CHLOROPHYLL CONTENT INDEX AND LEAF AREA OF SOME TOMATO LOCAL CULTIVARS FROM N-E ROMANIA, UNDER SALT STRESS

INDICELE CONȚINUTULUI DE CLOROFILĂ ȘI SUPRAFAȚA FOLIARĂ A UNOR POPULAȚII LOCALE DE TOMATE DIN NORD-ESTUL ROMÂNIEI, EXPUSE STRESULUI SALIN

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Abstract: *Soil salinity is an important abiotic stress factor seriously affecting plant productivity and survival. Photosynthesis and growt of many plants are inhibited under NaCl salinity. The research was conducted under greenhouse condition. The biological material was represented by four local tomatoes populations collected from areas with saline soils from Moldavia region and compared with commercial type salt-tolerant tomato. Tomato genotypes in the study were subjected to salt stress for a period of 30 days is constantly wetted with saline solution to a concentration of 100 mM and 200 mM. The chlorophyll content was determinated whit chlorophyll meter and the leaf area with portable scanner AreaMeter AM 300 – 0002. Analyzed the results based on biphasic model of growth response under salt stress proposed by Munns (1993), and found that tomatoes reacted similarly. The transition from phase I to phase II, is done by salt stress intensity, but mostly by cultivated genotype.*

Key words: *Soil salinity, tomato, leaf area, chlorophyll content.*

Rezumat: *Dintre factorii de stres din mediu, salinitatea rămâne principalul factor care pune sub semnul întrebării viitorul agriculturii. Procesul de fotosinteză pentru multe specii de plante este inhibat de concentrația NaCl. Experiența a fost înființă în vase de vegetație în condiții de seră. Au fost luate în studiu 4 genotipuri de tomate colectate din solurile saline ale Moldovei și un soi comercial rezistent la salinitate. Acestea au fost expuse stresului salin pe o perioadă de 30 de zile, fiind udate constant cu soluții saline de concentrație 100 mM și 200 mM. Conținutul de clorofilă al frunzelor a fost determinat cu ajutorul clorofilometrului iar, pentru suprafața foliară s-a utilizat aparatul portabil AreaMeter AM 300 – 0002. Analizând rezultatele pe baza modelului bifazic de reacție al plantelor la salinitate propus de către Munns (1993), s-a constatat că și tomatele se înscriu în același model. Trecerea de la faza I la faza a II-a, făcându-se în funcție de intensitatea stresului salin și de genotipul cultivat.*

Cuvinte cheie: *salinitatea solului, tomate, suprafață foliară, conținut de clorofila*

INTRODUCTION

Soil salinity is an important abiotic stress factor seriously affecting plant productivity and survival. Growth and development of glycophytes are negatively

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affected but halophytes tolerate high salt concentrations (Doganlar et. al., 2010). Salinity resistance of crops is determined by the physical properties of the soil, physiological particularities of plant, growth and development phase (Jităreanu, 2007).

The tolerance to Na^+ of plants under salt conditions ($NaCl$), the prevention of the replacement of Mg^+ with Na^+ and the continuous increase of chlorophyll amount is accepted as an important indicator of salt tolerance. It is stated that plants with high chlorophyll content under salinity stress are more tolerant to salt (Yașar and Esra, 2012). The decrease in chlorophyll content of the leaves of the plants treated with $NaCl$, may be caused by the increase in the concentration of Cl^- in the chloroplast, which may be amplified simultaneously by increasing the concentration of Na^+, as a result of synergistic effect. An increase in the concentration of Mg^+ in the nutrient solution prevents effectively lowering the concentration of chlorophyll (Slabu, 2005).

Photosynthesis is one of the mostly affected factors due to salt stress (Babu et. al., 2011). The decline in photosynthesis due to salinity stress could be due to lower stomata conductance, depression in carbon uptake and metabolism, inhibition of photochemical capacity or a combination of all these factors (Zhani et. al., 2012).

Leaf area represent an important physiologic index in characterization of intensity to some metabolic process (groweing, transpiration, photosynthesis, respiration, etc) (Șumălan and Dobrei, 2002). Ciobanu (Popescu) and Șumălan (2009), shwoed that at the plant exposed to saline environment generally has the leaf area reduced.

MATERIAL AND METHOD

The research was conducted under greenhouse condition from USAMV Iași.

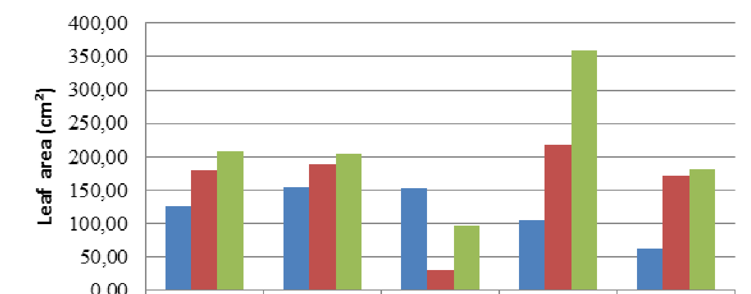
The biological material was represented by local tomatoes populations collected from areas with saline soils from Moldavia region and compared with commercial type salt-tolerant tomato (*Ursula* $_{F1}$) from Israel.

The bifactorial experience was conducted in a pots experiment in randomized blocks with four repetitions. Four tomato genotypes (*Copalău*$_3$, *Copalău* $_4$, *Dorohoi* $_4$, *Moșna* $_3$) studied were subjected to salt stress for a period of 30 days is constantly wetted with saline solution to a concentration of 100 mM and 200 mM.

The chlorophyll content was determinate whit chlorophyll meter and the leaf area with portable scanner Area Meter AM 300 – 0002.

RESULTS AND DISCUSSIONS

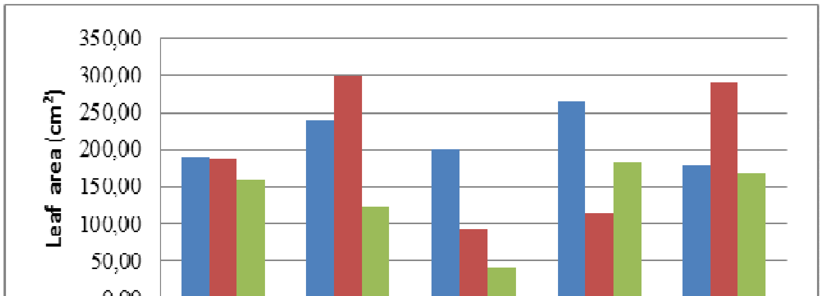
After 30 days, treatment with $NaCl$ did not interfere with the foliar growth in the base of the stem. Found an increase in leaf area in the two concentrations of $NaCl$ compared to control, in tomato genotypes under study, which shows that the leaves appeared before applying treatments with $NaCl$, grown in the absence of stress are not affected. An exception is genotype *Dorohoi*$_4$ exposed to a concentration of 100 mM (fig. 1).



	Copalău 3	Copalău 4	Dorohoi 4	Moșna 3	Ursula F1
Control	125,01	155,21	152,60	104,30	61,94
100 mM	179,20	189,60	29,80	218,40	172,60
200 mM	209,00	203,30	96,04	359,60	181,82

Fig. 1 - Effect of salt stress on leaf growth in the basal third of the stem

The middle third of the stem, salinity affects leaf growth compared to control to 2 genotypes (*Dorohoi*$_4$, *Moşna*$_3$,) exposed to 100 mM *NaCl* concentration. In the exposure 200 mM all genotypes showed lower values of leaf area. Compared to *Ursula* $_{F1}$, salinity resistant varieties all untreated genotypes showed higher values. When exposed to excess salt *Copalău*$_4$ one genotype showed higher values (fig. 2).

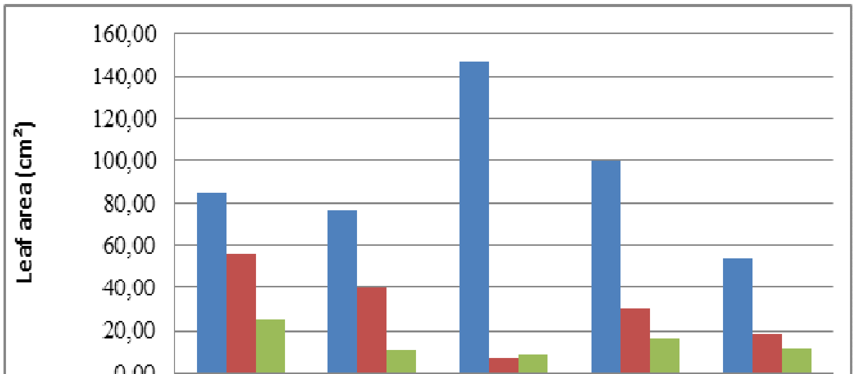


	Copalău 3	Copalău 4	Dorohoi 4	Moșna 3	Ursula F1
Control	189,56	238,06	201,12	266,67	178,95
100 mM	187,73	299,01	92,15	114,87	289,04
200 Mm	158,31	122,87	40,27	181,51	167,92

Fig. 2 - Effect of salt stress on leaf growth in the middle third of the stem

The manifestation of the negative effects of excess salt, to the leaves of the middle, can be explained by the fact that the leaves have started to grow under salt stress effect, and by the fact that the ions are transported with the mineral water to areas where they accumulate increased sweating.

Increased leaf from the top stem was strongly affected by excess salt to the all cultivars studied (fig. 3).



	Copalău 3	Copalău 4	Dorohoi 4	Moşna 3	Ursula F1
Control	85,00	77,19	146,93	99,78	54,20
100 mM	56,45	39,98	6,98	30,52	18,52
200mM	25,61	10,23	8,20	16,48	12,05

Fig. 3 - Effect of salt stress on leaf growth in the top of the stem

The chlorophyll content of leaves was determined as chlorophyll content index (CCI).

After 15 days salt stress has been found differences between the genotypes in the concentration of chlorophyll in the leaf level. In the case of tomatoes exposure to 100 mM concentration, in comparison with the plants watered only with water there is a lower value genotypes *Moşna*$_3$, *Copalău*$_3$ and an increase in chlorophyll index for the other genotypes.

When exposed to 200 mM the chlorophyll content is higher for all genotypes (fig. 4). This shows that plants to chlorophyll content index registers values higher compared with control variant, are in the phase osmotic stress.

After 30 days exposure to 100 mM, compared to control variant observed higher values of chlorophyll content of leaves for all genotypes, except genotype *Dorohoi*$_4$ which shows their maintenance during osmotic stress. In the exposure of 200 mM genotypes *Dorohoi*$_4$, *Moşna*$_3$ and *Ursula* $_{F1}$ have higher values compared to plants watered with water only, this means that they are still in the process of osmotic stress.

Genotypes *Copalău*$_4$ *Copalău*$_3$ has lower values compared with to control variant (fig. 5). In this case switch-on the second phase of stress, the ion toxicity, disturbances in the chloroplast. The transition from phase I (osmotic stress) to phase II (ions toxicity), is done by salt stress intensity, but mostly by cultivated genotype (Muuns, 1993).

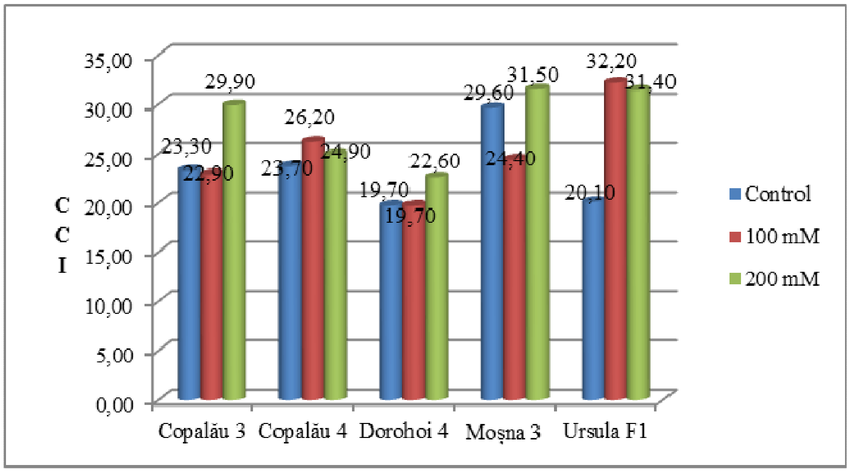


Fig. 4 - The index chlorophyll content after 15 days of exposure to salt stress

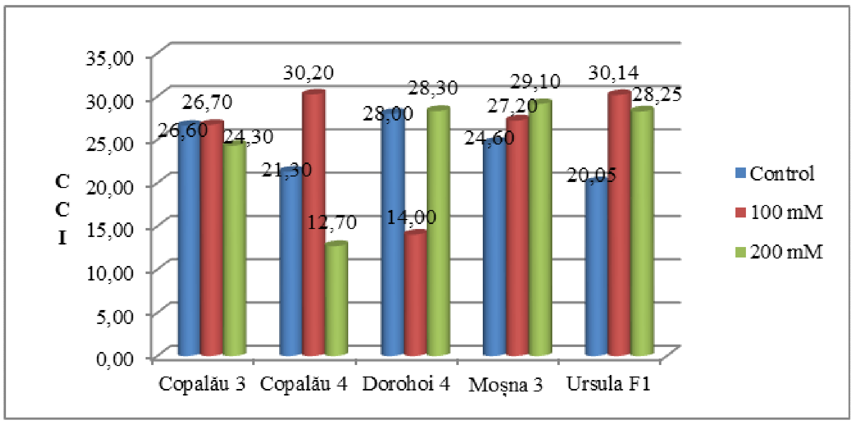


Fig. 5 - The index chlorophyll content after 30 days of exposure to salt stress

CONCLUSIONS

After 30 days, treatment with *NaCl* did not interfere with the foliar growth in the base of the stem but the middle third of the stem, salinity affects leaf growth compared to control to 2 genotypes. In the exposure 200 mM all genotypes showed lower values of leaf area.

Increased leaf from the top stem was strongly affected by excess salt to the all cultivars studied.

The plants to chlorophyll content index showing the higher values compared with control variant, are in the phase osmotic stress.

The transition from phase I (osmotic stress) to phase II (ions toxicity), is done by salt stress intensity, but mostly by cultivated genotypes.

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