EVALUATION OF THE CARBON CONTENT AND SOME PHYSICAL QUALITY PARAMETERS OF DIFFERENT SOILS FOR AGRICULTURAL USE IN BABYLON PROVINCE

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Abstract:
The study was conducted to evaluate the organic carbon and some physical parameters of soil quality under three types of agricultural exploitation in the Alexandria and Al-Nile sub-districts of the Al-Mussaib and Al-Mahaweel districts, respectively, in the Babylon governorate. Three locations were chosen in each district that differs in terms of agricultural exploitation for a period of more than six years, and these locations locations represent exploited soil orchards, soil exploited for the cultivation of field crops, in addition to unexploited soil. The studied soils were classified according to the American classification 2010, all the agriculturally exploited and non-exploited soils to the rank of Entisols if they were classified under the typic torriflurents group .Disassembled and disassembled samples were taken to estimate soil organic carbon and some soil quality parameters (bulk density, population stability, and ready water) for three soil depths (0-10, 10-20, 20-40 cm) and with three replicates for each exploitation location. The averages of the criteria were compared for each depth at the end of the three uses at the level of one site, depending on the value of the statistical criterion, the least significant difference at the level of probability (0.05) >p. The results of organic soil carbon indicated that at the first depth and for all locations in both Alexandria and the Al-Nile, there were no significant differences, but the highest value of 2.930 g / kg and 2,210 g / kg was observed in the unexploited soils in both the Alexandria and Al-Nile sides, respectively, in the depth 0-10 cm. As for the depth of 10-20 cm, it was observed in the Alexandria district, there were no significant differences, while significant differences were observed in the Al-Nile district, and the highest value of 2.507 g/kg was observed in the cultivated orchard soil that excelled on the two agriculturally unexploited soils. As for the depth of 20-40 cm, significant differences appeared in the locations for both sides, and the differences were close .The highest value of 2.233 g / kg appeared in the unexploited soil and the lowest value in the exploited soil was an orchard 1.917 g / kg in the Alexandria district and in the Al-Nile district it appeared in the exploited soil (orchard) 1.717 g / kg and the lowest value was 1.020 g / kg in the unexploited soil. Through this result, the organic matter content as a percentage is <1 low and is due to environmental conditions from erosion or other processes. As for the trait of the bulk density, it was noticed that the bulk density was lower in orchard soil and for all locations and for all depths and for the two sides of Alexandria and the Al-Nile until its value in Alexandria was much lower than it is in the Al-Nile soil, which shows through this result there is a significant effect between the three uses of the study depths in the two sides of Alexandria and the Al-Nile . The lowest value of 1.313 mcg/m^3 was observed within 0-10 and 10-20 cm, while the highest value was observed at 1.410 mcg/m^3. This result shows that the soil at a depth of 10-20 cm (20-40 cm) has excelled on the critical value of 1.40 for the growth of most crops. The values of the bulk

density showed a decrease in the locations that were characterized by a high organic carbon. The results of the analysis indicated that there were no significant differences between the average values of the ready water under the influence of the type of the planted crop for all depths and for both locations. The results showed that there were significant differences between the average values of the stability clusters under the influence of the type of plant grown for all depths and for both locations. The highest value was observed within 10-20 cm depth 51.27% and 45.23% in the exploited soil in an orchard in both the Alexandria and the Al-Nile sub-districts, respectively, and the lowest value in the unexploited soil within 20-40 cm depth was 25,620% in the Alexandria district and 19.61% in the Al-Nile district. Through this result, the parameters of bulk density and soil aggregates were affected by the organic carbon content.
Keywords: carbon, physical quality parameters, soils

Introduction:

Soil is a major component of all terrestrial ecosystems, whether they are natural (forests and grasses) or managed (agricultural and urban), a habitat and a living entity for plant and animal life. Its description ends as a living entity or soil when it is devoid of its living community. The productivity of all-natural or managed ecosystems depends on the soil quality and its dynamic nature. The term soil quality refers to the capacity of the soil to perform its functions and its potential for special functions that can be accomplished in an efficient, sustainable or long-term manner (Soil Science Society of Americas Ad Hoc Committee and Karlen et al. 1997 and Lal and Shukia, 2004). Soil organic carbon (the carbon stored in soil organic matter) is critical to the health, quality and fertility of soil and ecosystem functions, enabling the soil to perform many basic functions, including its ability to support plant and animal growth, Filtering and preserving material and nutrients, and regulating water flow through the soil pot (Larson and Pierce, 1991, 1994). Clearly, soil quality must be maintained and maintained to meet the increasing demand for food and provide food security and environmental safety, for this reason, soil scientists have recently begun to pay attention to finding and developing successful strategies for assessing soil quality related to improving capabilities for sustainable soil management and searching for soil indicators and working methods by which soil quality can be determined (Arshad and Cohen, 1992, Doran and Parkin, 1994. Chatterjee and Lal, 2009). at the same time, it is very useful to estimate soil physical, chemical and biological parameters, which include bulk density, texture, degree of soil reaction, electrical conductivity, particulate organic matter and nitrogen-nitrate. While USDA, (2006) chose seven physical traits as indicators of soil quality (soil texture, soil structure, bulk density, cluster stability, soil compaction, overflow and depth of top soil) and three chemical traits (soil interaction degree, salinity, plant nutrients) and two biological traits. biocontamination, respiratory rate). Soil organic carbon (the carbon stored in soil organic matter) is critical to the health, quality and fertility of soil and ecosystem functions. This enables the soil to perform many basic functions, including its ability to support plant and animal growth, filtering and preserving matter and nutrients, and regulating water flow through the soil volume (Larson and Pierce, 1991, 1994). The significant decline in soil quality has occurred all over the world as a result of reversible changes in its physical, chemical and biological traits and pollution by organic and inorganic chemicals. In the second half of the last century, the area of land affected by degradation was about 2 billion out of 8.7 billion hectares of agricultural land, pastures, forests and timber.The growth rate in world cereal production decreased from 3% in 1970 to 1.3% for the period 1983-1993, and the first reason for this decline is the improper management of soil and water (Steer, 1998). For this reason, soil scientists have recently begun to pay attention to the search for finding and developing successful strategies for soil quality assessment related to improving capabilities for sustainable soil management, and searching for soil indicators and working methods by which to determine soil quality assessment (Doran and Parkin 1994). Wander and Bollero, (1999) will employ three farming practices (conventional tillage, no-tillage and relatively loose soil) to cultivate fields planted with corn and soybeans located at four locations in Illinois, To study its effect on soil quality depending on the indicators of soil organic matter (particle organic content, soil organic carbon and total nitrogen) and biological activity indicators (soil microbial revival carbon and nitrogen mineralization ability and physical indicators (soil apparent density, agglomeration stability, weighted diameter rate, soil resistance to penetration and tipping) and chemical indicators (EC and pH). The results of the study showed that the physical and biological traits affected by the organic matter were the most variable in the field practices and that the practice without cultivation improved the biological and physical condition of the topsoil within the depth (0-15 cm) despite the increase in consolidation, and that particulate organic matter was a distinctive and promising measure of soil quality. Vander Bygaart et al. (Blanco_Conqui and Lal, 2007, 2008) indicated that most of the previous work evaluated the effect of tillage on soil organic carbon concentration only within the topsoil layers (less than 30 cm),While the samples taken from the underground depths showed conflicting results. When Liebig et al. (2004) study the effects of cultivation and cultivation processes on soil quality indicators in the northern great plains of the northern United States of America. The continuous crop cultivation system under no-tillage or minimum tillage management has excelled over the tweer-crop cultivation system under conventional tillage management, with the soil organic carbon content, as well as the greatest aggregate stability and the fastest tipping rates.They concluded that the soil under a continuous crop cultivation system without cultivation or minimal cultivation improved the soil in terms of its ability to provide a source of nutrients for the plant, resist erosion and ease the movement of water.They emphasized that soil quality and agricultural sustainability can be improved by adopting intensive cropping practices while managing cropping operations. The loss of soil organic carbon under conventional tillage is widely documented (Conat et al., 2007), while soil organic carbon is stored away from Its susceptibility to degradation by microorganisms and their enzymes varies widely as a result of the complex interaction between climate, soil type, crop cycle, time period and management factors (Vanden Bygaart et al. 2002, Puget, Lal, 2005). It was reported by Blanco Canqui and Lal, 2007 that long-term no-till practice induces moderate changes in soil compaction and population stability. He also indicated a change in soil pH within a short period as a result of the organic acids produced during the decomposition of crop residues (Ismail et al. 1994), so the evaluation of physical, chemical and biological parameters is done at the same time, Criteria including bulk density, tissue, pH, EC, particulate organic matter and NO3-N may provide a better understanding of the mechanism responsible for the possibility of soil carbon being stored between particles and within soil aggregates (Six et al. 2006) under no-till technology. Muslat and Omar (2012) also indicated that there is an important correlation between the content of organic carbon in the soil and its physical and chemical properties, as the size of soil aggregates and their stability, total porosity, water holding capacity, electrical conductivity (EC) and cation exchange capacity increase. While the bulk density of the soil and the degree of soil reaction (pH) decrease. Odeh (1990) explained that bulk density is one of the important characteristics affected by soil management processes and the duration of soil exploitation.The tillage and smoothing change the bulk density value in a very large methods, and this change lasts for a long or short period depending on many factors, the most important of which is the soil texture and the type of tillage or smoothing machine. Al-Bakri and Mubaraka (2010) concluded that the cultivated soil has an increase in the organic matter content, and then the linkage between soil particles or its aggregates increases.In view of the increase in the population and its growth expectations and the high standards of living and industrialization in order to build a strong economy, this leads to increased pressure on soil resources, making it vulnerable to degradation and a decline in its quality in particular. This pressure was accompanied by misuse and management and an increase in pollution by industrial and civil waste. Because of the importance of the topic in the field of sustainable agricultural development, and the lack of studies interested in soil quality in Iraq, this study was directed to assess the organic soil carbon under the influence of three long-term agricultural uses of soil (more than Four years) in four regions in the province of Babylon. These agricultural uses in each of the four regions include a field planted with field crops (P), a field planted with horticultural trees (T), and an uncultivated field (C). The aim of the study: to compare the distribution of soil organic carbon and soil quality indicators with depth under the influence of agricultural use (T, P, C). Establishing a database for subsequent and expanded studies in the field of soil quality and sustainability.

2- Materials and methods:

The study was conducted in three fields chosen on the basis of the difference in the type of agricultural exploitation for a period of more than six years in two regions, the first in the Al-Nile sub-district of Al- Mahaweel district and the second in the Alexandria sub-district of Al- Musayyib district in the Babylon province at longitudes 44016'50.22" - 44016'25.28 "East and Latitude - 32044'44.95" 32044'06.02"N,In Al- Mahaweel district, in the Al-Nile side, at longitudes 44024'57.10" - 44025'01.94" east, and latitudes 32041'24.67" - 32041'32.02"N.The soils of the fields under study have been classified into the rank of Entisols according to the American classification 2010. The three fields represent in each of the two study areas,An exploited field for the orchard (citrus trees), an exploited field for field crops (wheat and maize during the year) and an uncultivated field (abandoned). Three locations were identified in each field (as replicates) in the form of an equilateral triangle with a side length of 50 m.Soil samples were taken from the corners of the triangle. And for three depths of 0-10,10-20,20-40 cm and these samples are excited and others unexcited to impose the assessment of soil organic carbon and some quality standards under different types of agricultural exploitation. A part of the unexcited samples was used to estimate the bulk density of the three depths using the cylinder method (5 cm in diameter and 5 cm in height) according to the method of BIake, Hartge (1986).As for the second part of it, it was used to estimate the moisture of the prepared water, which was obtained from the difference between the two moistures of field capacity and permanent wilting point, using the pressure disc device (BIack (1965).While the agitated samples were dried aerobically, then they were ground and sieved with a sieve with holes diameter of 2 mm and packed with nylon bags to carry out the required analyzes in the study for each region, field, location and depth. Soil organic carbon was estimated according to Walkely and Black method described in (Jackson 1958). The stability of the assemblies was estimated. Larger than 50 µm was determined by the described method (Hillel, 1980)

Suggested design for the research:

The three fields (T, P, C) in one region are not replicates, so three sampling locations are selected randomly in each field as replicates. The three fields in each of the four regions are analyzed as if they were random. A one-way ANOVA is performed for different soil depths (0-7.5, 15-7.5, 15-30 cm) for one area and separated separately on each of the physical, chemical and biological properties of the soil and the treatment averages are separated by (0.05=&(Fishes) LSD using SAS software (2003SAS 9.1.ver)

3- Results and discussion: -

Agricultural use in bulk density

Table 1 The average bulk density of the districts of Al-Mussaib and Al-Mahawil within the Alexandria and Al-Nile sub-districts for uncultivated soils, orchards and crops, and for the three depths in Mg/m3

soil depth (cm(			land use	locations
40 – 20	20 -10	10-0	orchard	Al-Mussaib
1.350	1.313	1.313		
1.376	1.346	1.346	crops	
1.410	1.380	1.370	not cultivated	
0.007	0.030	0.034	L.S.D(0.05)	
1.380	1.336	1.353	orchard	Al-Al-Nile
1.416	1.363	1.376	crops	
1.456	1.416	1.403	not cultivated	
0.019	0.007	0.017	L.S.D(0.05)	

The effect of the type of agricultural use significantly on the values of bulk density (pb) in Al-Mussaib and the Al-Nile districts in Table 1, as it showed significant differences between the average values of (pb) in the three depths except depth (0-10) cm. The difference was not significant between the mean values of the soil used for orchard cultivation and crops, as well as between the soil of crops and uncultivated in the Alexandria district. The results also showed that the lowest apparent density was in the soils exploited by cultivating the orchard in the Alexandria district (1.313) mcg / m3 at the level of the study at depth 0-10 cm and the Al-Nile side 1.336 mcg / m3 At the level of the study at a depth of 10-20 cm, while we notice the highest bulk density was in the agriculturally unexploited soils in the Alexandria sub-district of 1.410 mcg / m3 at the level of study at a depth of 20-40 cm and in the Al-Nile district 1.456 mcg / m3 at the level of the study at depth 20 -40 cm. Through this result, it appears that the soils exploited by cultivation of orchards had the lowest apparent density, followed by soils exploited by cultivation of crops, and finally soils that were not exploited agriculturally. We also note through the results contained in the above-mentioned table that the values of the bulk density of the three agricultural uses in the Alexandria region were lower than their values in the Al-Nile region and for the same depth. Certain (Blanco-Canqui and Lal, 2007) as a result of the exposure of their surface to climatic influences (rain, temperature, solar radiation and wind), grazing, and the lack of exposure to the tillage process that helps to dismantle the surface layer of the soil. While the orchard soil is exposed to cultivation operations, which leads to the disintegration of the upper soil layer and helps to remove the effect of compaction. Also, the spread of roots in the soil and the falling parts of the vegetative system of cultivated trees and the amount of protection they provide to the soil surface as a result of the large area covered by the soil surface (Al-Ani 1980) help in improving the properties of the soil, including the bulk density. In general, the value of the bulk density of crop and orchard soils is below the critical value for grains and for all depths, while it exceeded the critical value for uncultivated soils for all depths. It was mentioned (kuht and Reintam 2004) that the maximum bulk density of 1.40 µg/m3 for the growth of grain crops and when this value is exceeded, it will negatively affect the growth and productivity of grain crops. Soil service operations, including soil tillage, directly affect the bulk density of the soil, as well as the roots of plants and what they add of organic matter to the soil, which improves the construction of the soil, increases its porosity and reduces its apparent density. On the bulk density of the soil The low value of the bulk density is an indicator of soil quality, and it is considered among the set of criteria, less is better (Mukherjee and Lal 2014). The reason for the moral difference in the bulk density between the exploited soil and the non-exploited soil is due to the management processes to which the orchard soil is subjected, such as plowing, hoeing, organic fertilization and irrigation. The apparent density of the soil is one of the most prominent indicators of statistical prediction in the field of soil physics, as it is a function of a large number of soil properties. It also reflects the state and style of good or poor management of the soil resource, as its low is evidence and indication of the existence of continuous cultivation and the high content of soil organic matter. And stable stability of soil building assemblies and a porous space that allows a high flow of water and air movement in the soil environment. Graft, Anderson 2009))

2- Agricultural use in the stability of aggregates

Table 2 The average stability of AS assemblies for the districts of Al-Mussaib and Al-Mahawil within the Alexandria and Al-Nile sub-districts for uncultivated soils, orchards and crops, and for the three depths in percentage unit %

soil depth (cm(			land use	locations
40 – 20	20 -10	10 -0	orchard	
35.857	51.27	50.93		
32.160	48.30	47.68	crops	Al-Mussaib
29.620	45.90	45.37	not cultivated	
0.406	1.005	1.141	L.S.D(0.05)	
24.58	45.23	42.24	orchard	
22.02	42.00	39.31	crops	
19.61	38.56	36.79	not cultivated	Al-Al-Nile
1.256	0.808	1.860	L.S.D(0.05)	

The results in Table 2 showed that there were significant differences between the average values of the stability values of the aggregates under the influence of the type of plant grown for all depths and for both locations. It was noticed in the location of Alexandria that the highest value of the aforementioned characteristic within the depth 0-10 cm was 50.93% and the lowest value was 45.37% under the influence of the orchard and the uncultivated soil, respectively.The cultivated soil with crops outperformed 47.68 % over the uncultivated soil. The same effect was also observed for the type of planted plant and for the same depth mentioned in the Al-Nile area. The cultivated orchard soil significantly excelled (42.24%) on all cultivated soil with crops of 39.31 % and the uncultivated soil 36.79%.The reason for the decrease in the percentage of fixed assemblies in uncultivated soil is due to its exposure to the joining process (Blanco- Canqui and Lal, 2007) and this is evident from the value of the bulk density (Table 1) when compared with the soil cultivated with crops and the soil planted with orchards. As for the excelled of the soil planted with orchards in the stability values of the clusters over the soil planted with crops, this is due to the decrease in the service operations of the orchard soils and the large coverage of the soil surface because the vegetative sum of the trees is large, which provides protection for the soil aggregates from the action of precipitation (Forth and Turk, 1972; Al Kubaisi, 1982), . It appears from the results of Table 2 that the values of the stability values of the aggregates of the soil planted orchard was the highest, followed by the soil planted with crops and then the unexploited soil at any depth and either of the two locations.It was also noted that the percentage of fixed soil aggregates under the three types of agricultural use within any of the depths of the study in the location of Alexandria, was higher than its counterpart in the location of the Al-Nile. The reason for this is due to the clay content of the soil of the Alexandria location, which was greater than it is in the soil of the Al-Nile location. As Chappell et al. 1919 indicated that the differences in the stability of the assemblies are related to the organic carbon, the clay content and the percentage of exchanged sodium.That with the increase in the depth of the soil, the percentage of fixed agglomerations decreases, and this decrease corresponded with the increase in the bulk density

(Table 1). In the field of soil quality, the stability of aggregates can be considered among the group of indicators that when its value is increased, it is better (Mukherjee and Lal, 2014).

Agricultural use of organic soil carbon

Table 3 The average soil carbon SOC of Al- Musayyib and Al-Mahaweel districts within the Alexandria and Al-Nile sub-districts for uncultivated soils, orchards and crops, and for the three depths in g/kg unit.

soil depth (cm(			land use	locations
40 – 20	20 -10	10 -0	orchard	Al-Mussaib
1.917	2.800	2.697		
2.117	2.637	2.623	crops	
2.233	2.710	2.930	not cultivated	
0.241	0.532	0.654	L.S.D(0.05)	
1.717	2.507	2.177	orchard	Al-Al-Nile
1.583	2.200	2.100	crops	
1.020	1.593	2.210	not cultivated	
0.118	0.224	0.248	L.S.D(0.05)	

The effect of the type of agricultural use on the concentration of SOC varies between significant and insignificant. In general, the highest concentration of the above-mentioned characteristic was 2.930 g/kg in the Alexandria area within the soils not exploited agriculturally within the depth 0-10 cm at the level of the study, and there are no significant differences between the averages under The effect of the type of agricultural exploitation and the two locations in Alexandria and the Al-Nile within the mentioned depth.As for the depth of 10-20 cm, the highest value of 2.800 g/kg was observed in the exploited soil in an orchard in Alexandria district, and this value did not differ significantly with each of the exploited soil and untapped soil crops at the study level within the Alexandria district.While the value of SOC (2.507) g/kg within the exploited soil in an orchard in the Al-Nile side was significantly excelled on the soil exploited for the cultivation of crops, 2,200 g/kg, which in turn excelled on the unexploited soil 1.593 g/kg within the mentioned depth and location. While within the depth 20-40 cm, significant differences were observed between the SOC averages under the influence of the type of agricultural exploitation for both locations. We note in the location of Alexandria, that the unexploited soil of 2.233 g / kg significantly excelled the exploited soil of the orchard of 1.917 g / kg, which is the lowest value for the characters mentioned in the mentioned location.

While the soil used for growing crops, 2.117 g/kg, did not differ significantly from the soil of the two types of agricultural exploitation mentioned, orchard and unexploited. As for the Al-Nile location, with the same depth of 20-40 cm, significant differences were observed between the three types of agricultural exploitation. The exploited orchard soil of 1.717 g/kg outperformed the crop soil of 1.583 gm/kg, which in turn significantly outperformed the unexploited soil of 1.020 g/kg, which is the lowest concentration of SOC observed at the level of the two locations and types of exploitation for the three depths. Leaving the soil without cultivation and the high percentage of salt in it, as well as the lack or absence of plant roots, leads to a decrease in the soil content of organic matter. Basically, the agriculturally exploited soil always has a percentage of organic matter that is less than the uncultivated soil, because there is always an activity of micro-organisms and it is not exposed to tillage operations, which leads to a loss or loss of organic carbon. The role of adding organic matter to the soil, whether it is mixed with the soil or not mixed with the soil or left on its surface, thus increases the resistance of such lands to drought. The addition of organic matter to the cultivated land does not increase the percentage of humus in it, and because the various service operations increase or oxidize it, or the reason for this is because the organic waste reduces or prevents the adhesion of particles with each other, in addition to its somewhat flexible characteristics (Gupta et al., 1987). Mosaddeghi et al., 2000) The storage of water in the soil increases as a result of increasing the soil's organic matter content by improving the soil and porosity (size and quality) and increasing the number of water-stored pores and increasing the surface area of the improved soil. Soil texture is also affected by it, and it is known that clay soils protect organic matter as much as possible, and accordingly, the quantities added in this study, if they were added to sandy soils, the remaining quantity would be more than what we obtained in this study, and this is consistent with (Krull et al., 2004). We note by this that the content of organic matter varies from one soil to another depending on agricultural exploitation and the surrounding conditions. The rate of organic matter in the soil is less than 0.1% in desert soils and 100% in organic soils (1978, Schnitzer, M and S.V. Khan.)

4 Agricultural use of available water

Table 4. Average available water content of Al-Mussaib and Al-Mahaweel districts within Alexandria and Al-Nile sub-districts for uncultivated soils, orchards and crops, and for the three depths in percentage unit %

soil depth (cm(			land use	locations
40 - 20	**20 -10**	**10 -0**		
12.06	**14.25**	**14.56**	**orchard**	**Al-Mussaib**
11.87	**14.53**	**14.65**	**crops**	
12.56	**14.82**	**15.67**	**not cultivated**	
2.284	**4.868**	**3.967**	**L.S.D(0.05)**	
9.27	**11.44**	**11.03**	**orchard**	**Al-Al-Nile**
9.75	**12.42**	**12.79**	**crops**	
10.96	**11.41**	**13.14**	**not cultivated**	
2.007	**2.251**	**3.675**	**L.S.D(0.05)**	

The results in Table 4 indicated that there were no significant differences in the average values of ready water under the influence of the type of the cultivated crop for all depths and for both locations, Alexandria and the Al-Nile. This result is consistent with what was obtained by Karlen et al. (1994) and Armenise et al. (2013), who found that soil management was not influencing the bulk moisture content.

Conclusions:

1. The results showed that the value of the bulk density of the soils of crops and orchards is below the critical value for all depths, while it exceeded the critical value for uncultivated soils and for all depths. We conclude that the management process has an important role in the various processes, and we note that the last depth has variations because it was far about tillage operations.
2. We conclude that in the field of soil quality, the clusters can be considered stable within the set of indicators that when their value is increased will be better. It was noted through the results of the study for the types of agricultural exploitation and for both locations that with the increase in the depth of the soil, the percentage of the stability of the agglomerations decreased, and this decrease corresponded with the increase in the bulk density.
3. It was noted that the carbon concentration of organic matter increased in the Alexandria location over its content in the Al-Nile location. The difference is due to the soil texture, especially the clay content.

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