The effect of Irrigation Water Salinity on the growth of *Vignaunguiculata L* plants in terms of Appearance and Total Chlorophyll Content

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ABSTRACT: *This study was accompanied in the Department of Life Sciences, College of Education for Girls, for the period from July 24 to October 4, 2022, by planting. VignaunguiculataL seeds, The investigate was conceded by using plastic pots and three replicates with the aim of studying the effect of added irrigation water salinity. Three types of irrigation water were used: river water, Shatt al-Kufa, groundwater, well water, and Najaf Sea water. This water differed in its intensity of salinity depending on its EC values, which reached(1.78,7.33,10.52)dice-Siemens/m Respectively, it was noted through the above measurements that the water of the Najaf Sea was more salty, then the water of the well, and then the water of the river near Kufa. Then follow the effect of these three types of water on cowpea seed germination, vegetative growth, and chlorophyll content And some of the root characteristics. The results of the research showed that river water was significantly superior when added to pots planted with VignaunguiculataL seeds over well water and Najaf Sea water in all the characteristics studied. Represented by (germination percentage, plant height, number of leaves, number of branches, fresh weight of shoot and root systems, and total chlorophyll content)The well water treatment was also significantly superior to Najaf Sea water in terms of plant height, number of leaves, and fresh weight of the shoot and root system. Likewise, no germination occurred in the seeds of VignaunguiculataL plant that were watered with water from the Najaf Sea*
KEYWORDS: *system, root, river, dice.*

INTRODUCTION

Salinity devours a substantialinfluence proceeding the growing and propagation of numerous plants, whether meadow, perennial or seasonal, comprising the cowpea plant. It belongs to the legume family, which is considered the main food item in most countries of the world (Bu Shama et.al2013). It is characterized by its richness in high calories and containing carbohydrates, fats and vitamins. It is the main source of vegetable protein. These characteristics create it the ideal crop to sustenance food security for communities This plant originated in Central Africa and is now extensively cultivated in Africa, Latin America, Southeast Asia, the southern United States of America, and the Mediterranean countries. Its cultivation is also widespread in the alluvial plain areas in central and southern Iraq.(Salemet.al 2016). Cowpea (Vignaunguiculata (L.) Walp.) is an important legume and a key crop in the context of global climate change and food security [Carvalho, B.M.2019]. This species has become one of the eight grain legume crops being targeted for yield and agronomic improvement by the Consultative Group for International Agricultural Research (CGIAR) [Salinas-Gamboa, R 2016) It represents an environmental friendly, stress-tolerant, and inexpensive source of protein in many countries, and is especially indispensable for fruitarianinhabitants.

Salinity has been recognized as the most adverse condition, above other environmental constraints, in terms of severe effects on plant growth and development, photosynthesis, and ion homeostasis [Ahanger, M.A 2014] The majority of the experiments conducted on salinity involved the exposure of plants to sudden salt shock, where seedlings experienced severe osmotic abnormalities, leading to uncontrolled cell death [Shavrukov, Y et.al.2013,Banerjee, A ,et.al 2019]. This does not occur in reality under field conditions, because soil slowly becomes more saline as groundwater content is reduced gradually during summer or dry periods [Banerjee, A ,et.al 2019]. Several factors or mechanisms operate independently or jointly to enable plants to cope with abiotic stresses, especially under high salinity or water deficit; their tolerance is manifested as a complex trait [Krishnamurthy, L.C , et.al 1996]. These regulatory mechanisms induce anatomical, physiological, and biochemical adjustments of plants that are considered to be an integrated response of different organs, especially roots and leaves [Galmés, J et.al 2006].The cowpea plant was chosen

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in this study because it is one of the important crops in Iraq, and the effect of irrigation water salinity on its phenotypic characteristics and total chlorophyll content was detected and monitored.

MATERIALS AND METHODS

3-1 Experiment implementation site:-

This revision was steered in the Department of Life Sciences, College of Education for Girls, for the period from July 24 to October 4, 2022, by planting. *Vignaunguiculata*L seeds. In 10 kg pots with mixed soil, the experimental conditions were standardized in terms of soil quality and number of irrigations

3-2 Preparing irrigation water

Three forms of irrigation water were secondhand: river water, Shatt al-Kufa, groundwater, well water, and Najaf Sea water. The electrical conductivity of water was measured using an EC device ,the readings are taken directly from the device's scale, and then the values obtained are adjusted at a temperature of 25 C, considering it to be the standard degree of electrical conductivity.(tuna et.al ,2008)

Table No. (1): Represents the electrical conductivity values EC of the irrigation water used in the experiment

Values of EC are decisiemmens/meter	waterworks
1.78	Shatt al-Kufa
7.33	well water
10.52	Najaf Sea water

Table No. (2) Classification of irrigation water according to the American Salinity Laboratory

Class C1 Minor:-The water is suitable for most plants and soil, with little risk of salinization, and the washing resulting from irrigation is sufficient to get rid of the salts.	0 - 160	0 – 0.25
Class C2 medium:-The water is suitable for plants that tolerate salts well in the case of sufficient soil washing	160 - 480	0.25 – 0.75

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Class C3 severe:- The water is suitable for plants that tolerate salts well in In well-drained soil, it is necessary to add an additional amount of water for the purpose of washing	480 - 1440	0.75 – 2.25
Class C4 very severe**:-**The water is suitable for plants that are very tolerant to salts. In permeable soil that is good for drainage, good washing of salts is necessary	1440 - 2200	2.25 5.0

3-3Experiment transactions
Cowpea seeds were planted in pots with a capacity of (10) kg of mixed soil, with (10) seeds in each pot. Irrigation water was added daily at equal times and quantities, and the pots were distributed as follows:
- Pots that were watered with water from the Kufa River ,Pots that were watered with well water ,Pots watered with water from the Najaf Sea.

3-4- Studied characteristics
3-4-1- Germination percentage
The number of germinated seeds was counted in the pots used in the experiment that contained mixed soil, and after (10) days had passed
From the date of cultivation, the values have been converted to a percentage according to the following law:
Germination percentage = number of germinated seeds/Total number of seeds .100%

3-4-2- Seedling height (cm)
The average height of the seedlings was taken at the end of the experiment. This characteristic was measured using a metric tape. The height was measured starting from the area where the stem meets the soil surface until the growing top of the plant.

4- 3 - Total number of leaves (leaf, seedling).
The number of leaves for each seedling was counted, and then the total rate for each experimental unit was calculated

3- 4 - 4 - Number of lateral branches (branch. Seedling)
The number of branches for each experimental unit was calculated, and then the average of this trait was extracted

3-4-5- Fresh weight of shoots and roots (g)
At the end of the experiment, the seedlings were carefully uprooted after watering well the day before to preserve the largest possible vegetative system. After that, the roots were stripped of the soil and washed well. The vegetative system was separated from the root system using pruning shears, and then the vegetative parts (stem, leaves, branches, and stems) were washed. Root) and then the fresh weight of the root and shoot total was measured

RESULTS

4-1- Germination percentage (%)
The results mentioned in (Table 3) showed that the germination percentage of *Vingaungiculata* plants in pots that irrigated by river water with (EC=1.78 $dS.M^{-1}$) reached (100%) compared with well water which has (EC=7.33 $dS.M^{-1}$) where reached (60%), While no germination observed in the pots that irrigated by water taken from the Bahar Al-Najaf water with (EC=10.52 $dS.M^{-1}$) and (0%) of germination percentage.

4-2- Seedling height (cm)
The results of (Table 4) indicated that the (river water) treatment was significantly superior to the rest of the experimental treatments in terms of *Vingaungiculata*seedling height, which gave the highest growth rate of (32.3 cm) compared to the (well water and Bahar Al-Najaf water) treatments, which were (15.2 and 0 cm) respectively, while the treatment of well water was significantly superior to Najaf Sea water, which didn't achieved any germination.

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4-3- Number of leaves (leaf.seedling^{-1})

The results also demonstration that the river water treatment was significantly superior to the rest of the experimental treatments in terms of the number of leaves of cowpea plant seedlings, with a rate of (22.8 leaves/Seedling), while the well water treatment was significantly superior to the Bahar Al-Najaf treatment, with a rate of (14.7 leaves/ Seedling), and the average for this trait was in relation to Bahar Al-Najaf water (0.00) due to failure of germination of *Vingaungiculata* seeds.

4-4- Number of branches (seedling.branch^{-1})

Also, the Kufa River water treatment was significantly superior when irrigated to the pots planted with *Vingaungiculata* seeds at a rate of (6.6 seedlings / branches) in trait number of branches compared to the well water treatment irrigated to the pots at a rate of (1.3 seedlings/branches), and no significant difference observed between it and the Bahar Al-Najaf water treatment, which it gave an average of (0 seedlings/ branch), as mentioned in (Table 4).

4-5- Fresh weight of shoots (g)

The results exposed in (Table 4) indicate that the river water treatment was significantly superior to the rest of the experimental treatments at a rate of (41.8 g) in terms of fresh weight of the shoots, while the well water treatment was significantly superior to the Bahar Al-Najaf water at a rate of (22.5 g) compared to Bahar Al-Najaf water treatment which was (0 g).

4-6- Fresh weight of root system (g)

The results revealed in (Table 4) indicated that the river water treatment was also significantly superior to the rest of the experimental treatments in terms of the fresh weight of the root system, at a rate of (25.3 g) for this trait, while the average for the above-mentioned trait for the plants grown in pots that were irrigated with well water was (12.1 g), thus it is significantly superior to the treatment of Bahar Al-Najaf water treatment, which gave an average of (0 g).

4-7- Total chlorophyll content of leave (spad)

Irrigating the *Vingaungiculata* with water from the Kufa River had a positive effect on it's growth. This observed in the results indicated in (Table 4), which showed that the river water treatment was significantly superior to the rest of the treatments in terms of total chlorophyll content in the leaves, at a rate of (46.8 spad) compared to the well water treatment, which gave an average of (28.9 spad), and the last was significantly superior to Bahar Al-Najaf water treatment, when added to pots planted with understudy seeds which no germination occurred, as the average of this trait for this treatment was (0 spad).

Table 3 : The effect of irrigation water salinity in the percentage of *Vingaungiculata* seeds germination

Water stations	EC (dS.cm^{-1})	Germination percentage (%)
Kufa River water	1.78	100 %
Well water	7.33	60 %
Bahar Al-Najaf water	10.52	0 %

Table 4 : The effect of irrigation water salinity in the percentage of *Vingaungiculata* seeds germination

phenotypic traits / Irrigation water	Seedling height (cm)	Number of leaves (leaf.seedling^{-1})	Number of branches (seedling.branch^{-1})	Fresh weight of shoots (g)	Fresh weight of root system (g)	Total chlorophyll content of leave (spad)
Kufa River water	**32.3**	**22.8**	**6.6**	**41.8**	**25.3**	**46.8**
Well water	**15.2**	**14.7**	**1.3**	**22.5**	**12.1**	**28.9**
Bahar Al-Najaf water	**0**	**0**	**0**	**0**	**0**	**0**
L.S.D.	**14.4**	**7.4**	**4.5**	**17.3**	**11.8**	**15.2**

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DISCUSSION

Over and done with the results exposed in Tables (3 , 4) it suitedperfect to us that irrigation with the river water (Shatt Al-Kufa) used in the experiment had a clear positive effect on the growth of the *Vingaungiculata* seeds,and that was done by calculating the percentage of germination compared to the other irrigation water that was used in the experiment was represented by well water, which gave the lowest percentage, and Bahar Al-Najaf water, which didn't record any germination of seeds. The reason is due to the high salinity of this water compared to river water, and this is what was shown by electrical conductivity measurements, indicating clear differences between the three types of water used in irrigation; also, water salinity has a clear effect in delaying or inhibiting seed germination. The germination stage is considered one of the critical stages in the life of the plant, and the presence of the seed in a high-salinity medium prevents the absorption of water by it and reduces the number of embryonic roots and root hairs as a result of high osmotic pressure, which leads to an imbalance in the germination process (Al-Zwick 2010).arabic .As for the effect of salinity on the growth of the cowpea plant, it was also clear in the results shown in (Tables 3,4) that there are clear significant differences between the rates of plant height, and irrigating with river water had a positive effect on the growth of the *Vingaungiculata* plant in a good and natural way compared to the two types of water used in the experiment. The reason is due to the effect of salinity on the growth of the *Vingaungiculata*. Salinity also affects plant growth, as the seedlings appeared small in size compared to their counterparts that were irrigated with low-salinity water. This is what is called plant dwarfing, which negatively affects in the yield quantitatively and qualitatively, because salinity has an effect on the upper part of the plant (leaves and stems) as well as it's lower part (roots) (Zaki 2017).The results of the current research agree with what was found by (Al-Shahat. 2000) that salinity causes dwarfing of the main stems, reduces the formation of lateral branches and leads to their death. It also works to inhibit cambium activity, whenever it's concentration increases in the medium which the plants grow.

Salinity also causes the edges of the leaves to burn, then dry, and then fall (Zaki. 2017).(Cakirlar et.al 2002) showed that most of the toxicity is due to the plant’s absorption of sodium and chlorine ions, which in turn accumulate in the plant leaves in large quantities, causing the burning of the leaf and the death of it's edges, especially the serrated leaves. The leaves are spotted with a light yellow color, then dry and die after taking a concave shape because of it's dryness.The plant seeds also suffered from a noticeable increase in salinity of the irrigation water that was added to the seeds and then the seedlings of the *Vingaungiculata*. As mentioned, the river water gave positive results compared to the well water and the Bahar Al-Najaf.Salinity reduces the formation of lateral branches, leading to weak shoot and root growth of the plant. The reason is due to weak meristematic activity and stopping the elongation of the cells of the growing tips, which leads to dwarf of the plant and prevents the lateral buds from unfolding and turning into shoot growths (branches) (Ahmed 2010).

It was also noted from the research results shown in (Table 4) that there is a clear effect of the salinity of irrigation water on the fresh weight of both the shoot and the root system of the *Vingaungiculata* plant, as salinity works to dwarf the main stems and reduce the formation of lateral branches, and then the death of the newly formed young branches. It also works to inhibit cambium activity (Al-Shahat 2000).

(Lin & Kao 1995) explained the effect of salt stress on the root tissue through the direct effect caused by osmotic pressure in the soil resulting from an increase in the concentration of dissolved salts.

The increase in the concentration of salinity in the irrigation water used in the current research (Bahar Al-Najaf water, well water) indicated a reduction in the total chlorophyll rate in the leaves of the *Vingaungiculata* compared to the river water, which was less salty. This is what was observed in (Table 4) that the high concentrations of salinity in water, it has a clear negative effect on the process of photosynthesis through it's effect on the delicate structures of chloroplasts, as their membranes shrink with the deformation of the membrane lamellae carrying the chlorophyll pigment, so it's concentration will decrease in high concentrations of salinity as a result of the lack of absorption of the elements necessary to build the chlorophyll molecule (Al-Wahaibi, 2009).

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The results of the current research are consistent with the findings of (Shin, 2020) in a study he conducted on the tomato plant. He noticed a decrease in the chlorophyll content in the plant's leaves. He found that the reason is due to the presence of sodium chloride, which caused a decrease in the biosynthesis of chlorophyll and a lack of nutrients, as salt stress causes decrease in the content of photosynthetic pigments.The accumulation of sodium ions, Na^{+2}, and chloride Cl^{-1}, has an inhibitory effect on the construction of various pigments and the destruction of chloroplast membranes. Sodium chloride (NaCl) works to deform plastids and destroy chlorophyll. It also works to increase the permeability of cellular membranes due to the effect of oxidative stress, which reduces the accumulation of Aminolevulinic acid, which is considered the initiator of the construction of chlorophyll, which leads to reduction chlorophyll content in leaves (Mohammed, 2007).

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