OPTIMIZATION OF TOMATO CULTIVATION TECHNOLOGY IN PROTECTED AREAS THROUGH THE USE OF CONTINUOUS ELECTRIC CURRENT

OPTIMIZAREA TEHNOLOGIEI DE CULTIVARE A TOMATELOR ÎN SPAȚII PROTEJATE PRIN UTILIZAREA CURENTULUI ELECTRIC CONTINUU

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Abstract. *Electric and magnetic fields of different intensities can influence the metabolism of plants. The results presented in this paper particularly follow the morphological changes that the electricity may have on tomato plants. The electric and magnetic field has been applied constantly on plants, from the seedling stage, to the moment of reaching the technological maturity of the fruits.*
Key words: tomato, electric field, magnetic field

Rezumat. *Câmpurile electrice şi magnetice de diferite intensităţi pot influenţa metabolismul plantelor. Rezultatele prezentate în această lucrare urmăresc în mod deosebit modificările morfologice pe care curentul electric continuu le poate avea asupra plantelor de tomate. Câmpul electric şi cel magnetic a fost aplicat în mod constant pe plante, de la stadiul de răsad, până la momentul atingerii maturităţii tehnologice a fructelor.*
Cuvinte cheie: tomate, câmp electric, câmp magnetic

INTRODUCTION

The need for food is one that is increasingly accentuated, an aspect that results from the statistics that envisage population growth, which leads to new innovations in the scientific field that can solve this disadvantage (Topkins and Bird, 1973; Belyavskaya, 2004). The use of synthetic chemicals has a significant effect of increasing the yield of production, but it has been found that these substances endanger human health (Ahmand and Wani, 2013; Cakmak *et al*., 2010).

Fluctuation of biometric characteristics of the plant is caused by the ion exchange between apoplastic and symplastic space transmitting signals in the phloem wich create a change of electric potential on both sides on membrane cells (Black *et al.,* 1971; Dannehl *et al*., 2011; Rochalska, 2008).

The purpose of application of low intensity electric and electromagnetic stimuli was to determine the effect they have on the morphological characteristics of the plants (Dayal and Singh, 1986; Blackman, 1924; Collins *et al.,* 1929). For this

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purpose, five digital regulated DC power supplies, medical needles, and electrical wires were used (Ward, 1996; Dubinin and Vaulina, 1979; Dannehl *et al.,* 2011).

MATERIAL AND METHOD

Starting from this goal, the aim of the research was to use a continuous electric current in the tomato hybrid Qualitet F1, a hybrid with semi-determined growth that adapts easily to the crops under different technological conditions. In the experiment, six variants of continuous current with an intensity of 0.15 A, 0.30 A and 0.45 A. were used, each variant having a number of 4 repetitions.

For the first three variants, an electric field was used to generate a current that flowed through a spiral wire around plant organs for each repetition. The current intensity were of 0.15 A, 0.30 A, and 0.45 A.

The fourth variant was represented by four plants with two medical needles inserted into each plant. One needle was inserted into the plant stem, and the other into the apical area. Both medical needles were connected to a DC power supply with a current of 1.5 V (the positive pole being connected at the apical area, and the negative one at the base of the plant).

In the case of the fifth variant, two copper electrodes were inserted into the plant substrate. Both electrodes were connected to a DC power supply with a current of 1.5 V.

The sixth variant was for reference. Plants were grown under the same ecological conditions and with the same culture technology.

RESULTS AND DISCUSSIONS

For this experiment, morphological particularities were observed, reaching the following results.

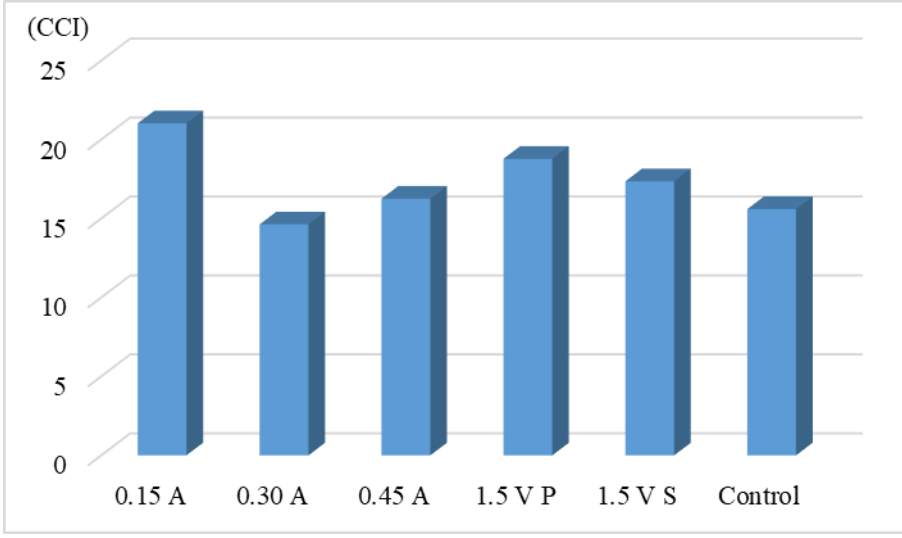

Fig. 1 Chlorophyll content in tomato plant

According to the measurements, the highest chlorophyll content was recorded in the case of the sample where an electric current with a intensity of 0.15 A was used (fig. 1).

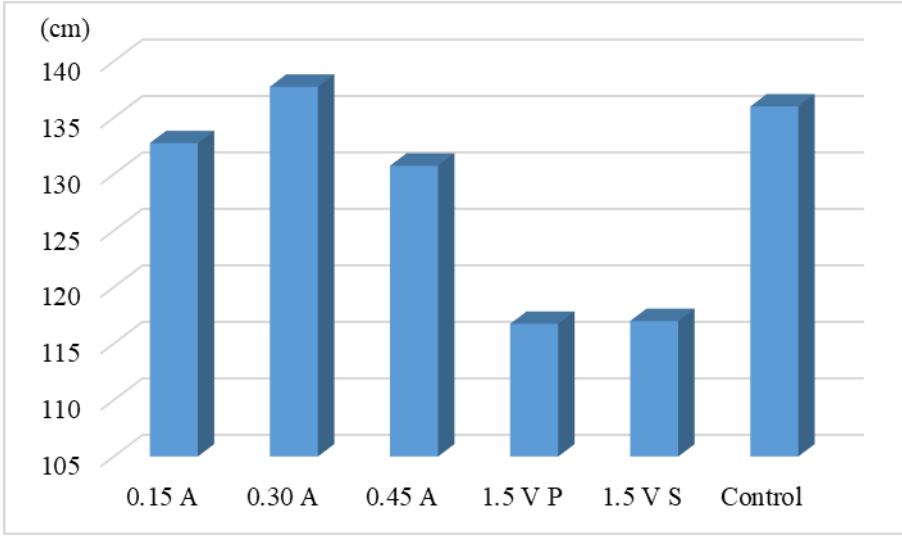

Fig. 2 Plants height of tomato

Another morphological parameter which was measured was the height of plants (fig. 2). The results indicated a wider development in the case of the sample where an electric current intensity of 0.30 A was used.

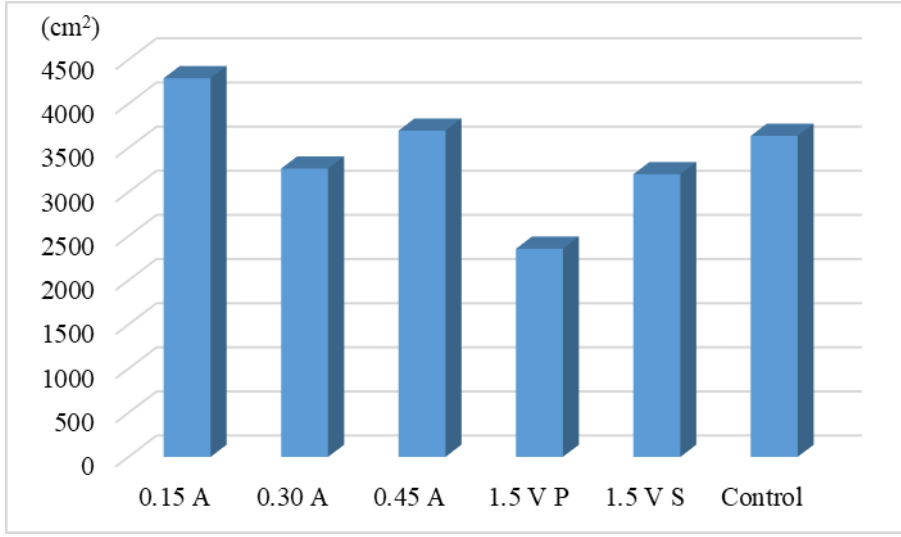

Fig. 3 Tomato area surface

The leaves area was measured using Li-3100 LI-COR. The best results were obtain again for the sample that used an DC current with an intensity of 0.15 A (fig. 3).

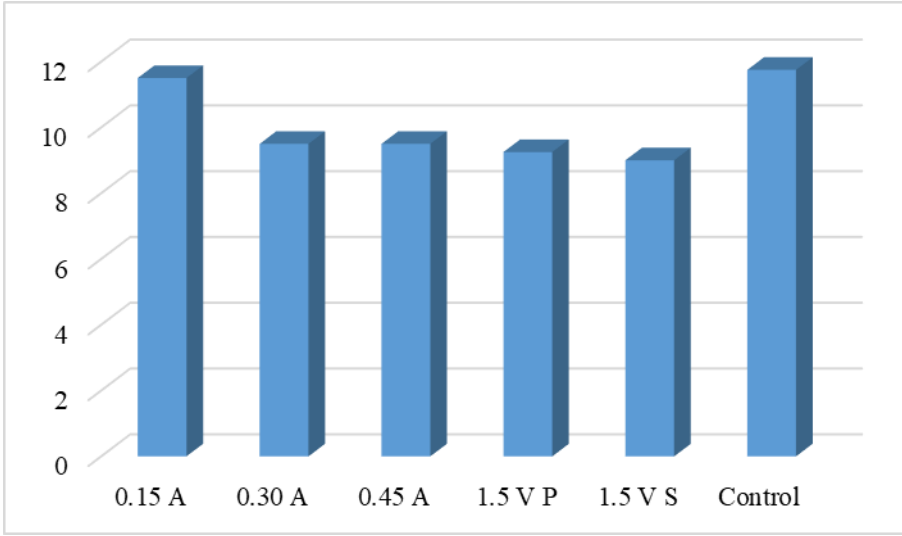

Fig. 4 Tomato leaves number

The average number of leaves (fig. 4) was relatively similar for each sample, the higher number of leaves being observed for the reference sample and for the sample that used a DC current with 0.15 A.

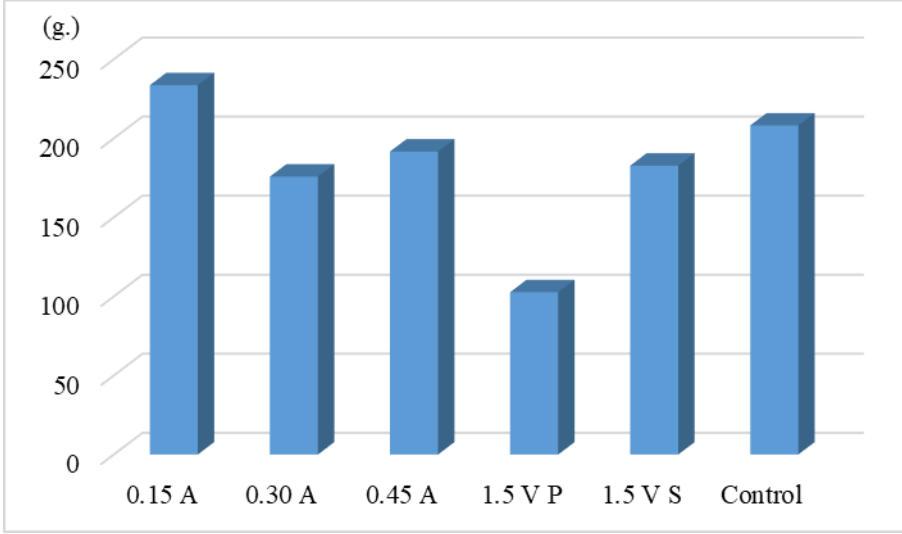

Fig. 5 Tomato plants weight

The plants weight variation was significant, best results being obtained for the sample that used a DC current with an intensity of 0.15 A (fig. 5). For the samples that used a DC current with an intensity of 0.30 A, 0.45 A, a DC of 1.5 V and the reference sample the results were very similar, while for the sample that used a DC of 1.5 V by using biological electrodes in the apical area and at the bottom of the stem of tomato plants could be observed a significant lower rate of development.

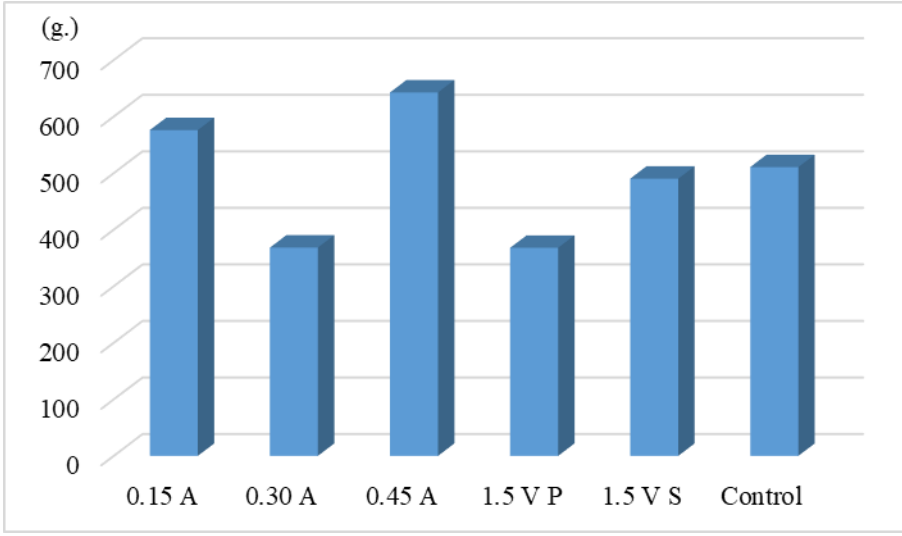

Fig. 6 Average fruits weight of tomato

The best results for the average fruits weight was registred by the sample that used DC current with a intensity of 0.45 A, followed by the sample that used a DC with a intensity of 0.15 A (fig. 6).

CONCLUSIONS

Based on the measured values it was concluded that a low intensity electric current stimulates the vegetative growths (they develop at a faster rate), but the higher intensities lead to a better absorption of the nutritional elements corroborated with a higher growth of fruit mass.

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