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USING THE STANDARD MULTIPLICATION AND ADDITION METHODS IN EVALUATING THE AGRICULTURAL LANDS FOR A SELECTED AREAS AT NORTHEASTERN NINEVEH GOVERNORATE

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ABSTRACT

This study was carried out for the purpose of conducting an evaluation of agricultural lands for wheat and barley crops and monitoring changes in the nature of land use for the studied area located northeast of Nineveh governorate (longitudes 43°04¯26ⁿ and 43°22¯23ⁿ east and latitudes 36° 22¯56ⁿ and 36°34¯43ⁿ) Thirteen soil samples were obtained from the study areas for laboratory analysis. Through this information, soil suitability values were found according to its analyzed characteristics in addition to climate characteristics and according to (Sys *et al.*, 1993) standards, which finally came to establish appropriate soil as well as land values for wheat and barley crops. The results indicated that the lands of the region are classified according to their suitability for the production of selected crops into highly suitable lands (S1) for the cultivation of wheat and barley, and constitute (7.70%) of the study samples and suitable lands (S2) for cultivation, and constitute (92.30%) of the study samples, with Considering that the climate factor was not specific for the cultivation of wheat and barley crops.

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INTRODUCTION

Land use is defined as the human use of the land that includes land management and modifying the natural environment into a sustainable environment such as fields, pastures, and settlements. Also defined as the arrangements, of events and activities that people undertake to produce or maintain change, (FAO , 2013).

The studies connected with the topic of agricultural land uses increased with the increase in the plans put in place by civilized countries to control their resources and make the right decisions in overcoming the problems of agricultural land degradation, so the study of trends in agricultural land uses reveals the nature of the geographical distribution of agricultural uses and their determinants and then the possibility of controlling those Agricultural uses and directing it in scientific ways that are compatible with natural controls and human factors, in order to reach the best uses of agricultural land. (Hussein, 2006).

MATERIALS AND METHODS

General characteristics of the area:

Study Area:

The study area is located north - east of the center of Nineveh governorate, which is about 15 km from the center of the city of Mosul, with a total area of (255,000) hectares, and is located between longitudes 43°04¯26= and 43°22¯23= east and latitudes 36°22¯56= and 36°34¯43 in the north, which were represented by three locations as in (Figur 1)

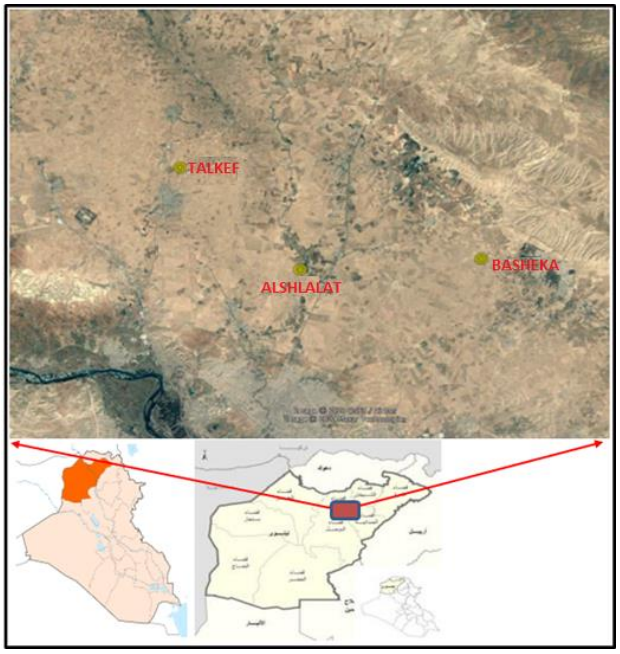

Figure (1) The study locations.

Soil climate

The soil temperature regime was of the thermic type and the soil moisture system was of the aridic (Torric) type.

Field work

A semi-detailed soil survey was conducted for the area depending on the Free Lance Soil Survey, as the study area was surveyed as a preliminary step by field investigation and observing local changes by studying the type of land use and the topography of the area as well as the way it is managed to cover a total area of (2,550) km^2 (1,020.000) dunums, Nine sites were tested for digging soil pedons. After this procedure, the area was filmed horizontally and observations about this area were recorded. Later, it was possible to return to the registration to review the emerging issues. The sites of the study areas were described and a morphological description according to the principles mentioned in the modern soil survey manual (Soil Survey Staff, 2006). The coordinates of the study area were read according to – Global Positioning System.

Laboratory work;

Soil samples were collected from each horizon and placed in plastic bags, and sealed after numbering and transported to the laboratory, then were air dried, and and passed through a 2 mm sieve to determine the physical and chemical properties of the study soils.

Soil analyzes:

- Particles size distribution : Sand , silt and clay percentage were determined in the soil using hydrometer method as described by Gee and Bauder (1986).

- Soil pH: Was determined in 1:1 soil extract as reported by Rowell (1996)

-The electrical conductivity (EC): The electrical conductivity measured described by Rowell (1996).

- Organic matter: was determined using Walkie and Black method as mentioned by Jackson (1958)**.**

-Calcium carbonate: The total calcium carbonate according to the method described by FAO, (1974).

-Soluble calcium and magnesium: were determined using EDTA method as mentioned by Richard (1954).

Office work

Land Evaluation Methods

All soil properties that affect the suitability for crop growing have been identified, and include soil properties. Where using two methods were used to reclamation the lands.

1- Standard multiplication method:

After determining the soil characteristics that affect the suitability of the lands, the assessment of the different land characteristics are multiplied together in order to obtain the final estimate of the land evaluation through which the class of land suitability is determined (Sys, 1980) according to the following equation:

Cs = A * B * C * D * E * F * G * H * I ……. (3)

Cs = Class suitability of soil for cultivation of economical field crops.

A, B, C…. Et.c = soil properties.

As for the values of the evidence, they are calculated from special tables prepared in advance, (Sys, 1980).

2- The standard addition method:

The assessment of the various land characteristics were collected together for the purpose of obtaining the final assessment of the evaluation of the land through which the classification of the suitability of the land is determined (AlMeini , and Mheemid , 2002).

This method assumes that a value is given to any specific depth of the and according to the importance of this depth in relation to plant growth (which is large in the soil profile surface and then decreases with depth) and it is called (depth correction factor) or the actual values of these factors are multiplied by the values of each soil characteristic at any depth to obtain a new values is the value weighted at that depth. Where the evaluation works for the character by giving it the appropriate rating (R) and the weight (W) from that corresponds to it after obtaining the required symbol from the table of requirements.

RESULTS AND DISCUSSION

Physical properties:

Soil moisture:

Results of measuring soil moisture showed a a low moisture content of the soil samples from Tilakif, Alshalalat pedon, which ranged between (2.45 – 4.10) table 1, while the soil moisture content in Alshalalat and Bashiqa soil increased

significantly and ranged between (3.91 - 11,420) The reason for these variations in soil moisture level due to the date of collecting soil samples (13/10/2019) as the climate was dry and before the rains fell. As for the soil, soil samples were collected on (11/18/2019), where Rainfall is limited. As for the soil samples in Bashiqa, they were collected on (11/29/2019), as rain fell on the area before the samples were collected. As for the distribution of moisture in the depths of the soil, it is shown in table (1).

Table (1): The physical and chemical properties of the study soil.

Name	No	Moisture content	Temp	CLAY	SILT	SAND	EC	pH	OM	CaCO3
		%	C°	gm/Kg			$dS.m^{-1}$		gm. Kg^{-1}	gm/Kg
TALKEF	1	3.330	16.3	384.5	435.0	180.5	0.49	8.13	9.488	364.4
	2	4.150	16.3	575.8	306.3	118.0	0.42	8.08	5.693	422.0
	3	4.080	16.3	622.0	245.0	133.0	0.46	7.83	5.003	412.4
	4	2.810	16.3	582.0	330.0	88.0	0.59	8.21	5.175	393.2
	5	2.450	16.3	359.5	328.8	311.8	0.82	7.97	4.313	450.8
ALSHLALAT	1	3.910	16.3	367.0	450.0	183.0	0.53	8.16	10.35	345.2
	2	6.120	16.3	679.5	162.5	158.0	0.29	8.28	5.175	340.4
	3	4.980	16.3	492.0	300.0	208.0	0.29	8.25	6.555	359.6
	4	5.990	16.3	567.0	300.0	133.0	0.29	8.34	6.038	374.0
BASHEKA	1	6.090	16.3	354.5	525.0	120.5	0.37	8.31	7.245	268.4
	2	8.010	16.3	554.5	387.5	58.0	0.25	8.31	5.003	268.4
	3	10.230	16.3	629.5	312.5	58.0	0.28	8.32	4.485	278.0
	4	11.420	16.3	617.0	300.0	83.0	0.28	8.35	4.140	268.4

Soil texture:

The results obtained from particle size distribution of soil separations, Table (1), showed that the majority of the studied soil samples are high in clay content. However, the lowest amount of clay was recorded in the surface horizon of the Bashiqa soil (354.5 g. Kg^{-1}), while the highest amount of clay was recorded in the subsurface horizon of alshalalat. (679.5 g. Kg^{-1}). Distribution of soil clay showed a clear increase with soil depth in all studded of soil pedon, and this could be justified by the mechanical movement of mud from the surface horizons to the subsurface horizons over long periods of time.

Silt content in the study soils ranged between (162.5 - 525.0 g. Kg^{-1}). It's also showed a different behavior the clay, as it concentrated in the surface horizons with a clear and gradual decrease with the depth of all study soils pedons.

However, sand recorded highest amount (311.8 g. Kg^{-1}) in the deepest horizon of Tlekif and the lowest amount was in the second and pedon (58.0 g/kg).

Chemical properties:

Soil reaction: pH

All the studied soil samples showed alkaline reaction Table (1), with pH values ranged between (7.83-8.35) The reason for that may due to the high percentage of calcium carbonate for the studied soils, derived from a related parent material Lime rocks, mentioned that in other reason for the high soil pH values are due to ground bases (dissolved base ions) such as calcium, sodium and magnesium.

Electrical conductivity: EC

The results of measuring the electrical conductivity (EC) indicated that all the studied soil samples in Table (1) showed a very low salts content (0.24 – 0.82) dsm^{-1} this is due to the low water table as this areas are depend on rain (not irrigated) The salinity distribution in studded soil profile showed similar behavior, where the values of electrical conductivity decreased with depth, with the exception of the last depth of Tilkeef soil, which reached (0.82) dsm^{-1}, and it may return due to the high percentage of gypsum on that horizon.

Calcium carbonate: CaCO3

Results showed that all of the study soils are calcareous soils, where the highest value was recorded in the fifth horizon of Tilkif soil (450.8 g. Kg^{-1}), while the lowest values were recorded in Bashiqa soil (268.4 g. Kg^{-1}), Table (1) As for the distribution of calcium carbonate in soil profile of the results showed some increases in calcium carbonate content with depth. This may be attributed to the climatic conditions of the study soils, which have a great role in dissolving the limestone rocks present in the source material, which leads to an increase of carbonate in the surface layer as well as alternating cycles of humidification and drying at these sites.

Organic Matter:

The organic matter content of the studied soils was very low and the reason is due to the nature of land use which is usually the cultivation of field crops (wheat and barley) in addition to the burning operations of wheat and barley fields after harvesting which reduces the organic matter. Table (1) that the highest values of organic matter appeared in the surface horizon of Al-shalalat soil, (10.35 g. Kg^{-1}), followed by the surface horizon of tellceef soil equal to (9.488 g. Kg^{-1}). As for the distribution of organic matter in all of the study soils , showed a Clear with depth decrease.

Evaluating the suitability of the land for growing cereal crops in the study area:- Tow Methods were used in this study of land evaluation

1- The standard multiplication method:

The results of the study showed that there are two types of results fitting according to the equation of the standard multiplication, which is as follows:

A- Highly suitable for S1:

The results obtained through the application of the standard multiplication equation described by Sys (1980) showed very suitable soils for cultivating cereal crops, which occupy a proportion (7.70%) of the study areas , as they are characterized by silty clay as well as a soil good drainage, a good soil texture , low salt content , and moderate ESP , moderate proportion of exchanged sodium was in most soil samples, The rest of these characteristics were very appropriate and all these values were placed within the category of lands that are very suitable for the cultivation of wheat and barley crops. and other crops, (Table 2).

B- Suitable S2:

The results of the study showed that (92.30%) of the study soils fall within the category of lands suitable for cultivation of wheat and barley crops, (Table , 2) , and this variety is characterized by a texture that ranged between clay and loamy clay soils in the sub-surface horizons with good to moderate drainage and soil structures vary from depth to depth. Electrical conductivity is low with

maximum about (0.82) dsm^{-1}, and maximum ESP (13.52%) in Alshalalat soil this led to a slight decrease in the land coefficient, which placed these soils within the appropriate land category.

Table (2): The land suitability units of the studied area for wheat and barley crops.

NAME	No	EC	pH	OC	Texture	$CaCO_3$	Gypsum	ESP	Drainage	Soil depth	Soil Profile Development	Weathering condition	Land index	Land index
TALKEF	1	99	93	98	100	89	99	98	100	100	100	100	77.91	S1
	2	99	95	92	100	83	99	98	100	100	100	100	69.68	S2
	3	99	97	91	100	84	99	98	100	100	100	100	71.22	S2
	4	99	91	92	100	86	100	97	100	100	100	100	69.14	S2
	5	99	96	87	85	80	100	97	100	100	100	100	54.54	S2
ALSHLALAT	1	99	93	99	100	90	100	96	90	100	100	100	70.88	S2
	2	100	91	92	100	90	100	96	90	100	100	100	65.10	S2
	3	100	91	94	100	90	100	97	90	100	100	100	67.21	S2
	4	100	79	93	100	88	100	93	90	100	100	100	54.12	S2
BASHEKA	1	100	76	95	100	93	100	99	100	100	100	100	66.47	S2
	2	100	76	92	100	93	100	99	100	100	100	100	64.38	S2
	3	100	76	92	100	92	100	99	100	100	100	100	63.68	S2
	4	100	78	92	100	93	100	95	100	100	100	100	63.40	S2

2- Standard addition method:

There is one variety according to the standard addition method and according to the method used by (ALmeini and Muhaimeed 2000) in the study area, namely:

S1 Highly suitable:

All three soils of the study are considered highly suitable for growing wheat, barley and other annual crops, as these soils were characterized by a loomy clay-clay textures, good drainage, with low salinity, while the rest of the characteristics were appropriate and this led to an increase in the suitability values The land factor is S1, so these soils are within a highly suitable land class.

1- Conclusions:

A- All the studied soils highly suitability values for wheat and barley crop ,so S1 was the predominant suitability class.

B- The role of the inferred geographic models was effective and efficient in reducing time, effort and money, as well as high accuracy in producing maps and dealing with data from its various sources to be used directly by land users and monitor continuous environmental changes through the use of satellite visuals and the need to update data obtained from soil surveys. Old, as well as creating an evaluation system that fits the Iraqi environmental conditions.

2- Recommendations:

A- Executing studies that determine the suitability of the land characteristics to cultivate various crops, in order to inventory highly suitable lands for the purpose of implementing agricultural economic projects.
B- The process of evaluating and planning for land use requires competencies in multiple fields, not only in the agricultural field, in addition to working as teams and not as individuals, due to the importance of this process in preserving the natural resources of any country.

Table (3): The land suitability units by standard addition method

NAME	No	EC	pH	OM	Texture	$CaCO_3$	Drainage	Soil depth	Land index	Land index class
TALKEF	1	99	93	98	100	89	100	100	96	S1
	2	99	95	92	100	83	100	100	96	S1
	3	99	97	91	100	84	100	100	95	S1
	4	99	91	92	100	86	100	100	92	S1
	5	99	96	87	85	80	100	100	96	S1
ALSHLALAT	1	99	93	99	100	90	90	100	95	S1
	2	100	91	92	100	90	90	100	95	S1
	3	100	91	94	100	90	90	100	93	S1
	4	100	79	93	100	88	90	100	95	S1
BASHEKA	1	100	76	95	100	93	100	100	94	S1
	2	100	76	92	100	93	100	100	94	S1
	3	100	76	92	100	92	100	100	95	S1
	4	100	78	92	100	93	100	100	95	S1

استخدام طريقتي الضرب القياسي والاضافة في تقييم الاراضي الزراعية في مناطق مختارة شمال شرق محافظة نينوى

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الخلاصة

نفذت هذه الدراسة لغرض اجراء تقييم الاراضي الزراعية لمحصولي الحنطة والشعير ورصد التغيرات في طبيعة استخدامات الاراضي لمنطقة الدراسة التي تقع شمال شرق مركز محافظة نينوى بين خطي طول "26ـ04ـ43° و "23ـ22ـ43° شرقا ودائرتي عرض "56ـ22ـ36° و "43ـ34ـ36° شمالاً , حيث تم استحصال ثلاثة عشر عينة كمناطق مختارة لأغراض اخذ النماذج وتحليل الترب وقياس لون التربة حقلياً وجمع الملاحظات الحقلية الخاصة بالتقييم كذلك تسجيل ما تم مشاهدته من طبوغرافية المنطقة.
من خلال هذه المعلومات تم ايجاد قيم الملائمة للتربة وفقاً لخصائصها التي تم تحليلها بالإضافة الى خصائص المناخ ووفقاً لمعايير (Sys واخرون، 1993) والتي الت في النهاية الى وضع قيم ملائمة التربة وكذلك الارض لمحصولي الحنطة والشعير. وقد اشارت النتائج الى ان اراضي المنطقة تصنف بموجب ملائمتها لإنتاج المحاصيل المختارة الى اراض ملائمة جداً (S1) لزراعة الحنطة والشعير وتشكل نسبة

(7.70%) من عينات الدراسة و اراض ملائمة (S2) للزراعة وتشكل نسبتها (92.30%) من عينات الدراسة ، مع اعتبار ان عامل المناخ لم يكن محدداً لزراعة محصولي الحنطة والشعير.
الكلمات المفتاحية : استعمالات الاراضي ، تقييم ، تصنيف.

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