Effect Variation in Agricultural System on Some Alluvial Soil Characteristics in Abu Ghraib Region – Iraq

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Abstract. This study was carried out to determine the effect of the type of agricultural system as a result of exploitation on the characteristics of alluvial soil morphology, physically and chemically, as the study was carried out in the fields of College of Agriculture - Abu Ghraib, during which four agricultural systems were identified, namely, the Crop alfalfa, palms, Cereal, Cowpea as well as the land that is not exploited agricultural. After determining the sites of the examination, pedons were excavated for a representative of each type of agricultural system and their horizons were identified.. The results showed that there are differences in the morphological, chemical and physical properties of soils from one site to another, horizontally and from one horizon to another vertically, due to the effect of the different management method used in each agricultural system in terms of plowing and fertilization compared to soil that is not agricultural utilized.

1. Introduction
Soils and their various groupings are important basic economic resources that have various uses, because soils are nothing but a function of their known formation factors. Each of the factors of formation has a specific geographical distribution within the perspective of the earth influencing or affected by it. Therefore, spatial patterns of its units may arise in terms of distribution, repetition, succession, conjunction and complexity, subject to a specific system mainly, and these factors dominate the characteristics of this distribution and affect it with different levels of intensity and influence, The patterns of spatial distributions of soils in nature reveal the influence of many factors, including natural, such as geomorphological changes and variation in sedimentation and abnormal conditions that reflect the influence of the human intervention factor through the management of this resource as well as their effects on the nature of the variation between types of soils [1].

The description means a diagnosis that is linked to observation and documentation and the best descriptions and what is produced for the purposes of surveying, characterization and management together, and it is on degrees of intensity and for the purpose of revealing the truth and reliability of that description requires an analysis of all or at least most of the
characteristics mentioned and recorded in a survey report Soil, through following the analytical, quantitative design approach, which depends on the deductive inductive method, and through the sequence of scientific facts and a logical arrangement so that each formula leads to an understanding of what follows it down to the interconnectedness of the characteristics with each other and out of that goal in the service of soil management purposes. And following the morphological rule that appearance is the evidence of the essence and that the morphological characteristics of some explain each [2],[3]indicated that the type of land use affects the chemical properties of the soil. Cultivation of gliricidia has significantly improved soil content of organic carbon, moisture content and exchange capacity of positive ions and organic matter, as it showed an increase of 42.3% compared to soils exploited for cultivation of cowpea and forests. Which was reflected positively in the fertile state of the soil and according to the order of the type of land use as follows: gliricidia > pasture > cowpea > woodland.

[4] noted in their study of the impact of 20 years on agricultural exploitation of land in arid and semi-arid areas in Sudan that the values of apparent soil density in pasture soils were significantly lower than those recorded in cultivated lands and for all studied depths, with a high significant decrease in the stability of clusters. The dry soil with an increase in the apparent soil density as a result of exposure to the tillage equipment. They noted that the soil organic matter and total nitrogen content was twice as high in the land cultivated with fodder alfalfa and Cereal compared to pasture land. As for [5], they observed a significant change in the stability values of soil aggregations with the variation in the type of land use in Britain, as the lands exploited for the cultivation of fodder (jet) recorded a superiority in the values of this indicator compared to the lands exploited for the cultivation of grains and orchards. In their study, [6] indicated the determination of the effect of different land use systems on the physical and chemical properties of soils in the Sodo Zuria Woreda region of the Wolaita region in southern Ethiopia. Whereas, the soils exploited for cultivation of crops had the degree of interaction, electrical conductivity, phosphorous, ready-made zinc, and calcium and potassium with a higher exchange, which was attributed to the addition of organic fertilizers, while the lands exploited for cultivation of maize showed the lowest ready content of K and Mg, and the exchange capacity of positive ions (CEC), percentage basic saturation (PBS), and total N and OC. Noting that land use has continuous and multiple impacts on the spatial variability of soil resources. [7] when studying the impact of land use change in Rwanda, showed that changing land use from forest to growing crops reduced soil organic matter content, nitrogen, soil moisture and porosity while increasing bulk density and degree of reaction dramatically. On the other hand, replaceable potassium and replaceable phosphorous did not change significantly for both types of land use. Therefore, reducing the area of forests and agricultural lands increases the sensitivity of the soil to erosion and thus leads to a decrease in soil fertility.

Therefore, the current study was carried out to identify the effect of the nature and type of land use on some morphological, physical and chemical characteristics of alluvial soils within the middle of the alluvial plain in Iraq.

2. Materials and methods

After examining the nature of land use in the fields of college agriculture at the University of Baghdad, five sites were chosen for the study. The first is exploited for planting alfalfa (P1), the second for planting palm trees (P2), the third for growing cereal (P3), and the fourth for growing vegetables (P4), as well as Unused agricultural land (P5). After determining their preliminary and geographic locations (Figure 1), and during the implementation of field
procedures, six drill holes were drilled in each selected study site to a depth of one meter, during which the variation in the type of tissue and salinity was studied to ensure the accuracy of the selected site, then pedon was excavated at each Study site.

The pedons described morphology based on the basics provided in the [8] after diagnosing their horizons, and then excited soil samples were obtained representing each of the horizons diagnosed. And put in polyethylene bags, numbered and transported to the laboratory for some physical and chemical analyzes. The soils were dried, milled, and then passed through a sieve with holes diameter of 2 mm, and the following characteristics were found in it:

2.1. Physical characteristics

1- Volumetric distribution of soil separators by the method of hydrometer suggested by the scientist [9].

2- The bulk density was estimated by the cylinder method according to the method mentioned in [10].

2.2. Chemical characteristics

1- Electrical conductivity: It was estimated by the saturated dough method and according to the described method [11].

2- The degree of soil reaction (pH): it was estimated using the saturated paste method according to the described method [11].

3- Positive and negative ions dissolved in the soil solution, according to the methods mentioned in [12].

4- Soil content of organic matter: was estimated by the wet digestion method [13].

5- Soil content of carbonate equivalent: it was estimated according to the methods mentioned in [12].

6- Soil content of gypsum: it was estimated according to the method mentioned in [11].

The soils were classified according to the family level according to [14] and the level of chains was completed based on [15] proposal on alluvial soils.

Figure (1) Selected sites for a study within the boundaries of the College of Agriculture - University of Baghdad - Abu Ghraib
3. Results and Discussion

3.1. Morphological characteristics

The results of the morphological description indicated that the source material for the study site was sedimentary material transported by the Euphrates River, with no significant variation in the natural vegetation with the variation in the type of land use. And that all morphological examination sites were within the physiographic unit of river basins and that the topography of the area is flat with deep ground water. The thickness of the surface horizon ranged between 20-35 cm, depending on the nature of agricultural operations associated with the existing agricultural system, which increased in thickness compared to the horizon A in pedon P5 (not exploited in agriculture), which reached a thickness of 20 cm, due to the agricultural exploitation and the accompanying use of the dump plow in the core of crop residues and to a depth consistent with the nature of the root system of the existing agricultural system [16]. This variation in the depth of cultivation was evident during the morphological diagnosis of the cultivated agricultural cultivar, as the greatest depth was recorded at 35 cm when planting vegetables, while it was 25 cm for the other agricultural systems under study.

As for the subsurface horizons, they differed in thickness, as their range ranged between 20-40 cm. This difference is due to the nature of sedimentation and the amount of material deposited during the formation phase of the soils of the area. As for the tissue characteristic, which is one of the important morphological characteristics and the most stable with time, which reflects the homogeneity of the original material, as it varied between sandy (soft texture) and medium soft (SiCl, Cl, SCI) with a variation of the vertical joints with the dominance of texture, Medium softness. The observed variation in soil separations vertically within the soil series under study is mainly due to the nature of the source material and the extent of its homogeneity during sedimentation. This is one of the characteristics of sedimentary soils, which is known as the phenomenon of stratification, which he referred to [17]. As for the color, it is observed from the morphological description of study pedon and Table (1) that the wavelength of all horizon materials was (10YR) with a difference in the values and chroma with the difference of both of these indicators in both the dry and wet conditions. 50% of the surface horizons were of chroma 3 and the remaining 50% were of 2 purity, while 83% of the subsurface horizons had a purity of 3 and 17% had a purity of 2, meaning that there was an increase in the fineness value of the subsurface horizons by 33% compared to the surface horizons. It is noticed in Table (1) that the value of the intensity was within the value of 5 except for the horizons C2, C1 and Ap in the pedon P4, which ranged between 3-4, and the horizon C1 for the pedon 5, which was within the category 6. As for the reading of the color in the case the dry one indicated that 80% of the surface horizons had a purity of 3 and 20% had a purity of 4, noting that this percentage was the same in the subsurface horizons for all the pedons. The increase in the purity value indicates the purity of the color, and the intensity value was 6 for all horizons.

Noticed from Table (1) that the sub angular blocky composition prevails, with different sizes ranging from medium to coarse, with the appearance of the soft size at the horizon C2. It is also noticed from Table (1) that the building of the soil was of the moderate type in terms of the degree of clarity of construction, it turned to the strong type at the horizon Cd1 at the pedon P2 and P3 as a result of the intensity of the agricultural operations and the force imposed on the soil during the preparation of the land for cultivation, while it became of the type. It is weak in relation to the degree of clarity at the ap horizon of the pedon P1 and the
pedon 4 due to the decrease in the agricultural processes associated with the cultivation of the green crop and the green crop and the survival of the crop for a long time in the land without being exposed to the effects of agricultural mechanization, in addition to the role of leguminous crops in improving the properties of the soil [18].

As for the soil Consistence values, they varied between the firm and very friable in the dry state and the slightly sticky and slightly plastic in the wetted state, depending on the size distribution of the soil separators.

The study of soil softness at the dry state showed that it was of a slightly hard type at the horizon A1 and Ap. In all the pedons under study it transformed into the hard type at the horizon C1 and in all pedons except for P4, which was of the slightly hard type as it was of the soft fractured type at the C2 horizon. Then it turned into a slightly hard type at the C3 horizon, and it is noticed that the tissue role was dominant in influencing with this characteristic in the soil, especially in the C2 and C3 horizons.
Table 1: Some morphological features of the study pedons soil

| Pedon No. | Land use                | Color   | Consistency | Roots | pores | Boundary |
|-----------|-------------------------|---------|-------------|-------|-------|----------|
|           |                         | Depth   | Texture class | Structure | Dry | Moist | Wett(S) | Stick | PL |
|           |                         | (cm)    | (1)         | (2)    | (3)  | (4)    |         |       |    |
| P1        | Legumes (Alfalfa)       | Ap      | 10YR6/3     | SCl    | sh   | v£    | ss      | sp    | common 2 Cs |
|           |                         | C1      | 10YR6/3     | CL     | h    | fi    | ss      | sp    | Few 2 Cs |
|           |                         | C2      | 10YR6/3     | SCl    | sh   | v£    | ss      | sp    | -    1 As |
|           |                         | C4      | 10YR6/3     | SC     | sh   | v£    | ss      | sp    | -    2 |
|           | Date palm trees         | Ap      | 10YR6/3     | SCl    | h    | fi    | ss      | sp    | -    1 As |
|           |                         | C1      | 10YR6/3     | SC     | sh   | v£    | ss      | sp    | -    2 |
|           | Cereals (Cultivation)   | Ap      | 10YR6/3     | SCl    | sh   | v£    | ss      | sp    | -    2 Cs |
|           |                         | C1      | 10YR6/3     | SC     | sh   | v£    | ss      | sp    | Fow 1 Cs |
|           | Vegetable (Cowpea)      | Ap      | 10YR6/3     | SCl    | sh   | v£    | ss      | sp    | -    2 Cs |
|           |                         | C1      | 10YR6/3     | SC     | sh   | v£    | ss      | sp    | -    2 Cs |
|           | Fallow                 | Ap      | 10YR6/3     | SCl    | sh   | v£    | ss      | sp    | -    1 As |
|           |                         | C1      | 10YR6/3     | SC     | sh   | v£    | ss      | sp    | -    2 Cs |
|           |                         | C2      | 10YR6/3     | SCl    | sh   | v£    | ss      | sp    | -    1 As |

Key: (1) CL: Clay loam  SCL: Sandy clay loam  SC: Sandy clay  SCl: Silty clay loam
(2) 1: weak  2: moderate  3: strong  f: fine  m: medium  c: coarse  Sbk: Sub-angular blocky
(3) d(sh): Slightly hard  d(h): hard  d(s): Soft
(4) m(vfr): very friable  m(fr): friable  m(fi): firm
(5) w(ss): Slightly sticky  w(sp): Slightly plastic
(6): Abrupt smooth boundary  C: Clear smooth boundary
As for the posture in the wet state, it is noticed from Table (1) that the horizon C1 is distinguished by a firm strength in the wet state, and as a result of this cohesion it was clearly distinguished by the construction of this type as moderate, then it transformed into the strong type in the pedon P3, while it was of the friable type in the pedon P5. This is due to the role of tree roots at this type of use and the organic matter they add at this horizon. As for the C2 horizon, it showed very friable strength in all pedons except for P5, which was of the friable type. While the Horizon C3 showed the friable type. The observed variation in the outcome at these two horizons is mainly due to the nature of the parent material from which it was deposited and the nature of the available texture with its limited influence on the administrative processes of the soil compared to the first two horizons.

As for the separating boundaries, they ranged from clear and abrupt with respect to the width of the boundary and smooth with respect to the shape, and this is due to the nature of sedimentation as well.

It is evident from Table (1) that the porosity was high in the surface horizons and of the common type, with a decrease in the value at the second horizon and the C3 horizon of the soil body where it became of the few type, for all the pedons under study, This is due to the compression of the soil material as a result of exploitation and the nature of agricultural operations.

Study the distribution of roots in the soil body, as shown from the morphological description of the study pedon in Table (1). Their distribution was between common and few, and it is noticed that their sizes ranged between very fine and coarse, which was diagnosed with pedon only P2, and the reason is attributed to heterogeneity, The size of the roots depends primarily on the type of agricultural system in place in the field. It is noticeable that the concentration of the roots was only at the horizons A and C1, especially in the pedons P1, P2 and P3. Whereas, the low distribution of roots in pedon P4 is due to the fact that the roots of vegetable crops are shallow and do not go deep into the soil body compared with other agricultural systems under study.

3.2. Soil physical properties

3.2.1. Volumetric distribution of soil separators

It is Table (2) that the soil texture in the study area ranged from soft texture type (SC) sandy clay at the C4 horizon to medium softness (SiCL, CL and SCL) at the other horizons. In general, it is noticed from the results that there is a clear decrease in the amount of sand with depth, especially at the horizon C4, as the content of this component ranged between 90-50 g kg⁻¹ soils, while the content of separated silts was recorded first in terms of dominance, as its percentage ranged in soils. The study ranged between 550-100 g kg⁻¹ soil, while the content of the clay joint was ranked second in the dominance compared to the sand and silt joints, as the soil content ranged from this separation according to Table (2) between 415-245 g kg⁻¹ soil, which shows a variation in Soil texture in the vertical direction, i.e. the presence of a distinctly stratified characteristic, and this is consistent with what [17] indicated about the prevalence of stratification phenomenon in sedimentary soils in Iraq when it numbers the exploratory map of country soils. The conditions of the sedimentation process and the ability of the carrier to carry, when the current was strong or the flood was high, it carried with it a large amount of course materials that were deposited at great distances from the Euphrates, and on the contrary, when the momentum of the flood was weak, it carried with it large
quantities of soft materials deposited at the site. The same, which caused a variation J Soil Tissue [1].

Texture is one of the most stable characteristics compared to the rest of the traits, so it is an important differential characteristic and a major factor in soil classification systems, including the alluvial soil classification system at the level of series referred to before [15].

Table (2) Some physical characteristics of the study pedon soil

| Pedon No. | Land use     | Horizons | Depth (cm) | Sand gmKg$^{-1}$ | silt gmKg$^{-1}$ | Clay gmKg$^{-1}$ | Texture class | Bulk density gmcm$^{-3}$ | Practical density | Total porosity |
|-----------|--------------|----------|------------|-----------------|-----------------|-----------------|---------------|------------------------|-----------------|--------------|
| P1        | Legumes      | Ap       | 0.25       | 150             | 480             | 370             | SCL           | 1.25                   | 2.63            | 52.5         |
|           | (alalfa)     | C1       | 25-50      | 295             | 355             | 350             | CL            | 1.30                   | 2.64            | 50.8         |
|           |              | C2       | 50-70      | 650             | 100             | 250             | SCL           | 1.42                   | 2.65            | 46.4         |
|           |              | C3       | 70-150     | 305             | 355             | 340             | CL            | 1.48                   | 2.65            | 44.2         |
|           |              | C4       | 150-200    | 50              | 550             | 400             | SC            | 1.51                   | 2.65            | 43.0         |
|           |              | The Average |          | 290a           | 368b            | 324b            | CL            | 1.39a                  | 2.64            | 47.4d        |
| P2        | Date palm    | Ap       | 0.25       | 142             | 483             | 375             | SCL           | 1.40                   | 2.64            | 46.9         |
|           | trees        | C1       | 25-40      | 293             | 355             | 352             | CL            | 1.48                   | 2.65            | 44.2         |
|           |              | C2       | 40-65      | 645             | 110             | 245             | SCL           | 1.51                   | 2.65            | 43.0         |
|           |              | C3       | 65-150     | 302             | 354             | 344             | CL            | 1.55                   | 2.65            | 41.5         |
|           |              | C4       | 150-200    | 90              | 500             | 410             | SC            | 1.56                   | 2.65            | 49.4         |
|           |              | The Average |          | 314a           | 360b            | 326a            | CL            | 1.50a                  | 2.65            | 45.0b        |
| P3        | Cereal       | Ap       | 0.30       | 142             | 478             | 380             | SCL           | 1.34                   | 2.64            | 49.2         |
|           | cultivation  | C1       | 30-50      | 299             | 353             | 348             | CL            | 1.46                   | 2.65            | 44.9         |
|           |              | C2       | 50-70      | 642             | 105             | 253             | SCL           | 1.50                   | 2.65            | 43.4         |
|           |              | C3       | 70-150     | 295             | 355             | 350             | CL            | 1.53                   | 2.65            | 42.2         |
|           |              | C4       | 150-200    | 90              | 510             | 400             | SC            | 1.55                   | 2.65            | 41.5         |
|           |              | The Average |          | 294a           | 360b            | 346b            | CL            | 1.48b                  | 2.65            | 44.2a        |
| P4        | Vegetable    | Ap       | 0.35       | 150             | 480             | 370             | SCL           | 1.15                   | 2.63            | 56.3         |
|           | (Cowpea)     | C1       | 35-67      | 300             | 350             | 350             | CL            | 1.22                   | 2.63            | 53.6         |
|           |              | C2       | 67-110     | 646             | 100             | 254             | SCL           | 1.36                   | 2.65            | 48.7         |
|           |              | C3       | 110-150    | 535             | 120             | 345             | CL            | 1.48                   | 2.65            | 44.2         |
|           |              | C4       | 150-200    | 78              | 510             | 412             | SC            | 1.51                   | 2.65            | 43.0         |
|           |              | The Average |          | 342c           | 312a            | 346b            | CL            | 1.34a                  | 2.64            | 49.2e        |
| P5        | Fallow       | A        | 0.20       | 151             | 475             | 374             | SCL           | 1.31                   | 2.65            | 50.6         |
|           |              | C1       | 20-35      | 295             | 350             | 355             | CL            | 1.34                   | 2.65            | 49.4         |
|           |              | C2       | 35-65      | 645             | 105             | 250             | SCL           | 1.46                   | 2.65            | 44.9         |
|           |              | C3       | 65-150     | 298             | 347             | 355             | CL            | 1.49                   | 2.65            | 43.8         |
|           |              | C4       | 150-200    | 73              | 512             | 415             | SC            | 1.51b                  | 2.65            | 43.0         |
|           |              | The Average |          | 292a           | 358b            | 350b            | CL            | 1.42                   | 2.65            | 46.3c        |
|           |              | A or Ap  |            | 147b           | 479d            | 374c            |               | 1.29a                  | 2.64            | 51.1e        |
|           |              | C1       |            | 296c           | 353c            | 351b            |               | 1.36b                  | 2.65            | 48.6d        |
|           |              | C2       |            | 646e           | 104a            | 250a            |               | 1.48c                  | 2.65            | 45.3e        |
|           |              | C3       |            | 347d           | 306b            | 347b            |               | 1.51c                  | 2.65            | 43.2a        |
|           |              | C4       |            | 76 A           | 516e            | 408d            |               | 1.52c                  | 2.65            | 44.0b        |
|           |              | LSD0.05 for Horizon | | 10.132           | 8.321            | 7.653           |               | 0.032                   | NS             | 0.522        |
|           |              | LSD0.05 for agricultural system | | 18.320           | 15.421            | 13.762           |               | 0.0522                  | NS             | 0.742        |
3.2.2. Soil bulk density

The results shown in Table (2) indicate that there is a significant effect of the type of the existing agricultural system on the soil bulk density values, and that the agricultural utilization process has caused a significant decrease in the values of the soil bulk density rate, by 0.7%, 2.0%, 7.9% and 11.3% at the use of land to grow alfalfa, palm trees, Cereal, and finally vegetables, respectively, compared to those not in agricultural use, and this is consistent with what was indicated by [19]. This is due to the nature of the root system of the crop itself, and the reason for this is also due to what legumes add of organic residues to the soil, as well as the nature of organic fertilization of the vegetable cultivation system, which increases the soil content of organic matter and its positive role in improving soil construction and reducing soil apparent density, and this is consistent with what [16] Comparison of land use to grow date palms.

It is noticed from Table (2) that the depth also has a significant effect on this characteristic, as the Ap horizon showed the lowest values of the apparent density amounting to 1.29 mcg m-3 as a rate that increased to reach 1.53 mcg m-3 at the C4 horizon. The horizon of plowing is directly attributable to the repeated agricultural operations and the use of heavy agricultural machinery, repeatedly at the same depth and for long periods of time, which led to compacting the soil and increasing its apparent density, That the bulk density of the plow layer ranged between (1.59 -1.30 Mg m3-) and its values differed significantly from the layers adjacent to it, as its porosity values ranged between 50.94% -32.91%, and the soil moisture content at the tension of 33 kPa was between 23.94% and 23.94%. 34.26% and at a tension of 1500 kPa between 11.96% and 22.22%, and it was observed that the tissue of the plow layer was of medium smoothness (mixture, silty clay and clay loam).

In general, a significant decrease is observed in the bulk density values of the surface horizons of all soil pedons in the study, due to the high soil content of organic matter due to the density and type of the existing natural vegetation and the existing agricultural system, in addition to the organic fertilization that was recorded at the site P4 through field observations and this is in agreement with [20] and [21] observed a high significant negative relationship between the soil organic matter content and the soil apparent density, with a tendency for a significant increase in the values of the apparent soil density with depth, which is attributed to agricultural additions and processes. The surface horizon has been affected to a greater degree.
compared to the subsurface horizon, and its exposure to pressure as a result of administrative processes.

The study of the simple correlation relationship of soil content of organic matter with this trait showed a negative significant correlation with a value of $r = -0.504$ and this is in

Table (3) some chemical properties of the study pedon soil

| Pedon No. | Land use          | Dissolved ions | OM (gmKg$^{-1}$) | CaCO$_3$ (meqL$^{-1}$) |
|-----------|-------------------|----------------|------------------|------------------------|
| A or Ap   |                   |                |                  |                        |
| P1        | Legumes (alfalfa) |                |                  |                        |
| P2        | Date palm trees   |                |                  |                        |
| P3        | Cereal cultivation|                |                  |                        |
| P4        | Vegetable (Cowpea)|                |                  |                        |
| P5        | Fallow            |                |                  |                        |

**Table 3**: Some chemical properties of the study pedon soil.
|     | C3     | C4     | LSD0.05 for Horizon | LSD0.05 for agricultural system |
|-----|--------|--------|---------------------|---------------------------------|
|     | 4.2a   | 7.8b   | 18.4a               | 2.9a                            | 0.043  | 0.013  | 1.096  | 0.022  | 1.035  | 1.095  | 1.058  | 0.024  | 0.018  | 2.108  |
|     | 13.5a  | 19.2b  | 14.8a               | 2.0a                            | 1.7b   | 271b   |        |        |        |        |        |        |        |        |        |
|     | 2.9a   | 13.5a  | 19.2b               | 14.8a                           | 2.0a   | 1.7b   | 271b   |        |        |        |        |        |        |        |        |
|     | 7.8b   | 13.5a  | 19.2b               | 14.8a                           | 2.0a   | 1.7b   | 271b   |        |        |        |        |        |        |        |        |
|     | 18.4a  | 2.9a   | 13.5a               | 19.2b                           | 14.8a  | 2.0a   | 1.7b   | 271b   |        |        |        |        |        |        |        |        |
|     | 23.8c  | 4.8d   | 17.7c               | 17.8a                           | 17.6b  | 2.4d   | 1.1a   | 278b   |        |        |        |        |        |        |        |        |
|     | 0.043  | 0.013  | 1.096               | 0.022                           | 1.035  | 1.095  | 1.058  | 0.024  | 0.018  | 2.108  |        |        |        |        |        |
|     | 1.096  | 0.022  | 1.035               | 1.095                           | 1.058  | 0.024  | 0.018  | 2.108  |        |        |        |        |        |        |        |        |
|     | 1.035  | 1.095  | 1.058               | 0.024                           | 0.018  | 2.108  |        |        |        |        |        |        |        |        |        |
|     | 1.095  | 1.058  | 0.024               | 0.018                           | 2.108  |        |        |        |        |        |        |        |        |        |        |
|     | 0.043  | 0.013  | 1.096               | 0.022                           | 1.035  | 1.095  | 1.058  | 0.024  | 0.018  | 2.108  |        |        |        |        |        |
|     | 1.096  | 0.022  | 1.035               | 1.095                           | 1.058  | 0.024  | 0.018  | 2.108  |        |        |        |        |        |        |        |        |
|     | 1.035  | 1.095  | 1.058               | 0.024                           | 0.018  | 2.108  |        |        |        |        |        |        |        |        |        |
|     | 1.095  | 1.058  | 0.024               | 0.018                           | 2.108  |        |        |        |        |        |        |        |        |        |        |
|     | 0.043  | 0.013  | 1.096               | 0.022                           | 1.035  | 1.095  | 1.058  | 0.024  | 0.018  | 2.108  |        |        |        |        |        |
|     | 1.096  | 0.022  | 1.035               | 1.095                           | 1.058  | 0.024  | 0.018  | 2.108  |        |        |        |        |        |        |        |        |
|     | 1.035  | 1.095  | 1.058               | 0.024                           | 0.018  | 2.108  |        |        |        |        |        |        |        |        |        |
|     | 1.095  | 1.058  | 0.024               | 0.018                           | 2.108  |        |        |        |        |        |        |        |        |        |        |        |
|     | 0.043  | 0.013  | 1.096               | 0.022                           | 1.035  | 1.095  | 1.058  | 0.024  | 0.018  | 2.108  |        |        |        |        |        |
|     | 1.096  | 0.022  | 1.035               | 1.095                           | 1.058  | 0.024  | 0.018  | 2.108  |        |        |        |        |        |        |        |        |
|     | 1.035  | 1.095  | 1.058               | 0.024                           | 0.018  | 2.108  |        |        |        |        |        |        |        |        |        |
|     | 1.095  | 1.058  | 0.024               | 0.018                           | 2.108  |        |        |        |        |        |        |        |        |        |        |        |
The effects recorded on the apparent soil density were adversely reflected in the values of soil porosity, as the decrease in soil density was accompanied by an increase in the porosity of the soil, statistically, and that the pedon P4 of the land exploited for growing vegetables had the highest content of pores compared to the non-cultivated ones.

3.3. Effect of type land use on the chemical properties of the soil

3.3.1 Electrical conductivity

The electrical conductivity values ranged from low salinity to medium salinity as in pedon P1 and P6, respectively. The electrical conductivity values of the saturated paste extract for the soil models under study in Table (3) show a clear picture of the nature of the distribution of salts in the soil body, with its significant effect on the type of agricultural use on the values of this characteristic, as the pedon P6 (not used in agriculture) showed the highest rate of dS.m⁻¹ 15.9 compared to soils exploited in agriculture, in which irrigation plays an important role in the process of washing salts in the soil body, as the lowest rate was recorded for pedon P1 (exploited for growing fodder) and amounted to 3.5 dS.m⁻¹, and this is due to the high amount of Irrigation water added to the crop of jet compared to the needs of other crops, and this is consistent with what [23] observed, where he observed a significant decrease in the electrical conductivity values of soils exploited for cultivation of jet compared to other types of uses as well as not exploited in agriculture.

It is noticeable to the distribution of this characteristic with the depth in the soil body, especially with P5, the presence of a clear decrease in its values with depth, which is due to the role of the climate and the high temperatures causing the movement of water with the capillary characteristic and its evaporation from the surface leaving the salts to accumulate at the surface and with the passage of time and the absence of the amount of water that works to wash the salts, In addition to the limited role of deepening the root system for plants not to cultivate them, which caused an increase in the values of their electrical conductivity. The study of the correlations has shown the existence of a significant and negative correlation between the soil content of organic matter and the electrical conductivity of the soil with an amount of \( r = -0.465 \) * and this result is consistent with what he indicated [24].

3.3.2. soil reaction (pH)

It appears from the results of Table (3) that the values of the estimated pH soil reaction in the saturated soil paste extract ranged between 7.9-7.6 for the area soils, meaning that it is simple to moderately alkaline, with a significant effect of the type of land use on the values of this characteristic as the pedon showed P1 (Exploited to cultivate jets) and pedon P4 (exploited to grow vegetables) The lowest rate for this trait was 7.7 compared to other pedon
representing the other types of land use under study, which showed the highest rate of soil interaction rate of 7.8, due to the nature of the existing agricultural system and the extension of the root system, which Their secretions have an important role in influencing the degree of soil reaction [25].

The results in Table (3) indicate that there is a gradual increase in the values of the degree of soil interaction with depth in all the study pedons, as this increase observed in the subsurface horizons is due to the increase in the soil carbon content with the decrease in the soil content of organic matter. [26], indicates that there is a positive and significant correlation between the carbonate content of the soil and the degree of soil interaction, which in this study reached $r = 0.852 \,*$, as well as the negative significant relationship between the soil content of organic matter and the degree of soil interaction, which amounted to $r = -0.532 \,*$. The recorded decrease of the values of this characteristic at the surface horizon of all the pedon under study is due to the acidic effect of plant residues and their role in reducing the values of this indicator [27] as well as the role of salts in reducing the degree of soil interaction and this confirmed our results, as the simple correlation coefficient for these Chemical characteristic with electrical conductivity of soil $r = -0.522 \,*$.

3.3.3 Soil content of organic matter

Table (3) explain that there is a significant variation in the organic matter content of the area's soils with the variation in the type of land use, and it ranged between 12.9 - 0.9 g Kg\(^{-1}\) soil, where pedon P1 (alfalfa cultivator) scored the highest value of 5.2 g Kg\(^{-1}\) soil on average, while the lowest value for this characteristic was recorded for pedon P5 (not exploited in agriculture), which was 1.6 g Kg\(^{-1}\) soil with a significant decrease in soil organic matter content with depth for all sites. It recorded the highest value at the Ap horizon, at 7.5 g Kg\(^{-1}\) soil as an average for the area's soils, while the lowest value was at the C4 horizon of 1.1 g Kg\(^{-1}\) soil.

It is noticeable from the results that the estimated soil organic matter content has been characterized by a decrease due to the rapid decomposition of organic matter as a result of its oxidation due to high temperatures in the summer in addition to the low moisture content in the soil. It is noticed from Table (3) that the values of these two chemical properties were higher at the surface horizon Ap or A1, then decreased with the depth, due to agriculture and its associated processes such as adding animal wastes as in pedon P4, which increases the soil content of organic matter, and this is in agreement with What was observed by [25] where they indicated that the concentration of organic carbon increases at the surface layer of the soil by 0-15 cm, and the soil content of it decreases with depth and regardless of the type of land use.
The data of the study of this chemical characteristic indicate that the soils under study have a low content of organic matter, as is the case for soils in arid and semi-arid regions. It is a clear characteristic of Iraqi sedimentary soils that increases the possibility of breaking the good physical composition of the soil and increases the compressibility of the soil [28].

3.3.4 Carbonate content of soil

The values of carbonate content in the soil ranged between 256 and 287 g. Kg\(^{-1}\) soil, with an increase in the carbonate content of the soil with the depth and at all pedons, because the source material for the soil of the area is limestone, and the source of carbonate emergence in this area is the denudation of the calcareous sedimentary rocks and their mechanical weathering. These products are carried by running water and then deposited in the Mesopotamian Basin. [17] indicated that the sedimentary soils in Iraq have a high calcium carbonate content, ranging between (300 - 180) g. Kg\(^{-1}\) soil.

The presence of this high percentage of this component in the soils of the region and under our dry conditions, can be considered the main binder in the soils due to its low content of organic matter, which made the soil building more solid and cohesive due to its working of the pores between the grains [29] have indicated that the reason for the compression of some horizons in sedimentary soils in Iraq is due to their high calcium carbonate content.

3.4. soil classification

The results of the morphological examination and chemical analyzes of the soil horizons of the study soil pedons indicated that these soils fall within the rank of newly formed soils [14], because the main characteristic of these soils is the absence of a pedological development in the genetic and morphological concept and the absence of the subsurface horizon (B), the sub-order level was among the Fluvents, the Great Torrifluvents, and under the Great Group Typic Torrifluvents, and the Fine Loamy Soil Family; calcareous; mixed; hyperthermic; Torrifluvents extracted the family level in the US system based on the texture triangle family, the existing minerals and the soil temperature system. Based on the classification proposed by [15], the soil of the study was classified into series level (TW844).

4. Conclusions

Through the study of the morphological, physical and chemical characteristics of the horizons, it becomes evident that there is a significant effect of agricultural operations associated with the type of land use on the characteristics of the soil, where the agricultural exploitation caused an increase in the bulk density of the soil, especially for subsurface horizons, with a significant decrease in the electrical conductivity values of the exploited soil.
Agricultural compared to the untapped. In addition, the use of the land for the cultivation of alfalfa, cereal and vegetables has shown a significant increase in the soil's organic matter content, especially at the surface horizon.

The recorded variation in soil tissue class affected the characteristic of texture prevailing in the diagnosed horizons in all cases of dry, wet and wet study, as well as the values of strength and purity in soil color. This indicates the need to use the land in the area for agricultural purposes, especially for the cultivation of legumes, to improve their physical and chemical properties and to avoid the deterioration of their soil.

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