ACTION OF SALINITY ON SEED GERMINATION AND SEEDLING GROWTH OF *SOLANUM MELONGENA* L.

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ABSTRACT

Effect of seven salinity levels on seed germination, and seedling length, fresh and dry weights, carbohydrates contents and α- amylase activity of *Solanum melongena* (eggplant) was studied. Salinity progressively decreased the percentage of germination. The seedling length and the fresh and dry weights of root and shoot increased with increasing level of salinity up to 8.5 m. mhos/cm EC, indicating that eggplant tolerate quite high level of salinity at seedling stage. The soluble and insoluble carbohydrates contents and α-amylase activity were also affected by salinity.

INTRODUCTION

Its well recognized that salinity is a serious global agriculture issue. It is estimated that 20% of all cultivated and half of irrigated land is salt-affected **(Ghassemi *et al.*, 1995)**. High levels of salinity aggravate the delay in emergence and also retard the final percentage of seed germination in many plants **(Ayears and Hayward, 1948; Paliwal and Mailwal, 1972; Varshney and Baijal, 1977 ; Basalah, 1991 and Al-Moaikal, 2006)**. Salinity decreased the percentage of emergence (germination) in soybeans **(Abel and Macenzle, 1964; Barley (Kumar *et al.*, 1981);** eggplant **Savvas and Lenz, 2000**, wheat **(Khetawat *et al.*, 1967)** and *Zea mays* as moderate salinity did not affect the germination much **(Vrma, 1981)** and only caused retardation in emergency of wheat and barley **(Ayears *et al.*, 1952)**. Fresh and dry weights of root and shoot were decreased with increasing salinity levels **(Vrma, 1981, Kumar *et al.*, 1981 and Siddiqui *et al.*, 2009)**. In addition to inhibition of germination and early seedling growth stages also may be sensitive to salinity. It has been reported that soluble salts at high salinity levels significantly suppressed growth in different crop plants **(Bernstein and Hayward, 1958; Nieman, 1962; Siddiqui *et al.*, 2008)**. The saline aerosol has

affected much the sugar contents in beans **(Sacher and Staples, 1985; Al-Moaikal, 2006).** Since, some arid regions are characterized with high salt content in the soil and one of the problems isseed germination and establishment of crops under these conditions. In addition, the information available on crop performance under saline conditions is very limited **(Paliwal, 1972),** it may be of much importance to know the effect of different salinity levels on different growth parameters, especially the germination and early seedlings growth. In this study the most common *Solanum melongena* (eggplant) seeds were used to evaluate the effect of different salinity levels on germination, seedling growth, carbohydrate contents and α-amylase activity.

MATERIAL AND METHODS

Eggplant (*Solanum melongena*) seeds cv. Balady were obtained from market sources and experiments were performed under saline conditions at controlled temperature (20 ± 1^{0}C) in 9 cm Petri dishes. Initially seeds were surface sterilized with 1% sodium hypochlorite, and then seeds were germinated in Petri dishes, each containing two Whatman No. 1 filter paper.

Saline solution of specific m mhos/cm EC was prepared by dissolving NaCl, $NaHCO_3$, Na_2SO_4 and $CaCl_2$ in distilled water, by adopting the **method of United States Salinity Laboratory Staff Hand-Book No. 60(1968).** Treatments consisted of 5 ml, saline solution at 0, 4, 8, 12, 16, 20 and 24 m mhos/cm EC were added to the Petri dishes. Each treatment was replicated 3 times following the soaking numbers of germinated seeds were taken at every 24 hours up to 7 days, when germination was almost complete. Measurements of root and shoot (hypocotyls) lengths (for all the seeds) and samples for weights (fresh and dry) and sugar contents were taken from 7- day-old seedlings as previously described by **Basalah (1991).**

Two grams samples of plant material (root and shoot) were taken in triplicate for the extraction of α-amylase and carbohydrates. Enzyme assay and analysis of carbohydrates were carried as previously done by **Basalah *et al.*, (1986).** standered deviation from the mean values was calculated for all the parameters.

RESULTS

With an increase in the salinity level, the percentage of seeds germination was progressively decreased (Fig. 1). However, the rate of germination during the first few days of incaution in root and shoot length was observed with the increase of salinity level of 4-8 m mhos/cm EC, but above those levels there was a gradual decrease (Fig. 2). The fresh and dry weights of root and shoot were increased at salinity levels of 4-8 m mhos/cm EC.

Fig. 1 Effect of salinity on egg plant seed germination %

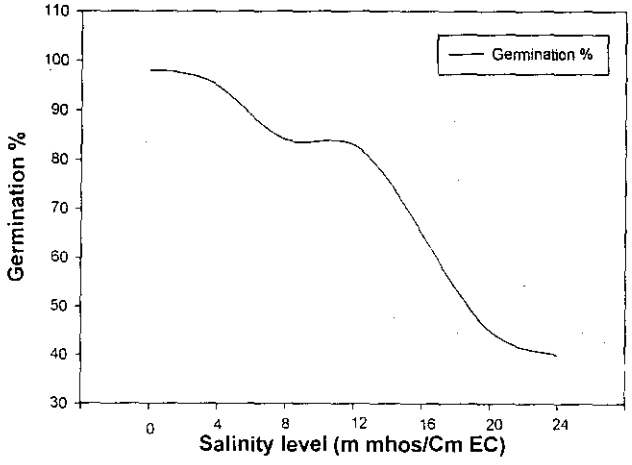
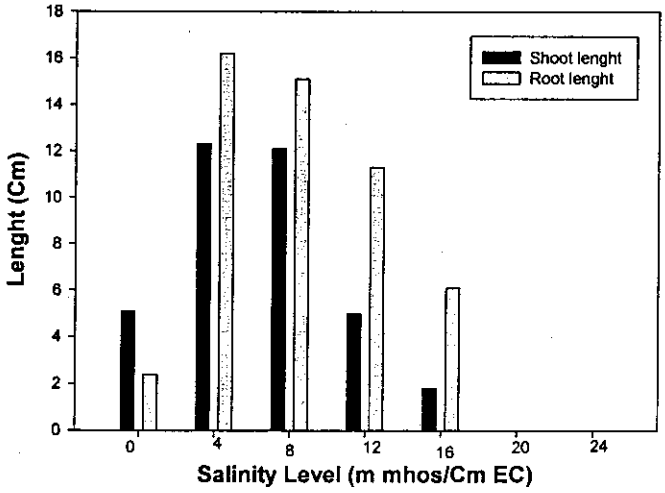
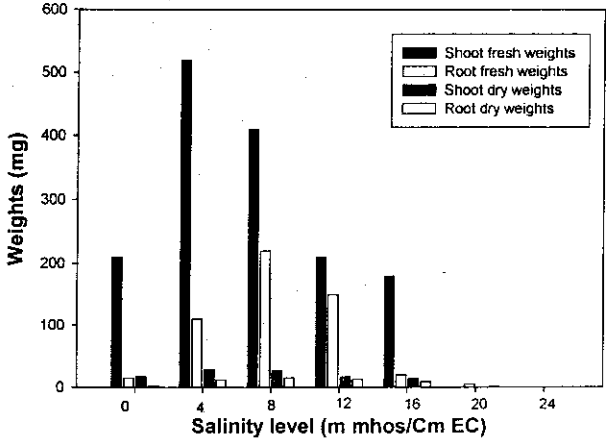


Fig. 2 Effect of salinity on shoot and root lenght of egg plant seedling



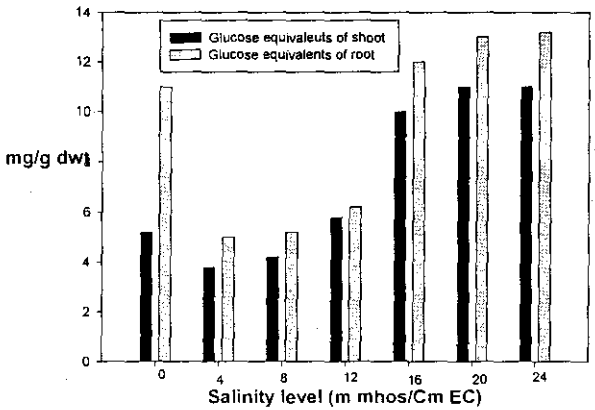
However, shoots showed maximum weight (fresh and dry) at 4, and roots at 8 m mhos/cm EC salinity levels. Above those levels of salinity, the fresh and dry weights in both root and shoot were decreased gradually (Fig. 3).

Fig. 3 Effect of salinity on fresh and dry weight of shoot and root of egg plant



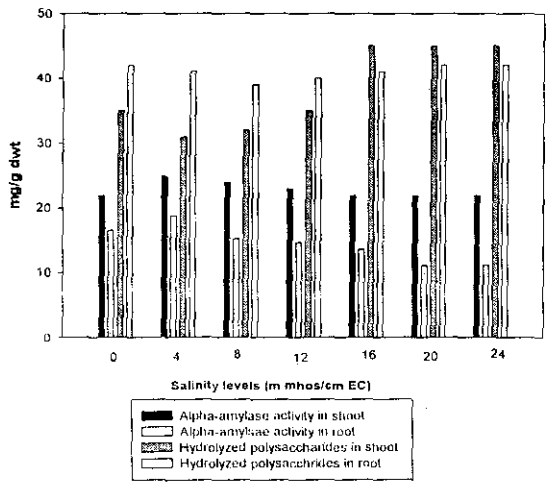
The sugar content in seedlings treated with different levels of salinity was found maximum at 20 and 24 m mhos/cm EC as compared with the other treatments and control (Fig.4).

Fig. 4 Effect of salinity on glucose equivalents of shoot and root of egg plant



The α-amylase activity was increased at low salinity levels compared with the control (Fig. 5), in both of root and shoot, but the activity decreased with an increased in salinity levels.

Fig. 5 Effect of salinity on Alpha-amylase activity and hydrolyzed polysaccharides contents in shoot and root on egg plant seedlin



Conversely, hydrolyzed polysaccharides were decreased at low salinity in roots and shoots but increased sharply in shoots with the increase in salinity levels (Fig. 5). However, in roots, the hydrolyzed polysaccharides did not show much increase with the increase in salinity levels (Fig. 5)

DISCUSSION

The percentage of germination was decreased with increasing salinity levels in this study. These results agree those of **Kumar *et al.*, (1981), Abel and Macenzle (1964), Paliwal and Maliwal (1972), Al-Moaikal (2006) , Varshney and Baijal (1977) and Basalah (1991)** who reported that salinity decreased both the rate and percentage of germination and emergence, in different crops. The decrease in the ultimate germination in the present study, may be due to the combined effect of osmotic pressure and toxicity of salts **(Al-Moaikal, 2006, Bernstein and Hayward, 1958 and Uhvit, 1946)** or due to the effect of added Cl^- ions **(Abel and Mackanzie, 1964 and Gill *et al.*, 2002)** who examined the effect of sodium chloride in the cell under conditions that give raise to osmotic stress without exposing seeds to toxic concentrations of salt.

During growth, it was observed that root and shoot fresh and dry weights were increased at low salinity levels and decreased at high levels of salinity. **Varma (1981) and Savvas and Lenz (2000)** on eggplant has reporte the decreased in fresh and dry weights due to salts stress. A similar effect was also observed in *Zea mays* seedlings as stated by **Al-Moaikal (2006), Bruria *et al.*, (1986)** on egg plant and in barley seedlings **(Abel and MacKenzle 1964, Kumar *et al.*, 1981).** However, the increase in fresh and dry weights at low salinity levels may be due to more growth at those levels on uptake of more salts at that stage of growth **(Basalah 1991).**

In the present study, it is observed that there was more growth at low salinity (4 and 8 m mhoss/cm EC) levels than in the control and more than higher levels of salinity. This suppressed growth at higher levels of salinity as reported by many workers **(Al-Moaikal, 2006; Gauch and Eaton, 1942; Hayward and Wadleigh, 1949; Nieman, 1962; Sacher and Staples, 1985).** However, more growth at lower levels of salinity may be explained by the findings of **Kumar *et al.*, (1981)** who found that the effect of salinity on plant growth may be

depended on its stage of development. Moreover, responses may be quite different at the germination stage and later stage of development as in *Zea mays* **(Al-Moaikal 2006) , Akinci *et al.*, (2004)** on egg plant and **Basalah (1991)** on squash.

Elevated sugar content in salt-stressed tissues is widespread phenomenon **(Greenway and Munns, 1980; Basalah, 1991)** in *cucubita pepo* (squash), **Al-Moaikal 2006** in *Zea mays* and **Zafar *et al.*, (2005)** in cotton. In the present study (Fig.3), it was observed that there is a maximum growth at 4 to 8 m mmho/cm Ec salinity levels as well as less sugar (Fig.4), though there is more α-amylase activity at those levels of salinity (Fig.5). This result is in good agreement with **Basalah, (1991)** on squash **and Pascale and Barbieri (1995)**. On winter vegetables Conversely, there is more sugar recorded at higher salinity levels with less enzyme activity. These results may be explained on the assumption that accumulation of sugars, which occurred in the control and at higher salinity levels, may be the result of reduced utilization due to reduced growth **(Basalah, 1991; Dash and Panda 2001 and Gill *et al.*, 2002)** and reduction in sugar content at lower salinity levels may be the result of higher growth and hence, more utilization of sugars **(Sacher and Staples, 1985)**. The hydrolyzed polysaccharides, in the present study, are generally correlated with the enzyme activity and those resulted are in good agreement with **Basalah, (1991) Al-Moaikal (2006) and Jaradat *et al.*, (2004).**

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الملخص

فعالية الملوحة علي إنبات ونمو بادرات الباذنجان

محمد عمر عبد الله باصلاح

قسم النبات والأحياء الدقيقة – كلية العلوم – جامعة الملك سعود ص.ب ٢٤٥٥ الرياض ١١٤٥١ المملكة العربية السعودية.

بدراسة سبعة مستويات من الملوحة علي انبات بذور الباذنجان البلدى الاسود، وطول المجموع الجذري والخضري والوزن الطازج والجاف للبادرات ومحتوي السكريات ونشاط انزيم الفا اميلاز. وجد ان النسبة المئوية تتناقص بزيادة الملوحة، مع ان بذور الباذنجان الاسود ابدت مقاومة للملوحة في المراحل الاوليه للانبات ، لكن مع زيادة الملوحة زاد طول المجموع الجذري والخضري والوزن الطازج والجاف للبادرات حتي ٨ مليموز/سم من التوصيل الكهربائي، مما يدل الي ان البادرات تمكنت من تحمل تركيزات عالية من الملوحة. وقد تأثر بالملوحة محتوي السكريات الذائبة وغير الذائبة ونشاط انزيم الفا اميلاز.