AENSI Journals

Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: http://www.aensiweb.com/AEB/

The study of Formation, Alteration and classification of Saline Soils under Pistachio Cultivation in Zeydabad plain, Kerman Province of iran

[1]Ali Zeinadini Meymand, [2]Mohammad Hassan Masihabadi, [2]Mehrdad Esfandiari

[1]Ph.D student, Department of Soil Science, Science and Research Branch, Islamic Azad University (IAU), Tehran, Iran.
[2]Faculty, Department of Soil Science, Science and Research Branch, Islamic Azad University (IAU), Tehran, Iran.

ARTICLE INFO

Article history:
Received 2 April 2014
Received in revised form
13 May 2014
Accepted 28 June 2014
Available online 23 July 2014

Keywords:
Pistachio,saline soils, Soil alteration, Sirjan - Zeydabad plain.

ABSTRACT

Zeydabad plain is located in the west of Kerman Province which is considered as the main areas for pistachio cultivation and production in Kerman and Iran.. The recent study aims to investigate the cause of formation, classification and properties of saline soils in Zeydabad plain. For this purpose, a transect perpendicular to the field was selected from the east of Zeydabad adjacent to west of the plain; its coordinates: 29° 33´ 277 N, 55° 28´ 164E (Pedon,1) & 29° 34´ 081N, 55° 37´ 837E (Pedon,12). Then, 12 profiles were described, sampled and analyzed in physiographies under pistachio cultivation. Accordinge to soil taxonomy On surface, Ochric epipedon and diagnostic horizons of Salic, Cambic and Gypsic on subsurface were separated. Studied profiles are classified in Aridisols and Entisols orders from east to west. Furthermore, the salinity and alkalinity of the soils increase on topsoils and subsoil from east to west and change severely. Generally, accumulation of salts in soils will be affected by several factors such as local geological structure, saline sediment horizontal transfer by water from upper to lower lands, vertical transfer from above to beneath, high level of ground water mainly in low lands, and saline sediment transfer through wind and irrigating orchards with saline waters.Salinity and sodium absorption ratio (SAR) are considered as the main parameters resulting in the reduction of pistachio production. Further studies and consistency of information, appropriate improvement of soil salinity and alkalinity are recommended.

To Cite This Article: Ali Zeinadini Meymand, Mohammad Hassan Masihabadi, Mehrdad Esfandiari., The study of Formation, Alteration and classification of Saline Soils under Pistachio Cultivation in Zeydabad plain, Kerman Province of iran. ***Adv. Environ. Biol., 8(12),*** *120-123, 2014*

INTRODUCTION

Zeydabad plain is one of the major areas in pistachio production of Kerman province where includes various soils, variable salinity and alkalinity which are in excess and limiting in most regions [14]. Different soils include different physicochemical parameters. Identifying various properties and investigating capabilities and limitations will be the first step in scientific planning and sustainable exploitation. [10]. Horticultural plants are economically, socially and vocationally important in the country [13]. Among them, pistachio is an exception as Iran has the first place in production and cultivation area for pistachio, internationally [5]. some pistachio orchards have many limitations which make them scientifically and economically unjustifiable [13].

Naghavi [11] studied the reasons of soil formation and change in pistachio cultivation of Rafsanjan County. In this research, some parameters are presented including sodium absorption ratio (SAR), soil salinity, gypsum growth decrease, and pistachio yield.

Abdolazimi [1] investigated the cause of pistachio cultivation soil salinity in Anar County. For this purpose, diagnostic horizons of Salic and Gypsic in studied pedons were separated. growth and yield of pistachio are affected by some factors such as salinity, sodicity, soil texture, fertility conditions and gypsum.

Salehi *et al*, [15] have also examined the effects of cultivation soils on pistachio growth and yield. Results showed that high salinity and clay content have significantly decreased pistachio yield. Shahrirarpour *et al*, [16] in their studies involving the effects of salinity and phosphor on the growth and combination of long Iranian pistachio saplings showed that high level of salinity reduces growth while phosphor high amount increases the growth of sapling. Likewise, phosphor and salinity together have decreased the growth while high level of salinity increased proline.

Corresponding Author: Ali Zeinadini Meymand, Ph.D student, Department of Soil Science, Science and Research Branch, Islamic Azad University (IAU), Tehran, Iran.
Tel: +989359259968; E-mail: ali_zeinadin@yahoo.com

According to the studies by Ebrahimi [4], Rezaiinejad [14], and Golzari [7] on pistachio cultivation soils in Kerman Province, they showed that salinity is one of the major factors resulting in reducing pistachio growth and yield, and Salic horizon is separated in physiographies of flood plains, low lands and playa.

MATERIAL AND METHODS

2.1. Study Area:

Zeydabad plain is located in west of Kerman Province and south east of Iran. The average altitude is about 1700 meters. Interestingly, more than 10000 hectare of the plain lands is used for pistachio cultivation [9]. Average annual rainfall is estimated 141.5 mm and average annual temperature is 17.3° Celsius [14]. In this area, soil moisture regime is Aridic and soil temperature regime is Thermic [2].

The major geological formation of the studied area includes: sand dunes, clay (agricultural plains), salt mixture, gypsum and clay, young terraces and alluvial fans which constitute the major part of geological formations of area belonging to igneous and metamorphic facies [7].

2-2. Methodology:

In this study an east-west transect 12 pedons were selected, sampled, analyzed and studied in each Physiography [5]. The soils of the selected feracious pistachio orchards were in different conditions. Excavated soil samples were tested through physical and chemical soil examinations such as EC, pH, Gypsum, Lime, Texture, Anions, Cations, N, P and K, then SAR was calculated [12]. Then, studied soils were classified in accordance with soil taxonomy to family level classification [17]. Finally, major properties of the soils such as the cause of formation, alteration and their classification, deep transformations and physical and chemical properties were also examined along transect. Furthermore, main inhibiting factors of pistachio production were determined in saline soils based on which managing strategies were presented for usage improvement of soil resources. Figure (1) presents schematic imagery of transect as well as some data on studied areas. Table (1) indicates physical and chemical soil analysis of selected profiles.

RESULTS AND DISCUSSIONS

According to the studies conducted on pistachio cultivation soils in Kerman province, it is shown that such soils classified in Aridisols and Entisols order level and contain Salic and Gypsic diagnostic horizons based on soil taxonomy [14,11].

Studied profiles from east to the west of the plain in Physiographies of gravelly collu- alluvial fans, piedmont plains, flood plains, and low lands. The plain slope decreases from east to west while parent materials are transferred and sedimented from upper lands and around (east, pedon 1) to the center and west of the plain (pedon 12). Sedimentation occurred from coarse to fine grains, respectively, based on the total slope and transfer power, as the finest sediments and heavy soil textures can be seen sedimented on lowlands.

Soils formed in Zeydabad plain are mostly affected by parent materials as soils in arid and semi arid areas [3]. Generally, natural alteration rate of soil is low in this area. In addition to parent materials with maximum effects on the soil formation and alteration, other soil forming factors are climate, topography, human beings and time.

Studying the profiles indicated that gravelly collu-alluvial fans lack diagnostic horizon. Effective factors on soil lack of alteration are soil erosion and sedimentation, relative high steep, excessive gravels, light soil texture, poor vegetation, and insufficient time for soil forming process.

In the studies, four profiles studied along piedmont plains. Although, comparing to upper lands, there is less slope, more salinity and alkalinity, heavier soil texture, lower amount of gravel, and better conditions for pistachio cultivation and production. Profiles 5 and 6 has blocky and subangular blocky structure. Based on structure formation, diagnostic horizon of cambic subsoil forms and thus, classification into Aridisols order and Cambids suborder. Principally, soil properties are in the best conditions for pistachio cultivation in this physiography and the highest yield of pistachio in surface unit belongs to the orchards in this area. During three recent decades, excessive pistachio cultivation in this plain resulted in soils salinity, specifically in the west of this transect. Effects of increased soil salinity are evident in profiles 5 and 6.

Accordingly, the decreased slope from east to west along the transect, saline groundwater [9], physical soil properties, evaporation, and specifically saline parent materials provides the required conditions for Salic horizon formation.

Four profiles are excavated and analyzed on flood plains. Salts accumulation affected by factors such as parent materials (gypsum, salt, calcareous marls), gypsum transfer from topsoil to subsoil, decreased slope (water transfer from upper to lower lands) and sedimentation by wind results in Salic horizon formation. In this area, increased salinity decreases pistachio yield. however, Profiles 8 to 12 containing both Salic and Gypsic horizons are observed. Gypsic and Salic horizons are both formed on subsoils as a result of some factors such as

high groundwater level in the past, parent materials, irrigation water with excessive saline waters after pistachio cultivation and slight slope. Pistachio yield has been decreased significantly on cultivation lands in this area. Based on soil taxonomy, profile 7 classified into Aridisols order and Gypsids suborder while profiles 8 to 10 are classified as Aridisols and Salids.

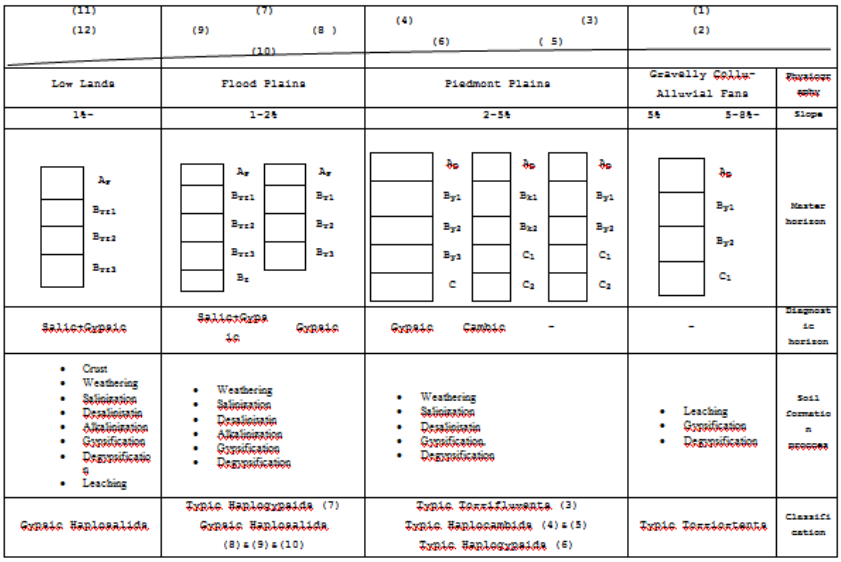

Fig. 1: schematic imagery of transect and some data on studied areas.

Table 1: physical and chemical soil properties of studied profiles.

Ava. K	Ava. P	texture	C	Si	Sa	OC %	Lime %	Gypsum %	SAR	PH	ECe	depth	horizon	profile	physiography
mg kg^{-1}			%							(paste)	dS m^{-1}	(cm)			
220	9.5	Sa.L	6	18	76	0.2	14.1	0.0	4.1	7.9	5	0-20	A_p	2	Gravelly collu-alluvial fans
210	8.3	Sa.L	12	28	60	0.09	13.5	0.5	4.5	7.5	5.65	20-50	B_{y1}		
205	6.0	Sa.L	12	26	62	0.05	13.2	0.3	4.45	7.45	5.90	50-85	B_{y2}		
210	6.5	L	16	29	55	0.65	14.8	0.0	5.2	7.4	7.1	85-115	C		
290	16.5	L	20	25	55	0.65	27.5	0.0	4.8	7.8	1.9	0-25	A_p	4	Piedmont plains
240	14.1	C.L	28	27	45	0.4	29.0	0.65	7.5	7.9	3.1	25-65	B_{yw1}		
255	12.5	C.L	30	27	43	0.25	25.5	2.2	12.6	7.6	6.7	65-97	B_{yw2}		
220	13.6	Sa.C.L	22	28	50	0.25	24.2	1.8	16.3	7.75	8.3	97-130	B_y		
400	36	C.L	27	42	31	0.95	26.5	0.5	24.2	7.5	25.1	0-20	A_p	8	Flood plains
295	24	C.L	30	35	35	0.4	39.0	4.9	35.6	7.7	33.5	20-48	B_{yz1}		
250	17	L	20	35	45	0.25	31.5	12.5	48.7	7.45	55.2	48-75	B_{yz2}		
275	14	C.L	28	32	40	0.09	33.2	11.2	37.2	7.4	41.7	75-105	B_{yz3}		
255	13	L	25	38	37	0.2	24	10.4	36.8	7.55	39.1	105-140	B_{yz4}		
290	19.5	Sa.C.L	22	23	55	0.31	35.7	10.6	53.5	7.9	51.5	0-30	A_{pyz}	11	Low lands
285	16.3	C.L	28	28	44	0.3	32	21.2	38.1	7.8	33.1	30-65	B_{yz1}		
280	14.1	Sa.C.L	21	25	54	0.11	31.5	23.5	47.2	7.79	30.5	65-90	B_{yz2}		
240	14.0	C.L	30	29	41	0.09	30.0	4.1	76.5	8.1	50.6	90-115	B_{yz3}		
225	9.5	C.L	30	30	40	0.05	33.1	2.2	110	8.2	71.2	115-140	B_{yz4}		

Low lands are located at the extreme of the studied transect (west area) adjacent to salt lake in Kheyrabad. Salic and Gypsic horizons have both formed in each profile as a result of high level of groundwater in the past, gentle slope and water supply from upper lands, inappropriate quality of irrigation water as well as heavy soil texture.

Flood plains and low lands are considered as the area drainers. Thus, receiving more water and also groundwater level rises regarding physical properties of lower levels.

Generally, the major soil formation processes in studied profiles are crust, gypsification, desalinization, salinization, degypsification, solonization, and solodinization.

irrigation water quality and studied pedon locations, has various effects on the soils and pistachio yield. In the east of studied transect, irrigating with relative appropriate water has lead to the decrease of salinity and their low accumulation over subsoil. However, irrigation water quality and the slope decreases from east to west, while in the past, groundwater level was higher in the west of transect. Agricultural activities have lead to the accumulation of salts on these lands. Agricultural activities seem to result in soil washing and improvement across the physiography of slope plains and in the east of profiles located in flood plains; however, regarding change procedures and poor quality of irrigation waters, agriculture leads to salts accumulation and increase of sodium absorption ratio as well as other cations and anions. Therefore, during three recent decades, ambivalent effects of human beings agricultural activities have been seen on the alteration of pistachio cultivation soils.

3. Conclusion:

The following issues are recommended by the present study in order to exploit soil resources of pistachio orchards:

- Providing exact soil map of pistachio cultivation soils and sustainability of the data during specified time periods;
- Providing local soil map specifically in saline areas and investigating their change procedure across the entire area;
- Applying appropriate management regarding scarcity of soil resources such as salinity, gypsum, severe poor organic materials;
- Training exploiters in executing improvement and producing under specific conditions such as saline and sodic soils.

REFERENCES

[1] Abdolazimi, H., 2003. Causes of soil salinization in Anar plain. M.Sc. Thesis, Islamic Azad University, Tehran, Iran.
[2] Banaii, M.H., 1978. Soil moisture and temperature regime map of Iran. Soil Res. Institute of Iran. Ministry of Agriculture
[3] Buol, S.W., F.D. Hole and R.J. McCraken, 2003. Soil genesis and classification, Iowa State University Press, Ames.
[4] Ebrahimi, F., 2009. Influence of irrigation water on physical and chemical properties of Robat- shahre babak with different cultivation period. M.Sc. Thesis, Chamran University, Ahvaz, Iran.
[5] FAO, 1991. Guidelines for soil description, 70.
[6] Food and Agricultural organization of the United Nations. Data web. Accessed November (2010) Available at http://Faostat.Fao.org/fao stat/subset= agriculture.
[7] Golzari. l., 2012. effect of irrigation water with different quality on properties and taxonomy of soil and yield of pistachio in sirjan area. M.Sc. Thesis, fars science and research branch, Islamic azad University.
[8] Management of water compony, Kerman province, 2011. study of groundwater condition in Sirjan plain, pp: 77.
[9] Management Planning Kerman province, 2011. Statistical Yearbook of Kerman province. Department of Statistics and Information, Management and Planning Organization of Kerman province, pp: 699.
[10] Mohamadi, J., 2006. Pedometery 1 (classical statistics). Pelk press, Tehran,iran.
[11] Naghavi, H., 1996. Study of physical & chemical Characterization and soil formation and development of pistachio in Rafsanjan. M.Sc. Thesis, Esfahan University of Technology, Iran.
[12] Olsen, S.R., 1980. Methods of Soil Analysis . Journal of Soil Science. Part 2. 403-430.
[13] iranian Pistachio Research Institute, 2010. Comprehensive program of the average height plan of pistachio production in Kerman province.
[14] Rezaiinejad, R., 2011. Investigation of soils charasterictics evalution in Sirjan plain (Kerman province) due to land use change. M.Sc. Thesis, Shiraz University, Iran.
[15] Salehi, M.H., M. Heydari, M. Mohammadkhani and J. Hosseinifard, 2009. effect of soil properties on groth and yield of pistachio. Iranian J. Soil Research (Soil and water Sci). 23: 1.
[16] Shahriarpour, R., A. Tajabadipour and V. Mozaffari, 2011. Effect of Salinity and soil phosphorous on Growth and chemical composition of pistachio seedling. Communication in soil science and plant Analysis, 42.
[17] Soil survey staff, 2010. Keys to soil Taxonomy USDA-NRCS, pp: 327.
[18] Tedeschi, R., 2005. Effect of irrigation with saline water at different concentrations, on soil physical and chemical characteristics. Agricultural Water Management, 77: 308-322.