

## STUDY OF SOILS SUITABILITY FOR VARIOUS CROPS PRODUCTION IN ABU- GHRAIB USING GIS TECHNIQUES

I. J. Mohammed\*

E. H. Kamel\*\*

A. A. Al-Falahi\*\*\*

K. A. Saliem\*\*\*

### ABSTRACT

Eleven soil pedons were selected representing the area of Abu-Ghraib project. Soil pedons reclassified after the site of pedons checked for their electrical conductivity and exchangeable sodium percentage. The pedons were classified at subgroup level of Typic Torrifluvents, Vertic Torrifluvents and limited area of Typic Haplogypsis.

Lands of the area were also evaluated for their suitability for crops, wheat, barley, maize, potato and clover.

About 74% of lands out of studied area (90293 ha) is under class (S2) suitable for wheat and barley followed by 25.4, 29.7 and 36.5%, respectively are suitable under class (S2) for clover, potato and maize respectively. Some lands of the area unsuitable for studied crops. The main limitations were salinity (slight to severe) and /or alkalinity, soil depth, fertility, lime content and pH.

### INTRODUCTION

The Abu-Ghraib project (AGP) is a part of lower Mesopotamian plain (3) of Holocene deposits belong to flood plain of mainly Euphrates River, with only a relatively narrow strip in the east containing sediments from Tigris river (13). Limited gypsiferous soils of Pleistocene formation also allocated in west of the studied area (2, 13). The soils of the area are deep of calcareous alluvium parent materials. The soils are well drained with irrigation-drainage network provided for the project. However, problem of soil salinity still exist. The topography is almost flat, however meso-relief have been formed, due to ancient irrigation system (3). Euphrates and Tigris rivers are the main sources for irrigation in the project area. However, much more project land is irrigated from Euphrates River more than Tigris. Climatic data of Baghdad meteorological station illustrated by Al-Falahi (1). Based on these data the climate of the project area is sub-tropical, hot and arid. It is characterized by two well- marked seasons with short transitional periods, long hot rainless summer from May to October and comparatively short cool winter from December to February. The area represents arid with mean annual rainfall of 126.6 mm and mean annual temperature is 22.5 °C. The area under sub-tropical desert (15). The soil temperature regime is hyperthermic (16) and the soil moisture regime is torric (13).

Available information on the soil classification of the area (6, 13) was based on old system of soil classification (14). Moreover, informations on land suitability for irrigated crops production weren't available for the project area. However, some works of land suitability for crop have been done for other areas in Iraq (7, 8, 11) by using parametric approach of FAO (4) and outlined by Sys (18). There are some studies done in Iraq. However, GIS techniques for final suitability map for single crops have not yet been done in Abu-Ghraib project. While in some other countries widely used (9, 10, 12). The objective of this study is to update the soil classification which already prepared soil map by INP-AEZ

Funded by ICARDA as the part of Water Livelihood Initiative project (WLI)

\* Consultant of INP- AEZ, Ministry of Agric.- Baghdad, Iraq

\*\* INP- AEZ, Ministry of Agric.- Baghdad, Iraq

\*\*\*Office of Agric. Res.- Ministry of Agric.- Baghdad, Iraq

(6) Based on most recent soil classification of Soil Survey Staff (17) and to evaluate the suitability of projects lands area for Wheat, Barley, Maize, Potato and clover respectively by using GIS technique for these maps (4).

### MATERIAL AND METHODS

The studied area is a part of Abu-Ghraib project area (AGP) covered approximately 90293 hectare. The area is about 20 km west of Baghdad and lies between latitudes 33° 06' and 33° 50' N and longitudes 43° 50' and 44° 25' E. (Fig. 1). The altitude of the plain varies from 45 m. + m.s.l in the north-west to 42 m.+ m.s.l in the AGP.

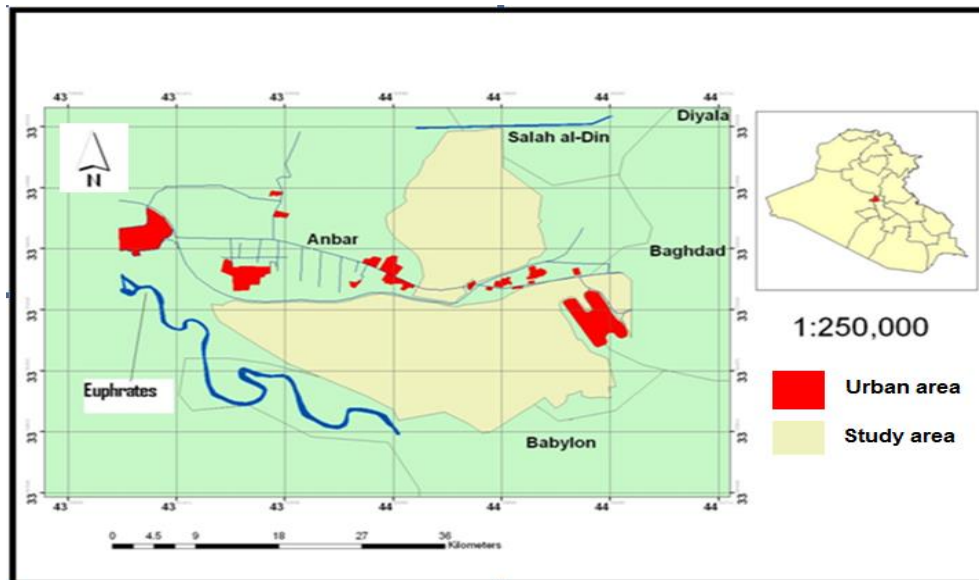


Fig. 1: Location of the study area

The Fig (2) shows the land use and land cover in Abu\_Ghraib Project which was produced by 23 satellite image (Modis) with resolution of 250 m for the period of 15/12/2004 to 15/1/2006. Using of ERDAS (Version 8.7) program- Unsupervised classification which has a facility to produce 7 classes for Abu-Ghraib project.

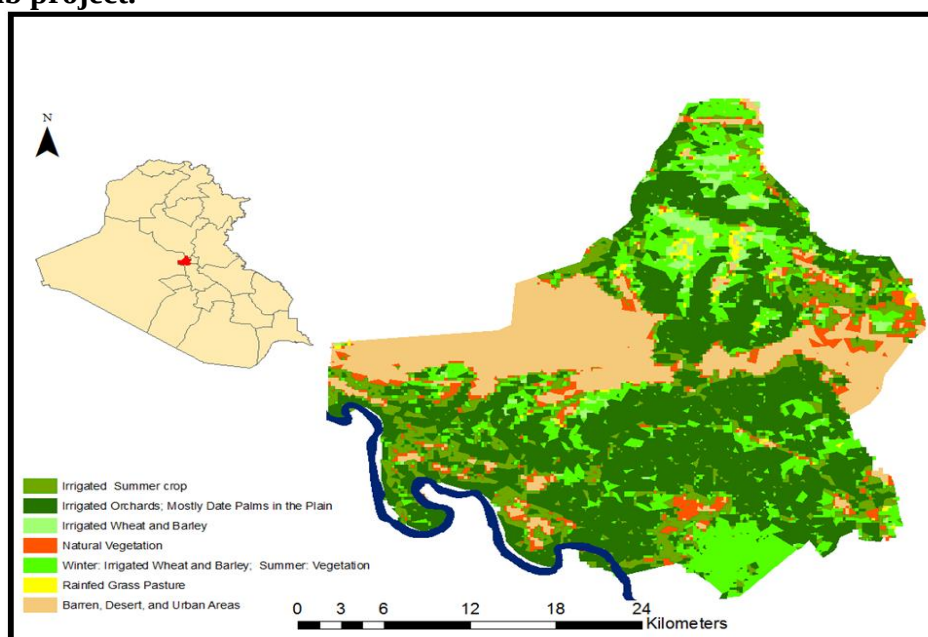


Fig. 2: land use , land cover classes in Abu Ghraib site

Eleven soil pedons (located on various physiographic position), representing different soil units (Fig.3) of the studied area were select and studied. These soil pedons were sampled from four different soil depth 0-25 cm, 25-50 cm, 50-75 cm and 75-100 cm and analyzed for electrical conductivity of soil saturation extracts and exchangeable Na (19). All other soil data or properties assume to be unchanged with time. All soil pedons were reclassified according to most recent soil Taxonomy of Soil Survey Staff (17).

The collected data were used for land suitability for irrigated wheat, barley, maize and potato and clover production following the principles outlined by FAO (4). Data include climate (Table 1), land scape and soils.

**Table 1: Relevant climatic data on Baghdad metrological station (34.1 m above m.s.l) according to Al-Falahi (1) for period of 1971 to 2009**

| Month       | Average monthly Temp, °C ) |       |       | Rainfall mm | Evaporation mm | Relative humidity % | Sun shine hours | Wind Speed m/sec |
|-------------|----------------------------|-------|-------|-------------|----------------|---------------------|-----------------|------------------|
|             | Max                        | Min   | Mean  |             |                |                     |                 |                  |
| Jan         | 15.5                       | 3.7   | 9.60  | 28.9        | 69.8           | 72                  | 6.2             | 2.6              |
| Feb         | 18.3                       | 5.2   | 11.75 | 19.7        | 101.7          | 61                  | 4.7             | 2.9              |
| Mar         | 22.9                       | 9.2   | 16.75 | 21.8        | 179.3          | 52                  | 8               | 3.3              |
| Apr         | 29.8                       | 14.9  | 22.35 | 14.6        | 267.4          | 42                  | 8.9             | 3.2              |
| May         | 36.3                       | 19.7  | 28.00 | 3.1         | 386.7          | 31                  | 10.3            | 3.3              |
| Jun         | 41.2                       | 22.8  | 32.00 | 0.1         | 503.4          | 24                  | 12.3            | 4.0              |
| Jul         | 43.8                       | 25.1  | 34.45 | 0           | 561.6          | 24                  | 12.2            | 4.3              |
| Aug.        | 43.4                       | 23.9  | 33.65 | 0           | 504.8          | 26                  | 11.8            | 3.8              |
| Sept        | 40.1                       | 20.1  | 30.10 | 0           | 370.8          | 30                  | 10.5            | 2.8              |
| Oct         | 33.1                       | 15.4  | 24.15 | 2.3         | 123.8          | 40                  | 8.8             | 2.5              |
| Nov         | 23.8                       | 9.2   | 16.50 | 13.5        | 123.9          | 57                  | 7.3             | 2.5              |
| Dec         | 17.0                       | 5.2   | 11.10 | 22.6        | 69.2           | 72                  | 6               | 2.4              |
| Annual Mean | 30.43                      | 14.53 | 22.50 | 126.6       | 3138.6         | 44.3                | 9.16            | 3.13             |
|             |                            |       |       | Annual      |                | M. Annual           |                 | M. Annual        |

Climate is not limiting factor in the project area, since irrigation is provided from mainly Euphrates River for proposed crops. It is worth to mention that recently water analysis of river water at site of the area showed on EC value of 1.7 dS.m<sup>-1</sup> which has slight to moderate effect on use for agriculture (5). The other climatic factors related to plant growth of concerning crops are all have optimal rating. As the whole studied area is flat to almost flat, therefore land scape limitation is excluded as well.

Accordingly, wheat, barley, maize, potato and clover requirement tables given by Sys (17) were used to evaluate each different soil parameters. These are rating for soil profile depth (A), rating for texture (B), rating for CaCO<sub>3</sub> (C), rating for pH (D), rating for EC (E), rating for ESP (F), rating for apparent CEC (G), rating for coarse fragments(H), rating for organic carbon (I) and rating for slop class (L).

Finally the crop index or suitability index (si) was found by using IAO methodology given by Ongaro (14) through equation:

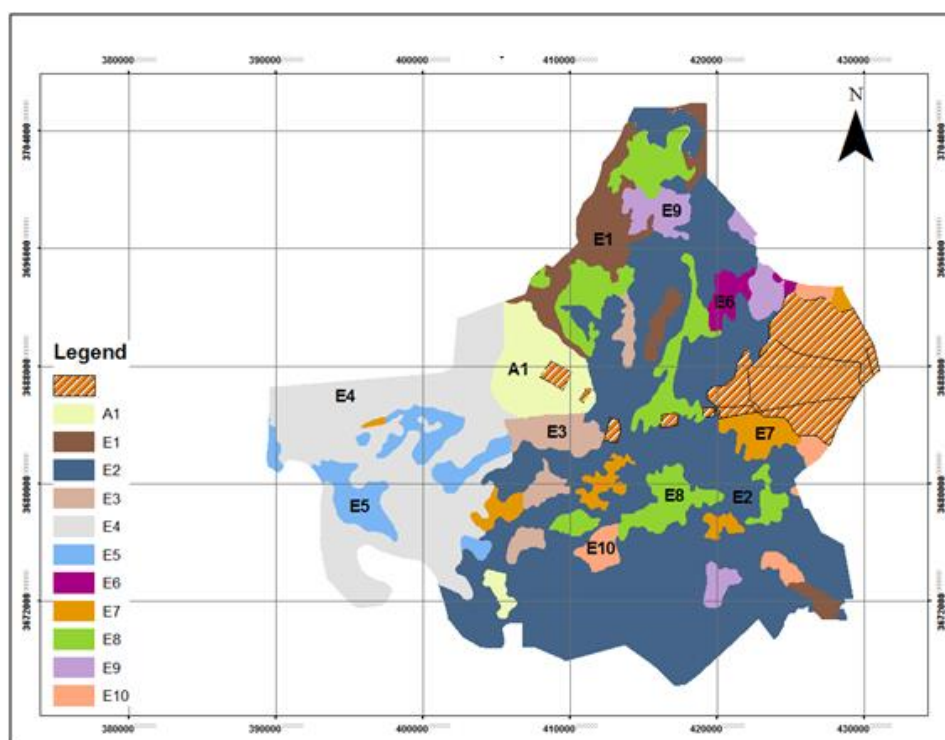
$$Si = \frac{A+B+C+D+E+F+G+H+I+L}{10}$$

The results of suitability index of each crop were used to find the land suitability class. S1-class has suitability index (si) 80-100 very suitability, S2-class (60-80) moderately suitability, S3-class (40-60) marginally suitable, N1 class (25-

40) currently unsuitable and N2-class (0-25) permanently not suitable. Based on the soil map (Fig 3) crop suitable maps were prepared by using GIS techniques.

## RESULTS AND DISCUSSION

The revised soil map of the studied area is shown in Fig 3. The soil data of the soil pedons of the area along with their mapping unit presented in Table (2), indicating that all soil pedons except pedon 11 are developed on stratified alluvium as evidenced by irregular distribution of organic carbon. The soils of the area are affected by variable degree of salinity. The soils of the area are calcareous with pH above 7. The gypsiferous soils are exist in small area, represented by soil pedon P11 (mapping unit A1) which has high gypsum content at shallow depth. In general, the soils of pedons P 9 and P 10 (soil units E9 and E 10) of irrigation depression physiographic position are heavier in soil texture (Table 2) than the soil of P4, P5, P6, P7 and P8 (soil units E4, E5, E6, E7 and E8) of basin soils as well as soils of P2, P3 (soil units E2 and E3) of silted basin and also soil pedon P1 (soil unit E1) of irrigation levee. Though the constituents of all mentioned soil pedons are belong to recent calcareous alluvium deposits of mainly Euphrates River. But, due to ancient irrigation system (Buringh, 3) of rectangular irrigation canals, the whole area was divided into small sections surrounded by canals.



- E1: Typic Torrifuvents , medium texture surface and slight to moderately saline soils .  
 E2 : Typic Torrifuvents , moderately fine texture surface and moderately saline soils .  
 E3 : Ttypic Torrifuvents , medium texture surface and strongly saline soils .  
 E4: Typic Torrifuvents , medium surface texture and free saline soils .  
 E5: Typic Torrifuvents , moderately fine texture surface and free saline soils.  
 E6: Typic Torrifuvents , moderately fine texture surface slight to moderately saline soils .  
 E7: Typic Torrifuvents , moderately fine texture surface and moderately saline soils .  
 E8 : TypicTorrifuvents , moderately fine texture surface and strongly saline soils .  
 E9 : Vertic Torrifuvents , moderately texture surface and slight to moderately saline soils .  
 E10: Vertic Torrifuvents , moderately fine and strongly saline soils .  
 A1 : Typic Haplogypsid : medium texture surface and slight to moderately saline soils.

Fig. 3: Revised soil map for the selected area of Abu-Ghraib Project Legend

Table 2: Relevant soil data of the pedons of the area

| Mappi<br>ng unit | Horizon                                          | Depth<br>(cm) | Soil<br>texture* | pH  | ECe<br>dS.m <sup>-1</sup> | CEC<br>C.mol.kg <sup>-1</sup> | ESP  | Gypsum<br>g.kg <sup>-1</sup> | CaCO <sub>3</sub> | O.C<br>g.kg <sup>-1</sup> |
|------------------|--------------------------------------------------|---------------|------------------|-----|---------------------------|-------------------------------|------|------------------------------|-------------------|---------------------------|
| E1               | P1: irrigation levee-Typic Torrifluvents         |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | Ap                                               | 0-17          | SiL              | 8.3 | 15                        | 16.9                          | 57.5 | 5.9                          | 206               | 6.9                       |
|                  | C1                                               | 17-35         | SiL              | 8.1 | 11.21                     | 18.7                          | 27.3 | 7.7                          | 228               | 3.4                       |
|                  | C2                                               | 35-50         | SiL              | 7.8 | 3.66                      | 13.6                          | 8.4  | 8.8                          | 238               | 3.9                       |
|                  | C3                                               | 50-78         | SiL              | 7.9 | 2.66                      | 12.9                          | 6.7  | 1.5                          | 238               | 1.7                       |
|                  | C4                                               | 78-105        | SiL              | 7.9 | 2.92                      | 14.8                          | 6.2  | 3.7                          | 252               | 2.2                       |
| E2               | P2: Silted Basin-Typic Torrifluvents             |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | Ap                                               | 0-20          | SiCL             | 8.1 | 15                        | 17.1                          | 52.0 | 6.0                          | 212               | 6.3                       |
|                  | C1                                               | 20-31         | SiL              | 8.1 | 8.1                       | 19.2                          | 28.0 | 7.0                          | 210               | 7.0                       |
|                  | C2                                               | 31-48         | SiL              | 8.0 | 8.2                       | 14.4                          | 30.1 | 8.2                          | 230               | 2.2                       |
|                  | C3                                               | 48-80         | SiL              | 8.0 | 9.4                       | 13.0                          | 32.0 | 1.4                          | 241               | 2.9                       |
|                  | C4                                               | 80-110        | SiL              | 7.9 | 7.1                       | 15.0                          | 13.1 | 3.6                          | 261               | 1.8                       |
| E3               | P3: Silted Basin-Typic Torrifluvents             |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | A1z                                              | 0-15          | SiL              | 7.6 | 24                        | 16.2                          | 64.4 | 15                           | 236               | 7.9                       |
|                  | C1z                                              | 15-37         | SiL              | 7.6 | 29                        | 18.5                          | 64   | 9                            | 252               | 3.9                       |
|                  | C2z                                              | 37-65         | SiL              | 7.7 | 25.9                      | 18.0                          | 65.0 | 11                           | 266               | 2.2                       |
|                  | C3z                                              | 65-105        | SiL              | 7.7 | 25.3                      | 17.0                          | 62.5 | 9                            | 238               | 3.2                       |
|                  | C4z                                              | 105-130       | SiL              | 7.7 | 25.3                      | 16.2                          | 62.0 | 13                           | 287               | 2.1                       |
| E4               | P4: Basin-Typic Torrifluvents                    |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | A1                                               | 0-14          | SiL              | 7.7 | 1.8                       | 13.2                          | 5    | 13                           | 240               | 6.1                       |
|                  | C1                                               | 14-41         | SiCL             | 7.7 | 1.5                       | 20.0                          | 8    | 8                            | 245               | 2.1                       |
|                  | C2                                               | 41-70         | SiL              | 8.0 | 1.4                       | 16.0                          | 7    | 12                           | 260               | 2.1                       |
|                  | C3                                               | 70-100        | SiL              | 8.1 | 1.2                       | 18.0                          | 5    | 10                           | 240               | 3.2                       |
|                  | C4                                               | 100-150       | SiL              | 7.7 | 1.4                       | 16.0                          | 7    | 12                           | 242               | 2.1                       |
| E5               | P5: Basin-Typic Torrifluvents                    |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | Ap                                               | 0-10          | SiCL             | 8.0 | 2.0                       | 21                            | 8    | 11                           | 240               | 7.4                       |
|                  | C1                                               | 10-40         | SiCL             | 8.1 | 1.8                       | 18                            | 9    | 7                            | 320               | 3.2                       |
|                  | C2                                               | 40-72         | SiCL             | 7.7 | 1.4                       | 19                            | 7    | 8                            | 330               | 2.1                       |
|                  | C3                                               | 72-102        | SiCL             | 7.8 | 1.2                       | 20                            | 10   | 10                           | 335               | 3.2                       |
|                  | C4                                               | 102-150       | SiCL             | 7.4 | 1.1                       | 21                            | 7    | 11                           | 236               | 2.2                       |
| E6               | P6: Basin-Typic Torrifluvents                    |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | Ap                                               | 0-39          | SiCL             | 7.9 | 2.4                       | 20.0                          | 6.0  | 20.0                         | 298               | 3.7                       |
|                  | C1                                               | 39-52         | SiCL             | 8.0 | 1.3                       | 21.9                          | 8.2  | 21.4                         | 310               | 3.1                       |
|                  | C2                                               | 52-94         | SiC              | 8.0 | 3.1                       | 24.5                          | 18.7 | 18.1                         | 326               | 3.9                       |
|                  | C3                                               | 94-114        | SiCL             | 8.1 | 4.5                       | 14.9                          | 30.2 | 11.1                         | 317               | 1.8                       |
|                  | C4                                               | 114-135       | SiCL             | 8.1 | 6.1                       | 18.5                          | 31.9 | 13.5                         | 323               | 1.9                       |
| E7               | P7: Basin-Typic Torrifluvents                    |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | Ap                                               | 0-15          | SiCL             | 8.0 | 8.0                       | 18                            | 14   | 11                           | 270               | 3.8                       |
|                  | C1                                               | 25-69         | SiCL             | 8.1 | 8.6                       | 19                            | 16   | 12                           | 269               | 3.2                       |
|                  | C2                                               | 69-95         | SiCL             | 7.9 | 9.5                       | 18                            | 18   | 15                           | 285               | 3.2                       |
|                  | C3                                               | 95-105        | SiCL             | 8.1 | 7.0                       | 29                            | 19   | 17                           | 290               | 1.9                       |
|                  | C4                                               | 105-150       | SiCL             | 8.0 | 6.4                       | 30                            | 19   | 10                           | 295               | 2.8                       |
| E8               | P8: Basin-Typic Torrifluvents                    |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | A1z                                              | 0-20          | SiCL             | 7.6 | 24                        | 21                            | 49   | 11                           | 300               | 3.1                       |
|                  | C1z                                              | 20-61         | SiCL             | 7.8 | 29                        | 29                            | 55   | 8                            | 310               | 3.3                       |
|                  | C2z                                              | 61-92         | SiCL             | 7.9 | 28                        | 30                            | 51   | 7                            | 312               | 3.8                       |
|                  | C3z                                              | 92-112        | SiC              | 7.8 | 30                        | 32                            | 59   | 11                           | 298               | 1.2                       |
|                  | C4z                                              | 112-150       | SiC              | 8.0 | 29                        | 28                            | 51   | 12                           | 295               | 1.5                       |
| E9               | P9: Irrigation depression- Vertic Torrifluvents  |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | Ap                                               | 0-30          | SiCL             | 7.7 | 2.4                       | 20.0                          | 6.0  | 20.0                         | 298               | 3.7                       |
|                  | C1                                               | 30-60         | SiC              | 8.0 | 1.3                       | 21.9                          | 8.2  | 21.4                         | 310               | 3.1                       |
|                  | C2                                               | 60-94         | SiC              | 8.0 | 3.1                       | 24.5                          | 18.7 | 18.1                         | 326               | 5.7                       |
|                  | C3                                               | 94-112        | SiL              | 8.1 | 4.5                       | 14.9                          | 30.2 | 11.1                         | 317               | 1.7                       |
|                  | C4                                               | 112-130       | SiCL             | 8.2 | 6.1                       | 18.5                          | 31.9 | 13.5                         | 323               | 1.8                       |
| E10              | P10: Irrigation depression- Vertic Torrifluvents |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | Apz                                              | 0-25          | SiCL             | 8.0 | 18.2                      | 19.1                          | 28.1 | 5.7                          | 249               | 2.6                       |
|                  | C1z                                              | 25-60         | SiC              | 8.1 | 29.0                      | 22.0                          | 29.2 | 7.7                          | 268               | 3.1                       |
|                  | C2z                                              | 60-102        | SiC              | 8.0 | 30.0                      | 26.0                          | 30.0 | 11.1                         | 290               | 4.1                       |
|                  | C3z                                              | 102-150       | SiC              | 8.1 | 29.1                      | 27.2                          | 28.0 | 9.2                          | 310               | 1.1                       |
| A1               | P11: Desertic gypsiferous- Typic Haplogypsid     |               |                  |     |                           |                               |      |                              |                   |                           |
|                  | A1                                               | 0-10          | SiC              | 7.0 | 1.35                      | 28.3                          | 1.4  | 5.0                          | 292               | 1.8                       |
|                  | A1.2                                             | 10-51         | SiL              | 7.1 | 2.95                      | 23.9                          | 1.36 | 29.8                         | 239               | 1.4                       |
|                  | By                                               | 51-60         | SiL              | 7.1 | 3.05                      | 16.1                          | 3.3  | 61.6                         | 161               | 0.2                       |

\*SiL: Silt loam, SiCL: Silty clay loam, SiC; Silty clay

Due to constant sedimentation, the strip along the canals gradually becomes higher forming irrigation levee, and then the silted basin and soils at lower physiographic position and the middle part gradually become depression. As those depressions have no outlet may be waterlogged, consequently fine particles and salt may deposit. The processes have given soils of P 9 and 10 (soil units E9 and E10) different soil classification at subgroup of Vertic Torrifluvents (19). These soils have fine texture and cracks and wedge shape peds. While the soils of P1, P2, P3, P 4, P5, P6, P7 and P8 belong to one subgroup of Typic Torrifluvents. However, all of foregoing soils have no diagnostic horizon other than ochric epipedon and therefore key out as Entisols soil order. The limited gypsiferous of the project soil is belonging to Aridisols order and have gypsic diagnostic horizons, therefore can be classified as subgroup of Typic Haplogypsis.

Based on soil data, (Table 2 and the soil map, Fig.3) different crop suitability maps of wheat, barley, maize, potato and clover were prepared. These are illustrated in Fig. (4, 5, 6, 7 and 8). The crops suitability classification of the mapped soils in the studied area is given in Table (4).

The sever salinity and or alkalinity (n) in some lands of the studied area and shallow soil depth (d) due to high gypsum content (Table3) have excluded 21% (Table 4) of unsuitable lands (N2) out of the studied area for wheat, barley and clover production. However, the figure was higher for maize 59% and 66% for potato as unsuitable lands for production of these crops.

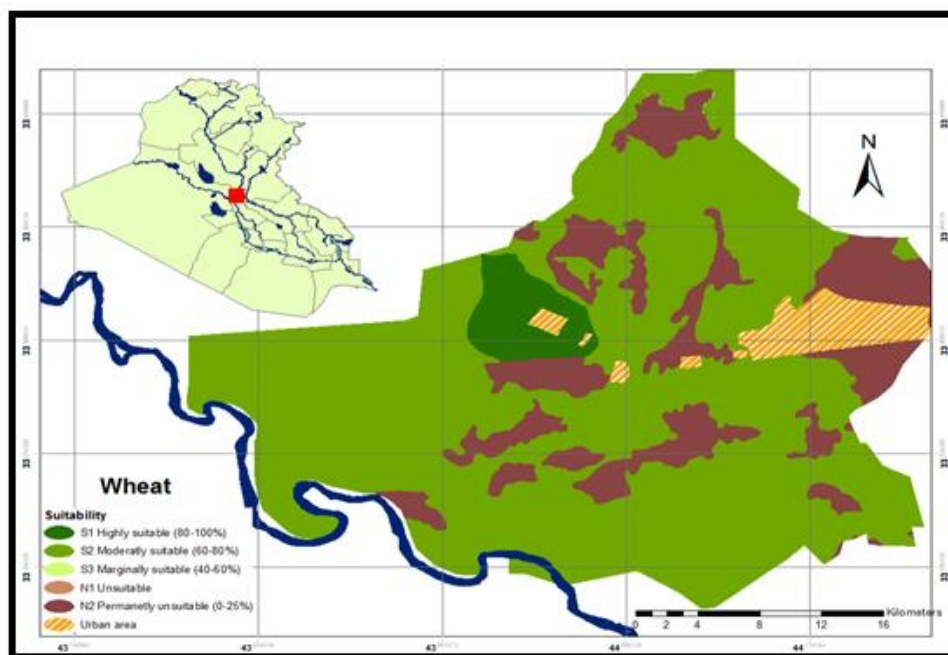
On the other hand, limitations of slight salinity, fertility or organic carbon (f),  $\text{CaCO}_3$  content (m) and soil reaction or pH (R) were had only slight effect on the rest of the land of area on their suitability of concerning crops. As such that 74% of the studied area is under class (S2) suitable for wheat and barley, however, 25.4, 29.7 and 36.5% respectively of land out of total studied area were suitable under class (S2) for clover, potato and maize, respectively (Table 4). Very suitable lands under class (S1) about 44% and 4.4% marginally suitable land under class (S3) out of total studied area were recorded for clover crop (Table 4).

**Table 3: Crops suitability classification of the mapped soils in the studied area**

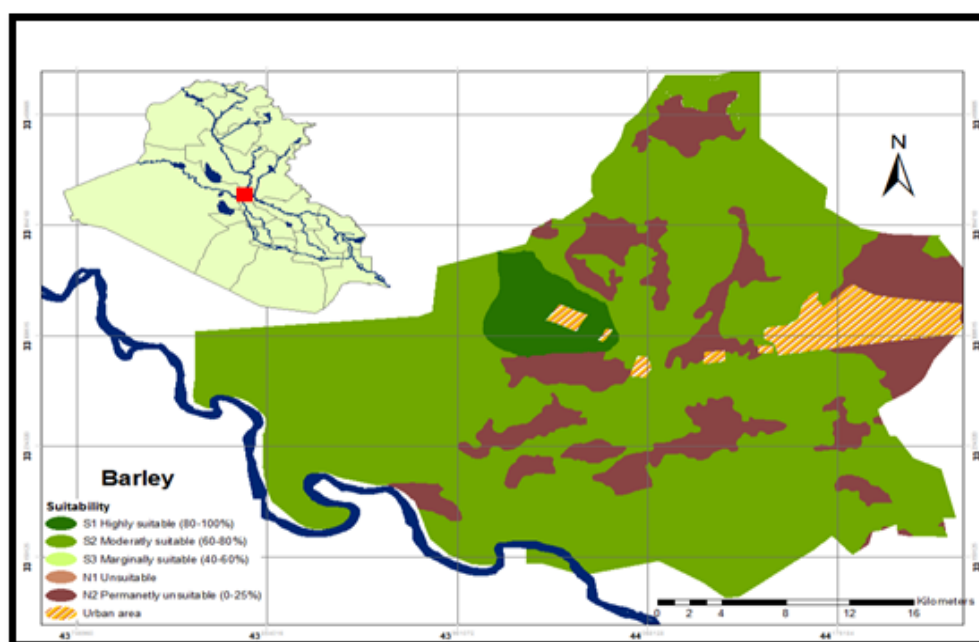
| Mapping unit | Crops Suitability Classification of the Mapped Soil in Studied Area |        |      |        |        | Area ( hectare) |
|--------------|---------------------------------------------------------------------|--------|------|--------|--------|-----------------|
|              | Wheat                                                               | Barley | Maiz | Potato | Clover |                 |
| E1           | S2nR                                                                | S2nR   | S2nm | S2mn   | S2fR   | 4846            |
| E2           | S2nR                                                                | S2nR   | N2nR | N2n    | S3nfR  | 37437           |
| E3           | N2n                                                                 | N2n    | S2nm | N2n    | N2n    | 3226            |
| E4           | S2Rm                                                                | S2Rm   | S2nm | S2nm   | S2nf   | 15522           |
| E5           | S2m                                                                 | S2m    | S2m  | S2nm   | S1     | 3080            |
| E6           | S2mf                                                                | S2m    | S2n  | Snf    | S1     | 845             |
| E7           | S2nR                                                                | S2nR   | S2nm | N2nfm  | S3nf   | 2881            |
| E8           | N2n                                                                 | N2n    | N2n  | N2n    | N2n    | 7173            |
| E9           | S2m                                                                 | S2m    | S2nm | S2nm   | S2fm   | 2542            |
| E10          | N2n                                                                 | N2n    | N2n  | N2n    | N2m    | 2994            |
| A1           | N2d                                                                 | N2d    | N2d  | N2d    | N2d    | 3882            |
| Total        |                                                                     |        |      |        |        | 86428           |

**Tale 4: Total area and percentage for the land suitability classes for different Crops of the studied area**

| Crop suitability classes | Area of crops suitability classes |      |         |      |         |      |         |      |         |      |
|--------------------------|-----------------------------------|------|---------|------|---------|------|---------|------|---------|------|
|                          | Wheat                             |      | Barley  |      | Maize   |      | Potato  |      | Clover  |      |
|                          | hectare                           | %    | hectare | %    | hectare | %    | hectare | %    | hectare | %    |
| S1                       | -                                 | -    | -       | -    | -       | -    | -       | -    | 3925    | 44   |
| S2                       | 67153                             | 74.4 | 67153   | 74.4 | 32942   | 36.5 | 26833   | 29.7 | 22910   | 25.4 |
| S3                       | -                                 | -    | -       | -    | -       | -    | -       | -    | 40318   | 44.6 |
| N2                       | 19275                             | 21.3 | 19275   | 21.3 | 53486   | 59.2 | 59593   | 66   | 19275   | 21.3 |
| Area under classes       | 86428                             | 95.7 | 86428   | 95.7 | 86428   | 95.7 | 86428   | 95.7 | 86428   | 95.7 |
| Urban area               | 3865                              | 4.3  | 3865    | 4.3  | 3865    | 4.3  | 3865    | 4.3  | 3865    | 4.3  |
| Total area               | 90293                             | 100  | 90293   | 100  | 90293   | 100  | 90293   | 100  | 90293   | 100  |



**Fig.4: Suitability map for wheat crop of the studied area**



**Fig.5: Suitability map for barley crop of the studied area**

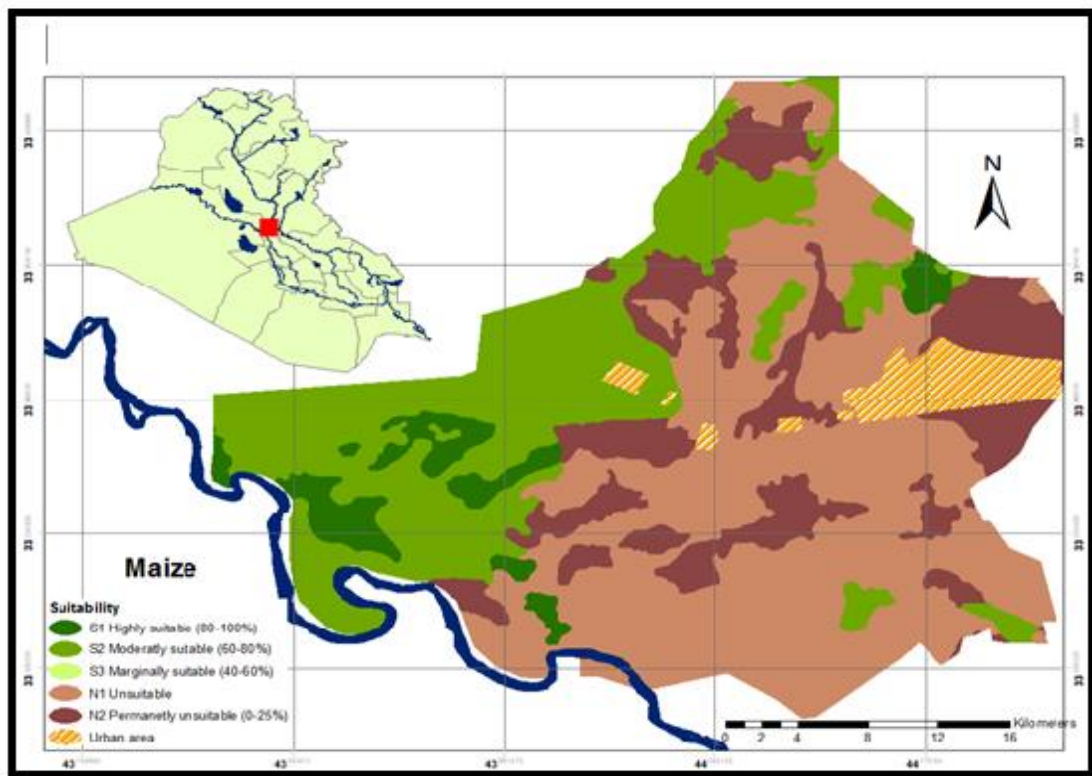


Fig.6: Suitability map for maize crop of the studied area

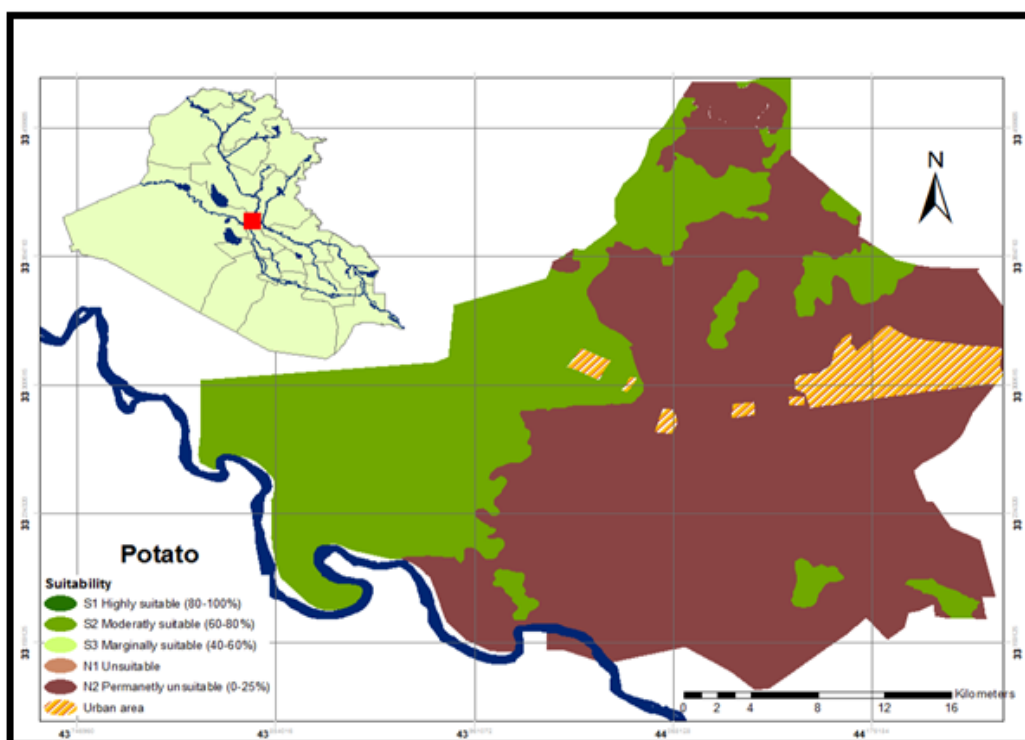


Fig.7: Suitability map for potato crop of the studied area

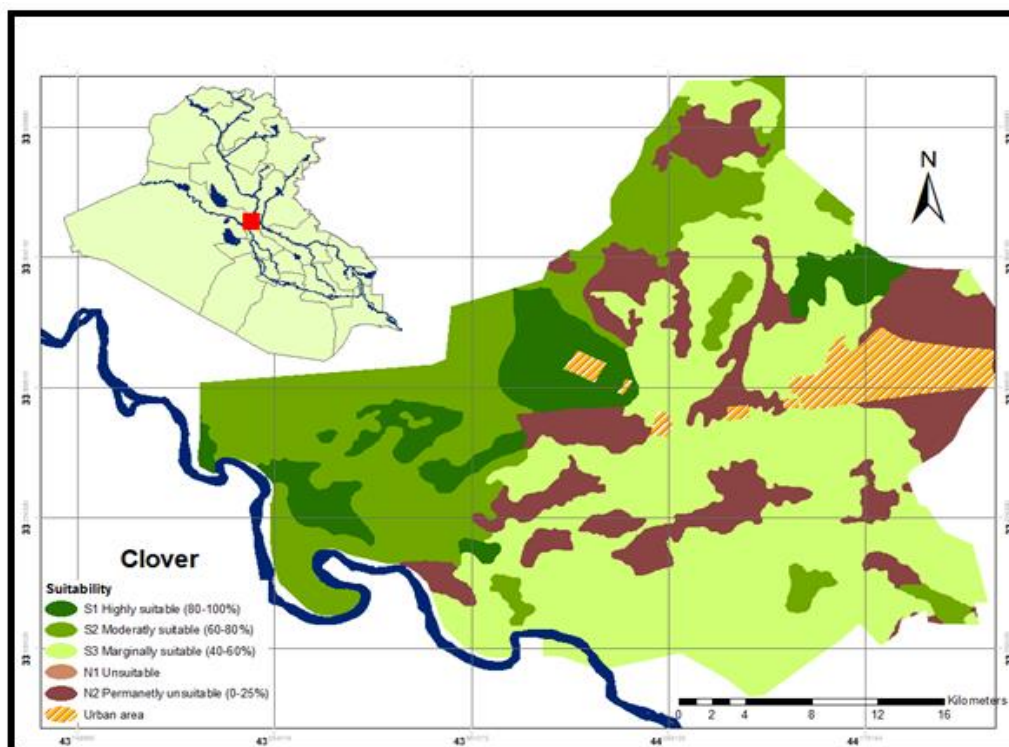


Fig.8: Suitability map for clover crop of the studied area

## Conclusions

It can be concluded that the soils of selected studied area in Abu-Ghraib project classified according to the most recent soil classification of soil Taxonomy. On subgroup levels they are Typic Torrfluvents, Vertic Torrfluvents and Typic Haplogypsid.

The present study of land suitability for the crops wheat, barley, maize, clover and potato of the area are providing the decision- makers with very reliable information, especially at present conditions of water shortage and rather low water quality of irrigation water in the area.

## REFERENCES

- 1- Alfalahi, A.A. (2010). Final report of the Bio-physical and Socio-Econon characterization in the WLI Benchmark site. WLI, ICARDA- USAID.
- 2- Barzanji, A.F. (1973). Gypsiferous soil of Iraq. PhD thesis. Ghent State University, Belgium.
- 3- Buringh, P. (1960). Soils and soil conditions in Iraq. Ministry of Agriculture, Baghdad, Iraq
- 4- FAO. (1996). A frame work for land evaluation. Soil Bulletin 32, FAO, Rome, Italy.
- 5- FAO. (1985). Water quality for Agriculture. 29 REV., I, Rome, Italy.
- 6- INP-AEZ. (2001). Soil maps of surveyed area in Iraq. Prepared by soil survey staff of Water Resources Ministry, presented to Iraq National Program of Agro-Ecology Zone Map, Ministry of Agriculture- Baghdad, Iraq. (Unpublished Report)
- 7- Jassim, H.F. (1982). Principles of regional soil survey land evaluation and land use planning in Iraq. PhD thesis, Ghent State University, Belgium.
- 8- Khiddir, S.M. (1986). A statistical approach in use of parametric systems applied to FAO framework for land evaluation. PhD thesis, Ghent State University, Belgium

- 9- Kalogirou, S. (2002). Expert systems and GIS: an application of land suitability evaluation. Computer Environment and urban systems, 26 (2-3): 89-112, Newcastle upon Tyne, NEI, UK.**
- 10- Luis, A., Bojorgulez-Tapia, Salmbn Diaz-Mondragon and Exequied Ezcuira (201). GIS- based approach participatory decision making and land suitability assessment. International journal of Geographical Information sciences.**
- 11- Mohammad, I. J. (2002). Soils of Adhaim area and their land suitability for wheat and spring maize production. Iraq J. Agric. (Special Issue) Vol. 7, No. 2, Jan, 2002.**
- 12- Moshia, M.E.; M.B. Mashatola; P. Shaker and PS. Fouche (2008). Land suitability assessment and precision farming prospects for irrigated maize-soybean intercropping in Syferkuil experimental farm using Geospatial Information Technology. Journal of Agriculture and Social Research (JASR), Vol. 8, No. 2, ISSN: 1595- 7476.**
- 13- NEDECO. (1978). Semi detailed soil and hydrological survey for Abu-Ghraib project. Vol.1, main report, Ministry of Agriculture and Agrarian, Reform Baghdad, Iraq.**
- 14- Ongaro L. (2008). Land unit mapping for land Evaluation (revised). IAO methodology. Handout of the Master's degree, Geometrics and Natural Resources Evaluation, IAO, pp.30.**
- 15- Papadakis, J. (1995). Climate of the world and their potentialities. Ar. Cordoba, 4564, Buenas Aires, Agrentina.**
- 16- Soil survey staff (1999). Soil Taxonomy. A basic system of soil survey. USDA, Soil Conserv. Service, Agric. Handbook No. 436, USA.**
- 17- Soil survey staff (2010). Key to Soil Taxonomy Eleventh Edition, USDA-NRCS, USA.**
- 18- Sys, C. (1985). Land evaluation. State University of Ghent, Belgium.**
- 19- U.S. Soil Salinity Laboratory (1954).Diagnosis and improvement of saline and alkali soil. Agric. Handbook No. 60, USDA, U.S. Gov.**

## دراسة ملائمة الترب لانتاج المحاصيل المختلفة في منطقة ابي غريب باستخدام تقنية الـ GIS

عماد حميد كامل\*\*

ابراهيم جعفر محمد\*

قاسم احمد سليم\*

احمد عدنان الفلاحى\*\*\*

### الملخص

اختيرت احد عشر بيدون من البيدونات ممثلة لمنطقة مشروع ابي غريب . أعيد تصنيف البيدونات بعد إن تم التأكد من توصيلها الكهربائي ونسبة الصوديوم المتبادل فيها. Vertic Torrifluvents ,Typic Torrifluvents صنف البيدونات على مستوى تحت المجموعة الى Typic Haplogysids. ومساحة محدودة، لقد قومت الاراضي والتربة لمدى ملائمتها للمحاصيل الحقلية (الحنطة، الشعير، الذرة الصفراء، البطاطا والبرسيم)، إذ تبين بأن 74% من الاراضي تحت الدراسة البالغة (90293 هيكتار ) هي تحت الصنف الثاني (S<sub>2</sub>) وهي ملائمة لزراعة الحنطة والشعير كما وجد بان 25.4، 29.7 و 36.5 من المساحة المشار اليها آنفاً التي هي تحت الصنف الثاني (S<sub>2</sub>) هي ملائمة للزراعة لكل من البرسيم، البطاطا والذرة الصفراء على التوالي. بعض الأراضي تحت الدراسة الحالية غير ملائمة للمحاصيل المشار اليها آنفاً.

لقد استخدمت العوامل الرئيسة المحددة التالية لتقويم اراضي منطقة الدراسة وهي الملوحة او القلوية، عمق التربة، نسبة كاربونات الكالسيوم في التربة، تفاعل التربة وخصوبتها.

---

البحث ممول من قبل المركز الدولي للبحوث الزراعية في المناطق الجافة وهو جزء من نشاطات مشروع تحسين المستوى المعاشي للمزارعين WLI -

في مشروع ابي غريب

\* استشاري في قسم الخارطة البيئية -وزارة الزراعة -بغداد - العراق.

\*\* وزارة الزراعة - بغداد - العراق.

\*\*\* دائرة البحوث الزراعية - وزارة الزراعة - بغداد - العراق.