J. of Soil Sciences and Agricultural Engineering, Mansoura Univ., Vol. 12 (12):893 - 898, 2021

Journal of Soil Sciences and Agricultural Engineering

Journal homepage: www.jssae.mans.edu.eg
Available online at: www.jssae.journals.ekb.eg

Soil Fertility and its Relationship to Soil Mineralogy of some Areas in Southwest Sinai, Egypt

Abbas, H. H.[1]; I. M. A. Abdel Maboud[2]; A. S. A. Alshami[2]; Heba S. A. Rashed[1] and Wessam R. Zahra[1*]

Cross Mark

[1]Soil and Water Dept., Faculty of Agriculture, Benha University, Egypt.
[2]Nuclear Materials Authority (N.M.A), Egypt.

ABSTRACT

Soil minerals represent an important component of its system, and study of their role in soil fertility is essential for better soil management and consequently high productivity. The aim of this research is to study the influence of soil minerals on some soil fertility attributes such as clay percentage, OM and CEC. Physical and chemical properties of clay minerals affect soil fertility by controlling nutrient availability and supplies, through the stabilization and sequestration of soil organic matter. Clay minerals also affect soil physical properties through microaggregate formation and controlling soil microbial population and activity. The soils of the study area had a coarse texture with low water retention and high permeability. The clay content is very low. Quartz grains are one of the most common detritus minerals present in different percentages. It was derived from granite and sandstone as parent materials in the study area. Most quartz contains extremely low concentrations of plant nutrient elements other than Si. Although quartz is highly resistant to weathering, silica is slightly soluble at the common pH values of soils. Feldspars are alkali aluminosilicates and are, by far, the most abundant igneous rock forming minerals. Calcite is a calcium carbonate mineral, which was formed in the study area form the breakdown of the carbonate rocks e.g. limestone and dolomite. The low soil-CEC and low organic matter are the main fertility constraints of these soils. Therefore, organic matter application is recommended to improve CEC, carbon content, and nutrient availability.

Keywords: Clay minerals; soil fertility; and Sinai soils.

INTRODUCTION

Soil mineralogy has a profound influence on the dynamic behavior of soils namely, the gains, losses, transformation and translocation of inorganic and organic substances Therefore, understanding soil mineralogy is important for assessing functional soil properties , such as interactions with nutrients, nutrient quantity (stock) and availability (intensity or strength of retention by soil) (Kamau *et al*., 2012)., sorption of metals, organics and nutrients to mineral surfaces (Violante *et al.*, 2010) fertilizer response (Selassie *et al.*, 2020), water storage (Schaller *et al.*, 2020), erosion susceptibility ((Hack, 2020), and provision of sites for microbial and faunal activities (Kooistra *et al*., 2010). These properties determine soil agricultural, environmental and engineering qualities (La Rosa, 2006). In general, Clay minerals have a layered structure, commonly consisting of sequenced sheets of Si tetrahedra and Al octahedra. Due to their distinguished layer structure and their effectiveness as ion exchangers, the formation of clay minerals can have important effect on the chemical and isotopic compositions of solid and liquid phases during weathering (Wimpenny, 2016). When residual clay minerals change in internal structures, they can no longer accommodate nutrient cations, i.e., losing their Base Exchange Capacity (Rajamani, 2002). This leads to soil infertility for sustainable agriculture. Soil provides elements that are useful for the growth of the plants for example Ca is an essential element that is present as calcite ($CaCO_3$) in the rock., Silica is present as quartz in the rock which by weathering is released as SiO_2 in the sediments (Mishra *et al*., 2020).

Clay minerals are primary or secondary, silicates or non-silicates and crystalline or amorphous (Karathanasis, 2006). Primary minerals form at elevated temperatures and pressures, and are usually derived from igneous or metamorphic rocks, while secondary minerals are the culmination of either alteration of the primary mineral structure or neoformation through precipitation or recrystallization of dissolved constituents into more stable structure ones (Bartonn, 2002 and Wilson, 1999). Soil mineralogical properties appear to have a significant role in soil fertility management (Badraoui *et a.l*, 1995). Furthermore, soil mineralogy-soil fertility relationship is a basic component in understanding and interpreting the results of fertility experiments and soil analytical data, especially in developing fertilizer recommendation systems (Goh, 2004 and Bar-Yosef *et al.*, 2015). Weathering of feldspars plays an important role in soil formation especially for increasing soil fertility for food production (Mishraa and Samant, 2020). The common rock-forming minerals consist of elements like Si, Al, K, Na, Ca, Mg, and Fe. The crust contains over 40% of these elements. The most abundant minerals on Earth's continental crust are feldspar group minerals (Radoslovich, 1957), which play a basic role in the overall reactions of macronutrients, K and Ca, in soils (Somasiri and Huang,1973). Feldspars are commonly present in the silt and sand fractions of young to moderately

[*] Corresponding author.
E-mail address: w.zahra@fagr.bu.edu.eg
DOI: 10.21608/jssae.2022.107489.1038

developed soils representing various soil parent materials and soil-forming conditions (Somasiri *et al*., 1971).

Alkali feldspars are present in the clay fraction of moderately weathered soils (Owens and Rutledge, 2005). Feldspars alter during weathering and soil formation to many secondary minerals (Eswaran and Bin. 1978) like halloysite and kaolinite (Hughes and Brown, 1977), gibbsite (Lodding, 1972), montmorillonite (Wilson, 1975) and muscovite mica or illite (Eggleton and Buseck, 1980) Lack of integrated soil mineralogy-soil fertility studies is mentioned by Bühmann *et al.* (2004). According to Karathanasis (1985), the effect of soil mineralogical composition on soil fertility and productivity is: 1) it influences chemical reactions regulating nutrient availability and uptake and 2) it affects physical properties controlling soil moisture balance and physical conditions of the soil. It is important to appropriately combine inorganic with organic fertilizers to avoid the undesirable environmental effects and maximize the overall income because the application of NPK fertilizers only was not effective in maintaining soil fertility (Abdelfattah *et al.*, 2021). The present study towards exploration of the relationship between clay minerals and soil fertility.

MATERIALS AND METHODS

Location of the study area

The study area involves Wadi Baba, Wadi El-Bidaa, Wadi Naga El-Gada and Elwet Baba in the southern part of Abu Zenima area, southwestern Sinai. This area is bounded by longitude 33º 10' 25'' to 33º 21' 21'' - E and latitudes 29º 00' 11'' to 28º 52' 19'' N (Fig.1). The total study area is about 25000 ha.

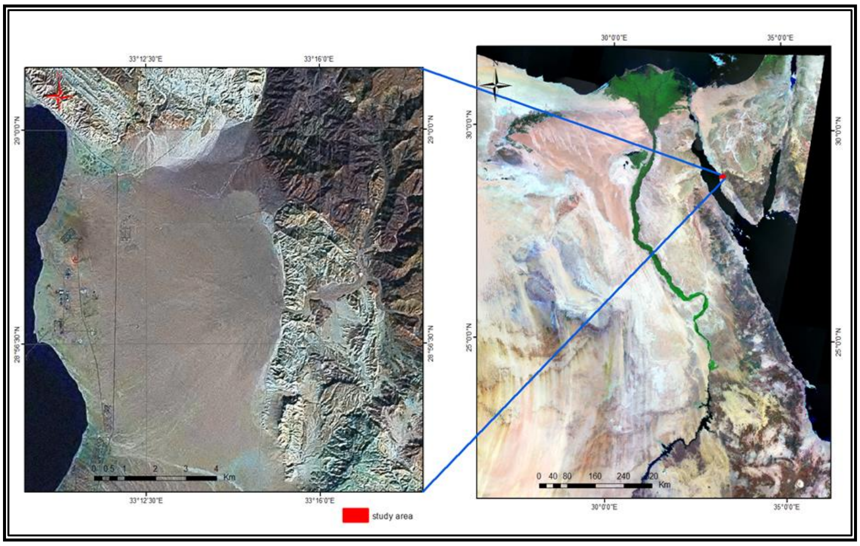


Figure 1. Location of the study area

Field work

Preliminary remote sensing interpretation map was checked in the field by different ground observations to confirm the boundaries of the geomorphic units to revise the shift of every unit characteristics. Eighteen soil profiles were dug at sites representing the predominant characteristics of each geomorphic unit. Global Positioning System (GPS) was used for geographically locating these sites as shown in Figure 2. Soil profiles were dug to a depth of 150 cm, bed rock or ground water whatever it appears first. They were described, using the nomenclature of the Soil Survey Manual (USDA, 2003). Munsell soil color chart (Anon, 1975) was used for the elements of soil color description (the color name and notations).

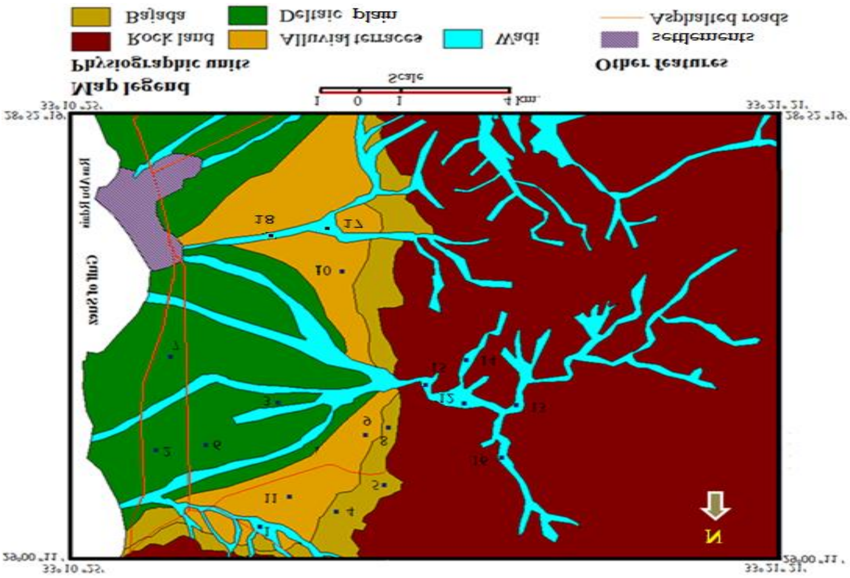


Figure 2. Soil profile sites within physiographic units of the study area

Laboratory work

Samples of soil were air dried, crushed with wooden hammer, sieved through a 2 mm sieve and kept for analyses.

Physical and chemical analyses:

Particle size distribution was carried out using the pipette method after getting rid of the organic matter and salts and usage of sodium hexametaphosphate as a dispersing agent as outlined by Klute (1986). The particle size distribution was done on basis of the USDA dimensions of mineral particles and the USDA triangle has been used in assessing the textural class. The assessment of gravellness-coarseness of the textural classes was expressed as modified textural class. Organic matter content was determined by the modified method of Walkley and Black and CEC was determined according to the standard methods outlined by Page *et al.* (1982).

Mineralogical analysis:

The identification of the mineral types of the soils under study was carried out using X-ray diffraction technique, (X.R.D), using Philips PW- 3710 diffractometer, with generator PW-1830, Cr target tube and Ni filter at 40 kV and 30 mA. The representative soil samples were separated as disoriented powder mounted in glass samples holder for X.R.D analysis. All the steps were done in Nuclear Material Authority (NMA) laboratory.

RESULTS AND DISCUSSION

Bajada

Bajadas are mostly common in semiarid and desert regions as gently inclined surface extending from the base of mountain ranges out into land basin. They are formed by lateral coalescence series of alluvial fans to produce a depositional belt along the piedmont zone (Chorley *et al*., 1985). In the study area, these bajadas are mostly extending along the foot slopes of the relatively high lands, covering area of 1253.6 ha.

Organic matter content was extremely low in soils of this physiographic unit. It ranged from 3.0 to 8.0 g kg^{-1}. The highest O.M value was detected in profile 5while the lowest one was recorded for profile 4. Cation exchange capacity (CEC) was very low and did not excceed 3 cm mol$_c$ kg^{-1} mostly due to the low contents of clay and OM (**Costa *et al*., 2020**). The lowest value of CEC was in profile 1 (2.64 cmol$_c$ kg^{-1}) while the highest value (4.74 cmol$_c$ kg^{-1}) was in profile 8. The dominant soil fraction was sand. Clay contents were low with values of 3.5, 5.3 and 7.55, the highest one was in profile 8 while the lowest was in profile 1 (Fig. 3). Low organic matter was associated with low CEC of these soils and the therefore rendered soil fertility.

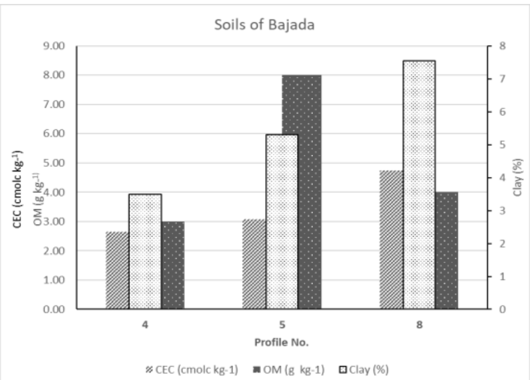
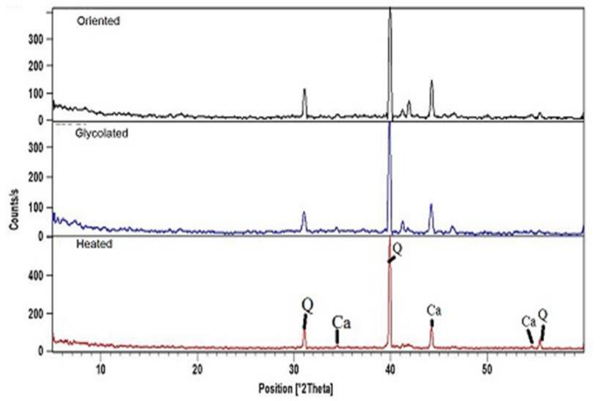


Figure 3. Soil characteristics of Bajada

Table 1 and Figure 4 show that quartz is the dominant mineral in soils of Bajada. The predominance of quartz in these soils is mostly related to the primary assemblage of the parent material and its resistance to weathering and disintegration during the multi-cyclic process of sedimentation. Calcite is occurred in most soils at different degrees of intensity and may have been inherited from the limestone parent material in immature soil profiles developed on young geomorphic surfaces. It is a brittle, colorless transparent to translucent and associated with galena, dolomite, and quartz. Calcite is an important source of calcium

Table 1. Clay minerals and soil types of the physiographic Units of the study area

Geomorphological Unit	Profile No.	Mineral	Soil type
Deltaic Plain	3	Quartz Kaolinite Albite Calcite	*Typic Torriorthents, sandy skeletal, mixed, hyperthermic*
Wadi El Bidaa	1	Quartz Kaolinite Calcite	Typic Torrifluventes, coarse loamy, mixed, hyperthermic.
Alluvial Terraces	10	Quartz Calcite	Typic haplocalcids, fine loamy, mixed, hyperthermic.
Wadi Baba	14	Kaolinite Calcite Kaolinite	Typic Torrifluventes, coarse loamy, mixed, hyperthermic.
Bajada	5	Quartz Calcite	Typic Torriorthents, sandy skeletal, mixed, hyperthermic.
Wadi Naga El Gada	18	Quartz Kaolinite Calcite	Typic Torripsamments, Sandy, mixed, (calcareous), hyperthermic.



Ca = Calcite, Q = Quartz

Figure 4. X-ray diffractogram of the different fractions separated from soil in bajada

Alluvial terraces

Afify *et al.* (2010) concluded that the term of alluvial terraces indicates soils derived and deposited by water. Alluvial parent material of terraces of the present study is mainly derived from limestone rocks and may have moved moved downwards during the fluvial periods. These terraces are distributed westwards from bajadas to the deltaic plains, having an area of 2543.9 ha. (i.e.10.2% of the total study area.)

Figure 5 shows that, organic matter content was extremely low in the investigated soils. It ranged from 8.0 to 9.0 g kg^{-1}. The highest was in profile 9, while the lowest one was in profile No. 11. Lowest CEC was in profile 11 (3.04 $cmol_c$ kg^{-1}) while the highest was in profile No. 9 (.9.74 $cmol_c$ kg^{-1}). Soil texture was loamy sand and sandy loam. Therefore, clay ranged between 4 % in profile 9 and 6.1% in profile 11.

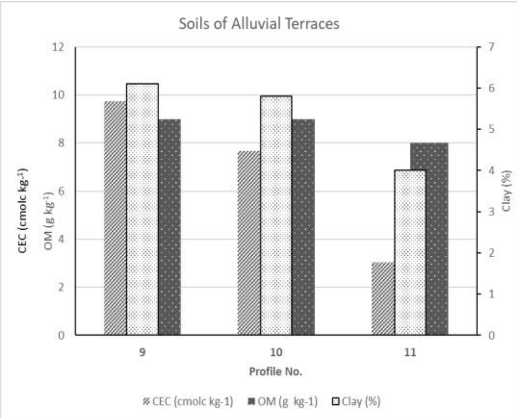
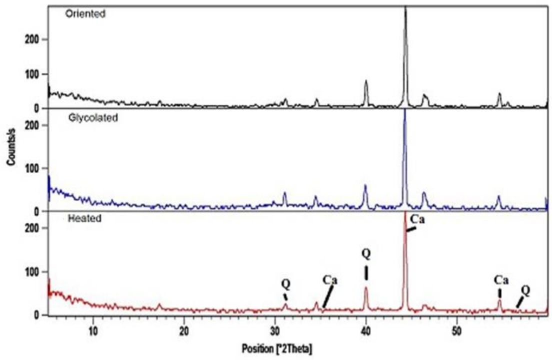


Figure 5. Characteristics of soils of the alluvial terraces

The mineralogical data in Table 1and Figure 6 show that, quartz is the dominant mineral (alluvial terraces) due to resistance of the parent material for weathering. Calcite was in the bajada soils.



Ca = Calcite, Q = Quartz

Figure 6. X-ray diffractogram of the different fractions separated from soil in alluvial terraces

Wadis

Afify *et al*. (2016) described Wadis as confined drainage system within rock lands and bajadas but somewhat opened within the alluvial terraces. They collect a seasonal run-off from intermittent rains on catchment areas having soils of the most recent ones that are still affected by the seasonal flood. Wadis in the present study (Wadi El Bidaa, Wadi Baba and Wadi Naga ElGada) have nearly level surface extending eastwards to the Gulf of Suez from the catchment areas that are mostly formed in limestone rocks. They cover an area of 3005.1 ha. As shown in Figure 7, The organic matter content was very few and did not exceed 9.0 gkg^{-1}. This is due to the absence of natural vegetation beside of the high temperature which causes organic matter to decompose into CO_2 and H_2O.

The cation exchange capacity was low except in some soils which contained relatively high organic matter and clay as found in profile 15.

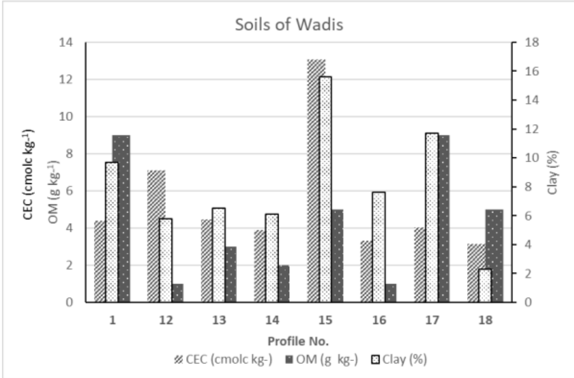
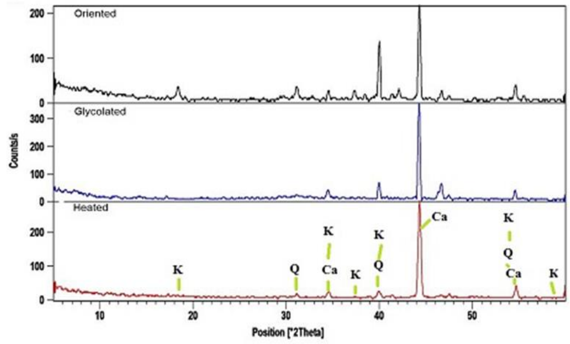


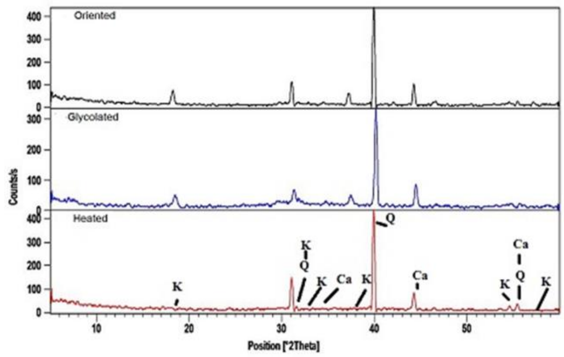
Figure 7. Soil characteristics of the Wadis.

The clay mineral composition of Wadis soils was quartz, kaolinite and calcite in Wadi Bidaa. In soils of Wadi Baba and Wadi Naga ElGada, Quartz, kaolinite and calcite were the predominant. Kaolinit clay minerals are formed due to the breakdown of feldspars of the granitic rocks south of the studied area. This kaolinite is a 1:1 clay mineral. It has low CEC of 3–15 $cmol_c$ kg^{-1}, and does not expand with varying water content or respond to replacements by iron or magnesium (Pettijohn, 1975). It is, principally, formed by the hydro-thermal action as low temperature and pressures within acidic condition. Kaolinit minerals give narrow sharp peaks, which may indicate a high degree of crystallinity as intensively weathered product in the source area.These minerals reflect the specifics of parent materials whether they were fledspathic or limestone in immature soil profiles developed on young geomorphic soils.



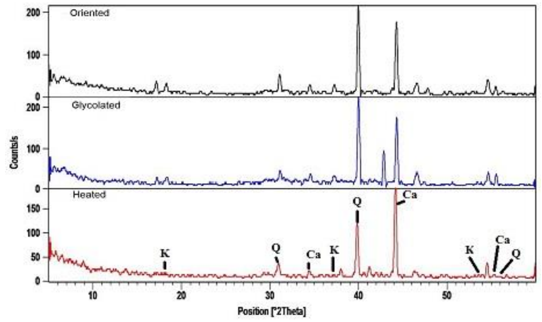
K = Kaolinite, Ca = Calcite, Q = Quartz

Figure 8. X-ray diffractogram of the different fractions separated from soil profile 1 in Wadi El Bidaa



K = Kaolinite, Ca = Calcite, Q = Quartz

Figure 9. X-ray diffractogram of the different fractions separated from soil profile 14 in Wadi Baba



K = kaolinite, Ca = calcite, Q = quartz

Figure 10. X-ray diffractogram of the different fractions separated from soil profile 18 in Wadi Naga ElGada soils

Deltaic plain

Elazab (2011) stated that, deltas are precipitated along the shoreline with curved fronts with almost flat surfaces, but in situ separated from that shoreline by marine sediments. In the present study, the deltaic plains were delineated in the western part of the study area adjacent to the shoreline of the Gulf of Suez, with an area of 4616.1 ha.

The organic matter content was extremely low in soils and ranged from 0.1 to 7.0 g kg^{-1}. The highest was in profile 6 while the lowest was in profile 3.

CEC ranged from 1.8 to 4.5 $cmol_c$ kg^{-1}, the lowest was in profile 3 and the highest was in profile 6 as shown in Figure 11.

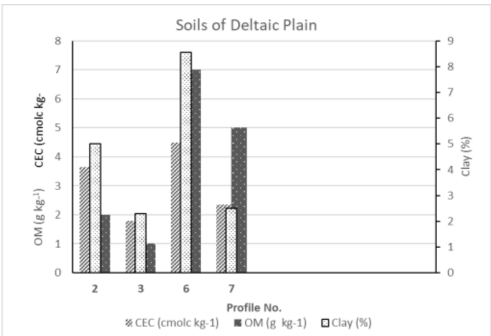
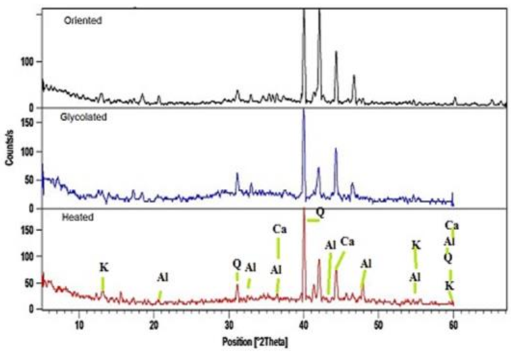


Figure 11. Soil characteristics of the Deltaic plain.

Soil mineralogical composition is shown in Table 1 and Figure 12 .



Al = albite, K = kaolinite, Ca = calcite, Q = quartz

Figure 12. X-ray diffractogram of the different fractions separated from soil in deltaic plain.

Quartz was one of the most common minerals of all the studied geo-morphological units including this one. It was predominant in all soils with more than 50% of the mineral composition. It was well sorted, rounded and sub rounded. Quartz was mainly associated with kaolinite, albite ($NaAlSi_3O_8$) beside calcite ($CaCO_3$).

CONCLUSION

Differences among clay mineral contents contribute to the different soil qualities, therefore soils dominated with primary minerals, especially quartz do not supply elements necessary for plant growth and probably need high fertilization. The clay content of the studied soils was very limited. The chemical decay is rather limited as a result of the predominance of aridity. hence, sand and silt are main contents of the soil body.

Quartz which are the most common detritus minerals in soils of the studied area were detected in different percentages. Quartz mineral was derived from rocks of granites and sandstones, which are the parent rocks of these soils. Quartz (-SiO2) is highly resistant to weathering, but silica is slightly soluble. Dissolution is enhanced by organic acids in soils**.**

Feldspars are alkali aluminosilicates and are, by far, the most abundant igneous rock forming minerals, and in terms of plant nutrition, are important sources of K, Ca and Na. Calcite is calcium carbonate minerals, which was formed in the studied area form the breakdown of the carbonate rocks (limestone and dolomite).. The low soil CEC and low organic matter content are the main constraints of fertility of these soils. Therefore, organic matter application is recommended to improve CEC, carbon content, and nutrient availability. It is important to combine inorganic with organic fertilizers to avoid the undesirable environmental effects and maximize the overall income because the application of NPK fertilizers only was not effective in maintaining soil fertility.

REFERENCES

Abdelfattah, M.A., Rady, M.M., Belal, H.E.E., Belal, E.E., Al-Qthanin, R., Al-Yasi, H.M., Ali, E.F. 2021. Revitalizing fertility of nutrient-deficient virgin sandy soil using leguminous biocompost boosts phaseolus vulgaris performance. Plants. 10, 1637

Afify, A. A., Wahdan, M. E., Fahmy, F. M. 2016. Characterizing land cover, physiography and soils in a representative area of different soil parent materials east of River Nile in El Menya Governorate, Egypt. J. of Soil Sci. and Agric. Eng., Mansoura Unv., 7 (7): 469-476.

Afify, A. A., Arafat, S., Aboel-Ghar, M. 2010. Physiographic soil map delineation for the Nile alluvium and desert outskirts in middle Egypt using remote sensing data of EgyptSat-1 Egypt. J. Remote Sensing & Space Sci. 13: 129-135. Elsevier Science Publishers B.V. Amesterdam, the Netherlands.

Anon, 1975. Munsell soil color charts. 1975 Edition. Munsell Color, Macbeth Division of Kollmorgen Corp. 2441 North Calvert Street, Baltimore, Maryland, USA.

Badraoui, M., Soudi, B., Moujahid, Y., Bennani, F., Bouhlassa, S. and Mikou, M. 1997. Mineralogical Consideration in Soil Fertility Management in Morocco. In: Ryan, J., Ed., Accomplishments and Future Challenges in in dryland soil fertility research in the Mediterranean area, Ryan, J. (ed.) (ICARDA, Aleppo (Syria)).- Aleppo (Syria): ICARDA, 1997.- ISBN 92 9127-040-7.

Barton, C.D. and Karathanasis, A.D. 2002. Clay Minerals. In: Lal, R., Ed., Encyclopedia of Soil Science, Marcel Dekker, New York, USA, 187-192.

Bar-Yosef, B., Magen, H., Johnston, A.E. and Kirkby, E.A. 2015. Potassium Fertilization: Paradox or K Management Dilemma? Renewable Agriculture and Food Systems. 30, 115-119. https://doi.org/ 10.1017/ S1742170514000295

Chorley, R. J.; Schuma, S.A. and Sugden, D.E. 1985. Geomorphology. Methune, Inc. 733 Third Avenue, New York, U.S.A.

Drever, J. I. and Zobristmm J. 1992. Chemical weathering of silicate rocks as a function of elevation in the southern Swiss Alps. Geochim Cosmochim Acta 56: 3209–3216

Costa, A.C.S., Souza Junior, I.G., Canton, L.C., Gil, L.G, Figueiredo, R. 2020. Contribution of the chemical and mineralogical properties of sandy-loam tropical soils to the cation exchange capacity. Rev Bras Cienc Solo.; 44: e0200019.https:// doi.org/ 10.36783/18069657rbcs20200019

Eggleton, R. A., Buseck P. R., 1980. High-resolution electron microscopy of feldspar weathering. Clays & Clay Minerals 28, 173-178.

El-Azab, H.E.M., 2011. Study on physiography, soils, series and flora in some areas of the Eastern desert, Egypt. Ph.D. Thesis, Fac. of Agric. Banha Univ., Egypt.

Eswaran, H., Bin, W. C. 1978. A study of a deep weathering profile on granite in Peninsular Malaysia. III. Alteration of feldspars, Soil Sci. Soc. Amer. J. 42, 154-158.

Goh, K.J. 2004. Fertilizer Recommendation Systems for Oil Palm: Estimating the Fertilizer Rates. In: Soon, C.P. and Pau, T.Y., Eds., Proceedings of MOSTA Best Practices Workshops: Agronomy and Crop Management, Malaysian Oil Scientists and Technologies Association, Kuala Lampur, 235-268.

Hack, H. R. G. K. 2020. Weathering, erosion, and susceptibility to weathering. Springer Inter- national Publishing, 291-333.

Hughes, J. C., Brown, J. 1977. Two unusual minerals in a Nigerian soil: (1) Fibrous kaolin; (2) Bastnaesite. Clay Miner. 12, 319-329.

Jackson, M. L., 1958. Soil chemical analysis. Prentice-Hall. Inc, Englewood Cliffs, N. J., USA.

Kamau, M.N., Mochoge, B., Shepherd, K.D. 2012. Mineralogy of Africa's soils as a predictor of soil fertility. Third forum Biennial Meeting, 24 - 28 September 2012, Entebbe, Uganda.

Karathanasis, A.D. 1985. Mineralogy and Soil Productivity. Agronomy Notes, 18, 1-4.

Karathanasis, A.D. 2006. Soil Mineralogy. Land Use and Land Cover, from Encyclopedia of Life Support Systems (EOLSS), Developed under the Auspices of the UNESCO. EOLSS Publishers, Oxford, UK.

Klute, A. 1986. Methods of soil analysis. Part 1: Physical and mineralogical methods. 2nd Edition, American Society of Agronomy and Soil Science Society of America, Madison, USA.

Kooistra, M. J., Pulleman, M. M. 2010. 18- Features Related to Faunal Activity, Editor(s): Georges Stoops, Vera Marcelino, Florias Mees, Interpretation of Micromorphological Features of Soils and Regoliths, Elsevier, 2010, 397418, ISBN 9780444531568, https:// doi.org/ 10.1016/B978-0-444-53156-8.00018-0.

Kusparwanti, T.R., Eliyatiningsih, W, R. 2020. Application Legume Compost with Bio-Activator Trichoderma sp. as Inorganic Fertilizer Substitution in Sweet Corn (Zea mays L. Saccharata) Cultivation. IOP Conf. Series. Earth Environ. Sci., 411, 012063.

La Rosa, D. D. 2006. Relation of several pedological characteristics to engineering qualities of soil. European Journal of Soil Science 30(4),793-799.

Lodding, W. 1972. Conditions for the direct formation of gibbsite from K feldspar discussion. Amer. Mineral. 57, 292-294.

Millot, G. 1970. Geology of Clay. Chapman and Hall. London, 429 pp.

Mishra, M., Samant, B. 2020. Feldspars: Life-Sustaining Minerals on the Earth. In: Minerals and their properties novel approach for applications. pp 227- 252. Nova Science Publishers, Inc. New York.

Owens, P. R., Rutledge E. M., 2005. Encyclopedia of Soils in the Environment, 295-303.

Page, A.L., Miller, R.H. and Keeney, D.R. 1982. Methods of soil analysis. Part 2. Chemical and microbiological properties. Soil Sci. Am. Madison, USA.

Pettijhon, F. J. 1975. Sedimentary Rock. 2 nd Edition, Harper and Row Publishe, New York, 628 p.

Piper, C. S. 1950. Soil and plant analysis. Inter-science Publishers, Inc. New York, USA.

Radoslovich, E. W., 1975. Feldspar Minerals. In: Gieseking J.E. (eds) Soil Components. Springer, Berlin, Heidelberg, 27-57.

Rajamani, V. 2002. Farmland geology – an emerging field in sustainability science. Current Science, 83(5), 557-559.

Schaller, J., Frei, S., Rohn, L. and Gilfedder, B. S. 2020. Amorphous silica controls water Storage capacity and phosphorus Mobility in soils. Front. Environ. Sci. 8(94). DOI 10.3389/fenvs.2020.00094.

Selassie, Y. G., Molla E., Muhabie, D., Manaye, F. and Dessie, D. 2020. Response of crops to fertilizer application in volcanic soils. Heliyon. 6(12), 1-6.

Somasiri, S., S.Y. Lee, and P.M. Huang. 1971. Influence of certain pedogenic factors on potassium reserves of selected Canadian Prairie soils. Soil Sci. Soc. Am. Proc. 35:500–505.

Somasiri, S., Huang P. M. 1973. The nature of K-feldspars of selected soils in the Canadian prairies. Soil Science Society of America Proceedings. 37, 461–464.

Violante, A., Cozzolino, V., Perelomov, L., Caporale, A. G., Pignam M. 2010. Mobility and bioavailability of heavy metals and metalloids in soil environments. J. Soil. Sci. Plant Nutr. 10(3), 268 -292.

Wilson, M. J., 1975. Chemical weathering of some primary rock-forming minerals. Soil Sci. 119, 349-355.

Wilson, M. J. 1999. The Origin and Formation of Clay Minerals in Soils: Past, Present and Future Perspectives. Clay Minerals. 34, 7-25.

Wimpenny, J. 2016. Clay Minerals. In: White W. (eds) Encyclopedia of Geochemistry. Encyclopedia of Earth Sciences Series. Springer, Cham. https://doi.org/ 10. 1007/978-3-319-39193-9_51-1.

خصوبة التربة و علاقتها بمعادن التربة لبعض المناطق بحنوب غرب سيناء، مصر

حسن حمزة عباس[١]، إبراهيم عبده عبد المعبود[٢]، عبد الله سليمان عبد الله راشد[١]، هبة شوقى عبد الله الشامى[٢]، وسام رشاد زهرة[١]

[١]كلية الزراعة، جامعة بنها

[٢]هيئة المواد النووية

تمثل معادن التربة مكونا هاما فى نظامها، و دراسة دورها فى خصوبة التربة يعد أمراً ضرورياً من أجل إدارتها بشكل أفضل و بالتالى زيادة إنتاجيتها. إن الهدف من هذا البحث هو دراسة تأثير معادن التربة على بعض خصائص خصوبة التربة مثل نسبة الطين، المادة العضوية و السعة التبادلية الكاتيونية. تتحكم الخصائص الفيزيائية و الكيميائية لمعادن الطين فى تيسر المغذيات و الإمداد بها من خلال تثبيت و تخزين المادة العضوية، كما تؤثر فى الخصائص الفيزيائية للتربة من خلال تكوين مجمعات أرضية دقيقة بالإضافة إلى التحكم فى تكاثر و نشاط الكائنات الحية الدقيقة. تتميز أراضى منطقة الدراسة بقوام خشن و قوة إحتفاظية منخفضة للماء مع نفاذية عالية. تعتبر حبيبات الكوارتز واحدة من أكثر المعادن المجواة و أكثرها إنتشاراً، و تتواجد بنسب مختلفة ، كما أنها تشتق من الجرانيت و الحجر الرملى كمواد أصل لأراضى منطقة الدراسة. و يحتوى معظم الكوارتز على تركيزات منخفضة جداً من العناصر الغذائية للنبات بالمقارنة بالسليكون. و بالرغم من كون السليكون مقاوماً للتجوية إلا أن السليكا تذوب ذوباناً بطيئاً عند قيم رقم حموضة التربة العادية. تعتبر أمينوسليكات قاعدية و هى تمثل أكثر معادن الصخور النارية وفرة فى التربة. يتكون الكالسيت من كربونات الكالسيوم و الذى نشأ من تكسير و تحلل الصخور الكربوناتية مثل الحجر الجيرى و الدولوميت. تمثل قلة المادة العضوية و السعة التبادلية أهم معوقات خصوبة التربة لهذه الأراضى؛ لذلك فإن إضافة المادة العضوية تعمل على تحسين السعة التبادلية الكاتيونية، محتوى الكربون و زيادة تيسر المغذيات.