

## NITRATE AND NITRITE ACCUMULATION LEVELS IN DIFFERENT HYBRIDS AND VARIETIES OF TOMATOES

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### Abstract

*The aim of this study was to establish the nitrate and nitrite levels in tomatoes, as it follows: varieties Marissa F1, Cristal F1 and hybrids Minidelicia, Ailsa Craig. The quantitative determinations of undesirable compounds were realized according with standardised method STAS 11581-83. The nitrate contents of analysed tomatoes ranged between 112,5 and 116,75 mg/kg and was under the safe limits set by Romanian legislation. The nitrite levels ranged between 0,30-0,40 mg/kg.*

*Keywords: tomato, nitrate, nitrite, nitrogen fertiliser.*

### Introduction

The vegetal products produced in Romania and destined for markets or for export must obey to the European Union regulations regarding safety and quality. Because of pollution processes and improper nitrogen fertilisation, vegetal products can accumulate higher quantities of nitrates and nitrites that can produce health problems.

The concentration and amount of nitrates levels in plants will vary depending on the type of vegetable, the temperature that it is grown at, the sunlight exposure, soil moisture levels and the level of natural nitrogen in the soil. Also, nitrogen fertilisers incorrectly applied can lead to nitrate accumulation in plants and the nitrate levels can be found 2-3 times higher than in plants grown on soil without supplementary nitrogen fertilisers.

Nitrates and nitrites are very toxic substances that can produce inside the human body carcinogenic products like nitrosoamines and nitrosoamides. These pollutants can lead to the development of a disease called methemoglobinemia or "blue baby syndrome" because its first manifestation is a bluish colour of the infant's skin. High nitrate and nitrite concentration in human body can also produce gastric cancer (Prakasa et al., 2000).

## Experimental

This study was undertaken in order to characterise the tomato hybrids Marissa F1, Cristal F1 and varieties Minidelicia and Ailsa Craig from nitrate and nitrite levels point of view. The tomatoes were collected from greenhouse.

Previously, the tomatoes were nutritional characterised and it has been found that present high content of proteins, total ash, minerals and vitamin C. The energetic value of Minidelicia is 23,40 kcal/100g meanwhile Ailsa Craig presents 15,25 kcal/kg. The energetic value of Cristal F1 is 18,10 kcal/100g and for Marissa F1 it has been found the value 14.27 kcal/100g.

The nitrate and nitrite levels were carried out according with standardised method STAS 11581-83. Homogenised tomato samples, precisely weighted were placed in distilled water and heated under stirring at 80°C, using a water bath.

Nitrite is quantitative determined using Griess method. This reaction was firstly described in 1879 and due to its simplicity and precision was intensively used to determine the nitrites from biologic samples, soil, food (Sun et al., 2003).

In order to determine the nitrite concentration it was measured the intensity of the colour of azo compound that was formed after diazotation reaction between sulphanilic acid and nitrites, followed by coupling reaction with naphtylamine, as it presented in the figure 1.

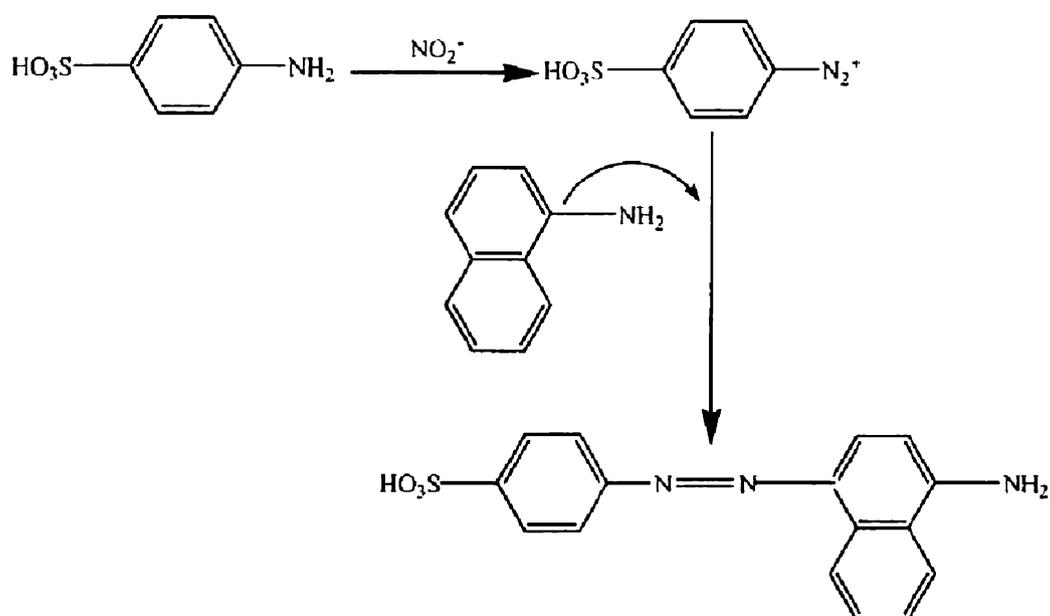


Fig. 1: Griess reaction

The following step consists in nitrates reduction to nitrites using metallic cadmium. In this way, it is determined the total nitrite level. Nitrate concentration is found making the difference between total nitrite level and initial nitrite level.

The calibration curves were linear for studied concentration range (figure 2). The measurements were performed using UV/VIS Jasco V-550 spectrophotometer and the samples were processed using water bath Selecta Model Precisdig and homogeniser Ultra Turrax T25 Basic.

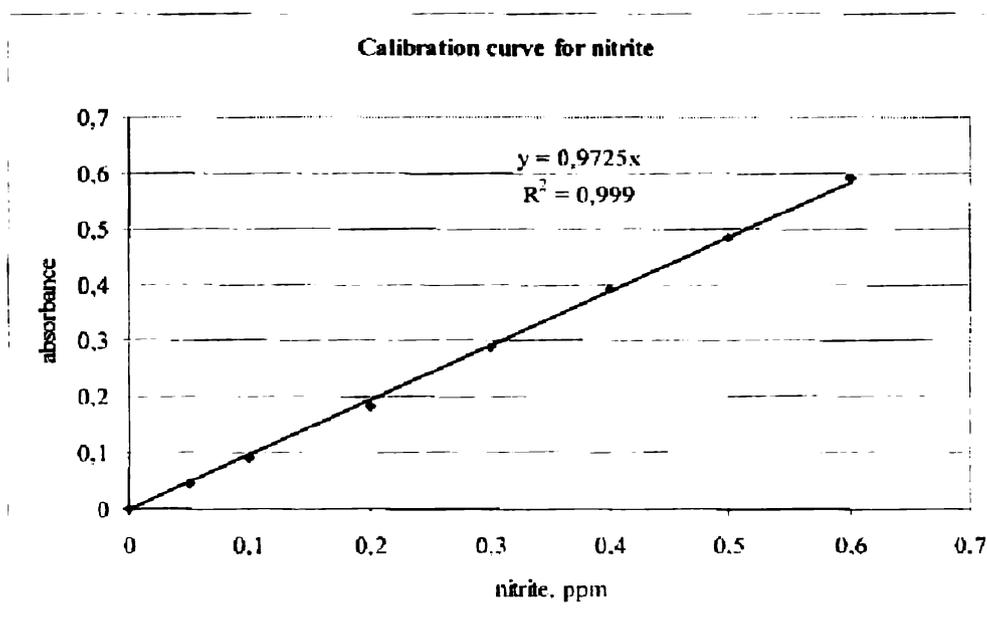


Fig. 2: Calibration curve for nitrite

## Results and Discussions

The results of the analysis indicate that the nitrate levels ranges between 112,5 – 116,75 mg/kg, with an average of 114,95 mg/kg. The nitrite levels ranges between 0,30-0,40 mg/kg, with an average of 0,34 mg/kg. The results are presented in table 1.

Table 1: Nitrate and nitrite levels in tomatoes

Nitrate and nitrite levels	Tomato variety		Tomato hybrids	
	Minidelicia	Ailsa Craig	Cristal F1	Marissa F1
NO <sub>3</sub> <sup>-</sup> , mg/kg	112,5	114,57	115,98	116,75
NO <sub>2</sub> <sup>-</sup> , mg/kg	0,30	0,37	0,32	0,40

According with Romanian legislation, the safe nitrate level in tomatoes grown in greenhouse is maximum 300 mg/kg. All the analysed tomatoes presents nitrate levels lower than imposed by legislation and in conclusion, the tomatoes are safe to be consummated.

Also, lower concentration of nitrates in tomatoes indicates that it was used proper quantities of nitrogen fertilisers and the plants grew in optimal conditions. Analysing the obtained results, it can be noticed that there are no significant differences between studied tomatoes regarding nitrate and nitrite contents.

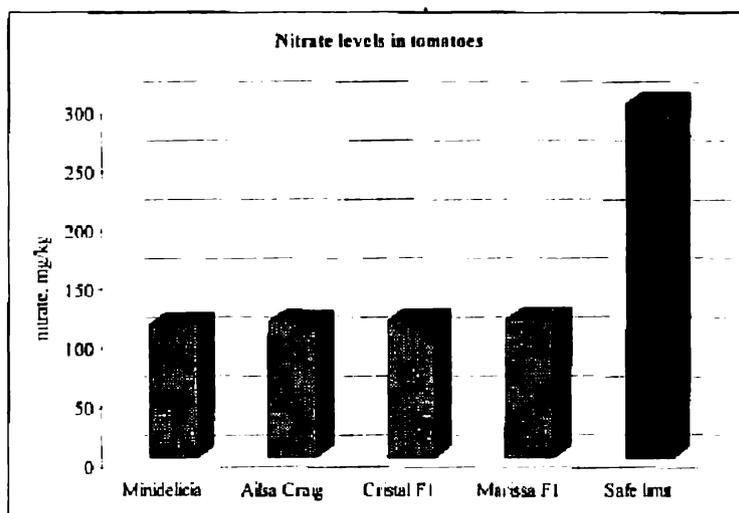


Fig 2: Comparison between nitrate levels in tomatoes

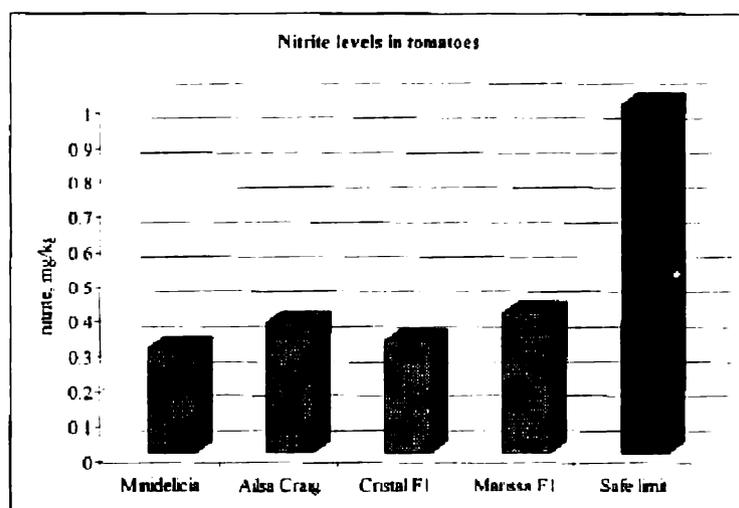


Fig 3: Comparison between nitrite levels in tomatoes

The nitrite levels in tomatoes are very low, under 1mg/kg. Anyway, nitrite contents in vegetal products are generally lower than nitrate ones. The

transformation processes of nitrate in plants lead to nitrite and this step is a transitory one because the nitrites are reduced by nitritoreductase to nitrogen oxides very rapidly.

### **Conclusions**

Nitrates and nitrites are among the chemical indicatives monitored by different organisations that are concerned about environment pollution and safety of food products. According with this, the purpose of our study was to determine the nitrate and nitrite levels in tomatoes grown in greenhouse and to establish if these vegetables are safe for human health. It was analysed tomato varieties Marissa F1, Cristal F1 and hybrids Minidelicia, Ailsa Craig. For Minidelicia variety it has been found the lowest nitrate and nitrite content, meanwhile for hybrid Marissa it has been found the highest concentrations.

The average level of nitrate and nitrite of analysed tomatoes under safe limits set by Romanian legislation and the vegetables are safe from this point of view.

### **References**

- Jie Sun, Xueji Zhang, Mark Broderick and Harry Fein, 2003 – *Sensors*, 3, 276-284  
Ordinul nr. 1 din 3 ianuarie 2002 privind condițiile de securitate și calitate pentru legume și fructe proaspete destinate consumului uman  
Prakasa R. and Puttanna, K., 2000 - Nitrates, agriculture and environment, *Curr. Sci.*, 2000, 79, p.1163-1168.  
STAS 11581-83 „Produse de legume, fructe și legume cu carne. Determinarea conținutului de nitriti și nitrati”