SALINITY STRESS INFLUENCE CUPON SOME PHYSIOLOGICAL PROCESSES IN BEAN GENOTYPES

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Abstract. *Phaseolus vulgaris has a great variability regarding the tolerance to saline stress, starting with values of 1 - 5 atm NaCl P.O.The seeds from the control variant V_0 were moistened with distilled water. Also we studied the proline content in stresed bean variant. The experimental results achieved made evident the existence of some bean genotypes with a good tolerance to salinity regarding germinative response (Tincova), free proline acumulation (Santana) and dry matter content (Tincova). 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 also measured the of stressed genotype.*

Keywords: salt stress, germination, dry matter, free proline, *Phaseolus vulgaris*, tolerance.

INTRODUCTION

Osmotic stress tolerance in plants is a complex phenomenon that involve morphological and developmental changes as well as physiological and biochemical processes. Two components have been identified as the probable cause of salinity toxicity, osmotic stress and ion toxicity (Munnas and Termat, 1986). Beans are an important source of protein in the diet of the Banat population and are farmed in an array of cropping systems, in areas ranging from less than one hectare to hundreds, under rain fed conditions or supplementary irrigation, providing three major harvests per year (Wyn Jones, 1981). The methods used for attenuate the hyper salt soils effects are very expensive and overfull field by the expansion of this field in agricultural circuit. Excessive soil salinity is an important constraint limiting the distribution of plants in natural habitats, and is an increasingly severe agricultural problem in arid and semiarid regions (Shannon, 1986). Various strategies have been adopted by plant scientists in overcoming salinity (Kingsbury and Epstein, 1984). One important component is the evaluation of genetic variability of the cultivated species or its wild relatives to identify a tolerant genotype that may sustain a reasonable yield on salt affected soils (Kingsbury and Epstein, 1984). From this consideration, our research fallowed the tolerance showed by 5 bean genotypes at salt stress.

MATERIAL AND METHOD

The sampling procedure was directed to seeds from the farmer's own stocks kept in cellars, conditioned in bags, boxes or any other container. Information collected for each sample was recorded in a logbook at the time of sampling,

considering several parameters: the county; the local variety name; the period of time the variety had been utilized; its origin, if known; Samples of *Phaseolus vulgaris* were collected 2009, in different localities from Banat area. Genetic diversity is well preserved in the region, because farmers market the commercial, enhanced varieties, but keep on cultivating the old ones for self consumption.

The biological material used in our study consists of 5 *Phaseolus vulgaris* local landraces: Santana, Tincova, Sudrias pitica, Sudrias urcatoare and Berini. The experimental variants are were: V_0 – control (distillated water), V_1 – 1 atm NaCl P.O., V_2 – 3 atm NaCl P.O., V_3 – 5 atm NaCl P.O.

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 (Gama et al., 2007; Kingsbury and Epstein, 1984).

The germination seed rate was determined by counting germinated seeds and it was repeatedly done during the experimental period. The dry matter was obtained by the difference between fresh weight of biological material and his humidity and was determined by thermobalance Kern MLS 50-3ha160 (Sumalan and Dobrei, 2002). For this determination we used embrions axes and cotyledons. The proline accumulation is a common metabolic response of superior plants affected by water deficit and osmotic stress condition.

RESULTS AND DISCUSSION

From the results obtained regarding the germination potential measured at various time intervals, it has been noticed that Tincova local landrace showed the higher germination rate on V_3 (70% after 192 hours), but this result can be inconclusive because of the fact that this land race have origin unknown (Fig. 1,2). From the data analysis presented in Table 1, after 96 hours it has been noted that the best result regarding growing rate of plants was obtained in Santana genotype (V_3). After 192 hours the best results regarding growing rate was noted at genotype Santana and Sudrias pitica (V_3) (Table 2).

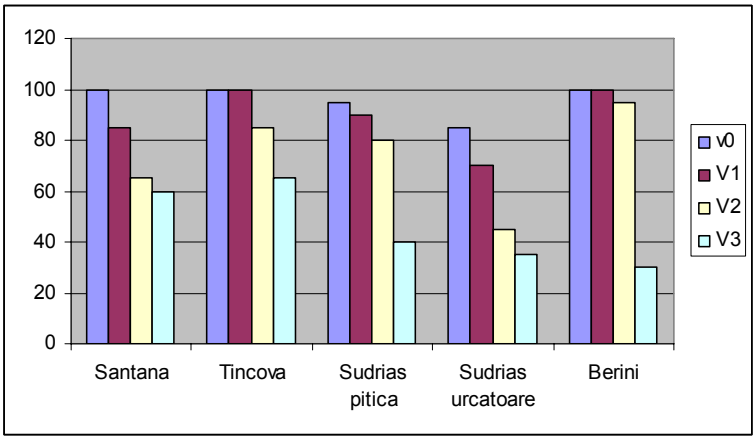

Fig. 1. Experimental results regarding germination potential of studies genotypes after 96 hours (%)

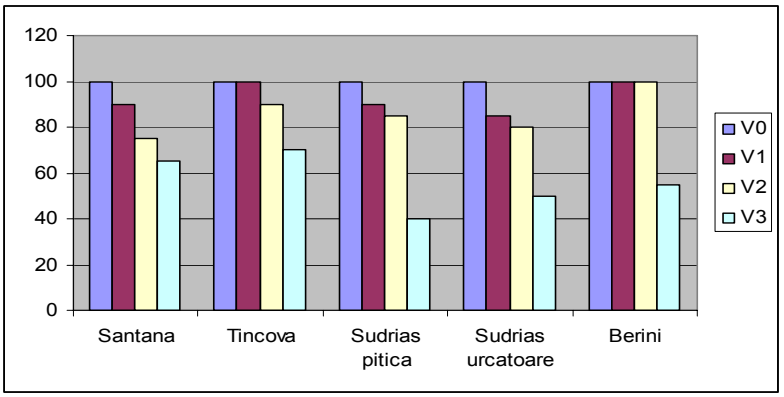

Fig. 2. Experimental results regarding germination potential of studies genotypes after 192 hours (%)

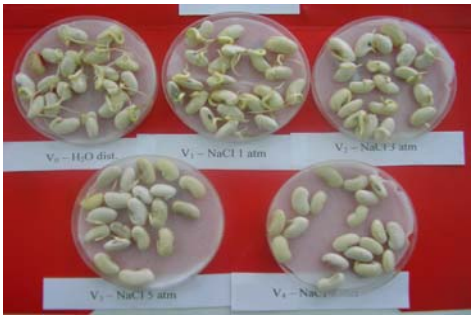

Fig. 3. Germination potential of studies genotypes after 192 hours (%)

The dry matter percent showed that in V_3 the most tolerant genotypes was Tincova with 12.50 % (radicle) and 12.02 % (cotyledon) d.m. (Fig. 3).

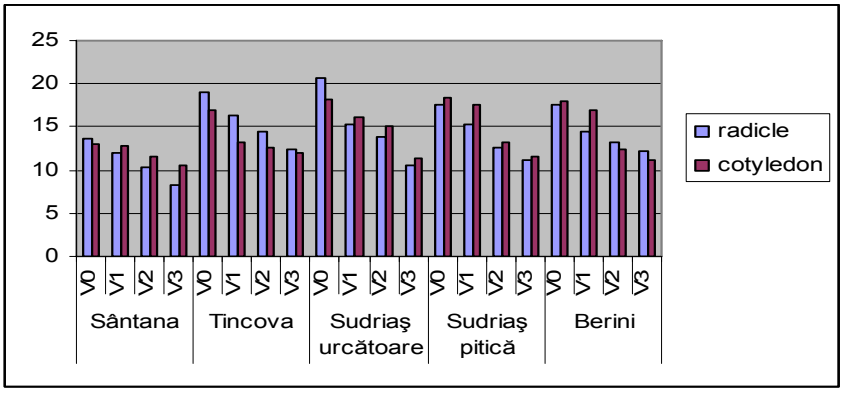

Fig. 3. Dry matter content at studied genotypes (%)

The same results was observed in the case of free proline accumulation, the higher value was obtained in genotypes Santana with 2.979067 mg/g f.w. on (V_3) variant (Table 3).

Table 1

Radicle and cotyledon lenght after 96 hours (cm)

Genotype	V_0		V_1		V_2		V_3	
	radicle	cotyledon	radicle	cotyledon	radicle	cotyledon	radicle	cotyledon
	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$
Santana	3.27±0.39	0.82±0.35	3.0±1.15	0.60±0.2	1.24±0.6	0.38±0.34	0.97±0.7	0.40±0.2
Tincova	3.36±1.35	0.79±0.23	2.31±0.8	0.73±0.2	1.25±0.6	0.55±0.37	0.45±0.2	-
Sudrias pitica	2.32±1.72	0.76±0.55	1.89±1.2	0.75±0.5	1.86±0.9	0.91±0.31	0.6±0.35	0.3±0.12
Sudrias urcatoare	1.25±0.81	0.65±0.53	1.33±0.6	0.27±0.3	0.82±0.4	0.2±0.26	0.03±0.1	-
Berini	0.93±0.23	1.52±0.55	0.73±0.1	1.09±0.6	0.60±0.2	0.36±0.44	0.46±0.2	-

Table 2

Radicle and cotyledon lenght after 192 hours (cm)

GENOTYPE	V_0		V_1		V_2		V_3	
	radicle	cotyledon	radicle	cotyledon	radicle	cotyledon	radicle	cotyledon
	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$	$X \pm Sx$
Santana	6.40±3.21	1.86±0.56	5.86±1.84	1.47±0.38	3.31±2.37	1.22±0.44	1.76±0.02	0.68±0.36
Tincova	4.40±1.5	2.28±1.27	7.44±2.76	2.85±1.25	1.57±0.68	1.77±0.26	1.24±0.68	0.80±0.21
Sudrias pitica	3.0±1.87	3.18±1.32	5.60±1.89	2.93±1.27	3.27±2.01	3.24±1.24	0.72±0.25	1.00±0.01
Sudrias urcatoare	2.2±1.78	2.21±0.87	3.67±1.77	1.55±0.58	2.90±1.30	0.80±0.23	1.57±0.39	0.67±0.19
Berini	10.44±2.2	1.55±0.52	5.77±3.19	1.62±0.63	3.81±1.10	1.22±0.31	0.81±0.32	0.26±0.55

Table 3

Experimental results regarding the free proline accumulation level

Genotype	Var.	Mean (mg/g F.W.)	%	Dif. Mt.
Santana	V_0	1,1334±0,0622	100	0
	V_1	1,2362±0,0848	109,0701	0,1028
	V_2	1,368967±0,07045	120,7841	0,235567
	V_3	2,979067±0,35315	262,8434	1,845667
Tincova	V_0	0,969267±0,04475	100	0
	V_1	0,921633±0,0207	95,08563	-0,04763
	V_2	1,155633±0,0575	119,2276	0,186367
	V_3	1,891533±0,030301	195,151	0,922267
Sudrias pitica	V_0	1,394833±0,09635	100	0
	V_1	1,107267±0,00675	79,38344	-0,28757
	V_2	0,9982±0,134	71,56411	-0,39663
	V_3	1,272533±0,073451	91,23193	-0,1223
Sudrias urcatoare	V_0	1,078633±0.0657	100	0
	V_1	1,337533±0.04289	124,0026	0,2589
	V_2	1,396467±0.1425	129,4663	0,317833
	V_3	1,805033±0.00879	167,3445	0,7264
Berini	V_0	1,6964±0.04219	100	0
	V_1	1,219467±0.0578	71,88556	-0,47693
	V_2	2,4538±0.9086	144,6475	0,7574
	V_3	1,6615±0.7685	97,9427	-0,0349

The proline accumulation is a common metabolic response of superior plants affected by water deficit and saline stress condition. We noted that the higher amount of free proline content were in stressed variants (V_3), because of osmoprotectant role of this (Fig. 4).

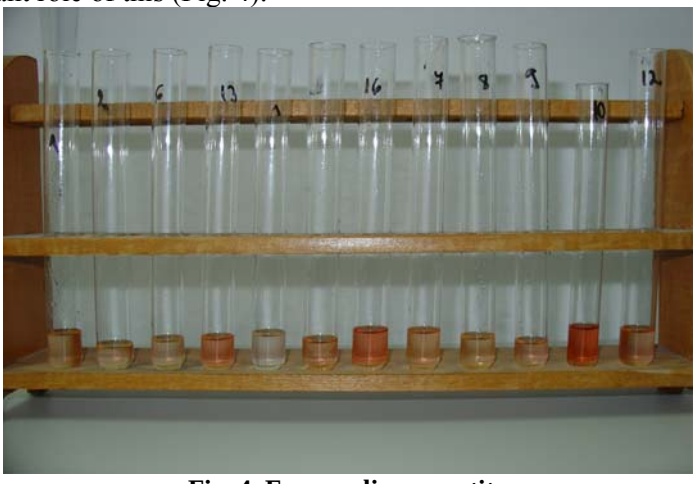

Fig. 4. Free proline quantity

CONCLUSIONS

The osmotic stress induced using saline solution (5 atm NaCl P.O.) generated reduction of the germinating rate during the entire experimental period.

Regarding the dry matter amount osmotic stress produce an increase of dry matter percent and some genotypes showed some tolerance (Tincova).

The results confirm the correlation between the synthesis of free proline and tolerance to osmotic stress, the best genotypes was Santana.

Regarding the growing rate the saline stress produce a decrease of growing rate of studied genotypes, but some genotypes showed moderate tolerance (Santana and Tincova).

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