Indian Journal of Ecology (2021) 48 Special Issue (15): 000-000

Manuscript Number: 000
NAAS Rating: 5.79

Effect of Cement Plants Emissions West of Iraq on Neighboring Lands Suitability for Wheat and Olive Trees Cultivation

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Abstract: This study carried out for land suitability assessment adjacent to the cement plants located within Anbar province for cultivation of wheat and olive trees. The location of pedons which representative to regions soils were selected at 5000m move away on every directions of Kubasi and Al-Qaim Cement plant. Pedons were described and soils are classified to series level at every location, then lands were assessment according to the standard method - determinants limitation parametric approach. The main limiting factor for the cultivation of wheat crop and olive trees in regions were the soil physical factor and climate is not limited factor. The soil physical condition showed high gypsum content in all locations, while Al-Qaim cement plant lands s showed high carbonate content as major limited to cultivated wheat crop. Lands suitability for olive trees cultivation was unsuitable (N2s) because of higher content of gypsum at first degree, and soil organic matter content in second degree which distinguished for neighboring areas of Kubasi Cement plant. All the lands neighbored to Al-Qaim cement factory showed marginal suitability (S3s) to olive trees cultivation.

Keywords: Anbar province lands, Cement kilns, Emission Cement factories, Land evaluation

Cement is one of the most extensively used construction materials in the world. But the amount of CO_2 which has been produced by calcinations of limestone and combustion of fuels make the cement industry one of the top sources, among manufacturing industries, of carbon dioxide emissions, which is considered the main culprit in climate change (El-Atasi 2013). The development of any country depends on the collection and inventory of natural resource information for use in future planning or solutions related to the country's economy. There have been numerous methods of gathering information, accuracy made the routine methods inefficient, so remote sensing currently in monitoring variations in natural resources. Despite all the advantages, cement manufacturing also generates serious atmospheric pollution and contributes to the deterioration of the air quality by producing hazardous air pollutants. Among released contaminants in atmospheric air by cement manufacturing, various heavy metals are also widely spread in the atmosphere covering up to thousands of kilometers around the emission source and gradually deposited metals are scattered by wind and affect all the components of the environment, air, water, soil and plants (Mehraj and Bhat 2014). Cement emissions have attracted great interests over the years due to their contribution in the environmental contamination (Arfala et al 2018). Hence building industry is one of the leaders in deterioration of environment by depleting resources and consuming energy or creation of waste (Devi et al 2018). Sivakumar and Britto (1995) infer the dust emitted from cement factories often precipitates, causing deterioration in the characteristics of the surrounding plant and change the soil characteristics due to the interaction between its contents, which changed the soil structure, soil PH reaction, CEC and soil exchange bases, which negatively affect in soil fertility. Machin and Navas (2000) recorded a significant decrease in the amount of available nutrients and their solubility in soils exposed to cement dust. Tervahattu et al (2001) observed that Kunda Nordic cement plant in northeastern Estonia produces very high dust of up to 100,000 tons per year which have a negative effect on the health and environment .These emitted substances and high concentrations of Ca^{++}, K^{+}, Mg^{++} and Sulfur compounds and CaO accounted for more than 40% of the dust, while the soil pH of 10-12 Km from the plant was ranged between 7.1 and 7.3. Ade-Ademilua and Umebese (2007) showed that the soil surrounding the cement plants showed an increase in concentrations of Cr, Si, Fe and Ca with low levels of contamination of these elements while moving away from the plant. Fakery and Migahid (2011) observed the high pH of the Egyptian desert soils affected by the dust of the cement factories 8.35 and 8.37 in the south and west sites respectively, compared to the eastern and southern directions, which recorded pH values of 7.01 and 7.06 respectively. Ding et al (2021) used the remote sensing and geographic information systems (GIS) techniques to assess the Abu Ghraib land as a model for the soil in the Iraqi sedimentary plain. The results showed that the TW565 series was moderately suitable for wheat and barley crops and suitable for maize crop and accounted for 9.7% from total study area, while the results showed that the series DP47 was not suitable for maize crop and 35.5% of the total area that formed other series was not suitable for cultivation the three crops. Arfala et al (2018) was analyzed the metallic contents released into the air from cement kilns of Oujda cement plant (Northeast Morocco) and revealed the presence of various Heavy metal. Furthermore, an increase in production output or change in fuel type and usage as well as dust control technology affects the volume and concentration of contaminant released. Therefore, this study was carried out to evaluate the land surrounding cement plants located in western Iraq and its suitability for current use of wheat and olive crops.

MATERIAL AND METHODS

Selection of study sites: In this study two cement plants in Anbar province Kubasi and Al-Qaim plants (K and Q), respectively were selected. The two sites were within the same geological age that are the Triassic Tertiary, the Neogene and entrusted Miocene (Fig. 1)

Meteorology: Drawn wind-rose shows the frequency of wind direction and speed in the study area (2000- 2019) is 3.0 ± 0.2 m/s and the most frequent wind direction is between 60.2- 62.4%, which blows from 285–350°. The seasonal rank order of average wind speed was in summer (4.00 m/s) >

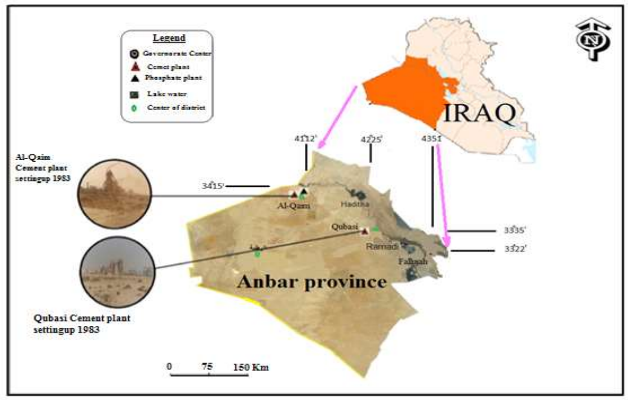

Fig. 1. Cement plants sites administratively within Al- Anbar province

spring (2.80 m/s) > autumn (2.43 m/s) > winter (2.00 m/s). The climate condition of the study area is arid and annual precipitation range is 110.7–129.7 mm. The elevation of this area is about 194.6–297.4 m above sea level at Kubasi, and Al-Qaim respectively.

Field procedures: A survey of the soils of these lands surrounding each plant was conducted in a Free Lance Soil Survey method, depending on the variations of natural and geomorphic sources at each study area, and a study of the variations in soil texture and salinity to a depth of 100 cm which limited by geographic modeling location was determined using GPS technology GARMIN'S GPS 72 personal navigator manufactured in eight pedons sites. Each study site was described according to the Soil Survey Manual (1993). Soil samples were obtained for each diagnostic horizon, and based on the results of the morphological,

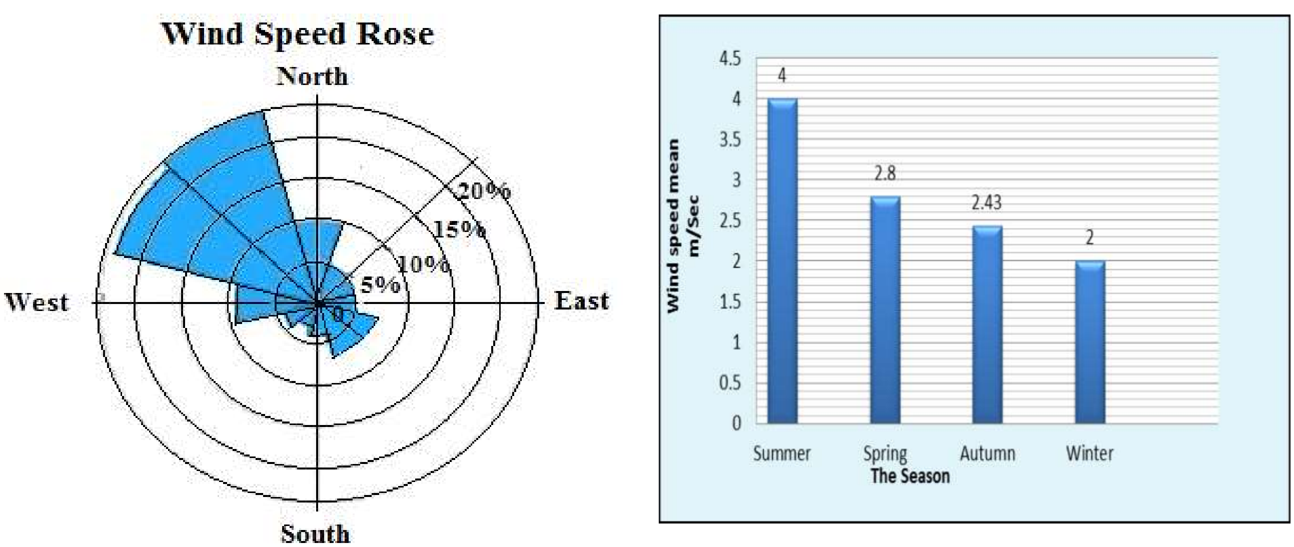

Fig. 2. Wind rose plot and the mean wind speed during the seasons in the studied regions (2000- 2019)

chemical and physical analysis, were classified according to the American classification (Soil Survey Staff 2006). Figures 3 and 4 illustrate pedons sites in all sites studied. The four directions for each plant (north, east, west, and south) symbolize S, W, E, and N, respectively.

Laboratory procedures: The particle size distribution of the soil separators estimated by the pipette method described by Day (1965). The chemical characteristics were estimated according to the methods in Richards (1954). Electrical conductivity was measured in the saturated soil paste extract and soil reaction (pH) measured by the glass pole in the saturated soil paste extract /2. The cation exchange capacity CEC was determined by the displacement method to sodium with the 8.2 degree sodium acetate and replacement of ammonium place of sodium. The base saturation ratio was estimated: Base saturation ratio = 100 x CEC/

Soil total carbonate content was estimated by Alijani and Sarmadian (2014) method and organic matter by Walkely

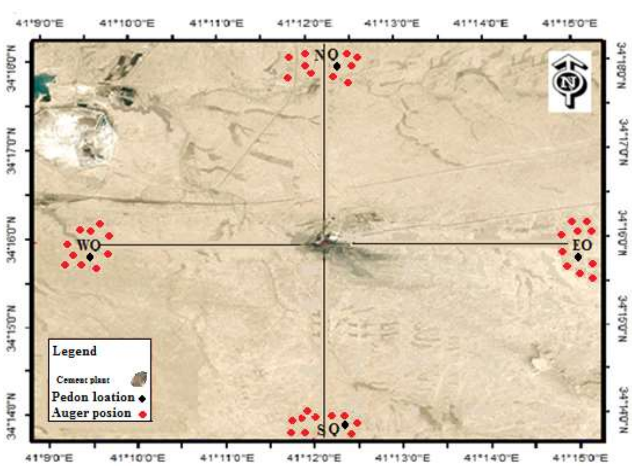

Fig. 3. Aerial photograph of Al-Qaem cement plant showing the modeling sites

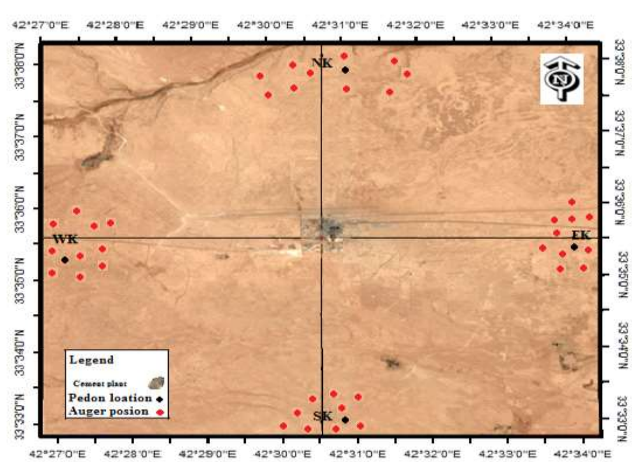

Fig. 4. Aerial photograph of Kubasi Cement plant showing the modeling sites

and Black method in Jackson (1958). The gypsum was determined by sedimentation method (Al-Zubaidi et al 1980), using a mixture of 80% acetone with 20% acetic acid and a few drops of calcium nitrate. The Cation-Exchange Capacity for the clay fraction was estimated according to the Savant (1994) method.

Climate: The climate characteristics which was required for the assessment of land for wheat and olive trees cultivation in irrigation conditions were determined according to the growth period of every crop and the basis of the information which proposed by Sys et al (1993), under the climatic data for Ramadi, Haditha and Al-Qaim for the years 2000 to 2019, obtained from the Ministry of Transport and Communications General Commission for Meteorology and Seismic Monitoring (Table 1).

Assessment and classification of land for cultivation chose crops: It was included the following steps:

- Agro-ecological characteristics, which include all the characteristics surrounding and directly affecting the soil's suitability for the cultivation of the wheat crop and olive trees, which are the characteristics of the soil and the eco-climatological characteristics, which include the characteristics of the climate and the hydrological conditions of the soil as well as the topography. These attributes were assessed by the correlation between the parametric method and the limitation method proposed by Sys et al (1993).
- The land was classified according to its suitability for wheat and olive trees cultivation. The Land index was calculated by multiplying the individual property according to the standard method, and then classified according to the values of the land index proposed by Sys et al (1993) (Table 2).
- The soil characteristics (climatic, soil and topographical characteristics) were matched with those equivalent traits in the table of requirements proposed by Sys et al (1993) and for each selected crops for study.

RESULTS AND DISCUSSION

Characterization and classification soil

Kubasi Cement plant site: It is a desert soil developed from the origin of calcic sandstone material, with moderately coarse texture. The thickness of the B horizon is between 30-46cm, with well internal drainage class and gradient less than 1%. The most important natural vegetation prevailing are *Rumex vesicaria*, *Artemisia scoparia*, *Alhagi maurorum* and *Cutandia Memphitica*. Soil texture varied according to the heterogeneity of the soil separators, as a loam and silt loam in the upper horizon that changed to the sand loam in the lower horizons. Soil structure was moderately fine to medium sub angular blocky. In terms of chemical properties, there was a linear increase in the soil content of carbonate which reached to the highest level (600 gm.Kg^{-1}soil) at the horizon Ck, while the gypsum distribution trend was opposite to this characteristic. The lowers in the soil content from organic matter and the increase in carbonate content horizontal sequence, the Ochric horizon was diagnosed at the surface and the calcic horizon in sub surface horizons. This series in terms of family level classification is: *Coarse loamy; Carbonatic; Superactive; Calcarous; Hyperthermic; Typic Haplocalcids*.

Al- Qaim cement plant site: It is a desert soil with coarse texture and a weak development from calcareous material. The thickness of B horizon between 18-15 cm and affected by wind erosion, which has helped to spread some of the gravel materials on the surface of the soil. The slope in this region not exceed 1%, with moderately internal drainage class. The soil of this series returns to the order of Aridisols and subclass of Calcids and within the great soil group Haplocalcids. Exploited as a pasture with the exploitation of areas for grain cultivation. They are dotted with *Rumex vesicarius*, *Gundelia tournefortii*, *Stipagrostis plumosa* and *Heliotropium bacciferum* and *Polygonum aviculare*. The structure of the soil, which was diagnosed at the Ck horizon, the ratio of total carbonate showed a clear variation in the vertical direction. Its values increased with the depth of the soil to reach 600 gm.Kg^{-1}soil, this was due to the effect of the calcareous parent material of the region's soil. The classification family level for this series and according to the American classification (1994) are: *Coarse loamy; Carbonatic; Superactive; Calcareous; Hypothermic; Typic Haplocalcids.*

Land assessment: Depending on some of the morphological, chemical and physical characteristics of the studied soil, which have a direct impact in the process of assessing the land in terms of suitability for the cultivation of wheat and olive trees Tables (3-6) are:

Morphological and Topographical properties.

Topography: All the studied sites had a gradient less than 1%, and according to the requirements (Sys et al 1993b) for

Table 2. Correlation between the levels of identification and the varieties of suitability and estimation for each levels of determination of Sys (1993)

Equivalent suitability	Rating	Intensity of limitation	Symbol
Suitable (S1)	100-96	NO	0
	95-86	Slight	1
Moderately suitable (S2)	85-61	Moderate	2
Marginally suitable (S3)	60-41	Severe	3
Unsuitable (N1)	40-25	Very severe	4
Unsuitable (N2)	<25	---	----------

Table 1. Maximum and minimum temperatures and monthly and annual averages (C°) at monitoring stations near to study areas for period (2000- 2019)

Month	* Haditha station			Al-Qaim station **		
	Maximum temperature	Minimum temperature	Monthly average	Maximum temperature	Minimum temperature	Monthly average
January	13.9	2.8	8.0	12.9	2.6	7.8
February	16.4	4.5	10.3	16.4	5.0	10.4
March	21.3	7.6	14.0	21.6	8.3	14.8
April	28.3	14.0	21.2	28.0	13.3	20.6
May	35.0	19.1	27.3	33.9	18.3	26.4
June	39.8	22.0	29.9	38.5	22.8	30.9
July	42.8	26.0	33.1	41.2	25.4	33.6
August	42.6	25.7	34.2	40.9	24.6	32.7
September	38.5	21.4	29.8	36.6	20.5	28.5
October	31.7	16.4	23.7	30.6	15.5	23.0
November	22.4	9.2	15.1	22.0	8.1	14.7
December	16.1	5.1	9.8	15.7	4.1	9.3
The annual rate	29.1	14.5	21.4	28.2	14.0	20.1

* The Haditha meteorological station at latitude 33 °04"longitude 42 ° 44", elevation above sea level (108.0 m).
** Al-Qaim meteorological station at latitude 33 ° 2" longitude 42 ° 17", elevation above sea level (297.4 m).
Source: Ministry of Transport and Communications, the Public Authority for meteorological and seismic monitoring, climate department, Unpublished data.

Table 3. Some physical and chemical properties of pedons surrounding Kubasi cement plant site

Pedon poison	Horizon	Depth (cm)	The separate (%)			Texture class	Percentage of stones	Base saturation %	Apparent exchange capacity of cation Cmol(+). Kg^{-1} clay	Total dissolved cations Cmol(+) kg^{-1} soil	Total dissolved anions Cmol(+) kg^{-1} soil	Exchangeable Sodium percentage	Cation exchangeable capacity of soil Cmol(+).kg^{-1} soil	Soil content of (%)			pH	Electrical conductivity $dS.m^{-1}$
			Clay	Silt	Sand									Gypsum	Calcium Carbonate	Organic matter		
NK	A	0-15	4.0	38.0	58.0	SL	3.0	43.1	127.5	16	2.2	7.32	5.1	17.0	39.6	0.7	7.7	1.6
	Bk	15-45	2.0	40.0	58.0	SL	3.0	27.0	240.0	20	1.3	7.37	4.8	21.7	41.2	0.3	7.8	2.0
	Ck	45-80	10.0	34.0	56.0	SL	0.3	77.8	54.0	20	4.2	7.38	5.4	19.7	40.8	Nil	7.9	2.1
EK	A	0-15	6.0	48.0	46.0	SiL	0.1	67.3	86.6	15	3.5	7.32	5.2	20.6	38.8	0.8	7.7	1.6
	Bk	15-45	10.0	36.0	54.0	SL	0.01	75.0	56.0	19	4.2	7.36	5.6	20.1	40.2	0.3	7.7	1.9
	Ck	45-100	4.0	35.0	61.0	SL	0.01	44.0	125.0	22	2.2	7.41	5.0	17.3	41.2	Nil	7.9	2.3
WK	A	0-14	6.0	50.0	44.0	SiL	5.0	71.4	81.6	19	3.5	7.36	4.9	19.8	34.6	0.6	7.6	1.9
	Bk	14-60	10.0	36.0	54.0	SL	2.1	76.9	52.0	23	4.0	7.42	5.2	23.2	39.6	0.2	7.7	2.4
	Ck	60-100	7.0	33.0	60.0	SL	0.001	77.0	68.5	40	3.7	7.64	4.8	17.0	41.6	Nil	7.9	4.3
SK	A	0-15	12.0	36.0	52.0	L	2.1	82.5	52.5	16	٤,٢	7.33	6.3	14.3	35.0	0.6	8.0	1.7
	Bk	15-50	14.0	32.0	54.0	SL	1.0	81.1	37.8	27	4.3	7.45	5.3	21.3	39.5	0.2	7.7	2.7
	Ck	50-80	7.0	33.0	60.0	SL	0.02	75.5	70.0	29	3.7	7.48	4.9	18.9	41.0	Nil	7.9	2.9

Table 4. Some physical and chemical properties of pedons surrounding Al-Qaim cement plant site

Pedon poison	Horizon	Depth (cm)	The separate (%)			Texture class	Percentage of stones	Base saturation %	Apparent exchange capacity of cation Cmol(+). Kg^{-1} clay	Total dissolved cations Cmol(+) kg^{-1} soil	Total dissolved anions Cmol(+) kg^{-1} soil	Exchangeable Sodium percentage	Cation exchangeable capacity of soil Cmol(+).kg^{-1} soil	Soil content of (%)			pH	Electrical conductivity $dS.m^{-1}$
			Clay	Silt	Sand									Gypsum	Calcium Carbonate	Organic matter		
NQ	A	0-15	19.0	25.0	56.0	SCL	6.8	67.7	52.6	15	6.7	7.31	10.0	2.9	51.4	0.7	7.9	1.5
	Bk	15-30	5.0	42.0	53.0	SL	3.0	54.0	100.0	16	2.7	7.33	5.0	2.3	55.9	0.3	7.8	1.7
	Ck	30-95	7.0	37.0	56.0	SL	0.04	71.1	74.2	39	3.7	7.60	5.2	1.6	60.4	Nil	7.9	3.9
EQ	A	0-15	7.0	30.0	63.0	SL	4.8	82.2	64.2	16	3.7	7.32	4.5	3.2	51.1	0.7	7.8	1.6
	Bk	15-30	12.0	32.0	56.0	SL	2.6	66.0	41.6	17	3.3	7.34	5.0	2.1	55.0	0.4	7.8	1.8
	Ck	30-80	10.0	37.0	53.0	SL	0.01	67.3	52.0	25	3.5	7.44	5.2	1.2	60.0	Nil	8.0	2.6
WQ	A	0-14	20.0	30.0	50.0	SCL	5.3	63.7	51.0	37	6.5	7.58	10.2	3.0	55.0	0.6	7.9	3.8
	Bk	14-32	10.0	39.0	51.0	SL	2.2	75.5	53.0	37	4.0	7.60	5.3	2.5	58.0	0.3	7.9	3.9
	Ck	32-95	14.0	33.0	53.0	SL	0.02	71.7	37.8	37	3.8	7.58	5.3	1.2	59.9	Nil	8.0	3.8
SQ	A	0-15	5.0	32.0	63.0	SL	10.0	57.4	94.0	15	2.7	7.32	4.7	2.9	54.5	0..8	7.9	1.6
	Bk	15-33	10.0	33.0	57.0	SL	5.3	80.3	51.0	17	4.1	7.34	5.1	2.7	55.0	0.3	7.9	1.8
	Ck	33-80	7.0	32.0	61.0	SL	0.3	78.7	67.1	29	3.7	7.48	4.7	1.6	59.0	Nil	8.0	3.0

the two crops on which the land was evaluated. Therefore, the gradient is not a limit factor for the cultivation of wheat and olive.

Soil depth: The soil depth ranges between 80 cm and 110 cm, and according to the requirements of both crops, the first depth (80 cm) is very suitable for wheat growing, but this depth was very limited for the cultivation of olive trees, while the depth 110 cm is very suitable for wheat growing, while moderately suitable for planting olive trees.

Napteral drainage L: There was no diagnosis of the presence of molting in the studied areas soils, which means that drainage is well and is not a limit factor for the growth of both crops, noting that all study sites fall within the category Suitable S1.

Soil structure L: It was generally sub angular blocky type and ranged from, moderately to strong classes and between fine to course in size.

Physical and Chemical Properties

Soil texture: The study pedons was sandy loam in most of the sites, and SL is very limit to wheat cultivation (S3), while the class L is the very suitable (S1) for wheat cultivation. As for the olive trees according to its requirement, the prevailing

Table. 7. Assessment of the climatic conditions of Kubasi area for olive cultivation according to the proposal Sys et al (1993)

Climatic condition for olives growing cycle	Value	Degree of limitation	Rating
Mean annual temperature (C)	21.4	1	89
Averge min. temp. of coldest month (C)	4.1	3	60
Climatic index (Ci)		S2	54
Suitability class of climate			
Over all climatic rating			86.0

Table. 8. Assessment of the climatic conditions of Al-Qaim area for olive cultivation according to the proposal Sys et al (1993)

Climatic condition for olives growing cycle	Value	Degree of limitation	Rating
Mean annual temperature (C)	20.1	1	100
Averge min. temp. of coldest month (C)	9.4	2	70
Climatic index (Ci)		S2	70
Suitability class of climate			
Over all climatic rating			94.0

Table. 5. Assessment of the climatic conditions of the Kubasi area for wheat cultivation according to the proposal of Sys et al (1993)

Climatic condition for different development periods with wheat growing cycle	Value	Degree of limitation	Rating
Mean temp. of the growing cycle	13.0	1	88
Mean temp. of the vegetative stage	9.7	0	100
Mean temp. of the flowering stage	14.0	0	100
Mean temp. of the ripening stage	24 -30	1	95
Average daily min combined with average daily Max. Temp. of coldest month (C°)	2.8	0	100
	13.9	0	100
Climatic index (Ci)		S1	83.6
Suitability class of climate			
Over all climatic rating			100

Table. 6. Assessment of the climatic conditions of Al-Qaim area for wheat cultivation according to the proposal Sys et al (1993)

Climatic condition for different development periods with wheat growing cycle	Value	Degree of limitation	Rating
Mean temp. of the growing cycle	23.0	1	88
Mean temp. of the vegetative stage	9.6	0	100
Mean temp. of the flowering stage	14.08	0	100
Mean temp. of the ripening stage	24 -30	1	85
Average daily min combined with average daily Max. Temp. of coldest month (C°)	2.86	0	100
	1329	0	100
Climatic index (Ci)		S12	74.8
Suitability class of climate			
Over all climatic rating			100

Table 9. Evaluation of the lands suitability of Kubasi Cement plant environment for wheat cultivation according to the characteristics of the land

Location	Climate (C)	Coarse fragm (%)	Top (t) slope (%)	Wetness (w) drainage	Physical soil condition (s)				Fertility condition (f)						Salinity ds m^{-1}/ ESP (%)	Land index	Land class
					Texture	Depth (cm)	$CacO_3$ (%)	Gypsum (%)	Apparent CEF cmol (+) kg^{-1} clay	Base saturation (%)	Sum of bases cmol (+) kg^{-1} soil	pH	O.M (%)	Mean			
NK	83.6 1 (83.6)	2.3 1 (95)	<1 0 (100)	Well 0 (100)	SL 3 (60)	80 1 (92.5)	40.6 3 (60)	19.6 3 (40)	147.0 0 (100)	45.2 2 (77.0)	17.6 0 (100)	7.79 1 (91)	0.02 2 (85)	90.6	1.97/7.3 0 (97.6)	9.4	$N2_s$
EK	83.6 1 (83.6)	0.04 0 (100)	<1 0 (100)	Well 0 (100)	SL 3 (60)	100 0 (100)	35.4 2 (72.5)	19.3 3 (40)	86.3 0 (100)	62.8 1 (89.3)	16.6 0 (100)	7.76 1 (91)	0.09 2 (85)	93.1	1.97/7.3 0 (97.6)	13.2	$N2_s$
WK	83.6 1 (83.6)	2.5 1 (95)	<1 0 (100)	Well 0 (100)	SL 3 (60)	100 0 (100)	36.5 2 (72)	21.0 4 (25)	63.2 0 (100)	75.0 1 (93.3)	20.8 0 (100)	7.71 1 (92)	0.11 2 (85)	94.1	2.6/7.4 0 (96.7)	7.8	$N2_s$
SK	83.6 1 (83.6)	1.2 1 (95)	<1 0 (100)	Well 0 (100)	SL 3 (60)	80 1 (92.5)	40.9 3 (59)	18.5 3 (40)	48.7 0 (100)	79.8 1 (95.0)	20.4 0 (100)	7.83 1 (90)	0.14 2 (85)	94.0	2.4/6.6 0 (97.0)	9.5	$N2_s$

Table 10. Evaluation of the lands suitability of Kubasi Cement factory environment for olive cultivation according to the characteristics of the land

Location	Climate (C)	Coarse fragm (%)	Top (t) slope (%)	Wetness (w) drainage	Physical soil condition (s)				Fertility condition (f)						Salinity ds m^{-1}/ ESP (%)	Land index	Land class
					Texture	Depth (cm)	$CacO_3$ (%)	Gypsum (%)	Apparent CEF cmol (+) kg^{-1} clay	Base saturation (%)	Sum of bases cmol (+) kg^{-1} soil	pH	O.M (%)	Mean			
NK	94.0 1 (94)	2.3 0 (95)	<1 0 (100)	Well 0 (100)	SL 3 (60)	80 3 (60)	40.6 0 (100)	19.6 2 (65)	147.0 0 (100)	45.2 2 (70)	17.6 0 (100)	7.79 1 (94.5)	0.02 2 (60)	84.9	1.97/7.3 0 (100)	31.3	$N1_s$
EK	94.0 1 (94)	0.04 0 (100)	<1 0 (100)	Well 0 (100)	SL 3 (60)	100 2 (85)	35.4 0 (100)	19.3 2 (65)	86.3 0 (100)	62.8 1 (90)	16.6 0 (100)	7.76 1 (94.5)	0.09 2 (60)	88.9	1.97/7.3 0 (100)	46.2	$S3_s$
WK	94.0 1 (94)	2.5 0 (100)	<1 0 (100)	Well 0 (100)	SL 3 (60)	100 2 (85)	36.5 0 (100)	21.0 3 (60)	63.2 0 (100)	75.0 1 (94)	20.8 0 (100)	7.71 1 (94.6)	0.11 2 (60)	89.7	2.6/7.4 0 (100)	43.0	$S3_s$
SK	94.0 1 (94)	1.2 0 (100)	<1 0 (100)	Well 0 (100)	SL 3 (60)	80 3 (60)	40.9 0 (100)	18.5 2 (67.5)	48.7 0 (100)	79.8 1 (95)	20.4 0 (100)	7.83 1 (94.5)	0.14 2 (60)	89.9	2.4/6.6 0 (100)	34.3	$N1_s$

Table 11. Evaluation of the lands suitability of Al-Qaim Cement plant environment for wheat cultivation according to the characteristics of the land

Location	Climate (C)	Coarse fragm (%)	Top (t) slope (%)	Wetness (w) drainage	Physical soil condition (s)				Fertility condition (f)						Salinity ds m^{-1}/ ESP (%)	Land index	Land class
					Texture	Depth (cm)	$CacO_3$ (%)	Gypsum (%)	Apparent CEF cmol (+) kg^{-1} clay	Base saturation (%)	Sum of bases cmol (+) kg^{-1} soil	pH	O.M (%)	Mean			
NQ	74.8 2 (74.8)	2.8 1 (95)	<1 0 (100)	Moderately well 1 (95)	SL 3 (60)	95 0 (100)	56.6 3 (43.4)	2.1 0 (100)	73.2 0 (100)	66.1 1 (90.4)	10.0 0 (100)	7.8 1 (91)	0.02 2 (85)	93.3	2.6/7.3 0 (97.2)	15.9	$N2_s$
EQ	74.8 2 (74.8)	2.2 1 (95)	<1 0 (100)	Moderately well 1 (95)	SL 3 (60)	86 1 (92.5)	55.9 3 (44.0)	2.0 0 (100)	53.1 0 (100)	71.8 1 (92.3)	16.4 0 (100)	7.8 1 (91)	0.06 2 (85)	93.7	2.1/7.3 0 (97.5)	5.1	$N2_s$
WQ	74.8 2 (74.8)	2.2 1 (95)	<1 0 (100)	Moderately well 1 (95)	SL 3 (60)	95 0 (100)	57.9 3 (42.0)	2.1 0 (100)	45.7 0 (100)	70.4 1 (91.8)	52.4 0 (100)	7.9 1 (91)	0.08 2 (85)	93.6	3.7/7.6 0 (96.3)	15.3	$N2_s$
SQ	74.8 2 (74.8)	5.0 1 (90)	<1 0 (100)	Moderately well 1 (95)	SL 3 (60)	80 1 (92.5)	56.4 3 (43.6)	1.9 0 (100)	71.2 0 (100)	72.2 1 (92.4)	15.6 0 (100)	7.9 1 (91)	0.08 2 (85)	93.7	2.1/7.3 (97.5)	14.0	$N2_s$

Table 12. Evaluation of the lands suitability of Al-Qaim Cement plant environment for olive cultivation according to the characteristics of the land

Location	Climate (C)	Coarse fragm (%)	Top (t) slope (%)	Wetness (w) drainage	Physical soil condition (s)				Fertility condition (f)						Salinity ds m^{-1}/ ESP (%)	Land index	Land class
					Texture	Depth (cm)	$CacO_3$ (%)	Gypsum (%)	Apparent CEF cmol (+) kg^{-1} clay	Base saturation (%)	Sum of bases cmol (+) kg^{-1} soil	pH	O.M (%)	Mean			
NQ	86.0 1 (86)	2.8 1 (95)	<1 0 (100)	Moderately well 1 (90)	SL 0 (100)	95 0 (100)	56.6 3 (60)	2.1 0 (100)	73.2 0 (100)	66.1 1 (91)	10.0 0 (100)	7.8 1 (94.5)	0.02 2 (60)	89.1	2.6/7.3 0 (100)	41.4	$S3_s$
EQ	86.0 1 (86)	2.2 1 (95)	<1 0 (100)	Moderately well 1 (90)	SL 0 (100)	80 1 (92.5)	55.9 3 (60	2.0 0 (100)	53.1 0 (100)	71.8 1 (95)	16.4 0 (100)	7.8 1 (94.5)	0.06 2 (60)	90.0	2.1/7.3 0 (100)	41.8	$S3_s$
WQ	86.0 1 (86)	2.2 1 (95)	<1 0 (100)	Moderately well 1 (90)	SL 0 (100)	95 0 (100)	57.9 3 (60)	2.1 0 (100)	45.7 0 (100)	70.4 1 (95)	52.4 0 (100)	7.9 1 (94)	0.08 2 (60)	89.8	3.7/7.6 0 (100)	41.7	$S3_s$
SQ	86.0 1 (86)	5.0 1 (90)	<1 0 (100)	Moderately well 1 (90)	SL 0 (100)	80 1 (92.5)	56.4 3 (60)	1.9 0 (100)	71.2 0 (100)	72.2 1 (95)	15.6 0 (100)	7.9 1 (94)	0.08 2 (60)	89.8	2.1/7.3 (100)	41.7	$S3_s$

soils do not constitute a limited factor for cultivated of this crop and falls within the category very suitable for it cultivation.

Calcium carbonate: The ranged between 34.6%, which was registered west of the Kubasi cement plant and 60.4% north of Al-Qaim cement plant (Tables 3 , 4). These are very limited factor to the growth of the wheat crop (S3). For cultivation of olive trees, the soil content of this component was suitable for planting olive trees in all sites were within the suitable (S1) category.

Gypsum: The percentage of this component ranged between 1.2-23.2% and based on the requirements of wheat and olive crop cultivation (Sys et al 1993) is unsuitable (S4) for wheat cultivation, except for the location of Al Qaim Cement plant where it was very suitable for planting this crop, while the average content were within class S2 for planting olive trees in all locations except Al Qaim Cement plant which was within the very suitable category (S1).

Salinity and soil sodic: The comparison of the values recorded for these two parameters with the requirements of wheat and olive crops cultivation, showed that these characteristic were not limited factors to cultivation all sites land of wheat and olive trees.

Characteristics associated with soil fertility: Soils of the study sites was within the category the very suitable for the cultivation of both crops. pH ranged between 7.6- 8.0 and the climate was not a determinant factor for the growth of wheat and olive crops.

Land assessment for identified crop cultivation: The assessment of the surrounding land of the cement the land of all the sites is unsuitable (N2s) for wheat crop cultivation, due to the presence of a limited and severe factor, namely the physical conditions of the soil, including the high soil content of gypsum in Kubasi location, while Al-Qaim cement factory showed high soil content of carbonates, which was the main limitation of the cultivation of this crop in this site,. In addition the texture class was of second degree as a determinant of the growth of this crop at the studied sites. As for the cultivation of olive trees, the results were inappropriate due to the presence of a limited and severe factor, namely the soil content of the gypsum as the first factor, then the soil depth and the soil content of the organic matter as the second class, which distinguished the lands surrounding the Kubisa cement plant. while It was among the limited class for cultivation of olive trees (S3) in West and East of Kubisa Cement factory and lands which surrounding Al-Qaim cement plant.

CONCLUSIONS

The high content of the soil of carbonate and gypsum has been the effective determinant of the extent of the suitable land surrounding these cement plants for cultivation the wheat compared to olive trees, which showed remarkable resistance to these factors that are suitable for agricultural use. Implementation of an expanded plan to reduce the emissions from cement factories through the development or supply of dust deposits with modern technologies to avoid their emission to the atmosphere. The necessity of obliging the owners of industrial activity in this field to establish plant bumpers in the work sites to reduce the effects of these industries on the vegetation cover in the area and its suitability for agricultural and obligate them to put filters to filter emissions with follow-up and periodic monitoring.

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~~*Received 29 March, 2019; Accepted 10 May, 2019*~~

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