

YIELD AND PHYSIOLOGICAL PARAMETERS OF SIRIANA F1 UNDER CONVENTIONAL AND UNCONVENTIONAL STIMULANTS

REZULTATE PRIVIND PRODUCȚIA ȘI PARAMETRI FIZIOLOGICI AI CULTIVARULUI DE TOMATE SIRIANA F1 SUB INFLUENȚA STIMULATORILOR CONVENȚIONALI ȘI NECONVENȚIONALI

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Abstract. *Tomato (*Lycopersicon esculentum* Mill.) is a leading vegetable crop, in terms of global cultivation (open field and protected area) and consumption. The chemical nutrients of plants serve as critical factors that determine the plant growth and vigour, also the crop yield. In addition, these nutrients play a particular role in contributing to the survival of crop plants under environmental stress conditions. Under climatic or nutritional stress, the productivity is affected in a percentage that range between 45-70%. In this study, the influence of unconventional and conventional stimulants was evaluated for Siriana F1 in term of physiological parameters and yield. In order to achieve this, at UASVM Iasi was carried out an experiment on a tomato crop from the Siriana F1 hybrid, where six treatments were tested compared to a control version. The highest values of the analyzed physiological parameters were recorded under treatment of Au - citrate C; for the total pigments this variant had the lowest value, respectively 14.9 CCI.*

Key words: tomato, stimulants, physiological parameters.

Rezumat. *Cultura tomatelor (*Lycopersicon esculentum* Mill.) este o cultură legumicolă de frunte, în ceea ce privește cultivarea globală (câmp deschis și suprafață protejată) și consum. Nutrienții chimici ai plantelor servesc ca factori critici care determină creșterea plantelor, vigoarea pe lângă randamentul culturilor și acești nutrienți joacă un rol deosebit în contribuția la supraviețuirea plantelor de cultură în condiții de stres de mediu. Sub stresul climatic sau nutrițional, productivitatea este afectată într-un procent care variază între 45-70%. Pentru a atinge acest obiectiv, la USAMV Iași a fost efectuat un studiu pe o cultură de tomate utilizând hibridul Sirian F1, unde au fost testate șase tratamente comparativ cu o variantă martor.*

Valorile cele mai mari ale parametrilor fiziologici analizați au fost înregistrate în cazul variantei tratate cu Au-citrat C, în cazul pigmentilor clorofilieni, această variantă are cea mai mică valoare, respectiv 14,9 CCI.

Cuvinte cheie: tomate, stimulatori, parametri fiziologici.

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INTRODUCTION

Tomatoes are grown for their fruits, which are consumed at the physiological maturity in fresh or preserved state, also for their special nutritional values but also due to the high yields (Munteanu, 2003).

Stimulants are diverse substances and microorganisms used to enhance plant growth (Stoleru *et al.*, 2014).

In this paper we have looked on the influence of five conventional stimulators used in different concentrations: V₂ (citrate), V₃ (Au- citrate C/2), V₄ (Au- citrate C), V₆ (Au- chit 25), V₇ (Au -chit 50) and one unconventional stimulator: V₅ (chitosan 0.1) on the physiological productiv parameters Siriana F1 tomato plants. The untreated plants were used as control (V₁).

The goal of the research was to establish to what extend the used stimulators participate in the process of increasing plant production by exploiting the full biological potential.

MATERIAL AND METHOD

The plant material used

In this study was used Siriana F1 hybrid, an early hybrid with indefinite growth, intended for cultivation in protected areas and open field. At maturity, the fruit has a weight between 120 and 180 g. It is uniform, spherical, slightly flecked with a bright red color. The hybrid ensures good results in terms of production capacity (3 - 3.5 kg/plant), having a good transport resistance, and being perfectly adapted to the agro-pedological conditions of the area.

Method

The research carried out in the period 2018 - 2019, in the greenhouse of the horticultural farm "V. Adamachi" Iasi. The experiment was done with three replicates and consisted of 7 experimental variants: V₁ (control), V₂ (citrate), V₃ (Au- citrate C/2), V₄ (Au- citrate C), V₅ (chitosan 0,1), V₆ (Au- chit 25), V₇ (Au -chit 50).

Chitosan is a polysaccharide (polymer) made from chitin (Li *et al.*, 2019), a substance resulting from the processes of treating shrimp carapace as well as other crustaceans with sodium hydroxide. Stimulators represents an interesting solution to avoid yield losses and protect the natural environment (Rendina *et al.*, 2019).

Chitosan has a wide range of uses, in agriculture, medicine, winemaking but also in limiting fat absorption. In agriculture this product is used for the treatment of seeds but also as a biopesticide helping the plants to fight against fungal infections (La Kashyap *et al.*, 2015).

Citrate, the conjugated base of citric acid, is one of the series of compounds involved in the physiological oxidation of fats, proteins, and carbohydrates for carbon dioxide and water.

The tomato plants were produced in alveolar tray. The treatment with stimulants was applied foliarly, using an amount of 2.5 mL solution/plant each week. The first treatment was performed on February 19.

The height of plants, the number of flowers, the number of inflorescences and the number of fruits were measured weekly on each plant. The measurements were done starting February 18th.

Readings regarding the physiological parameters: photosynthesis, evapotranspiration, gas exchange and pigments were performed on March 18th (first measurement), March 21th (second measurement) and April 9th (third measurement). The tomatoes were irrigated daily with approximately 1.5 L of water.

Growing practices such as training and pruning work was done weekly or whenever needed (Stoleru *et al.*, 2014).

Fertilization was carried out phasially, every week, starting with February 20th, for seven weeks, by using Orgevit fertilizer (5 g/plant).

The harvesting was carried out on 8.04.2019.

RESULTS AND DISCUSSIONS

Within the experiment done in the greenhouse of the farm “V. Adamachi” Iasi we looked on the influence of the stimulators on the production and physiological indicators of tomato plants.

Results regarding the influence of stimulators on physiological parameters

The effect of the stimulant treatments on the physiological state of tomato plants was evaluated by determining a series of physiological indicators such as intensity of photosynthesis processes, transpiration, stomatal conductance of water, substomatal CO₂ concentration and chlorophyll content.

Photosynthesis rate (A, $\mu\text{mol CO}_2 \text{ m}^{-2} \cdot \text{s}^{-1}$), transpiration rate (E, $\text{mmol H}_2\text{O m}^{-2} \cdot \text{s}^{-1}$), stomatal conductance (gs, $\mu\text{mol H}_2\text{O m}^{-2} \cdot \text{s}^{-1}$) and substomatal CO₂ concentration (Ci, vpm) were measured using the ADC Lci Bioscientific Ltd portable system with a specific room for broad leaves, with a window area of 6.25 cm². Results regarding the influence of stimulants on photosynthesis are shown in figure 1.

The values varied between 4.5 $\mu\text{mol CO}_2 \text{ m}^{-2} \cdot \text{s}^{-1}$ in the case of the V₆ variant and 8.3 $\mu\text{mol CO}_2 \text{ m}^{-2} \cdot \text{s}^{-1}$ in the case of the variant treated with Au-citrate C.

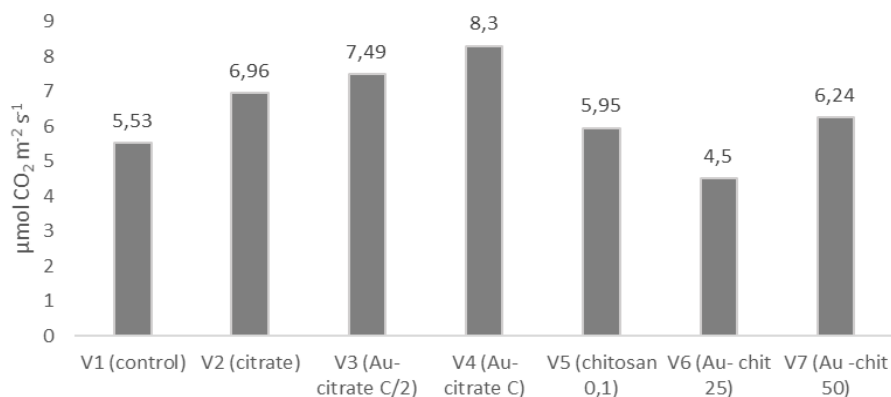


Fig. 1 Photosynthesis rate of tomato plants under conventional and unconventional treatment

Considering the transpiration rate (fig. 2) the lowest value was determined for the variant treated with Au-chit 25 ($1.92 \text{ mmol H}_2\text{O m}^{-2}\cdot\text{s}^{-1}$) and the highest for the variant treated with Au-citrate ($3.49 \text{ mmol H}_2\text{O m}^{-2}\cdot\text{s}^{-1}$).

Values close to $2.58 \text{ mmol H}_2\text{O m}^{-2}\cdot\text{s}^{-1}$ and $2.57 \text{ mmol H}_2\text{O m}^{-2}\cdot\text{s}^{-1}$ were achieved by the control and plants treated with citrate.

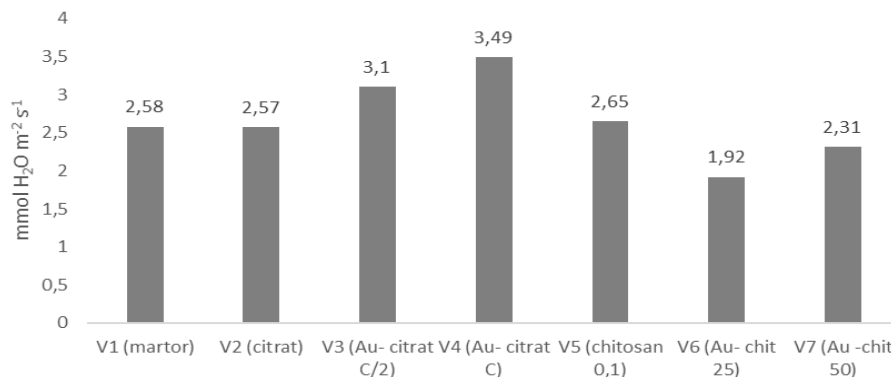


Fig. 2 Transpiration rate of tomato plants under conventional and unconventional treatment

Regarding the stomatal conductance (fig. 3), the highest values were $0.18 \mu\text{mol H}_2\text{O m}^{-2}\cdot\text{s}^{-1}$ achieved by the control variant, and the lowest values were recorded for the variants treated with citrate and Au-chit 50 ($0.09 \mu\text{mol H}_2\text{O m}^{-2}\cdot\text{s}^{-1}$).

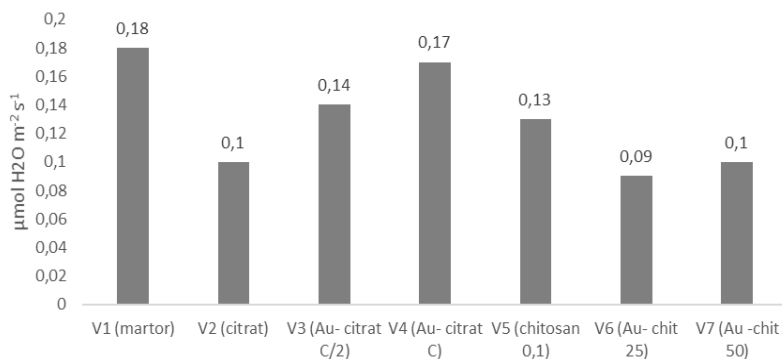


Fig. 3 Stomatal conductance of tomato plants under conventional and unconventional treatment

In the case of the pigments (fig. 4), differences were observed between the control and the plants treated with Au-chit. Lower values were achieved by the

plants treated with citrate, respectively the V₃ and V₄ variants with values of 16.3 CCI and 14.9 CCI.

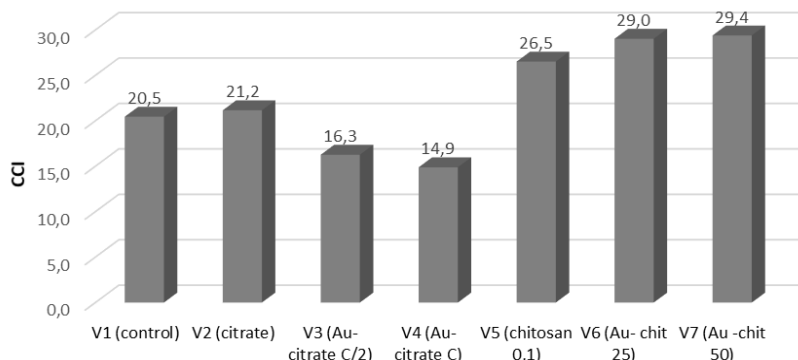


Fig. 4 Pigments of tomato plants under conventional and unconventional treatment

Results regarding the influence of stimulators on yield

The yield results were established by weighing the tomato fruits of each variant and repetition, resulting the total production depending on the conventional or unconventional product applied.

In terms of yield (fig. 5), the values ranged between 31.4 t/ha for the citrate-treated plants and 58.3 t/ha for the Au-citrate C/2-treated plants.

The variants treated with chitosan 0,1 (V₅) and Au-chit 25 (V₆) had almost the same yield (40.8 t/ha, respectively 40.3 t/ha); higher values of the production were registered in the case of variant V₇ (Au-chit 50) - 51.3 t/ha.

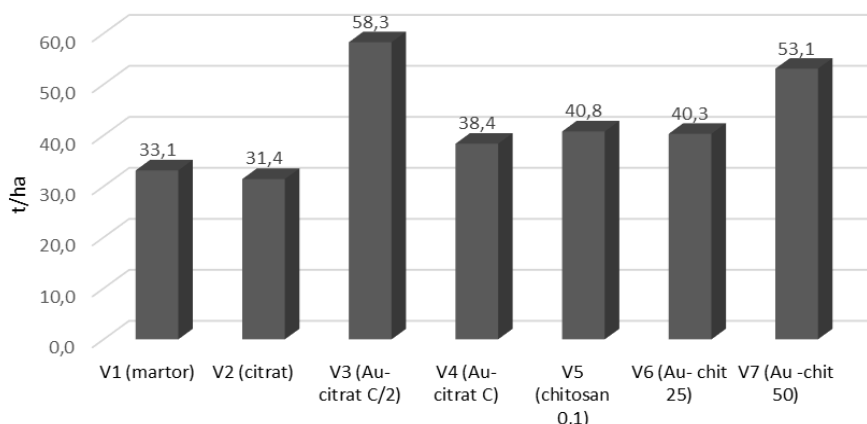


Fig. 5 Yield of tomato plants under conventional and unconventional treatment

CONCLUSIONS

1. The highest values of the analyzed physiological parameters were recorded in the case of the V₄ variant treated with Au - citrate C; for the total pigments this variant had the lowest value, respectively 14.9 CCI.

2. The highest yield was registered for V₃ (Au-citrate C/2). This variant achieved also high values for the physiological parameters, but in the case of pigments it showed low values of 16.3 CCI.

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