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Seasonal Nutrients Concentration in the Soil of Several Agricultural Fields in Baghdad City.

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Abstract: *The current study investigates nutrient concentration (Sodium (Na+), Magnesium (Mg+2), Phosphorus (P), Potassium (K+), Calcium (Ca+2) and Nitrogen (N)), for soil in three different agricultural fields (AL-Musafer village (site 1), AL-Autaifiyah (site 2) and AL-Huriyah (site 3)) with three replicates of each sample were taken during four seasons from October 2016 to June 2017 and a control sample in Baghdad City in Iraq. The highest mean values of Na+ ranged from 2720.7 to 5086.9 ppm, Mg+2 values ranged from 24752.0 to 33686.0 ppm. The values of P ranged from 580.2 to 2459.3 ppm, means value of K+ ranged from 5362.7 to 7032.7 ppm. For Ca content, the values ranged from 111738.0 to 124476.2 ppm. The highest and lowest means value for N was found in site 1 which ranged from 0.02 % to 0.1 % in spring. The results compared with an optimum limits and showed that Na+, K+ and Ca+2 level were adequate for plant growth, while the Mg+2 and P level were elevated, and the level of N was low.*

Keywords: *Agricultural fields, Nitrogen, Nutrient, Phosphorus, Plant grow*

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I. Introduction

Satisfactory crop growth and production is dependent on appropriate nutrition, nutrient deficiency in soil effect the normal growth of plants. Nitrogen (N), Phosphorus (P), Potassium (K^+), Calcium (Ca^{+2}) and Magnesium (Mg^{+2}) are essential nutrient elements because nearly all plants use them for growth and development. Nitrogen occupies the first plant requirement among these nutrient elements, followed by phosphorus and potassium [1].**Potassium** is one of the important essential nutrients for the development and growth of the plant and plays an important role in different physiological processes of plants [2]. It helps plant to resist disease and drought, also helps fruit to improve its size, flavor and texture [3]. Potassium also possesses many different functions like cell expansion process managing, nutrient movement and translocation [4], and stomata behavior[5].**Sodium** content is very important factor which affect soil quality and plant growth[6]. High level of sodium (Na^+) did not cause toxic hazard, but it has a dispersed effect on agriculture soils therefore reduction of soil permeability and soil aeration. It can cause separation of clay particles from each other; these separated particles will plug soil pores resulting in variation of soil permeability, and this effect is more serious in fine textured soils than in coarse textured[7].

Magnesium is a water soluble cation play an important role in plants which it is necessary for the synthesis of chlorophyll pigment in green plants and its deficiency causes the loss of healthy green colour of leaves [8].**Calcium** ion act as soil crust, structure and quality improver and also reduces soil salinity, erosion and phosphorous loss. However, its improved root and leaf development. Ca^{+2} reduce disease in most plants at optimum level. **Phosphorus** is a most important element which present in every livingcell [9]. It is very important to agriculture; the growth of cultivated and uncultivated plants is depended on the availability of P in the soils [10], andP compounds are used as fertilizers. P in plant plays vital roles in being the constituent of DNA, RNA, and ATP [11].

Nitrogen and nitrate are the most important and critical element in an ecosystem[12]. Nitrate in soil came from fertilizers which containing inorganic nitrogen and wastes containing organic nitrogen, they decomposed to give ammonia, and then oxidized to nitrite and nitrate. Plants taken up the nitrate during their growth and used in the synthesis of organic nitrogenous compounds, excessive nitrate directly moves with the groundwater[13]. Also nitrogen is essential for plants because of its function in the produce of chlorophyll and its part of various enzymatic proteins which regulate and catalyze plant-growth processes [14]. Plantsobtained Nitrogen from the soil and it is the most limiting factor in crop production [15],so the farmers had to increase the amount of N fertilizers to give better crop yield, but the high N supply in leafy vegetable crops becoming hazardous to human health due to its role in the development of several human diseases such as methahemoglobinaemia, gastric and bladder cancer [16]. The pale green color of N-deficient in plants is the most common deficiency symptom exhibited by growing plants [17]. There were many studies investigates nutrient concentration in soil such as Jodral-Segado*et al.,* in Spain[18], Khan *et al.*, in Pakistan[19], Raman and Sathiyanarayanan in India[20],Rana*et al.* in India[21], Silvanu*et al.,* in Kenya[22],Rahman*et al.,*in Bangladesh[23],Hossain*et al.,* in Bangladesh[24], Khadka*et al.,*in Nepal[25], Balland*et al.,* in France[26] andUmeri*et al.,* in Nigeria[27]. This study design to determine nutrient concentration in agriculture soil which it effect plant growth and development.

II. Material and methods

2.1 Sampling

The current study was designed to examine soil from from different three agricultural fields (AL-Musafer village (site 1), AL-Autaifiyah (site 2) and AL-Huriyah (site 3)) in Baghdad city during the study period from October 2016 to June 2017, 3 replicates from each site and a control sample. Fields location: AL-Musafer village located in south of Baghdad city (N 33°10.533', E 044°20.750').AL-Autaifiyah region located in the center of Baghdad city (N 33°20.961', E 044°21.916').AL-Huriyah region located in west of Baghdad city (N 33°20.548', E 044°19.416').The soil samples were collected in polyethylene bags for chemical analyses [28].

2.2 Nutrient Analyses

Soil samples which collected from the surface (0-10 cm) were cleaned by removing roots and rocked particles, then oven dried at 75°C, grind by mortar, sieved by 212 µm sieve to get fine particles and take 3 gram of it, analyzed by X-ray fluorescent technique to estimate Na^{+}, Mg^{+2}, P, K^{+} and Ca^{+2} level in the soil [29]. For Total Nitrogen (N),it was determined according to Kjeldahl procedure[30]. 1 gm. of dried soil was taken in clean conical flasks; wet digestion (A sample is mixed with a proportional amount of a concentrated sulfuric acid) was done. The resulting mixture is heated until it clarifies. The solution transferred to Kjeldahl tubes. Adding Boric acid to a conical flask and placed it under the condenser of the distillation apparatus in a way that the end of the condenser dips into the solution. Sodium hydroxide was added to the funnel of the apparatus and run slowly into the distillation chamber, the solution then titrated with hydrochloric acid.

III. Results And Discussion

3.1 Sodium (Na^{+})

The current study has found that Na^{+} concentration in control sample was higher than all other site in which was 15997.7ppm. However, site 1 gave the highest mean values during all seasons than those of other sites where it varied from 4092.0 ppm to 5086.9 ppm in winter and summer, respectively (table 1 and Figure1). Sodium is a soluble cation, excessive sodium levels can occur naturally or result from irrigation with high-sodium water, its affect soil quality and plant growth [6]. Sodium ions range in agricultural soilis 750-7500 ppm [31]. All values in this study are within that level. Current study disagreed with Khan *et al.*, in Pakistan (the highest value 735ppm)[19] and Raman and Sathiyanarayanan in India (150 ppm to 2050 ppm)[20] in which they recorded values lower than this study.

3.2Magnesium (Mg^{+2})

The highest and lowest Mg^{+2}mean values of current study was found in site 1, itwas ranged from 24752.0 ppm to 33686.0 ppm in spring and winter, respectively. All values were higher than control value with 10332 ppm (table 1 and Figure 2).Magnesium is a water-soluble cation and it is necessaryfor the synthesis of chlorophyll pigment in green plants [32], the higher mean in winter may be due to decreased plant growth in winter because of low day period, and then in spring and summer plant growth will increased and Mg^{+2}uptake increased leading to lower level in soil. Magnesium range in agricultural soilis 20-10000 ppm [31], all values in current study are above the acceptable value, and that may result from high Mg level in irrigation water. Results recorded in current study were much higher than Jodral-Segado*et al.*, in Spain (the mean 14.23 ppm)[18] and this may be return to geological nature of Iraqi soil.

3.3 Phosphor (P)

Results recorded found that site 2 has the highest mean values among all seasons and the highest mean value was 2459.3 ppm during summer, and the lowest value was 580.2 ppm in site 3 during spring, control sample value was 747.2 ppm (table 1 Figure 3).According to FAO, a soils available phosphor value is more than 10 ppm which is considered suitable for crop production [33] All means value in current study was much higher than the recommended value. The elevated means in site 2 among other sites may be due to the agricultural activities and fertilizer adding which may be different between studied sites, while the high means during summer in all studied sites may be because of increased fertilizer application for plant requirements. Means value in current study was higher than Umeri*et al.,* in Nigeria which recorded values ranged from 35.2 to 50.1ppm[27].

3.4 Potassium (K^+)

Mean values of K^+ recorded in this study showed that site 2 also had the highest means during study period (table 1, Figure4). The values ranged from 6309.9 ppm in spring to 7032.7 ppm in winter. While Site 1 showed the lowest mean values in all seasons (from 5362.7 ppm in summer to 5594.0 ppm in autumn, control sample value (3501.8 ppm) was lowest than studied sites.Potassium range in agricultural soilis 400-30000 ppm [31],all values in current study are within this level. Appropriate value of K^+ in the soil may be come from the decomposition of the minerals containing potassium and soil type [34]. High values in site 2 may be affected with the K^+ value in irrigation water and the elevated means value in autumn and winter among other seasons may be related with plant uptake for growth because it is important nutrient for plant growth, and its increased level in spring and summer could be resulted in decreased its value in in soil during these seasons. Current study recorded values higher than Raman and Sathiyanarayanan[20]which recorded values ranged from 100 to 586 ppm and Rana*et al.* in India (0.707 ppm)[21].

3.5 Calcium (Ca^{+2})

Calcium content in this study was different among sites, site 3 has the highest mean values during the study period except in summer which recorded higher means in site 1, the highest mean value was found in spring (124476.2 ppm). While site 2 had the lowest mean values during the study period and the lowest value was 111738.0 ppm at spring. However, control sample recorded higher value than all studied sites with 172714.2 ppm (table 1, Figure5).Calcium range in agricultural soilis 7000-500000 ppm [31], mean calcium level in studied sites was within the sufficient level. Calcium isan important nutrient for cell division in plants [25]. Its value in growing season related with plant uptake. Ca^{2+} source in soil may be the dissolution of carbonate minerals [35]. The results of current study disagreed with Silvanu*et al.*, in Kenya (the mean 720.00 ppm)[22] and Khan *et al.*, in Pakistan (the higher value 1420 ppm)[19]. The differences may be results from different soil components.

3.6 Nitrogen (N)

Results recorded in current study showed differences among the studied sites and seasons, the highest and lowest mean values were found in site 1 which ranged from 0.02 % in autumn and winter to 0.1 % in spring. While site 2 has highest values among the other sites (except in spring), and the mean values ranged from 0.04 % in autumn to 0.1 % in spring, control sample did not had N value (table 1, Figure6).The decomposition of organic matterwhich increased during spring and summer and application of some commercial nitrogen fertilizers is the most common sources of nitrogen in soil, nitrogen is important for plant growth but excessive nitrogen can have an adverse effect on crops. Total nitrogen analysis measures N in all organic and inorganic forms.Optimum limit of percentage of total nitrogen (N) is 0.180 - 0.450% according to [36]. The results in current study is lower than the optimum limit, so all sites considered as low fertile and farmers need to use different organic and inorganic fertilizers. Current study agreed with Rahman*et al.*,[23] and Hossain*et al.*, [24]in Bangladesh and Khadka*et al.*, in Nepal (the mean 0.08%)[25], while its disagreed with Balland*et al.*, in France in which they recorded values higher than this study[26].

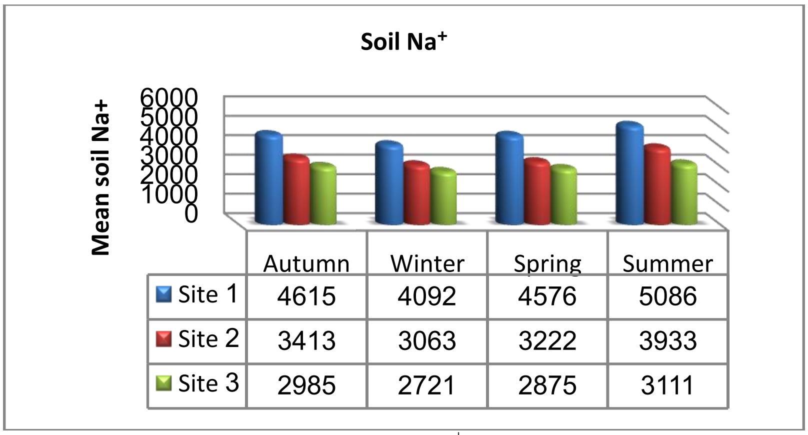
IV. Figures And Tables

Table 1: Mean value ± SD of soil Na^+, Mg^{+2}, P, K^+, Ca^{+2} and N and control.

Variable	Season	Mean ± SD			
		Control	Site 1	Site 2	Site 3
Na^+ ppm	Autumn	15997.7±124.2	4615.1 ± 372.3	3412.5 ± 148.7	2984.7 ± 247.9
	Winter		4092.0 ± 269.6	3062.9 ± 147.4	2720.7 ± 212.7
	Spring		4576.0 ± 685.2	3221.8 ± 206.0	2874.7 ± 306.4
	Summer		5086.9 ± 941.9	3933.1 ± 953.4	3110.6 ± 907.0

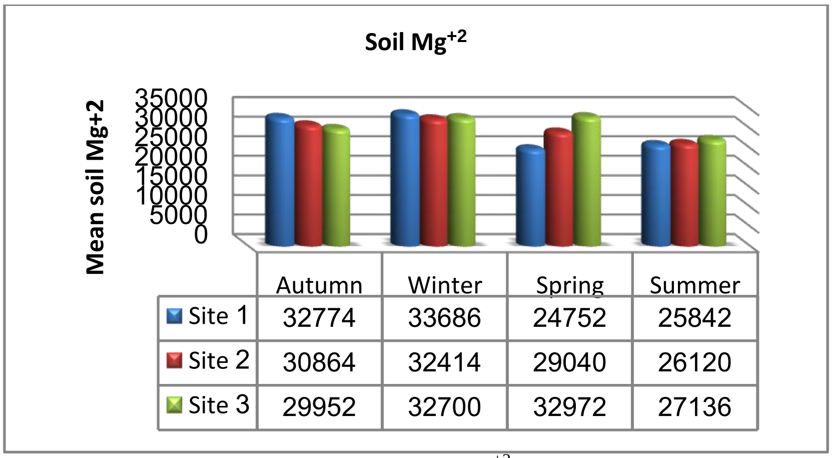
Mg^{+2} ppm	**Autumn**	10332±562.8	32774.0 ± 915.1	30864.0 ± 1293.9	29952.0 ± 1485.5
	Winter		33686.0 ± 736.8	32414.0 ± 776.1	32700.0 ± 562.9
	Spring		24752.0 ± 11309.1	29040.0± 921.3	32972.0 ± 637.0
	Summer		25842.0 ± 10156.4	26120.0 ± 10388.3	27136.7 ± 11138.2
P ppm	**Autumn**	747.2 ± 52.2	913.9 ± 97.8	1726.8 ± 178.8	686.8 ±112.0
	Winter		704.3 ± 51.6	1685.6 ± 50.5	587.5 ± 77.3
	Spring		826.0 ± 267.9	1816.1 ± 126.0	580.2 ± 25.2
	Summer		1064.0 ± 148.6	2459.3 ± 213.9	820.3 ± 247.1
K^{+} ppm	**Autumn**	3501.8 ±162.5	5594.0 ± 128.2	7018.4± 7.8	5675.2± 202.1
	Winter		5532.0 ± 22.5	7032.7 ± 173.3	5711.0. ± 53.8
	Spring		5503.1 ± 223.6	6309.9 ± 49.2	5852.8 ± 47.6
	Summer		5362.7 ± 192.8	6976.3 ± 522.5	6040.1 ± 374.9
Ca^{+2} ppm	**Autumn**	172714.2±1162.4	120547.6 ±3252.6	116952.1 ± 1512.4	123904.8±1782.7
	Winter		118738.1 ±774.4	116500.0 ± 2282.0	122642.9 ±2236.8
	Spring		118642.8 ±2071.0	111738.0 ± 623.6	124476.2 ±885.1
	Summer		120642.8 ±2876.8	116428.5 ± 518.4	118452.3 ±4118.3
N %	**Autumn**	0.0±0.0	0.020 ±0.0	0.04 ± 0.01	0.02 ±0.0
	Winter		0.020 ±0.0	0.08 ± 0.02	0.05 ±0.0
	Spring		0.100 ±0.03	0.10 ± 0.005	0.06±0.02
	Summer		0.047 ±0.005	0.09± 0.008	0.05 ±0.017

The values was the mean of three replicates



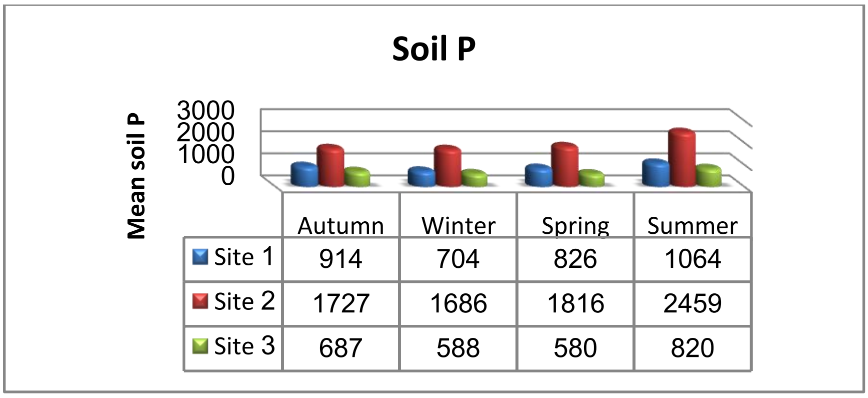
	Autumn	Winter	Spring	Summer
Site 1	4615	4092	4576	5086
Site 2	3413	3063	3222	3933
Site 3	2985	2721	2875	3111

Figure 1 seasonal mean of soil Na^{+} values of the study sites



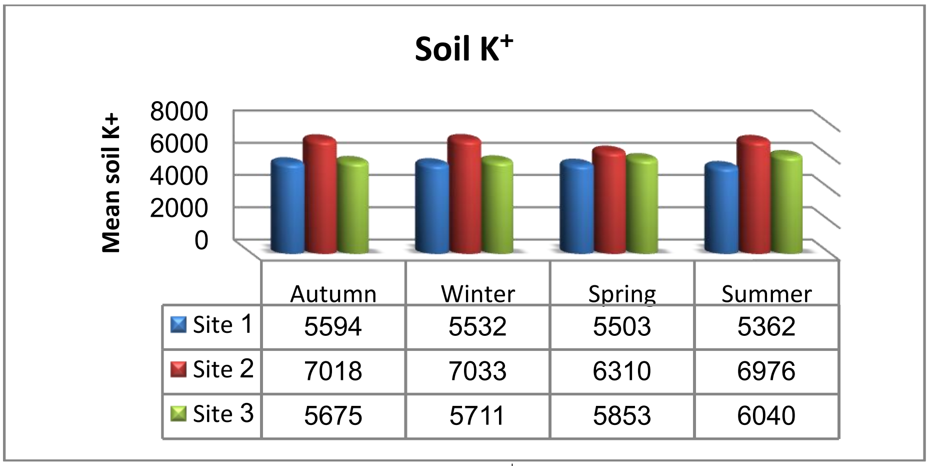
	Autumn	Winter	Spring	Summer
Site 1	32774	33686	24752	25842
Site 2	30864	32414	29040	26120
Site 3	29952	32700	32972	27136

Figure 2 seasonal mean of soil Mg^{+2} values of the study sites



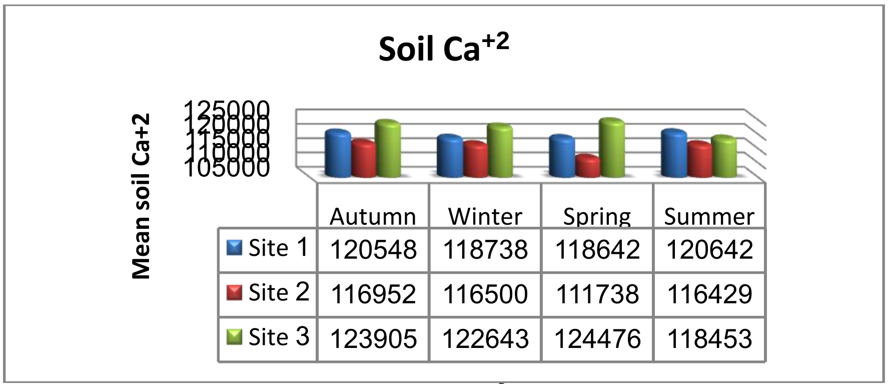
	Autumn	Winter	Spring	Summer
Site 1	914	704	826	1064
Site 2	1727	1686	1816	2459
Site 3	687	588	580	820

Figure 3 seasonal mean of soil P values of the study sites



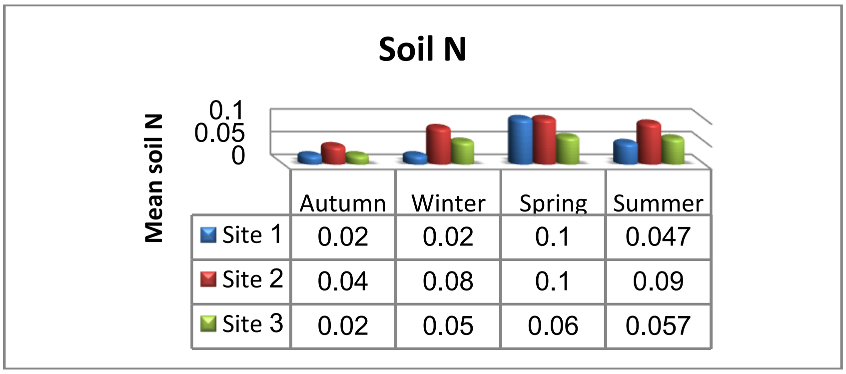
	Autumn	Winter	Spring	Summer
Site 1	5594	5532	5503	5362
Site 2	7018	7033	6310	6976
Site 3	5675	5711	5853	6040

Figure 4 seasonal mean of soil K^+ values of the study sites



	Autumn	Winter	Spring	Summer
Site 1	120548	118738	118642	120642
Site 2	116952	116500	111738	116429
Site 3	123905	122643	124476	118453

Figure 5 seasonal mean of soil Ca^{+2} values of the study sites



	Autumn	Winter	Spring	Summer
Site 1	0.02	0.02	0.1	0.047
Site 2	0.04	0.08	0.1	0.09
Site 3	0.02	0.05	0.06	0.057

Figure 6 seasonal mean of soil N values of the study sites

V. Conclusion

This study design to determine nutrient concentration in agriculture soil which it effect plant growth and development, the results were compared with an optimum limits for nutrients in agricultural soils [31][33], the findings used to determine if the soil contain adequate nutrient concentration for plant growth and development. From the findings of current study, it can be concluded that soil nutrients had recorded adequate Na^+, K^+ and Ca^{+2} mean values, while it is recorded elevated means of Mg^{+2} and P, and low level of N.

References

[1]. Samuel, A.L. and Ebenezer, A.O., Mineralization rates of soil forms of nitrogen, phosphorus, and potassium as affected by organomineral fertilizer in sandy loam. Advances in Agriculture,5.2014.

[2]. Solanki, HA. andChavda, NH., Physicochemical analysis with reference to seasonal changes in soils of Victoria park reserve forest, Bhavnagar (Gujarat). Life sciences Leaflets. 8, 2012, 62-68.

[3]. Buchholz, D.D. and Brown, J.R.,Potassium in Missouri Soils, Published by Uni. of Missouri Extension, guidelines to reprint or copy, 1993.

[4]. Dolan, L. and Davies, J., Cell expansion in roots CurrOpin. *Plant Biol. 7*, 2004, 33–9.

[5]. Dietrich, P., Sanders, D. and Hedrich, R., The role of ion channels in light-dependent stomatal opening *J. Exp. Bot. (52),* 2001, 159–96.
[6]. Pandit, P., Ansari, A. and Kanhare, R.R., Hydrochemistry of ground water in Barwani town (M.P.)An area of South western zone of Narmada river basin; At pre impoundment of SardarSarovar Dam, Proceedings of ICCE, 2005, 511-513.
[7]. NRCS (Natural Resources Conservation Service), Soil sodium testing, In: National Resources Conservation Service, US Department of Agriculture, 2007.
[8]. Mahajan, S. and Billore, D., Assessment of physico-chemical characteristics of the soil of Nagchoon pond Khandwa, MP, India. *Research J. of Chemical Sci., 4(1),* 2014, 26-30.
[9]. Tale, K.S. and Ingole, S., A Review on Role of Physico-Chemical Properties in Soil Quality, *ChemSci Rev Lett., 4(13),* 2015, 57-66.
[10]. Foth, H.D. and Ellis, B.G. *Soil fertility (2nd ed).* LLC., USA: Lewis CRC Press, 290 p, 1997.
[11]. Brown, D. and Weselby, C., NASA-funded research discovers life built with toxic chemical. NASA Feature, posted on NASA December, 2, 2010.
[12]. Chandaluri, S.R., Sreenivasa, R.A.,Hariharann, V.L.N. and Manjula, R., Determination of water quality index of some areas in Guntur district Andhra Pradesh. IJABPT, 1, 2010, 79-86.
[13]. USEPA, Estimated national occurrence and exposure to nitrate and nitrite in public drinking water supplies. Washington, DC, United States Environmental Protection Agency, Office of Drinking Water, 1987.
[14]. Sinfield, J.V.,Fagerman, D. and Colic, O., Evaluation of sensing technologies for on-the-go detection of macro-nutrients in cultivated soils. *Comput.Electron. Agric., 70,* 2010, 1–18.
[15]. Gorde, SP., *Int. J. of Engineering Research and Applications. 3(6),* 2013, 2029-2035.
[16]. Parks, S.E., Irving, D.E. and Milham, P.J., A critical evaluation of on-farm rapid tests for measuring nitrate in leafy vegetables. *Sci. Hort., 134,* 2012, 1-6.
[17]. Thompson, L.M. and Troeh, F.R.*Soils and soil fertility.*McGraw-Hill Pub., New York, USA, 1978.
[18]. Jodral-Segado, A.M., Navarro-Alarcón, M.,López-G De La Serrana, H. and M. C. López-Martínez, M.C., Calcium and Magnesium Levels in Agricultural Soil and Sewage Sludge in an Industrial Area from Southeastern Spain: Relationship with Plant (Saccharumofficinarum) Disposition. *Soil & Sediment Contamination, 15,* 2006, 367–377.
[19]. Khan, Z.I., Ashraf, M., Valeem, E.E., Ahmad, K. and Danish, M., Pasture concentration of minerals in relation to the nutrient requirements of farm livestock. *Pak. J. Bot., 39(6),* 2007, 2183-2191.
[20]. Raman, N. and Sathiyanarayanan, D., Physico-chemical characteristics of soil and influence of cation exchange capacity of soil in and around channel. *Rasayan J. Chem. 2(4), 2009,* 875-885.
[21]. Rana, L.,Dhankhar, R. and Chhikara , S., Soil characteristics affected by long term application of sewage wastewater. *Int. J. Environ. Res., 4(3),* 2010, 513-518.
[22]. Silvanus, S.K., Veronica, N., Hudson, N., Isaac, J. and Fredrick, O., Assessment of mineral deficiencies among grazing areas in UasinGishu County, Kenya. *Inter. J. of Nutrition and Food Sci., 3(2),* 2014, 44-48.
[23]. Rahman, M.A., Hassan, K.M., Alam, M.,Akid, A.S.M. and Riyad, A.S.M., Effects of salinity on land fertility in coastal areas of Bangladesh. *Inter. J. of Renewable Energy and Environ. Engineering, 2(3),* 2014, 174-179.
[24]. Hossain, N., Muhibbullah, M., Ali, K.M.B. and Molla, M.H., Relationship between Soil Salinity and Physico-chemical Properties of Paddy Field Soils of Jhilwanja Union, Cox's Bazar, Bangladesh. *J. of Agri. Sci.; 7(10),*2015.
[25]. Khadka, D., Lamichhane, S., Khan, S., Joshi, S. and Pant, B.B., Assessment of soil fertility status of Agriculture Research Station, Belachapi, Dhanusha, *Nepal. J. of Maize Research and Development, 2(1),* 2016, 43-57.
[26]. Balland-Bolou-Bi, C., et al., Impact of microbial communities from tropical soils on the mobilization of tracemetals during dissolution of cinnabar ore, *J. Environ. Sci. J J. Envi.Sciences. 56,* 2016, 122-130.
[27]. Umeri, C.,Onyemekonwu, R. and Moseri, H., Analysis of Physical and Chemical Properties of Some Selected Soils of Rain Forest Zones of Delta State, Nigeria. *Agri Res & Tech: Open Access J., 5(4),* 2017, 1-5.
[28]. APHA, AWWA *and* WEF., Standard Methods for the examination of Water And Wastewater. 22st ed. Washington, DC: American Public Health Association, American Water Works Association, Water Environment Federation, 2012.
[29]. Al- Derzi, N. and Naji, A.M., Mineralogical and heavy metal Assessment of Iraqi soils from urban and rural areas. *Al-Nahrain Uni. J., 17(2),* 2014, 55-63.
[30]. Labconco, C.A., Guide to Kjeldahl Nitrogen Determination Methods and Apparatus; Labconco Corporation: Houston, TX, USA, 1998.
[31]. Alloway, B.J., Bioavailability of Elements in soil, In: Essential of Medical Geology, impacts of the natural environment on public health, Selinus, O. (ed.), (Elsevier Academic Press, Amsterdam 2005) 347-372.
[32]. Saroj, M. and Dilip, B., Assessment of Physico-Chemical characteristics of the Soil of Nagchoon Pond Khandwa, MP, India.*Res. J. Chem. Sci., 4(1),* 2014, 26-30.
[33]. FAO, A Framwork for Land Evaluation, FAO Bulletin 32, FAO/UNESCO, France, 1976.
[34]. Sharpley, A.N., Relationship between soil potassium forms and mineralogy. *Soil Sci. Society of America J., 53(4),* 1989, 1023.
[35]. Hinsinger, P., Plassard, C., Tang, C. and Jaillard, B., Origins of root-induced pH changes in the rhizosphere and their responses to environmental constraints: A review. *Plant Soil, 248,* 2003, 43–59.
[36]. Chowdhury, M.A., Khairun, Y.,Salequzzaman, M. and Rahman, M.M., Effect of combined shrimp and rice farming on water and soil quality in Bangladesh. *Aquacult. Int., 19(6),* 2011, 1193-1206.

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