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Impact of soil biological and chemical activity on spectral reflectivity under anaerobic conditions

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Abstract

Numbers of soil samples from different areas had been selected, then wetted and putted them in enclosed place to ensure the anaerobic conditions, then taking digital images for this soils on different period, by using flatbed scanner, and reading its reflective during the time to find relation of the time effect on soil reflective, Photoshop 10 CS3 was using to read RGB values then making mathematical operations to calculate reflective. The study referred to the ability to draw the reflectivity of soil curves as part of soil studying in anaerobic circumstances, and it became obvious that the Spectral reflectivity of the wind deposit soil is decrement through the time in greatly form relatively, An indication of the activity of anaerobic organisms.

Keywords: Soil; Reflectivity; Anaerobic organisms; Wind deposit soil

1. Introduction

The concept of remote sensing was not limited to monitoring the renewable terrestrial phenomena and the possibility of evaluating the resources resulting from them, but the bulk of its techniques available now are to monitor the environmental risks resulting from climatic changes and the consequent terrestrial risks such as drought, desertification and sand encroachment in addition to floods, the subsequent landslides and the resulting natural disasters. As well as the waterlogging of the soil and changing the environmental environment of the soil to something else, which results from the dynamic imbalance between the basic natural components of the environment, which leads to its deterioration and from it to the deterioration of the land and the increase of its unsuitable area for agriculture, standing on the thresholds of desertification in the future. [1]. Remote sensing techniques in Earth observation, as well as related spatial data analysis tools, models and databases, contribute significantly at present to predicting, preventing, researching, treating, rehabilitating and managing these phenomena and their effects [2]. Just as drought has its negative impact, so does waterlogging and misuse of irrigation water, in addition to sudden heavy rain, it has the same effect through increased salt and alkalinity later [3–6].

For the purposes of monitoring the soil using remote sensing techniques, it is necessary to observe the shape of the soil on the ground closely and to note the measurement of the difference of soil colors in anaerobic conditions with time and the possibility of finding a mathematical or numerical expression that results in a drawing of the soil color curves with time [7] . This makes it easier to follow up and calibrate with satellite data when finding acceptable reflectivity formulas with the description.

Digital photography through the use of a digital camera and others is one of the most important ways to detect the appearance and structure of the soil and the mechanism of finding digital accounts for it, although in most cases the

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visible spectrum is given only when using these machines, as the digital results received from a view of the soil are entered into calculations through special equations Prepared for such research [8] .

2. Material and methods

It is known that in some or most of the devices for reading the reflectivity, spectrometry, etc., there are special containers for the sample to be examined and the reflectivity measurement for it. In this research, it was necessary to manufacture the soil loading tool to be measured in what is known in this research as (the reflectivity reading plate glass).

It is considered a tool for placing samples and exposing them for reading and measurement. A completely transparent glass plates the size of an A4 printing paper was taken according to the area of the scanner bottle. After that, several small transparent plastic containers were pasted, cylindrical with a tightly closed lid, so that no air could enter it, and the arrangement of these small containers would be On the glass plate in an engineering way for technical purposes so that it is possible to know the sample to be measured, especially since the snapshot will appear as one sentence. These cylindrical containers have been numbered in such a way that the numbers appear in the calibration scene on the display device so that the researcher, when applying programs and determining selected areas in the measurement, can benefit from These numbers are without errors, as shown in Figure (1).

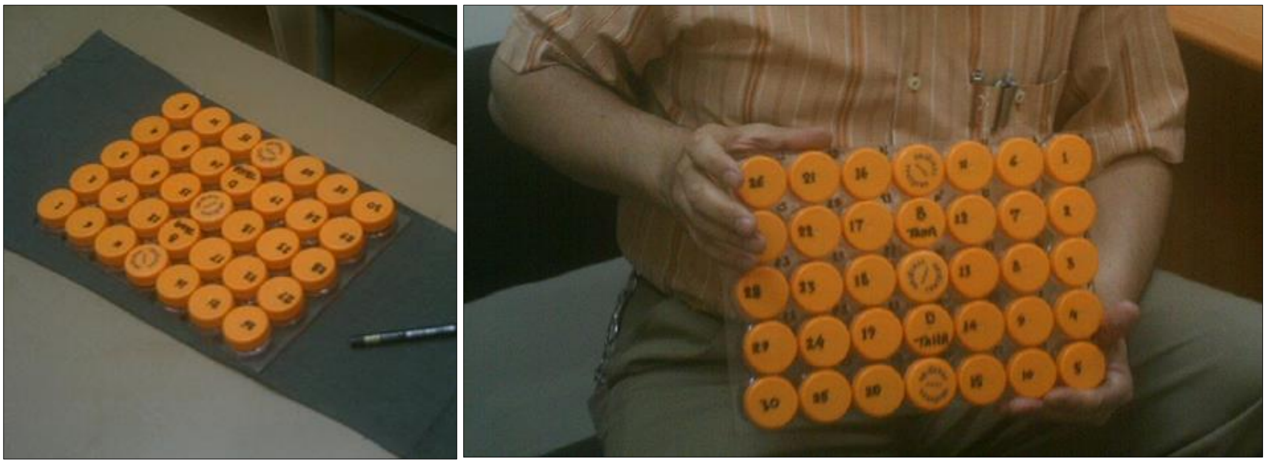

Figure 1 The reflectivity reading glass plate

Then, the soils taken from six sites with an amount of 7 grams of soil were placed in each container and five replicates for each sample. Then 5 ml of water was added to four replicates of each sample and the fifth was left without water to notice the difference, knowing that a calibrator was placed which is bright barium sulfate and household table salt. Supported by pure white iodine and pieces of bright white printing papers in order to find the rate of the bright white substance for the purpose of adopting it as a calibrator to find the percentage of reflectivity as shown in Figure (2).

Then the glass plate placed on the BenQ 5000 Color Scanner with a color scanning feature and with a resolution of 300 dpi [9] . In order to provide warmth as well as lighting, an increase in the vital processes inside the soil in containers, noting that the experiment began in June and the follow-up process of the survey continued for more than two months, and the survey process was repeated almost every week or less, an increase in follow-up.

Table 1 Locations of samples and containers included in the measurement from sample replicates

No.	Sample No.	Container No.	Sample Location
1	First	4	AlHatra area (grassland reserve)
2	Second	10	Dohuk (1 km northeast of Dohuk Dam)
3	Third	15	Al-Muaibidi village
4	Forth	20	Sheikh Mohammed village (near the river)
5	Fifth	25	Aeolian deposits (Arabian Peninsula)
6	Sixth	29	Rabea Road (Tal Talab area)

After the successive surveys ended, clear differences appeared between the first and last surveys, as shown in Figure (3).

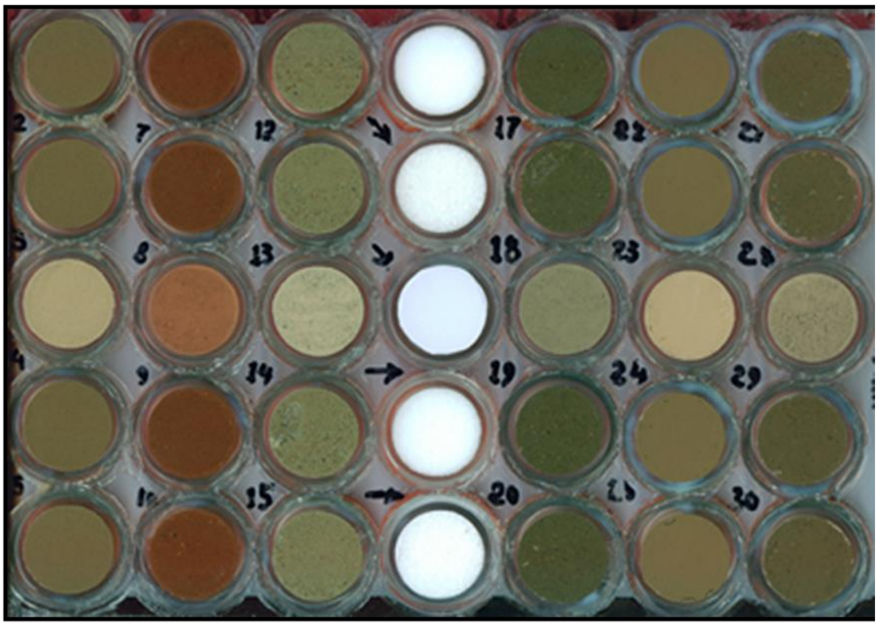

Figure 2 Glass reflectivity reading plate with soil samples and calibrator

After several successive scans, the repeater was accurately monitored in each sample most affected by the change in pattern and color over time, by sequencing images quickly on the display device screen, and accordingly it was chosen for scanning to shorten the time on the scanner during processing as well as during measurements and calculations. Table (1) shows the details of the locations of the samples and the containers selected from the replicates of the samples.

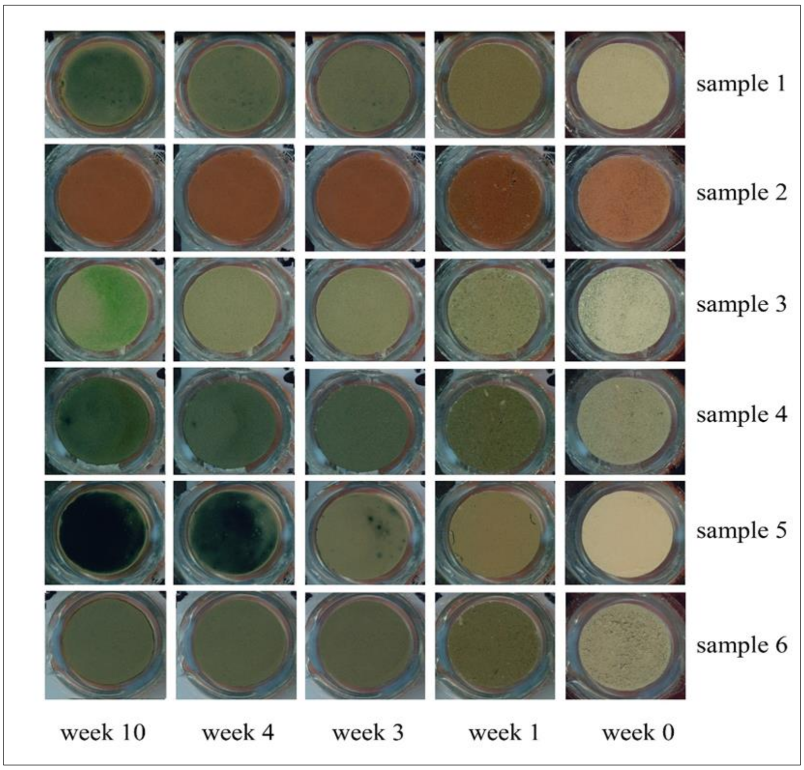

Figure 3 Visible changes of soil samples during the most variable weeks

After completing the digital scanner operations to create digital scenes for the samples, the reflectivity of each sample was measured with several readings over time, to eventually produce ten readings for ten weeks for each sample. The method of measurement is by taking a circle with an area of (110,889) pixels through the tools of the (Photoshop 10 CS3) program to find the RGB color values for each scene, to calculate the value of the color result of the circular area that was chosen through the sum of the squares of each of the primary colors under the square root to find one space value for color [10]. This circuit was initially passed on the white calibration areas to find its reading rate, and then it was passed on each soil sample and in all time periods of the digital scanner process. Then the color result of each scene is divided by the color result of the calibration material and multiplied by 100% to find the expression of reflectivity as a percentage, and in the same way the value of reflectivity is calculated for each sample and for each time period, so that it can be adopted in this research as a numerical value in preparation for its use in drawing the reflectivity curves of samples in the conditions Anaerobic through time.

3. Results and discussion

Figure 4 shows the curve of the reflectivity of the soil under anaerobic conditions during about ten weeks. It is known that this soil belongs to the AlHatra area (the pasture reserve), and it belongs to the dry and semi-arid areas and is exposed to high temperatures, which means a lack of biological activity in the soil, including bacteria Both aerobic and anaerobic. In general, this diagram shows the spectral signature of this soil within this period under anaerobic conditions [11] .

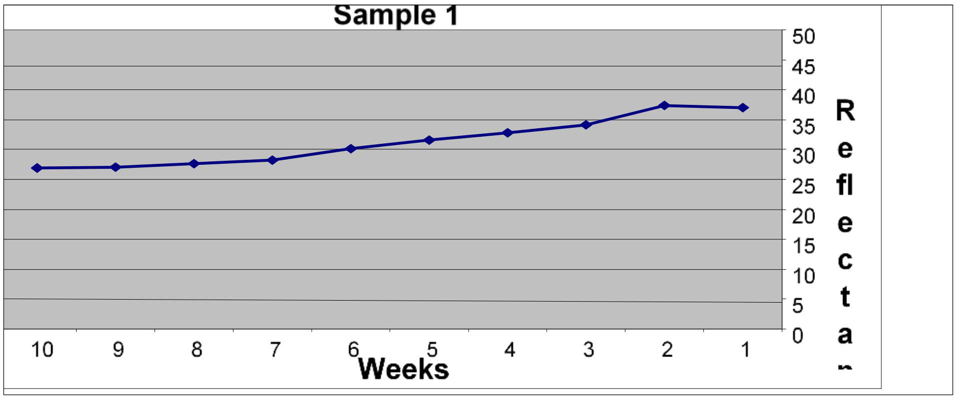

Figure 4 Reflectivity curve of the first sample soil under anaerobic conditions

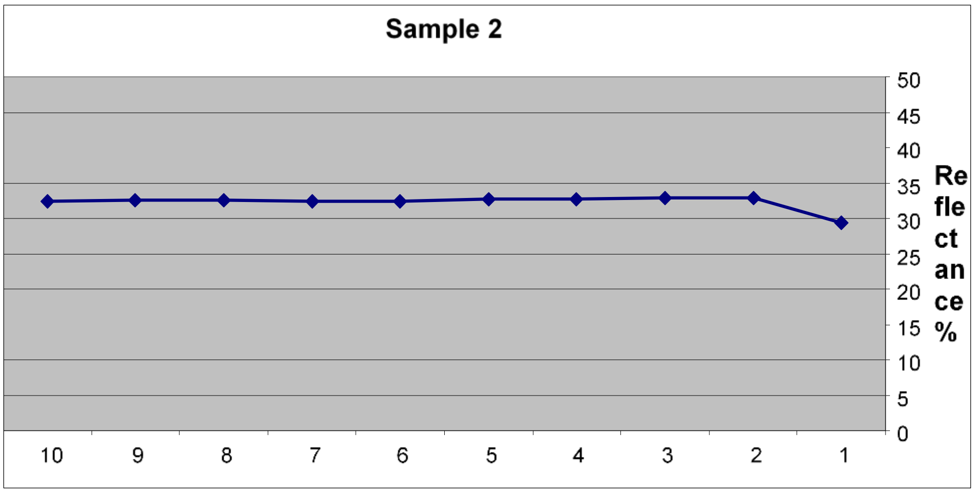

Figure 5 Reflectivity curve of the second sample soil under anaerobic conditions

As for Figure (5), which is the soil of the Dohuk region in a place 1 km northeast of the Dohuk Dam, it does not differ much from the previous one, except that there has been a slight change in the reflectivity after getting wet, and then continuing in the curve until the end of the experiment period, and this may be due to an increase in the percentage of oxides Iron in the soil, which affected the activity of bacteria, or the soil does not contain soil biota, or it is not soil primarily, but a variety of geological materials, and this discovery in this research gave it this characteristic[12].

As for the third sample, we note that it is stable in terms of reflectivity, but it began to decline in recent weeks, evidence of the inactivity of biological growth in this soil, which did not affect its color and thus its reflectivity, as shown in Figure (6).

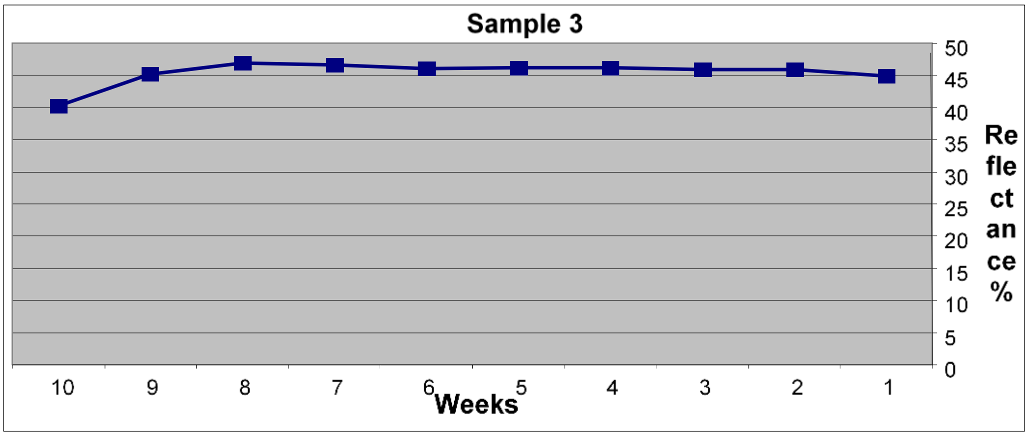

Figure 6 Reflectivity curve of the third sample soil under anaerobic conditions

The soil of the fourth sample is perhaps the most realistic, which gives the character of the usual agricultural soils in the country. It did not have a slow growth of bacteria with time and no remarkable acceleration, the two things that are clearly shown in Figure (7). As we notice stability in the first weeks for the reflexivity, then the decline in the curve regularly and slightly until the end of the experiment.

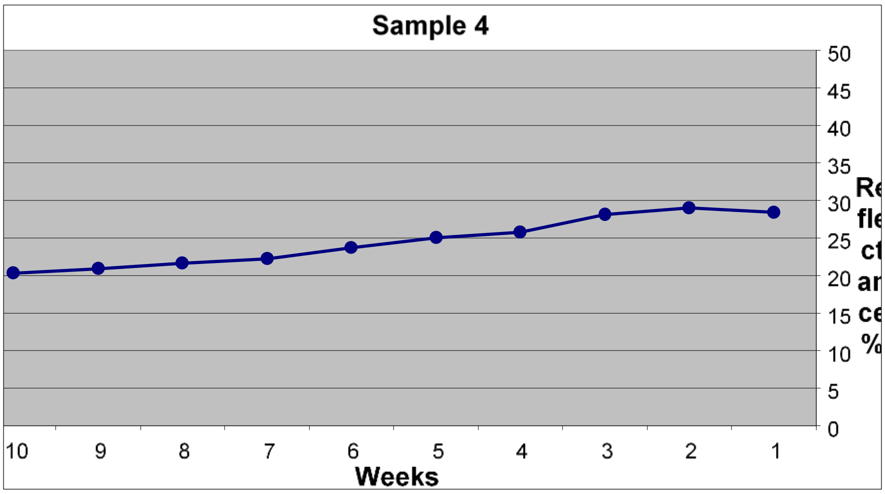

Figure 7 Reflectivity curve of the fourth sample soil under anaerobic conditions

The fifth sample is a very small deposition of tiny particles carried in the air, and this has passed through different areas in the air and from changing environments and various pollutants, which gave it clarity in the biological activity and since the first weeks, after which there was an acceleration in the spread of bacteria until it covered most of the container area reading. This is due to the large number of bacteria loaded on the small particles, as shown in Figure (8).

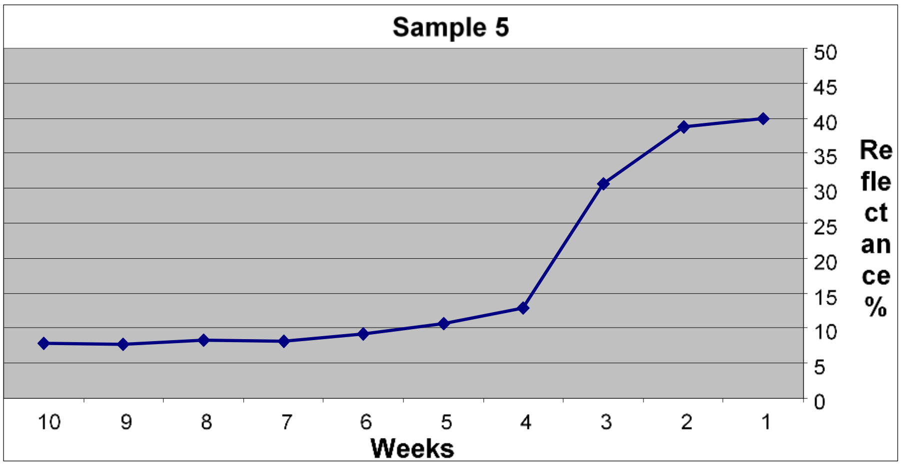

Figure 8 Reflectivity curve of the fifth sample soil under anaerobic conditions

In Figure (9), we notice that there is stability in the reflectivity at approximately one value, and this may explain the lack of soil revival or the lack of activity, which made the reflectivity scheme homogeneous with the length of the experiment.

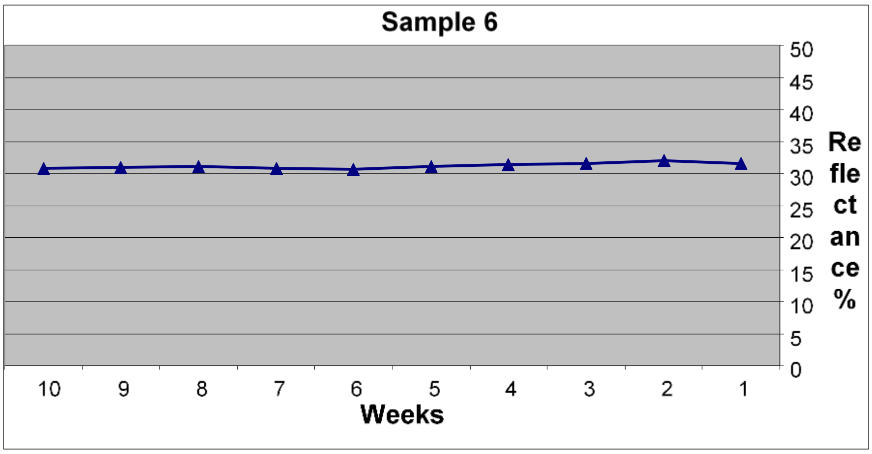

Figure 9 Reflectivity curve of the sixth sample soil under anaerobic conditions

4. Conclusion

- The purpose of the study is to draw reflexology diagrams that show the behavior of soil in anaerobic conditions and in a humid state within a certain period of time using tools that have not been used before for this purpose and have actually given the required results and this is the aim of the study.
- The plotting of soil reflectivity curves in these conditions was an indication of the biological status of the soil in certain time periods.
- This method can be adopted for the taxonomic studies of soils for the purposes of biological detection, as the flatbed scanner with the use of the glass calibration plate proved that it is an effective and promising method in terms of stabilization of lighting and accurate passage over all samples in an equal manner [13] .

After finding out the possibility of this study in drawing soil reflexivity charts, it is recommended to repeat the experiment on two types of soil only or on one soil with different samples in terms of soil inoculation with bacteria, pH difference and other soil characteristics.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The author declare no conflict of interest.

References

[1] Sabra REA, Abdulrahman HMN, Alnadi MA. Soil Conservation. Cairo: Blended Learning Center for Cairo University Center, 2015.

[2] Tsatsaris A, Kalogeropoulos K, Stathopoulos N, et al. Geoinformation Technologies in Support of Environmental Hazards Monitoring under Climate Change : An Extensive Review. ISPRS Int J Geo-Information; 10.

[3] Ayoub A. An assessment of human induced soil degradation in Africa, UN environmental program, Nairobi, Kenya. In: Second Soil Sci. conf, Cairo. 1991.

[4] Dwivedi RS, Sreenivas K, Ramana K. Inventory of salt-affected soils and waterlogged areas: a remote sensing approach. Int J Remote Sens 1999; 20: 1589–1599.

[5] El-Kassas M. Desertification and land degradation in arid regions. Alla, El-Morfa, Kuwait 1999; 258.

[6] Kawy WAMA, Darwish KM. Assessment of land degradation and implications on agricultural land in Qalyubia Governorate, Egypt. Bull Natl Res Cent 2019; 43: 1–14.

[7] Al-Mashhadani ASM. Soil survey and classification. Mosul: University of Al Mosul, 1994.

[8] Raphael VR, Christian W. Towards a quantitative assessment of soil organic carbon using proximally sensed digital imagery. 17 World Congr soil Sci 2002; IV: 1506.

[9] Al-jawwadi T, Daood N. Digital Correlation of Soil Munsell Colour and Compare It with Digital Image Classification for Different Samples of Soil Using Classification Program. Mesopotamia J Agric 2011; 39: 59–69.

[10] Thomas GB, Finney RL. Calculus and Analytic Geometry. 7th ed. Massachusetts: Addision-Wesley publishing company, 1988.

[11] Mulders MA. Remote sensing in soil science. Amsterdam: Elsevier, 1987.

[12] Page AL, Miller RH, Keeney Dr. Chemical and biological properties. In: Methods of soil analysis. Wiscons: American Society of Agronomy Inc. Mascson, 1982.

[13] Kirillova NP, Sileva TM. Colorimetric Analysis of Soils Using Digital Cameras. Eur J Soil Sci 2017; 68: 420–433.