Evaluation of Salinity Tolerance on New Selected Almond × Peach Hybrid Rootstocks

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Abstract

The main objective of this investigation was to evaluate the determination effect of salt tolerance of five new almond× peach hybrid rootstocks namely hybrid 1, 2, 3, 4 and 5 through their vegetative growth parameters and chemical concentrations. This evaluation aimed to recommend these rootstocks for the commercial use. This experiment was carried out at the Horticulture Research Institute, Agriculture Research Center, Giza, Egypt, during two successive seasons (2018-2019 and 2019-2020) respectively. Rootstocks chosen for this study included new almond× peach rootstocks which are resistant to nematode. Salinity irrigated water included four levels of NaCl salt which was 500, 1000, 1500, 2000 ppm and the control which was the usual irrigated water. Results cleared that increasing salinity levels led to reduction in all growth parameters including seedling stem diameter, heights, average leaves number and buds per one, leaf area, fresh and dry weights. High salinity levels declined gradually mineral concentrations like N, P, K, Mg%, Fe and Mn ppm. Moreover the highest level of salinity conducted to the highest levels of Na and Cl ppm concentrations. Chlorophyll values take the same trend with slightly differences with hybrid No.4. On the other hand hybrid No.3 was the least hybrid in all growth measurements, mineral concentration and chlorophyll except proline concentration it recorded the highest value. From the above investigation we can recommend hybrid number5 or hybrid number4 which had the best results compared to other seedlings rootstock under experiment salinity conditions.

Keywords: Prunus rootstock; almond× peach hybrids; salinity; NaCl.

1 Introduction

The cultivation of peach spreads all over the world. In Egypt peach grown in the newly reclaimed lands which include many soil types. In general woody plants are comparatively salt-tolerant during the first germination stage of seed but young seedling is more sensitive and gradually more tolerant with increasing age through the maturity stage. Temperate fruit trees are generally rated as susceptible to soluble salts and above all sensitive to...
chloride and irrigation with salty water may significantly reduce tree yields (Najafian et al. 2008). Also, the majority of the stone fruit trees (especially almond) are sensitive to salt stresses and their yield regularly reduces at salt concentrations above 1.5 dSm\(^{-1}\) but at 4 dSm\(^{-1}\) yield decrease to more than half (Hassan and El-Azayem 1990). Prunus species are included in the salt sensitive species group and they have different degrees to salt tolerance. The almond × peach hybrid GF677 is in-between salt tolerance compared with GF655/2 (P. insititia) (which is the relatively tolerant) and Myrobalan hybrid MsS. 2/5 or to peach seedlings (the fewer tolerant) (Massai and Gucci 1998). Kotuby-Amacher et al. (2000), reported different species of Prunus that reduce yield by 50% related to the salinity concentration (expressed as conductivity).

Several authors recommended using of interspecific hybrids of Prunus species as rootstocks. Therefore, using interspecific hybrids is one of the most promising ways to improve new clone rootstocks in Prunus species and one of the main features that should be taken into concern when selecting new rootstock for fruit trees is salt and drought tolerance (El-Motaium and Brown 1994; Noitsakis et al. 1997).

The tolerance rootstocks mainly reduce the uptake of Na\(^+\) and/ or Cl\(^-\) in the grafted shoots of Prunus cultivars. The root system physical characteristics had the main effect of mineral concentration of the aerial plant parts. Grafted plants development improved or reduced by water or minerals uptake. Other studies confirmed that increasing K\(^+\), Ca\(^{2+}\) or Mg\(^{2+}\) translocation to the leaves associated with grafted plants salt tolerance. Therefore, the essential role of rootstock is determining tree performance under saline conditions. Other studies have also shown relation between salt tolerance and boron sensitivity in Prunus rootstock that make some of them more suitable more to saline soil (Jalil et al. 2012).

Irrigated lands which located in semiarid zones face salinity problem. These agriculture zones between 100 to 110 million hectares; of which 20 to 30 million hectares damaged by salt accumulation and an estimated 0.25 to 0.5 million hectares are less production yearly because of salt accumulation (FAO 2002). The problem of salinity is especially serious in arid and semiarid areas due to excessive evaporation and the scarcity of good water quality for irrigation. The word salinity related to the total concentration of Na\(^+\), Ca\(^{2+}\), Mg\(^{2+}\), K\(^+\), HCO\(^{3-}\), and Cl\(^-\) ions in the soil solution. High salt levels lead to osmotic stress coupled with ionic imbalances caused by the increased uptake of toxic ions such as Na\(^+\) and Cl\(^-\) (Tilbrook et al. 2014). The salt stress has also an adverse effect on mineral Ca\(^{2+}\) and K\(^+\) homeostasis (Tounekti et al. 2012). An excess or deficiency of the major elements in plant’s tissues may cause disorders with respect to nutrient availability, uptake, transport or partitioning within the plant. Thus, there may be a need to use fertilizers to alleviate the harmful effects of excessive soil salinity. Salinity is a serious human ecological concern because the important crops are sensitive to salinity (Byrt and Munns 2008). Hence, salt tolerance plants improved crop yield and support agriculture on marginal lands. Salinity affected in different degrees on plant growth stage such as plant emergence, survival, growth, maturity and yield (Pilar et al. 2011). Generally, the main objective of this investigation was to evaluate the effect of NaCl at different concentrations on vegetative growth parameters and chemical concentrations of new almond × peach hybrid rootstocks.

2 Materials and Methods

2.1 Plant material and salt treatments

This experiment was carried out at the Horticulture Research Institute, ARC, Giza, Egypt, during two successive seasons (2018-2019 and 2019-2020). Rootstocks chosen for this study included five new almond × peach hybrids which coming from hybridization between Om Elfahm almond cv. as mother tree and Okinawa peach rootstock as father tree and they are classified as nematode resistant (Soliman 2014).
To conduct this research, rootstocks were propagated by the hardwood cutting to have a true to type seedlings. Cutting was taken from trees (F1 trees eight years old) of the hybridization maintained above. Hardwood cuttings of these hybrids were taken in late January of each season (≈20 cm were prepared and dipping in 3000 ppm IBA for 30 seconds to stimulate rooting formation). Cuttings were placed in black plastic bags included mixture of peat moss: sand (3:1 by volume) under greenhouse conditions. Seedlings were routinely subjected to the same nursery practices managements and irrigated with well water till the beginning of experiment treatments.

Seedlings for the present investigation were selected as possible uniformity in size and growth and free from any apparent infection. Seedlings were irrigated with water containing total soluble salts as in Table 1. The treatments were adopted by added NaCl at four concentrations (500, 1000, 1500 and 2000 ppm) in both seasons. To avoid osmotic shock, salinity levels were obtained by adding NaCl salt in equal parts on a 4 days interval each one increased 500ppm over than the previous one till the final salt concentration.

Each treatment comprised three replications with five rootstocks per each replicate. Fifteen plants were irrigated with well water served as a control treatment.

Table 1. well water analysis

| Cations | Anions | EC ppm | PH |
|---------|--------|--------|----|
| K⁺      | Na⁺    | Mg²⁺   | Ca²⁺ | SO₄⁻² | Cl⁻   | HCO₃⁻  | CO₃⁻   |
| 0.31    | 5.24   | 2      | 2.51 | 2.60  | 3.61  | 3.85   | …      |
| 320     | 7.40   |        |      | 3.61  |       | 3.85   |

Samples and data of this investigation were collected at the end of each season (15 weeks) as coming:

2.2 Morphological parameters

Growth characters including:
- Seedling stem diameter (cm.)
- Seedling heights (cm.)
- Number of leaves per seedling
- Number of buds per seedling
- Leaf area (cm²)
- Fresh weight (g.)
- Dry weight (g.)

2.3 Chemical analysis

Leaf samples were washed with tap water and dried at 70°C till constant weight and then ground and stored for analysis. The ground samples were digested with sulphuric acid and hydrogen peroxide according to Evenhuis (1978). 0.5gram of dried samples was digested using H₂SO₄ and H₂O₂ as described by Cottenie (1980).

The extracted samples were used to determine the following minerals content as follows:
- Total nitrogen% was determined according to (A.O.A.C.2000).
- Total phosphorus% (gm/ 100gm D.W.) was measured according to Murphy and Riley (1962).
- Potassium contents% (gm/ 100gm D.W.) were determined according to Piper (1950).
- Magnesium% (gm/ 100gm D.W.) was determined in plant according to Richards (1954).
- Iron (ppm) was determined according to Brandifeld and Spincer (1965).
- Chloride (ppm) of leaves was estimated according to the methods of Higinbothan et al (1967).
- Sodium (ppm) were determined by Flam photometer E.E.L., Model (Jackson, 1967).
- Proline (µg/g leaves) was determined as described by Bates et al (1973)
- Leaf chlorophyll content (mg/100 g leaves f.wt.) was determined according to Saric et al (1976).
2.4 Statistical analysis

Data were statistically analyzed in completely randomized design (CRD) with two factors, five new almond × peach hybrid rootstocks and irrigation water salinity in 5 levels of NaCl salt with three replications for each treatment. Data were analyzed according to the method of (Snedecor and Cochran 1980), LSD test at 5% level was used for comparison between means of each rootstock.

3 Results and Discussion

3.1 Effect of various salinity levels on seedling stem diameter (cm.) and height (cm.) of new almond × peach hybrid rootstocks

Data presented in Table 2 showed that, most vegetative growth parameters were significantly affected by salt treatments. Low salinity level showed the highest significant increase in seedling stem diameter as well as its height (cm.), as compared with high salinity levels for both seasons of study. Whereas different hybrids showed different response to the applied treatments.

Data showed that control treatment reached the highest significant value of seedling stem diameter in the 1st season (1.59 cm.) and the 2nd season (1.60 cm.) as well as 500ppm with slightly differences in the 1st season and without differences in the 2nd one. On the other hand 2000 ppm recorded the lowest significant values for stem diameter in both seasons (0.89 and 0.91 cm. respectively).

As for different hybrids, data cleared that in both seasons hybrid No.5 recorded the highest significant seedling stem diameter (1.43 cm.in the 1st season & 1.30 cm. in the 2nd one) as well as hybrid No.1 (1.30 cm.) & No.4 (1.39 cm.) in the 2nd season. However the lowest significant value was recorded with hybrid No. 2 and No. 3 in both seasons (in the 1st season 1.12&1.17cm. and in the 2nd season 1.18 cm. for both hybrids respectively).

Regardless the interaction between both factors, it was clear that hybrid No.5 with control treatment recorded the highest significant value in this respect (1.78 in 2018 and 1.70 cm. in 2019), while hybrids No. 2 & No. 3 got the least significant value with 2000 ppm (0.78 for the 1st season and 0.82 cm. for the 2nd season).

As for the specific effect of salinity levels on seedling height (cm.), data in Table 2 showed that control treatment recorded the highest significant values for both seasons (101.79 & 112.28 cm. respectively). Moreover the highest salinity level (1500 & 2000 ppm) recorded the lowest significant values (67.53 & 58.35 cm.in the 1st season & 72.20 & 62.63 cm. in the 2nd season respectively).

Referring to different hybrids, it is clear that hybrid No.5 recorded the highest significant value (93.24 in 1st season&102.08 in 2nd season). On the other hand hybrid No.3 gained the lowest significant value (69.86 and 70.99 cm. in the 1st season and the 2nd one respectively).

Interaction between both studied factors showed that, the highest significant value of seedling height (cm.) were recorded with control with hybrid No.5 in both seasons (118.32 & 128.97 cm. respectively). Whereas hybrids No.2 and No.3 under high salinity level got the lowest significant value (49.72&54.19 cm. for hybrid No.2 and 51.26&56.39 cm. for No.3 in both seasons respectively).

These results are in agreement with Najafian et al 2008 who cleared that at the highest salinity concentration, the minimum length of GF677 stem was recorded. Also, Zrig et al 2016 reported that it was no surprise that Garnam and Bitter almond shoot length were reduced by the addition of 75 mM NaCl to the growing medium. Moreover, Zhang et al 2016 reported that tomato leaf, shoot height and stem diameter reduced under salinity stress caused by photosynthesis reduction, tissues expansion reduction and cell divided inhibition.
| Salinity levels (ppm) | 1st season | Mean | 2nd season | Mean |
|----------------------|------------|------|------------|------|
| Control              | Control | 500  | 1000 | 1500 | 2000 | Control | 500  | 1000 | 1500 | 2000 |
| Hybrid 1             | 1.57ab   | 1.46b-d | 1.29de | 1.04fg | 0.89gh | 1.25BC | 1.66ab | 1.49a-c | 1.32cd | 1.08ef | 0.95fg | 1.30A |
| Hybrid 2             | 1.41c-e  | 1.30c-e | 1.18ef | 0.91gh | 0.78h  | 1.12C  | 1.44a-c | 1.33cd | 1.35cd | 0.96fg | 0.82g  | 1.18B |
| Hybrid 3             | 1.48b-d  | 1.37c-e | 1.19ef | 1.03fg | 0.78h  | 1.17C  | 1.50a-c | 1.33cd | 1.21de | 1.07ef | 0.82g  | 1.18B |
| Hybrid 4             | 1.69ab   | 1.55a-c | 1.35c-e | 1.13ef | 0.98f-h | 1.34AB | 1.71a   | 1.63ab | 1.40d-f | 1.19d-f | 1.03e-g | 1.39A |
| Hybrid 5             | 1.78a    | 1.69ab  | 1.47b-d | 1.19ef | 1.03fg | 1.43A  | 1.70a   | 1.54a-c | 1.23de | 1.07ef | 0.97e-g | 1.30A |
| Mean                 | 1.59A    | 1.47AB  | 1.30B  | 1.06C | 0.89C  |        | 1.60A  | 1.46A  | 1.30AB | 1.07C | 0.91D  |        |

*Means having the same letter (s) in a column or line are not significantly different at 5% level
*Capital letters refer to the effect of main factor while small one refer to the interaction effect between factors
3.2 Effect of various salinity levels on average number of leaves, buds and leaf area of new almond x peach hybrid rootstocks

The vegetative growth parameters of the new hybrids (average number of leaves, buds and leaf area) in the studied two seasons were shown in Table 3. Increasing application of salt levels significantly decreased the studied vegetative growth parameters in both seasons. Data also showed the superiority of hybrid No. 5 and inferiority of hybrid No. 3.

Among the application of various salinity levels on average number of leaves, the control treatment gave the highest significant values compared to the other treatments (24.90 & 30.05 in 2018 and 2019 respectively). While the highest concentration (2000 ppm) recorded the lowest significant value (4.68 in the 1st season & 5.30 in the 2nd season).

As for the effect of the salinity treatments on hybrids data showed that hybrid No. 5 recorded the highest significant value of average leaves number in both seasons (19.25 & 22.4 respectively), but hybrid No. 3 got the lowest significant values (11.25 & 15.75 in 1st season and 2nd season).

Regarding the combined effect between the two studied factors on average number of leaves, it was clear that data take the same trend, hybrid No. 5 with control recorded the highest value (29.75 & 35.40 in both seasons respectively). On the other hand hybrid No. 3 treated with 2000 ppm of salinity recorded the lowest value (1.75 in 1st season & 1.93 in 2nd season).

As for the specific effect of different salinity treatments on average number of buds, data was similar to average number of leaves. Un-salinated plants recorded the highest significant value (24.9 & 27.1 in both seasons). While the high salt concentration (2000 ppm) got the lowest significant value (13.95 & 15.45 in both seasons respectively).

Referring to the specific effect due to the different hybrids, data showed that hybrid No. 5 reached the highest significant values of average number of buds in both seasons (22.4 & 25.2 respectively). On the other hand hybrid No. 3 got the lowest significant value (15.75 in 1st season & 18.9 in 2nd season).

Data in Table 3 showed the interaction effect of both factors on average number of leaves where it was clear that hybrid No. 5 with control reached the highest significant value in both seasons (29.75 & 31.75 respectively). On opposite, high salinity level with hybrid No. 3 in the 1st season (11.25) and hybrid No. 2 in the 2nd season (13.50) recorded the lowest significant values in his respect.

Moreover, Data in Table 3 showed the effect of factors on average leaf area (cm²). Data recorded the same trend for the specific effect of each factor while the interaction took slightly differences.

It was clear that control plants recorded the highest significant value in both seasons (13.51 & 14.04 cm² respectively) as well as 500 ppm (13.09 & 13.30 cm² in both seasons respectively), while the lowest significant value recorded with 2000 ppm (7.66 cm² in 1st season & 8.29 cm² in 2nd one).

As for the effect of hybrids types on average leaf area, hybrid No. 5 recorded the highest significant value (11.68 cm² in 1st season and 13.08 cm² in 2nd season). On the other hand hybrids No. 1, 2 and 3 recorded the lowest significant value of leaf area (cm²).

As for the interaction between the two studied factors on average leaf area (cm²), it was clear that hybrid No. 5 at the low salt concentration (500 ppm or control) got the highest significant value in both seasons (13.83 & 15.42 cm² for control 13.83 & 14.8 9 cm² for 500 ppm). On the other hand the lowest significant values were recorded with hybrids No. 1, 2 & 3 with the high salt concentration.
Table 3. Effect of various salinity levels on average number of leaves, average number of buds and average leaf area of new hybrid rootstocks

| Salinity levels (ppm) | Average number of leaves | Average number of buds | Average leaf area (cm²) |
|-----------------------|--------------------------|------------------------|------------------------|
| Control               | 1st season               | Mean                   | 2nd season             | Mean                   |
|                       | Control  | 500      | 1000     | 1500    | 2000    | Control  | 500      | 1000     | 1500    | 2000    | Control  | 500      | 1000     | 1500    | 2000    | Control  | 500      | 1000     | 1500    | 2000    |
| Hybrid 1              | 24.00bc  | 20.75c-e | 13.25fg  | 9.25g-i | 4.75jk  | 14.4BC   | 30.00b   | 24.90cd  | 15.77fg  | 9.16hi  | 5.56ij  | 18.4BC   |          |          |          |          |          |
| Hybrid 2              | 21.75b-d | 18.75d-f | 11.00fg  | 5.75i-k | 2.25k   | 11.9CD   | 27.25b-d | 23.00de  | 12.75gh  | 7.06hi  | 2.50ij  | 16.5CD   |          |          |          |          |          |
| Hybrid 3              | 22.25b-d | 17.50ef  | 10.25g-i | 4.50jk  | 1.75k   | 11.25D   | 25.59cd  | 21.00de  | 12.81gh  | 5.27ij  | 1.93j   | 15.75D   |          |          |          |          |          |
| Hybrid 4              | 26.75ab  | 23.50b-d | 16.75ef  | 11.50gh | 6.25i-k | 16.95AB  | 32.00ab  | 28.25bc  | 19.50ef  | 12.75gh | 7.00i   | 20.45AB  |          |          |          |          |          |
| Hybrid 5              | 29.75a   | 25.00ab  | 18.50d-f | 14.00fg | 8.50h-j | 19.15A   | 35.40a   | 30.00bc  | 21.28de  | 16.38fg | 9.52hi  | 22.4A    |          |          |          |          |          |
| Mean                  | 24.90A   | 21.10A   | 13.95B   | 9.00C   | 4.68C   | 30.05A   | 25.43A   | 16.42B   | 10.12C   | 5.30C   |          |          |          |          |          |          |
| Hybrid 1              | 24.00d-f | 20.75d-f | 17.50f-h | 16.00gh | 13.75h-j| 18.4B    | 26.50d-f | 24.25e-c | 21.25e-g | 18.0gh  | 15.50hi | 21.1B    |          |          |          |          |          |
| Hybrid 2              | 21.75c-e | 18.75e-g | 15.50g-i | 14.50h-j| 12.00h  | 16.5BC   | 25.25b-d | 23.25c-e | 19.75f-h | 15.50hi | 13.50i  | 19.45C   |          |          |          |          |          |
| Hybrid 3              | 22.25c-e | 17.50f-h | 14.75b-j | 13.00h-j| 11.25f  | 15.75c   | 24.75c-e | 21.75e-f | 19.24f-h | 15.00hi | 13.75f  | 18.90C   |          |          |          |          |          |
| Hybrid 4              | 26.75ab  | 23.50b-d | 19.00e-g  | 17.25f-h| 15.75g-i| 20.45A   | 27.25a-c | 26.25b-d | 22.75d-f | 19.00f-h| 16.00hi | 22.25B   |          |          |          |          |          |
| Hybrid 5              | 29.75a   | 25.00bc  | 20.75d-f | 19.50e-g | 17.00f-h| 22.4A    | 31.75a   | 29.25ab  | 24.75c-e | 21.75e-g| 18.50gh | 25.2A    |          |          |          |          |          |
| Mean                  | 24.9A    | 21.1AB   | 17.5BC   | 16.05CD | 13.95D | 27.1A    | 24.95A   | 21.55B   | 17.85C   | 15.45C |          |          |          |          |          |          |
| Hybrid 1              | 13.30a   | 12.77ab  | 10.64cd  | 7.98fg  | 7.45g   | 10.43B   | 12.77bc  | 12.77bc  | 11.17de  | 8.51fg  | 7.98fg  | 10.64C   |          |          |          |          |          |
| Hybrid 2              | 13.30a   | 12.77ab  | 10.11cd  | 7.45g   | 6.92g   | 10.11B   | 13.30bc  | 12.77bc  | 10.11de  | 7.45g   | 6.38g   | 10.00C   |          |          |          |          |          |
| Hybrid 3              | 13.83a   | 12.77ab  | 10.64cd  | 7.98fg  | 6.92g   | 10.43B   | 13.83ab  | 12.77bc  | 10.64de  | 7.98fg  | 7.98fg  | 10.64C   |          |          |          |          |          |
| Hybrid 4              | 13.30a   | 13.30a   | 11.17bc  | 9.04d-f | 8.51ef  | 11.06AB  | 14.89a   | 13.30bc  | 11.70cd  | 10.11de | 9.57ef  | 11.92B   |          |          |          |          |          |
| Hybrid 5              | 13.83a   | 13.83a   | 12.23b   | 10c-e   | 8.51ef  | 11.68A   | 15.42a   | 14.89a   | 14.36ab  | 11.17de | 9.57ef  | 13.08A   |          |          |          |          |          |
| Mean                  | 13.51A   | 13.09A   | 10.96B   | 8.49C   | 7.66C   | 14.04A   | 13.30A   | 11.60B   | 9.05C   | 8.29D   |          |          |          |          |          |          |

*Means having the same letter (s) in a column or line are not significantly different at 5% level
*Capital letters refer to the effect of main factor while small one refer to the interaction effect between factor
These results are in agreement with Massai and Gucci 1998 who cleared that in all almond rootstocks significant decrease in stem height, leaf area and leaf number had recorded under high salinity levels (6 and 9 dSm⁻¹). The interaction between salinity levels and genotypes was significant only on leaf area index. Low salinity levels (1.5 and 3 dSm⁻¹) were not significant in all plant growth parameters. The decline in leaf growth is the earliest response to salinity.

3.3 Effect of various water salinity levels on fresh weight (g.) and dry weight (g.) of new almond × peach hybrid rootstocks

Data in Table 4 showed the effect of various water salinity levels on fresh and dry weights of the different hybrids. Data showed that both measurements take the same tendency as the previous growth parameters, both measurements were high with control while the opposite was true with 2000ppm. Also, hybrid No.5 was the superior one.

As for the specific effect of salinity levels, it was clear that control treatments reached the highest significant value of fresh weight (132.84 & 140.98g./plant) and dry weight (55.80 & 59.22g./plant) in both season respectively.

Moreover, data in Table 4 showed the hybrid specific effect. Where hybrid No.4 recorded the highest significant fresh weight (122.68 g./plants) and dry weight (50.24 g./plants) in the 1st season as well as hybrid No.5 in the 1st season and 2nd season (120.24 & 129 g./plants in fresh weight and 49.24 & 52.85 g./plants in dry weight). On the other hand hybrid No.3 got the lowest significant value in both measurements in both seasons.

As for the interaction between the two studied factors, data cleared that hybrid No. 4 irrigated with control treatment reached the highest significant value of fresh weight (136.7 g./plants) and dry weight (57.42 g./plants) in the 1st season as well as hybrid No.5 in the 2nd season (144.55 & 60.69 g./plant for fresh and dry weight respectively). While, hybrids No.1 and No.3 got the lowest significant value of both measurements with the high salt concentration. These results are in agreement with Massai and Gucci 1998 who showed that high salinity levels caused significant reduction in dry and fresh weight of all almond rootstock genotypes.

3.4 Effect of various water salinity levels on leaf nitrogen, phosphorus and potassium contents (g/100g dry weight) of new almond × peach hybrid rootstocks

Data in Table 5 reflected the effect of various water salinity levels on leaf nitrogen, phosphorus and potassium contents (g./100 g. dry wt) of new hybrid rootstocks. Data showed that the low concentration of salinity was better than the high salinity level. However, the effect of salinity levels on different hybrids takes the same trend as the previous growth parameters.

As for the effect of various water salinity levels, the highest significant values of N and K% were recorded with different hybrids irrigation with control (1.91 & 1.99 for N% and 2.11 & 2.34 for K% in 1st season and 2nd season respectively). On the other hand the highest salt concentration 2000ppm gave the lowest significant levels of both minerals N% (1.27 & 1.51) and K% (1.47 & 1.74) in both seasons. However, all hybrids were superior effective in levels of N% and K% but hybrid No.5 recorded the highest level of N% (1.66 & 1.80), and K% (1.83 & 1.99) in both season respectively as well as hybrids No.1, 2 and 4 with slightly differences. Moreover P% showed no significant differences between all hybrids in both seasons but hybrids No.1 and 3 recorded low significant value in the 1st season (0.21).

Interaction between the two studied factors was significant with leaf mineral contents in most cases, where the highest values of N% and K% were recorded by hybrid No. 5 irrigated with control treatment followed by the same hybrid with 500 ppm. Hybrid No.5 with control recorded for N% (1.97 & 2.05) while for K% recorded (2.32 & 2.41) in both seasons.
### Table 4. Effect of various water salinity levels on fresh weight (g.) and dry weight (g.) of new almond × peach hybrid rootstocks

| Salinity levels (ppm) | 1st season | 2nd season | Means | 2nd season | 2nd season |
|-----------------------|------------|------------|-------|------------|------------|
|                       | control    | 500        | 1000  | 1500       | 2000       | Mean       |
| Hybrid 1              | 134.8a     | 127.1cd    | 112.5f| 109.2gh    | 97.6j      | 116.2B     |
| Hybrid 2              | 131.6a-c   | 125.4de    | 114.2f| 106.3hi    | 104.3i     | 116.36B    |
| Hybrid 3              | 128.4b-d   | 121.3e     | 111.2f-h| 103.4i    | 98.2j      | 112.5C     |
| Hybrid 4              | 136.7a     | 128.6b-d   | 122.3e| 115.7f    | 110.1f-h   | 122.6B     |
| Hybrid 5              | 132.7a     | 126.5c-e   | 121.4e| 113.2f-g  | 107.4hi    | 120.24A    |
| Mean                  | 132.8a     | 125.78b    | 116.32C| 109.56D  | 103.52E    | 140.98A |

| Fresh weight (g.)     | 1st season | 2nd season | Means | 2nd season | 2nd season |
|-----------------------|------------|------------|-------|------------|------------|
| Hybrid 1              | 56.62ab    | 54.65bc    | 46.13f| 43.24gh    | 37.68j     | 47.66BC    |
| Hybrid 2              | 55.27bc    | 53.92cd    | 46.82f| 42.95gh    | 40.26i     | 47.85BC    |
| Hybrid 3              | 53.93cd    | 52.16d     | 45.60f| 40.95i     | 37.91j     | 46.11C     |
| Hybrid 4              | 57.42a     | 55.30bc    | 50.15e| 45.82f     | 42.50gh    | 50.24A     |
| Hybrid 5              | 55.74a-c   | 54.40c     | 49.78e| 44.83f-g   | 41.46hi    | 49.24AB    |
| Mean                  | 55.80a     | 54.09A     | 47.70B| 43.56C     | 39.96D     | 59.22A     |

*Means having the same letter(s) in a column or line are not significantly different at 5% level.
*Capital letters refer to the effect of main factor while small one refer to the interaction effect between factors.
Table 5. Effect of various water salinity levels on leaf nitrogen, phosphorus and potassium contents (g/100g dry. wt) of new almond × peach hybrid rootstocks

| Salinity levels (ppm) | 1st season | Mean | 2nd season | Mean |
|-----------------------|------------|------|------------|------|
|                       | Control    | 500  | 1000       | 1500 | 2000 | Control    | 500  | 1000       | 1500 | 2000 |
| N%                    |            |      |            |      |      |            |      |            |      |      |
| Hybrid 1              | 1.88ab     | 1.75b-d | 1.60d-e | 1.40e-g | 1.28g | 1.58AB     | 1.95ab     | 1.86a-c | 1.79b-d | 1.60d-f | 1.51ef | 1.74AB     |
| Hybrid 2              | 1.93ab     | 1.70cd | 1.63cd | 1.39fg | 1.26g | 1.58AB     | 1.98ab     | 1.83bc | 1.71c-e | 1.61d-f | 1.48f  | 1.72AB     |
| Hybrid 3              | 1.82ac     | 1.67cd | 1.52df | 1.37fg | 1.23g | 1.52B      | 1.93ab     | 1.81bc | 1.69c-e | 1.57ef | 1.46f  | 1.69B      |
| Hybrid 4              | 1.94ab     | 1.83a-c | 1.75b-d | 1.41e-g | 1.28g | 1.64A      | 2.04a      | 1.89ab | 1.80bc | 1.62d-f | 1.53ef | 1.78AB     |
| Hybrid 5              | 1.97a      | 1.86a-c | 1.72b-d | 1.45e-g | 1.30g | 1.66A      | 2.05a      | 1.91ab | 1.80bc | 1.67c-f | 1.55ef | 1.80A      |
| Mean                  | 1.91A      | 1.76AB | 1.64B  | 1.41C  | 1.27D  |            | 1.99A      | 1.86AB | 1.76BC | 1.62CD | 1.51D  |            |
| P%                    |            |      |            |      |      |            |            |      |            |      |      |            |            |
| Hybrid 1              | 0.24ab     | 0.24ab | 0.21cd | 0.19de | 0.16e | 0.21B      | 0.28a      | 0.26ab | 0.23b-d | 0.21cd | 0.20d  | 0.24A      |
| Hybrid 2              | 0.25ab     | 0.26ab | 0.24ab | 0.17e  | 0.17e | 0.22AB     | 0.28a      | 0.25a-c | 0.23b-d | 0.22cd | 0.21cd | 0.24A      |
| Hybrid 3              | 0.23bc     | 0.23bc | 0.23bc | 0.20c-e | 0.16e | 0.21B      | 0.27ab     | 0.25a-c | 0.25a-c | 0.22cd | 0.20d  | 0.24A      |
| Hybrid 4              | 0.27a      | 0.27a  | 0.24ab | 0.18de | 0.19e  | 0.23AB     | 0.29a      | 0.26ab | 0.24b-d | 0.21cd | 0.20d  | 0.24A      |
| Hybrid 5              | 0.28a      | 0.26ab | 0.23bc | 0.22b-d | 0.19de | 0.24A      | 0.29a      | 0.27ab | 0.25a-c | 0.23b-d | 0.21cd | 0.25A      |
| Mean                  | 0.25A      | 0.25A  | 0.23A  | 0.19B  | 0.18C  |            | 0.28A      | 0.26AB | 0.24BC | 0.22C   | 0.21C  |            |
| K%                    |            |      |            |      |      |            |            |      |            |      |      |            |            |
| Hybrid 1              | 2.06ab     | 1.78b-d | 1.67c-e | 1.54d-e | 1.45e  | 1.70BC     | 2.19a-c     | 1.99b-d | 1.85d-e | 1.77e  | 1.76e  | 1.91AB     |
| Hybrid 2              | 2.24a      | 1.78b-d | 1.65c-e | 1.58de | 1.47e  | 1.75AB     | 2.25ab     | 2.01b-d | 1.89cd | 1.78e  | 1.71e  | 1.93AB     |
| Hybrid 3              | 1.75cd     | 1.79b-d | 1.66c-e | 1.54d-e | 1.42e  | 1.63C      | 2.13bd     | 1.94c-e | 1.86de | 1.77e  | 1.69f  | 1.88B      |
| Hybrid 4              | 2.19a      | 1.80b-d | 1.75cd | 1.60c-e | 1.49e  | 1.77AB     | 2.44a      | 2.01b-d | 1.91c-e | 1.83de | 1.76e  | 1.99A      |
| Hybrid 5              | 2.32a      | 1.89bc | 1.76b-d | 1.65c-e | 1.53d-e | 1.83A      | 2.41ab     | 2.02b-d | 1.92c-e | 1.85de | 1.76e  | 1.99A      |
| Mean                  | 2.11A      | 1.81B  | 1.70BC | 1.58C  | 1.47D  |            | 2.34A      | 2.00B  | 1.89BC | 1.80D   | 1.74D  |            |

*Means having the same letter (s) in a column or line are not significantly different at 5% level

*Capital letters refer to the effect of main factor while small one refers to the interaction effect between factors.
Moreover, hybrid No.5 with 500ppm reached 1.86 & 1.91 for N% and 1.89 & 2.02 for K% in 1st and 2nd seasons respectively. Data showed that hybrid No.4 was same as hybrid No.5 with slightly differences in both seasons. On the other hand, hybrid No.3 recorded the lowest significant values of both minerals (1.23 & 1.46 for N% and 1.42 & 1.69 for K%) in both seasons.

Data in Table 5 showed that, the high salinity level gives the lowest P% while the low salinity level (control) reached the highest concentration of P% in both seasons. It also clear that there was a slightly differences between hybrids in the 1st season while there was no differences in the 2nd one. As for the interaction between the two factors on P% concentration, data cleared that with low salinity concentration hybrids No. 1, 2, 4 and 5 recorded the highest significant value of P%, while hybrid No.3 was the least hybrid with all salinity concentration.

3.5 Effect of various water salinity levels on magnesium content (g/100g dry weight), leaf iron and manganese content (ppm) of new almond × peach hybrid rootstocks

Table 6 showed the effect of various water salinity levels on Mg %, Fe and Mn (ppm) of the new hybrid rootstocks on the two seasons. Data took the same trend as well as the previous measurements. The highest significant values were recorded in either the lowest salt concentration or hybrids No.5 and No.4 while the high salinity treatment and hybrid No.3 was the least hybrid in this respect.

As for the effect of salt concentration, data cleared that the control plants exhibited the highest significant values in both seasons (0.49 & 0.44 for Mg%, 201.82 & 186.7 ppm for Fe and 82.2 & 75.4 ppm for Mn). The opposite view was true with the high concentration (2000 ppm) (0.30 & 0.20 for Mg%, 129.1 & 118.34 ppm for Fe and 46.6 for Mn in 1st and 2nd seasons respectively).

Hybrids were greatly affected by different salt concentration. It is clear that hybrid No.5 recorded the highest significant values (0.41 & 0.35 for Mg%, 174.22 & 160.08 ppm for Fe and for Mn 67.6 & 63.8 ppm) as well as hybrid No.4 (0.40 & 0.34 for Mg%, 169.84 & 156.76ppm for Fe and 65.0 & 61.2 ppm for Mn) for both seasons. While hybrid No.3 was the least hybrid in both seasons (0.37 & 0.30 for Mg%, 157.8 & 145.8 ppm for Fe and for Mn 60.6 & 58.0 ppm).

Interaction values cleared that hybrid No.5 irrigated with tap water (control) gained the highest significant values (0.51 & 0.47 for Mg%, 212.9 & 195.1 ppm for Fe and 86.0 & 79.0ppm for Mn). On the opposite hybrid No.3 under high salinity concentration (2000 ppm) got the lowest significant values (0.28 & 0.18 for Mg%, 121.0 & 113.2 ppm for Fe and for Mn 44.0 & 46.0 ppm) in both seasons respectively.

3.6 Effect of various water salinity levels on Na and Cl content (ppm) of new almond × peach hybrid rootstocks

Leaf Na and Cl concentration are important indicator minerals to be noticed for the effect of salinity experiments, data in Table 7 cleared that the Na concentration of the different hybrids increased significantly at the high salinity level as well as Cl concentration.

Regardless the effect of different salinity levels, data cleared that control treatment of salinity reached the lowest significant values of Na (2.70 & 2.63) and Cl (0.34 & 0.33) in 1st season and 2nd season respectively. On the opposite 2000ppm recorded the highest significant values of both minerals (6.54 & 6.84 for Na and 2.67 & 2.64 for Cl in both seasons respectively).

As for the hybrid type effect on Na and Cl concentration, data showed that hybrid No.5 reached the lowest significant value of Na (4.16 & 4.01) and Cl (1.29 & 1.28), while hybrid No.1 got the highest significant one (4.67 & 4.90 for Na and 1.59 & 1.49 for Cl) in both seasons respectively.
Table 6. Effect of various water salinity levels on magnesium content (g/100g dry wt), leaf iron and manganese content (ppm) of new almond x peach hybrid rootstocks

| Salinity levels (ppm) | 1st season | Mean | 2nd season | Mean |
|-----------------------|------------|------|------------|------|
|                       | Control 500 | 1000 | 1500 | 2000 | Control 500 | 1000 | 1500 | 2000 |
| Mg%                   |            |      |      |      |            |      |      |      |
| Hybrid 1              | 0.48ab     | 0.42b-d | 0.40b-d | 0.32e-g | 0.29g | 0.38B | 0.45ab | 0.36cd | 0.30d-f | 0.24fg | 0.20g | 0.31B |
| Hybrid 2              | 0.47ab     | 0.44a-c | 0.39c-e | 0.34e-g | 0.28g | 0.39AB | 0.42ab | 0.37bc | 0.30d-f | 0.25fg | 0.18g | 0.31B |
| Hybrid 3              | 0.46ab     | 0.42b-d | 0.37d-f | 0.33e-g | 0.28g | 0.37B | 0.41a-c | 0.36cd | 0.30d-f | 0.24fg | 0.18g | 0.30B |
| Hybrid 4              | 0.51a      | 0.42b-d | 0.41b-d | 0.33e-g | 0.31fg | 0.40A | 0.46a | 0.39bc | 0.34c-e | 0.28ef | 0.20g | 0.34A |
| Hybrid 5              | 0.51a      | 0.45a-c | 0.4b-d1 | 0.35d-f | 0.32e-g | 0.41A | 0.47a | 0.40a-c | 0.35cd | 0.28ef | 0.23fg | 0.35A |
| Mean                  | 0.49A      | 0.43AB | 0.40B | 0.34C | 0.30C | 0.44A | 0.38A | 0.32B | 0.26B | 0.20C |
| Fe (ppm)              |            |      |      |      |            |      |      |      |
| Hybrid 1              | 200.3ab    | 187.4b-d | 167.8e | 145.1fg | 128.5gh | 165.82AB | 183.2ab | 169.6b-d | 150.3ef | 140.2fg | 117.9i | 152.24B |
| Hybrid 2              | 196.1a-c   | 183.5cd | 166.3e | 142.5fg | 126.6gh | 163.00BC | 185.8ab | 168.1b-d | 153.3ef | 131.7gh | 113.4i | 150.46BC |
| Hybrid 3              | 194.6a-c   | 176.2c-e | 157.8ef | 139.4f-h | 121.0h | 157.8C | 178.6a-c | 162.2c-e | 145.8e-g | 129.4gh | 113.2i | 145.84D |
| Hybrid 4              | 205.2a-b   | 189.9b-d | 173.2de | 146.6f-g | 134.3gh | 169.84AB | 190.8a | 172.2b-d | 159.5de | 140.9fg | 120.4hi | 156.76AB |
| Hybrid 5              | 212.9a     | 192.2a-c | 174.6de | 156.3ef | 135.1gh | 174.22A | 195.1a | 175.3bc | 160.9de | 142.3fg | 126.8hi | 160.08A |
| Mean                  | 201.82A    | 185.84A | 167.94B | 145.98C | 129.1D | 186.7A | 169.48AB | 153.96B | 136.9C | 118.34D |
| Mn (ppm)              |            |      |      |      |            |      |      |      |
| Hybrid 1              | 80.0ab     | 75.0b-d | 60.0fg | 55.0gh | 47.0h | 63.4BC | 76.0ab | 68.0c | 63.0cd | 51.0fg | 47.0g | 61.0AB |
| Hybrid 2              | 82.0ab     | 73.0cd | 61.0fg | 52.0hi | 45.0f | 62.6C | 74.0ab | 69.0bc | 60.0de | 49.0fg | 46.0g | 59.6B |
| Hybrid 3              | 79.0a-c    | 72.0cd | 58.0fg | 50.0hi | 44.0j | 60.6C | 70.0bc | 68.0c | 57.0de | 49.0fg | 46.0g | 58.0B |
| Hybrid 4              | 84.0a      | 75.0b-d | 64.0ef | 54.0gh | 48.0i | 65.0AB | 78.0a | 67.0c | 65.0cd | 50.0fg | 46.0g | 61.2AB |
| Hybrid 5              | 86.0a      | 77.0bc | 70.0cd | 56.0gh | 49.0hi | 67.6A | 79.0a | 70.0bc | 67.0c | 55.0ef | 48.0fg | 63.8A |
| Mean                  | 82.2A      | 74.4B | 62.6C | 53.4D | 46.6E | 75.4A | 68.4AB | 62.4B | 50.8C | 46.6C |

*Means having the same letter (s) in a column or line are not significantly different at 5% level
*Capital letters refer to the effect of main factor while small one refer to the interaction effect between factors
### Table 7. Effect of various water salinity levels on Na and Cl content (ppm) of new almond × peach hybrid rootstocks

| Salinity levels (ppm) | 1st season | Mean | 2nd season | Mean |
|------------------------|------------|------|------------|------|
|                        | Control    | 500  | 1000       | 1500 | 2000 | Control    | 500  | 1000       | 1500 | 2000 |
| Hybrid 1               | 2.64i      | 3.41g-i | 4.56ef    | 5.84b-d | 6.92a | 4.67A       | 2.65j | 3.36h-j    | 4.76fg | 6.30bc | 7.42a | 4.90A |
| Hybrid 2               | 2.58i      | 3.26g-i | 4.45e-g    | 5.51cd   | 6.77ab | 4.51AB      | 2.57j | 3.21ij     | 4.12f-h | 5.84c-e | 7.14ab | 4.58B |
| Hybrid 3               | 2.76i      | 3.56g-i | 4.11fg     | 5.21c-e  | 6.59ab | 4.45AB      | 2.56j | 3.07ij     | 4.35f-h | 5.06ef   | 7.23ab | 4.46BC |
| Hybrid 4               | 2.85i      | 3.07i   | 4.21c-g    | 4.96d-f  | 6.22a-c | 4.26BC      | 2.65j | 3.11ij     | 3.85g-i | 5.21d-f  | 6.25bc | 4.21CD |
| Hybrid 5               | 2.66i      | 3.11hi  | 3.98f-h    | 4.82d-f  | 6.21a-c | 4.16C       | 2.71j | 2.85ij     | 3.51h-j | 4.83ef   | 6.15cd | 4.01D |
| Mean                   | 2.70D      | 3.28D  | 4.26C      | 5.27B    | 6.54A | 2.63D       | 3.12D | 4.12C      | 5.45B   | 6.84A    |         |      |

|                        | Control    | 500  | 1000       | 1500 | 2000 | Control    | 500  | 1000       | 1500 | 2000 |
| Hybrid 1               | 0.32h      | 0.92g  | 1.54ef     | 2.37bc  | 2.78ab | 1.59A       | 0.31i | 0.71hi     | 1.32f-h | 2.45bc   | 2.64ab | 1.49A |
| Hybrid 2               | 0.29h      | 0.91g  | 1.76de     | 2.16cd  | 2.94a  | 1.61A       | 0.35i | 0.89gh     | 1.56d-f | 1.94cd   | 3.05a  | 1.56A |
| Hybrid 3               | 0.36h      | 0.94g  | 1.63d-f    | 2.11cd  | 2.81ab | 1.57A       | 0.31i | 0.93gh     | 1.45ef   | 2.05cd   | 2.77ab | 1.50A |
| Hybrid 4               | 0.38h      | 0.71gh | 1.17fg     | 1.96c-e | 2.46bc | 1.34B       | 0.31i | 0.71hi     | 1.15f-h | 1.85de   | 2.34bc | 1.27B |
| Hybrid 5               | 0.35h      | 0.76gh | 1.21fg     | 1.81de  | 2.34bc | 1.29B       | 0.37i | 0.69hi     | 1.11f-h | 1.80de   | 2.42bc | 1.28B |
| Mean                   | 0.34C      | 0.81C  | 1.46B      | 2.08A   | 2.67A  | 0.33D       | 0.79C | 1.32BC     | 2.02AB  | 2.64A    |         |      |

*Means having the same letter(s) in a column or line are not significantly different at 5% level.
*Capital letters refer to the effect of main factor while small one refer to the interaction effect between factors.
Table 8. Effect of various water salinity levels on proline (Ug/g leaves Dw) and chlorophyll (mg/100g leaves Fw.) of new almond × peach hybrids rootstocks

| Salinity levels (ppm) | 1st season | Mean | 2nd season | Mean |
|-----------------------|------------|------|------------|------|
|                       | Control    | 500  | 100        | 1500 | 2000 | Mean | Control | 500 | 1000 | 1500 | 2000 | Mean |
| Hybrid 1              |            |      |            |      |      |      |         |      |      |      |      |      |
| Proline (Ug/leaves Dw) | 32.00j     | 39.00g-i | 47.00ef | 55.00cd | 63.00ab | 47.20B | 41.00h | 48.00g | 58.00ef | 62.00de | 74.00ab | 56.60BC |
| Hybrid 2              | 36.00j     | 43.00f-h | 50.00de | 59.00bc | 67.00a  | 51.00A | 41.00h | 52.00g | 60.00de | 70.00bc | 79.00a  | 60.40B |
| Hybrid 3              | 35.00j     | 40.00g-i | 49.00d-f | 55.00cd | 65.00ab | 48.80AB | 40.00h | 50.00g | 59.00d-f | 65.00cd | 79.00a  | 63.25A |
| Hybrid 4              | 33.00j     | 38.00h-j | 48.00ef | 53.00de | 60.00bc | 46.40BC | 37.00h | 48.00g | 54.00fg | 64.00cd | 76.00ab | 55.80C |
| Hybrid 5              | 29.00j     | 36.60ij | 44.20fg | 51.80de | 59.40bc | 44.20C  | 33.00h | 42.60g | 52.20e  | 61.80de | 71.40b  | 52.20D |
| Mean                  | 33.00D     | 39.32C | 47.64B    | 54.76B | 62.88A | 38.4E  | 48.12D | 56.64C | 64.56B  | 75.88A  |        |      |
| Chlorophyll (mg/100g leaves Fw.) | 1.10ab     | 1.08ab | 0.95d-f   | 0.85gh | 0.69j  | 0.94B  | 0.95a  | 0.86c  | 0.77d   | 0.64fg  | 0.49i   | 0.74B |
| Hybrid 1              |            |      |            |      |      |      |         |      |      |      |      |      |      |
| Hybrid 2              | 1.11ab     | 1.07bc | 0.94ef    | 0.86g  | 0.74ij | 0.94B  | 0.92ab | 0.84c  | 0.75de  | 0.59gh  | 0.43j  | 0.71C |
| Hybrid 3              | 1.10ab     | 1.03c  | 0.91fg    | 0.81h  | 0.69j  | 0.91C  | 0.93ab | 0.83c  | 0.70ef  | 0.54hi  | 0.42j  | 0.69C |
| Hybrid 4              | 1.12a      | 1.09ab | 0.98d    | 0.87g  | 0.75ij | 0.96AB | 0.95a  | 0.87bc | 0.82ed  | 0.64fg  | 0.51i  | 0.76A |
| Hybrid 5              | 1.13a      | 1.10ab | 1.01cd    | 0.89fg | 0.77hi | 0.98A  | 0.97a  | 0.88bc | 0.83c   | 0.68f   | 0.54hi | 0.78A |
| Mean                  | 1.12A      | 1.08A  | 0.96B    | 0.86C  | 0.73D  |         | 0.94A  | 0.86B  | 0.77C   | 0.62D   | 0.48E  |        |

*Means having the same letter (s) in a column or line are not significantly different at 5% level

**Capital letters refer to the effect of main factor, while small one refer to the interaction effect between factors
Moreover the interaction between the two factors, It was noticed that hybrid No.5 with 2000ppm reached the highest significant value of Na (6.21&6.15) and Cl (2.34&2.42 as well as hybrid No.4 with a slightly differences. While hybrid No.2 recorded the lowest significant values of both minerals with control, it got 2.58&2.57for Na and 0.29 for the 1st season as well as hybrids No.1, 3 and 4 in the 2nd season (0.31).

These results in agreement with those of Jalil et al 2012 who mentioned significant increasing in mineral concentration (Mg $^{2+}$, Cl$^-$ and Na$^+$) in the leaf of almond genotypes, while K$^+$ concentrations was not affected because of salinity.

### 3.7 Effect of various water salinity levels on proline (Ug/g leaves Dw) and chlorophyll (mg/100g leaves Fw.) of new almond ×peach hybrids rootstocks

It is quite evident from data in Table 8 that high salinity level had negative effect on chlorophyll concentration while proline concentration was increased under high salinity level. Moreover the different genotypes of rootstocks showed different response to salinity but overall hybrid No.5 was the superior one in this respect.

Data in Table 8 reveals obviously the effect of salinity level on proline and chlorophyll, data cleared that high level of salinity recorded the highest significant value of proline (62.88 & 75.88) and the lowest content level of chlorophyll (0.73 & 0.48) in both seasons respectively. On the other hand the control treatment recorded the lowest significant values of proline (33.00& 38.4) and the highest significant values of chlorophyll (1.12 & 0.94) in 2018 and 2019.

Regardless the effect of salinity on different hybrids, hybrid No.3 recorded the highest significant values of proline (48.80 & 63.25) and lowest significant values of chlorophyll (0.91 & 0.69) in the 1st and 2nd season respectively. While hybrid No.5 recorded the opposite in both season for proline (44.20 & 52.20) and for chlorophyll (0.98 & 0.78) as well as hybrid No. 4 which recorded (46.40 & 55.8 for proline and 0.96 & 0.76 for chlorophyll) in both seasons.

The interaction values cleared that under high salinity (2000 ppm) hybrid No.5 recorded the lowest significant values of proline (59.40 & 71.41) and the highest significant values of chlorophyll (0.77 & 0.54) with slightly differences with hybrid No.4. On the other hand under the same salinity level, hybrid No.3 recorded the highest significant values of proline (65.00 & 79.00) and the lowest significant values of chlorophyll (0.69 & 0.42) for both seasons respectively.

The previous results in agreement with Jalil et al 2012 who cleared that increasing salinity level significantly increase leaf proline contents in almond genotypes. Jalil et al 2012 mentioned that significantly reduction in chlorophyll (a, b, total and index) contents of leaves were recorded by increasing salinity level.

### 4 Conclusion

From the obtained data in this research was clear that hybrid No.5 was the most tolerance hybrid as a rootstock to salinity stress. The highest salinity concentration reduced its growth parameters by about 40% for seedling stem diameter, height, number of leaves, buds and leaf area, reduced fresh weight by 20%and dry one by 25%, chlorophyll content by 30%. On the other hand it decreased proline concentration by 80% and sodium concentration to three fold while chloride to seven folds. From the above data it could be recommended for using hybrid number5 or number4 under high salinity condition (2000 ppm) as a promising rootstocks to face salinity injuries.

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تقييم تحمل الملوحة في أصول مختارة من هجن جديد من اللوز × الخوخ

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الموجـZZ

الهدف الرئيسي من هذه التجربة هو تقييم تحمل خمسة أصول هجين جديد من اللوز × الخوخ للملوحة بدراسة مقاييس النمو الخضري والكيميائي لهم بهدف التوصية بالاستخدام التجاري لهذه الأصول في المشاتل.

وقد أجريت هذه التجربة في معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر، خلال موسمين متتاليين (2018–2019 و2019–2020). وشملت الأصول المختارة لهذه التجربة أصول جديدة من اللوز × الخوخ مقاومة للنيلاتودا. وشملت التجربة أربعة مستويات من كلوريد الصوديوم بتركيزات 500، 1000، 1500، 2000 جزء في المليون، كان هناك اختلاف اتصالات ببعض الامكانيات في تحمل هذه الأصول للملوحة. وشملت هذه الامكانيات اанныي وcentration. هذه الامكانيات سجلت اعلى قيمة في هجين رقم 3، وكان هناك اختلاف بين هجيني رقم 4 و5 في تركيزات البرولين في جميع الامكانيات، حيث سجل اعلى قيمة في هجين رقم 4.

وقد تحت ظروف هذه التجربة باستخدام أصل هجين رقم 5 والهجين رقم 4 لزراعة تحت ظروف الترکيزات العالية من الملوحة بالتجربة.