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# RESPONSE OF *FICUS NITIDA* L SEEDLINGS TO THE APPLICATION OF SOME ANTIOXIDANTS UNDER SOIL SALINITY CONDITIONS

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## ABSTRACT

This experiment was conducted during 2000 and 2001 seasons at king Abdulaziz Univ. Experimental Station in Wadi Hoda Al-Sham, Jeddah, Saudi Arabia to examine the effect of four soil salinity levels 0.0, 0.2, 0.4 or 0.8 % of 1:1 by weight mixture of $NaCl + CaCl_2$ as well as foliar application of three vitamins i.e ascorbic acid (Vit.C) at 25, 50 and 100 ppm, thiamine (Vit. $B_1$) at 25 and 50 ppm and riboflavin (Vit. $B_2$) at 25 and 50 ppm on growth, leaf pigments and proline content of *Ficus nitida* seedlings.

There was a slight reduction in plant height, number of shoots and leaves per plant, leaf area, fresh and dry weights of shoots and roots per plant, chlorophylls a and b as well as total chlorophylls with increasing soil salinity levels from 0.0 to 0.4 %. However, proline content tended to increase considerably by raising soil salinity levels from 0.0 to 0.8%. Growth criteria and plant pigments were measurably depressed with the raising in salinity levels from 0.4 to 0.8%. Application of the three vitamins; ascorbic acid, thiamin and riboflavin; was accompanied by stimulation of all growth aspects and plant pigments and was responsible for reducing proline content and the effect on for all such parameters was associated with the increase in vitamin concentrations. No measurable effect was noticed due to raising the concentration from 50 to 100 ppm for ascorbic acid and from 25 to 50 ppm for both thiamine and riboflavin vitamins. Such positive action of vitamins on growth aspects and plant pigments alleviated the adverse effects of soil salinity on growth characters and chemical constituents of *Ficus nitida* seedlings.

These results emphasized that *Ficus nitida* seedlings could tolerete 0.4% soil salinity without obvious adverse effects on growth and plant pigments. Also, foliar application of vitamins C at 50 ppm as well as $B_1$ or $B_2$ each at 25 ppm was necessary for counteracting the harmful effect of salinity on growth criteria and plant pigments.

## INTRODUCTION

*Ficus nitida* is an evergreen tree. It is considered as one of the most important species of Ficus commonly grown in Saudi Arabia. as shade, avenue tree and as a source of wood.

Soil salinity depresses water and nutrient availability and causes derangement of the normal metabolism of ornamental plants (Miller *et al.*, 1990). Any trial to increase the tolerance of plants to salinity is appreciated.

Vitamins are known as in important factors responsible for enhancing growth and influencing many physiological processes. The basic physiological significance connected with the vitamin $B_1$ thiamine pyrophosphate (TPP) cocarboxylase, is its role as a coenzyme in various types of decarboxylations (Wightman and Brown, 1953). It has been suggested that the effect of thiamine upon the meristem, may partly has indirect nature and be mediated by the nature tissue, through an altered supply of metabolites to the apex. Robinson (1973) stated that most of thiamine in plants is present as free vitamin.

Riboflavin (Vitamin $B_2$) occurs generally in plant tissues, only a small fraction of it appears to be free while the main part as coenzymes flavin mononucleotide and flavin adenine dinucleotide (Mer, 1957). Karabanov (1977) demonstrated that vitamin $B_2$ raised the photosynthetic rate of potato plants.

Ascorbic acid (Vitamin C) as antioxidant compound has an auxinic action and also synergistic effect on the biosynthesis of carbohydrates and controlling the incidence of most fungi on plants. In general the use of vitamins are safe to human, animal and environment.

Salinity conditions are known to have different adverse and imparied effects on growth and chemical constituents of several plants i.e. *Lantana camara*, *Dimorphatica ecklonis*, *Callistephus chinensis* and *Myoporum pictum (El-Mahrouk, 1980)*, *Tropaeolum* majus (Badran *et al.* 1984), Eucalyptus species (Omran, 1986); *Chrysanthemum morifolium* (Abdalla-Nadia *et al*, 1989); *Schinus molle*, *Schinus* terebenthifolius and *Myoporum acuminatum*

(Farahat,1990), Chrysanthemum species (Makary, 1991), *Cupressus sempervirens* and Eucalyptus camaldulensis (Shehata, 1992), some ornameatal shrubs (Mohamed, 1993), *Nerium olender* and *Adhatoda vasica* (Ismail, 1993), *Nerium olender* (El-Bagoury *et al.*, 1994 a), *Adhatoda vasica* (El-Bagoury *et al.*, 1994 b) and ornamental palms (Nofal *et al.*, 2001 a & b) and Dalbergio Sisso (Ahmed-Amany, 2002).

Application of vitamin $B_1$ and $B_2$ was very effective in enhancing growth and pigments of ornamental plants (Robbins 1939 and Scheuermann, 1952), *Ammi visnaga*, (Reda *et al.*, 1977), Soybean (Gendy *et al*, 1992), Lemon grass (Tarraf-Shahira *et al.*, 1999 and Refaat-Azza 2001), and Navel orange (Abd El-Wahab, 1999 and Rager,2002) Also, the results of Ahmed *et al.* (1998) on Flame vines, Abd El-Aziz (2001) and Ahmed and Morsy (2001) on Anna apple trees, supported the positive action of ascorbic acid on the growth of these crops.

The goal of this study was to test the tolerance of *Ficus nitida* seedlings to soil salinity and to elucidate the role of vitamins C,$B_1$ and $B_2$ on alleviating the adverse effects of soil salinity on growth and pigments Content.

## MATERIALS AND METHODS

Pot experiment was conducted during the two successive seasons of 2000 and 2001 at the Experimental Farm of King Abdulaziz Univ. at Hoda Al-Sham 120 km North East of Jeddah, Saudi Arabia. Uniform two years old seedlings of *Ficus nitida* were planted in 25 cm clay pots painted from the inside with bitumene and the lower hole of pot was stoppered. Each pot was filled with 3 kg salinized soil. Soil was mixed with a mixture of sodium chloride and calcium chloride as 1:1 by weight to achieve three concentrations of salinity namely 0.2, 0.4 and 0.8% in addition to the control in which the soil was not salinized with salt mixture (0.0 % salinity). Planting was done at the last week of February in both seasons Three water soluble vitamins namely ascorbic acid (Vit. C) at 25, 50 or 100 ppm, Thiamine (Vit. $B_1$) at 25 or 50 ppm and Riboflavin (Vit. $B_2$ ) at 25 or

50 ppm were applied. A seedlings was left without spraying served as control (water sprayed plants).

Triton B as a wetting agent was added to all vitamin solutions at 0.025%. The seedlings received four sprays of vitamins at one month intervals started one month after planting. The split plot design with four replicates was followed where the four levels of soil salinity assigned to the main plots and the eight vitamin treatments occupied the subplots. Therefore, the experiment included thirty-two treatments, four replicates per each and five plants per replicate. Soil fertilization was done for all *Ficus nitida* transplants at the rate of 3, 4 and 1.5 g per pot from ammonium nitrate (33.5% N), calcium superphosphate (15.5% $P_2O_5$) and potassium sulphate (48% $K_2O$), respectively. Other horticultural practices were carried out as usual.

Physical and chemical analysis of the soil according to Chapman and Paratt (1978) are shown in Table (1).

**Table 1: Some physical and chemical properties of the soil used .**

| | |
|---|---|
| **Particle size distribution** | |
| **Sand %** | 96.0 |
| **silt %** | 1.1 |
| **clay %** | 2.9 |
| **Texture** | sandy |
| **pH (1:2.5 extract)** | 8.02 |
| **E.C (1.2.5 extract) mmhos / 1 cm 25 °C** | 0.85 |
| **$CaCO_3$ %** | 5.0 |
| **O.M %** | 0.123 |
| **Ion concentrations ($meq1^{-1}$): (in saturated extract)** | |
| **$HCO_3$** | 3.20 |
| **$CL^-$** | 3.18 |
| **$SO_4$** | 1.70 |
| **$Ca^{++}$** | 3.40 |
| **$Mg^{++}$** | 0.50 |
| **$Na^+$** | 3.91 |
| **$K^+$** | 0.35 |
| **Total N %** | 0.01 |
| **Available P (ppm, Olsen)** | 16.5 |
| **Available k (ppm, ammonium acetate)** | 38.0 |

After the termination of each season (last week of Sept.), the following data were recorded.

1- Vegetative growth parameters such as plant height (cm), number of shoots per plant, number of leaves per plant, leaf area (according to Jain and Misra, 1966), fresh and dry weights of shoots and roots per plant.

2- Chemical analysis of chlorophylls a and b as well as total chlorophylls were determined in the leaves according to Moran (1982).

3- Proline ,content ($\mu$ mole /100 g F.W ) according to Bates *et al.* (1973).

Statistical analysis were conducted by the use of New L.S.D method described by Mead *et al* (1993).

## RESULTS AND DISCUSSION

**1- Effect of soil salinity levels and some vitamins on plant height and number of shoots per plant.**

Data in Table 2 clearly show that increasing salinity levels from 0.0 to 0.4% caused a slight reduction in plant height and number of shoots per plant. Soil salinity level at 0.8% $NaCl + CaCl_2$ resulted in significant inhibition in plant height and number of shoots per plant. The results obtained in 2000 and 2001 seasons were almost similar Table 2. These results are in agreement with those obtained by El-Mahrouk (1990) on *Lantana camara* and *Dimorphotica ecklonis*, *Callistephus chinensis* and *Myoporum pictum*, Badran *et al*, (1984) on *Tropaeolum majus* and Omran (1986) on various Eucalyptus species.

In respect to the effect of vitamins C, $B_1$ and $B_2$ on plant height and number of shoots per plant, the data showa significant promotion in these character with using Vit. C at 25 to 100 ppm as well as Vit $B_1$ and $B_2$ each at 25 and 50 ppm compared to control treatment. There was also a slight gradual stimulation in such growth traits with the increase in vitamin concentrations. However, raising concentrations of Vit. C from 50 to 100 ppm and , Vit $B_1$ and $B_2$ from 25 to 50 ppm had meaningless promotion on these characters. Application of Vit. C, Vit. $B_2$ and Vita $B_1$, in descending order was very effective in enhancing such growth characters (Table 2). These results are in harmony with those obtained by Robbins (1939)and Scheuermann (1952) on various ornamental plants, Reda *et al* (1977) on *Ammi visnaga* and Ahmed *et al.* (1998) on Flame vines.

The interaction between soil salinity and the three water soluble vitamins was significant for both traits in both seasons. Application of vitamins C, $B_1$, $B_2$ modified or counteracted the depressive effects of soil salinity on plant height and number of shoots per plant. Application of Vit C at 50 and 100 ppm gave satisfactory counteraction effects of soil salinity on these characters.

2- **Effect of soil salinity levels and some vitamins on number of leaves per plant and leaf area.**

It is evident from the data in Table 3 that number of leaves per plant and leaf area were slightly reduced with the increase in soil salinity levels from 0.0 to 0.4 %. Significant depression in such growth characters was observed due to salinizing the soil with 0.8% salinity level compared to the other salinity levels (0.0 to 0.4%). These results suggested that *Ficus nitida* plants could tolerate soil salinity us to 0.4% without any impaired effects on number of leaves per plant and leaf area. Similar results were obtained in both seasons.

The adverse effects of salinity on such growth traits confirmed the results of Abdalla-Nadia *et al* (1989) on *Chrysanthemum morifolium* and Farahat (1990) on *Schinus molle, Schinus terebenthifolius* and *Myoporum acuminatum*.

The results also reveal that spraying Vitamins C at 25 and 100 ppm and $B_1$ and $B_2$ each at 25 to 50 ppm significantly stimulated the number of leaves per plant and leaf area compared with the control treatment. Spraying Vit. C, Vit $B_2$ and Vit $B_1$, in descending order was fovourable for enhancing such growth criteria. The best promotion on such traits was detected on seedlings sprayed with Vit. C at 50-100 ppm in both seasons.

Under soil salinity conditions, spraying *Ficus nitida* seedlings with vitamins C, $B_1$ and $B_2$ was useful for avoiding the adverse effects of soil salinity on such growth characters. Values of growth criteria were enhanced significantly in *Ficus nitida* plants under salinity stress and spraying with Vit C at 25 to 100 ppm, as well as $B_1$ and $B_2$ each at 25 and 50 ppm compared to those under soil salinsty alone. These results were the same in both experimental seasons.

Table 2: Effect of soil salinity levels and some vitamins on plant height (cm) and number of shoots per plant of *Ficus nitida* plants during 2000 and 2001 seasons.

| Vitamin Conc. (B) | Plant height (cm) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 | | | | | 2001 | | | | |
| | Soil salinity levels (A) | | | | | | | | | |
| | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) |
| Control | 40.3 | 39.5 | 39.0 | 37.0 | 39.0 | 36.1 | 35.3 | 35.0 | 33.0 | 34.9 |
| 25 ppm V.C. | 47.3 | 47.1 | 47.0 | 45.8 | 46.8 | 44.0 | 43.7 | 43.5 | 41.4 | 43.2 |
| 50 ppm V. C. | 49.3 | 49.0 | 48.7 | 47.3 | 48.6 | 47.0 | 46.8 | 46.7 | 44.5 | 46.3 |
| 100 ppm V. C. | 49.7 | 49.5 | 49.2 | 48.0 | 49.1 | 47.5 | 47.3 | 47.2 | 45.0 | 46.8 |
| 25 ppm V. $B_1$ | 42.3 | 42.2 | 42.0 | 40.7 | 41.8 | 38.3 | 38.0 | 37.8 | 35.5 | 37.4 |
| 50 ppm V. $B_1$ | 43.0 | 43.0 | 42.8 | 41.6 | 42.6 | 38.5 | 38.0 | 37.9 | 35.6 | 37.5 |
| 25 ppm V. $B_2$ | 44.7 | 44.7 | 44.6 | 43.4 | 44.4 | 41.0 | 41.0 | 40.9 | 38.8 | 40.4 |
| 50 ppm V. $B_2$ | 45.0 | 45.0 | 44.9 | 43.7 | 44.7 | 41.3 | 41.2 | 41.0 | 38.9 | 40.6 |
| Mean (A) | 45.2 | 45.0 | 44.8 | 43.4 | | 41.7 | 41.4 | 41.3 | 39.1 | |
| New LSD. at 5% | A 1.1 | | B 1.7 | | AB 3.4 | A 1.4 | | B 2.0 | | AB 4.0 |
| Character | Number of shoots/plant | | | | | | | | | |
| Control | 10.1 | 9.7 | 9.4 | 8.1 | 9.3 | 8.2 | 8.0 | 7.9 | 6.2 | 7.6 |
| 25 ppm V.C. | 13.9 | 13.8 | 13.5 | 12.2 | 13.4 | 13.0 | 12.8 | 12.7 | 11.2 | 12.4 |
| 50 ppm V. C. | 14.9 | 14.8 | 14.6 | 13.4 | 14.4 | 14.5 | 14.4 | 14.2 | 12.8 | 14.0 |
| 100 ppm V. C. | 15.0 | 14.9 | 14.7 | 13.5 | 14.5 | 14.6 | 14.5 | 14.3 | 12.9 | 14.1 |
| 25 ppm V. $B_1$ | 11.3 | 11.2 | 11.1 | 9.8 | 10.9 | 9.4 | 9.3 | 9.2 | 7.8 | 9.0 |
| 50 ppm V. $B_1$ | 11.3 | 11.3 | 11.2 | 9.9 | 11.0 | 9.6 | 9.4 | 9.2 | 7.9 | 9.0 |
| 25 ppm V. $B_2$ | 12.5 | 12.3 | 12.2 | 11.0 | 12.0 | 10.8 | 10.7 | 10.6 | 9.2 | 10.3 |
| 50 ppm V. $B_2$ | 12.6 | 12.4 | 12.3 | 11.1 | 12.1 | 10.9 | 10.8 | 10.7 | 9.3 | 10.4 |
| Mean (A) | 12.7 | 12.6 | 12.4 | 11.1 | | 11.0 | 11.2 | 11.1 | 9.7 | |
| New LSD. At 5% | A 1.2 | | B 1.0 | | AB 2.0 | A 1.0 | | B 1.3 | | AB 2.6 |

Table 3: Effect of soil salinity levels and some vitamins on number of leaves per plant and leaf area (cm)$^2$ of *Ficus nitida* plants during 2000 and 2001 seasons.

| Vitamin Conc. (B) | Number of leaves / plant | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 | | | | | 2001 | | | | |
| | Soil salinity levels (A) | | | | | | | | | |
| | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) |
| Control | 41.1 | 41.0 | 39.8 | 37.5 | 39.9 | 44.8 | 44.0 | 43.8 | 41.0 | 43.4 |
| 25 ppm V.C. | 49.1 | 49.0 | 48.1 | 45.7 | 48.0 | 57.5 | 57.3 | 57.0 | 54.1 | 56.5 |
| 50 ppm V. C. | 52.2 | 52.0 | 51.9 | 49.7 | 51.5 | 62.0 | 61.8 | 61.6 | 59.0 | 61.1 |
| 100 ppm V. C. | 52.3 | 52.0 | 52.0 | 49.8 | 51.5 | 62.7 | 61.9 | 61.8 | 59.3 | 61.4 |
| 25 ppm V. $B_1$ | 43.6 | 43.4 | 43.2 | 41.0 | 42.8 | 48.1 | 48.0 | 47.8 | 45.0 | 47.2 |
| 50 ppm V. $B_1$ | 44.0 | 43.5 | 43.3 | 41.1 | 43.0 | 48.2 | 48.1 | 47.9 | 45.2 | 47.4 |
| 25 ppm V. $B_2$ | 46.0 | 45.7 | 45.6 | 43.1 | 45.1 | 51.5 | 51.4 | 51.3 | 49.0 | 50.8 |
| 50 ppm V. $B_2$ | 46.3 | 45.8 | 45.7 | 43.2 | 45.3 | 52.0 | 51.6 | 51.4 | 49.2 | 51.1 |
| Mean (A) | 46.8 | 46.6 | 46.2 | 43.9 | | 53.4 | 53.0 | 58.8 | 50.2 | |
| New LSD. at 5% | A 1.8 | | B 2.2 | | AB 4.4 | A 2.1 | | B 3.0 | | AB 6.0 |
| Character | Leaf area (cm)$^2$ | | | | | | | | | |
| Control | 13.2 | 13.0 | 12.9 | 11.7 | 12.7 | 12.2 | 12.0 | 11.8 | 10.3 | 11.6 |
| 25 ppm V.C. | 19.0 | 19.0 | 18.2 | 17.0 | 18.3 | 17.1 | 17.0 | 16.8 | 15.2 | 16.5 |
| 50 ppm V. C. | 20.6 | 20.5 | 20.3 | 19.1 | 20.1 | 18.9 | 18.7 | 18.5 | 17.0 | 18.3 |
| 100 ppm V. C. | 20.7 | 20.6 | 20.4 | 19.2 | 20.2 | 19.0 | 18.8 | 18.6 | 17.1 | 18.4 |
| 25 ppm V. $B_1$ | 15.8 | 15.7 | 15.4 | 14.3 | 15.3 | 13.6 | 13.5 | 13.4 | 11.9 | 13.1 |
| 50 ppm V. $B_1$ | 16.0 | 15.8 | 15.5 | 14.4 | 15.4 | 13.7 | 13.6 | 13.5 | 12.0 | 13.2 |
| 25 ppm V. $B_2$ | 17.5 | 17.5 | 17.4 | 16.1 | 17.1 | 15.1 | 15.0 | 14.7 | 13.2 | 14.5 |
| 50 ppm V. $B_2$ | 17.6 | 17.6 | 17.6 | 16.3 | 17.3 | 15.2 | 15.2 | 14.8 | 13.3 | 14.6 |
| Mean (A) | 17.6 | 17.5 | 17.2 | 16.0 | | 15.6 | 15.5 | 15.3 | 13.8 | |
| New LSD. at 5% | A 1.1 | | B 1.4 | | AB 2.8 | A 1.4 | | B 1.8 | | AB 3.6 |

The promoting effect of vitamins on growth was supported by the results of Gendy *et al* (1992) on soybean, Tarraf-Shahira *et al* (1999) on lemon grass and Abd El-Wahab (1999) and Ragab (2002) on Navel oranges.

**3- Effect of soil salinity levels and some vitamins on fresh and dry weight of shoots and roots per plant.**

Data in Tables 4 and 5 reveal that increasing soil salinity levels caused a gradual reduction in fresh and dry weights of shoots and roots per plant. The reduction was insignificant up to soil salinity level 0.4% and highly significant above this level. The minimum values were recorded in plants under 0.8% soil salinity level. These results demonstrate that *Ficus nitida* plants could tolerate soil salinity level up to 0.4%. The results were nearly similar in both seasons.

The unfavorable effects of high soil salinity on fresh and dry weights of shoots and roots are in agreement with those obtained by Makary (1991) on Chrysanthemum species and Shehata (1992) on *Cupressus sempervirens* and *Eucalyptus camadulensis*.

Data concerning the effects of vitamins on fresh and dry weights of shoots and roots clearly show that spraying of Vit C, Vit $B_1$ and Vit. $B_2$ was significantly effective in improving growth characters compared with the unsprayed plants. The promotion was conceded with the increase in vitamin concentrations. However, in most cases, no measurable increase in these traits was observed by using 50 or 100 ppm Vit. C in one hand and by using 25 or 50 ppm from vitamins $B_1$ and $B_2$ from the other side. However, spraying Vit. C at 50-100 ppm gave the maximum values.

Appling vitamins C, $B_1$ and $B_2$ effectively alleviated the adverse effects of soil salinity on the growth characters, since the untreated plants subjected to soil salinity had the lower values.

The results of Refaat-Azza (2001) on lemon grass and Abd El-Aziz (2001) and Ahmed and Morsy (2001) on Anna apples support the positive action of Vitamins C, $B_1$ and $B_2$ on growth.

The most pronounced counteracted effect on soil salinity was attributed to the use of Vit. C at 50 and 100 ppm. Similar results were obtained in 2000 and 2001 seasons.

**Table 4: Effect of soil salinity levels and some vitamins on fresh and dry weights of shoots of *Ficus nitida* plants during 2000 and 2001 seasons.**

| Vitamin Conc. (B) | Fresh weights of shoots / plant | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 | | | | | 2001 | | | | |
| | Soil salinity levels (A) | | | | | | | | | |
| | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) |
| Control | 28.3 | 28.0 | 27.9 | 25.7 | 27.5 | 29.1 | 28.8 | 28.5 | 26.3 | 28.2 |
| 25 ppm V.C. | 37.5 | 37.4 | 37.3 | 35.7 | 37.0 | 38.2 | 38.0 | 37.6 | 35.0 | 37.2 |
| 50 ppm V. C. | 39.6 | 39.6 | 39.5 | 37.3 | 39.0 | 41.0 | 40.8 | 40.7 | 38.5 | 40.3 |
| 100 ppm V. C. | 40.0 | 39.7 | 39.6 | 37.4 | 39.2 | 41.2 | 40.9 | 40.9 | 38.6 | 40.4 |
| 25 ppm V. $B_1$ | 30.5 | 30.3 | 30.2 | 28.1 | 29.8 | 32.2 | 32.0 | 31.8 | 29.9 | 31.5 |
| 50 ppm V. $B_1$ | 30.7 | 30.4 | 30.3 | 28.2 | 29.9 | 32.5 | 32.2 | 31.9 | 30.0 | 31.7 |
| 25 ppm V. $B_2$ | 33.1 | 33.0 | 32.8 | 31.3 | 32.6 | 35.2 | 35.0 | 34.8 | 33.0 | 34.5 |
| 50 ppm V. $B_2$ | 33.3 | 33.2 | 33.0 | 31.4 | 32.7 | 35.3 | 35.2 | 35.0 | 33.3 | 34.7 |
| Mean (A) | 34.1 | 34.0 | 33.8 | 31.9 | | 35.6 | 35.7 | 35.2 | 33.1 | |
| New LSD. at 5% | A 1.5 | | B 1.9 | | AB 3.8 | A 1.8 | | B 2.0 | | AB 4.0 |
| Character | Dry weight of shoots / plant | | | | | | | | | |
| Control | 10.1 | 10.1 | 9.9 | 8.7 | 9.7 | 9.9 | 9.8 | 9.7 | 10.6 | 10.0 |
| 25 ppm V.C. | 14.2 | 14.0 | 13.9 | 12. 7 | 13.7 | 14.5 | 14.4 | 14.3 | 13.1 | 14.1 |
| 50 ppm V. C. | 15.3 | 15.2 | 15.1 | 14.0 | 14.9 | 15.8 | 15.7 | 15.6 | 14.5 | 15.4 |
| 100 ppm V. C. | 15.4 | 15.3 | 15.2 | 14.1 | 15.0 | 16.0 | 15.8 | 15.7 | 14.6 | 15.5 |
| 25 ppm V. $B_1$ | 11.3 | 11.3 | 11.2 | 10.1 | 11.0 | 11.2 | 11.1 | 11.0 | 10.0 | 10.8 |
| 50 ppm V. $B_1$ | 11.4 | 11.4 | 11.3 | 10.2 | 11.1 | 11.3 | 11.2 | 11.1 | 10.1 | 10.9 |
| 25 ppm V. $B_2$ | 13.0 | 12.9 | 12.8 | 11.6 | 12.6 | 12.9 | 12.8 | 12.7 | 11.6 | 12.5 |
| 50 ppm V. $B_2$ | 13.2 | 13.0 | 12.9 | 11.7 | 12.7 | 13.0 | 12.9 | 12.8 | 11.7 | 12.6 |
| Mean (A) | 13.0 | 12.9 | 12.8 | 11.6 | | 13.1 | 13.0 | 12.9 | 12.0 | |
| New LSD. at 5% | A 0.9 | | B 1.0 | | AB 2.0 | A 1.0 | | B 1.2 | | AB 2.4 |

Table 5 : Effect of soil salinity levels and some vitamins on fresh and dry weights of roots (g) of *Ficus nitida* plants during 2000 and 2001 seasons.

| Vitamin Conc. (B) | Fresh weights of roots / plant | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 | | | | | 2001 | | | | |
| | Soil salinity levels (A) | | | | | | | | | |
| | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) |
| Control | 10.1 | 9.9 | 9.8 | 9.4 | 9.8 | 10.5 | 10.3 | 10.3 | 9.7 | 10.2 |
| 25 ppm V.C. | 12.5 | 12.4 | 12.3 | 11.9 | 12.3 | 13.1 | 13.0 | 12.9 | 12.2 | 12.8 |
| 50 ppm V. C. | 13.1 | 13.0 | 13.0 | 12.6 | 12.9 | 14.0 | 14.0 | 13.9 | 13.2 | 13.8 |
| 100 ppm V. C. | 13.2 | 13.1 | 13.2 | 12.7 | 13.1 | 14.2 | 14.1 | 14.0 | 13.3 | 13.9 |
| 25 ppm V. $B_1$ | 10.7 | 10.7 | 10.6 | 10.2 | 10.6 | 11.5 | 11.4 | 11.3 | 10.7 | 11.2 |
| 50 ppm V. $B_1$ | 10.8 | 10.8 | 10.7 | 10.3 | 10.7 | 11.6 | 11.6 | 11.5 | 11.0 | 11.4 |
| 25 ppm V. $B_2$ | 11.3 | 11.2 | 11.2 | 10.8 | 11.1 | 12.3 | 12.3 | 12.2 | 11.7 | 12.1 |
| 50 ppm V. $B_2$ | 11.4 | 11.3 | 11.3 | 10.9 | 11.2 | 12.4 | 12.3 | 12.2 | 11.8 | 12.2 |
| Mean (A) | 11.6 | 11.6 | 11.5 | 11.1 | | 12.5 | 12.4 | 12.3 | 11.7 | |
| New LSD. at 5% | A 0.3 | | B 0.4 | | AB 0.8 | A 0.5 | | B 0.6 | | AB 1.2 |
| Character | Dry weight of roots / plant | | | | | | | | | |
| Control | 3.4 | 3.3 | 3.3 | 3.0 | 3.2 | 3.5 | 3.5 | 3.4 | 3.0 | 3.4 |
| 25 ppm V.C. | 4.4 | 4.2 | 4.1 | 3.8 | 4.1 | 4.4 | 4.4 | 4.3 | 4.0 | 4.3 |
| 50 ppm V. C. | 4.4 | 4.4 | 4.3 | 3.9 | 4.3 | 4.7 | 4.7 | 4.6 | 4.1 | 4.5 |
| 100 ppm V. C. | 4.5 | 4.4 | 4.4 | 4.1 | 4.4 | 4.8 | 4.7 | 4.6 | 4.2 | 4.6 |
| 25 ppm V. $B_1$ | 3.6 | 3.6 | 3.6 | 3.3 | 3.5 | 3.8 | 3.8 | 3.7 | 3.4 | 3.7 |
| 50 ppm V. $B_1$ | 3.6 | 3.7 | 3.7 | 3.4 | 3.6 | 3.9 | 3.8 | 3.8 | 3.5 | 3.8 |
| 25 ppm V. $B_2$ | 3.8 | 3.8 | 3.7 | 3.4 | 3.7 | 4.1 | 4.0 | 4.0 | 3.6 | 3.9 |
| 50 ppm V. $B_2$ | 3.9 | 3.9 | 3.8 | 3.5 | 3.8 | 4.2 | 4.1 | 4.0 | 3.7 | 4.0 |
| Mean (A) | 3.9 | 3.9 | 3.9 | 3.6 | | 4.2 | 4.1 | 4.1 | 3.7 | |
| New LSD. at 5% | A 0.2 | | B 0.2 | | AB 0.4 | A 0.2 | | B 0.3 | | AB 0.6 |

V.C. = Vitamin C V. $B_1$ = Thiamine
V. $B_2$ = Riboflavin

**4- Effect of soil salinity levels and some vitamins on plant pigments:**

It is obvious from the data in Tables 6 and 7 that gradual reduction in chlorophylls a and b and total chlorophylls in the leaves was apparent with increasing soil salinity levels from 0.0 to 0.8 %. Insignificant reduction was observed as salinity levels increased from 0.0 to 0.4%. However, significant reduction was observed when soil salinity levels increased from 0.4 to 0.8 %. The minimum values of plant pigments were recorded in plants subjected to 0.8 % salinity level. Similar results were obtaind in 2000 and 2001 sesons.

The present results are in the same line with those obtained by Mohamed (1993) on some ornamental shrubs and El-Bagoury *et al.* (1994 a) on *Nerium olender*

Spraying vitamins C at 25 up to 100 ppm, $B_2$ at 25-50 ppm and $B_1$ at 25 and 50 ppm, in descending order was very effective in enhancing plant pigments compared to the unsprayed plants. The promotion was associated with increasing vitamin concentrations. Spraying 50-100 ppm Vit. C gave the best results . Similar results were also reported by Tarraf-Shahira *et al* (1999) on lemon grass.

**5- Effect of soil salinity levels and some vitamins on proline content.**

Data in Table 7 clearly show that proline content in the leaves of *Ficus nitida* was gradually increased with the increase in soil salinity levels from 0.0 to 0.8 %. Significant differences on such parameters was observed among the four soil salinity levels. The maximum and minimum values were recorded in seedlings under 0.8% and 0.0 % salinity levels, respectively. The results reported by Nofal *et al* (2001 a & 2001 b) on ornamental palms support the present findings.

Spraying vitamins C, $B_1$ and $B_2$ significantly reduced proline content compared to the control. The reduction in proline content was apparent in plants received C, $B_2$ and $B_1$, in descending order. The minimum values were detected on plants sprayed with 100 ppm, Vit. C, the untreated seedlings had leaves with maximum proline value. Similar results were detected in both seasons.

Table 6 : Effect of soil salinity levels and some vitamins on chlorophyll a and chlorophyll b (mg) /1g fresh weight of *Ficus nitida* plants during 2000 and 2001 seasons.

| Vitamin Conc. (B) | Chlorophyll a (mg / 1 g fresh weight) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 | | | | | 2001 | | | | |
| | Soil salinity levels (A) | | | | | | | | | |
| | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) |
| Control | 1.91 | 1.87 | 1.85 | 1.50 | 1.78 | 1.81 | 1.79 | 1.77 | 1.50 | 1.72 |
| 25 ppm V.C. | 3.15 | 3.11 | 3.10 | 2.71 | 3.02 | 3.05 | 3.00 | 2.95 | 2.70 | 2.93 |
| 50 ppm V. C. | 3.55 | 3.50 | 3.49 | 3.08 | 3.41 | 3.41 | 3.40 | 3.38 | 3.15 | 3.34 |
| 100 ppm V. C. | 3.57 | 3.55 | 3.50 | 3.11 | 3.43 | 3.42 | 3.42 | 3.39 | 3.16 | 3.35 |
| 25 ppm V. $B_1$ | 2.31 | 2.29 | 2.28 | 1.96 | 2.21 | 2.19 | 2.16 | 2.15 | 1.91 | 2.10 |
| 50 ppm V. $B_1$ | 2.35 | 2.30 | 2.29 | 1.97 | 2.23 | 2.22 | 2.20 | 2.18 | 1.96 | 2.14 |
| 25 ppm V. $B_2$ | 2.71 | 2.70 | 2.68 | 2.41 | 2.63 | 2.55 | 2.50 | 2.45 | 2.20 | 2.43 |
| 50 ppm V. $B_2$ | 2.72 | 2.72 | 2.70 | 2.42 | 2.64 | 2.57 | 2.55 | 2.50 | 2.22 | 2.46 |
| Mean (A) | 2.78 | 2.76 | 2.74 | 2.40 | | 2.65 | 2.63 | 2.60 | 2.35 | |
| New LSD. at 5% | A 0.29 | | B 0.33 | | AB 0.66 | A 0.22 | | B 0.30 | | AB 0.60 |
| Character | Chlorophyll b (mg / g fresh weight) | | | | | | | | | |
| Control | 0.61 | 0.60 | 0.59 | 0.43 | 0.56 | 0.64 | 0.63 | 0.62 | 0.50 | 0.60 |
| 25 ppm V.C. | 1.41 | 1.40 | 1.3 8 | 1.05 | 1.31 | 1.31 | 1.30 | 1.29 | 1.17 | 1.27 |
| 50 ppm V. C. | 1.70 | 1.68 | 1.66 | 1.50 | 1.64 | 1.52 | 1.51 | 1.50 | 1.37 | 1.48 |
| 100 ppm V. C. | 1.73 | 1.69 | 1.67 | 1.52 | 1.65 | 1.53 | 1.52 | 1.51 | 1.39 | 1.49 |
| 25 ppm V. $B_1$ | 0.88 | 0.87 | 0.86 | 0.70 | 0.83 | 0.85 | 0.84 | 0.83 | 0.71 | 0.81 |
| 50 ppm V. $B_1$ | 0.90 | 0.88 | 0.87 | 0.69 | 0.84 | 0.86 | 0.85 | 0.84 | 0.72 | 0.82 |
| 25 ppm V. $B_2$ | 1.16 | 1.15 | 1.13 | 0.93 | 1.09 | 1.09 | 1.08 | 1.07 | 0.93 | 1.04 |
| 50 ppm V. $B_2$ | 1.17 | 1.16 | 1.14 | 0.95 | 1.11 | 1.10 | 1.09 | 1.08 | 0.94 | 1.05 |
| Mean (A) | 1.20 | 1.18 | 1.16 | 0.97 | | 1.11 | 1.10 | 1.09 | 0.97 | |
| New LSD. at 5% | A 0.15 | | B 0.22 | | AB 0.44 | A 0.11 | | B 0.18 | | AB 0.36 |

V.C. = Vitamin C     V. $B_1$ = Thiamine
V. $B_2$ = Riboflavin

Table 7: Effect of soil salinity levels and some vitamins on total chlorophylls and proline content of *Ficus nitida* plants during 2000 and 2001 seasons.

| Vitamin Conc. (B) | Total chlorophylls (mg / 1 g fresh weight) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 | | | | | 2001 | | | | |
| | Soil salinity levels (A) | | | | | | | | | |
| | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) | 0.0 | 0.2 | 0.4 | 0.8 | Mean (B) |
| Control | 2.52 | 2.47 | 2.44 | 1.93 | 2.34 | 2.45 | 2.42 | 2.39 | 2.00 | 2.32 |
| 25 ppm V.C. | 4.56 | 4.51 | 4.48 | 3.76 | 4.33 | 4.36 | 4.30 | 4.24 | 3.87 | 4.19 |
| 50 ppm V. C. | 5.25 | 5.18 | 5.15 | 4.58 | 5.04 | 4.93 | 4.91 | 4.88 | 4.52 | 4.81 |
| 100 ppm V. C. | 5.30 | 5.24 | 5.17 | 4.63 | 5.09 | 4.95 | 4.94 | 4.90 | 4.55 | 4.84 |
| 25 ppm V. $B_1$ | 3.19 | 3.16 | 3.14 | 2.66 | 3.04 | 3.04 | 3.00 | 2.98 | 2.62 | 2.91 |
| 50 ppm V. $B_1$ | 3.25 | 3.18 | 3.16 | 2.66 | 3.06 | 3.08 | 3.05 | 3.02 | 2.68 | 2.96 |
| 25 ppm V. $B_2$ | 3.87 | 3.85 | 3.81 | 3.34 | 3.72 | 3.64 | 3.58 | 3.52 | 3.13 | 3.47 |
| 50 ppm V. $B_2$ | 3.89 | 3.88 | 3.84 | 3.37 | 3.75 | 3.67 | 3.64 | 3.58 | 3.16 | 3.51 |
| Mean (A) | 3.98 | 3.93 | 3.90 | 3.37 | | 3.70 | 3.73 | 3.69 | 3.32 | |
| New LSD. At 5% | A 0.30 | | B 0.35 | | AB 0.70 | A 0.23 | | B 0.31 | | AB 0.62 |
| Character | Proline (µ molle / 1000 g fresh weight) | | | | | | | | | |
| Control | 7.1 | 7.7 | 8.9 | 9.5 | 8.3 | 8.2 | 9.0 | 9.5 | 10.0 | 9.2 |
| 25 ppm V.C. | 5.4 | 5.5 | 5.7 | 6.0 | 5.7 | 6.0 | 6.3 | 6.7 | 7.1 | 6.5 |
| 50 ppm V. C. | 4.9 | 5.2 | 5.6 | 5.9 | 5.4 | 5.2 | 5.6 | 5.9 | 6.2 | 5.7 |
| 100 ppm V. C. | 4.5 | 4.9 | 5.4 | 5.7 | 5.1 | 4.5 | 4.9 | 5.3 | 5.7 | 5.1 |
| 25 ppm V. $B_1$ | 6.4 | 6.7 | 7.1 | 7.4 | 6.9 | 7.4 | 7.8 | 8.3 | 8.7 | 8.1 |
| 50 ppm V. $B_1$ | 6.3 | 6.6 | 6.9 | 7.2 | 6.8 | 7.3 | 7.6 | 8.0 | 8.3 | 7.8 |
| 25 ppm V. $B_2$ | 5.9 | 6.2 | 6.5 | 6.8 | 6.4 | 6.9 | 7.2 | 7.5 | 7.9 | 7.4 |
| 50 ppm V. $B_2$ | 5.8 | 6.1 | 6.4 | 6.7 | 6.3 | 6.8 | 7.0 | 7.4 | 7.87 | 7.3 |
| Mean (A) | 5.8 | 6.1 | 6.6 | 6.9 | | 6.5 | 6.9 | 7.3 | 7.7 | |
| New LSD. At 5% | A 0.3 | | B 0.4 | | AB 0.8 | A 0.3 | | B 0.4 | | AB 0.8 |

V.C. = Vitamin C V. $B_1$ = Thiamine

V. $B_2$ = Riboflavin

The maximum proline content was detected in plants under 0.8% soil salinity levels and did not receive any vitamin. However, application of 100 ppm Vit. C to plants grown under unsalinization conditions was accompanied with producing the minimal values.

The adverse effects of salinity on growth and plant pigments might be attributed to the inhibiting effect of salinity on cell division and cell elongation as well as collapsing the biosynthesis of organic foods and uptake of nutrients (Miller *et al* 1990).

It could be concluded from the present findings that *Ficus nitida* seedlings withstand soil salinity levels up to 0.4%, since growth and plant pigments at such levels did not change. A trend of modifying the adverse effects of salinity on growth could be attained by the use of vitamins C at 50 ppm , $B_2$, at 25 ppm or$B_1$ at 25 ppm.

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# استجابة شتلات الفيكس نيتدا لإستخدام بعض مضادات الأكسدة تحت ظروف ملوحة التربة

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أجريت هذه التجربة خلال موسمي ٢٠٠٠ ، ٢٠٠١ بمحطة الأبحاث الزراعية بجامعة الملك عبد العزيز بهدى الشام جدة – المملكة العربية السعودية وذلك لإختبار تأثير أربعة مستويات من ملوحة التربة هي صفر ، ٠,٢ ، ٠,٤ أو ٠,٨ % من مخلوط من كلوريد الصوديوم + كلوريد الكالسيوم بنسبة ١:١ بالوزن كذلك تأثير الرش الورقي لثلاث فيتامينات هي حامض الأسكوربيك (فيتامين جـ) بتركيز ٢٥ – ١٠٠ جزء في المليون و الثيامين (فيتامين ب١) بتركيز ٢٥ – ٥٠ جزء في المليون و الريبوفلافين (فيتامين ب٢) بتركيز ٢٥ – ٥٠ جزء في المليون على النمو والصبغات النباتية ومحتوى البروتين لشتلات الفيكس نتيدا .

– بزيادة تركيز ملوحة التربة من صفر الى ٠,٤ % كان هناك نقص طفيف في إرتفاع النبات ، عدد الأفرع للنبات و مساحة الورقة ، الوزن الطازج والجاف للأفرع والجذور للنبات وكلوروفيل أ ، كلوروفيل ب والكلوروفيل الكلي بينما زاد محتوى البرولين بدرجة كبيرة بزيادة معدل ملوحة التربة من صفر الى ٠,٨ %. أدى زيادة المعدل المستخدم من ملوحة التربة من ٠,٤ الى ٠,٨ % الى نقص كبير في خصائص النمو والصبغات النباتية. أدي إستخدام الثلاثة فيتامينات وهي حامض الأسكوربيك والثيامين والريبوفلافين الى تحسين جميع صفات النمو وزيادة الصبغات النباتية ونقص البرولين وكان التأثير سواء بالزيادة أو النقصان مرتبطاً بزيادة التركيز المستخدم من الفيتامين وكان هناك تأثير طفيف عند زيادة التركيز المستخدم من حامض الأسكوربيك ٥٠ الى ١٠٠ جزء في المليون وعند زيادة التركيز المستخدم من الثيامين والريبوفلافين من ٢٥ الى ٥٠ جزء في المليون ويكون التأثير الإيجابي على النمو والصبغات النباتية مفيداً في تقليل الآثار الضاره لملوحة التربة على النمو والصبغات النباتية لشتلات الفيكس نيتدا .

– تؤكد نتائج هذه الدراسة أن نباتات الفيكس نيتدا يمكن أن تتحمل ملوحة التربة حتى تركيز ٠,٤ % بدون أية أضرار واضحة على النمو والصبغات النباتية كذلك توضح هذه الدراسة ضرورة الرش الورقي بفيتامين جـ بتركيز ٥٠ جزء في المليون أو بفيتامين ب١ أو ب٢ بتركيز ٢٥ جزء في المليون وذلك لمقاومة الآثار الضارة لملوحة التربة على النمو والصبغات النباتية.

جامعة المنيا

كليـــة الـــــزراعة

# مجلة

# البحوث والتنمية الزراعية بالمنيا

مجلد ٢٢رقم ٣
٢٠٠٢