Study of the physical and Chemical properties of the soil related to the manifestations of desertification in the area extending from Al-Diwaniyah to Al-Fajr District, Dhi Qar, and the stabilization methods used, especially biological stabilization.

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Abstract :
The study was conducted in the area between Al-Diwaniyah province and Thi Qar province between latitudes (˚00̍32N from the north and ˚36̍30N from the south) and longitudes (˚12̍47E from the east and ˚36̍45E from the west). Within the Iraqi alluvial plain, which is one of the main regions of Iraq. Wind erosion and Sand Dunes are active in most parts of this region. Several methods, most of which are temporary, have been adopted in the region to reduce wind erosion and stabilize Sand Dunes. The study aims to study some soil properties related to desertification manifestations and the stabilization methods used, especially biological stabilization. Measuring the efficiency of the trees and shrubs approved for stabilization, or identifying the most efficient shrubs, most suitable for the conditions of the region, and most capable of stabilizing sediments and Sand Dunes in the study location, so that we can recommend and approve them by the parties interested in this field, and thus reduce efforts, expenses and time and to avoid ineffective trees and shrubs in the stabilization processes for wind sediments. The experiment was designed using the independent comparison system according to the block design (RCBD). The results were as follows:It was found that planting trees had a significant effect on some chemical properties of the study soil. Electrical conductivity increased in soils planted with trees compared to unplanted soils for all studied textures, reaching the highest value and Tamarix, where the highest average was (88.94 d.s), and that the values of (Ec) increased in the third site (sandy mixture soils). The soil pH reaction increased in planted soils and recorded values ranging between (6.83 - 7.83) and the highest value appeared in soils under the cover of eucalyptus. The soil content of organic matter recorded the highest percentage in the lands planted with Tamarix articulata, reaching 3.65. The soil content of calcium (Ca++) was the highest content in the lands planted with Tamarix, reaching (mg kg-1 105.63), while the soil content of magnesium and calcium carbonate (the highest rate in the unplanted soil reached (115 mg kg-1) and calcium carbonate (20.5 - 17.33%), the soil nitrogen content values reached 24.11 mg kg-1 in the soil planted with Tamarix articulata, and the highest value of available potassium in the soils of the study area planted with Tamarix reached 372.72 mg kg-1.

Introduction:

The dry and semi-dry areas of the world constitute approximately 53% of the Earth's surface, some of which are deserts. The concept of deserts is relative and not specific, but from a botanical point of view, it indicates a lack of vegetation cover or its absence. Calcareous soils are considered among the most important soils in dry and semi-dry areas. The soils in these areas can be characterized as basic, due to the lack of rain

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that helps wash away lime, calcium and sodium, which leads to the accumulation of these elements in them. The soil directly affects the vegetation cover growing in it, and at the same time is affected by this cover, meaning that the vegetation cover is one of the factors of soil formation, and the nature and texture of the soil are of great importance in the growth and distribution of vegetation cover, and the reason is due to the effect of these soil properties on its ability to retain water [1]. Soil and water conservation procedures in dry and semi-dry areas are essential for preserving rainwater or irrigation by improving the physical and chemical properties of the soil by increasing water permeability and soil moisture in the root zone and reducing runoff and erosion rates in it. Planting (afforestation) is considered one of the most important soil and water conservation measures, as it preserves the soils of areas exposed to erosion [2]. It improves soil structure through increasing additions of organic matter, which enhances the increase in water seepage and storage processes in the root zone, and also affects the biochemical cycle of soil nutrients and their spread [3] Vegetation is a determining factor in soil erosion, as it is of vital importance as a protector of the soil against erosion. The severity of soil erosion actually changes with vegetation cover and type.This study focused on selecting the area extending from Diwaniyah Governorate to Al-Fajr District \ Dhi Qar, planted with several types of trees, including Eucalyptus, Prosopis Farcta, Tamarix articulata and other trees. The study aims to:

.1Study some soil characteristics related to desertification manifestations and the stabilization methods used, especially biological stabilization.

.2Measuring the efficiency of the trees and shrubs approved for fixation, or identifying the most efficient and most suitable shrubs for the conditions of the region and the most capable of fixing the sediments and Sand Dunes in the study location, so that we can recommend and approve them by the parties interested in this field,

.3Reducing efforts, expenses and time and avoiding ineffective trees and shrubs in the stabilization processes of wind sediments.

Materials and methods:

Study area :

The study was conducted in the area between the provinces of Diwaniyah and Thi Qar between latitudes (˚00̍32N from the north and ˚36̍30N from the south) and longitudes (˚12̍47E from the east and ˚36̍45E from the west). Within the Iraqi alluvial plain, which is one of the main regions of Iraq .Wind erosion and Sand Dunes are active in most parts of this area. Several methods were adopted in the area to reduce wind erosion and stabilize Sand Dunes, during which different types of forest shrubs were relied upon. Thus, the area of unsuitable areas for agriculture reached (2,757,420 dunums) at a rate of (53.4%) of the total studied area of (5,160,000 dunums). Sand Dunes are one of the geomorphological forms that are transmitted and produced by winds. They are one of the main features spread in the study area, which is located in the east of Wasit provainc, located in eastern Iraq. The sandy soil and sediments were characterized by and chemical Characteristics shown in Tables (1 (

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Table (1) Some chemical properties of the soil of the studied sites for a depth of (0-70 cm(

N (mg kg-1)	P (mg kg-1)	K (mg kg-1)	O.M (%)	PH	Ec (d.s)	Model of the dune body	location
12.36	0.09	152.10	2.02	6.96	25.69	1	First location loam soil
19.16	0.48	372.72	3.46	6.93	53.53	2	
4.60	0.16	174.02	3.65	7.01	59.65	3	
12.99	0.82	186.17	3.53	7.83	15.09	4	
11.44	1.66	153.46	1.65	6.91	19.25	5	
9.09	0.17	147.75	1.49	7.76	3.84	1	Second location sandy loam soil
21.96	0.56	221.75	1.66	7.11	15.40	2	
24.11	0.54	281.00	1.36	7.09	24.38	3	
13.03	0.81	185.92	1.53	7.82	7.82	4	
13.10	0.53	146.13	1.28	7.37	14.70	5	
16.04	1.07	245.20	2.45	7.12	45.73	1	Third location sandy loam soil
7.15	0.25	172.28	3.03	6.86	63.94	2	
12.10	0.36	226.95	3.26	6.91	47.91	3	
13.09	0.83	185.67	3.51	7.86	15.09	4	
4.69	0.36	181.39	1.53	6.80	79.53	5	

Sample preparation and experimental design:

Soil samples were taken from the tree shade area at a distance of 1 meter from the trunk of the studied shrubs (Eucalypts Spp, Tamarix articulata Tamarix Spp, Prosopis Farcta Prosopis Farcta and Tamarisk Tamarix) and at a depth of 0-70 cm (which is the most appropriate depth to achieve the research objectives using a hoe from three locations with different textures (loam, sandy loam and loam sandy)[5] and with four replicates from the four sides of the same tree, and uncultivated soil samples (control) were taken from the same and also from four different texture models (heavy texture, medium texture, and light texture(

Measuring soil properties:

Some measurements of the physical and chemical properties were conducted on the air-dried samples as follows:

Chemical properties:

Soil samples were taken from a depth of (0-70 cm) to estimate some chemical properties of the soil as shown in Table (2), and using a 1:1 soil extract, the electrical conductivity was estimated using an (Ec. Meter) device and the degree of reaction using a (pH. Meter) device and according to the methods mentioned in [6] these properties were estimated in the graduate laboratories in the Department of Soil Sciences and Water Resources - College of Agriculture - University of Kufa and some laboratories outside the university.

Soil reaction (pH:(

The soil reaction (pH) was estimated after obtaining a 1:1 extract, using a pH meter according to what was stated in (1954, Richards), and the reason for not using the saturated dough method is that the soil is medium textured and may quickly become oversaturated when preparing the saturated dough for it, and thus it is difficult to obtain the dough [7[

.2Electrical conductivity Ec (d.s m-1:

From the 1:1 extract, the electrical conductivity (Ec) was estimated using the

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Conductivity Bridge device according to the method in [8[

.3Calcium carbonate:(%)

Calcium carbonate (CaCo3) was estimated using the Calcimeter method according to [9[

.4Soil organic matter:(%)

It was estimated by following the Walkley and Black method described [9[

.5Macronutrients (N.P.K:(

Nitrogen, phosphorus and potassium were estimated to evaluate the fertility content of the study sites.

-1-5Ready Nitrogen: Ammonium ion NH4 was estimated by extraction of potassium chloride solution (N2) and using MgO, and measured by micro-Kjeldahl device according to the method of Bremner 1965 and described in [10[

-2-5Ready Phosphorus: Ready phosphorus was extracted using NaHCO3 N 0.5, then the color was developed with ammonium molybdate and ascorbic acid and measured by spectrophotometer at a wavelength of 882 nm, according to [10[

-3-5Ready Potassium: Ready potassium was extracted with ammonium acetate solution (IN) and then ready potassium was measured by flame-photometer, as mentioned in [10[

Statistical analysis: The data were analyzed using the SAS program, version (24). The statistical analytical methods were represented by One Way ANOVA, and were represented by multiple distant comparisons using the Duncan's test. The significance level of the differences was adopted at the level of 5% and 1%.

Results and discussion

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Table (1) Some chemical and physical properties of the soil of the studied locations for a depth of (0-70 cm)

Electrical conductivity (Ec(

The results and the variance analysis Table (1) and figure 1 showed that there is a significant difference in the average values of electrical conductivity (Ec) in the soils planted with trees compared to the unplanted soils. The highest value of electrical conductivity was in the area planted with Tamarix articulata, where the highest average reached (88.94 d.s) and the lowest value was in the area planted with eucalyptus, where the highest average reached (15.09 d.s).It is clear from the above chart that the values of (Ec) increased in the third location (loam sandy soils) while they decreased in the second location (loam sandy soils), which are considered light-texture soils. This increase is due to the fact that the soil of the second location is lighter than the soil of the third location, so that it can be easily washed and salts removed, while these values remained Medium in the first location, as for the trees, the highest values were given in Tamarix articulate and Tamarix trees, followed by Prosopis farcta, and the lowest values were in Eucalyptus. The reason for this difference is that Tamarix articulata and Tamarix trees get rid of salts through the leaves and release them to the outside so that they can balance the osmotic pressure with the saline soils, unlike Prosopis farcta and Eucalyptus trees, which do not release excess salts to the outside, as they have the ability to absorb these salts and benefit from them in the plant's metabolic processes. This result is consistent with [11,12] which stated that the physiological characteristics of plants play a role in absorbing or washing salts from the soil

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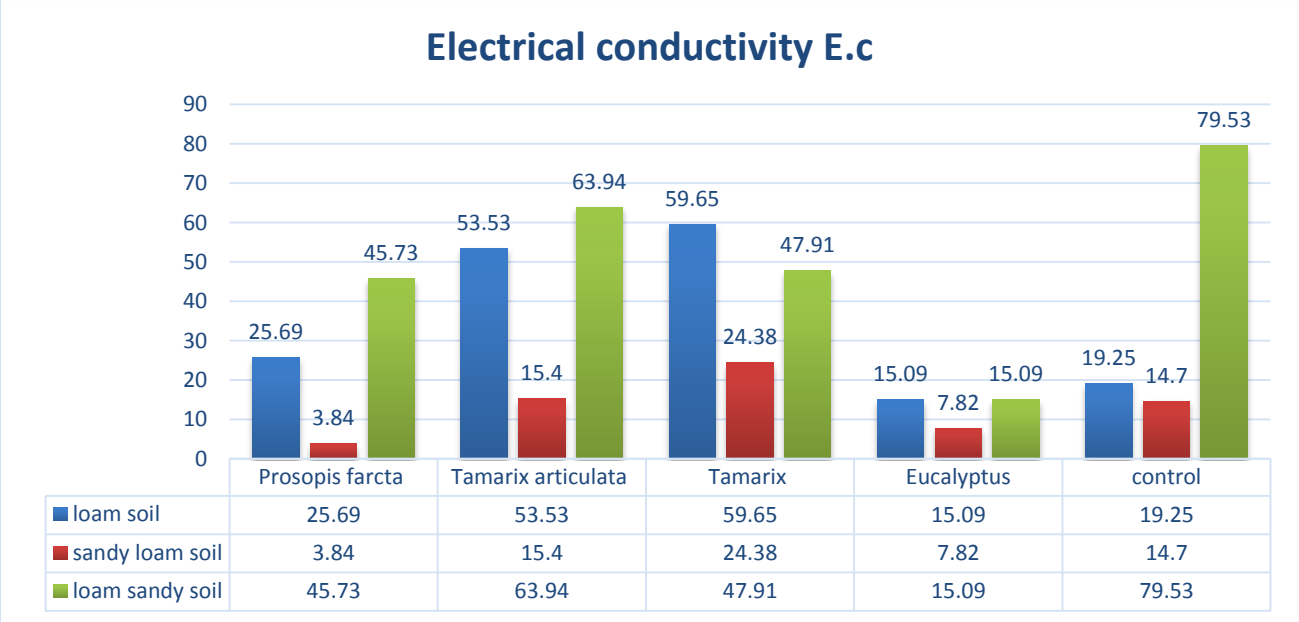

figure (1) Effect of locations and vegetation on Electrical conductivity (Ec(

Soil pH reaction

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The Table (1) and figure 2 shows that there is a statistically significant effect of the areas planted with trees on the soil pH reaction, which increased in the soils planted with trees. This is due to the process of salt accumulation, as it appears to be in its first stage, which is characterized by the dominance of carbonate and bicarbonate salts, which work to raise the value of the soil reaction [13] From the relationship between the type of vegetation (Prosopis farcta, Tamarix articulata and eucalyptus) and the soil pH reaction in the study soil, we find that the values ranged between (6.83 - 7.83). It was found that there was no significant effect of the type of vegetation on the soil reaction, and the highest value appeared in the soil under the eucalyptus cover. This result does not agree with (Baber et al., 2006) that the lands planted with eucalyptus in the dry and semi-dry areas of Pakistan (Peshawar) that the greater the distance from eucalyptus trees, the higher the soil reaction values (pH.(

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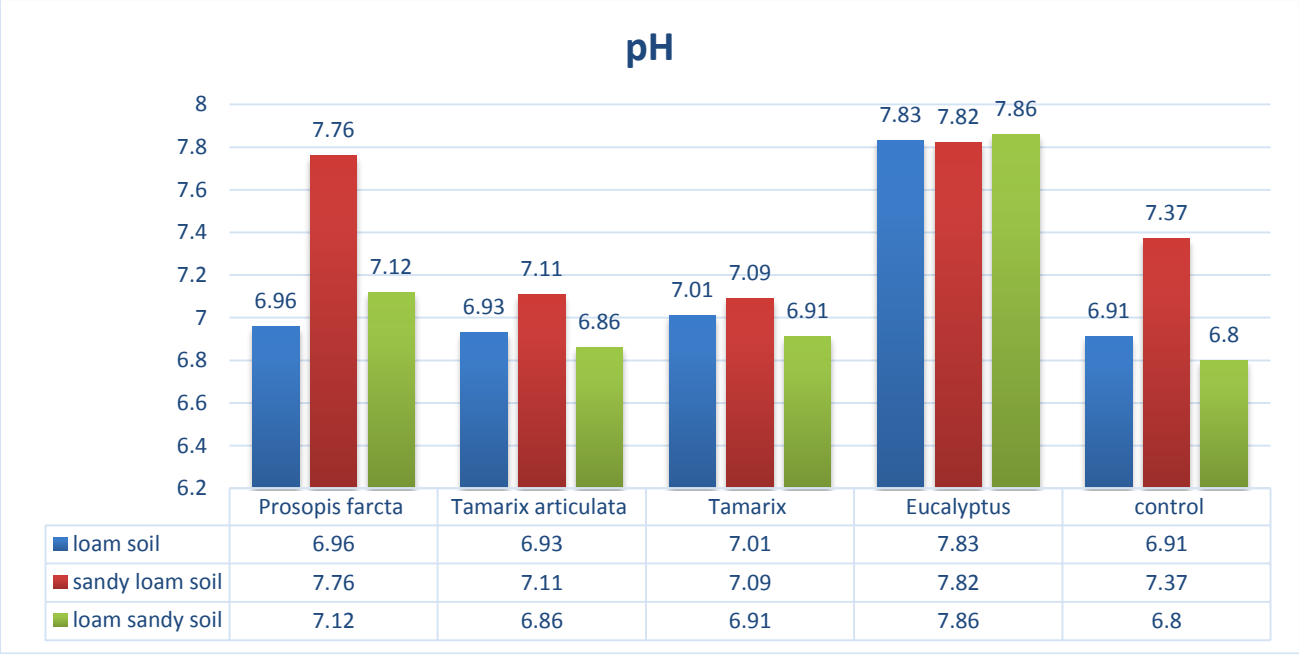

figure (2) The effect of locations and vegetation on the soil pH reaction

Soil organic matter content

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It is clear from figure 3 and the variance analysis table1 of the organic matter content values of the study soils that there is a highly significant effect of planting trees on the organic matter content, as it increased in the soils planted with trees. This proves that planting desert soils with vegetation increases the percentage of organic matter in them, where fallen leaves and root secretions lead to raising the organic content of the surface soil. Plant cover also plays an indirect role by [

creating suitable conditions for the biological cycle by lowering the air temperature and reducing evaporation, which reduces the decomposition of organic matter and increases its accumulation. As for uncultivated soils, the natural vegetation in them does not affect the formation and preservation of organic matter, and the reason for this is that the decomposition of organic matter in dry desert soils is faster than its accumulation in these areas [14

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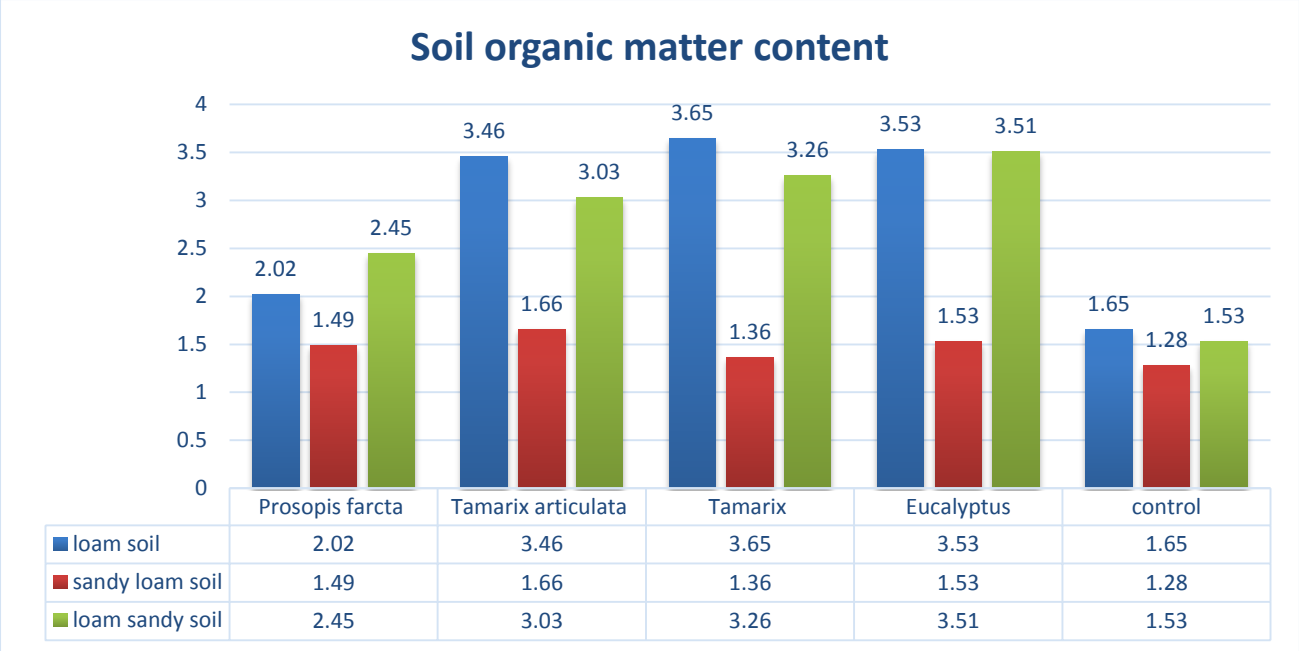

figure (3) The effect of locations and vegetation on Soil organic matter content

Soil calcium content (Ca:(++

Figure4 and the variance analysis table1 showed that there is a highly significant effect of planting trees on the soil calcium content, as the calcium values in the soil planted with eucalyptus decreased to 19.38(mg kg-1) while they increased in the soil planted with Tamarix articulata to (mg kg-1 105.63).The reason for this increase is due to the accumulation of salts in the soil planted with Tamarix articulata due to the plant getting rid of the salts and excreting them outside, while the decrease is due to the fact that eucalyptus trees do not get rid of salts easily and also help wash the salts easily because the rate of leaching is high in them

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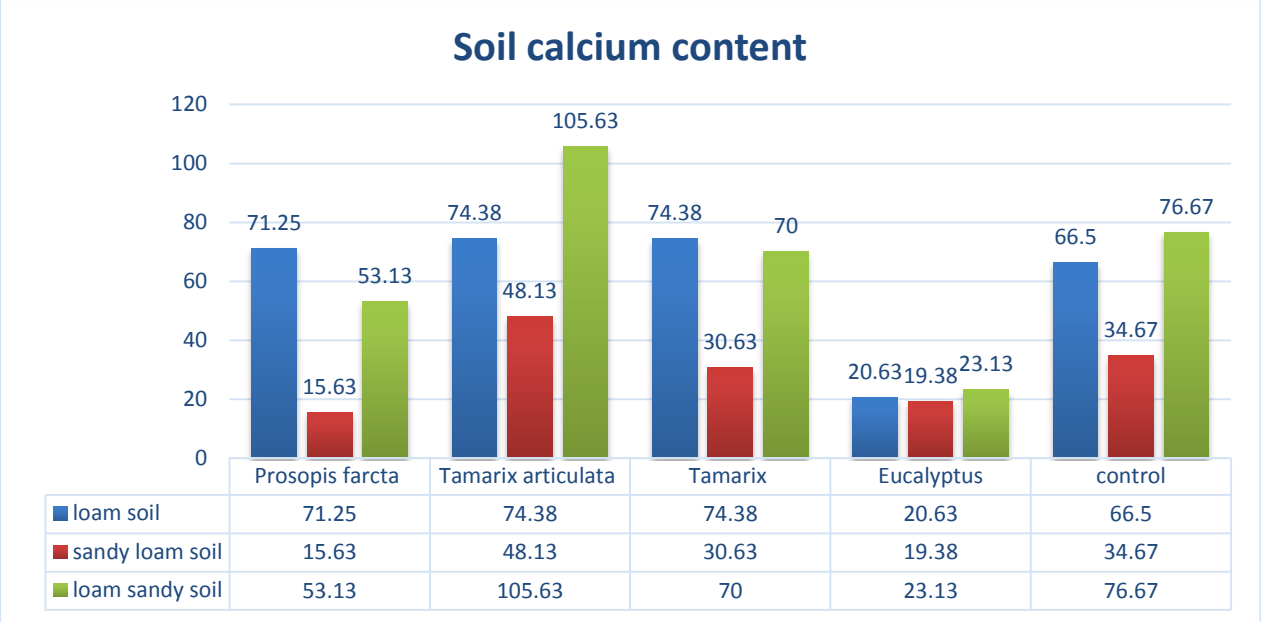

figure (4) effect of locations and vegetation on Soil calcium content (Ca:(++

Soil magnesium content (mg:(++

Figure 5 and variance analysis table 1 showed that there are highly significant differences in the values of the soil magnesium content in the areas planted with trees and control soil, as the soil magnesium content in control soil was (115 mg kg-1), while the average magnesium values decreased In the soils planted with trees, the lowest value was in eucalyptus trees (23.5 mg kg-1), this is for the first location, which is a mixture soil, while for the second location (sandy mixture soil), the magnesium values were lower than the first and third locations in both the comparison and tree-planted soils. [15] also mentioned that the levels of nitrogen (N), phosphorus (P), magnesium (Mg), and organic matter were significantly higher in the lower layer of Prosopis farcta trees compared to the adjacent areas that do not contain shades

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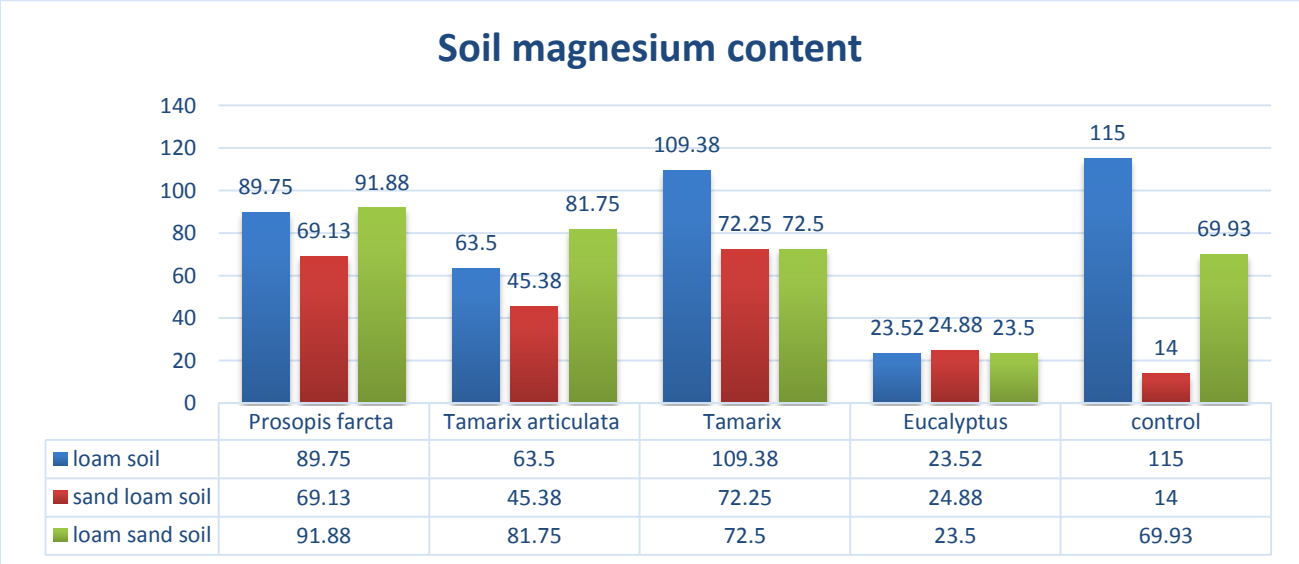

figure (5) effect of locations and vegetation on Soil magnesium content (Ca:(++

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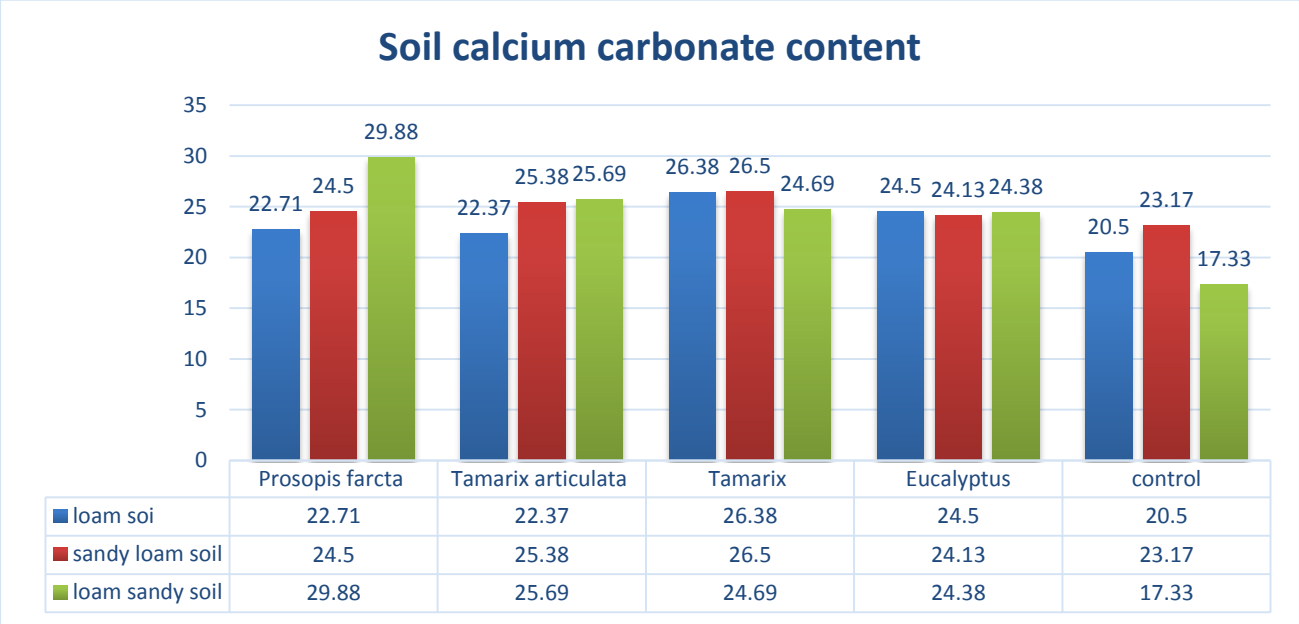
Soil content of calcium carbonate (CaCo3:(

The figure 6and table 1 showed that there is a highly significant effect of vegetation cultivation on calcium carbonate content, as it decreased in uncultivated soils (control soils) in all locations, ranging between (20.5 - 17.33%). As for the soils cultivated with trees, calcium carbonate values ranged between (29.88 - 22.71%) in trees (Eucalyptus, Prosopis farcta, Tamarix, and Tamarix articulata). This result does not agree with (Chen and Stark 1999) who drew the relationship between the type of vegetation and calcium carbonate content in the study soil.[16] also mentioned a significant in calcium carbonate content in areas cultivated 10 and 20 years ago, as the content increased in old farms, when they studied the effect of afforestation on some soil properties in Black pine plantations in the semi-arid Kaymaz region of Türkiye.



	Prosopis farcta	Tamarix articulata	Tamarix	Eucalyptus	control
loam soi	22.71	22.37	26.38	24.5	20.5
sandy loam soil	24.5	25.38	26.5	24.13	23.17
loam sandy soil	29.88	25.69	24.69	24.38	17.33

figure (6) effect of locations and vegetation on calcium carbonate (CaCo3:(

Nitrogen, phosphorus and potassium content in the soils of the study area (N.P.K:(

.1Available nitrogen in the soil of the study area N:

The figure 7 and the analysis of variance table showed that there is a highly significant difference in the values of the soil nitrogen content compared to the soils not planted with trees (control soil), as the nitrogen values in control soil reached (4.69 - 11.44 mg kg-1) in the three textures (loam, sandy loam and sandy loam), while in the soils planted with trees (Eucalyptus, Tamarix articulata, Tamarix and Prosopis farcta), the average nitrogen values reached (4.60 - 24.11 mg kg-1), so that the nitrogen values in the soils planted with trees were higher than the nitrogen values in control soil, which indicates that trees have the ability to fix nitrogen in the soil through the root nodules, and these results are consistent with [17] if the study indicated that after a long period of leaving the field without Cultivation, total nitrogen and organic carbon increased and accumulated in the soil. Prosopis farcta roots have the ability to increase soil fertility through nitrogen fixation.

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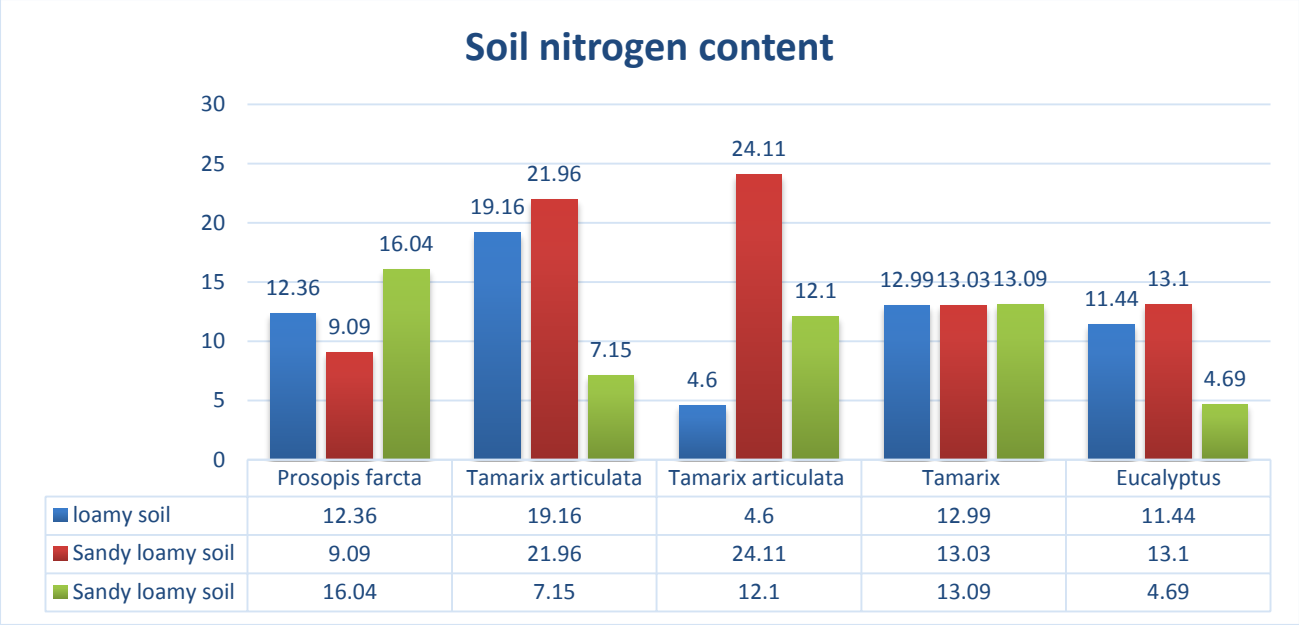

figure (7) effect of locations and vegetation on Available nitrogen in the soil

.2Available phosphorus in the soil of the study area (P:(

The figure 8 and table1 showed that there were highly significant differences between the uncultivated soils (control soil) and the soils planted with trees in the first location (loam soil), as the average phosphorus values in control soil were (1.66 mg kg-1), while in the soils planted with trees, the phosphorus values were (0.09 - 0.82 mg kg-1), as the phosphorus values increased in control soil, which indicates that the trees consumed the available phosphorus in the soil.As for the second location (loam sandy soil), the average phosphorus values increased in the soils planted with trees, especially in eucalyptus trees (0.81 mg kg-1), while the phosphorus values in control soil were (0.53 mg kg-1), while for the third location (loam sandy soil), the phosphorus values increased in the soils planted with Prosopis farcta (1.07 mg kg-1) In control soil, phosphorus values were (0.36 mg kg-1) and this result is consistent with (Seibert et al., 2007) who also mentioned that trees are highly depleting major nutrients.

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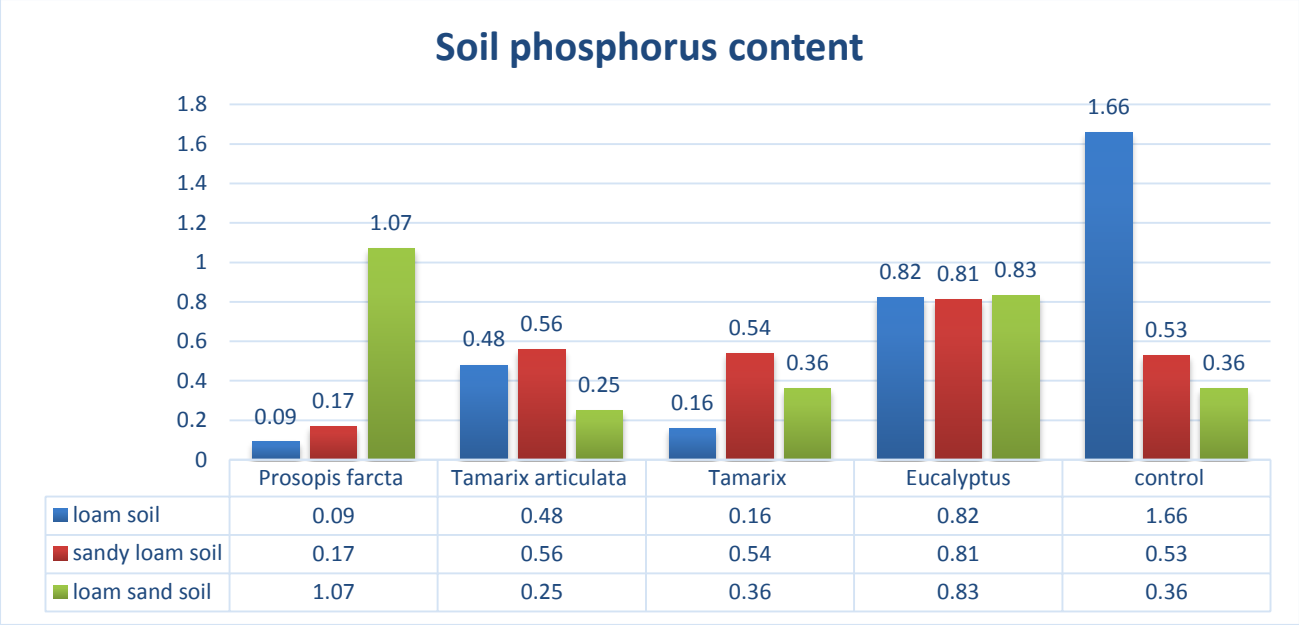
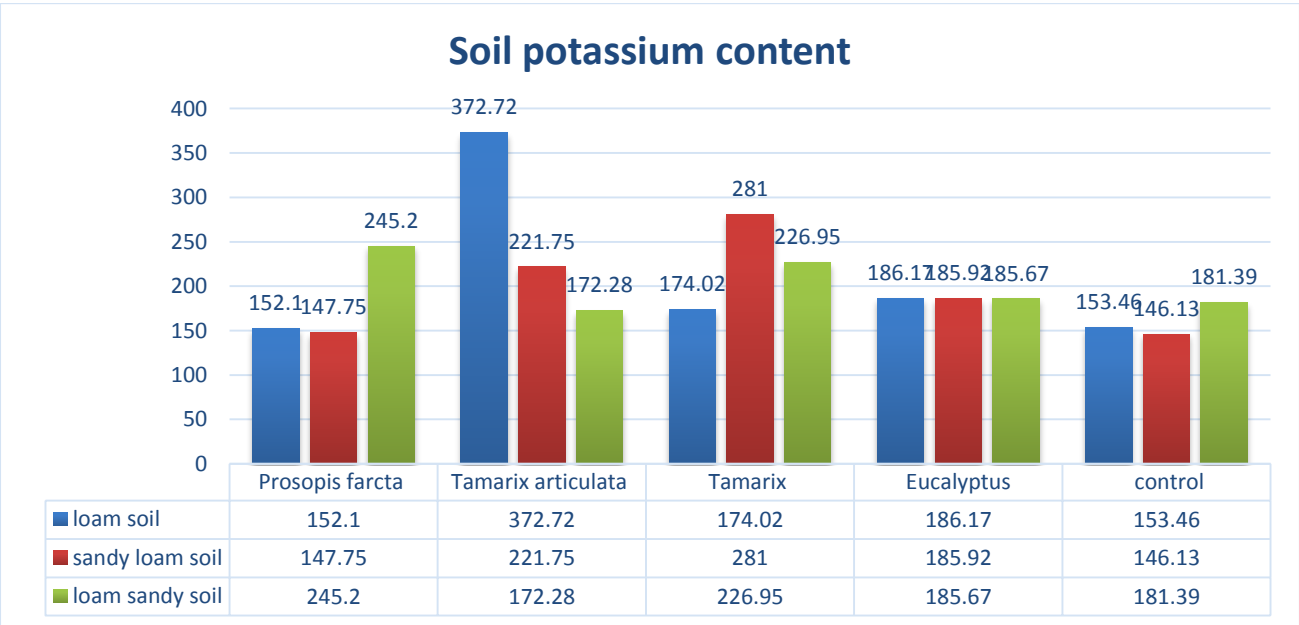


	Prosopis farcta	Tamarix articulata	Tamarix	Eucalyptus	control
loam soil	0.09	0.48	0.16	0.82	1.66
sandy loam soil	0.17	0.56	0.54	0.81	0.53
loam sand soil	1.07	0.25	0.36	0.83	0.36

figure (8) effect of locations and vegetation on Available phosphorus in the soil

Available potassium in the study area soils (K:(

The plot and analysis of variance table showed that there were highly significant differences in the average values of available potassium in control soil and soils planted with trees. It was found that there was an increase in potassium values in soils planted with trees compared to unplanted soils, as potassium values in soils planted with trees in the three locations ranged between (372.72 - 152.10 mg kg-1), while in control soil, potassium values ranged between (181.39 - 146.13).This result is not consistent with [18] who mentioned that trees deplete macro elements.



	Prosopis farcta	Tamarix articulata	Tamarix	Eucalyptus	control
loam soil	152.1	372.72	174.02	186.17	153.46
sandy loam soil	147.75	221.75	281	185.92	146.13
loam sandy soil	245.2	172.28	226.95	185.67	181.39

figure (9) effect of locations and vegetation on Available potassium in the study area soils

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Conclusions:

We conclude from this study in light of the results reached the following:

-1That planting trees and shrubs in the area extending from Diwaniyah Governorate to Al-Fajr District/Dhi Qar affected some of the chemical properties of the soil, and these properties affected each other, which was reflected positively on traits of the soil, as planting trees contributed to improving the chemical properties of the soil.

-2Eucalyptus has an important effect in increasing the soil content of organic matter due to the fall of its leaves throughout the year, and it can also reduce wind speed due to its distinctive height compared to other trees.

-3Tamarix has an important effect in releasing potassium retained in the soil due to the root secretions that the plant secretes from acids that dissolve rocks and release potassium.Tamarix articulata has an important effect in raising the nitrogen content in the soil due to nitrogen fixation through root nodules.

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