The suitability of the wheat crop in the western Jadwal district in Karbala governorate using geospatial techniques

Rania Hassan Jabbar ***Amal Radhi Jubier**
College of Agriculture / Al-Qasim Green University

***Email: amelradha@agre.uoqasim.edu.iq**

Abstract

The study area was chosen in the western Jadwal district in the holy governorate of Karbala, , with the aim of A study evaluating the suitability of the wheat crop, as 12 pedons were identified and the coordinates were determined by a GPS device, then it was saved and transferred to the laboratory and it was conducted The chemical and physical laboratory measurements required for it, and the final results of evaluating the soils of pedons in the study area indicated that there is a variation and diversity in the varieties suitable for the cultivation of wheat crop, as the assessment of suitability was classified into three categories, which are S3, N1, and N2, and the marginal variety S3 occupied the largest area of the study area.

Keywords: wheat crop, Karbala governorate, geospatial techniques the western Jadwal district

Introduction

The importance of evaluating the land is represented by raising the productivity of the land unit and stopping its deterioration, as many agricultural centers began to pay attention to this issue and focus on systems related to evaluating the land, such as the American Classification of Productive Capability of 1961 Suggestion (1), where it made updates based on linking the characteristics of the land and climate with the requirements of the crop, as these systems aim to increase the productivity of the land and protect it from deterioration (2).

The importance of evaluating the land lies in choosing the appropriate crop for cultivation, where it is grown, and the appropriate management and maintenance requirements to make it more productive and economical for the farmer, thus preserving the characteristics of the soil and natural resources from deterioration in order to achieve food security. To reach a successful evaluation, it requires linking the characteristics of the land according to the requirementsDifferent land uses and this leads to the production of different land use evaluation maps (3)The need has become necessary in order to take advantage of geospatial techniques because of their high-efficiency technology in agricultural studies in various fields, as it has become possible to monitor the changes that occur in them and monitor the processes of degradation, drought and desertification of land, and monitor and determine its area within the visible and infrared spectrum channels and the establishment of an integrated geographic information base using a set of geographic information system software and applications in the preparation of digital maps, which facilitates the process of dealing with, managing and analyzing them with ease of updating and storage and the possibility of displaying them from multiple angles in a short time (4)

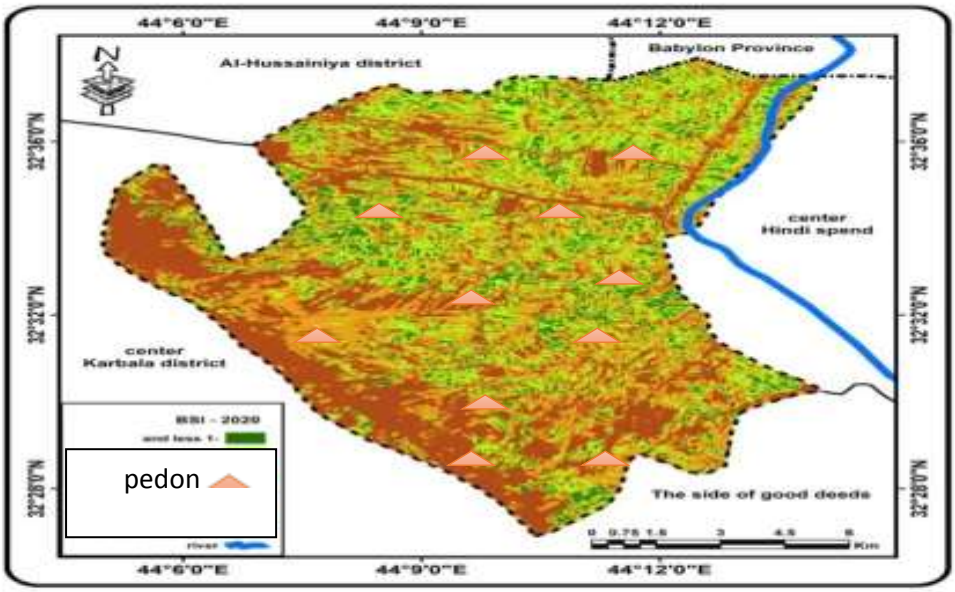
MATERIALS AND METHODS

The study area was chosen in the western Al Jadwal district of the Holy Karbala governorate, between longitudes 44° 10' 30' to 44° 7 30' east and latitudes 32° 25' 30' to 32° 37' 30' north , as the western Al Jadwal district is considered one of the agricultural areas, as it is 23 km away from the center of Karbala governorate and is bordered from the north by Al-Seddah district of Babylon Governorate and Al-Husseiniyah district and bordered by the south by Al-Khairat district of Al-Hindiya district , the area is about 16136.26

ISSN 2072-3857

hectares, 12 pedons of different agricultural exploitation were detected, and their coordinates were determined by a GPS device, as shown in Figure (1).

then their horizons were described in a fundamental morphological manner according to the principles contained in (5) .



vernorate

-Laboratory procedures

Soil samples were dried, ground and passed through a sieve with a diameter of 2 mm, and the necessary measurements were taken on them

Size distribution of particles

Estimated according to the pipette method given in (6)

The bulk density was estimated using the paraffin wax method according to the method (6) mentioned (7).

-Soil reaccion pH

The degree of soil reaction was estimated in the saturated soil paste extract, using a pH meter and according to the method (7)

-Electrical conductivity ECe

The electrical conductivity was estimated using the electrical conductivity device EC meter in the saturated paste extract according to the method described by (7)

-Organic matter in the soil

The percentage of organic matter was determined by the wet oxidation method according to described in (8) ,(9)

-Total calcium carbonate minerals

The total calcium carbonate minerals were estimated by the CO2 gas loss by weight method, according to the method described by (10).

-The exchange capacity of positive ions, CEC

The cation exchange capacity was estimated using the saturation method with sodium acetate at a reaction temperature (pH 8.2), washing with alcohol, and precipitation with ammonium acetate at a reaction temperature 7, (9) using a flame photometer, Optima model SP3000.

-Gypsum

Estimation of gypsum in the soil by sedimentation with acetone and measurement of electrical conductivity, where a device was used to estimate gypsum

ISSN 2072-3857

Centrifuge at a rate of 4000 rpm, 50 ml centrifuge tubes, electric shaker and acetone sedimentation (10)

-Total of carbonate (lime)

Calculate carbonate equivalents by denaturing with 0.5M sodium hydroxide according to the method given in (7)

-Sodium soluble

The amount of extracted from the soil was estimated using flame photometer type Optima model SP3000.

- Sodium Adsorption Ratio (SAR)

was estimated according to the following relationship:

SAR=Na/(Ca+Mg)1/2 ------ 1

- Exchangeable Sodium Percentage (ESP)

It was estimated according to the following relationship: It was mentioned in (7)

ESP = EX Na^{+}/CEC X 100 -------- 2

-Evaluating the suitability of soil characteristics for wheat cultivation:

At this stage, soil characteristics and suitability for wheat cultivation were evaluated according to (1), depending on soil requirements and topography (Table 1)Cationic, as these criteria increase their importance in relation to plant growth at the surface of the soil and decrease with depth, and therefore a certain weight was given within the pedon called the depth correction coefficient or the actual weight coefficient as a variable from the weight of the trait with the depth and then the following traits are evaluated, which are each of the soil texture, depth Soil, calcium carbonate, And the percentage of gypsum, drainage, salinity, the percentage of mutual sodium, and electrical conductivity, and it was used to achieve the table proposed by (11) and the suitability coefficient is extracted for each unit of land, which represents its suitability for growing the wheat crop according to the equation

Land Index = A1 x A2 x A3 x ----- An / 10^{2n-2} -------- 3

whereas

A1, A2, A3 ..... An evaluation of the estimates given for the various characteristics of the land used in the evaluation

ISSN 2072-3857

Table 1 Soil requirements and topography for wheat crop according to (1)

Land Characteristics		S1		S2	S3	N1	N2
		0	1	2	3	4	
		100	95 85	60	40	25	0
Topography	(t)						
Slope (%)		0 - 1	1 – 2	2 - 4	4 – 6	-	> 6
Wetness	(w)						
Flooding		F0	-	F1	F2	-	F3+
Drainage		good	Moder.	Imperf.	Poor and aeric	Poor, but drainable	Poor > not drainable
Physical soil characteristics	(s)						
Texture/struct.		C<60s, SiC, Co, Si, SiL, CL	C<60v, SC, C>60s, L	C>60v, SCL	SL, LfS	-	Cm, SiCm, LcS, fS, cS
Coarse fragm (vol%)		0 – 3	3 – 15	15 – 35	35 – 55	-	> 55
Soil depth (cm)		> 90	90 – 50	50 – 20	20 – 10	-	< 10
$CaCo_3$ (%)		3 – 20	20 – 30	30 – 40	40 – 60	-	> 60
Gypsum (%)		0 – 3	3 – 5	5 – 10	10 – 20	-	> 20
Soil fertility characteristics	(f)						
- Apparent CEC (cmole(+))/kg clay)		> 24	24 – 16	< 16 (+)	-	-	-
- Base saturation (%)		> 80	80 – 50	50 – 35	< 35	-	-
- Sum of basic cations (cmole(+))/kg)		> 8	8 - 5	5 – 3.5	3.5 - 2	< 2	-
- pH H_2O		7.0 - 7.6	7.6 - 8.2	8.2 - 8.4	8.4 - 8.5	-	> 8.5
- Organic carbon (%)		> 0.6	0.6 – 0.4	< 0.4	-	-	-
Salinity & Alkalinity	(n)						
- ECe ($ds.m^{-1}$)		0 – 4	4 – 8	8 – 12	12 – 16	16 - 20	20 - 24
- ESP (%)		0 – 15	15 – 20	20 – 35	35 – 45	-	> 45

Results and Discussion

Evaluation of the suitability of the study area for the cultivation of wheat

The final results of evaluating the soils of pedouns in the study area, which are shown in Table (2) and Figure (1), indicated that there is a variation and diversity in the varieties suitable for the cultivation of wheat crop, as the suitability assessment was classified into three categories, which are S3, N1, and N2, and the marginal variety S3 occupied the largest area of Study area The following are the appropriate categoriesAccording to the assessment of land characteristics according to (1).

- Class S3

This variety is located within the limited lands suitable for the cultivation of the wheat crop. This variety appeared in the soils of Al pedons 2, 3, 5, 6, 7, 8 and 9, due to the presence of determinants represented by the fertility factor represented by the exchange capacity of positive ions (CEC).

As for the results of the spatial distribution in tables and figures, this cultivar S3 occupied the largest area of 11986.91 hectares, at a rate of 73.98% of the study area, and this cultivar

ISSN 2072-3857

could turn into cultivar S2, after removing the limiting factors.

- Class N1

This variety is located within the lands that are not suitable for wheat cultivation due to the presence of determinants represented by the type of tissue and the fertility factor represented by the exchange capacity of positive ions and organic carbon. The spatial distribution was in Table 2 and Figure 1 that this variety occupied an area of 3847.25 hectares, with a rate of 23.74% of the total area. The area of the study areaThis variety appeared in the soils of pedons 1, 4, 10 and 12, and when the determinants are removed, this variety can turn into class S2 , is found (12) and (13)

- Class N2

This variety is located within the lands that are not very suitable for wheat cultivation because of the presence of determinants represented by the type of texture and the fertility factor represented by the exchange capacity of positive ions.this cultivar appeared in the soils of pedon 11 only , as it occupied a small area , as it was distributed spatially in a table and shape with an area of 369.53 hectares , at a percentage of 2.28% of the total area For the study area, and when removing the settings, this class can be converted to class S3 is found (13)

Table 2: Area and percentage of suitability of wheat crop varieties

property	Class	Range	Area (hectare)	Percentage %
Suitable Wheat	N2	25.38-12.57	369.53	2.28
	N1	38.19-25.38	3847.25	23.74
	S3	51.01-38.19	11986.91	73.98

ISSN 2072-3857

Table 3 Evaluation of soil characteristics for the suitability of wheat cr op

Suitable class	Suitable	ESP %	Soil depth	climatic	Drainage	Slope %	CEC	OC %	$CaCO_3$ %	Gypsum %	Texture	ECe dS. m^{-1}	pH	Pedon No.
N1	35.82	96.2	100	99	95	100	69.01	90	95.2	97.2	77	92.6	96.6	P1
S3	43.66	97.4	100	99	95	100	77.5	95	93.89	95	83.4	95.0	91.6	P2
S3	49.46	96.8	100	99	95	100	76.3	100	95.6	92.4	84.4	95.5	100	P3
N1	35.84	97.3	100	99	100	100	71.4	95	93.6	96.6	65.9	94.9	97.0	P4
S3	45.60	96.8	100	99	95	100	78.2	95	94.9	97.6	81.7	95.5	93.3	P5
S3	50.15	96.0	100	99	100	100	77.4	95	94.9	97.6	83.2	96.4	96.6	P6
S3	43.09	96.8	100	99	95	100	77.4	90	95.9	90.2	84	95.9	97.5	P7
S3	41.08	97.2	100	99	95	100	76.8	95	95.1	86.6	80.9	95.7	96.6	P8
S3	51.01	96.0	100	99	100	100	77.8	95	95.2	95.6	84.2	96.4	98.3	P9
N1	39.89	96.1	100	99	95	100	77.0	90	95.6	95.8	73.6	96.9	97.5	P10
N2	12.57	96.1	100	99	95	100	68.5	66	95.2	90.2	39.6	95.2	95.0	P11
N1	30.50	95.5	100	99	100	100	77.0	66	95.5	93.6	77.7	95.4	95.8	P12

ISSN 2072-3857

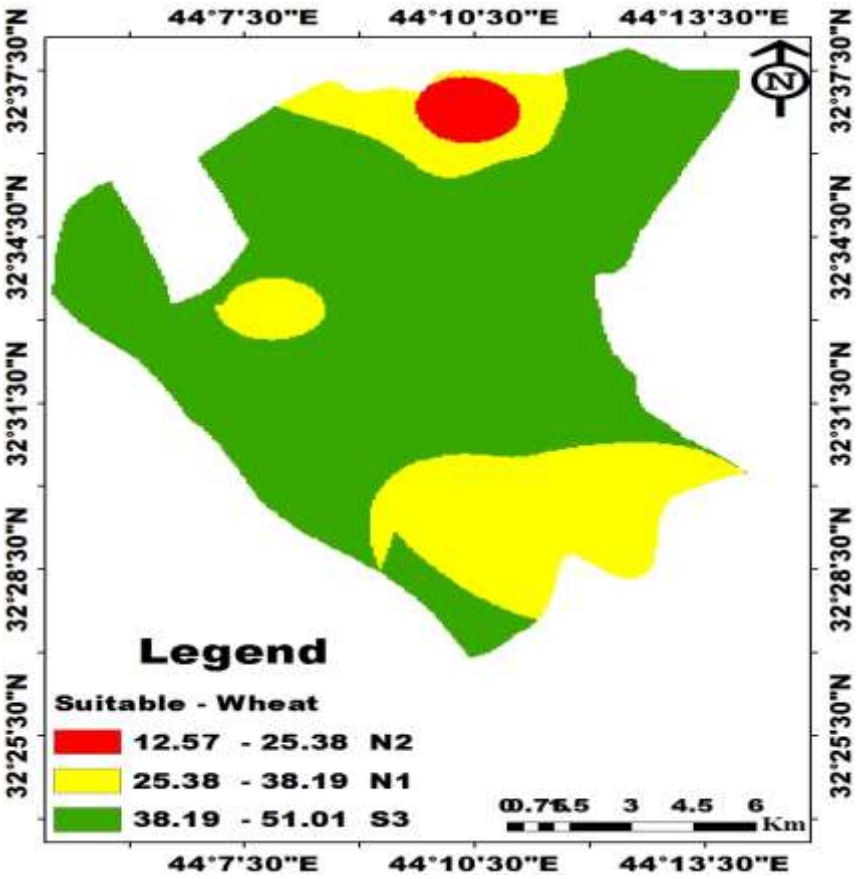


Figure 1 Varieties for assessing the suitability of the wheat crop

CONCLUSION

All soils of the western Jadwal are transformed into suitable varieties when the limiting factors for cultivation are remove

REFRENCE

1- **Sys**, C., Van Ranst, E. and Debaveye, J. and Beernaert, F. (1993). Land evaluation. Part I, II, III crops requirement Agri. Publications. general Administration for development cooperation Brussels. Belgium.

2- **Muhaimid**, Ahmed Salih, Nada Farouk Abboud, and Qassem Ahmed Selim (1), (2016). Temporal variation in soil suitability values for wheat cultivation in the irrigated areas of central Iraq. Iraqi Journal of Agricultural Sciences - 47 (1) 311-317.

3- **Al-Juraysi**, Salah Morshed (2013). Classification and assessment of the state of land degradation within the Ayman Al-Furat and Saqlawiya projects and its relationship to the physiographic site using ground information technologies. PhD thesis, College of Agriculture - Anbar University, Iraq.

4- **Younes**, A.H., and M. Abdel-Hady (2006). evaluation of Soil Degradation in Northern Sinai (Egypt). Using Remote Sensing and GIS Techniques. National Center. Soil and Water Dock, Giza, Egypt.

ISSN 2072-3857

5- **Soil Survey Division Staff** (2017). Soil survey manual . U.S.D.A . Hand book No 24, US goverment printing office Washington. D.C. 20402
6- **Black**, C.A. (1965) b.Methods of soil analysis Part 2. Chemical Properties Am.Soc. Agronomy9. madison, Wisconsin, USA.
7- **Page**, A.L., Miller, R.H., & Keeney, D.R. (1982). Methods of Soil Analysis. Part two. Madison, Wisconsin USA: American Society of Agronomy, Inc. Soil Science Society of America, Inc
8- **Jackson**, M.L. (1958). Soil chemical analysis Prentice-Hall Inc. Engelwood -9 Cliffs, NJ
9- FAO, 1990. Management of gypsiferous soils, SoilBull.No.62, Food and Agriculture Organization, Rome, Italy.
10- **USDA**. Salinity Laboratory Staff. 1954. Diagnosis and importance of saline and alkali soils. Handbook NO. 60 Washington, DC, USDA.
11- **Al-Juraysi**, S.M., & Mhede, I.R. (2021). proposing A table for weighing the characteristics of stratified samples instead of mathematical equations to study soil characteristics statistically. In IOP Conference Series: Earth and Environmental Science, 761(1), p. 012007
12- **Rabia,** A. H. (2012). GIS based land suitability assessment for Agricultural planning in Kilte Awulaelo district, Ethiopia. In the 4th International Congress of ECSSS, EUROSOIL (P.1257).
13- **Oleiwi** , Mohammed S. ,Amal R. Jubier and Bushra M.Alwan . (2021)..Evaluting the Available of Al kifl district in Babil governorate using information systems (GIS). Ecoiogy Environment art conservation supplement ISSUE

ISSN 2072-3857