SUMMARY & CONCLUSION

SUMMARY

This study was carried out at the Experimental Station of Agricultural Botany Department, Faculty of Agriculture, Moshtohor, Benha Branch, Zagazig University in the two successive seasons of 1993/1994 and 1994/1995 on two wheat cultivars (Giza 163 and Sakha 92) and two tomato cultivars (Castle Rock and Edkawi).

The study included two independent experiments: a laboratory experiment and a pot experiment.

I- The laboratory experiment:

The aim of this experiment was to study the effect of different salinity levels (0, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000 and 10000 ppm) on the germination percentages and rates of wheat cvs. (Giza 163 and Sakha 92) and tomato cvs. (Castle Rock and Edkawi). Also aimed to detect the maximum tolerable salinity level of certain wheat and tomato cultivars.

The obtained results could be summarized as follows:

1. Wheat cvs.(Giza 163 and Sakha 92):

For wheat cv. Giza 163, it was noticed that increasing salinity level from 0 to 7000 ppm progressively decreased the germination percentages and increased the number of days required for germination. But for wheat cv. Sakha 92, it was noticed that increasing salinity level up to 6000 ppm did not show a clear effect on the germination percentages or rates. Meanwhile, salinity at 7000 ppm decreased the germination percentage and increased the number of days required for germination. Besides, salinity at the concentrations more than 7000 ppm(8000,9000 and 10000 ppm) completely inhibited seed germination in the two assigned wheat cultivars.

2. Tomato cvs. (Castle Rock and Edkawi):

The dominant effect of salinity on seed germination of these two tomato cultivars was the reduction in germination percentages and the increase in number of days required for germination. This effect was directly proportional to the applied concentration. Furthermore, salinity concentrations more than 5000 ppm (6000, 7000, 8000 and10000 ppm)completely inhibited seed germination in Castle Rock cv. Although in Edkawi cv. all the seeds did not germinate at the high salinity concentrations (9000 and 10000 ppm).

The obtained results indicated that the maximum level of tolerable salinity (i.e. the salinity level after which the germination percentage was less than 50% of the control) was 7000 ppm for the two wheat cultivars and the tomato cv. Edkawi as well. While, the maximum level of tolerable salinity was 5000 ppm for the tomato cv. Castle Rock. Also, the results indicated that wheat cv. Sakha 92 and tomato cv. Edkawi were more salt-tolerant than wheat cv. Giza 163 and tomato cv. Castle Rock.

II- The pot experiment:

The aim of this experiment was to study the response of wheat and tomato plants to saline conditions including the differences between the more salt-tolerant and the less salt-tolerant cultivars. Also, to investigate if it is possible to improve the endurability of wheat and tomato plants to salinity through the usage of paclobutrazol as a new and common growth regulator. Paclobutrazol was applied as soaking material in two concentrations of 10 and 50 ppm before the treatment with the untolerable salinity levels. The treatments were as follows:

For wheat cvs. Giza 163 and Sakha 92 as well as tomato cv. Edkawi:

- Control (plants irrigated with tap water).
- Salinity at 7000 ppm (the maximum tolerable salinity level during germination stage).
- Salinity at 8000 ppm preceded with paclobutrazol at 10 or 50 ppm.
- Salinity at 9000 ppm preceded with paclobutrazol at 10 or 50 ppm.

For tomato cv. Castle Rock:

- Control (plants irrigated with tap water).
- Salinity at 5000 ppm (the maximum tolerable salinity level during germination stage).
- Salinity at 6000 ppm preceded with paclobutrazol at 10 or 50 ppm.
- Salinity at 7000 ppm preceded with paclobutrazol at 10 or 50 ppm.

In this pot experiment, some morphological characters, chloroplast pigments, flowering or heading, anatomical features, endogenous phytohormones, free proline accumulation, yield and yield components, nitrate reductase activity and nitrate accumulation and also the chemical contents of wheat grains and tomato fruits (total carbohydrates, sugars - reducing and non reducing sugars - and protein content and NPK) were measured and estimated. Besides, the content of ascorbic acid and the percentage of total soluble solids in tomato fruits were also estimated.

The obtained results could be summarized as follows:

a- Morphological characters:

1. Wheat cvs. (Giza 163 and Sakha 92):

Salinity alone at 7000 ppm (the maximum tolerable level) led to significant reduction in all studied morphological characters of the two wheat cultivars in both seasons of this study (the size of the root system, plant height, stem length, number of internodes, mean length of the internode, number of leaves on the main stem, number of leaves on the tillers/plant, total number of leaves/plant and the total leaf area/plant at 70 days after sowing as well as the number of fertile, unfertile tillers and total number of tillers per plant at 172 days after sowing). This negative effect of salinity was more pronounced in the less salt-tolerant cv. (Giza 163) than in the more salt-tolerant cv. (Sakha 92)

The application of paclobutrazol at 10 and 50 ppm before the treatment with the untolerable salinity levels (8000 and 9000 ppm) not only made wheat plants tolerate these salinity levels but also successfully overcame the deleterious effect of salinity on some morphological characters of the two wheat cultivars (the size of the root system, number of tillers/plant, number of leaves on the tillers and total number of leaves/plant at 70 days after sowing as well as number of fertile, unfertile tillers and total number of tillers/plant at 172 days after sowing leading to significant increase of these characters compared with the untreated plants. This positive effect of paclobutrazol was directly proportional to the applied concentration and also was more obvious in Sakha 92 (the more salt-tolerant cv.) than in Giza 163 (the less salt-tolerant cv.). Otherwise, the other studied morphological characters were negatively affected by paclobutrazol treatments under the untolerable salinity levels.

2- In tomato cvs. (Castle Rock and Edkawi):

Salinity alone at the maximum tolerable level of each cultivar (5000 ppm for Castle Rock cv. and 7000 ppm for Edkawi cv.) led to significant reduction in all studied morphological characters of both tomato cultivars (the size of the root system, length of: the stem, hypocotyl and internodes, mean length of the internode, number of leaves and total leaf area per plant at 70 days after sowing as well as the number of reproductive and vegetative branches per plant at 185 days after sowing). This negative effect of salinity was more pronounced in Castle Rock (the less salt-tolerant cv.) than in Edkawi (the more salt tolerant cv.).

The application of paclobutrazol at 10 and 50 ppm before the treatments with the untolerable salinity levels (6000 & 7000 ppm for cv. Castle Rock. and 8000 & 9000 ppm for cv. Edkawi)made tomato plants endure these salinity levels and also successfully overcame the harmful effect of salinity on the number of reproductive, vegetative branches and total number of branches per plant and significantly increased them compared with the untreated plants. On contrary, the other studied morphological characters were negatively affected by paclobutrazol treatments under the untolerable salinity levels. The only exception was that increase existed in the size of the root system in Edkawi cv.

b- Photosynthetic pigments:

Salinity at the maximum tolerable level of each cultivar (7000 ppm for wheat cv. Giza 163, cv. Sakha 92 as well as tomato cv. Edkawi and 5000 ppm for tomato cv. Castle Rock) obviously decreased chlorophyll a, b and carotenoids contents as well as the ratio of chlorophyll (a + b) to carotenoids and increased the ratio of chlorophyll a/b in both wheat and tomato cultivars during the two seasons of the present study. This inhibitory effect of salinity on chloroplast pigments synthesis was more pronounced in wheat

cv. Giza 163 and tomato cv. Castle Rock (the less salt-tolerant cvs.) than in wheat cv. Sakha 92 and tomato cv. Edkawi (the more salt-tolerant cvs.).

The application of paclobutrazol at 10 and 50 ppm before subjection of the plants to the untolerable salt-stresses (8000 and 9000 ppm for wheat cv. Giza 163, cv. Sakha 92 as well as tomato cv. Edkawi and 6000 and 7000 ppm for tomato cv. Castle Rock) clearly increased chlorophyll a, b and carotenoids contents as well as the ratio of chlorophyll (a + b) to carotenoids, while decreased the ratio of chlorophyll a/b. Hence, paclobutrazol had positive effect to overcome the inhibitory effect of salinity on chloroplast pigments synthesis. This positive effect of paclobutrazol was directly proportional to the used concentration and also was more obvious in the more salt-tolerant cultivars (wheat cv. Sakha 92 and tomato cv. Edkawi) than in the less salt-tolerant cultivars (wheat cv. Giza 163 and tomato cv. Castle Rock).

c- Dry weights and assmilation rate:

The dry weights of different plant organs, the distribution percentage of dry matter in the different organs and the assimilation rate (the proportion of leaves dry weight to their area) nearly behaved the same trend in the assigned wheat and tomato cultivars.

The application of salinity alone at the maximum tolerable level of each cultivar caused reduction in the dry weights of roots, stems and leaves, total dry weight per plant, the distribution percentage of dry matter in the stems and leaves and also the assimilation rate in both wheat and tomato cultivars in the two experimental seasons. Meanwhile, it increased the distribution percentage of dry matter in the roots leading to the increase of root/shoot ratio.

The application of paclobutrazol at 10 and 50 ppm caused reduction in the dry weights of both stems and leaves and also the distribution percentage of dry matter in the stems and leaves of both wheat and tomato cutlivars under the untolerable salinity stresses of each cultivar. Even though, the two applied concentrations of paclobutrazol led to overcome the deleterious effect of salinity on the dry weight of roots, total dry weight per plant, the distribution percentage of dry matter in the roots, root/shoot ratio and the assimilation rate resulting in obvious increase of these characters. The only exception was that reduction existed in the dry weight of roots in the tomato cv. Castle Rock.

d- Heading of wheat plants (cvs. Giza 163 and Sakha 92):

The treatment of salinity alone at the maximum tolerable salinity level (7000 ppm) accelerated the date of first spike emergance and the date of heading as well in both wheat cultivars in the two seasons of the present study.

The application of paclobutrazol at 10 and 50 ppm before the treatment with the untolerable salinity levels (8000 and 9000 ppm) delayed the date of first spike emergence and the date of heading as well in both wheat cultivars in the two seasons of this study.

e- Flowering of tomato plants (cvs. Castle Rock and Edkawi):

The application of maximum tolerable salinity level of each cultivar decreased the number of days needed for both first flower appearance and flowering of 50% of tomato plants as well as the number of flowers/plant in the two cultivars in both experimental seasons.

The application of paclobutrazol (10 and 50 ppm) before the treatment with the untolerable salinity levels of each cultivar showed variable effects on the date of both first flower appearnce

and flowering of 50% of the plants in the two tomato cultivars. For instance, in Castle Rock cv. paclobutrazol treatments delayed the date of both first flower appearance and flowering of 50% of the plants under the untolerable saline conditions in the two seasons of this study. Meanwhile, this effect of paclobutrazol was reversed in Edkawi cv. However, the two applied concentrations of paclobutrazol caused significant increase in the number of flowers/plant in the two tomato cultivars. This increase was more obvious in the more salt-tolerant cv. (Edkawi)than in the less salt tolerant cv. (Castle Rock)

f- Anatomical studies:

The histological responses of the roots, stems and leaves to the maximum tolerable salinity levels applied alone and to the untolerable salinity levels preceded with paclobutrazol were nearly similar in the two wheat cultivars and also in the two tomato cultivars.

1. Effect of the maximum tolerable salinity levels and the untolerable salinity levels preceded with paclobutrazol on the histological features of the root:

1.1. Wheat cvs. (Giza 163 and Sakha 92):

The application of salinity alone at the maximum tolerable level (7000 ppm) caused reduction in the primary root diameter in both wheat cultivars. This reduction could be attributed to reduction in some histological features e.g. thickness of the epidermis, the parenchymatous layers of both cortex and pith, diameter of the vascular cylinder and also the diameter of metaxylem vessels. Even though increase existed in some important anatomical features which could be related to the salt tolerance phenomenon. These increases were in number of exodermal layers, vascular bundles, protoxylem vessels in the vascular bundle, metaxylem vessels in the vascular cylinder and

also wall thickness of the metaxylem vessels. These effects of salinity (even negative or positive) were more pronounced in Giza 163 (the less salt-tolerant cv.) than in Sakha 92 (the more salt-tolerant cv.).

The application of paclobutrazol before the treatment with the untolerable salinity levels diminished or completely overcame the deleterious effect of salinity on the most histological features. These features were the thickness of: the epidermis, the parenchymatous layers of both cortex and pith, the vascular cylinder and the phloem tissue as well. This positive effect of paclobutrazol was proportional to the applied concentration and also was more pronounced in Sakha 92 cv. than in Giza 163 cv. Moreover, paclobutrazol highly increased some important anatomical features that could be played a role in enhancement the ability of wheat plants to tolerate high salinity levels. These features were the number of the exodermal layers, the vascular bundles and the protoxylem vessels in the vascular bundle and the metaxylem vessels in the vascular cylinder and also the wall thickness of metaxylem vessels, but the diameter of metaxylem vessels was decreased. This benificial effect of paclobutrazol was proportional to the applied concentration and also was more obvious in Giza 163 (the less salt-tolerant cv.) than in Sakha 92 (the more salt-tolerant cv.).

1.2. Tomato cvs. (Castle Rock and Edkawi):

The application of maximum tolerable salinity levels alone increased the root diameter in the two tomato cultivars. This increase was attributed to the increase in the thickness and number of exodermal layers, diameter of the vascular cylinder (included that increase existed in the thickness of the phloem, cambium and xylem regions, number of xylem vessels and also the wall thickness of xylem vessels). Even though reduction existed in the

thickness and number of cortical parenchyma layers and the diameter of xylem vessels. These negative and positive effects of salinity were mostly more pronounced in Castle Rock (the less salt-tolerant cv.) than in Edkawi (the more salt-tolerant cv.).

The growth regulator paclobutrazol when applied before the treatment with the untolerable salinity levels showed different effects in these two tomato cultivars. For instance, in Castle Rock cv. the application of paclobutrazol at 10 and 50 ppm before the untolerable salinity levels (6000 and 7000 ppm) led to reduction in the root diameter. This reduction was mainly due to reduction in the most histological features under study. However, increase existed in the thickness of the cortex (exodermal and parenchyma layers), number of xylem vessels and also wall thickness of these vessels. This decrease or increase was directly proportional to the applied concentration of paclobutrazol. While, in Edkawi cv. the application of paclobutrazol at 10 and 50 ppm before the untolerable salinity levels (8000 and 9000 ppm) led to the increase in the root diameter. This increase was mainly due to the increase in all histological characteristics under study.

2. Effect of the maximum tolerable salinity levels and the untolerable salinity levels preceded with paclobutrazol on the histological features of the stem:

2.1. Wheat cvs. (Giza 163 and Sakha 92):

The application of salinity alone at the maximum tolerable level (7000 ppm) led to reduction in many studied histological features of the main stem in these two wheat cultivars. This reduction existed in the stem diameter, hollow pith diameter,stem wall thickness (included the reduction existed in the thickness of the epidermis, ground parenchyma layers bundle sheath and phloem tissue, dimensions of the vascular bundls and also diameter of both protoxylem and metaxylem vessels) as well as the

mean length of the parenchymatous cells in the ground tissue which could explain the shortness of the internodes. Even though, increase existed in some important anatomical features which could accompany the salt tolerance phenomenon in these cultivars such as the cuticle thickness, thickness and number of the peripheral sclerenchyma (fibers) layers, number of the vascular bundles, number of the protoxylem vessels in the vascular bundle and also wall thickness of both protoxylem and metaxylem vessels. These contradictory effects of salinity were more pronounced in the less salt-tolerant cv. (Giza 163) than in the more salt-tolerant cv. (Sakha 92).

The application of paclobutrazol at 10 and 50 ppm before the treatment with the untolerable salinity levels (8000 and 9000 ppm) showed a clear compensating effect with regard to salinity in both wheat cultivars. This was expressed in many important trends for instance:

- increase in the cuticle thickness.
- increase in the number of vascular bundles.
- decrease in the dimensions of these bundles.
- increase in the number of protoxylem vessels in the vascular bundle.
- decrease in the diameter of both protoxylem and metaxylem vessels.
- increase in wall thickness of these vessels.
- increase in the number of peripheral sclerenchyma (fibers) layers.
- decrease in the width of the fiber cells in the ground tissue or arround the bundles.
- increase in the number of the ground parenchyma layers that sometimes led to the disappearance of the hollow pith.
- decrease in the mean length of the ground parenchymatous cells.

Hence, paclobutrazol seemed to be a very effective agent for increasing the tolerability of wheat plants to endure the high salinity levels. In addition, paclobutrazol stimulated the transverse growth on the account of the longitudinal one. This made the wheat plants not only more resistant to salinity but, also to lodging.

2.2. Tomato cvs. (Castle Rock and Edkawi):

The histological response of the main stem to the applied maximum tolerable salinity levels (5000 ppm for Castle Rock cv. and 7000 ppm for Edkawi cv.) was nearly similar in these two tomato cultivars. Since, reduction existed in most studied histological characters e.g. the stem diameter, thickness of the epidermis, the cortex (collenchyma and parenchyma layers), the parenchymatous pith layers, the phloem tissue-even the outer or the inner one, the cambium region and the xylem tissue and also diameter of the xylem vessels. Even though, increase was noticed in the cuticle thickness, number of the xylem vessels and wall thickness of this vessels as well. While, the number of vascular bundles-even large or small bundles was not affected. These positive and negative effects existed with salinity were more pronounced in the less salt-tolerant cv. (Castle Rock) than in the more salt-tolerant cv. (Edkawi).

The situation with paclobutrazol when applied before the treatment with the untolerable salinity levels was different in the two tomato cultivars. For instance in Castle Rock cv., the application of paclobutrazol at 10 and 50 ppm before the treatment with the untolerable salinity levels (6000 and 7000 ppm) led to reduction in most of anatomical features under study. This reduction was not only proportional to the used concentration of paclobutrazol but also was more obvious than that existed with maximum tolerable salinity levels alone. However, increase

existed in the cuticle thickness, number of xylem vessels and also wall thickness of these vessels. While, the number of the vascular bundles and cortical parenchyma layers was not affected. But in Edkawi cv., the application of paclobutrazol at 10 and 50 ppm before the untolerable salinity levels (8000 and 9000 ppm) exhibited a clear compensating effect with regard to salinity. The expression was in many important trends for instance:

- diminish the deleterious effect of salinity on some anatomical traits e.g. the stem diameter and thickness of: the epidermis, the cortex (collenchyma and parenchyma layers) and the parenchymatous pith layers.
- increase of some important anatomical features in this respect e.g. thickness of: the cuticle, the phloem tissue-even the outer or the inner one -, the xylem tissue and the cambium region, number of the small vascular bundles, dimensions of the vascular bundles, number and width of the xylem vessels, wall thickness of these vessels and number of the pith layers.

Hence, paclobutrazol seemed to be a very effective agent for increasing the ability of this cultivars to tolerate the used high levels of salinity.

3. Effect of the maximum tolerable salinity levels alone and the untolerable salinity levels preceded with paclobutrazol on the histological features of the leaf:

3.1. Wheat cvs. (Giza 163 and Sakha 92):

The application of salinity alone at the maximum tolerable level (7000 ppm) led to reduction in most studied histological features of the leaf in both wheat cultivars. this reduction existed in the thickness of: the central main vein, the lamina, the upper and lower epidermis and the mesophyll tissue. Even though, increase existed in the cuticle thickness and wall thickness of both protoxylem and metaxylem vessels. While, the number of

mesophyll layers and xylem vessels was not affected. These contradictory effects of salinity were more pronounced in Giza 163 (the less salt-tolerant cv.) than in Sakha 92 (the more salt-tolerant cv.).

In case of the application of paclobutrazol at 10 and 50 ppm before the treatment with the untolerable salinity levels showed a clear compensating effect with regard to salinity in the two wheat cultivars. This was expressed in many important trends for instance:

- diminish or overcome the deleterious effect of salinity on the thickness of the upper and lower epidermis and the mesophyll tissue as well.
- increase in the cuticle thickness.
- increase in the number of mesophyll layers especially with the high concentration of paclobutrazol (50 ppm).
- increase in the number of both protoxylem and metaxylem vessels.
- increase in the wall thickness of both protoxylem and metaxylem vessels as the decrease in their diameter.

This compensating effect of paclobutrazol was parallel to the applied concentration and also was more pronounced in Sakha 92 (the more salt-tolerant cv.) than in Giza 163 (the less salt-tolerant cv.). Hence, paclobutrazol seemed to be a very effective agent for increasing the tolerability of these cultivars to endure the used high levels of salinity.

3.2. Tomato cvs. (Castle Rock and Edkawi):

The application of maximum tolerable salinity level of each cultivar alone caused reduction in most studied histological features of the leaf in these two tomato cultivars. This reduction existed in the thickness of: the midrib, the lamina, the upper and

lower epidermis, both collenchyma and parenchyma tissues - even the uppermost or the lowermost - the uppermost and lowermost phloem tissues and xylem tissue as well as the diameter of xylem vessels. However, increase existed in the cuticle thickness, number of xylem vessels and wall thickness of these vessels as well. These negative and positive effects of salinity on the leaf histology was more pronounced in the less salt-tolerant cv. (Castle Rock) than in the more salt-tolerant cv. (Edkawi).

The growth regulator paclobutrazol when applied at 10 and 50 ppm before subjection of the tomato plants to the untolerable salt-stresses (6000 and 7000 ppm for Castle Rock cv. and 8000 and 9000 ppm for Edkawi cv.) exhibited a clear compensating effect with regard to salinity. The expression was in many important trends for instance:

- increase in the thickness of: the cuticle, the upper and lower epidermis and the palisade and spongy tissues, the number of spongy layers - especially with the high concentration of paclobutrazol (50 ppm) -, the number of xylem vessels and also the wall thickness of these vessels.
- diminish or overcome the adverse effect of salinity on the thickness of both uppermost and lowermost collenchyma tissues, dimensions of the vascular region, thickness of both uppermost and lowermost phloem tissues and also xylem tissue thickness.

This compensating effect of paclobutrazol was directly proportional to the applied concentration and also was more pronounced in Edkawi than in Castle Rock . Hence, paclobutrazol seemed to be a very effective agent for increasing the ability of these cultivars to tolerate the used high salinity levels.

g- Endogenous phytohormones:

The endogenous phytohormones (auxins, gibberellins and cytokinins) behaved the same trend in the shoots of the experimental cultivars of wheat and tomato plants.

The application of salinity alone at the maximum tolerable level of each cultivar caused clear reduction in the endogenous levels of auxin, gibberellin and cytokinin-like substances in the shoots of the treated wheat and tomato plants.

The application of paclobutrazol at 10 and 50 ppm before the treatment with the untolerable salinity level of each cultivar (8000 ppm for wheat cv. Giza 163, cv. Sakha 92 as well as tomato cv. Edkawi and 6000 ppm for tomato Castle Rock) led to great reduction in the endogenous levels of auxin and gibberellin-like substances and striking increase in the endogenous level of cytokinin-like substances in the shoots of the treated wheat and tomato plants.

h- Free proline accumulation:

The application of salinity alone at the maximum tolerable level of each cultivar greatly increased the accumulation of the free amino acid proline in the leaves of the treated wheat and tomato plants. This increase was more obvious in wheat cv. Giza 163 and tomato cv. Castle Rock (the less salt-tolerant cvs.) than in wheat cv. Sakha 92 and tomato cv. Edkawi (the more salt-tolerant cvs.).

The application of paclobutrazol at 10 and 50 ppm before the treatment with the untolerable salinity levels of each cultivar diminished the stimulating effect of salinity on the accumulation of free proline in the leaves of the treated wheat and tomato plants. This negative effect of paclobutrazol on free proline accumulation was parallel to the applied concentration and also was more

pronounced in the more salt-tolerant cultivars (Sakha 92 and Edkawi) than in the less salt-tolerant cultivars (Giza 163 and Castle Rock).

i- Yield and yield components:

1. Wheat cvs. (Giza 163 and Sakha 92):

The application of maximum tolerable salinity level alone (7000 ppm) significantly decreased the length and weight of main spike, weight and number of grains/main spike, number of spikes/plant and the grain yield/plant as well as the grains index (weight of 1000-grains) in the two assigned wheat cultivars in both seasons of this study. This reduction was more pronounced in Giza 163 (the less salt-tolerant cv.) than in Sakha 92 (the more salt-tolerant cv.).

The application of paclobutrazol at 10 and 50 ppm before subjection of the wheat plants to the untolerable saltstresses (8000 and 9000 ppm) overcame the inhibitory effect of salinity on the different measured aspects of yield and yield components leading to significant increase in the yield and its components - especially under the untolerable salinity level of 8000 ppm -compared with those of the untreated plants. This positive effect of paclobutrazol was parallel to the applied concentration and also was more pronounced in Sakha 92 than in Giza 163 .

2. Tomato cvs.(Castle Rock and Edkawi):

The application of maximum tolerable salinity level alone (5000 ppm for Castle Rock cv. and 7000 ppm for Edkawi cv.) significantly decreased the number of fruits and percentage of fruit sitting per plant, the fruit diameter (cm), mean weight of the fruit and consiquently the fruits per plant in both tomato cultivars in the two experimental seasons. This reduction was more pronounded in

Castle Rock (the less salt-tolerant cv.) than in Edkawi (the more salt-tolerant cv.).

The application of paclobutrazol before subjection of the tomato plants to the untolerable salt-stresses (6000 and 7000 ppm for Castle Rock cv. and 8000 and 9000 ppm for Edkawi cv.) successfully overcame the deleterious effect of salinity on yield and its components of the two tomato cultivars leading to significant increase in the yield and its characters - especially under the untolerable salinity level of 6000 for Castle Rock cv. and 8000 ppm for Edkawi cv. - compared with those of the untreated plants in both seasons of this study. This positive effect of paclobutrazol on the yield and yield components was proportional to the applied concentration and also was more obvious in Edkawi than in Castle Rock .

Hence, the obtained results directly indicate that paclobutrazol made wheat and tomato plants able to tolerate the applied untolerable salinity levels and economically to be cultivated under such saline conditions.

j- Nitrate reductase activity and nitrate accumulation:

Nitrate reductase activity and nitrate content were estimated in tomato fruits at different stages of their growth (i.e. new-set, mid-growth and ripening fruits). The obtained results could be summarized as follows:

The applied maximum tolerable salinity levels alone decreased the nitrate reductase activity as well as the nitrate accumulation during the different stages of fruit growth in the Castle Rock and Edkawi cultivars.

The application of paclobutrazol at 10 and 50 ppm before the treatment with the untolerable salinity levels highly increased the nitrate reductase activity and obviously decreased nitrate accumulation during different stages of fruits growth in both tomato cultivars. In this respect paclobutrazol at 50 ppm showed the maximum enzyme activity and the lowest nitrate content at the ripening stage of tomato fruits. These results are of interest, since minimizing the nitrate content in the marketable fruits (ripening stage) is desirable from the side of human health.

k- Chemical analysis:

The chemical analysis included determination of total carbohydrates, sugars (reducing and non-reducing) and protein contents and NPK levels in both wheat grains and tomato fruits, nitrate content in wheat grains as well as total soluble solids percentage and ascorbic acid content in tomato fruits.

1. Wheat cvs. (Giza 163 and Sakha 92):

The applied maximum tolerable salinity level alone (7000 ppm) decreased the total carbohydrates, non-reducing sugars, crude protein, nitrate-nitrogen as well as NPK contents in grains of the two wheat cultivars and increased their content of reducing sugars. Otherwise, the grains content of total soluble sugars (reducing and non-reducing sugars) was not affected. Besides, this negative effect of salinity on the chemical contents of wheat grains was more pronounced in the more salt-tolerant cv. (Sakha 92) than in the less salt-tolerant cv. (Giza 163).

The application of paclobutrazol at 10 and 50 ppm before the treatment with the untolerable salinity levels obviously increased the grains content of total carbohydrates, total soluble sugars (or their fractions), crude protein and NPK, wheras decreased their content of the nitrate-nitrogen. Furthermore, this

positive effect of paclobutrazol on the chemical contents of wheat grains was directly proportional to the applied concentration. This also was more obvious in Sakha 92 cv. Than in Giza 163 cv.

2. Tomato cvs. (Castle Rock and Edkawi):

As for the fruit contents of total carbohydrates, total soluble sugars (reducing and non-reducing sugars), crude protein as well as NPK even under the maximum tolerable salinity levels applied alone or the untolerable salinity levels preceded with paclobutrazol (10 and 50 ppm) were completely behaved the same trend as in the two wheat cultivars.

With regard to the total soluble solids percentage as well as ascorbic acid (Vitamin C) content, they were decreased with the maximum tolerable salinity levels applied alone, meanwhile increased when paclobutrazol (10 and 50 ppm) was applied before the untolerable salinity treatments.