PHYSIOLOGICAL STUDIES ON SALT-RESISTANCE IN WHEAT

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Note

Besides the work carried out in this thesis, the author has attended and passed successfully the following postgraduate courses:

1. Methodology.
2. Biological statistics.
3. Physiology.
4. Enzymology.
5. Phytochemistry.
6. Mineral nutrition.
7. English.
8. Statistical course
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THIS THESIS HAS NOT BEEN SUBMITTED TO THIS OR ANY OTHER UNIVERSITY.THE REFERENCES GIVEN SHOW HOW FAR I HAVE AVAILED MYSELF TO THE WORK OF OTHER INVESTIGATORS.

SIGNATURE

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1. INTRODUCTION

In Egypt, the overincreased population is coupled with the severe shortage of cultivated area, in such a narrow strip of the Nile Valley. Efforts were concentrated towards new land reclamation for this reason, Sinai is one of the best distinguished example, it covers an area of some 60,000 km² in the form of a triangle with its apex in the South and the base (200 km²) in the North.

Some of the problems of Sinai are the arid climate, the rare rain, the calcareous soils and the saline underground water, besides the drastic environmental conditions that limits its plant cover. Wadi Sudr region is located on the South-West of Sinai. Growing plants under these environmental conditions are suffering from difficult germination of seeds, stunting of stems and decreasing quantity and quality of seed yield. Therefore, the plants grown under Wadi Sudr conditions require a certain management to overcome these environmental factors and to achieve suitable yield.

Some investigators take these problems into consideration by using different growth regulators with different concentrations to overcome the drastic changes in plant metabolism imposed under saline conditions. Recently, Khider (1991) found that using a specific concentration from IAA and kinetin mixture as soaking solution for wheat grains gave a promotive effect on the salt tolerance of wheat plants. Therefore, this study was conducted to study the effect of application method and application time of IAA and kinetin mixture on growth characters, some chemical constituents and yield quantity and quality as well as yield components of wheat plants grown under saline water irrigation and salt-affected calcareous soils of Wadi Sudr.

REVIEW OF LITERATURE

I- Effect of Salinity on:

A- Growth characters:

Generally cultivated plants show marked differences in their salt tolerance as well as numerous investigators showed that salinity depressed the growth of the salt sensitive plants. Where saline conditions generally inhibit the growth and accumulation of dry matter of many plant species, water content is remarkably decreased during salt treatments, and the nutrient uptake was also inhibited (Black, 1956).

Protsenko (1956), suggested that some tolerant cultivars have lower water content and greater water hodling capacity as compared to the non-tolerant ones. He attributed such observation to the fact that in tolerant cultivars and species the stomata remain open for longer periods during the day.

Ogo and Nishikawa (1959), found that NaCl decreased the water content in rice, wheat and barley plants and the average decrease ranged from 0.7 to 1.5%.

Nieman (1962), studied the effect of increasing salinity on twelve crop plants covering a wide range of salt tolerance. He showed that the ratio of water to dry matter content increased in most species, and the greatest increase occurred in the most tolerant species.

Strongonov (1962), showed a sharp increase in fresh weight and thickenning in leaves of cotton plants grown under chloride salinity. This increase was due to the increase in water content, rather than the dry matter content. Chloride salinity was characterized by a sharp reduction in the transpiration rate and an increase in the cell volume of stored water.

Asona and Kale (1965), studied the effect of salinity on four varieties of wheat, and found that salinity depressed tillering, leaf size and shoot height.

Abd-El-Rahman *et al.* (1972), found that increasing salinity significantly decreased the vegetative growth of some range plants. The studied species showed remarkable differences in their salt tolerance which may be due to their relatively high osmotic potentials and their ability to accumulate more salt in their cell sap.

Uprety and Sarin (1975) revealed that salinity decreased plant height and elongation, leaf production, relative growth rate of the whole plant and dry matter content of leaves and stems of pea.

Chhipa and Lal (1978) reported that high NaCl content and sodium absorption rate of the irrigation water had an adverse effect on germination, plant height and tillering of wheat plant.

Ahmed *et al.* (1980) reported that increasing NaCl concentration caused a considerable reduction of dry matter accumulation and leaf area of some leguminous plants.

Hassan (1983) showed that prolonged exposure of barley to salinity during heading stage reduced the fresh weight under all salinity levels applied. He also found that lower salinity level had no significant effect on the number of tillers per plant.

Hassan and Poljakoff-Mayber (1983) reported that the shoot length, fresh and dry weights of pea plants decreased with increasing salinity levels. The effect of salinity on shoot length was expressed mainly by a reduction in length of internodes, while internodes number was reduced only by the highest salinity.

Khafagi *et al.* (1986) showed that the plant fresh and dry weights as well as plant height of some leguminous plants were significantly depressed by increasing the levels of NaCl. The authors also attributed the adverse effect of salinity on plant growth to the specific toxic effect of ions excessively absorbed from saline soil and building up the osmotic pressure of the developing cells, or to the disturbance in the ratios of nutritional cations in tissues of salt affected plants.

More and Malewar (1988) reported that the soil salinization resulted in the reduction of germination and dry matter yield in both sorghum and cotton crops. Most of the varieties of sorghum and cotton germinated well at 4 mmhos/cm, where the varieties of sorghum showed relatively tolerance to salinity and could be grown up to 8 mmhos/cm, the variety of cotton is most tolerant to salinity at germination.

Alwan *et al.* (1989) worked on five corn varieties which were grown in sand culture with four levels of salinity (0.7, 10.0, 15.0 and 20.0 mmhos/cm) made from tap and drainage water. They found that increasing salinity caused a delaying seed ion percent by 2.2%, 16.4% and 43.3% as salinity increased from 0.7 to 10, 15 and 20 mmhos/cm respetively. A siginficant decrement in growth was found as a result of increasing salinity under high salinity (i.e. 15 and 20 mmhos/cm and the seedlings had died after being germinated.

Bolain and Fernandez (1991) used the different conc. of the salt concentration on the growth of four wild species of Lycopersicon. They found that salinity even the lowest salt concentration decreased the leaf and stem dry weights. For this reason their tolerance can not be assessed on the basis of the salinity threshold, but on the basis of the slope of the function, vegetative yield.

Johnson (1991) found certain physiological responses under salinity stress similar to salt-resistant tall wheat grass. Tall wheat grass and high producing crested wheat grass maintained average leaf turgor of 1.0 MPa over a range of Nacl irrigation solutions from 0 to 1.8 MPa, but turgor of low producing crested wheat grass was reduced by 1.2 and 1.8 MPa solutions. He also found that the high saline solution causes lated of developmental stages and germination of plants.

Ranney *et al.* (1991) evaluated the tissue osmotic potential ($\psi_{\pi,sat}$) and solute consituents in leaves and roots of well-watered and water-stressed *Pseudocerasus*