Bangladesh j. Bot. **47**(3): 795-797, 2018 (September) Special **- Short communication**

EFFECTS OF SODIUM CHLORIDE, BORON AND ALUMINIUM STRESSES ON FREE PROLINE CONTENT DURING WATERMELON SEED GERMINATION

WEISHUN CHENG, DANLI ZENG[1], ANHUA ZHANG*, HONGXIA ZENG, JUHONG ZHU AND YUHUA LI

Institute of Crops, Wuhan Academy of Agricultural Sciences, Wuhan, Hubei430345, China

Keywords: NaCl, Boron, Aluminium, Stress, Proline, Watermelon, Seed germination

Abstract

Plants accumulate proline under a variety of stress conditions thereby preventing stress-caused damages. The proline accumulation in germinating seeds of watermelon in response to NaCl, boron and aluminium treatments were studied. Results showed increased accumulation of proline in salinity, boron and aluminium stressed in germinating watermelon seeds.

Abiotic stresses influence survival, biomass production and crop yield in negative manner. Proline, an electro cyclic low molecular weight protein amino acid of glutamate family, has attracted considerable attraction of many ecophysiologists in last two decades. It is an organic osmoprotectant which accumulates in large number of plant species exposed to environmental stresses such as salinity, drought, extreme temperature, UV radiations and heavy metals (Hare and Cress 1997). The level of proline accumulation varies from species to species and also among the plant organs (Nathalie and Christian 2008).

The present work was carried out to investigate the effects of salinity, boron and aluminium toxicity on proline accumulation so as to assess the significance of proline in stress tolerance in germinating seeds of watermelon.

Healthy seeds of watermelon were sorted out and surface sterilized with 1% sodium hypochloride for two min. Petri dishes were sterilized with absolute alcohol and lined with Whatman filter paper No.1 at bottom. Ten seeds of watermelon were allowed to germinate on a Petri dish at 30ºC in BOD under the influence of three concentrations of NaCl (0.4, 0.8 and 1.2%), Boron (10, 50 and 100 mg/l) and aluminium (5, 10 and 50 mg/l) and these Petri dishes were covered at different stages of germination from 24 to 120 hrs. The free proline content was determined by employing the method of Bates *et al.* (1973). In addition, nine Petri dishes were used for each treatment and also for control.

The results revealed highest proline content at 120 hrs of seed germination by lower doses of NaCl as compared to 24 hrs whereas decrease in proline content was found. The role of proline as osmolyte in salt stressed tissues is supported by many physiologists. The increase in proline content due to NaCl treatment has been reported by some workers (Durgaprasad *et al.*1996). Similarly Wang *et al.* (2011) found higher proline contents, increased activity of orn-δ-amino transferase and reduced proline dehydrogenase in the leaves of *Saussurea amara* under salinity stress. Results obtained during the present study showed that accumulation of proline at 120 hrs may play a significant role against the salt stress (Fig. 1).

*Author for correspondence: <405650151@qq.com>. [1]Faculty of Material Science and Chemistry, China University of Geosciences, Wuhan, Hubei 430074, China.

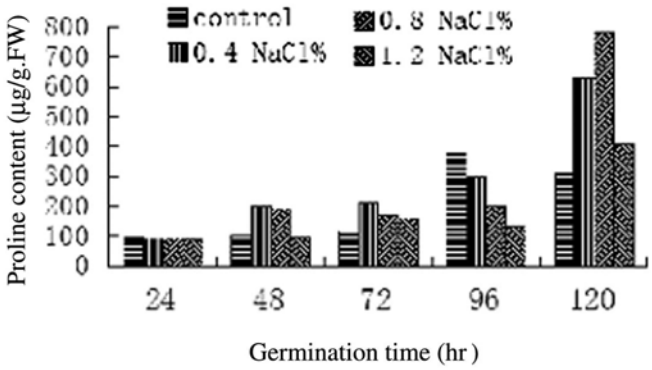

Fig. 1. Effect of various NaCl stress on the free proline content during watermelon seed germination.

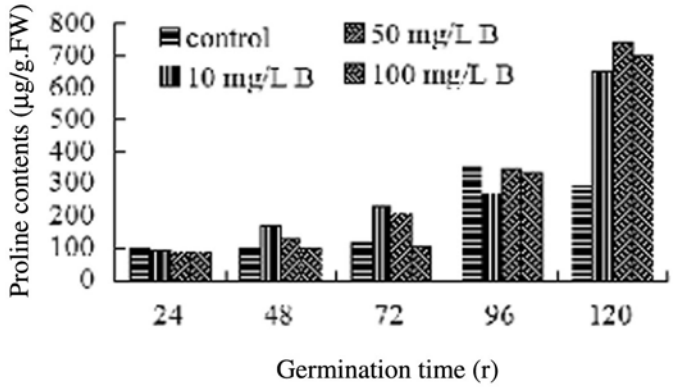

Fig. 2. Effect of various concentrations on boron on free proline content during watermelon seed germination.

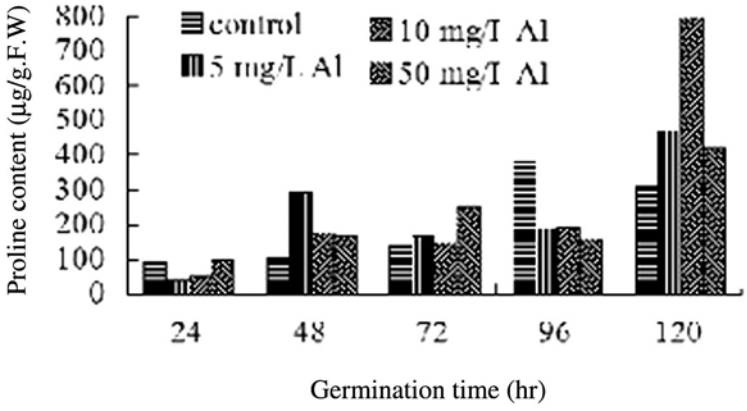

Fig. 3. Effect of various concentrations of aluminium on free proline content during watermelon seed germination.

Induction in proline accumulation was found at different stages of watermelon seed germination more particularly by 10 and 50 mg/l of boron. However higher concentrations of boron (100 mg/l) in the medium adversely affected the proline concentration (Fig. 2). If a level of proline is related to stress tolerance potential it can be concluded that boron concentrations above 50 mg/l are not desirable for the watermelon seed germination.

In acidic soil major problem is aluminium toxicity was found to be limit the growth of plants (Kochiana *et al.* 2005). Soil acidity is reported to cause accumulation of proline in pea, soybean, wheat, barley, maize, sorghum and Polygonum (Guo *et al.* 2004). The proline accumulation was found to be increased by aluminium treatments at 48, 72 and 120 hrs, while opposite trend was noticed at 24 and 96 hrs of watermelon seed germination (Fig. 3). The initial decrease in proline content is in agreement with the earlier report of Satokopan *et al.* (1990). Guo (2004) stated that Al and Cd toxicity caused increase in proline levels in barley seedlings.

Result obtained during the present study indicated that the stimulation in proline accumulation may reflect a common strategy to overcome the stresses due to NaCl, boron and aluminium in germinating watermelon seeds.

Acknowledgements

This work was financially supported by a grant from the Wuhan Academy of Agricultural Science and Technology Project Foundation (CX 201806).

References

Bates LS, Waldern RP and Teare TD 1973. Rapid determination of proline for water stress studies. Plant Soil **39**: 205-207.

Durgaprasad KMR, Muthukumarswamy M and Panneerselvum R 1996. Changes in protein metabolism induced by NaCl salinity in soybean seedlings. Indian Jr.Plant Physiol. **1**: 98-101.

Guo T, Zhang G, Zhou M, Wu F and Chen J 2004. Effects of aluminium and cadmium toxicity on growth and antioxidant enzyme activities of two barley genotypes with different Al resistance. Plant and Soil **258** (1): 241-248.

Hare PD and Cress WA 1997. Metabolic implications of stress-induced proline accumulation in plants. Plant Growth Regulation **21**: 79-102.

Herrera-Rodriguez MB, Gonzalez-Fontes A, Rexach J, Camacho-Cristobal JJ, Maldonado JM and Navarro-Gochicoa MT 2010. Role of boron in vascular plants and response mechanism to boron stresses. Plant Stress **4**(2): 115-122.

Kochiana LV, Pineros MA and Hoekenga OA 2005. The physiology, genetics and molecular biology of plant aluminium resistance and toxicity. Plant Soil **274**: 175-195.

Nathalie V and Christian H 2008. Proline accumulation in plants: a review. Amino Acids **35**: 753-759.

Satokopan VN, Sankar M and Baskaran 1990. Determination of toxicity levels of Al^{3+} in chickpea (*Cicer arietinum* L) seedlings. Indian Jr. Plant Physiology **35**:90-94.

Wang K, Liu Y, Dong K, Dong J, Kang J, Yang Q, He Z and Sun Y 2011. The effect of NaCl on proline metabolism in *Saussurea amara* seedlings. African Journal of Biotechnology **10**(15): 2886-2893.

(Manuscript received on 7 May, 2018; revised on 15 July, 2018)