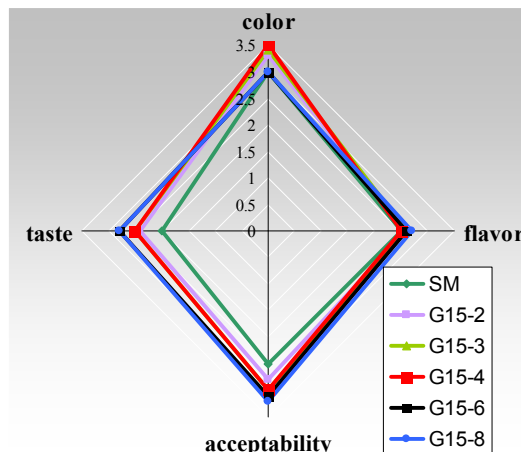
**Table 2** Sensorial characteristics of soybean fermented seeds at 15, 20 and 25°C

Sample	Color	Flavor	Taste	Acceptability
<i>Germination at 15°C</i>				
SM	3	2,5	2	2,5
G15-2	3,3	2,6	2,4	2,8
G15-3	3,4	2,6	2,5	3
G15-4	3,5	2,5	2,5	3
G15-6	3	2,6	2,8	3,1
<b>G15-8</b>	<b>3</b>	<b>2,7</b>	<b>2,8</b>	<b>3,2</b>
<i>Germination at 20°C</i>				
SM	3	2,5	2	2,5
G20-2	3,3	2,8	2,5	2,9
G20-3	3,3	2,8	2,6	3,1
G20-4	3,5	3	3	3,3
G20-6	3,5	3,2	3,1	3,4
<b>G20-8</b>	<b>3,7</b>	<b>3,4</b>	<b>3,5</b>	<b>3,6</b>
<i>Germination at 25°C</i>				
SM	3	2,5	2	2,5
G25-2	3,3	2,8	2,5	2,9
G25-3	3,5	3	3	3,2
G25-4	3,6	3,2	3,3	3,4
G25-6	3,6	3,4	3,3	3,6
<b>G25-8</b>	<b>4</b>	<b>3,8</b>	<b>3,7</b>	<b>4</b>

For a better interpretation of the results, we have analyzed the influence of the germination temperature on the sensorial characteristics of the soybean seeds and the results were represented in the sensorial profile analysis figure.

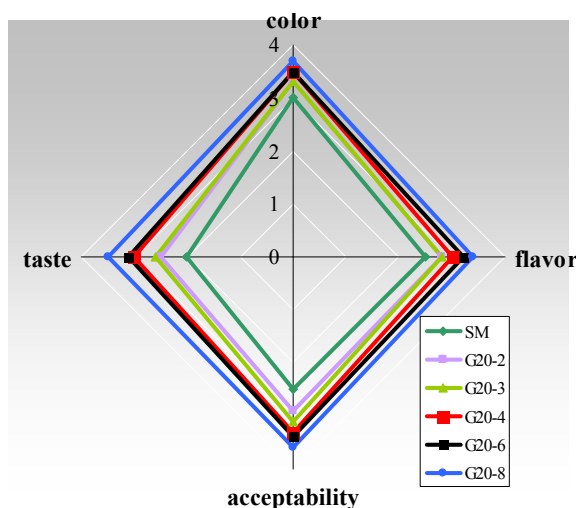
The sensorial profile for the germinated soybean seed at 15°C show no big difference between the germinated seed compared to the control samples (the profile area are almost the same size).

The duration of the germinative process also affects less the evolution of the sensorial characteristics of the soybean.



**Figure 1** Sensorial analysis profile for germinated soybean seeds at 15°C

Data from figure 2 show that by germination of the soybean seeds at 20°C registers a slightly increasing of the scores, which remain under the 3,5 value (from maximum 5), except the color (which is 3,7) and general acceptability (3,6) for the samples germinated for 8 days.



**Figure 2** Sensorial analysis profile for germinated soybean seeds at 20°C

Figure 3 represents the scores and the sensorial analysis profile for the germinated soybean seeds at 25°C and it can be observed that for these conditions there are 2 scores bigger than 4 (for color and acceptability).

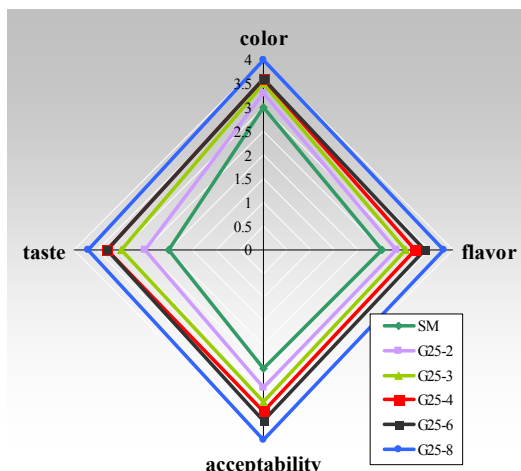


Figure 3 Sensorial analysis profile for germinated soybean seeds at 25°C

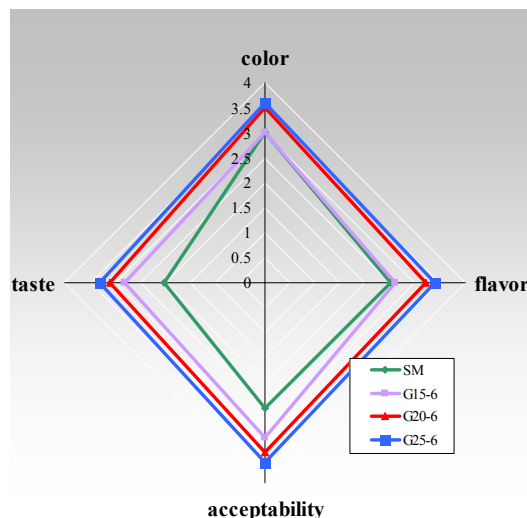


Figure 5 Sensorial analysis profile for germinated soybean seeds for 6 days

From the above data we can observe the evolution of sensorial characteristics of soybean seeds with time, for the same temperature.

It is also very interesting to find out the influence of the duration of the germinative process for different temperature to the sensorial characteristics of the germinated soybean seeds.

The data presented in figure 4 shows the sensorial characteristics for the same duration of the germinative process (3 days) at different temperature (15, 20 and 25°C).

From figures 4 and 5 it can be observed that the influence of the germination time is more important than the temperature, the area of the profile is increasing with a bigger rate for the increasing of the germination period then the germination temperature.

In figure 6 there are the scores and the sensorial profile for the best appreciated germinated soybean seeds, germinated for 8 days at different temperature.

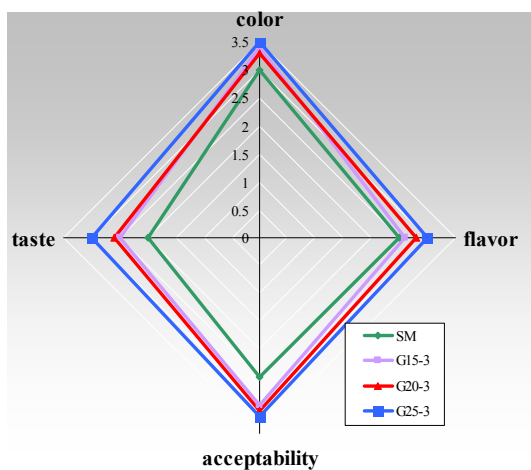


Figure 4 Sensorial analysis profile for germinated soybean seeds for 3 days

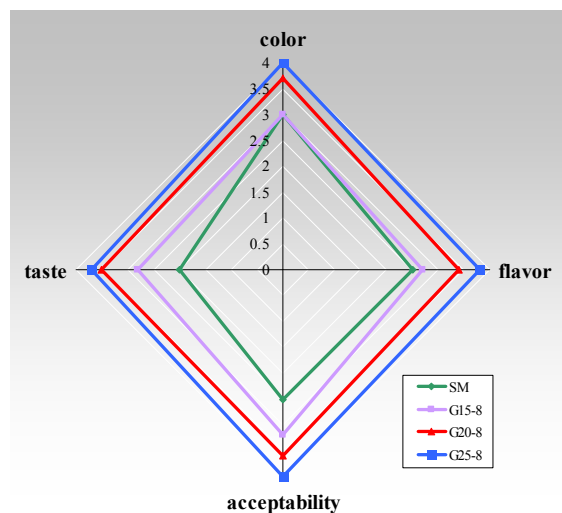


Figure 6 Sensorial analysis profile for germinated soybean seeds for 8 days

#### 4. CONCLUSIONS

It can be concluded that the germination of the soybean seeds determines the improvement of the investigated sensorial characteristics (color, taste, flavor, acceptability), which may make them more attractable for the consumers.

Thus, germination of soybean seeds determines the decreasing of the bitter and legume taste and flavor and the increasing the acceptability of those products.

The germination time and temperature influences the sensorial quality of the seeds compared to control sample (ungerminated soybean seeds), the best processed samples are those germinated for 8 days (for all temperatures 15, 20 and 25°C) and the more appreciated are those germinated at 25°C.

#### 5. REFERENCES

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