5.- Summary

The current study represents series of experiments aiming to investigate the capability of some plants to tolerate the adverse effects of both salinity and drought. The first series of experiments was conducted under laboratory conditions to determine the effects hazardous of salinity and the specific ion effect as well the effects due to drought on germination percentage and germination rate of sorghum (Sorghum bicolor S. V.10017), barley (Hordeium vulgare G. 123) tomato (Lycopersion esculentum super strain B and Lycopersicon esculentum Edkawi), beans (Phaseolus acutiflius tebary 16) and cotton (Gossypium barbadense G 85 line 96).

The second series of experiments was consisted of some pot trials under greenhouse conditions to investigate the effects of salinity and the specific ion effect as well as drought on growth and chemical composition of plants that are mostly tolerant to both salinity and drought indicated from the previous experiments. These plants were barley, tomato (S.) and sorghum.

These greenhouse experiments were conducted in the greenhouse of Faculty of Agriculture at Moshtohor Kalubia Governorate.

The obtained results reveal the following:

I- Laboratory trials:

A- Salinity effect on seed germination :-

1- Germination percentage:

- The concentration of salt solutions were 0 (control), 25 , 50 , 75 , 100, 150, 200 and 300 me L^{-1} at Na: Ca ratio 3 and CI : So_4 ratio 9.
- Increasing total salinity concentration resulted in a significant decreasing in germination percentage.
- The maximum level of tolerable salinity (i.e. the salinity level after which the germination percentage was less than 50% of the control) was 100, 150 , 200

and 300 me L^{-1} for tomato (E.), (cotton and barley), (beans and tomato (s)) and sorghum, respectively.

2- Germination rate :

- Increasing total salinity concentration resulted in increasing germination rate as follows:

The germination of tested plant seeds at 0 salt concentration (control) started at 3.05, 3.11, 3.27 , 3.50 , 3.75 and 5.85 days from the start of incubation for sorghum, beans, cotton, tomato (S.), tomato (E.) and barley, respectively. Seeds in such high salt solutions continued to germinate until 4.06 days for cotton at (19 dsm^{-1} i.e. 200 me L^{-1}) and 7.13 days for tomato (E.) at (14.5 dsm^{-1} i.e. 150 me L^{-1}) and 3.58, 4.61 , 7.17 and 8.0, days for sorghum, beans tomato (S.) and barley , respectively at (27.5 dsm^{-1} i.e. 300 me L^{-1}).

- The six studied plant can be arranged according to their ability to tolerate salinity at the germination stage as follows:-

Sorghum > Beans > Tomato (S.) > Barley > Cotton > Tomato (E.)

B- Specific ion effect on seed germination :

1- Effect of sodicity on seed germination:

- Increasing the SAR value decreased the germination percentage and increased the germination rate but the effect is more pronounced at total salinity concentration of 150 me L^{-1} than at 100 me L^{-1}.
- Sorghum followed by tomato (S.), beans and barley are the most tolerating seeds to sodicity conditions at the germination stage, while tomato (E.) followed by cotton were of the least tolerancat capability against sodic conditions.

2- Effect of sulfate ion on seed germination :-

Increasing the $SO4^{-2}$ instead of the chloride ion under total salinity of 100 or 150 me L^{-1} increased the germination percentage of the six studied plants

approximately with the same degree but had no effect on germination rate.

3- Effect of magnesium ion on seed germination :-

Increasing Mg^{2+} concentration gradually instead of Ca^{2+} or Na^{+} under total salinity concentration either 100 or 150 me L^{-1}, had a toxic effect on seed germination of tomato (E.), Cotton, tomato (S.) and sorghum but had a stimulation effect on seed germination of barley and beans.

C. Drought effect on seed germination :-

The levels of the studied soil moisture content were 100, 70, 65, 60, 40 and 30% of available water. Decreasing soil moisture content from 100 to 30% of A.W. decreased the germination percentage from 100 to 97, 95 to 88, 90 to 80, 88 to 80, 85 to 75 and 85 to 73% for barley, beans, tomato (S.), tomato (E.), sorghum and cotton respectively, while increased germination rate from 3.8 to 4.2 from 4.0 to 6.0 , from 2.9 to 3.3 from 3.3 to 4.5 from 4. to 4.7 and 3.1 to 3.3 days for cotton, barley, beans, tomato (S.), tomato (E.) and sorghum, respectively. Thus the studied plants can be arranged according to their ability to tolerate drought as follows:

Barley > Beans > Tomato (S.) > Tomato (E.) > Sorghum > Cotton.

I- Greenhouse experiment:

1- Effect of total salinity on growth and chemical

The concentration of salt solutions were 0 (control), 25, 50, 75 and 100 me L^{-1}

A-Plant growth

i) Dry weight: -

- Increasing total salinity levels resulted in a decreasing in dry weight of plant. The reduction as a percentage from the control (0 me L^{-1}) was 1.25, 8.75, 10.00, 13.75% for barley,2.88, 12.5, 14.42, 20.19% for tomato (s.) and 6.67, 14.55, 25.45, 28.48% for sorghum at 25, 50, 75 and 100 me L^{-1}, respectively.

ii) Plant height: -

Increasing total salinity levels resulted in a decreasing in plant length.The reduction as a percentage from the control (0 me L^{-1}) was 1.94, 3.42, 6.50 and 8.78 for barley ; 0.70, 7.67, 9.41 and 14.11 for tomato (S.) and 3.43, 5.50, 14.85 and 15.16 for sorghum at 25, 50, 75 and 100 me L^{-1}, respectively.

- Accordingly, plants could be arranged according to their ability to tolerate salinity at growth stage as follows:

Barley > Tomato (S.) > Sorghum.

B- Chemical composition of plant shoots: -

Increasing salinity level from 0 up to 100 me L^{-1} resulted in a progressive decrease in N and K- content and slight decrease in Mg- content. However, increasing salinity level from 0 up to 100 me L^{-1} resulted in a progressive increase in N and Ca content, but there was no a significant increase in P- content.

1- Specific ion effect on growth and chemical composition of plant at 100 me L^{-1}: -

There were no significant differences among the treatment pairs of specific ion either on plant growth or chemical composition of plant shoots.

2- Effect of drought on growth and chemical composition of plant.

The level of soil moisture content were 45, 40 and 35% of available water.

A) Plant growth: -

i) Dry weight: -

Decreasing soil moisture content resulted in a decreasing in dry weight of plants. The reduction in dry weight of plants as a percentage from the control (45% A. W.) was 1.23, 8.64 for barley, 13.89 , 18.44 for tomato (S.) and 8.88, 12.43 for sorghum at 40 and 35% of A. W., respectively.

ii) Plant height: -

Decreasing soil moisture content resulted in a decreasing in plant height. The reduction in length of plants as a percentage from the control (45% A. W.) was 1.9, 4.47 for barley, 2.05, 7.85 for tomato (S) and 4.65, 18.51 for sorghum, at 40 and 35% of A. W., respectively.

Accordingly, plants could be arranged according to their ability to tolerate the drought during the growth stage as follows: -

Barley > Tomato (S.) > Sorghum.

B- Chemical composition of plant shoots: -

Decreasing the soil moisture content from 45 to 35% of A. W. resulted in a significant increase in N, P, K, Na, Ca and Mg content of plant shoots.