*J. Agric. Sci. Mansoura Univ., 31 (9): 5899 - 5907, 2006*

# RESPONSE OF *Calliandra eriophylla* Benth SEEDLINGS TO SALINE WATER IRRIGATION UNDER EI-ARISH CONDITIONS

**El-Mekawy, M. A. M.**
**Plant Production and it's Protection, Faculty of Environmental Agriculture Science, El-Arish, Suez Canal University**

## ABSTRACT

Two field experiments were carried out during two successive seasons of 2003/2004 and 2004/2005 on sandy soil at the Experimental Farm of the Faculty of Environmental Agriculture Science, El-Arish, Suez Canal University to evaluate the effect of using the regional high salinity groundwater from representative wells (3200 ppm. as control, 5120 and 7040 ppm.) in drip irrigation of the transplants of *Calliandra eriophylla* Benth.

The results generally showed that using saline well water as drip irrigation at 3200 and 5120 ppm. had non significant effects on vegetative growth of seedlings. Increasing the level of salinity above 5120 was accompanied with significant decreases in most vegetative growth characters compared with control (3200 ppm.). On the other hand, all saline water irrigation levels above control decreased the pigments content. Generally there were steady increases in the leaf content of proline, as well as Na, Ca and Cl.

**Keywords:** Saline Water Irrigation, *Calliandra eriophylla* Benth

## INTRODUCTION

Sinai peninsula, the eastern gate of Egypt, has been left without development until the last two decades. Many great projects have been planned and executed to achieve this goal, especially through increasing the habitants of this important area. The transfer of Nile water to Sinai is the utmost of these projects. However, the Nile water cannot be reached to every location in Sinai because of its vast area and the nature of its topography, so groundwater is considered the only resource of water in such location. Generally, the groundwater of North Sinai is high saline and the lack of the water supply are the major problems facing the extension of plantation under desert and newly reclaimed land conditions. The search for salinity resistant plant species is of a great importance for landscaper to select plants for such Sinai areas and it allows to increase the cultivated plants in areas with sever shortage of water and in regions where saline water is used for irrigation.

Fairy Duster (*Calliandra eriophylla* Benth) Family: Fabaceae also called False Mesquite, Mock Mesquite, Hairy-leaved it is low-growing evergreen shrub, Height 1 – 3 feet tall, with a spread of 3 – 4 feet. Flowers: pink flowering balls formed by the long pink filaments of 20 or more stamens emerging from small clustered flowers. Blooming time: February - May. Sometimes again in the fall. Leaves: Bipinnately compound, 1 - 1.5 inches long 1/2 inches across with fern shaped leaflets, 0.5 inch wide, 2 to 4 pairs of pinnate, each with 5 to 10 pairs of leaflets, 0.12 inch up to 0.2 inch long. Seeds dehiscent pods which pop open and eject seeds for a great distance at maturity. Landscape use as accent shrub for desert gardens (Isely,1973). Therefore, several investigators studied the relative salt tolerance of various

ornamental plants; El-Labban and El-Trawy (1977) on some annuals, Nofal *et al.* (1983) on *Thuja orientalis*, El-Shewakh (1995) on *Acalypha macrophylla*, *Sambucus nigra* and *Justicia gendarussa*, Farahat *et al.* (1995) on *Acalypha macrophylla*, Omran *et al.* (1996) on some tree seedlings, Kandeel (1997) on *Hibiscus rosa sinensis* and El-Shennawy (2005) on *Encelia farinosa* and *Oenothera missouriensis* plants. Thus, the objective of the current study was to evaluate the effects of using the regional saline groundwater of El-Arish in irrigation of *Calliandra eriophylla* plants.

## MATERIALS AND METHODS

Two field experiments, in a complete randomized design were carried out in the Nursery of Floriculture, Faculty of Environmental, Agriculture Science, El-Arish, Suez Canal University during two successive seasons of 2003/2004 and 2004/2005 under the conditions of sandy soil.

On March 20$^{th}$ in the two seasons, uniform seedlings (about 6 months old) were individually transplanted at spacing of 45 cm. between plants and 100 cm. between rows. The plants received enough amounts of control water for obtaining a good establishment. On April 15$^{th}$, the seedlings in saline groundwater treatments were irrigated with suffusion water to maintain soil moisture at 65-70 % of the field capacity by using drip irrigation system. The concentration of well water were 3200 ppm. as a control, 5120 and 7040 ppm. The chemical analysis of the water irrigation examined is shown in Table (A).

**Table A: Chemical analysis of the used water irrigation in both seasons.**

| meq / L | | 1$^{st}$ well | 2$^{nd}$ well | 3$^{rd}$ well |
|---|---|---|---|---|
| $Ca^{++}$ | ,, | 10.60 | 16.89 | 23.67 |
| $Mg^{++}$ | ,, | 5.80 | 9.24 | 12.95 |
| $Na^{+}$ | ,, | 32.70 | 52.32 | 73.35 |
| $K^{+}$ | ,, | 0.98 | 1.56 | 2.18 |
| $Cl^{-}$ | ,, | 40.50 | 64.55 | 90.49 |
| $CO_3^{--}$ | ,, | ,, | ,, | ,, |
| $HCO_3^{-}$ | ,, | 5.68 | 9.25 | 12.96 |
| $SO_4^{--}$ | ,, | 3.90 | 6.21 | 8.71 |
| EC $dSm^{-1}$ | ,, | 5.00 | 8.00 | 11.00 |
| Concentration | ppm | 3200 | 5120 | 7040 |

**Table B: Chemical and mechanical analysis of the soil before conducting the experiment in both seasons.**

| Soil properties | Seasons | |
|---|---|---|
| | 2003 | 2004 |
| **Mechanical analysis** | | |
| Coarse sand% | 27.95 | 27.90 |
| Fine sand% | 62.05 | 61.60 |
| Silt% | 7.00 | 7.05 |
| Clay% | 3.00 | 3.10 |
| Soil texture | Sandy | Sandy |
| **Chemical analysis** | | |
| | meq/L | |
| $Ca^{++}$ | 1.20 | 1.60 |
| $Mg^{++}$ | 0.89 | 1.00 |
| $Na^{+}$ | 22.01 | 21.10 |
| $K^{+}$ | 0.60 | 0.68 |
| $Cl^{-}$ | 23.10 | 22.90 |
| $CO_3^{--}$ | - | - |
| $HCO_3^{-}$ | 0.88 | 0.86 |
| $SO_4^{-}$ | 0.72 | 0.74 |
| EC $dSm^{-1}$ | 2.47 | 2.45 |
| pH | 8.27 | 8.63 |

The plants were treated with different levels of saline water for 8 months. All the other agricultural practices were carried out. The following data were recorded: plant height (cm.), stem diameter (mm.), number of branches / plant, number of leaves / plant, fresh and dry weight of leaves, stem and roots (g).

Pigment contents were determined in leaf samples (mg/g f.w.) according to Saric *et al.* (1967). Total carbohydrates % in dried leaves, stems and roots were determined according to Herbert *et al.* (1971). The proline content(u mol/100 gm f. w.) was determined in fresh leaves according to Bates *et al.* (1973). Total nitrogen % was determined by microkjeldahl method (Pregl, 1945), Phosphorus % was estimated colorimetrically (Trough and Meyer, 1939). Potassium and sodium % were determined by flame-photometer method. Calcium was volumetrically determined (EDTA- Method) as described by Dewis and Freitas (1970). The content of chloride was estimated volumetrically as described by Jackson (1970). The chemical analyses of the experimental soil such as cations ($Ca^{++}$,$Mg^{++}$, $Na^{+}$, $K^{+}$ ) and anions ($Cl^{-}$ , $SO_4^{--}$ $HCO_3^{-}$) were determined according to Black (1965) as shown in Table (B). The mean values of each treatment were compared by the Duncan's Multiple Range Test according to Sendecor and Cochran (1980).

## RESULTS AND DISCUSSION

### 1- Vegetative growth characters:

Data on vegetative growth of *Calliandra eriophylla* seedling in response to irrigation with saline well water are presented in Table (1). The results can be discussed as follows:

**Table (1): Effect of saline water irrigation on some growth parameters of *Calliandra eriophylla* seedlings during 2003/2004 and 2004/2005 seasons.**

| Salinity levels (ppm) | Plant height (cm.) | Stem diameter (mm.) | No. of branches / plant | No. of leaves / plant | Fresh weight (gm) | | | Dry weight (gm) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Leaves | Stems | Roots | Leaves | Stems | Roots |
| | First season (2003/2004) | | | | | | | | | |
| 3200 | 71.18 | 10.25 | 7.24 | 32.5 | 51.4 | 38.61 | 30.12 | 11.24 | 10.54 | 9.68 |
| 5120 | 69.76 | 9.86 | 6.32 | 28.8 | 48.3 | 35.45 | 28.37 | 10.58 | 10.16 | 7.95 |
| 7040 | 54.27 | 7.93 | 5.66 | 25.6 | 30.2 | 28.64 | 25.87 | 6.64 | 9.41 | 6.24 |
| LSD at 5% | 4.25 | 1.54 | 1.31 | 5.32 | 4.12 | 3.94 | 2.58 | 1.91 | 0.92 | 1.53 |
| | Second season (2004/2005) | | | | | | | | | |
| 3200 | 76.81 | 11.41 | 7.68 | 40.2 | 53.53 | 41.24 | 33.51 | 11.85 | 11.47 | 10.45 |
| 5120 | 73.94 | 10.32 | 6.42 | 36.4 | 50.35 | 39.59 | 30.85 | 11.38 | 10.84 | 9.74 |
| 7040 | 62.45 | 8.17 | 5.73 | 27.8 | 33.47 | 30.54 | 27.22 | 7.14 | 9.76 | 6.61 |
| LSD at 5% | 4.81 | 1.56 | 1.41 | 5.61 | 5.24 | 4.05 | 2.94 | 1.95 | 1.13 | 1.64 |

### a. Plant height (cm):

The saline water irrigation treatment generally decreased plant height as, this decrease was significant with the level of 7040 ppm. comparing with 5120 and 3200 ppm. Also, the plant height was decreased as salinity levels were increased up to 7040 ppm. which gave the minimum values, while the maximum plant height was achieved at low saline water irrigation (3200

ppm.) in the two seasons. El-Mahrouk *et al.* (1992) found similar results on *Dodonea viscosa*, El-Shewakh (1995) on *Acalypha macrophylla*, *Sambucus nigra* and *Justicia gendarussa* and Omran *et al.* (1996) on some tree seedlings. Such decrease in plant height might be due to that salinity which results from the saline irrigation water decreased cells division of plant, and caused inhibition of both meristematic activity and biosynthesis of hormones responsible for cell elongation (Afanas' ev *et al.*, 1991)

**b- Stem diameter:**

The data indicated that, in the first season, irrigation of the seedlings with saline water containing 3200 and 5120 ppm. salts increased the stem thickness as compared with the highest level of salinity (7040 ppm.) with significant changes in stem thickness were found among the two high levels of salinity especially in the second season. However, it can be mentioned that the low level of saline water had a slight promoting effect on this character, as compared with the control, but the differences were significant when compared with the high level of salinity. These results agree with Bernstein *et al.*(1974) who pointed out that the accumulation of specific ions such as sodium and chloride in different plant tissues would probably exert an inhibitory effect on plant growth and development. Similarly, El-Khateeb (1994) on *Murraya exotica*, who reported that using saline water up to the level of 3000 ppm. had a promoting effect on stem thickness compared with the control (tap water) and Abdella (1995) on some timber trees, have demonstrated that increasing salinity level markedly decreased the stem diameter.

**c. Number of branches / plant:**

The obtained results revealed that there was a gradual decrease in the branches number as the level of salinity was increased. The reduction in branches number in the two seasons, occurred when saline water was attained the level of 5120 up to 7040 ppm. compared with the control (3200 ppm.) These results are in accordance with those of El-Khateeb (1994) on *Murraya exotica* and Kandeel (1997) on *Hibiscus rosa sinensis.* The decrease in branches number per plant due to saline water irrigation treatments might be due to the inhibitory effect of the salinity of well water on meristimatic activity consequently inhibiting the branching during growth. Also, salinity might cause a disturbance in natural hormones in plants leading to inactivate the growth of lateral buds (Tagawa and Ishizaka, 1963)

**d. Number of leaves / plant:**

The results obtained in the two seasons revealed that number of leaves / plant was markedly reduced with irrigating the seedlings with saline water at the different levels, with no significant differences between the level 5120 ppm. and the control (3200 ppm.). Similar results were found by Ismail (1993) on *Nerium oleander* and *Adhatoda vasica*. The decrease in leaves number might be due to the reduction in the whole development occurring in the plant as a result of salinity conditions leading to unbalanced growth of the plant consequently, the decrease in number of leaves per plant. (Benzioni *et al.*, 1996)

**e. Fresh and dry weight:**

In both seasons, the obtained results revealed that the fresh weight of leaves, stems and roots decreased with increasing the level of salinity. The decreases in fresh weights were significant when salinity used reached the level of 7040 ppm. as compared with the control. The greatest reductions in fresh weight of leaves were obtained with the highest level of salinity (7040 ppm.) in both seasons. Also the data revealed that the use of saline water at levels above 5120 ppm. caused a significant reduction in the dry weight of leaves and stems. On the other hand, the dry weight of roots was significantly reduced with the highest level of salinity (7040 ppm.) when compared with the control and (5120 ppm.) of salinity. Similar findings were reported by Mohamed *et al.* (1996) on *Acacia saligna*, El-Shennawy (2005) on *Encelia farinosa* and *Oenothera missouriensis* plants and El-Mekawy (2006) on *Achillea santolina* plants who stated that well water at the concentration of 7000 ppm. significantly reduced the survival percentage and vegetative growth parameters when compared to irrigation with 3000 and 5000 ppm.

The effect of saline water irrigation on growth may be due to that soluble salts in the well water decrease the free energy of the soil water, accordingly deceasing the availability of water to plants, the growth is inhibited by an excess of salts taken up by plants from saline soil as energy spent by plants to maintain turgur pressure is at the expense of the growth and salts may exert detrimental effect on plant growth through, toxicity of one or more specific ions present in higher relative concentrations (Everado *et al.*, 1975).

**2. Pigments content:**

Data on the effect of saline water irrigation on chlorophyll a, b and total carbohydrate content are shown in Table (2). The data indicated that there were significant reduction in pigments as a result of increasing saline water irrigation treatment. However low saline water (3200 ppm.) gave the highest values of total chlorophyll a and b content, while high concentration of saline water irrigation gave the minimum values in this respect. Similar results were reported by Ismail (1993) on *Nerium oleander*, El-Khateeb (1994) on *Murraya exotica* and Kandeel (1997) on *Hibiscus rosa sinensis*.

Also, all salinity levels (except the highest level of 7040 ppm.) in both seasons decreased the content of total carbohydrates in the leaves as compared with the control (3200 ppm.). The irrigation with saline water at the different levels decreased the total carbohydrates in the stems, the greatest reduction was obtained with the highest salinity level (7040 ppm.) comparing to the control in the two seasons. Plants, irrigated with saline water at the level of 5120 ppm. decreased the rate of carbohydrates accumulation in the roots, but with increasing the levels of saline water irrigation there were increases in the rate of carbohydrates accumulation. Similar results were reported by Farahat *et al.* (1995) on *Acalypha macrophylla*.

Such decrease in total carbohydrates under saline condition may be attributed to the hazard effect on photosynthetic activity due to a decrease in the amount chlorophyll per unit of fresh leaf surface (Marler and Zozor, 1996 and Bethke and Drew, 1992) who attributed this effect of salinity to stomatal

closure under saline conditions which in turn cause reduction in photosynthesis products available for growth.

Concerning the response of proline to saline water treatments the data in Table (2) indicated that increasing the saline water irrigation caused an increase in the content of proline in the leaves, such increment was in proportion to the level of salinity. Therefore, the highest content of amino acid "proline" was recorded in both seasons, with the highest level of salinity (7040 ppm). The increases in proline content, accompanied with the increase in salinity stress, were in agreement with the previous results of El-Leithy and El-Khateeb (1992) on *Thevetia nereifolia* and El- Khateeb (1994) on *Murraya exotica* who found an accumulation in the content of proline as a result of salinity treatments.

**Table (2): Effect of saline water irrigation on content of pigments (mg/gm F.W.), total carbohydrates, proline (u mol/100 gm F.W.) of *Calliandra eriophylla* seedlings during 2003/2004 and 2004/2005 seasons.**

| Salinity levels (ppm) | Chl. a | Chl. b | Total carbohydrates % | | | Proline (u mol/100 gm F.W.) |
|---|---|---|---|---|---|---|
| | (mg/g f. w.) | | Leaves | Stems | Roots | |
| | First season (2003/2004) | | | | | |
| 3200 | 1.62 | 1.54 | 29.74 | 35.26 | 27.54 | 36.54 |
| 5120 | 1.12 | 1.19 | 26.58 | 30.58 | 28.54 | 40.21 |
| 7040 | 1.09 | 1.11 | 24.75 | 24.86 | 30.47 | 44.58 |
| | Second season (2004/2005) | | | | | |
| 3200 | 1.85 | 1.24 | 30.88 | 31.25 | 24.63 | 33.54 |
| 5120 | 1.68 | 1.15 | 27.31 | 24.36 | 27.65 | 37.25 |
| 7040 | 1.31 | 1.02 | 25.74 | 21.53 | 29.47 | 41.21 |

**3- Elements content:**

Data on the elements content (% D. W.) in the leaves of *Calliandra eriophylla* seedlings in response to underground saline water irrigation are presented in Table (3). The obtained data indicated that the highest level of saline water irrigation as 7040 ppm. decreased the N % in the leaves, while the level of 5120 ppm. increased it when compared to control (3200 ppm.) inthe first season. As for the second season the levels from 5120 to 7040 ppm. decreased the N % in the leaves when compared the control. In addition as salinity of water concentrations increased, the percentage of P and K were decreased to reach its minimum values with the 7040 ppm. concentration compared with 5120 and 3200 ppm. which gave the maximum values in this respect in both seasons.

Concerning Na and Cl percentages data in Table (4) revealed that with increasing the levels of saline water irrigation treatment the values were increased in the two seasons. However, the low saline water irrigation concentrations (3200 and 5120 ppm.) gave the minimum values. In addition, as salinity of water concentration increased, the percentage of Na, Ca and Cl were increased to reach maximum with that of 7040 ppm. In this respect similar results were reported by El-Mahrouk *et al.* (1992) on *Dodonea viscosa*, El-Shewakh (1995) on *Acalypha macrophylla*, *Sambucus nigra* and *Justicia gendarussa* and Kandeel (1997) on *Hibiscus rosa sinensis*.

Finally, from the above-mentioned results and discussion, it may be concluded that the seedlings of *Calliandra eriophylla* Benth can be irrigated with saline water irrigation containing salinity less than 7040 ppm. under El-Arish conditions without serious injuries.

**Table (3): Effect of saline water irrigation on nitrogen, phosphorus and potassium % in leaves, stems and roots of *Calliandra eriophylla* seedlings during 2003/2004 and 2004/2005 seasons.**

| Salinity levels (ppm) | Nitrogen % | | | Phosphorus % | | | Potassium% | | |
|---|---|---|---|---|---|---|---|---|---|
| | eaves | Stems | Roots | Leaves | Stems | Roots | Leaves | Stems | Roots |
| | First season (2003/2004) | | | | | | | | |
| 3200 | 1.52 | 1.23 | 1.24 | 0.18 | 0.25 | 0.13 | 3.31 | 2.66 | 1.77 |
| 5120 | 1.41 | 1.32 | 1.15 | 0.23 | 0.21 | 0.14 | 3.41 | 3.32 | 1.35 |
| 7040 | 1.38 | 1.16 | 1.09 | 0.17 | 0.19 | 0.12 | 3.56 | 2.86 | 0.99 |
| | Second season (2004/2005) | | | | | | | | |
| 3200 | 1.62 | 1.27 | 1.29 | 0.24 | 0.24 | 0.15 | 3.15 | 1.99 | 1.89 |
| 5120 | 1.51 | 1.19 | 1.24 | 0.25 | 0.21 | 0.14 | 3.25 | 2.94 | 1.74 |
| 7040 | 1.42 | 1.08 | 1.18 | 0.22 | 0.18 | 0.14 | 3.42 | 2.12 | 1.71 |

**Table (4): Effect of saline water irrigation on calcium, sodium and chloride % in leaves, stems and roots of *Calliandra eriophylla* seedlings during 2003/2004 and 2004/2005 seasons.**

| Salinity levels (ppm) | Calcium % | | | Sodium % | | | Chloride % | | |
|---|---|---|---|---|---|---|---|---|---|
| | Leaves | Stems | Roots | Leaves | Stems | Roots | Leaves | Stems | Roots |
| | First season (2003/2004) | | | | | | | | |
| 3200 | 2.35 | 2.29 | 1.24 | 2.34 | 2.24 | 1.80 | 0.23 | 0.21 | 0.21 |
| 5120 | 2.41 | 2.31 | 1.35 | 2.51 | 2.41 | 1.94 | 0.25 | 0.23 | 0.23 |
| 7040 | 2.52 | 2.47 | 1.47 | 2.57 | 2.45 | 1.97 | 0.29 | 0.26 | 0.28 |
| | Second season (2004/2005) | | | | | | | | |
| 3200 | 2.42 | 2.30 | 1.32 | 1.89 | 1.71 | 1.62 | 0.22 | 0.18 | 0.21 |
| 5120 | 2.47 | 2.33 | 1.37 | 2.18 | 1.89 | 1.69 | 0.24 | 0.19 | 0.26 |
| 7040 | 2.63 | 2.51 | 1.40 | 2.39 | 2.02 | 1.77 | 0.27 | 0.21 | 0.26 |

## REFERENCES

Abdella, E. M. (1995). Physiological response to salinity of some timber trees seedlings. M. Sc. Thesis, Fac. of Agric., El-Fayoum, Cairo University.

Afanas' ev, V.; V. Malofeev and T. Khisamov (1991). Cotton response to salt-water regime. Khlopok No. 4, 49-51. (C. F. Field Crop Abstr., 45 (9): 6533.

Bates, L. S.; E. P. Waldren and I. D. Teare (1973). Rapid determination of free proline under water stress studies Plant and Soil, 39: 205- 207.

Benzioni, A.; M. Ventura and Y. Demalach (1996). Long-term effect of irrigation with saline water on the development and productivity of jojoba clones. J. Hort. Sci., 71 (6): 835-846.

Bernstein, L.; L. E. Francois and R. A. Clark (1974). Interaction effects of salinity and fertility on yields of grains and vegetables. Agron., J. 66. 412-421.

Bethke, P. C. and M. C. Drew (1992). Stomatal and nonstomatal components to inhibition of photosynthesis in leaves of *Capsicum annuum* during progressive exposure to NaCl salinity. Plant Physiol., 99: 219-226.

Black, C. A. (1965). Methods of Soil Analysis Am. Soc. Agron., Madison, Wisconsin, U. S. A.

Dewis, J. and F. Freitas (1970). Physical and Chemical Method of Soil and Water Analysis. Food and Agric. Organ. U. N. , Rome (1970).

El-Khateeb, M. A. (1994). Response of *Murraya exotica* L. seedlings to saline water irrigation. Bull. Fac. Agric. Univ. Cairo, 45: 149-164.

El-Labban, H. M. and M. A. El-Trawy (1977). Effect of salinity on the growth and chemical analysis of *Kochia trichophylla* and *Zinnia elegans*. J. Agric. Res., Tanta Univ., 3 (2): 989-1008.

El-Leithy, A. S. and A. M. El-Khateeb (1992). Response of *Thevetia nereifolia* seedlings to saline water irrigation. Bull. Fac. Agric., Cairo, Univ., 43 (1): 313-332.

El-Mahrouk, E. M.; F. A. Menesy and B. A. Abdel-Maksoud (1992). Effect of salinity on the growth and chemical analysis of *Dodonea viscosa*. J. Agric. Res., Tanta Univ., 18 (4): 744-755.

El-Mekawy, M. A. M. (2006). Effect of irrigation intervals and salinity of irrigation water on the growth and chemical composition of *Achillea santolina* L. plants. J. Agric. Res., Tanta Univ., 32 (1): 149-172.

El-Shennawy, O. A. (2005). Effects of salinity on *Encelia farinosa* and *Oenothera missouriensis*. J. Agric. Sci. Mansoura Univ.,30 (6): 3301-3318.

El-Shewakh, Y. M. E., (1995). The response of some ornamental shrubs to irrigation with saline water. M. Sc. Thesis, Fac. of Agric. Cairo Univ.

Everado, A. N.; L. H. Stolzy and G. R. Mehuys (1975). Effects of soil osmotic potential produced with two salt species on plant water potential, growth and grain yield of wheat. Plant and Soil, 42: 619-627.

Farahat, M. M.; M. A. El-Khateeb and Y. M. El-Shewaikh (1995). The physiological response of *Acalypha macrophylla* plants to saline water irrigation. Zgazig J. Agric. Res., 22 (6): 1493-1506.

Herbert, D.; P. J. Phipps and R. E. Strange (1971). Determination of total carbohydrate. Methods in Microbial. 5 B p. 209-344.

Isely, D. (1973). Leguminosae of the United States: I. Subfamily Imosoideae. Mem. New York Bot. Gard., 25(1):79.

Ismail, M. F. M. (1993). Effect of salinity on growth and chemical composition of some ornamental shrubs. M. Sc. Thesis, Fac. Agric. Cairo Univ.

Jackson, M. L. (1970). Soil Chemical Analysis Prentice Hall of India, Private Limited; New Delhi, P. 115.

Kandeel, Y. M. (1997). Effect of soil salinity on the growth and chemical analysis of *Hibisius rosa sinensis* L. transplants. J. Agric. Res. Tanta Univ. , 23 (1): 32-47.

Marler,T. E. and Y. Zozor (1996). Salinity influences photosynthetic characteristics, water relation and foliar mineral composition of *Annona squamosa* L. J. Amer. Soc. Hort. Sci., 121(2): 243-248.

Mohamed, S. Y.; M.S. Shehata and Y. A. Husney (1996). The growth, specific gravity and fiber length of *Acacia saligna* seedlings as affected by saline irrigation water. Zagazig J. Agric. Res., 23 (1): 167-177.

Nofal, E. E., M. A. El-Trawy and E. M. Badawy (1983). Effect of sodium and calcium chlorides in soil on the growth and chemical analysis of *Thuja orientalis*. J. Agric. Res. Tanta Univ., 9 (1): 150-162.

Omran, T. A.; O. A. Badran and A. B. El-Sayed (1979). Growth of some timber tree seedling irrigated with saline water. Alex. J. Agric. Res., 27 (3): 725-731.

Pregl, F. (1945). Quantitative Organic Micro Analysis 4th ED. Churchill, London.

Saric, M.; R. Kastrori, T. Cupine and I. Geric (1967). Chlorophyll determination : Univerzite Noveon Sadu. Praktikum 12 Fiziologize Biljaka – Beograd Haucna Anjiga, pp. 215.

Sendecor, G. W. and W. C. Cochran (1980). Statistical Methods. 6th ed., Iowa Univ. Press. Ames. Iowa, U. S. A., p. 237.

Tagawa, T. and N. Ishizaka (1963). Physiological studies on the tolerance of rice plant to salinity. Field Crop Abs., 18: 237 and 1850.

Trough, E. and A. Meyer (1939). Improvement in deigns colorimetric method for phosphorus and arsenic Ind. Eng. Chem. Anal. Ed., 1: 136-139.

## استجابة شتلات الكلياندرا للري بالماء المالح تحت ظروف العريش

**محمد عبد الحميد محمد المكاوي**

**قسم الإنتاج النباتي ووقايته – كلية العلوم الزراعية البيئية بالعريش – جامعة قناة السويس**

أجريت تجربتان حقليتان علي ارض رملية في المزرعة التجريبية بكلية العلوم الزراعية البيئية بالعريش – جامعة قناة السويس خلال موسمي ٢٠٠٣/٢٠٠٤ و ٢٠٠٤/٢٠٠٥ بهدف دراسة مدي استجابة شتلات شجيرات الكلياندرا *Calliandra eriophylla* Benth و هي شجيرات تزهر أزهارا في نوران كبيرة خيطية أرجوانية فترة طويلة من السنة و يمكن استغلال زراعتها في الاراضى الجديدة بالري بالتنقيط بمياه الآبار المحلية و تركيزات ملوحتها ٣٢٠٠ ، ٥١٢٠ ، ٧٠٤٠جزء في المليون.

– وقد أوضحت النتائج عموما أن الري بالتنقيط بمياه الآبار الجوفية و التي تركيز ملوحتها ٣٢٠٠ و ٥١٢٠ جزء في المليون لم يكن لة تأثير معنوي علي النمو الخضري للشتلات.

ومن جهة أخري تركيزات ملوحة ماء الري الزائدة عن الكنترول ٣٢٠٠جزء في المليون أدت إلي نقص المحتوي الكلورفيللي و كان هناك زيادة تدريجية في المحتوي من البرولين و البوتاسيوم و الصوديوم و الكالسيوم والكلوريد.