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THE EFFECT OF SOIL SALINITY ON PLANTS AND BACTERIA

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Abstract
The research included the study of soil salinity, where salts accumulate in the soil. And knowing the causes of the sources of salinity and what is the gain of salinity. Among the effects on the salt on the soil by prevent the plant to reach to the water by increased the osmosis pressure. Likewise, salinity on plants is morphologically and physiologically. the high salinity of the soil leads to a decrease in the activity of microorganisms in the soil, including bacteria, note that some groups of bacteria can grow and multiply in a relatively high salinity, and there are also some types of bacteria are classifiedas halophiles, as for actinomycetes. Soil salinity can be treated by several methods, including the cultivation of halophytes.

Keyword: Soil, plant, primary salinity, bacteria, secondary salinity, nitrogen fixation

Introduction

Soil salinity or salinity is known as the high level of salt in the soil. Soil salinity is a major factor threatening the ability of agricultural crops to support the growing population, and it is one of the biggest global problems at the present time due to the damage it causes to arable lands and thus the resulting disturbance in Plant growth and productivity at the global level (Khan *et al*. 2010).

More than 930 million hectares, which means that 7% of the land area in the world (i.e. 20% of agricultural land) has become threatened by salinity, and it is estimated that 6% of it has been affected during the last forty-five years (Zhang *et al*.,2010). In the study conducted in Turkey, he mentioned in it about the comparison with neighboring countries that salinity in the Iraqi environment constitutes 6726,000 hectares, equivalent to 25% of the area of Iraq (Altay and Ozturk, 2012). The

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phenomenon of soil salinization is spread rapidly in central and southern Iraq. Saline lands are increasing by 25,000 hectares annually (Qadir and Shideed, 2012).

Sources of Soil Salinity

Soil salinity refers to the presence of soluble salts in soil or soil water at levels that negatively affect plant growth. Of these salts (sodium chloride, calcium, magnesium and also sulfates, carbonate and bicarbonate), sodium chloride is the most common. The increase in the concentration of dissolved salts in the soil becomes difficult for plants to extract water from the soil, in the ground, although the weathering of primary minerals is the main source of salts in the lands. However, salinity arises as a result of the transfer of salts by water from one place to another and then their accumulation as a result of environmental conditions. Can explain the sources of salts in the lands in the following (Gupta and Abrol, 1990; Nichols *et al.*, 2010) :

1-Weathering of minerals that make up the base material.

2-The presence of layers that are impermeable or weak permeability, this impedes the movement of water down, which helps the accumulation of salts in such lands.

3 -The rise in the ground water level, which depends on the topography of the land, as it rises in the ground sector with capillary properties, causing the accumulation of salts in the root zone.

4 -In low-level lands, near the sea level, or adjacent to the sea, water is moved to it as a result of hydraulic pressure or in the form of mist.

5-The death and decomposition of salt-loving plants that withdraw and store salts in their bodies, which leads to the accumulation of salts in saline lands.

6 -The salts may move by leachate from higher ground to lower ground, or as a result of lack of settlement in industrially irrigated lands.

7-The salts may transfer to the ground with the irrigation water as they pass through the water channels by dissolving some salts, and they may be contaminated by the wastewater adjacent to the irrigation channels.

8-High temperatures lead to increased salinization.

The salinity of the land is closely related to the temperature, and this effect appears in many lands of the country with a high temperature. secondary salinization is formed, especially since the amounts of rain are small. In general, the higher the temperature, leads to increase the capillary activity, s, the rise of groundwater through the pores of the earth, especially in lands with a high content of clay and which suffer from poor drainage, where the fine clay pores act as capillary tubes, and the water rises up, for the activity of the water evaporation process. Under the conditions of higher temperatures, and by repeating this process, the concentration and accumulation of salts in the surface or subsurface layer increases (Che et al ., 2021).

-Volcanoes: the eruption of volcanoes is associated with the release of large quantities of gases and fumes that contain chlorine and sulfur, which contribute to the formation of chloride and sulfate salinity.

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That is, salinity can be natural (natural salinization) or as a result of the action of natural factors, and salinity in this case is called primary salinization, while if salinity arises in the ground as a result of mismanagement of the land, then the land that was not originally saline becomes saline, it is called Salinity in this case secondary salinization usually causes poor irrigation and the use of water with a high concentration of salts to the formation of secondary salinity, and to cultivate these salts must be disposed of by washing with non-saline water to reach a concentration of salts less than 4 mm / cm. (Nichols *et al.* , 2010).

Some Methods for Measuring Soil Salinity

The shape and condition of the plant is a good indication of the presence of dissolved salts, especially sodium in the soil. There are scientific methods and devices for measuring soil salinity to identify the properties of natural soil and thus know the effect of salinity on the soil (Al-Sayegh and Bashoure, 2007). Salinity can be measured by the method of electrical conductivity and it is by using the electrical conductivity measuring device and by applying the following law:
Amount of salinity = electrical conductivity * 0.064
The salinity of the soil samples can be measured by using a multi-meter device type HANA \ 211 after making the saturated paste.
The salinity of the soil can be measured by a device called a "slew bridge" where the electrical conductivity of the aqueous extract ions of the saturated soil is measured, and then the numbers are interpreted as follows: (Mukhopadhyay *et al* ., 2021)
When reading is on the device
From 0 - 2 the effect of salinity is often not significant.
From 2 to 4 the yield of very sensitive plants is limited.
From 4 to 8 the yield of many plants is limited.
From 8 - 16 resistant plants give only a satisfactory crop.
Of more than 16 large resistant plants give a satisfactory crop.
Note that the unit of measure is in milliose / cm in 25 m.

Negative Effects of Soil Salinity

1-harmful effects on plant and crop growth.
2-Damage to infrastructure (roads, buildings, corrosion of pipes(
3-Low water quality for users, and problems with precipitation.
4-Ultimate soil erosion, when the crops have been severely affected by the amounts of salts (Yang *et al* ., 2021).

The Effect of Salinity on Plants

The overall effect of the concentration of salts in the ground solution leads to an increase in the osmotic pressure of it, and thus the movement of water to the plant may be absent, that is, the rate of plant absorption of water decreases, and in general soil salinity affects many aspects of plant physiology by reducing its ability to absorb water as a primary effect (Martins-Noguerol *et al* ., 2021).

Due to the decrease in the growth rate and the occurrence of many metabolic changes, the harmful effect of salinity can be observed on the level of the whole plant by its death or decrease in height, weight, living mass and productivity (Sai et al., 2009), in addition to the effect on the growth of seeds and seedlings, the overall vegetative growth and flower formation and the fruits (Sairam and Tyagi,2004).

The most obvious metabolic changes include both the regulation of ions as well as the building of materials that reduce osmotic effort, antioxidant enzymes, building plant hormones and transforming the pathway of photosynthesis (Parida and Das, 2005).

The increase in salinity may lead to a reduction in the surface area of the growing leaves by reducing the number and dimensions of the epidermal cells, and each of them contributes to an increase in the degree of succulence of some plants as a result of the increase in the difference in water effort between the leaves and the surrounding environment, as was found in some plants such as sugar cane. Sucrose, as salinity caused by sodium ions reduces the activity of the enzyme responsible for converting it into starch (Gulzar and Khan, 1998).

Classification of Vegetable Crops According to Salinity

From the results of experiments on some taxonomic plants as follows (kwagri.org, 2017):

First: Fruit Trees

High salinity: date palms.
Resistant to salinity - pomegranate, olives, grapes.
Resistant to salt: pears, apples, oranges, grapefruit, plums, apricots, peaches, lemons (Sahab *et al* ., 2021).

Second: Vegetables and Fruits

Highly salty: shalgam and spinach.
Resistant to salt: tomatoes, cauliflower, cabbage, lettuce, sweet corn, potatoes, onions, carrots, peas, melons, squash and zucchini.
Resistant to salt: radish, beans, strawberry.

Third: Field Crops - Grains

High resistance to salinity: barley, beet, cotton.
With moderate resistance to salinity: corn, sunflower, wheat, rice, flax, oats.

The Effect of Salinity on Microorganism

Soils are generally characterized by their high content of bacteria, and these soils differ in the numbers and genera of the dominant bacteria (Shrivastava & Kumar 2015). This variation is not limited to different soils, but rather this difference appears very

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clearly for the same soil, for example, it increases the number of bacteria is large in the rhizosphere and decreases dramatically as soil samples are taken from areas away from the rhizosphere, the number of bacteria also varies with the depth of the soil, and the nature and density of the dominant plants play a role in the dominance of certain types of bacteria, in addition to the fact that all environmental factors also affect the numbersand the types of bacteria prevalent in the soil (Rath *et al* ., 2019).
In addition, the numerous studies conducted on various types of soils , under different environmental conditions indicate the dominance of some bacterial genera, which are able to grow on the cultural media, on the contrary others cannot tolerate these conditions, and the following figure indicates the shapes and pictures of bacterial cell assemblies (Egamberdieva *et al* ., 2017).
Some of them are motile and some are immobile, some of them are compulsive or forced anaerobes or optional anaerobes. Large, up to a few micrometers in length. It is found in the soil, usually small spherical and sticky, which is predominant in most soils and the most widespread, while the helical species Spirilla is not uncommon in the soil (Radhakrishnan & Baek 2017; Yaish *et al* ., 2016).
The soils contain autotrophic bacteria that obtain carbon from carbon dioxide and energy from sunlight (Photoautotrophs) and other organotrophs (Chemoautotrophs). Also the soil contain bacteria are suitable for high temperature (Thermophiles), others suitable for medium temperature (Mesophiles) and three compatible with low temperature (Psycherphiles). There are also bacteria in the soil that degrade cellulose, oxidize sulfur, or fix nitrogen or reduce nitrates, sulfates and ferric (Moreira *et al* ., 2020).
In general, the high salinity of the soil leads to a decrease in the activity of microorganisms in the soil, including bacteria, note that some groups of bacteria can grow and multiply in a relatively high salinity, and there are also some types of bacteria are classified as halophiles, as for actinomycetes, their numbers and activity can overcome other bacteria when soil salinity increases (Rath *et al* ., 2019; León-Lorenzana *et al* .,2018).

Treating or Reducing Soil Salinit

To treat or reduce the soil from salts, the following must be observed:
The soil must be well drained so that salt does not accumulate, and so that this does not affect crop production.
 - The level of groundwater, its source, and the level of salinity in it should be known if possible, especially if the soil drainage is insufficient, and in this case a plan for drainage of water must be developed (kwagri.org, 2017).

Among the Methods of Treatment Are

-Cultivation of saline or halophilic plants, which is one of the most important methods, and this treatment is called biological treatment.
-Plowing the land with a two-stroke plow for deep plowing.

-Irrigation the land more than once with brackish water and try to drain it surface.
-Adding agricultural gypsum (calcium sulfate) to the land 750 kg / ha and turning it over by plowing the soil.
-Abundant irrigation of the land and leaving the land to absorb the water inside it without surface drainage, with irrigation of the land more than once until salts are exchanged(Zhang *et al* ., 2020).
-Attention to adding organic fertilizers from animal manure and bird droppings before planting to improve the fertility of the land.
-Cultivation of the land with crops that are somewhat tolerant to salinity, such as barley and alfalfa (Mohammadifar *et al* ., 2021).
-Try to fertilize with the following fertilizers:
1- Adding 200 kilograms of agricultural sulfur while serving the land and preparing it for cultivation.
2-Addition of mono superphosphate 15.5% at a rate of 350 kilo / hectare during land service.
3-Paying attention to spraying trace elements on plants more than once during the growing season, because these lands are not accessible to those elements until the plant absorbs them and shows signs of deficiency quickly. (Mukhopadhyay *et al* ., 2021)
4-Add potassium sulfate by sprinkle on crops.
5-Attention to fertilizing with acid fertilizers during the growing season of the crop to improve the absorption property of plant roots and provide it with major nutrients.
With these methods of serving, additions, irrigation and cultivation, many soil salts can be disposed of and converted into land suitable for economic cultivation (Hasanuzzaman *et al*., 2014 and Du, 2017).

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