SAMMARY AND CONCLUSION

This study was carried out during 1996 and 1997 summer seasons at the Experimental Farm of the Faculty of Agriculture, Moshtohor, Zagazig University to study the effect of some chemical materials on growth, flowering, yield and quality characteristics of tomato plants grown under saline conditions, and the possibility of using drainage water in replacing partially the Nile water in irrigation of tomato plants. This study included two experiments as follows:

The first experiment : (Pots experiment):

This experiment was carried out to investigate the effect of the foliar application of some chemical materials on vegetative growth, flowering behaviour, chemical composition of leaves, yield and its components , fruits quality as well as roots and leaves anatomy of tomato plants cv. UC97-3. This experiment included 35 treatments which were the combinations of 5 salinity levels of irrigation water i.e. 0, 3000, 6000, 9000 and 12000 ppm of sodium chloride beside control treatment (tap water) with 7 treatments of chemicals foliar applied for alleviating the expected deleterious effects of such conditions. Chemical materials tested in this investigation were as follows:

1- Phosphoric acid at 10 and 20 mM.
2- Proline acid at 30 and 60 p.p.m.
3- Paclobutrazol at 100 and 200 p.p.m.
4- Distilled water as control.

Obtained results can be summarized as follows :

1-Vegetative growth characteristics: Vegetative growth characteristics as plant height, root length, number of both leaves

and branches/ plant, fresh and dry weight of each shoots and roots as well as shoot/ root ratio were gradually decreased by increasing salinity levels. In this regard, application of the studied chemical, especially phosphoric acid at 10 and 20 mM and proline acid 30 and 60 ppm minimized the depressive effects of salinity on all studied vegetative growth parameters. On the other hand, paclobutrazol treatments showed superiority only in case of root parameters.

2-**Chemical composition of leaves:** Irrigation tomato plants with increasing salinity levels, decreased greatly and steadily tomato leaves content of chlorophyll a, b and a+ b. However carotenoids content were increased. This depression in chlorophyll a and b can be reduced by the application of any kind of chemical materials, especially phosphoric acid at 10 and 20 mM.

3-Increasing salinity levels led to a progressive and continuos reduction in leaves content of N, P, K, Ca and Mg. However, opposite trend was detected in case of Na and Cl. Using phosphoric acid at 10 mM showed superiority in increasing content of N, P, K, Ca and Mg and decreasing those of Na and Cl in tomato leaves as compared with any other treatment studied under all salinity conditions.

As for Na^+:K^+, Na^+ :Ca^{++} and Na^+ :Mg^{++} ratios as well as free proline content in tomato leaves, an increasing tendency was detected as salinity level increased. In this regard, spraying tomato plants, grown under salinity conditions with either phosphoric acid (10 and 20 mM) or proline acid (30 and 60 mM) decreased the harmful effect of salinity through minimizing Na^+: cations ratios. Whereas

application of proline acid led to a further increase in leaves content of free proline.

4-Flowering characteristics: Flowering characteristics of tomato plants as number of clusters and flowers/plant were gradually decreased by increasing salinity level. In the regard, application of phosphoric acid (10 and 20 mM) improved this parameters.

5-yield and its components: Tomato yield and its components expressed as number of fruits/plant, average fruit weight, length and diameter as well as plant yield were progressive and steadily decreased by increasing salinity level. This depression in these parameters can be reduced by the application of any of the studied chemicals, especially phosphoric acid (10 and 20 mM), proline acid (30 ppm) and paclobutrazol (100 ppm).

6-Fruit quality: Increasing levels of salinity in irrigation water gradually increased fruits content of ascorbic acid (Vit.C.), titratable acidity total soluble solids (T.S.S.). In this regard, application of either phosphoric acid (10 and 20) or paclobutrazol (100 ppm) significantly improved fruits content of Vit.C. and T.S.S. compared with the control, whereas proline acid (30 or 60 ppm) led to significant increase in fruits content of T.S.S. only. On the contrary, application of all used chemicals did not affect significantly fruits content of titratable acidity.

7-Fruits content of reducing and total sugars were gradually decreased as salinity levels in irrigation water increased. Vice- versa results were detected in case of non-reducing sugars. In this connection, spraying tomato plants with phosphoric acid (10 and 20 mM)

improved fruit content of sugars and decreased the harmful effect of salinity in this respect. Paclobutrazol exhibited to some extent a positive effect on fruits content of sugars.

8-Tomato plants that irrigated with solutions contained increasing levels of salinity show a gradual reduction in fruits content of N, P, K and Ca elements. However, contra trend was observed in case of Na. Such deleterious effects on fruits mineral composition can be diminished by application of any of the used chemicals (phosphoric acid, proline acid and paclobutrazol). On the other hand, spraying tomato plants with such materials led to decreased fruits content of Na element compared to control treatment.

9-Anatomy features of plant: Increasing salinity level reduced the thickness of all studied features of root i.e epidermis, cortex, phloem, xylem and pith tissues, as well as leaf i.e blade, measophyll (palisade and spongy tissues), upper and lower epidermis, and number of xylem vessels whereas, diameter and width of midrib exhibited slightly increase with increasing salinity levels. In this respect, spraying tomato plants with any of the studied chemicals, especially phosphoric acid (10 and 20 mM) resulted the highest values of root parameters as well as all chemicals in case of leaves anatomy features exhibited the highest values compared to control treatment.

Conclusion:

Generally, it may be concluded that irrigating tomato plants UC97-3 cv. with saline water containing up till 6000 ppm Na Cl can be safety used. This must be accompanied by spraying tomato plants with the different chemical materials, especially phosphoric acid at 10

or 20 mM in order to produce acceptable yield with good quality as well as minimizing the deleterious effects of salinity stress.

The second experiment: (Field experiment):

This experiments were carried out to elucidate the possibility of using drainage water as well as its application frequencies in irrigation of tomato plants on vegetative growth, chemical composition of leaves, yield and its components as well as fruits quality and leaves anatomy for some tomato cultivars. This experiments included 12 treatments, which were the combination between 6 irrigation treatments on two tomato cultivars (Edkawy & UC97-3). The water frequencies applied of irrigation were:

1- Irrigation with Nile water only throughout the growing seasons (ten irrigations as control).

2- Irrigation twice with drainage water followed by eight irrigations with Nile water.

3- Irrigation four times with drainage water followed by six irrigations with Nile water.

4- Irrigation six times with drainage water followed by four irrigations with Nile water.

5- Irrigation eight times with drainage water followed by two irrigations with Nile water.

6- Irrigation with drainage water only throughout the growing season (10 irrigations).

Obtained results can be summarized as follows:

1- **Vegetative growth characteristics:** Using drainage water twice or four times in irrigation increased all vegetative growth characteristics axpress as plant height, number of branches, number of leaves as well as fresh and dry weight per plant. On the other hand increasing irrigation frequencies with drainage water more than four times and up to 10 times led to a gradual and significant reduction in most growth parameters. Edkawy cv. exhibited the best results in this regard compared with UC97-3 cv.

2- **Chemical composition of leaves:** Irrigation tomato plants with drainage water four times resulted in the highest values of photosynthetic pigments (chlorophyll a, b as well as carotenoids). Increasing irrigation frequencies with drainage water more than four times led to a gradual reduction in all these pigments. In this regard, plants of Edkawy cv. recorded the highest concentrations in all studied pigments as compared with those of UC97-3.

3- Irrigation with drainage water up to four times increased leaves content of N, P, K and Mg elements. However, further applications with drainage water up to ten times, gradually decreased these elements. On the other hand, leaves content of Ca gradually decreased with increasing drainage water irrigation frequencies. In this connection, plants of Edkawy cv. contained in their leaves the highest concentrations of all previous elements in comparison with those of UC97-3.

4- Using drainage water in irrigation led to progressive and gradual increase in leaves content of Na and Cl elements and free

proline, as well as Na^+: K^+, Ca^{++} or Mg^{++} ratios. In this respect, the highest values were recorded with the highest irrigation frequencies with drainage water- ten times- compared with control - Nile water only- throughout the growing seasons. Plants of Edkawy cv. exhibited the highest values in this regard compared with those of UC97-3.

5- **Flowering, yield and its components:** Using drainage water in irrigation up to four times during the growing period led to a progressive increase of number of clusters and fruits per plant, average fruit weight, length and diameter plant yield as well as early and total yields per feddan. On the contrary, increasing drainage water frequencies more than four times drastically and constantly decreased all these characters, especially with the highest irrigation frequencies with drainage water-eight and ten times- In this regard, Edkawy cv. exhibited the highest values in average fruit weight, length and diameter, plant yield and total yield per feddan, whereas, UC97-3 recorded the highest values in number of clusters and fruits per plant as well as early yield per feddan.

6- **Fruit quality:** Using drainage water in irrigation up to four times led to a gradual increase in fruit content of both ascorbic acid (Vit.C.) and titratable acidity, whereas increasing irrigation frequencies with drainage water resulted in constant reduction in this respect. As for total soluble solids (T.S.S.) it is evident that increasing drainage water frequencies from O up to 10 times resulted in a gradual increase in this respect. Fruits of Edkawy cv. contained the highest amounts of Vit.C and T.S.S.

whereas, those of UC97-3 showed superiority in titratable acidity.

7- Using drainage water in irrigation led to an increase in fruits content of non-reducing sugars in case of 2 irrigations and reducing and total sugars in case of 4 irrigations meanwhile, further applications up to 10 times constantly reduced such items. In this regard, tomato plants of Edkawy cv. recorded the highest content of reducing and total sugars in their fruits, whereas those of UC97-3 cv. were superior regarding non-reducing sugars content.

8- Increasing frequencies with drainage water led to gradual and progressive reductions in the contents of N, P and Ca elements in tomato fruits, meanwhile, contra results were detected in case of Na element. As for K fruits content, it was increased as irrigation frequencies with drainage water increased up to 4 times then decreased gradually by increasing drainage water application. In this respect, Edkawy cv. exhibited higher contents of N, P, K and Na, whereas UC97-3 recorded the highest Ca values.

9- **Anatomy features of leaves:** Using drainage water in irrigation up to ten times during the growing season led to decrease the thickness of all leaf anatomy features i.e blade, measophyll (palisade and spongy tissues), upper and lower epidermis and number of xylem vessels tissue. Whereas, slightly increase in diameter and width of leaf midrib had been detected under such conditions. In this regard, Edkawy cv. exhibited the highest values in all studied parameters compared to UC97-3.

Conclusion:

It can be concluded that using drainage water in irrigation of tomato plants for four times led to obvious improving effects on all vegetative growth characteristics as well as yield and its components of all tested cultivars. Whereas, increasing irrigation frequencies with drainage water more than four times had adverse and deleterious effects in most tested parameters. Also, it seems that plants of Edkawy cv. proved to be the most durable compared with those of UC97-3 under salinity stress conditions, hence it produced the highest yield with the best quality under such conditions.

Generally, it can be concluded that under similar condition it is possible and to extent desirable to replace agricultural drainage water up to 4 times instead of Nile water for irrigation of tomato plants of both cultivars, especially those of Edkawy. Thus, we can save and spare about 40% of fresh Nile water that can be directed for other purposes.