STOMATIC CONDUCTANCE AND CHLOROPHYLL CONTENT INDEX AND LEAF AREA OF SOME BEANS LOCAL CULTIVARS FROM NORTH-EAST OF ROMANIA, UNDER SALT STRESS

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Abstract: *Salinity represent the main factor which limits agricultural productivity and result from poor management of irrigation. This, put questioned the future of agriculture in a context in which areas affected by excess salinity they have come to be for over 200 milion hectares right across the planet and approximate 400.000 in Romania. At the moment, it is estimated that about 20% from irrigated surfaces from the world are affected by salinity and this trend grow with climate change and with the use of excess irrigation. From an agronomic point of view, salinity disrupts growth and plant physiology. Phaseolus vulgaris L. it is a sensitive species to the salts. For this reason, the purpose of work was determining the effect of excess NaCl on the dynamics of the chlorophyll content index and foliar stomatic conductivity of 7 bean genotypes, collected from saline soils, from north-east of Romania, as an indicator of salt stress tolerance.*

Key words: *stress saline, Phaseolus vulgaris L., chlorophyll content index, stomata, conductance.*

INTRODUCTION

Halofites represent *"salt-loving plants"*, and glycopheres are plants which prefer *"sweet"* substrates (GRIGORE, 2008).

Resistance of plants to salinity is determined by the physical properties of the soil the qualities morfo-anatomy and physiology to ensure their tolerance to a high salt concentration (JITĂREANU, 2007), but also the initial salt content and the degree of mineralization of irrigated water (PLEȘA AND CÂMPEANU, 2001).

The salinity of the soil constitutes an abiotic stress what limits plant growth (MUNNS AND TESTER, 2008). A plant response to saline stress represents it closing of stomata (MUNNS AND TERMAAT, 1986), and the main catastrophic factor for the cell represents it inhibition of photosynthesis.

Conformable, research done by DOBREI ET AL., (2007), *Phaseolus vulgaris* L. shows great variability in terms of tolerance to saline stress, from 40 - 46 mM NaCl to 196-207 mM NaCl.

BEINȘAN ET AL., (2010) are of the opinion that the plants grown under conditions of saline stress show a low photosynthetic activity, what leads to low plant growth. All of the above, they studied and the sweat rate for six local bean varieties. The results showed that, application of salt to all varieties has caused stress in young bean plants which caused growth retardation and photosynthetic activity. At the same time, the manifestation of the salinity reaction was different depending on the variety.

To plants, exchange foliar gas it is realizing through stomatic movements. This is crucial for the acquisition of CO_2, which is directly bound of photosynthetic production and biomass, as well as by sweating control with an eye to maintaining the water balance.

As a reaction to the osmotic component of saline stress, for reducing the sweat, the stomata are partially closed. In this case, stomatic movements affects the balance between reducing sweating and supplying carbon dioxide (BARTHA, 2012).

MATERIAL AND METHOD

Research was performed in greenhouse conditions, at USAMV Iași, in 2017. Biological material was represented of local bean populations, collected from areas with saline soils, from north-east of Romania.

Bifactorial experience was create in pots of vegetation using seven bean genotypes (Blăgeşti 1, Blăgeşti 2, Blăgeşti 3, Blăgeşti 4, Moşna, Săveni, Truşeşti 2). These were exposed to saline stress, for 30 days being watered constant at concentrations of 100 mM NaCl and 200 mM NaCl.

Chlorophylle contente of the leaves was determined using the CCM 200 PLUS (Chlorophyll Content Meter Sciences), which uses a non-destructive method for appreciation chlorophylle contente. Method is based on the determination of the chlorophyll concentration index.

Stomatic conductance leaf was determined using the SC-1-Terra-Preta foliar porometer, which measures vapor stream between stomates of the leaves and outside, what it is a direct indication of stomate conductance.

RESULTS AND DISCUSSIONS

Effect of saline stress on foliar stomatic conductivity

Stomatal conductance to the beans was determined using the porometer, and readings were made at 15, respectively 30 days from application saline treatments.

Stomatal conductance 15 days after application of saline treatments, to the variant treated with 100 mM NaCl, comparative with the control, was decreasing to all populations studied. The genotype with the biggest stomatal conductance is Blăgeşti 2 (24.40 mmol/m^{2}s), and the cultivar Blăgeşti 3 he presented the smallest stomatal conductance (15.12 mmol/m^{2}s), which proves a discount the process of sweating (table1).

To the variant treated with 200 mM NaCl, stomatal conductance has been reduced to all bean genotypes taken into study, except for the cultivar Blăgeşti 4 to which was recorded a stomatal conductance of 32.49 mmol/m^{2}s, fact which confirms the data from the literature so as a reaction to the osmotic component, the stomates are partially closeds, causing a reduction in sweat (MUNNS AND TESTER, 2008).

Table 1.

Effect of 15 days of saline stress on foliar stomatic conductivity

Genotype	***Control***	***100 mM NaCl***	***200 mM NaCl***
Blăgeşti 1	*24.85*	*23.93*	*24.23*
Blăgeşti 2	*35.07*	*24.40*	*20.85*
Blăgeşti 3	*20.92*	*15.12*	*17.50*
Blăgeşti 4	*34.46*	*17.87*	*32.49*
Moşna	*17.61*	*16.52*	*16.41*
Săveni	*17.66*	*15.57*	*27.80*
Truşeşti 2	*20.24*	*19.20*	*21.61*

30 days from applying saline treatments, stomatal conductance to the variant treated with 100 mM NaCl, was decreasing to all the populations studied, compared to the control. The genotype Blăgeşti 4 recorded the biggest value (16.16 mmol/m^{2}s), and the population Săveni presented the smallest stomatal conductance (8.92 mmol/m^{2}s), which fact show a reduction of

the sweating process (tabel 2). And the variant treated with 200 mM NaCl, the highest stomatic conductance was recorded to the same cultivar Blăgești 4 (14.67 mmol/m^2s), the minimum amount was found to the population Blăgești 1 (7.69 mmol/m^2s) (table 2).

Acording of the literature (BARTHA, 2012), we can afirm that after 30 days, of exposure to saline stress, were not observed to the experimental variants symptoms specific to ionic stress (chlorosis, necrosis).

Table 2.

Effect of 30 days of saline stress on foliar stomatic conductivity

Genotype	***Control***	***100 mM NaCl***	***200 mM NaCl***
Blăgești 1	*19.58*	*13.06*	*7.69*
Blăgești 2	*10.26*	*12.45*	*10.52*
Blăgești 3	*11.48*	*14.54*	*7.83*
Blăgești 4	*18.92*	*16.16*	*14.67*
Moșna	*19.50*	*9.04*	*6.98*
Săveni	*18.94*	*8.92*	*9.17*
Trușești 2	*15.13*	*10.54*	*13.11*

Effect of saline stress on chlorophyll content index

Research looking the contente of chlorophylle pigments, after 15 days of saline stress highlights significant differences between genotypes studied, values of this index oscillating, from 12.99 CCI to 44.98 CCI. When applied concentration of 100 mM NaCl, in comparison with the control, it can be noted a value lower for genotypes Săveni, Blăgești 3, Blăgești 2, Blăgești 1 and an increase of the chlorophylle contente index for the other genotypes. To variant treated with 200 mM NaCl, the chlorophylle contente is superior for all 7 genotypes studied; the biggest growth of the chlorophylle contente index was Blăgești 1 (44.98 CCI), and to Săveni was recorded the smallest growth of this index, respectiv (35.40 CCI) (table 3).

Increasing chlorophyll contente in plants exposed to stress, compared to untreated variants, shows that they are in the first phase of manifestation of saline stress, namely saline stress phase.

Table 3.

The effect 15 days of saline stress on the chlorophyll content index (CCI)

Genotype	***Control***	***100 mM NaCl***	***200 mM NaCl***
Blăgești 1	*19.09*	*13.79*	*44.98*
Blăgești 2	*13.88*	*12.99*	*39.82*
Blăgești 3	*17.72*	*14.73*	*45.25*
Blăgești 4	*10.42*	*12.42*	*30.36*
Moșna	*16.92*	*17.58*	*42.52*
Săveni	*19.07*	*14.10*	*35.40*
Trușești 2	*13.09*	*17.19*	*44.50*

From the data presented in tabel 4. it can be seen that after 30 days, in case of exposure to 100 mM NaCl, compared to the control, values contente of chlorophylle from the leaves are superior to 3 of the genotypes studied (Blăgești 4, Trușești 2, Blăgești 2), these being contained between 17.33 and 28.49 CCI, while for other 4 genotypes (Moșna, Săveni, Blăgești 3, Blăgești 1) values are lower being contained between 13.71 and 21.58 CCI, revealing their maintenance in the osmotic stress phase. The results confirm the data from the literature, which suggests the fact that decrease in chlorophyll contente under the influence of saline stress is the result of chlorophyll degradation (MURAT ET AL., 2007).

In the case of exposure to 200 mM NaCl, the population Trușești 2, Moșna, Blăgești 4, Blăgești 3 and Blăgești 2 genotypes show superior values to plants dampened with waterwhich demonstrates their maintenance in the osmotic stress phase; also, these high values indicate a good adaptation of the five genotypes at an intense photosynthetic rhythm, which allows for an accumulation of assimilation products in sufficient quantities for the entire vegetation period. On the other hand, the genotypes Săveni and Blăgești 1, show lower values compared to the control variant, confirming that the second phase of stress (ion toxicity) has been triggered,with disturbances in chloroplasts (MUNNS, 1993).

Table 4

The effect of 30 days of saline stress on the chlorophyll content index (CCI)

Genotype	*Control*	*100 mM NaCl*	*200 mM NaCl*
Blăgești 1	*23.77*	*21.58*	*21.13*
Blăgești 2	*11.93*	*28.49*	*23.32*
Blăgești 3	*20.23*	*18.02*	*28.61*
Blăgești 4	*14.33*	*17.33*	*22.31*
Moșna	*15.25*	*13.71*	*26.34*
Săveni	*25.55*	*17.89*	*12.97*
Trușești 2	*23.27*	*26.34*	*33.88*

CONCLUSIONS

1. Saline stress influences the conductance of stomates causing significant differences between cultivation. The foliar stomatic conductivity, both after 15 and after 30 days, after applying saline treatments was generally reduced to genotypes studied, except for the Blăgești 4 local population from variant 200 mM NaCl. As a reaction to the osmotic component of saline stress, to reduce perspiration, the stomata are partially closed. Because stomates movements are affected by the osmotic effect of saline stress, we can conclude that the Blăgești 4 genotype exhibits a low tolerance to osmotic stress, in comparison to other cultivar.

2. Populations exposed for 15 days to saline stress, have recorded much higher values of pigments content in the sample treated with 200 mM NaCl, for after 30 days of exposure to the same variant, three cultivars showed lower values (Blăgești 1, Blăgești 2, Săveni), which denotes that genotypes are part of the biphasic model proposed by MUNNS (1993). The duration of the transition from the osmotic stress phase to the ionic toxicity is based on the intensity of the saline stress, but especially according to cultivated genotype.

3. To the version treated with 200 Mm NaCl, Blăgești 3, Blăgești 4, Moșna, and Trușești 2 genotypes show higher values than control plants, demonstrating their maintenance in the osmotic stress phase; these high values indicate a good adaptation of the four cultures at an intense photosynthetic rhythm that allows them to accumulate assimilation products in quantities appropriate to the overlay throughout the growing season.

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