GERMINATIVE RESPONSE TO SALT STRESS CONDITIONS IN SOME BEAN LANDRACES FROM BANAT AREA

RĂSPUNSUL GERMINATIV LA STRESUL SALIN A UNOR POPULAȚII LOCALE DIN ZONA BANATULUI

Carmen DOBREI*, R. ŞUMĂLAN*, Astrid LĂZUREANU*, D. CAMEN*, G. MOŞOARCĂ**

**Agricultural and Veterinary University of the Banat, Timişoara, Romania*
***Politehnica University of Timisoara*
Corresponding author: Carmen Dobrei, e-mail:carmen_dobrei@yahoo.com

Abstract: *Phaseolus vulgaris has a great variability regarding the tolerance to saline stress, starting with values of 40-46 mM NaCl and up to 196-207 mM NaCl. The experimental results achieved made evident the existence of some bean genotypes with a good tolerance to salinity during germination (Ohaba Forgaci I, Ohaba Forgaci II and Berini). These genotypes have recorded during germination normal intensities of radicle growth and cotyledon development, and they have synthesized important amounts of free proline with osmoprotector role. We have also determined the dynamics of the dry matter percent during germination and within the post-germination phases. The increase of the dry matter percent in the sensitive genotypes is due to their incapacity of hydration and water maintenance.*

Rezumat: *Phaseolus vulgaris prezintă o mare variabilitate in privința toleranței la stres salin, pornind de la 40 - 46 mM NaCl până la valori cuprinse între 196 – 207 mM NaCl. Rezultatele experimentale obținute au evidențiat existenta unor genotipuri de fasole cu o buna toleranta la salinitate pe parcursul germinării.(Ohaba Forgaci I şi II şi Berini). Aceste genotipuri au înregistrat pe parcursul germinării intensități normale ale creşterii radiculei si dezvoltării cotiledoanelor, au sintetizat cantitati importante de prolina libera cu rol osmoprotectant. De asemenea s-a determinat dinamica procentului de substanță uscată pe parcursul germinării şi în etapele postgerminare. Creşterea procentului de s.u. la genotipurile sensibile se datorează incapacității de hidratare şi reținere a apei a acestora.*

Key words**:** *Phaseolus vulgaris, salt stress tolerance, free proline, seed germination, dry matter, osmoprotection*
Cuvinte cheie: *Phaseolus vulgaris, toleranță la stres salin, prolină, germinare, substanță uscată, osmoprotecție*

INTRODUCTION

The methods used for attenuate the hyper salt soils effects are very expensive and over-fulfilled by the expansion of this field in agricultural circuit.

From this reason the improvement of salt tolerance of cultivated species is a necessity by capitalization of the salt tolerance variability in local land races of the same species or other species or by the "*novo*" creation of some varieties by different methods.

The common bean is the main protein source in human alimentation in numerous course of development countries.

Bean protein is very valuable from qualitative point of view, including the majority of essential amino acids, at a lower cost comparative with animal protein.

From this consideration, our research fallowed the tolerance showed by 8 bean genotypes at salt stress.

MATERIAL AND METHOD

The negative influence of the salt excess on plants is reflected in two directions, these being osmotic and toxic.

The osmotic effect restrains water supplies and induces tissue dehydration. The physiological drought is installed when external solution contains combinations that cannot reach the plant cells and in such conditions high osmotic pressure is induced.

The experiment were conduced to examine a range of genetic variability for salinity tolerance among and within *Phaseolus* species, and to confirm the reproducibility of the germination and seedling growth performance (2, 3).

The biological material used in our study consists of 8 *Phaseolus vulgaris* local land races: Surduc, Berini, Ohaba Forgaci I, Ohaba Forgaci II, Nerău, Moşniţa nouă, Căpăt I and Căpăt II.

The experimental variants were V_0 – control (distilled water), V_1 – NaCl 41,067 mM (O.P. = -1atm.), V_2 – NaCl 122,005 mM (O.P. = - 3 atm), V_3 – 205.33 mM (O.P. = - 5 atm).

During seed germination we have determined the seed germinating rate, dry matter accumulation (%) and free proline content (µg/mg).

The germination seed rate was determined by counting germinated seeds and it was repeatedly done during the experimental period (1).

The amount of dry matter is obtained through calculation, considering the difference between material fresh weight and its moisture.

The proline accumulation is a common metabolic response of superior plants affected by water deficit and saline stress condition. This subject was intensely debated in the scientific world in the last 20 years (4).

From the results obtained regarding the germination potential measured at various time intervals, it has been noticed that Ohaba Forgaci II local land race showed the higher germination rate on V_3, but this result can be inconclusive because of the fact that this land race have origin unknown (Table 1).

Table 1

Experimental results regarding germination potential of studies genotypes (%)

Genotype	96 ore				192 ore			
	V_0	V_1	V_2	V_3	V_0	V_1	V_2	V_3
Berini	95	100	70	55	100	100	75	60
Surduc	90	90	70	45	95	100	75	50
Ohaba Forgaci I	95	95	75	60	100	100	75	60
Ohaba Forgaci II	95	100	70	60	100	100	80	65
Nerău	85	90	65	20	90	95	65	35
Moşniţa Nouă	85	85	60	25	95	90	65	25
Căpăt I	70	75	60	30	80	90	65	35
Căpăt II	80	85	65	35	90	95	65	35

Table 2

Experimental results regarding the plant length of studied genotypes (cm)

Genotype	96 ore				192 ore			
	V_0	V_1	V_2	V_3	V_0	V_1	V_2	V_3
Berini	5.41± 0.99	6.30± 0.98	1.48± 0.73	0.63± 0.34	7.4± 1.19	9.65± 1.95	1.55± 0.43	1.48± 0.43
Surduc	3.03± 0.71	4.09± 0.90	2.37± 0.78	1.02± 0.31	7.07± 1.1	8.51± 1.79	4.45± 1.34	1.82± 0.39
Ohaba Forgaci I	3.65± 0.87	4.24± 0.47	2.21± 0.29	1.08± 0.40	6.62± 0.54	6.01± 0.86	2.33± 0.82	1.88± 0.42
Ohaba Forgaci II	4.96± 0.97	5.38± 1.01	2.77± 0.38	0.80± 0.01	9.95± 1.58	7.56± 0.49	2.92± 0.39	1.58± 0.42
Nerău	3.16± 0.35	3.50± 0.22	1.44± 0.22	0.6± 0.31	10.38 ±1.26	4.01± 0.16	1.94± 0.73	0.63± 0.15
Moşniţa Nouă	3.25± 0.93	3.47± 0.65	1.12± 0.34	0.7± 0.28	8.17± 1.84	7.66± 0.88	3.97± 0.76	1.64± 0.62
Căpăt I	2.31± 0.77	3.71± 0.41	2.04± 0.23	1.22± 0.27	8.52± 1.04	4.88± 1.16	3.71± 0.19	1.26± 0.47
Căpăt II	2.37± 0.70	3.86± 1.05	2.02± 0.42	1.06± 0.23	8.27± 1.14	5.64± 1.32	3.78± 0.64	1.38± 0.58

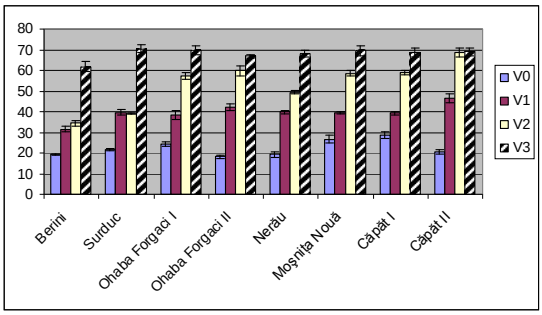

Figure 1. Dry matter content in bean (*Phaseolus vulgaris* L.) genotypes (%)

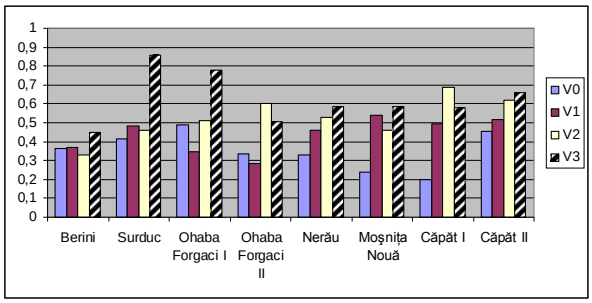

Figure 2. Free proline content in bean (*Phaseolus vulgaris* L.) genotypes at the end of germination process (µg/mg)

From the data analysis presented in table 2, it has been noted that the best result regarding growing rate of plants was obtained in Ohaba Forgaci I genotype and the lower growing rate was observed in Nerău genotype on V_3.

In addition, the amount of dry matter accumulation registered the higher values on variant (V_3) in Surduc genotype (Figure 1).

The same results were observed in the case of free proline accumulation, the higher value was obtained in Surduc genotypes on (V_3) variant (Figure 2).

CONCLUSIONS

Experimental research showed the following:

The osmotic stress induced using saline solution (205.33 mM) generated reduction of the germinating rate during the entire experimental period.

Regarding the growing rate the saline stress produce a decrease of growing rate of studied genotypes, but some genotypes showed moderate tolerance (Ohaba Forgaci I).

For the dry matter amount we observed that the values is higher in the case of stressed variant and the same result was obtained regarding the free proline content, fact that confirm the correlation between this and saline stress. The most tolerant genotype was Surduc which showed value 70.34 % for dry matter and 0,68 µg/mg for free proline.

LITERATURE

1. BEWLEY, J.D., Black, M., *Seeds. Physiology of development and germination.* Plenu Press, New York, 1994.
2. GAMA, P.B.S., INANAGA, S., TANAKA, K., NAKAZAWA, R., *Physiological response of common bean (Phaseolus vulgaris* L.) *seedlings to salinity stress,* African Journal of Biotechnology , vol. 6 (2), 2007, pg. 079-088.
3. SUMALAN, R., DOBREI CARMEN, *Lucrari practice de fiziologie vegetala,* Ed. Marineasa, Timisoara, 2002.
4. SUMALAN, R., *Fiziologia plantelor (Elemente de fiziologie a plantelor si reactia la stres),* Ed. Eurobit, Timisoara, 2004.