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Comparison Between Keys to Soil Taxonomy and WRB to Classification of Soils in Segzi Plain (Iran)

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Abstract: Aridic soil moisture regime, occupy the largest area in central of Iran. Objective of this research was compare between Keys to Soil Taxonomy and WRB in classification of soils in Segzi plain. Segzi plain is located in the Eastern of Isfahan province in center of Iran. In order to do this research, 5 profiles as a vertical transect were studied. Soil colors were defined using a Munsell soil color charts. Soil pH, electrical conductivity, Gypsum percent, carbonate calcium and organic matter were measured. Several samples have got from some of Profiles for Micromorphological analysis. Frequently classification of soils in Segzi plain in Keys to Soil Taxonomy is Gypsic Aquisalids and in WRB is Hypersalic Solonchaks (Sodic). This research has also shown that both of classification system can rather reasonable classify this zone but both of them are defect in soil classification of natural resources.

Key words: Aridisols, Solonchaks, WRB, taxonomy, classification

INTRODUCTION

The actual plains of central of Iran that have become desert and barren, used to be big and small lakes in the past, this is shown by fossil of fishes and sweat water oysters that are left on the plains, and even on the higher parts of the region (Karimi, 1997). Moisture regime prevalent in central of Iran is aridic regime.

Aridisols are soils of the aridic moisture regime which occur normally in arid climates (Khresat and Qudah, 2006). Aridisols occupy more than 18% of the earth's land surface and are the most common soils in the world, Aridisols is the dominant soil order in the Middle East, While 65% of Iran has an aridic soil moisture regime (Khademi and Mermut, 2003).

Aridisols have a cambic horizon, or an argillic horizon or natric horizon, or a calcic or petrocalcic horizon or a gypsic or petrogipsic horizon or a duripan horizon, or a salic horizon (Khresat and Qudah, 2006).

Solonchaks are Reference Soil Groups in WRB. Based on WRB solonchaks having a salic horizon starting within 50 cm of soil surface.

Moazallahi and Farpoor (2009) researched about Soil Micromorphology and Genesis along a Climotoposequence in Kerman Province, Central Iran. This research showed Soils of Kerman plain (aridic part of the transect) are Typic Haplocalcids that change to Petrocalcic Calcixerepts and Calcic Haploxerepts toward the upslope positions. Soil processes, gypsum and calcite micromorphology, and soil classifications were different during the gradient that showed role of topography and climate in soil formation.

Owliaie *et al.* (2006) examined Pedogenesis and clay mineralogical investigation of soils formed on gypsiferous and calcareous materials, on a transect, southwestern Iran, this result showed Gypsiferous soils showed more pedogenic palygorskite as compared to calcareous soils. Three morphological forms of palygorskite, related to degree of weathering, were identified in the studied pedons. New great groups and subgroups of Ustepts (Aridic Gypsiustepts and Aridic-calcic Gypsiustepts) are suggested to be included in Soil Taxonomy based on the properties of some of the studied pedons.

MATERIALS AND METHODS

Study area: Segzi plain is located in the Eastern of Isfahan province in the center of Iran and is about 40 km from Isfahan city center (31° 23′N, 51°7′E to 32° 55′N, 51° 56′E), Climate of zone of De Martonne methods is dry (Honarjoo *et al.*, 2010).

In order to do this research, 5 profiles as a vertical transect were studied in 2010.

Analytical methods: Soil colors were defined using a Munsell soil color charts. Soil pH was measured on

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saturated soil paste, The electrical conductivity was measured on saturation extracts, Gypsum percent was obtained by precipitation with acetone method, Equivalent calcium carbonate was determined for all soil samples using acid neutralization method (Richards, 1954). Organic matter was measured (ASA, 1982). Several samples have got from some of profiles for Micro morphological analysis (Stoops, 2003).

RESULTS AND DISCUSSION

Morphological properties: Morphological properties are in Table 1, it should be noted that a high percentage of organic matter in the surface layer of some profiles in vertical transect because mulch sprinkled on the surface for fixation blowing sand, mixed with the surface soil. Age detection of organic matter, dark layer rich in fossilized organic material in Segzi plain by Ayobi *et al.* (2006) by Carbon-14 method showed that this layer has been developed in the time limit from 10 to 11 thousand years ago.

In Segzi plain hardpans has been created due to pressure from the upper layer.

Micromorphological properties: According micromorphologica properties of selected horizons (Table 2): in profile 2 horizon of 109-135 cm, can be seen redoximorphic feature as mattling. In this horizon can be seen Fe oxides and organic material nodules.

In profile 3 horizon of 54-90 cm, can be seen filling pores by gypsum. In profile 4 horizon of 128-148 cm, can be seen fiber residue and gypsum nodules. In Fig. 1a-f can be seen micro morphological properties of selected horizons that described them in above.

Classification of profiles in WRB and Keys to Soil Taxonomy systems is in Table 3.

According to Table 3, classification of profiles in WRB system is Hypersalic Solonchaks (Sodic) and in Keys to Soil Taxonomy system are Gypsic Aquisalids and Gypsic Haplosalids.

Evaluated Keys to Soil Taxonomy and WRB in classification of profiles (IUSS/ISRIC/FAO, 2007)

Profile 1: In taxonomy: gypsic aquisalids:

According to subgroup, can be diagnosed salic, gypsic and gleyic horizons in this profile but cannot be diagnosed that there are argillic horizons in depth of 139-156, 156-169 and +169 cm, calcic horizon in depth of 156-169 cm and hardpan in horizons of 139-156, 156-169 and +169 cm.

In WRB: Hypersalic Solonchaks (Sodic).

According WRB can be diagnosed salic horizons and sodic condition in this profile but cannot be diagnosed argillic horizon, calcic horizon, gypsic horizon and hardpan.

Profile 2: In taxonomy: gypsic aquisalids:

According to subgroup, can be diagnosed salic, gypsic and gleyic horizons in this profile but cannot be diagnosed that there are argillic horizons in depth of 158-173 and +173 cm, calcic horizon in depth of84-109 cm and hardpan in horizons of 84-109, 109-135, 135-158, 158-173 and +173 cm.

In WRB: Hypersalic Solonchaks (Sodic).

According WRB can be diagnosed salic horizons and sodic condition in this profile but cannot be diagnosed gleyic horizon, calcic horizon, gypsic horizon and hardpan.

Profile 3: In taxonomy: gypsic haplosalids:

According to subgroup, can be diagnosed salic and gypsic horizons in this profile but cannot be diagnosed that there are gleyic horizons in depth of 149-70 and +170 cm and hardpan in horizons of 90-127, 127-149 and 149-170 cm.

In WRB: Hypersalic Solonchaks (Sodic).

According WRB can be diagnosed salic horizons and sodic condition in this profile but cannot be diagnosed calcic horizon, gypsic horizon and hardpan.

Profile 4: In taxonomy: gypsic haplosalids:

According to subgroup, can be diagnosed salic and gypsic horizons in this profile but cannot be diagnosed that there are argillic horizon in depth of 161-173 cm, gleyic horizons in depth of 107-128, 128-148, 148-161 and +173 cm and calcic horizons in depth of 74-107, 107-128, 128-148, 148-161 and 161-173 cm.

In WRB: Hypersalic Solonchaks (Sodic).

According WRB can be diagnosed salic horizons and sodic condition in this profile but cannot be diagnosed argillic horizon, calcic horizon, gypsic horizon and hardpan.

Profile 5: In taxonomy: Gypsic aquisalids:

According to subgroup, can be diagnosed salic, gypsic and gleyic horizon in this profile but cannot be diagnosed that there are calcic horizons in depth of 100-122, 122-133 and 133-176 cm and hardpan in horizons of 122-133 and 133-176 cm.

In WRB: Hypersalic Solonchaks (Sodic).

According WRB can be diagnosed salic horizons and sodic condition in this profile but cannot be diagnosed calcic horizon, gypsic horizon and hardpan.

Table 1: Morphological properties

Horizon	Depth (cm)	Color (moist)	Sand (%)	Silt (%)	Clay (%)	Structure	pH	EC (dS m^{-1})	$CaCO_3$ (%)	$CaSO_4$ (%)	O.M (%)	SAR
Profile 1												
Cz	0-14	2.5Y 5/3	37.50	44.00	18.50	m	7.48	60.00	36	34.23	1.05	296.0
2By	14-43	2.5Y 5/2	30.50	49.00	20.50	2 m abk	7.45	17.61	35	31.29	0.94	149.0
2Bzy	43-67	10YR 5/2	29.17	44.37	26.10	2 m abk	7.82	32.30	35	31.29	0.68	146.0
2Bw	67-139	2.5Y 5/2	26.50	48.30	25.20	2 m pr	8.02	21.58	33	36.07	0.68	102.1
3Btgd	139-156	N 2.5/1	25.17	35.63	39.20	2 m pr	7.50	28.12	13	53.57	1.36	159.4
4Btkd	156-169	2.5Y 4/3	24.50	27.00	48.50	3 co pr	7.78	26.16	15	46.72	0.68	130.0
5Btgd	+169	10B 2.5/1	24.17	23.63	52.20	2 m pr	7.84	14.65	33	47.19	1.57	139.8
Profile 2												
Cz	0-19	2.5Y 5/2	50.50	36.67	12.83	m	7.54	31.39	20	41.92	1.57	221.4
$2Bzy_1$	19-32	10YR 5/2	31.50	54.30	14.20	2 m abk	7.64	40.54	36	25.98	0.94	108.8
$2Bzy_2$	32-84	2.5Y 4/1	28.80	54.00	17.20	2 m pr	8.14	31.80	40	33.65	0.68	133.3
3Bzgd•	84-109	10Y 3/1	29.17	52.73	18.10	2 m pr	7.48	34.54	28	32.47	1.05	176.3
4Bkd	109-135	2.5 Y 5/2	28.16	50.84	21.00	2 m abk	8.16	14.39	15	33.79	0.63	144.9
5Bkgd	135-158	N3	28.16	43.84	28.00	2 m abk	8.42	13.73	33	33.96	1.97	200.4
6Btkd	158-173	10YR 6/3	29.00	37.00	34.00	3 m abk	7.90	23.54	22	31.72	0.63	190.1
7Btgd	+173	N3	27.50	30.00	42.50	3 m abk	8.12	28.89	47	33.20	0.92	106.6
Profile 3												
Cz	0-20	10YR 4/2	50.10	37.80	12.10	m	7.31	96.85	10	32.05	0.94	331.9
2Bzy	20-54	2.5Y 4/4	32.50	53.30	14.20	2 m abk	7.78	50.21	13	31.27	0.84	166.6
2Btzy	54-90	10YR 5/2	24.80	55.37	19.83	2 m pr	7.61	34.67	13	41.85	0.78	111.8
2Bkd	90-127	2.5Y 5/3	25.10	54.90	20.00	2 m pr	7.58	25.62	23	30.79	0.57	183.0
$3Bgd_1$	127-149	N 2.5/1	24.50	51.67	23.83	3 co pr	7.53	25.62	7	31.65	1.84	217.8
$4Bgd_2$	149-170	10Y 4/1	28.17	48.00	23.83	3 co pr	7.62	25.62	7	37.01	1.15	254.8
4Bzg	+170	10Y 2.5/1	29.17	44.63	26.20	3 m pr	7.49	31.08	53	30.01	1.05	273.7
Profile 4												
Cz	0-32	2.5Y 4/4	40.50	39.67	19.83	2 vf gr	7.48	57.39	10	27.91	1.00	127.5
2Bkzy	32-74	10YR 5/3	29.17	47.83	23.00	2 m abk	7.19	31.08	7	31.63	0.94	82.6
2Bzyd•	74-107	10YR 3/2	26.17	51.83	22.00	2 m abk	7.13	28.69	18	39.43	0.84	124.3
$3Bygd_1$•	107-128	10Y 5/1	29.00	46.90	24.10	3 m abk	7.37	26.30	7	41.19	0.57	130.3
$3Bygd_2$•	128-148	10Y 2.5/1	24.17	33.33	42.50	3 m pr	7.39	27.50	7	44.05	0.92	114.1
3Bkgd	148-161	5GY 2.5/1	25.80	45.47	28.73	3 m pr	7.40	19.13	14	38.32	1.18	119.9
4Btkd	161-173	7.5YR 4/2	22.50	46.67	30.83	3 co abk	7.67	25.10	20	35.41	0.73	271.8
5Bg	+173	10B 2.5/1	30.80	40.00	29.20	3 co abk	7.51	22.71	53	26.29	1.05	196.8
Profile 5												
Cz	0-17	10YR 4/3	50.50	39.50	10.00	m	7.01	55.00	12	32.76	0.73	258.2
$2Bzy_1$	17-61	10YR 4/3	31.80	45.70	22.50	2 m abk	7.41	39.00	10	46.90	0.47	174.2
$2Bzy_2$	61-100	10YR 3/3	28.50	44.30	27.20	2 m abk	7.56	38.26	8	49.16	0.63	138.1
3Bzyg•	100-122	10Y 3/1	26.17	46.63	27.20	2 m pr	7.37	35.87	21	47.34	1.05	144.7
3Bzygd•	122-133	10Y 2.5/1	29.50	40.00	30.50	3 m pr	7.40	36.96	15	50.61	0.92	188.8
4Bzyd•	133-176	2.5YR 4/2	26.80	40.70	32.50	3 co pr	7.51	30.08	42	46.96	0.78	138.1
5Bzg	+176	10B 3/1	28.17	49.73	22.10	3 m pr	7.24	32.28	47	36.17	1.18	164.2

•: Horizon has Carbonate Calcium

Table 2: Micromorphological properties of selected horizons

Horizon depth(cm)	Voids	C/F	Microstructure	b-Fabric	Coating	Infilling	Nodules
Profile 2							
(109-135)4Bkd	Vughchamberchanelplane	Fine monic	Weakly separated angular blocky to fissure	Crystalic	Typic calcite	Dense complete and incomplete calcite	Fe oxides and organic material
Profile 3							
(54-90)2Bzy	Chambervughchanel	Fine moni	Weakly separated suangular blocky to fissure	Crystalic	Typic gyspum	Dense incomplete gypsum	-
Profile 4							
(128-148)3Bygd•	Vughchanelplane	Fine monic	Weakly separated angular blocky	Crystalic	Typic calcite and gypsum	-	Fe oxides and organic material

•: Horizon has carbonate calcium

Considering the above results is clear that Keys to Soil Taxonomy and WRB are defect in soil classification of natural resources because in Keys to Soil Taxonomy tosubgroups and WRB the surface layer are more attention but in the natural resources lower layers is also important. This result is consistent with reviews of Toomanian *et al*. (2003).

Toomanian *et al*. (2003) has expressed the 1994 version of the USDA Soil Taxonomy allows for more characteristics of the Gypsiferous Soils in Northwest Isfahan to be defined as compared with the previous versions, while the more recent versions (1996, 1998 and 1999) have remained unchanged in this regard.

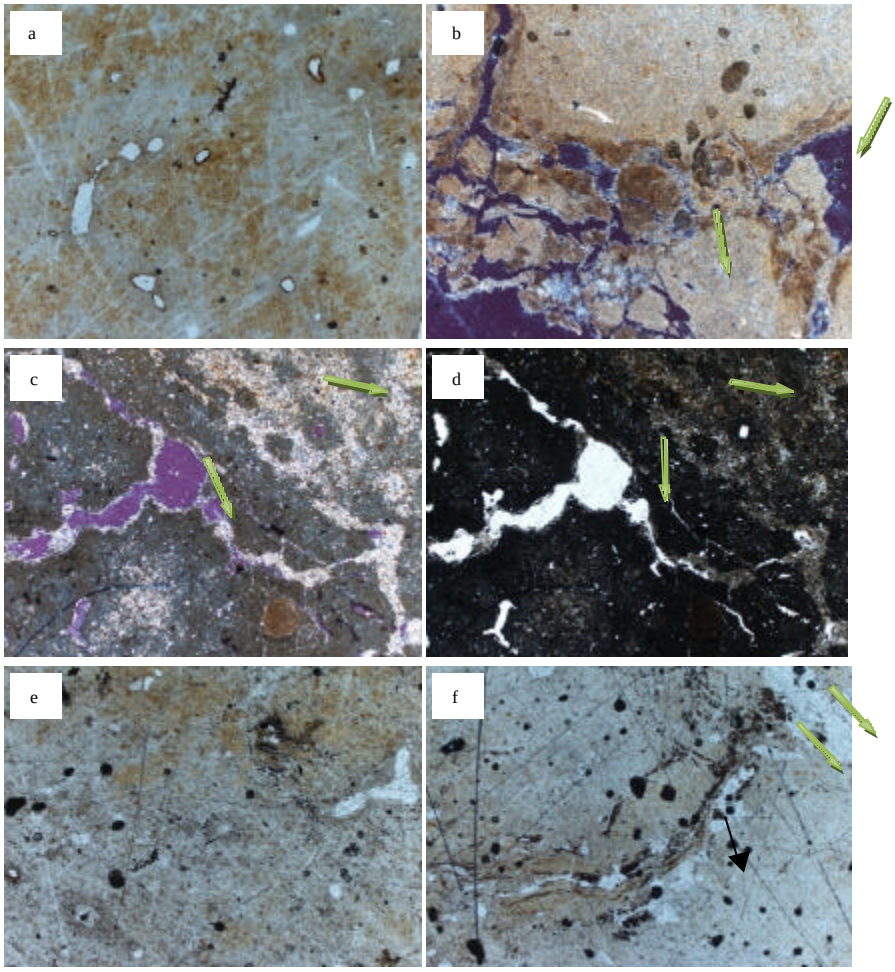

Fig. 1: (a) Soil compaction in the 4Bkd of profile 2, PPL; (b) calcite coating and infiling in the 4Bkd of profile 2, PPL; (c) gypsum coating and infiling in the 2Bzy of profile 3, PPL; (d) gypsum coating and infiling in the 2Bzy of profile 3, XPL; (e) soil compaction in the 4Bkgd$^{\bullet}_{2}$ of profile 4, PPL and (f) fiber in the 4Bkgd$^{\bullet}_{2}$ of profile 4, PPL

Table 3: Classification of soil for each profile

WRB	Keys to soil taxonomy(subgroups)*
Vertical Transect	
Profile 1	
Hypersalic Solonchaks (Sodic)	Gypsic Aquisalids
Profile 2	
Hypersalic Solonchaks (Sodic)	Gypsic Aquisalids
Profile 3	
Hypersalic Solonchaks (Sodic)	Gypsic Haplosalids
Profile 4	
Hypersalic Solonchaks (Sodic)	Gypsic Haplosalids
Profile 5	
Hypersalic Solonchaks (Sodic)	Gypsic Aquisalids

*Source: Soil Survey Staff (2006)

CONCLUSION

Both of classification system can rather reasonably classify this zone but both of them are defect in soil classification of natural resources.

REFERENCES

ASA, 1982. Methods of Soil Analysis. Part 2. In: Chemical and Microbiological Properties, Page, A.L. (Ed.). 2nd Edn., Agronomy Society of America, Madison WI.

Ayobi, S.H., M.K. Eghbal and A. Jalalian, 2006. Evaluation evidence micromorphological change of Quaternary climate in the palesols of Isfahan zone. J. Sci. Technol. Agric. Nat. Resour., 10: 137-150.

Honarjoo, N., A. Mojiri, A. Jalalian and H.R. Karimzadeh, 2010. The effects of salinity and alkalinity of soil on growth of Haloxylon sp. in Segzi plain (Iran). Proceeding of the International Conference on Chemistry and Chemical Engineering, (ICCCE'10), Kyoto, Japan, pp: 285-288.

IUSS/ISRIC/FAO, 2007. World reference base for soil redources 2006, first update 2007. World Soil Resources Reports No. 103. FAO, Rome. http://www.fao.org/ag/agl/agll/wrb/doc/wrb2007_corr.pdf.

Karimi, K.A., 1997. Comprasion of soil properties on associated bare and vegetated sites in Segzi area of Isfahan. M.Sc. Thesis, College of Agriculture, Isfahan University of Technology (In Persian).

Khademi, H. and A.R. Mermut, 2003. Micromorphology and classification of Argids and associated gypsiferous Aridisols from central Iran. Catena, 54: 439-455.

Khresat, S.A. and E.A. Qudah, 2006. Formation and properties of aridic soils of Azraq Basin in Northeastern Jordan. J. Arid Environ., 64: 116-136.

Moazallahi, M. and M. Farpoor, 2009. Soil micromorphology and genesis along a climotoposequence in Kerman Province, Central Iran. Aust. J. Basic Applied Sci., 3: 4078-4084.

Owliaie, H.R., R.J. Heck and A. Abtahi, 2006. Pedogenesis and clay mineralogical investigation of soils formed on gypsiferous and calcareous materials, on a transect, Southwestern Iran. Geoderma, 134: 62-81.

Richards, L.A., 1954. Diagnosis and Improvement of Saline and Alkali Soils. United States Government Printing Office, Washington, DC., USA., pp: 160.

Soil Survey Staff, 2006. Keys to Soil Taxonomy. 10th Edn., US. Department of Agriculture, Natural Resources Conservation Service, Washington DC., USA.

Stoops, G., 2003. Guidelines for Analysis and Description of Soil and Regolith thin Sections. Soil Science Society of America Inc., Madison, WIM, USA., pp: 155.

Toomanian, N., A. Jalalian and M.K. Eghbal, 2003. Application of the WRB (FAO) and US taxonomy systems to gypsiferous soils in northwest Isfahan, Iran. J. Agric. Sci. Technol., 5: 51-66.