

## Influence of different production systems and tomato genotypes on the content of macroelements in tomato fruits

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DOI: 10.46793/ICCBi23.205C

**Abstract:** Agriculture has managed to produce enough food for the accelerated population growth, which has led to environmental transformation and increasingly intensive exploitation of both renewable and non-renewable natural resources. The use of synthetic plant protection agents and fertilizers can lead to negative consequences in food production. Identification of agricultural food production systems is gaining importance in order to protect human health and the environment. Interest in the cultivation of certain plant species with an innovative approach to cultivation and technology has grown significantly. Organic and integrated agriculture implies the use of natural products while limiting or completely eliminating the use of synthetic resources. Knowledge of the mineral composition in tomato samples can be used as a potent tool in the identification of chemical markers as potential indicators of the farming system. The goal of the research is to determine the impact of different production systems on the content of macroelements in the fruits of different types of tomatoes.

**Keywords:** tomato, organic and integrated, macroelement, growing systems

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### 1. Introduction

Tomato (*Lycopersicon esculentum* L.) is an important vegetable in daily feeds to enrich our foods with a number of contents such as organic acids, vitamins, carotene, lycopene, sugars, amino acids, and minerals that are essential in human health and proper functioning [1]. Tomatoes are rich in vitamins C, E and B, copper and iron, and minerals such as potassium, sodium, magnesium and calcium [2]. Vitamin E ( $\alpha$ -tocopherol), carotenoids, lycopene in particular, and various phenolic compounds are among the chief components of tomato fruit that have beneficial health properties. Mineral

elements are essential substances which are required for proper physiology and anatomy of humans and animals [3]. Magnesium is an essential element required as a cofactor for over 300 enzymatic reactions and is therefore necessary for the biochemical functioning of numerous metabolic processes [4]. Sodium is vital in the human body for regulating blood pressure, stimulating nerves and muscles; calcium has some very important life-supporting functions because it is a structural component of bones, teeth, and soft [5,6]. Phosphorus is a basic unit in DNA, and RNA and serves as an energy store in metabolic reactions of biological systems [7,8]. To ensure food and ecosystem security, it is necessary to design a model and produce future crops for sustainable agriculture by maximizing production and minimizing adverse environmental impacts [9].

The aim of the work was to determine the content of macroelements in tomato fruits of different types, as well as which type of tomato has a higher content of the examined macroelements.

## 2. Material and method

The research was conducted during one growing season in 2020, in controlled microclimate conditions, in order to examine the influence of integrated and organic cultivation systems on the content of macroelements in tomato fruits. The research was conducted on the sample of the company "Zeleni hit", in "13. May", in the vicinity of Zemun Polje. The experiment was set up in a closed facility, the total area of 320 m<sup>2</sup> (8 m x 40 m), a ridge height of 5 m.

The experimental parts of the research were designed as a two-factor experiment:

- Factor A: growth system
  - o integrated
  - o organic;
- Factor B: selected tomato genotypes, a total of 4 hybrids, two from each of the dominant tomato species
  - o Cherry (hybrids: Sakura and Tomagino)
  - o Beef (hybrids: Rally and Velocity)

In both systems, researchers have used bio-pesticides, beneficial microorganisms and predators, as well as pheromone traps and mass trapping systems to protect crops from pests and diseases. Everything was done to harvest the final product without pesticide residues, which was confirmed by certified laboratories Faculty of Chemistry in Belgrade. The determination of trace element content in the tomato sample was carried out by elemental analysis using an ICP-OES device. When it comes to weed control, researchers used silver polyethylene mulch in the integrated farming system, and a layer of organic matter for covering in the organic system, which allows for high thermal stability, as well as preservation of soil moisture and accessible nutrients in the soil.

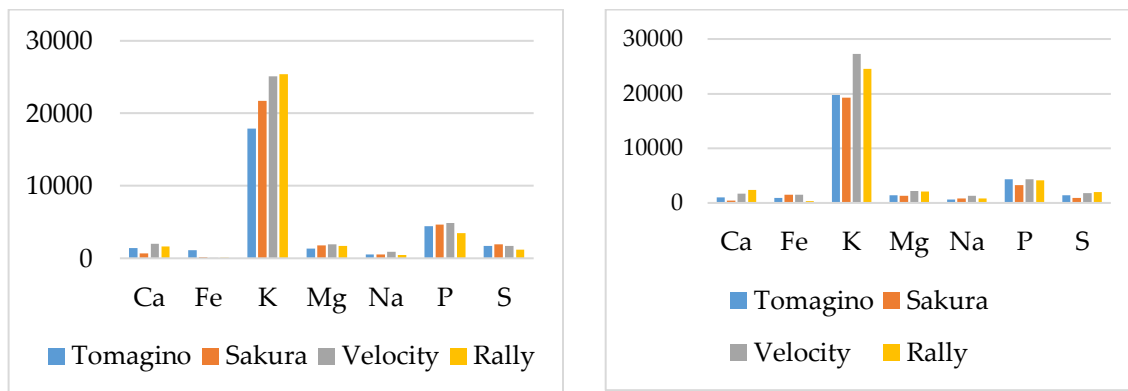
## 3. Results

Table 1 shows the results of the analysis of the content of seven macroelements in the fruits of the tomato hybrids tested. Based on the average values from both production systems, tomato fruits from the integral production system had a higher content of Ca by 2,44%, P by 8.53% and S by 5.71%. The obtained results can be explained by the fact that mineral fertilizers based on these elements can be used in integral production, which is not allowed in the organic system.

The content of K was higher in the organic system by only 0.89% and Mg by 3.13%. In both production systems, according to the number of identified macroelements, hybrids of the type that stood out were Beef.

**Table 1.** The content of macroelements in the fruits of tomato hybrid grown in both production systems.

|                    | Hybrids            | Type   |   | Ca          | Fe          | K            | Mg          | Na          | P           | S           |
|--------------------|--------------------|--------|---|-------------|-------------|--------------|-------------|-------------|-------------|-------------|
| Integrated         | Tomagino           | Cherry | 1 | 1380        | 1130        | 17900        | 1310        | 540         | 4430        | 1680        |
|                    | Sakura             |        | 2 | 704         | 142         | 21700        | 1780        | 543         | 4680        | 1890        |
|                    | <b>Average 1-2</b> |        |   | <b>1042</b> | <b>636</b>  | <b>19800</b> | <b>1545</b> | <b>541</b>  | <b>4555</b> | <b>1785</b> |
|                    | Velocity           | Beef   | 3 | 1990        | 67          | 25100        | 1950        | 918         | 4870        | 1690        |
|                    | Rally              |        | 4 | 1620        | 80          | 25400        | 1720        | 482         | 3470        | 1180        |
|                    | <b>Average 3-4</b> |        |   | <b>1805</b> | <b>73</b>   | <b>25250</b> | <b>1835</b> | <b>700</b>  | <b>4170</b> | <b>1435</b> |
| <b>Average 1-4</b> |                    |        |   | <b>1424</b> | <b>355</b>  | <b>22525</b> | <b>1690</b> | <b>621</b>  | <b>4363</b> | <b>1610</b> |
| Organic            | Tomagino           | Cherry | 1 | 1040        | 889         | 19800        | 1420        | 668         | 4340        | 1410        |
|                    | Sakura             |        | 2 | 389         | 1530        | 19300        | 1350        | 809         | 3280        | 915         |
|                    | <b>Average 1-2</b> |        |   | <b>714</b>  | <b>1209</b> | <b>19550</b> | <b>1385</b> | <b>738</b>  | <b>3810</b> | <b>1162</b> |
|                    | Velocity           | Beef   | 3 | 1730        | 1540        | 27300        | 2160        | 1300        | 4360        | 1780        |
|                    | Rally              |        | 4 | 2400        | 296         | 24500        | 2040        | 798         | 4100        | 2000        |
|                    | <b>Average 3-4</b> |        |   | <b>2065</b> | <b>918</b>  | <b>25900</b> | <b>2100</b> | <b>1049</b> | <b>4230</b> | <b>1890</b> |
| <b>Average 1-4</b> |                    |        |   | <b>1390</b> | <b>1064</b> | <b>22725</b> | <b>1743</b> | <b>893</b>  | <b>4020</b> | <b>1526</b> |



**Figure 1.** Content of macroelements in the fruits of tomato hybrids grown in an integral system and organic system ( $\text{mg}\cdot\text{kg}^{-1}$  dry matter).

### 3. Conclusions

The content of certain elements, the concentrations of which are higher in integrally produced tomato fruits than in organically produced fruits, may be the result of the application of fertilizers that, in addition to macroelements, also contain microelements. Beef type hybrids had a higher concentration of examined macroelements in both production systems.

### Acknowledgment

This paper is a result of the research conducted within the contract on the implementation and financing of scientific research in 2023, between the Institute for Science Application in Agriculture, Belgrade and the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, contract numbers: 451-03-47/2023-01/ 200045 and 451-03-47/2023-01/ 200378.

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